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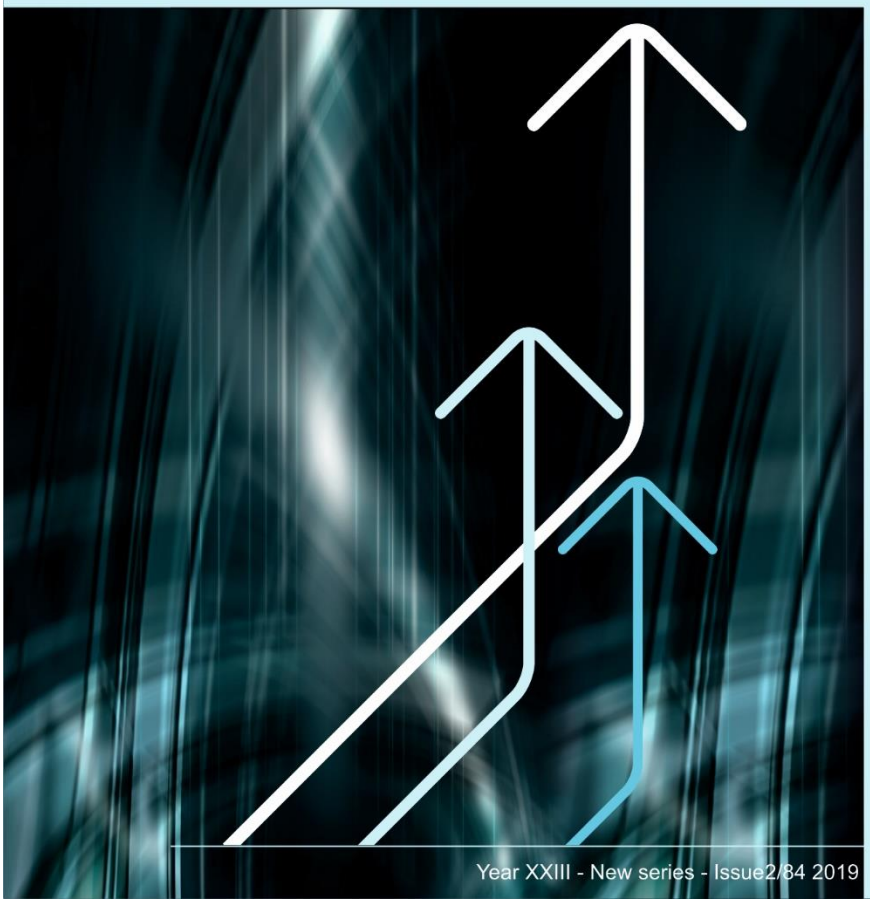

Year XXIII - New series - Issue2/84 2019

“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

ROMANIAN ACADEMY
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Quarterly journal of financial and monetary studies

EDITORIAL BOARD

Issue 2/2019 (84,Year XXIII)
ISSN 2066 - 6071
ISSN-L 2066 - 6071

Contents

PROSPECTS AND CHALLENGES FACING FRONTIER STOCK MARKETS IN THE WESTERN BALKANS: QUO VADIS?[1]

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Abstract

The aim of the research paper is to present empirical results on a tested framework of factors influencing selected frontier stock markets of the Western Balkan countries in their accession path to the European Union. These stock markets are juxtaposed with the frontier stock market of Bulgaria – a country full member of the EU in the course of 11 years now, thereby inferring important comparative conclusions. Based on the comparative analysis between the capital markets in Southern and Eastern Europe (including that of Bulgaria), the paper proposes tentative insights into the road ahead for future regional integration and financial development of the capital markets of the Western Balkans.

Keywords: frontier stock markets, emerging stock markets, financial integration, financial development

JEL Classification: G10, G23, G28

1. Introduction

Stock markets influence economic growth by promoting savings and improving the quality and quantity of investments. Emerging markets in particular need to boost economic growth by offering diverse financing opportunities to SMEs at lower financing costs. This decreases their dependence on bank financing and reduces their exposures to the risk of squeezed lending in constrained

[1]*The present research is an updated part of a completed individual academic research project of the author at Economic Research Institute of the Bulgarian Academy of Sciences: Stefanova, J. (2017). Capital markets in Southern and Eastern Europe countries upon their preparation for EU accession. Sofia. ZaPechat.com. ISBN 978-954-2987-25-3. http://www.bg.cobiss.net/scripts/cobiss?id=1017386077400684*

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economic situations. Empirical studies linking the development of stock markets with economic growth reported positive correlation (Levine and Zervos, 1998), especially in emerging markets with positive effects on GDP per capita, reduced credit risks and increased level of legal protection (Durham, 2000).

