STOCK MARKET AND ECONOMIC GROWTH IN UKRAINE

by

Andriy Gamolya

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Abstract

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Head of the State Examination Committee: Mr. Serhiy Korablin,
Economist, National Bank of Ukraine

This paper investigates Ukrainian reality, searching for facts of statistical dependence between financial and real sector performance. Financial sector is deemed as an indispensable part of any national economy. Allegedly, it is somehow connected to real sector productivity and this relationship is supposedly two-sided. The million dollar question here would be – exactly how they affect one another? By scrutinizing this ambiguous relationship we try to identify the role of financial intermediaries in this complex system. Structural Vector Autoregression model is being employed as an instrument of assessing alleged ties, while Stock Market is singled out in order to ascertain ponderable role attributed to it *ad hoc*.

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Chapter 1

INTRODUCTION

Economic growth has long been under meticulous study. Though, the idea of connecting it to the financial advancement of the country has arisen only recently. Since early 90's a huge amount of econometric instruments have been employed to shed some light upon the ambiguous relationship between financial sector activity and economic growth. This paper is another tribute to the study of empirical link between financial intermediaries and the national economy. Exploring the nature of those ties serves us as a goal, whereas learning to extract benefit from this knowledge is our task.

The underlying theory can be concisely summarized this way. Financial sector interacts with the national economy. This relationship is allegedly two-sided and mutual. The case can be divided into following clauses:

a. financial sector development enhances economic growth by means of efficiently allocated resources;
b. economic expansion spurs improvement and enlargement within the net of financial intermediaries;
c. financial factors, though, may simply contain some information about future movements in the macroeconomic variables without affecting the real side of economy and vice versa.

The most popular ideas always on the agenda of our government are political and economical stability. The latter task is narrowed to search for tools and methods of regulating macroeconomic performance. Thus, understanding the

insights of financial and real sector interdependence and pointing out some oblique levers of influencing economy will be mostly appreciated. To be more specific, detection of the causal linkage between financial sector and economy will equip us with a tool for promoting economic advancement. Detection of the purely indicative linkage will provide us with a tool for economic forecasting. Absence of any interdependence will prove the failure of such theory within Ukrainian reality and will force us to pick more suitable model comprising financial and economic sectors.

Following an idea introduced by Levine (1997), we let banks and stock market (SM) represent financial system. This is a reasonable assumption, since investment transactions are conducted mainly through banks as loan-issuing institutions and SM as a mean of attracting new investments and repurchasing the existing ones. Furthermore, combined capitalization of banks and SM is incomparably bigger than that of mutual funds, pension funds, etc. The core of our analysis would be analyzing the nature of connection between financial sector and real economy, focusing on the stock market.

We will concentrate on the SM as the prior object for examination, though controlling for influence of banks as a crucial element of the model. The arguments for this according to Levine (1997) are as following:

a. IPO's provide economy with extra investment which eventually will result in GDP growth;
b. stock markets can affect economic activity through the creation of liquidity. People will be willing to invest more for long periods if their risk is decreased by liquid assets (stocks);
c. stock prices reflect the expectations of the company's future profits. Therefore, market index can be considered a generalized measure

for the expected profitability of all businesses involved. Overall performance of businesses is a basis for economic development;

d. remembering the notion of "asymmetric information" we may refer to the stock market as an ex-ante-information-acquiring facility. This brings us to the idea of SM incorporating all information relevant to either growth or recession, which is reflected in prices, indices, trade volumes.

A few researchers have tried to position financial advancement in general and stock market functioning in particular as a factor of economic growth. This idea has been checked in several developing economies, such as Malaysia (Choong (2003)) and Turkey (Karamustafa (2002)). The indicating role of SM market has been explored by Henry (2001). Caporale (2004) looked for the evidence of casual linkage between the two fields. The cross-countries studies have been done by King (1993), Levine (1998) and Arestis (2001). Transition economies were given some attention as well. Uvarov (2003) and Laurenceson (2002) showed development of financial sector to be a leading factor of economic progress. I will focus on searching for the empirical evidence of such dependence or its absence in Ukraine.

Once again I stress that I will concentrate on the SM activity, though, controlling for the impact of banks, which is supposed to give us a proxy for estimating return on capital employed by economy. That means – capital in circulation is concentrated mainly in banks and stock market and all the profits (e.g. deposit interest or return on investment) are concentrated there. Following this, we will estimate the nature of connection between financial performance and economic growth. Assessment of alleged ties will be complicated by the absence of variety of factors, which might influence the

balance between the two sectors. E.g. institutional investors are recently gaining importance; qualitative characteristics of a sector (like credibility of investors) matter a lot. Though, working in the framework of the income method of calculating GDP, we narrow this circle to a reasonable extent. We concentrate on the core elements of both sectors, realizing that this is an artificial, though, required simplification.

The structure of this thesis follows a simple pattern: Chapter 2 is a short overview of the relevant theoretical and empirical papers; Chapter 3 is dedicated to the methodology of assessing ties between financial and real sectors; Chapter 4 contains data and variables description; Chapter 5 contains a short description of Ukrainian stock market and banking institutions; Chapter 6 reveals empirical results with corresponding comments; Chapter 7 is devoted to conclusions, implication policies and possibilities for further research.

Chapter 2

LITERATURE REVIEW

A lot of attention has been drawn to the question of the interdependence between stock market activity and economic growth at recent decade. Numerous scientists have tried to assess the nature of this connection. As a result of those endeavors to understand finance-growth relationship we have a number of research and working papers. All results subdivide into several classical cases:

a. stock market spurs economic growth
b. stock market indicates economic growth
c. economic growth promotes financial activity
d. there is no connection between the two fields

The main aim of this paper is to investigate the nature of connection between stock market performance and economic growth. This relation is being viewed in the general framework of synchronism between financial and real sector. The list of questions to be addressed comprises several basic issues – stock market as a crucial element for economic advancement, type of connection (indicative or influential) and magnitude of influence, if any.

We will perform an in-depth analysis of the provided research and will try to elaborate our own view of the alleged connection in Ukraine. And the most obvious starting point would be a logical consideration of the abovementioned issue.

There were several attempts to elaborate a theoretical basis and logical background of such connection without direct relationship to any country. Natural desire was to explain the sources of potential interdependence and provide a simple reasoning for the idea's viability. The theoretical framework for the connection between finance and growth is a straightforward matter according to Levine (1997). Financial markets and intermediaries perform a number of vital functions, e.g. mobilizing and reallocating resources, managing risks, etc. Thus, providing for capital investments and supporting technological innovation, financial sector is said to have an impact over economic growth. On the opposite side is Dornbush (1989) with his remarkable conclusion pertaining to growth related issues. It is his opinion that the effects of financing economic growth, especially through covering deficit areas, are ambiguous and rather hazardous. Though, significant results might be achieved by letting those resources free instead of direct channeling. Bencivenga (1991) provides a model describing the relationship between financial intermediaries' activity and economic growth. He discovers positive correlation between the two and the main argument for this that financial intermediaries are overwhelming and they possess enormous amounts of resources. Efficiency of resources allocation will consequently reinforce economic advancement, since money is fuel for the "national economy engine".

Described clauses are believed to be a good approximation of reality and, thus, we expect that Ukrainian stock market is affecting the national economy as well, which gives us some turf for further thoughts.