The major function of stock markets is to serve as a mechanism to transform savings to finance the real sector (Baumol, 1965). Moreover, they can lead to increased efficiency of the financial system by encouraging competition in the financial sector, pushing down the cost of financing for companies, increasing transparency, reducing asymmetric information and establishing financial discipline in economic governance. This is especially becoming an ever-important issue in the current digital global economy environment and the ongoing discussions about the gains and losses from trade, financial and digital integration and disintegration processes (Peterson Institute for International Economics, 2019).

In theoretical terms, there are two basic traditional approaches to assess the development of capital markets: 1) institutional approach and 2) macroeconomic approach. The digitalization of the financial markets worldwide presently requires introduction of a third strand as well, namely 3) technological & digital approach (TD) (IMF, 2018). Future research directions may require establishment of a fourth strand of factors influencing stock market development in the light of the new inter-disciplinary approach (Batten, 2017; Burke et al., 2015) as 4) climatic changes and environmental disasters and their impacts on economic development in general (IMF, 2019).

2. Objectives, limitations, hypotheses and methodology of research

The objective of the research paper is to empirically test a framework of macroeconomic an institutional factor influencing financial development in frontier stock markets in the Western Balkans. It does not include analysis of microeconomic factors: supply side factors, based on the pecking order theory of capital structure; nor demand driven factors as risk-return preferences in respect of the funds invested, nor climatic or technological factors, which will be object of future research. The tested framework of institutional and macroeconomic variables includes data from World Bank Worldwide

Governance Indicators and World Development Indicators database for the period 2004 – 2017 as follows:

A) Institutional variables: political stability and absence of violence/terrorism; control of corruption; regulatory quality; voice and accountability; government effectiveness; rule of law.

B) Macroeconomic variables: FDI as % of GDP; domestic credit to private sector as % of GDP; real interest rate; GDP growth per capita; inflation (GDP deflator); gross domestic savings as % of GDP; gross fixed capital formation as % of GDP; trading volume as % of GDP; broad money as % of GDP.

The research rationale is to test a theoretical framework of institutional and macroeconomic variables and their impact on stock market development in selected frontier stock markets in the Western Balkans, namely Republic of North Macedonia, Serbia, and Montenegro – countries on their path to accession to the European Union, against stock market development of another frontier capital market, namely that of Bulgaria – a country which has been a full-fledged member of the European Union for 11 years till the present, and to draw some conclusions about the natural evolutionary path of development of frontier markets toward emerging markets upon the realization of certain conditions. The methodology of the research has been based on a modification of the Calderon-Rossel model (1991), El-Wassal (2005, 2013) and Garcia and Liu (1999) framework of variables. Specifically, the model of Calderon-Rossel and the modified model of Garcia and Liu studied emerging markets in countries of Latin America and Asia. These models have reached results that GDP growth, domestic investments and the development of the sector of financial intermediation are important factors in this process. Then, El-Wassal (2005) has researched the link between stock market development and economic growth, financial liberalization and foreign portfolio investments in approximately 40 emerging markets between 1980-2000 and found out that economic growth, policy measures for financial liberalization and increased volumes of foreign portfolio investments are major factors determining stock markets' development in emerging economies.

The empirical design includes application of an Engle-Granger or autoregressive regression (AR) model consistently for each of the analysed countries in the Western Balkans. Dependent variable in each case is market capitalization/GDP of the respective frontier market stock exchange. Initially an Augmented Dickey Fuller (ADF) is

applied to all tested variables included in the model to determine their stationarity.

The research paper has formulated two testable hypotheses as follows:

1) Although being a full-fledged member of the European Union eleven years till the present, the frontier capital market of Bulgaria has not been upgraded to status of emerging market (as per MSCI classification) due to persisting institutional environment weaknesses at the background of improving macroeconomic conditions.

2) The evolutionary path forward to the frontier stock markets of the selected Western Balkan countries requires significant changes in the institutional and macroeconomic setting. This could hardly be achieved in the course of a decade due to the wider costs of re-adjustments to current financial integration and disruption processes (Peterson Institute for International Economics, 2019).

3. Specifics of frontier stock markets

Within the present research design framework, the case in point is presenting and discussing some stylized facts about frontier stock markets from theoretical and practical point of view. The main specifics of these of stock markets in general, and for the analyzed Western Balkan countries in particular, can be summarized as follows:

Table 1

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
1) Definition used	Belonging to low to upper-middle income developing countries; not fulfilling the criteria of global bond and equity indices; having less developed capital markets; with structural weaknesses (illiquid, non-transparent and low regulation levels; high-transaction costs); higher idiosyncratic risks (i.e. political and currency risks) and higher volatility (IMF, 2014b)(MSCI, 2018)

Source: see cited academic sources within the table

Regarding the countries in the analysis, all of them belong to the group of upper-middle income states according to the World Bank (GNI per capita between USD 3,896 and USD 12,055). Among the

Western Balkans countries aspiring for EU membership the highest GNI p.c. has been realized by Montenegro (USD 7,350 by 2017), yet it is still 22 % of the EU average income (which for 2017 is USD 32,777 by World Bank data). In comparison, for Bulgaria, the GNI p.c. in 2008 when the country became member of the EU, stood at USD 6,100 and by 2017 it had slightly risen to USD 7,760 (or representing 24 % of EU GNI p.c.) (see: https://data.worldbank.org/region/european-union).

Table 2

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
2) Asset returns	Good diversification strategy due to low correlation with global market returns due to low levels of integration with global financial markets (Berger, Pukthuanthong & Yang, 2011; Oey, 2014; IMF, 2016). Annualized returns for all FM are 11% (Vanguard research, 2013) while according MSCI annualized returns since 2002 were 7,49%.

Source: see cited academic sources within the table

The MSCI Serbia index since 2008 has realized negative annualized return of -12,10%; for Bulgaria since 2005 it stood on negative ground at -9,46%; for Bosnia and Herzegovina since 2010 annualized returns were also negative -2,82% (MSCI Index, 2019).

Table 3

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
3) Attraction of private equity flows	Between 2000-2014 portfolio flows exceeded those to emerging markets by 1.4 % of GDP (IMF, 2016)

Source: see cited academic sources within the table

Regarding Serbia, the average portfolio investments for the period 2014 – 2018 were negative -1,1 % of GDP, while the FDI balance stood at 4,9 % of GDP (IMF, 2017). For Bulgaria during 2013-2018, average portfolio investments were on negative ground of -0,1% of GDP and annualized FDI amounted to 3,67 % of GDP (IMF, 2018).

In Republic of North Macedonia during 2012-2018, portfolio investments represented also negative, -1,7 % of GDP, while FDI registered annualized fall by 2,7 % of GDP due to high corruption levels, regulatory and institutional weaknesses (IMF, 2017). In Montenegro for the same period portfolio equity investments registered positive annualized average growth of 0.7 % of GDP, while annualized average FDI was 11,2 % of GDP.

Table 4

Frontier stock markets – Stylized fact

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
4) Financial integration	Before 2008 the correlation between FM bond index returns and global bond market returns is insignificant, while after 2008 it has become comparable to that of Emerging Markets (beta of approximatelly 1.7) (IMF, 2016). Between 2002-2013 average intercountry correlation among MSCI FM index stood at 0.36 (Rowader, 2015)

Source: see cited academic sources within the table

For the period 2004-2014 the correlation coefficient between the regional stock exchanges in the Western Balkans has been as follows (Stefanova, 2017):

1) moderately strong correlation existed between Serbia and Republic of North Macedonia 0,521; Republic of North Macedonia and Montenegro 0,514; Bulgaria and Republic of North Macedonia 0,425.

2) strong correlation existed between Montenegro and Serbia 0,937; Bulgaria and Serbia 0,993; Bulgaria and Montenegro 0,966.

Table 5

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
5) GDP growth rate	Over 2008-2013 median compound annual growth rate among FM economies was 3.2% while till 2017 it expanded at a median rate of 3.5 % (Rowader, 2015).

Source: see cited academic sources within the table

According to IMF reports (2017, 2018) for 2013-2018 annualized average GDP growth in Montenegro stood at 2,7 %; in Bulgaria it also was 2,7%; in Serbia it was 1,83 % and in Republic of North Macedonia GDP grew at 2,9 %, i.e. lower economic growth in all analysed countries than the median rate for FM economies.

Table 6

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
6) Stock market value	Stock market value is equivalent to a median value of 23.4 % of GDP (Rowader, 2015)

Source: see cited academic sources within the table

For the analysed period 2006-2017 the annualized average stock market capitalization in the countries from the Western Balkans was as follows: in Serbia 26,36 % of GDP; in Bulgaria 18,16 %; in Republic of North Macedonia 28,64% and in Montenegro 77,80 %.

Table 7

Frontier stock markets – Stylized facts

Stylized Fact	**Frontier Markets (FM)** Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
7) Volatility	Average annual volatility of FM 2003-2014 was 18.88 % (Rowader, 2015)

Source: see cited academic sources within the table

For the analysed countries in the report average annualized volatility of the stock market index on the respective stock exchange was as follows: 10 years' standard deviation of index return for Bulgaria 29,23 %; for Serbia 34,62 % and 5 years' standard deviation of the index return for Bosnia and Herzegovina was 15,09 %. The 10 years' average annual volatility of MSCI Frontier Markets index stood at 15,57 %, while MSCI Advanced Markets Index was 14,65%.

Table 8

Frontier stock markets – Stylized facts

Stylized Fact	Frontier Markets (FM) Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
8) Liquidity	Limited liquidity. Stock markets dominated by major institutional investors. Since 2000 turnover of FM was less than 20% and FM needed 10 trading days to liquidate 94 % of the portfolio (Vanguard Research, 2013).