The first choice of approach would naturally be a cross-country analysis. King (1993) has received a strong evidence of correlation between financial variables and economic growth. This result was consistent along the whole spectrum of the countries under investigation. What is more, the control over predetermining

financial variables will give a desirable consequent response in economic parameters. Further on, Rajan (1996) has gone even further. He was analyzing this ambiguous relationship from a narrow point of view – financial development, he believes, lowers transaction costs and thus facilitates economic growth. Their results in a number of countries show that financial evolution has a significant "supportive effect" on economy. We have another view offered by Arestis (1997). He approaches the relationship under study from two different angles. First – to what extent financial development can contribute to economic wellbeing; second – whether financial liberalization can become a factor of economic prosperity. Though, the results proved to be consistent with the underlying assumptions, author is skeptical towards the cross-countries studies and calls this method "over-simplified". He suggests that individual country peculiarities should be taken into consideration. Further on, Rousseau (1998) conducted empirical research on five industrialized countries. His main point of concentration was historical time period at which these countries experienced a high speed economic growth. He finds that this was a direct consequence of improved financial sector activity. He also claims that the direction of influence is "finance to economy" and finds little evidence of a reverse effect. We also find interesting the work done by Mauro (2000), who uses a straightforward approach analyzing Stock Market returns and economic growth within a group of emerging economies. Author comes to a conclusion that stock market is a stable predetermining factor of economic growth. This result is sustainable in a row of developed economies as well as in developing ones. Though, Henry (2001) argues the statement above. Though he indicates positive correlation between stock returns and output growth, he finds it to be very small and, thus, stock market plays an informative role rather than a productive one. The latest word in studying finance-growth relationship across countries available in publishing belongs to Trabelsi (2002). He once again supports the idea of a strong

relationship and states that the main channel for the impact is amount of investment.

Though cross-country approach is widely used, we will not rely on it, since it is hard to distinguish effects between countries and we are inclined to concentrate on Ukraine. Further on, numerous profound tests were performed employing this technique, which stimulates us to alter the methodology seeking perfection.

In contrast to the popular cross-country analysis, it is possible to look at a particular country. Some researchers did explore the alleged connection in separate countries. For example, Choong (2003) finds an evidence for finance-led growth hypothesis in Malaysia. Based on autoregressive distributed lag (ARDL) bounds test approach and vector error correction model (VECM) he finds co-integration between stock market and economic performance, where SM Granger causes economic growth. Laurenson (2002) analyzes the appealing fact of simultaneous growth of financial and economic growth in China. His conclusive idea is that the impact of financial sector in general and stock market in particular on economic growth is very limited. Financial intermediaries do not cope with effective resources reallocation in these countries. Thus, financial variables are week indicators of economic advancement. Further on, Nieuwerburgh (2005) explores those ties in Belgium. Karamustafa (2002) did the same for Turkey. The results were basically the same, with few minor variations – GDP growth is directly related to the amount of resources available through the national stock market and banking institutions.

Unfortunately, mentioned authors simplify matters drastically and use VAR econometric model not minding the complex of statistical problems adjoining to it. In this we see a chance for improvement. We will follow the same bottom line, though a relevant solution to the omitted variables problem will be introduced.

An interesting alternative approach is to estimate the direct causality. Though a bit restrictive this method allows to evaluate the direct effects of two factors on each other. The causality linkage has been checked by Caporale (2004) and Gursoy (2000). They have come to conclusion that:

a. a well-developed stock market can spur economic growth;
b. the effect, more often than not, is found to have a reverse effect;
c. developing countries show closer relation between stock market and economic growth.

We have to mention also the ambiguity of the results obtained from this technique, since there is often no underlying logic predetermining the testing itself.

We pay a great attention to research papers aiming at singling out the role of stock market in the process of economic development. A few researchers have had a closer look at the stock market and its relation with economic advancement. Dow (1997) suggests that effective stock market is not a prerequisite for economic efficiency, since other financial intermediaries are capable of performing the function of money channeling. The role of stock market as resources allocating facility is limited to informational part only. Levine (1998) on the contrary argues that stock market and banks performance is directly influencing productivity, industrial growth and capital accumulation. Filer (1999) is proposing a similar idea, though concentrating on developing countries. He insists that stock market incorporate all the information about future growth in stock prices. Arestis (2001) is another author to take part in the discussion. His insight of the ties between financial and real sectors is rather in line with the one of Dow's, mentioned above. Stock market, according to him, contributes too little to economic growth compared to banks activity. Those arguments seem reasonable and applicable in Ukraine. The growing importance of the stock market could not be denied. The evidence from abroad witnesses in favor of

strong relationship between stock market and economic performance. Thus we are urged to look at this interdependence in Ukraine.

We observe that majority of papers take finance-to-economy direction as granted. To be complete and just we have to mention a counter-theory suggesting that economic growth is a leading factor of development which induces growth in financial sector. This idea has been checked by Garcia (1999). He has been drawn to the conclusion that the development of other financial intermediaries and overall market liquidity have an impact over stock market evolution and prosperity. While macroeconomic stability proves to be an insignificant factor of stock market performance. He also finds, that stock market and banking institutions are rather complements than substitutes.

A few EERC students were trying to find some evidence of the connection between financial sector and economic growth. Osinski (2000) has explored the cross-countries effects and put an accent on pair-correlation while analyzing panel data. He has discovered a positive connection between economic growth and macro variables (per capita income, inflation, openness to trade, etc.). Uvarov (2003) did almost the same though using generalized least squares and two stage least squares procedures for estimating the magnitude of relationship. Though picking other variables and regression model the author came to a similar conclusion – financial intermediaries affect economic growth by channeling investment flows and lowering transaction costs.

We would rectify a few of their omissions and will approach the issue from a different angle. That is – single country instead of a group of countries, VAR instead of two stage GLS, intuitive background instead of purely mathematical approach. What is more, we will single out the stock market effect, which was not done before.

We will partly follow procedures described by Caporale (2004), who uses the methodology first invented by Toda (1995), to find empirical evidence of interdependence between stock market and economic growth. This approach allows to lessen the problem of omitted variables and to single out a stock market effect on economic growth. Though, in contrast to Caporale, our main focus falls onto contemporaneous effects of shocks, since practice regards stock market as too weak to sustain long-run relationship. A simple sketch of my approach is as following:

a. use income method of GDP calculation to relate economic growth and financial performance;
b. pick several variables to proxy the return on capital employed by economy;
c. create structural VAR model by introducing several restrictions;
d. assess the significance of each variable and analyze the impulse response functions;
e. introduce another relevant variable into the initial model to check whether the former result preserves its significance.

Thus, we will be able to single out stock market effect on economy and to make sure this result is stable.

We have already come to an idea of the connection between financial sector (stock market in particular) and economic growth. A simple explanation to this would be money channeling, resources attracting and funds allocating functions performed by intermediaries. Though, we may argue about the logical reasons of the existence of such interdependence, some econometric analysis will still have to be used.

Chapter 3

METHODOLOGY

Methodological approach is divided into several logical steps. Those steps include combining studied factors under a single economic framework, estimating the mutual impact of included variables and assessing the reliability of achieved results – a robustness check. Relying on recognized yet innovative approach introduced by Toda and Yamamoto (1995) we use Vector Autoregression (VAR) model to estimate long-run relationship between variables, seeking for proof of causality effects between the vectors. We impose several restrictions and test for their viability using Granger causality test, while accounting for other crucial effects between the two spheres. Further on, we employ a technique suggested by Caporale (2004). By adding another relevant variable into the model we determine whether the former results remain significant or their explanatory power is eroded. Contemporaneous effects also fall into a core of our study, since author is inclined to check whether the stock market (SM) has some indicative power over economic growth within a reasonably short time period. This goes in line with a previously explained concept and relies on basic reasoning and commonly accepted econometric methods of estimation.

Since we scrutinize the alleged connection between financial and real sectors, we have to provide an underlying system, where both sectors come into contact. We believe that income method of GDP calculation perfectly comprises two spheres. To be specific – this equation explains the sources of GDP formation as a major macroeconomic indicator, one of which is a common profitability of capital employed by economy. Thus, in a simple way we combine financial sector

performance and macroeconomic development. The basic formula is the following:

$$GDP = W + R + I$$

Where, W – is a return on labor (wage); R – return on land (rent); I – return on capital (interest). By proxying the latter item with variables characterizing financial sector activity we construct the sought model. The main presumption here is that stock market and banking institutions can represent the whole financial sector. We believe this assumption to be not too restrictive, since those institutions control overwhelming majority of money available to economy. Cumulative banking and stock market capitalization amounts to 90% of financial sector capacity in Ukraine. Furthermore, majority of investments are carried out through either banks, stock market or both and funds invested into economy is the major factor of real sector advancement. With the development of financial sector the set of variables used to proxy 'return on capital' will also include equity and hedging funds, private investment funds, insurance companies and other financial intermediaries.