Source: see cited academic sources within the table

Regarding the countries, included in MCSI Frontier Markets index, the turnover ratio (a proxy for liquidity) stood at: Serbia 0,42 % (2018); Bosnia and Herzegovina 0,00 %. The MSCI Frontier Markets index turnover ratio amounted to 11,80 % in 2018. Regarding Bulgaria for the period 2004 - 2017 annualized average turnover ratio was 18,7%, and in 2018 it climbed up remarkably to 35,15%. One of the reasons for the change could be explained with the introduction of the new EU regulatory regime for algorithmic and high-frequency trading which led to significant reductions of these practices on the Bulgarian stock exchange (Stefanova, 2018).

Table 9

Frontier stock markets – Stylized facts

Stylized Fact	Frontier Markets (FM) Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
9) Operational Complexity	Less automated settlement process; higher trading costs due to complex custodian relationships; ownership restrictions (IMF, 2014)

Source: see cited academic sources within the table

All the analysed stock exchanges in the Western Balkans have introduced electronic trading systems: Bulgarian capital market has been using the Frankfurt stock exchange trading system Xetra since 2008; the other stock markets are using also electronic trading systems: Serbia: BELEx Fix; Bosnia and Herzegovina stock market in Sarajevo uses SASE; Montenegro stock exchange uses BTS trading system. The analysed countries do not impose restrictions to foreign

trade and the relations are based on concluded double taxation treaties. The capital gains tax imposed is as follows: Serbia 15 %; Bosnia and Herzegovina 10 %; Republic of North Macedonia 10 %; Montenegro 9 %; Bulgaria 10 %.

Table 10

Frontier stock markets – Stylized facts

Stylized Fact	Frontier Markets (FM) Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
10) Fiscal stability	FM mean public debt as a % of GDP by 2014 stood at 48.2 % (IMF, 2014).

Source: see cited academic sources within the table

The annualized mean public debt during the period 2013 -2018 for the countries under analysis is: Montenegro 67% of GDP; Republic of North Macedonia 37,2 % of GDP; Serbia 79,9 % of GDP; Bulgaria 24 % of GDP.

Table 11

Frontier stock markets – Stylized facts

Stylized Fact	Frontier Markets (FM) Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
11) Political Environment	Lower rankings in terms of economic freedoms by Heritage Foundation (2018)

Source: see cited academic sources within the table

For 2018 Heritage Foundation has determined that in the group of mostly free countries from the research paper sample is only Republic of North Macedonia (33rd rank); while in the group of moderately free countries belonged Bulgaria (47th rank); Montenegro (68th rank); Serbia (80th rank) and Bosnia and Herzegovina (91st rank).

Table 12

Frontier stock markets – Stylized facts

Stylized Fact	Frontier Markets (FM) Bulgaria, Republic of North Macedonia, Serbia, Bosnia and Herzegovina (MSCI, FTSE, S&P, Russell)
12) Corruption	Lower rankings in terms of corruption control (Transparency International, 2018)

Source: see cited academic sources within the table

Transparency International has ranked the countries in the present analysis in 2017/2018 as follows: lowest perception of corruption has been registered for Montenegro (64th rank of 180 countries); followed by Bulgaria (71st rank); Serbia (77th rank); Bosnia and Herzegovina (91st rank) and highest perception for corruption in Republic of North Macedonia (107th rank).

4. Prospects and challenges for regional financial development in selected Western Balkan frontier stock markets

The financial development of the Western Balkans is part of the overall process of preparing the countries in the Western Balkans for accession to the EU. In this report, there are only three countries in the Western Balkans that are in an advanced stage of preparation for EU accession, namely Serbia, Montenegro and with some conditionality, Republic of North Macedonia. Regional adaptation of the capital markets in the Western Balkans is expected to be a slow and difficult process. Progress can be expected in harmonizing the laws of these countries in line with EU requirements but given the extreme underdevelopment of these countries' capital markets, market practices are expected to be well behind the legislative framework. Problematic factors to the capital markets in the Western Balkans remain the limited range of financial instruments, significant fluctuations in the prices of traded financial instruments, lack of built-in clearing and other infrastructures for introducing new financial instruments such as warrants, derivatives, etc. (see point 2 above).

EU policy towards the countries of the Western Balkans is aimed at deepening the cooperation and integration of the countries in the region as a condition for achieving full EU membership and a course towards their integration in the EU through a strategy for adjustment of their economies. Candidate countries should meet the

Copenhagen criteria (1993), which include institutional aspects (such as institutional stability, democracy and law enforcement, etc.) and economic aspects (such as a functioning market economy, ability to meet competitive pressure and adapt to market forces in the EU). In addition, the requirement for compliance with the Madrid criteria is included, such as the need to develop administrative and judicial capacity to implement the EU acquis Communautaire. A report by the European Commission on the promotion of EU enlargement (2018) outlined recommendations for reforming the rule of law, safeguarding the fundamental rights, fighting corruption and organized crime and improving the functioning of democratic institutions. For Montenegro and Serbia, the accession process is expected to be realized in perspective by 2025. In the current period, the intermediate objective of the preparatory process for Serbia is the challenge of normalizing relations with Kosovo, as regional cooperation and good neighbourly relations are an important part of the evaluation of the progress in preparation for EU membership of each of the analysed Western Balkan candidate countries.