The list of variables included in the model comprises figures which characterize both SM and banks activity. They are:

a. SM index as the measure of general market profitability. According to underlying hypothesis it is directly connected to GDP growth;
b. volume of SM trade as it is the measure of investors activity, who anticipate growth or recession;
c. total banking institutions capitalization, as they are the major financial intermediaries;
d. average wage rate, which is introduced as testing instrument.

We will use data on several financial indicators to proxy variables included into the model. The GDP data series is describing the macroeconomic situation in general. We believe that economic growth is associated with GDP growth above all. The most reasonable step is to look at changes in log of GDP, since absolute amounts matter less than month-to-month percentage change does. The same logic applies to banking capitalization and stock market turnover – we reckon growth as the most meaningful item. Thus, we will run regression in logarithms. We discard income received from land use since rent relations are not that developed in Ukraine. Land laws are still being elaborated and all rent relations are thus deferred and barely contribute to monetary gains of agents. Therefore, our model will be transformed to a 'reduced' version of income method of GDP calculation. Return on invested labor will be introduced into the model. For that purposes we use average wage level.

The most important part is to proxy income earned from use of capital. Controlling for banks' activity, we introduce the variable total bank capitalization, which approximates amount of money available for active transactions. Stock market activity is characterized with monthly index, which is a composite reflection of all facts, rumors and anticipations regarding investment environment in general. Development of stock market index is a direct sign of investors' mood. Stock market monthly turnover to some extent represents investors' decisiveness as well. Though, it is frequently formed by speculative operations, we believe that growing amount of speculation transactions witnesses for the overall anticipation of growth. And the million dollar question would be – whether this anticipation reflects on real sector performance.

The starting point is a simplified set of equations, including some time lag:

$$A_0 Y_t = A_1 + A_2 Y_{t-1} + \ldots + A_n Y_{t-n+1} + \varepsilon_t, \quad (1)$$

where Y is a set of basic variables*:*

GDP – *Gross Domestic Product*

SMI – *Stock Market Index*

SMT – *Stock Market Turnover*

TBC – *Total Banking Capitalization*

AMW – *Average Monthly Wage*

Since we decided to look at percentage change in variables, we run regression in logarithms and thus our model is modified to:

$$A_0 \ln Y_t = A_1 + A_2 \ln Y_{t-1} + \ldots + A_n \ln Y_{t-n+1} + \varepsilon_t \quad (2)$$

Relying on standard tests (Schwartz's Bayesian information criterion and the Hannan and Quinn information criterion) we define the effective number of lags as 1-period time lag.

(See Appendix A)

Yet we run a following regression:

$$A_0 \ln Y_t = A_1 + A_2 \ln Y_{t-1} + \varepsilon_t \quad (3)$$

Checking for stationarity. Running standard unit root test (Dickey-Fuller) for each variable we discover that lnGDP is integrated of order one (visibly the pattern of its development reveals signs of integration as well), lnSMI is integrated of order one, lnSMT is integrated of order one, lnTBC is integrated of

order one, lnAMW is integrated of order one. Thus we will have to run regression in differences. All variables will be differentiated once according to statistic results. Moreover, we are interested in differences rather than absolute values. *(See Appendix A)*

Therefore, we arrive to the next matrix form of regression:

$$A_0 d.\ln Y_t = A_1 + A_2 d.\ln Y_{t-1} + \varepsilon_t \quad (4)$$

According to Toda and Yamamoto (1995) we disregard cointegration revealed by Johansen pre-estimation procedure. Authors insist that small-size samples, which are typical for economic time-series, provide very unreliable results and are very sensitive to all kinds of nuisances. Thus, cointegration pre-testing may suffer from a huge bias. This problem is resolved via implementing standard VAR procedures with standard number of lags being increased by the number of presumably cointegrated vectors (two for the first and three for the second model). This allows us to concentrate on studying causality, while missing the dubious effects of cointegration. Successfully developed and implemented by Caporale (2004) this technique has proved positive relation between stock market performance and economic growth in seven developing countries.

After all, for the first time we run a four-factor structural VAR in logarithms with a 3-periods time lag, all variables differentiated once. The model we actually end up with is:

$$\begin{bmatrix} 1 & \lambda_{12} & \lambda_{13} & \lambda_{14} \\ \lambda_{21} & 1 & \lambda_{23} & \lambda_{24} \\ \lambda_{31} & \lambda_{32} & 1 & \lambda_{34} \\ \lambda_{41} & \lambda_{42} & \lambda_{43} & 1 \end{bmatrix} \cdot \begin{bmatrix} d.\ln GDP_t \\ d.\ln SMI_t \\ d.\ln SMT_t \\ d.\ln TBC_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \end{bmatrix} + \overline{\beta} \cdot \begin{bmatrix} d.\ln GDP_{t-1} \\ d.\ln SMI_{t-1} \\ d.\ln SMT_{t-1} \\ d.\ln TBC_{t-1} \end{bmatrix} + \\ + \overline{\omega} \cdot \begin{bmatrix} d.\ln GDP_{t-2} \\ d.\ln SMI_{t-2} \\ d.\ln SMT_{t-2} \\ d.\ln TBC_{t-2} \end{bmatrix} + \overline{\gamma} \cdot \begin{bmatrix} d.\ln GDP_{t-3} \\ d.\ln SMI_{t-3} \\ d.\ln SMT_{t-3} \\ d.\ln TBC_{t-3} \end{bmatrix} + \begin{bmatrix} \varepsilon_{10} \\ \varepsilon_{20} \\ \varepsilon_{30} \\ \varepsilon_{50} \end{bmatrix} \quad (5)$$

Economic reasoning suggests that we have a number of restrictions:

a. SMI is calculated based on performance of selected companies with assigned weights, this way representing the average market performance. It may be indirectly influenced in the long run, though non of the mentioned factors can contribute to the SMI value contemporaneously;
b. TBC depends solely on amounts attracted by banking system, which are formed by private and corporate deposits. It may possibly vary within a month, though no factors entering the model have immediate impact over TBC.

Thus, $\lambda_{21} = \lambda_{23} = \lambda_{24} = \lambda_{41} = \lambda_{42} = \lambda_{43} = 0$

Finalized form of the first regression is:

$$\begin{bmatrix} 1 & \lambda_{12} & \lambda_{13} & \lambda_{14} \\ 0 & 1 & 0 & 0 \\ \lambda_{31} & \lambda_{32} & 1 & \lambda_{32} \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} d.\ln GDP_t \\ d.\ln SMI_t \\ d.\ln SMT_t \\ d.\ln TBC_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \end{bmatrix} + \overline{\beta} \cdot \begin{bmatrix} d.\ln GDP_{t-1} \\ d.\ln SMI_{t-1} \\ d.\ln SMT_{t-1} \\ d.\ln TBC_{t-1} \end{bmatrix} + \\ + \overline{\omega} \cdot \begin{bmatrix} d.\ln GDP_{t-2} \\ d.\ln SMI_{t-2} \\ d.\ln SMT_{t-2} \\ d.\ln TBC_{t-2} \end{bmatrix} + \overline{\gamma} \cdot \begin{bmatrix} d.\ln GDP_{t-3} \\ d.\ln SMI_{t-3} \\ d.\ln SMT_{t-3} \\ d.\ln TBC_{t-3} \end{bmatrix} + \begin{bmatrix} \varepsilon_{10} \\ \varepsilon_{20} \\ \varepsilon_{30} \\ \varepsilon_{50} \end{bmatrix} \quad (6)$$

Following the predefined scheme we will try to reassess the results. Caporale (2004) has suggested one way to reassure the significance of results. We will introduce an extra variable (average monthly wage, which theoretically is a component of GDP and thus has a direct impact on it) into the model and will run structural VAR once again to assure the stability of former results.

$$\begin{bmatrix} 1 & \lambda_{12} & \lambda_{13} & \lambda_{14} & \lambda_{15} \\ \lambda_{21} & 1 & \lambda_{23} & \lambda_{24} & \lambda_{25} \\ \lambda_{31} & \lambda_{32} & 1 & \lambda_{34} & \lambda_{35} \\ \lambda_{41} & \lambda_{42} & \lambda_{43} & 1 & \lambda_{45} \\ \lambda_{51} & \lambda_{52} & \lambda_{53} & \lambda_{54} & 1 \end{bmatrix} \cdot \begin{bmatrix} d.\ln GDP_t \\ d.\ln SMI_t \\ d.\ln SMT_t \\ d.\ln TBC_t \\ d.\ln AMW_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \\ \alpha_{50} \end{bmatrix} + \overline{\beta} \cdot \begin{bmatrix} d.\ln GDP_{t-1} \\ d.\ln SMI_{t-1} \\ d.\ln SMT_{t-1} \\ d.\ln TBC_{t-1} \\ d.\ln AMW_{t-1} \end{bmatrix} +$$
$$+ \overline{\omega} \cdot \begin{bmatrix} d.\ln GDP_{t-2} \\ d.\ln SMI_{t-2} \\ d.\ln SMT_{t-2} \\ d.\ln TBC_{t-2} \\ d.\ln AMW_{t-2} \end{bmatrix} + \overline{\gamma} \cdot \begin{bmatrix} d.\ln GDP_{t-3} \\ d.\ln SMI_{t-3} \\ d.\ln SMT_{t-3} \\ d.\ln TBC_{t-3} \\ d.\ln AMW_{t-3} \end{bmatrix} + \overline{\mu} \cdot \begin{bmatrix} d.\ln GDP_{t-4} \\ d.\ln SMI_{t-4} \\ d.\ln SMT_{t-4} \\ d.\ln TBC_{t-4} \\ d.\ln AMW_{t-4} \end{bmatrix} + \begin{bmatrix} \varepsilon_{10} \\ \varepsilon_{20} \\ \varepsilon_{30} \\ \varepsilon_{40} \\ \varepsilon_{50} \end{bmatrix} \quad (7)$$

Economic reasoning suggests that we have a few additional restrictions:

a. previous statements remain unchanged, since introduction of AMW does not disturb mentioned logics. Though, growth in AMW may cause TBC to rise whenever people deposit part of their earnings.

Thus, $\lambda_{21} = \lambda_{23} = \lambda_{24} = \lambda_{25} = \lambda_{41} = \lambda_{42} = \lambda_{43} = 0$

b. AMW is not influenced by financial indicators like SMI. It is rather dependant on Consumer Price Index or sources available from the state or company's budget

Thus, $\lambda_{52} = 0$

Finalized from of the second model is:

$$\begin{bmatrix} 1 & \lambda_{12} & \lambda_{13} & \lambda_{14} & \lambda_{15} \\ 0 & 1 & 0 & 0 & 0 \\ \lambda_{31} & \lambda_{32} & 1 & \lambda_{34} & \lambda_{35} \\ 0 & 0 & 0 & 1 & \lambda_{45} \\ \lambda_{51} & 0 & \lambda_{53} & \lambda_{54} & 1 \end{bmatrix} \cdot \begin{bmatrix} d.\ln GDP_t \\ d.\ln SMI_t \\ d.\ln SMT_t \\ d.\ln TBC_t \\ d.\ln AMW_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \\ \alpha_{50} \end{bmatrix} + \overline{\beta} \cdot \begin{bmatrix} d.\ln GDP_{t-1} \\ d.\ln SMI_{t-1} \\ d.\ln SMT_{t-1} \\ d.\ln TBC_{t-1} \\ d.\ln AMW_{t-1} \end{bmatrix} + \tag{8}$$

$$+ \overline{\omega} \cdot \begin{bmatrix} d.\ln GDP_{t-2} \\ d.\ln SMI_{t-2} \\ d.\ln SMT_{t-2} \\ d.\ln TBC_{t-2} \\ d.\ln AMW_{t-2} \end{bmatrix} + \overline{\gamma} \cdot \begin{bmatrix} d.\ln GDP_{t-3} \\ d.\ln SMI_{t-3} \\ d.\ln SMT_{t-3} \\ d.\ln TBC_{t-3} \\ d.\ln AMW_{t-3} \end{bmatrix} + \overline{\mu} \cdot \begin{bmatrix} d.\ln GDP_{t-4} \\ d.\ln SMI_{t-4} \\ d.\ln SMT_{t-4} \\ d.\ln TBC_{t-4} \\ d.\ln AMW_{t-4} \end{bmatrix} + \begin{bmatrix} \varepsilon_{10} \\ \varepsilon_{20} \\ \varepsilon_{30} \\ \varepsilon_{40} \\ \varepsilon_{50} \end{bmatrix}$$

To summarize, we are combining financial and real sector in a single model. Next we are running structural VAR for two times. By introducing another relevant variable into the model we can observe the behavior of previously found results for initial set of variables. By scrutinizing impulse response functions we determine the interdependence between shocks in stock market activity and economic growth. Applying Wald test allows us to reveal the Granger causality type of relation. Furthermore, we analyze the sensitiveness of the model to omitted variables.

Chapter 4

DATA DESCRIPTION

This work relies on recent data received from official sources - First Stock Trading System (FSTS), World Bank in Ukraine (WBU), National Bank of Ukraine (NBU). We will operate the monthly data, which runs eight years (1998-2005) and thus forms a total number of 96 observations.

We managed to collect data representing all variables included into the model:

a. monthly GDP
b. monthly stock market index
c. monthly turnover on Ukrainian stock market
d. total banking capitalization as of the end of each month
e. average monthly salary

The datasets for (b) and (c) are downloaded from the official FSTS web-site. They publish the results of automatic daily monitoring of a trading floor.

The datasets for (a) and (d) were extracted from the WBU database. Data on numerous aspects, including macroeconomic performance and banking sector performance, is stored in this database. What is more, all relevant PPI and CPI indices are contained in this database as well, which allows us to make data comparable.

The dataset for (e) was received from NBU macroeconomic statistics provided on their web-site.

We need to bring all monetary values to comparable basis. For that purposes we employ a month-to-month PPI index provided by WBU. Thus, GDP, stock market turnover, total banking capitalization and average monthly salary will be measured in current prices equivalent, since we take December 2005 as a base month.

Preliminary data analysis represents graphically development of all variables over time. By sketching a simple graph – development of value vs time, we can visually assess directions of trends, general tendencies, probably a time lag.
(See Appendix B for charts)

Descriptive statistics for included variables is summoned in a following table:

Table 4-1. Data analysis

Variable	**Measurement units**	**Mean**	**Variance**	**Standard Deviation**
GDP	UAH mln	28193.73	5.49e+07	7410.41
Stock Market Index	basic points	95.07	9145.79	95.63
Stock Market Turnover	UAH mln	551.02	389118	623.79
Total Banking Capitalization	UAH mln	55702.27	1.60e+09	40007.3
Average Salary	UAH	562.54	23751.98	154.12

Chapter 5

UKRAINIAN STOCK MARKET AND BANKING INSTITUTIONS

Putting theory and estimation methods aside for a moment we try to understand the environment. We realize that Ukrainian stock market and banking sector endure both a temporary perturbation at the moment. Any comments on current situation may, therefore, seem partial. What is more, recent events and anticipation of evolutionary processes leave us undecided whether to praise financial sector or bury it. Any kind of forecast is, therefore, restricted in preciseness.