The Regional Cooperation Council has an important role to play in promoting regional cooperation in the Western Balkans through the "Southeast Europe 2020 Strategy: Jobs and Prosperity in a European Perspective" adopted in 2013. It aims to achieve economic growth in SEE through 86 measures in 16 directions, respecting the principles of regional support for EU accession through shared implementation of regional and national commitments and political will to achieve ambitious goals such as increasing the average GDP of per capita to 44% of the EU average by 2020, increasing total intra-regional trade in SEE and reducing trade deficits to 12% of GDP by 2020. The current global realities of disruptions in trade, financial disintegration threats and rising risks from digitalization and cybersecurity may require serious re-definition of the established targets in Southeast Europe 2020 Strategy.

By 2017, in the analysed Western Balkan countries, stable macroeconomic indicators have been achieved by **Montenegro** (as GDP growth) due to investment projects undertaken in public infrastructure and active tourism. Montenegro would need time to meet the Maastricht criteria due to a significant government debt-to-GDP ratio of 78% and a budget deficit of 7% of GDP (IMF, 2018). Incoming FDIs have reached 11% of GDP and cover over 60% of the current account deficit. The IMF projections are for an expected fall in GDP

growth by 2019 due to worsened demographic trends and external risks such as strong dependence of the country on FDI and external financing.

As far as **Serbia** is concerned, economic growth in the country remains heavily dependent on such factors as public sector reform, a reduction in the share of the grey economy, elevating the efficiency of judicial and tax systems. The main engines of economic growth in Serbia remain net exports, recovery of industrial production and investment. Net incoming FDIs by 2017 stood at 6% of GDP and fully covered the current account deficit. An IMF report (2017) made recommendations for building sustainable institutions in Serbia as a step for further economic growth and EU accession.

In **Republic of North Macedonia**, the lowest GDP growth rate has been reported in recent years due to political instability and the need to undertake comprehensive structural reforms in the institutional environment, stimulation of employment and social inclusion, budget consolidation. Due to a significant drop in FDI levels reaching 2.6% of GDP by 2018, an increased external debt of 70% of GDP is reached in the course of the outflow of foreign investors due to rising political instability in the country and the increased perception of corruption levels.

According to the Corruption Perceptions Index of Transparency International, Montenegro ranks 64th, followed by Bulgaria (71st rank), Serbia (77th rank), Bosnia and Herzegovina (91st rank) and Republic of North Macedonia at 107th rank. Then the Global Competitiveness Index 2017-2018, which has not ranked Republic of North Macedonia, positions Montenegro at the 77th place out of 137 countries, followed immediately by Serbia (78th position) from the group of member states from the Western Balkans aspiring for EU accession. Bulgaria, as a full member of the EU for 11 years till the present, has reached 49th rank. For the Western Balkan countries, in general, problematic factors for increasing the competitiveness of their economies remain factors such as: 1) limited access to finance; 2) corruption; 3) ineffective government bureaucracy.

The results of the Global innovation index for 2018 showed that Montenegro is the leading innovative country among the EU aspiring Western Balkan countries (52nd position in 126 countries), followed by Serbia (55th position) and Albania (83rd position). By contrast, Bulgaria being a member of the EU ranks ahead at 37th due to constantly improving business environment for innovations.

A step in the regional financial integration of the frontier stock markets in the Western Balkans was setting up SEE Link as the regional technology platform for stock trading between the Bulgarian, Macedonian and the Croatian stock exchanges in 2014 with the financial support of the EBRD. The aim of the trading platform is to attract foreign investors from the regional capital markets, to improve the visibility of stock exchanges and increase their efficiency. By 2018, members of SEE Link trading platform are: Bosnia and Herzegovina, Croatia, Greece, Republic of North Macedonia, Serbia, Bulgaria and Slovenia.