According to the latest information, available from official analytical reports on Ukrainian financial sector, we witness an upswing of stock market performance accompanied by slow-down in real sector growth. The theory claiming the stock market to be a realistic indicator of economic growth receives another portion of distrust as we discover that Total Market Capitalization amounts to less than 10% of GDP, which seems insignificant when compared to 35% in Russia and 40% in Poland. On the other hand, such outburst in PFTS index may be explained by speculative motives of participants. This means that connection is still present, though it is not stable due to overall weakness of Ukrainian stock market.

Ukrainian stock market has not shown any significant achievements for the past 10 years – only 1% of private investors' money has reside on the stock market, not all financial instruments are adopted and even fewer freely circulate. Nevertheless, stock market is expected to advance in the coming years since the environment is favorable. Stock market development indeed moves faster than overall economic advancement, which is a token of rapid positive changes (compared to the slow advancement before 2005).

Ukrainian banking sector is now facing a continuous series of mergers and take-overs with foreign banks. Entrance of foreign capital will change situation in banking sector drastically. Professional analysts expect those Ukrainian banks surviving mass buy-outs will be forced to go public on world-wide trading platforms, which is another way to attract foreign capital.

Total loans and deposits grow annually at approximately the same 60% pace, allowing us this way to anticipate major improvements in banking institutions stability during nearest coming years. Active participation in housing estate construction projects of the majority of Ukrainian banks strengthens the basis for long-term development strategies. Loans in national currency are becoming cheaper, which is a token of healthy bargaining environment.

Ukrainian banking sector, as well as other financial institutions, are being heavily relied upon by policy makers. Many macroeconomic expectations are linked to and are conditional of steady financial growth. The ties between real and financial sector are becoming more obvious and integrated as the two spheres evolve. Stock market is positioned and recognized as an indicator of economic growth in all developed countries by politicians, investors, financiers and hopefully we are about to become no exception. Though, whether this relationship is true nowadays we will discover in the next chapter.

C h a p t e r 6

EMPIRICAL RESULTS

Following the discussed procedure we run structural VAR for the defined model for the first time. Summarized statistics is provided herein.

Table 6-1. Estimated coefficients (first model)

	Coefficient	***Stand. Error***	***Z-value***	***P>|Z|***
a_1_1	1	-	-	-
a_2_1	0	-	-	-
a_3_1	6.15	0.37	16.50	0.00
a_4_1	0	-	-	-
a_1_2	-2.77	0.20	-14.08	0.00
a_2_2	1	-	-	-
a_3_2	-3.05	0.14	-22.26	0.00
a_4_2	0	-	-	-
a_1_3	1.60	0.11	15.19	0.00
a_2_3	0	-	-	-
a_3_3	1	-	-	-
a_4_3	0	-	-	-
a_1_4	-5.99	0.35	-16.88	0.00
a_2_4	0	-	-	-
a_3_4	-8.4	0.33	-25.43	0.00
a_4_4	1	-	-	-

We draw several conclusions regarding estimated coefficients:

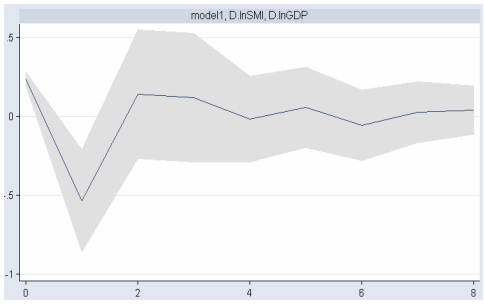
a. $\lambda_{12}, \lambda_{13}, \lambda_{14}, \lambda_{31}, \lambda_{32}, \lambda_{34}$ are statistically significant at 1% level, which drives us to conclusion that stock market index and total banking capitalization indeed have some impact over GDP development. They both positively influence GDP, which completely complies with our expectations – strengthened financial sector contributes to real growth;

b. the reverse effect is somewhat dubious. GDP affects negatively the stock market turnover, as well as the SMT has a negative impact on GDP. This might be a result of the speculative nature of transactions mostly held on the Ukrainian stock market.

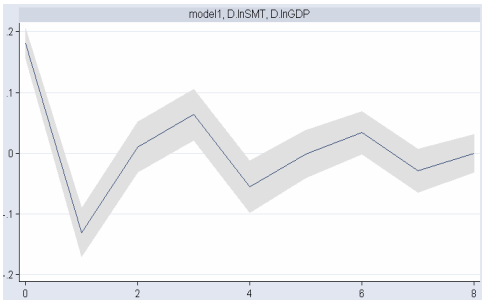
Following our procedure we analyze the most meaningful impulse response functions, which fall in the core of our stock market study. We will look at the shocks spurred by the stock market and will try to recognize the responsive behavior of the real sector, represented by GDP in our case. The effects have a good chance of being two-sided, so we include GDP shocks and their consequences into the study as well. The most attention is brought to periods zero and one, since farther effects will most certainly be eroded in a spinning environment.

Figure 6-1. Impulse Response Functions (first model)

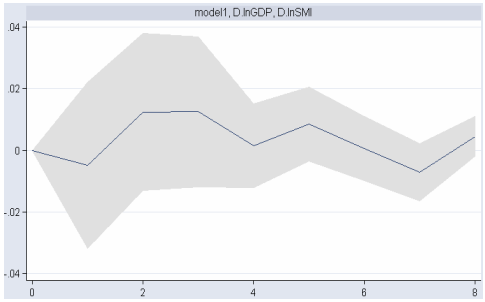
Impulse in d.lnSMI, response d.lnGDP



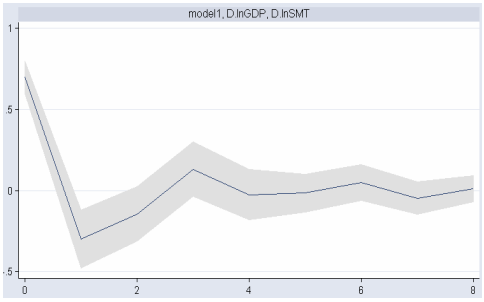
Impulse in d.lnSMT, response d.lnGDP



Impulse in d.lnGDP, response d.lnSMI



Impulse in d.lnGDP, response d.lnSMT



A shock in SMI leads to positive shock in GDP within the same period. Next period GDP responds negatively, which brings us to a conclusion that increase in SMI preceding GDP growth was too optimistic and now GDP is adjusting backwards. Further deviations are not supported with statistical evidence. Outside shock effect vanishes over time after a few fading spikes. This means that relative change of GDP becomes constant. SMT effect over GDP is also observable. Positive shock in period zero is followed by negative shock in period one, which is explained by speculative turnover artificially overstating the true state of affairs. Only two-months-old performance may influence GDP according to confidence interval interpretation. SMT reacts to shocks in GDP in the same manner.

Now we follow with the analysis of variance decomposition. The most meaningful parts describing the ultimate relationship between stock market and economic growth are provided herein:

Table 6-2. Forecast Error Variance Decomposition (first model)

Step	*Structural Forecast Error Variance Decomposition, %*		*Step*	*Structural Forecast Error Variance Decomposition, %*
Impulse in SMI, response in GDP			Impulse in SMT, response in GDP	
0	0.00		0	0.00
1	7.03		1	4.05
2	25.42		2	3.70
3	26.30		3	3.63
4	18.09		4	2.59
5	17.29		5	2.61
Impulse in GDP, response in SMI			Impulse in GDP, response in SMT	
0	0.00		0	0.00
1	0.00		1	3.62
2	0.00		2	3.30
3	0.02		3	2.85
4	0.03		4	2.12
5	0.03		5	2.00

Relying on STATA output we may conclude that variance of stock market characteristics is not really determined by shocks in GDP, while an opposite impact is quite observable. For instance, shock in SMI contributes 7% of increase in GDP variance in one month. This impact is increased up to 25% in the next month, while SMT still explains only 4% of variation in GDP.

Repeating the same procedure for the second time we perform a robustness test by assuring the stability of former results. Thus, we scrutinize a new set of coefficients.

Table 6-3. Estimated coefficients (second model)

	Coefficient	***Stand. Error***	***Z-value***	***P>|Z|***
a_1_1	1	-	-	-
a_2_1	0	-	-	-
a_3_1	4.95	0.73	6.75	0.00
a_4_1	0	-	-	-
a_5_1	4.99	0.49	10.17	0.00
a_1_2	-2.89	0.30	-9.69	0.00
a_2_2	1	-	-	-
a_3_2	-2.23	0.25	-8.95	0.00
a_4_2	0	-	-	-
a_5_2	0	-	-	-
a_1_3	1.14	0.19	6.16	0.00
a_2_3	0	-	-	-
a_3_3	1	-	-	-
a_4_3	0	-	-	-
a_5_3	-0.86	0.08	-11.18	0.00
a_1_4	-29.91	3.86	-7.74	0.00
a_2_4	0	-	-	-
a_3_4	23.03	4.32	5.33	0.00
a_4_4	1	-	-	-
a_5_4	-11.14	3.48	-3.20	0.00
a_1_5	4.91	2.81	1.75	0.08
a_2_5	0	-	-	-
a_3_5	-19.32	2.63	-7.34	0.00
a_4_5	19.73	1.49	13.25	0.00
a_5_5	1	-	-	-

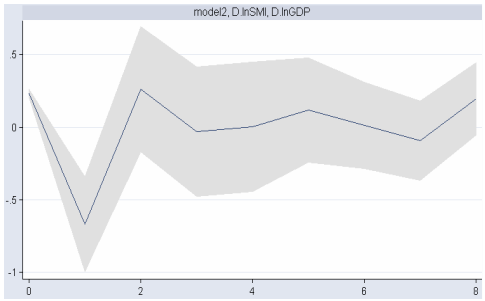
This time we conclude:

a. $\lambda_{12}, \lambda_{13}, \lambda_{14}, \lambda_{31}, \lambda_{32}, \lambda_{34}, \lambda_{35}, \lambda_{45}, \lambda_{51}, \lambda_{53}, \lambda_{54}$ are significant at 1% level, which means that stock market index and total banking capitalization has not lost their meaning and they still contribute to the GDP growth. The signs remained unchanged - financial sector still positively influences GDP growth;
b. newly introduced variable (average monthly salary) proves to be insignificant in the first equation, i.e. no contemporaneous impact on GDP. This enables us to conclude that adding another variable contributes little to the specification of the second model.

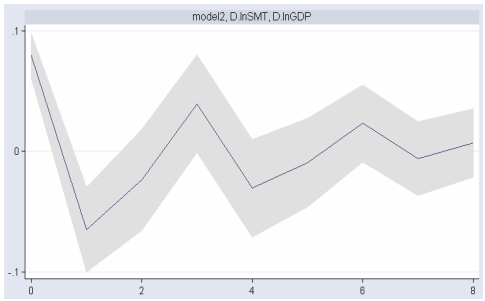
Let us have a look at new impulse response functions:

Figure 6-2. Impulse Response Functions (second model)

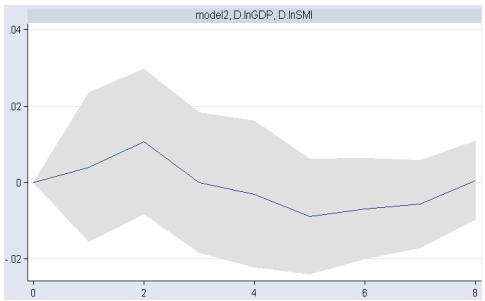
Impulse in d.lnSMI, response d.lnGDP



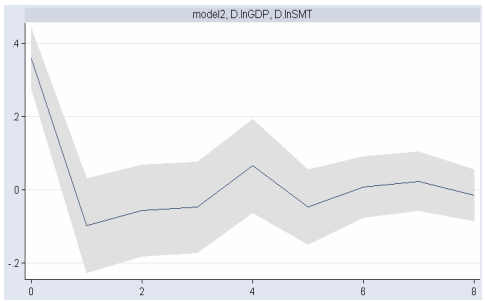
Impulse in d.lnSMT, response d.lnGDP



Impulse in d.lnGDP, response d.lnSMI



Impulse in d.lnGDP, response d.lnSMT



The situation remains the same when analyzing effects of shocks in Stock Market on GDP. We observe no drastic change neither in magnitude of shocks nor in direction of impact. SMT, though, has significant impact over GDP in the first period only. Just to mention the whole spectrum of variables – a shock in TBC fosters positive response in GDP, which in its turn fosters a small but positive response in AMW.

Again we follow with the analysis of variance decomposition. The most meaningful parts are provided herein:

Table 6-4. Forecast Error Variance Decomposition (second model)

Step	*Structural Forecast Error Variance Decomposition, %*		*Step*	*Structural Forecast Error Variance Decomposition, %*
Impulse in SMI, response in GDP			Impulse in SMT, response in GDP	
0	0.00		0	0.00
1	68.45		1	7.94
2	92.40		2	1.96
3	92.71		3	1.81
4	92.07		4	2.06
5	91.24		5	2.19
Impulse in GDP, response in SMI			Impulse in GDP, response in SMT	
0	0.00		0	0.00
1	0.00		1	4.06
2	0.00		2	3.93
3	0.01		3	3.99
4	0.01		4	3.88
5	0.01		5	3.84

Relying on STATA output we may conclude that the impact of shocks in GDP has small explanatory power for deviations in variance of stock market characteristics. The deviations of the SMI from its future expected value may not be explained by volatility of GDP since variance decomposition has ascribed a

zero value to it. Stock market though has preserved and increased its explanatory power after introducing another variable. Of course, we should be cautious when treating 92% of explanatory power as a credible figure, since we know that newly introduced AMW is not significant. Furthermore, it contributes little to understanding variations in GDP, whereas its own volatility depends on changes in GDP somewhat more heavily.

We shall proceed with the analysis of relationship using Granger Causality test. The numerical results are provided below.

Table 6.5 Test for Granger Causality (first model)

Equation	*Excluded*	χ^2	*df*	$P > \chi^2$
First model				
d.lnGDP	*d.lnSMI*	5.9665	3	0.113
d.lnGDP	*d.lnSMT*	18.773	3	0.000
d.lnGDP	*d.lnTBC*	4.151	3	0.246
d.lnGDP	*ALL*	25.966	9	0.002
d.lnSMI	*d.lnGDP*	5.867	3	0.118
d.lnSMI	*d.lnSMT*	1.4694	3	0.689
d.lnSMI	*d.lnTBC*	2.2818	3	0.516
d.lnSMI	*ALL*	9.8566	9	0.362
d.lnSMT	*d.lnGDP*	2.5005	3	0.475
d.lnSMT	*d.lnSMI*	1.013	3	0.798
d.lnSMT	*d.lnTBC*	1.8635	3	0.601
d.lnSMT	*ALL*	4.0084	9	0.911
d.lnTBC	*d.lnGDP*	1.7034	3	0.636
d.lnTBC	*d.lnSMI*	15.276	3	0.002
d.lnTBC	*d.lnSMT*	2.6057	3	0.456
d.lnTBC	*ALL*	19.418	9	0.022

We detect little evidence of Granger causality in the first model, except for SMT granger-causing GDP. Another conclusion drawn from this table is that SMI somehow contributes to the evolution of TBC.