Table 13

Market capitalization in selected Western Balkan countries (before and after SEE Link was created) in billion USD

Year	Republic of North Macedonia	Serbia	Bulgaria	Montenegro (not a member of SEE Link)
2006	2,04	10,8	8,9	1,9
2007	5,8	23,7	17,1	3,9
2008	2,3	12,6	7,3	1,9
2009	2,6	11,4	6,9	2,3
2010	2,5	1,5	6,3	2,3
2011	2,4	1,7	7,3	2,7
2012	2,3	7,5	5,8	2,9
2013	**2,1**	**7,9**	**5,9**	**2,8**
2014	1,8	2,8	5,6	2,9
2015	1,8	2,7	5,1	2,9
2016	2,2	2,1	5,7	2,9
2017	2,3	2,5	13,9	2,8

Source: the author, according to data from the stock exchanges of the respective countries and the Worldbank database

As seen from Table 13 above, since the creation of SEE Link in 2014, the stock exchanges of the SEE Link member states reported a slight increase in their market capitalization. There are still **problematic factors** behind the potential for successful regional financial development in the analysed countries of the Western

Balkans, besides the stylized facts about frontier stock markets, analysed in point 2 above, including:

1) a structural barrier to the potential for deep capital markets development remains the small size of the economies of these countries.

2) all analysed stock markets continue to be classified as "peripheral" or "frontier" because of their low level of economic development, a significant share of state ownership in the equity of publicly listed public companies, tax constraints, underdeveloped infrastructure for offering innovative financial products.

3) lack of initial public offerings, which indicates that companies in the region have no interest in the capital markets as an alternative way of financing, and dominance of banks as a major source of financing for SMEs.

4) the need for reforms of pension systems, which is expected to contribute to the development of capital markets in the Western Balkans in the future by removing existing restrictions on voluntary pension funds and insurance companies to invest in shares in public companies.

5) despite the implementation of corporate governance codes developed in close cooperation with international institutions, which is binding on companies listed on Western Balkan stock exchanges, many of these companies do not provide public information on the corporate social policy they follow and, in this respect, activities for maintaining relations with investors is at an early stage.

6) In the Western Balkan countries, the privatization process is not yet over, and this influences the volatility of their capital markets. Many companies in the real sector face bankruptcies, high indebtedness, limited access to finance, inefficient asset and equity management, and a low degree of flexibility of the capital structure of public companies. Moreover, in the course of the privatization, dominate the sales to strategic investors or employee-management privatizations, resulting in a high concentration of equity ownership.

7) last but not least, a significant challenge remains improving liquidity of the government securities market (especially the secondary one), activating the repo-market development and the more active use of money market instruments. Excluding Bulgaria (being under currency board regime), the repo markets are dominated by central bank interventions through interbank lending and repo transactions.

Among the important **enabling factors** for the future success of the regional financial development and technological integration of the Western Balkan stock exchanges are:

1) the potential for harmonization of trading rules and the general regulatory framework for capital markets in the current stage preparing aspiring Western Balkan countries for full EU membership.

2) a similar degree of stock market (under)development.

3) increasing the visibility of stock markets with further diversification of the financial products offered (especially with the potential for introduction of structured and derivative securities in the future in SEE Link) and access of SMEs to stock equity financing through future development of specialized segments at stock exchanges for securities trading of SMEs (as BEAM segment at the Bulgarian stock exchange).

4) all these stock exchanges have established cooperation agreements with other exchanges in the South-eastern Europe region, which is indicative of their aspirations to deepen regional cooperation.

5) a number of empirical studies (Stefanova, 2017; Stoykova and Paskaleva, 2018) have established strong correlations between stock exchanges in SEE (especially between the stock exchanges of Bulgaria, Serbia and Montenegro, where the correlation coefficients are above 0.9).

Last, but not least, the regional financial development in Western Balkan EU aspiring countries cannot be considered as happening in a vacuum, and may be confronted by **global risk factors,** arising from challenges as:

1) increasing vulnerabilities from trade protectionist measures which call into question the distribution of gains and losses from trade liberalization policies, especially in peripheral countries in the long run.

2) financial integration is facing disruptive threats world-wide arising from digitalization of financial services, cyber-security risks, deepening and persisting social inequalities etc. which require strengthened resilience in the mix of macroprudential policies and increased international cooperation efforts for setting harmonized rules providing equitable distribution of costs and benefits from financial integration, particularly for peripheral countries.

5. Discussion of results regarding framework of factors influencing frontier stock markets in the Western Balkans

5.1 Macroeconomic factors

Applying a model of multivariate regression analysis and Engle-Granger cointegration for the countries of the Western Balkans between 2006-2017 the following statistically significant **macroeconomic factors** influencing their stock markets (respectively - their market capitalization) have been identified:

Serbia

The applied Engle-Granger cointegration model for the period 2006-2017 did not establish existence of **statistically significant** macroeconomic factors on the market capitalization rate in Serbia (see Table 6A, in the Appendix). However, in a study (Stefanova, 2017, pp162-163) of Southern and Eastern Europe applicant countries, specifically for Serbia a multi-step regression model established the following:

1) gross savings as a % of GDP (+) (Sig., 000). This is consistent with an IMF study (2008) which found out that gross savings were positively correlated with market capitalization but were statistically insignificant in explaining the development of emerging stock markets due to the dominance of banking intermediation in the financial system.

2) FDI as% GDP (Sig.000) (+). A similar correlation between market capitalization and FDI/ GDP ratio has been established by the author in a study of capital markets in Romania and Croatia (Stefanova, 2017), while Furstenberg (1998) concluded that financial integration of a country could be promoted by enhancing competition and technology transfer, which is the result of foreign participation in a given market. Thus, according to Montiel (1994), countries characterized by a high degree of financial integration with the rest of the world, ceteris paribus, should attract average larger gross capital flows.

Montenegro

The applied autoregressive model (see Table 4 in Appendix) established the existence of the following **statistically significant** relationships between market capitalization rate and included factor macroeconomic variables:

1) real interest rate (p-value 0.0050) (+). Interest rates are an important economic variable directly related to economic growth and associated with the cost of capital. When real interest rates rise, this

leads to a reduction in investment in the economy and is one of the reasons for the decline in market capitalization (ie stock prices). For Lee (1997), the relationship between these two variables is not stable over time (i.e., it is non-linear), gradually changing from a significantly negative to a lack of dependence or even a positive (but insignificant) dependence.

2) domestic credit to nonfinancial institutions/ GDP (p-value 0.0085)(-). This is an evidence of the underdevelopment of the stock market and dominance of the banking sector in the financial intermediation.

3) gross domestic savings rate (p-value 0.0069)(-). Similar negative relationship was established by Garcia and Liu (1999) for Latin America supporting the fact that greater part of domestic savings is intermediated through the banking system.

4) value of trade/GDP (p-value 0.0084)(-). This is an evidence of concentrated ownership structure with low level of free float and dominance of institutional investors on the stock market following „buy-hold" strategies.

5) broad money/GDP (p-value 0.0045) (+). As a measure of the size of banking sector, this positive relationship supports other empirical studies (Boyd & Smith, 1996) that on emerging stock markets banks and the stock exchange are complementary sources of financing.

6) FDI/GDP (p-value 0.0231)(-). This negative relationship supports the evidence that during the analysed period significant part of capital in Montenegro was accumulated through FDI inflows and not through the intermediation of the stock exchange.

7) inflation rate (p-value 0.0239)(+). The positive relationship is indiciative of the stabilizing role of moderate inflation on boosting stock market activity and is in line with empirical results of Boyd and Smith (1996, 2001) about the non-linear relationship between inflation and financial development.

8) gross fixed capital formation (p-value 0.0110)(+). As the stock exchange with the highest annualized stock market capitalization in the analyzed period (see Table 6 above), the postitive relationship is indicative of increased role of the stock exchange in Montenegro in transformation of savings to investment projects.

The Republic of North Macedonia

The applied weighted least square model (see Table 2 in Appendix) on the macroeconomic factors influencing stock market

capitalization did not establish **statistically significant** relationships for the analysed period. However, another study (Stefanova, 2017) on the Macedonian stock market underlined the importance of real GDP growth per capita (p-value 0.006) (+). Demirguc-Kunt & Levine (1996a), Levine & Zervos (1998) also confirmed a positive two-way relationship between economic growth and long-term stock market development.

Bulgaria

Obvious from Table 7 in Appendix, the empirical results for Bulgaria are as follows:

1) the real interest rate (p-value 0.0546) (+). An increase in the real interest rate by 1 pp is associated with a rise of the market capitalization rate by 1.90271 p.p.

2) domestic credit to non-financial institutions/GDP (p-value 0.0105)(-) whereby increase by 1 pp was associated with decline in market capitalization by 2.77 pp.

These empirical results for the Bulgarian stock exchange confirm the underdevelopment of the capital market under the period 2006-2017 and the dominance of the banking sector (providing funding for investment mainly by the banking sector) as shown by 2) above.

5.2. Institutional factors

As a second step, an application of an autoregression model and/or Engle-Granger cointegration model to test the relationship between market capitalization and institutional variables on the stock exchanges in the Western Balkans between 2006-2017, identifies the following statistically significant relationships:

Serbia

The applied Engle-Granger cointegration model (Table 5 in Appendix) did not establish **statistically significant** relationships for Belgrade stock exchange, although the results are indicative of improved estimates for the rule of law, but worsened estimate for control over corruption

Republic of North Macedonia

For this stock market (see Table 1 in Appendix), **statistically significant** institutional variables for the period under review are:

1) the deteriorated estimate of corruption control (p-value 0.0118)(-), whereby decrease by 1 pp. has led to a decrease of the market capitalization by 212 pp.

2) the worsened government effectiveness score (p-value 0.0172)(-), whereby decrease by 1 pp. has led to a decrease of the market capitalization by 106 pp.

3) the deteriorated assessment of the rule of law (p-value 0.0318)(-), whereby decrease of 1 pp. is associated with a fall of the market capitalization by 168 pp.