Table 6.6 Test for Granger Causality (second model)

Equation	*Excluded*	χ^2	*df*	$P > \chi^2$
Second model				
d.lnGDP	*d.lnSMI*	11.679	4	0.020
d.lnGDP	*d.lnSMT*	24.156	4	0.000
d.lnGDP	*d.lnTBC*	7.8028	4	0.099
d.lnGDP	*d.lnAMW*	9.9791	4	0.041
d.lnGDP	*ALL*	50.673	16	0.000
d.lnSMI	*d.lnGDP*	3.8931	4	0.421
d.lnSMI	*d.lnSMT*	8.5394	4	0.074
d.lnSMI	*d.lnTBC*	15.386	4	0.004
d.lnSMI	*d.lnAMW*	10.482	4	0.033
d.lnSMI	*ALL*	28.549	16	0.027
d.lnSMT	*d.lnGDP*	6.5816	4	0.160
d.lnSMT	*d.lnSMI*	1.7731	4	0.777
d.lnSMT	*d.lnTBC*	6.2586	4	0.181
d.lnSMT	*d.lnAMW*	13.223	4	0.010
d.lnSMT	*ALL*	20.123	16	0.215
d.lnTBC	*d.lnGDP*	1.3439	4	0.854
d.lnTBC	*d.lnSMI*	14.362	4	0.006
d.lnTBC	*d.lnSMT*	2.9146	4	0.572
d.lnTBC	*d.lnAMW*	4.0087	4	0.405
d.lnTBC	*ALL*	25.524	16	0.061
d.lnAMW	*d.lnGDP*	1.0933	4	0.895
d.lnAMW	*d.lnSMI*	9.2627	4	0.055
d.lnAMW	*d.lnSMT*	5.5824	4	0.233
d.lnAMW	*d.lnTBC*	21.323	4	0.000
d.lnAMW	*ALL*	36.09	16	0.003

Results of the second model produce more factors granger-causing GDP – this time it is SMI and SMT. Basically that implies that constructed equation having GDP on the left would for sure have SMI and SMT on the right side. Financial sector, on the other hand, has no support from GDP. We witness TBC Granger causing SMI, and vice-versa. Moreover, TBC is a factor of AMW development over time.

To make sure we endure no statistical problems we run Lagrange multiplier test for autocorrelation. We detect no autocorrelation between residuals in all time lags. Another post-estimation test shows that the results of the underlying model fitted with simple VAR satisfy eigenvalue stability condition.
(See Appendix C)

Relying on the results of regressions, IRFs, FEVDs and postestimation procedures we derive the following conclusion – stock market indeed has some impact over GDP formation along with banking institutions. The magnitude of influence is seemingly small, though still palpable. This conclusion might be altered as new variables enter the model. We do not anticipate movement in perfect unison due to numerous stock market imperfections (insufficient capitalization before all), though, we believe that the interrelation will grow more tight as the financial sector does better.

Chapter 7

CONCLUSIONS AND POLICY IMPLICATIONS

We have been looking at the intersection of the Ukrainian real economy and the Ukrainian financial sector. We have been trying to understand the threads connecting these two spheres. We scrutinized financial intermediaries, allocating larger portion of attention to the role of the stock market in the national economy. Among other factors introduced in the model we paid due attention to stock market index and banking capitalization, thus assessing the ties between financial sector and economic growth. With the help of structural VAR and various post-estimation techniques we assessed mutual impact of variables comprised in the model. Finally, we have discovered a few interesting moments.

We witness a clear ability of Ukrainian stock market to at least somehow advance economic activity. This conclusion is supported by statistically estimated coefficients. Further exploration of results points out a few Granger-causality-type of relations. Those effects are one-sided and their direction is expectedly simple – financial sector fosters economic growth. Unfortunately, we are skeptical about the ultimate role of the stock market. The claimed impact may have been credible unless the insignificant size and restricted activity of Ukrainian stock market. It is not contributing a lot to the real sector growth, since the number of IPO is close to zero. No money is channeled through the stock market to real business projects and ordinary transactions do not add much to the final volume of economy's output. Therefore, at this point, it would be logical to position stock market as a forecasting instrument, rather than a determining factor of growth.

Another conclusion drawn from the study of impulse responses is that Ukrainian stock market indeed plays rather an indicative than a productive role in economy. Relying on the mentioned study we state that the stock market reacts faster to changing environment and gives a lead to gross domestic product. GDP growth, in its turn, is too slow to affect SM activity, at least at this stage. Moreover, stock market embodies a huge potential in explaining volatility in GDP. Our results, derived from forecast-error variance decomposition, imply that stock market index has a ponderable explanatory power over deviations in GDP growth rate.

Ukrainian stock market is functioning spontaneously and sometimes even in contrast to all expectations, like it did for a few consequent months at the beginning of year 2006. Nevertheless, we believe that it is only a matter of time that Stock Market Index becomes a major indicator of impending swings in economic performance. The reasons for that are pretty straightforward:

a. joint stock company is the most reliable and transparent form of ownership. By transforming their businesses and going public enterprises will improve the capitalization of the stock market;

b. foreign capital entering Ukrainian economy will most probably connect itself to the outstanding shares, thus, promoting stock market activity.

Though, in our opinion, SMI should be interpreted only within a complex of indicators, since its own meaning can yet be deceitful.

Stock Market proved to be a reliable and significant indicator of economic growth in many countries. It is no secret that S&P 500 or Dow Jones are closely monitored by investors from all around the world in anticipation of impending events and they are often regarded as "heralds" of economic forthcomings. There is no way developing economy can evolve without perfectly operating stock market, so Ukraine will sure meet high standards of financial performance in the

future. Stock Market then will become a perfect leading indicator of economic growth.

Long-run causality effects might be ensured as well. In order to strengthen financial sector performance, improve ties within the net of financial intermediaries and promote the sought finance-growth relationship we would suggest a few ultimate measures. Namely:

a. make the market credible. As of now, no more than 1% of private savings reside on the stock market. Foreign agencies are reluctant to increase our crediting rating;

b. provide incentives for IPOs. Entrepreneurs are underestimating the possibilities embodied in the stock market. Learning to use outside sources will make difference;

c. attract some assistance from abroad. That includes consultations of recognized experts, collaboration of our financial institutions with similar ones from abroad, not to mention investments.

Proper functioning and overall significant performance is a reality for Ukrainian stock market, though success is subject to the whole spectrum of innovative undertakings. The success will become more likely as soon as the incoming international players in the banking sector stabilize the situation and make the public feel more secure. Banking sector will work then in unison with a productive sphere. Other intermediaries will follow.

The research of this interdependence could be advanced further by means of introducing new data on different financial intermediaries. For example, accounting for private investment funds would improve the precision of results. Unfortunately, this data is not available at the moment. Another chance to improve results is to collect data on Stock Market Capitalization, which will certainly add to our understanding of financial sphere progress.

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APPENDIX A
STATA output

Table A-1. Number of Lags

	First model			***Second model***	
Lag	*HQIC*	*SBIC*		*HQIC*	*SBIC*
0	4.9908	5.0562		2.4208	2.5026
1	-3.1522*	-2.8252*		-6.5325*	-6.0421
2	-3.0509	-2.4624		-6.3659	-5.4668
3	-2.7435	-1.8934		-6.2254	-4.9176
4	-2.7389	-1.6272		-6.0293	-4.3128

Table A-2. Stationarity of Data

Augmented Dickey-Fuller test for unit root				
	Test Statistics	*1% Critical Value*	*5% Critical Value*	*10% Critical Value*
d.lnGDP	-5.676	-3.523	-2.897	-2.584
				P-value for Z(t) =0.000
d.lnSMI	-3.738	-3.523	-2.897	-2.584
				P-value for Z(t) =0.004
d.lnSMT	-5.582	-3.523	-2.897	-2.584
				P-value for Z(t) =0.000
d.lnTBC	-2.937	-3.523	-2.897	-2.584
				P-value for Z(t) =0.041
d.lnAMW	-4.448	-3.523	-2.897	-2.584
				P-value for Z(t) =0.000

APPENDIX B
Data graphs

Figure B-1. GDP evolution over time

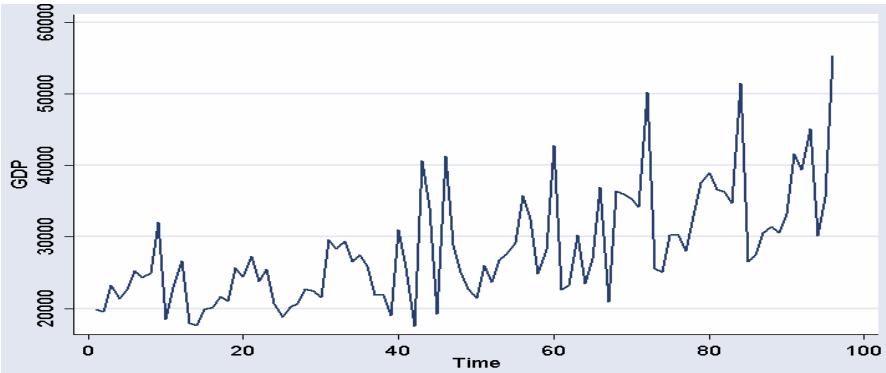


Figure B-2. SMI evolution over time

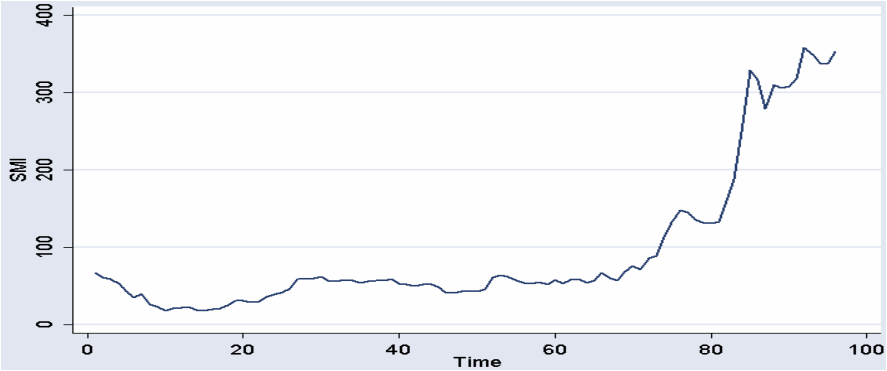


Figure B-3. SMT evolution over time

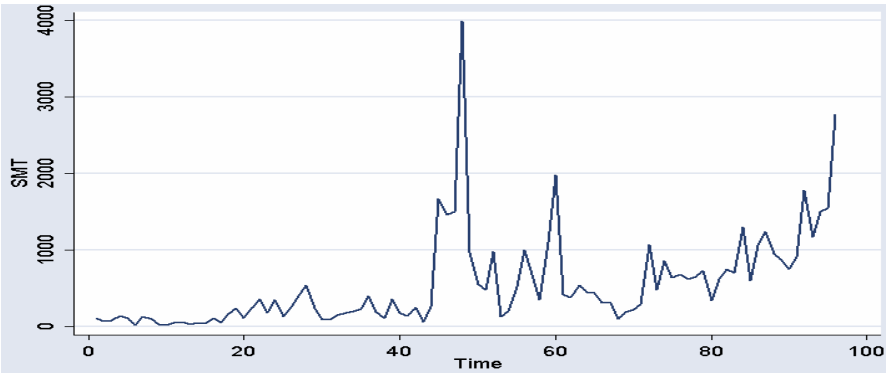


Figure B-4. TBC evolution over time

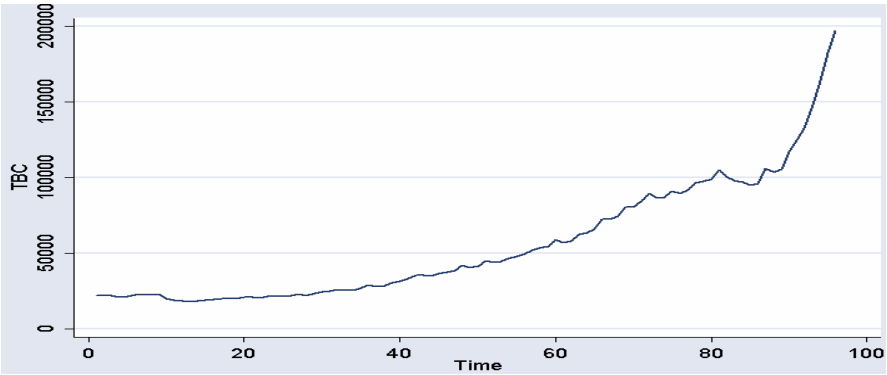
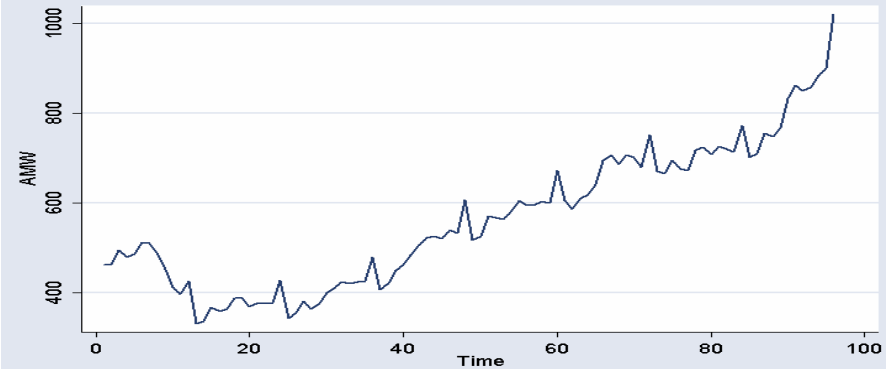


Figure B-5. AMW evolution over time



APPENDIX C
Postestimation Tests

Table C-1. Test for Autocorrelation

Lagrange-multiplier test								
First model					*Second model*			
Lag	χ^2	*df*	$P > \chi^2$		*Lag*	χ^2	*df*	$P > \chi^2$
1	19.633	16	0.237		1	27.815	25	0.316
2	21.422	16	0.163		2	14.646	25	0.949
H0: no autocorrelation at lag order								

Table C-2. Test for Stability

Eigenvalue stability condition				
First model			*Second model*	
Eigenvalue	Modulus		Eigenvalue	Modulus
.8610177	.861018		-.4522282 + .76697i	.890367
-.423614 + .6874184i	.807461		-.4522282 - .76697i	.890367
-.423614 - .6874184i	.807461		.8269411	.826941
-.3453044 + .677351i	.760289		-.394667 + .6955964i	.79976
-.3453044 - .677351i	.760289		-.394667 - .6955964i	.79976
.04058321 + .6258249i	.627139		-.7100442 + .2989163i	.770398
.04058321 - .6258249i	.627139		-.7100442 - .2989163i	.770398
-.5610531 + .1665527i	.585252		-.2138423 + .7250463i	.755924
-.5610531 - .1665527i	.585252		-.2138423 - .7250463i	.755924
.3780361 + .3756631i	.532948		.2692681 + .7011907i	.751115
.3780361 - .3756631i	.532948		.2692681 - .7011907i	.751115
.3035195	.30352		-.734269	.734269
			.5361934 + .3720742i	.652643
			.5361934 - .3720742i	.652643
			-.0468797 + .6003789i	.602206
			-.04687972 - .6003789i	.602206
			.5515256	.551526
			.4520183 + .2813369i	.53242
			.4520183 - .2813369i	.53242
			-.504509	.504509
All eigenvalues lie inside the unit circle. VAR satisfies stability condition				

NOTES