4) improved estimate of voice and accountability (p-value 0.0091)(+) boosted market capitalization rate by 217 pp.

5) deteriorating estimate of political stability (p-value 0.0572)(-) was associated with fall in market capitalization rate of 16 pp.

Montenegro

The results for Montenegro (see Table 3 in Appendix) identified the following **statistically significant** dependencies between market capitalization and institutional variables:

1) improved rating for regulatory quality (p-value 0.0022)(+) led to an increase in market capitalization rate by 1,423 pp.

2) improved estimate of the indicator for government effectiveness (p-value 0.0053)(+) was associated with an increase of the market capitalization rate by 1,402 pp.

3) worsened estimate of rule of law (p-value 0.0076) (-) was associated with a drop in market capitalization rate of 1,819 pp.

Bulgaria

Last but not the least, the empirical results (see Tables 8 and 9 in Appendix) show the following **statistically significant** institutional factor associated with the stock market capitalization ratio:

1)improved estimate of voice and democratic accountability (p-value 0.0199)(+) is associated with an increase of the market capitalization of the stock exchange in Bulgaria by 149 pp.

2) improved estimate of political stability (p-value 0.0017)(+) was related with boost of market capitalization of 28.05 pp.

3) heightened control of corruption (p-value of 0.0469)(+) cointegrated with rising market capitalization by 21.92 pp.

4) worsened estimate of regulatory quality (p-value of 0.0075)(-) associated with fall in market capitalization by 19.65 pp.

The model applied is adequate (p-value 0.000060) and explained over 90 % of the changes in the market capitalization rate in Bulgaria with the variation of the independent institutional factors (see table 9 in Appendix). The empirical results for Bulgaria correspond to the findings made as follows: 1) in the ECB Convergence Report (2018) where it is specifically recommended for Bulgaria to achieve

steady convergence with maintenance of macroeconomic and fiscal stability, which requires stable institutions and a supportive business environment. 2) Furthermore, the European Commission Convergence Report for 2018 set out other important factors for the economic integration and convergence of Bulgaria, including stability of the institutional environment, and special attention to be paid to the current weaknesses: relatively low institutional quality, governance weaknesses and corruption.

Based on the above empirical results regarding the influence of various macroeconomic and institutional factors on the stock market development (i.e. the market capitalization rate) of the selected frontier stock markets from the Western Balkans (including that of Bulgaria - as a member country of the EU), the formulated testable hypotheses in point 2 above have been proved:

1) Despite macroeconomic stability in Bulgaria and improving GDP growth rate after 2013, the Bulgarian stock market has been deterred from effectively performing its function to promote direction of savings to the most profitable investments and offering diverse financing opportunities due to the fact that it continues to be bank dominated and is facing various institutional weaknesses relating to deteriorating regulatory quality and corruption (see point 4 empirical results for Bulgaria). Besides, following 11 years of full membership in EU there are significant structural weaknesses facing the Bulgarian economy. The low GNI per capita for Bulgaria for the entire period under analysis being about 24 % of EU average (see stylized fact 1) is a proof of the increased financial openness of the country, which in the aftermath of the global financial crisis in particular has contributed to outflow and repatriation of profits of foreign (and local) investors (see stylized fact 3 and 4 - negative portfolio flows and falling FDIs in Bulgaria), including that of domiciled multinational enterprises along the value chains from Bulgaria, under conditions of increasing volatility (see stylized fact 7, for Bulgaria); negative asset returns (see stylized fact 2, for Bulgaria); falling stock market value (see stylized fact 6, for Bulgaria); limited liquidity (see stylized fact 8).

2) The evolutionary path and upgrade from frontier to emerging stock market status for the Wester Balkan countries aspiring for EU membership in the future will require more than a decade of significant improvements in the institutional environment (see point 4 above - i.e. Low regulatory quality, high corruption levels; worsened government efficiency) and the challenge of sustaining the positive influence of

enabling macroeconomic conditions (i.e. positive impact of FDI/ GDP on stock market development in Serbia and of real GDP growth per capita in the Republic of North Macedonia). Obviously, the empirical results in the present paper support potential preparedness of Montenegro for upgrade to emerging market status in the foreseeable future due to improved institutional environment (see the empirical results for improved regulatory quality, democratic accountability and political stability), which has been conducive to maintenance of macroeconomic stability and economic growth, thereby boosting stock market development (highest levels of FDIs and portfolio flows; highest stock market value as % of GDP etc.).

6. Conclusions

Based on the empirical study of the frontier stock markets in Western Balkans, important conclusions can be drawn for the future financial development of Western Balkan aspiring countries' preparation for EU accession, taking into account the limitations of the study. Applying the concepts of financial development in peripheral countries within the context of the new institutional economy (North, 1990 Acemoglu & Johnson, 2005 etc.), EU membership aspiring countries and Bulgaria as a full-fledged EU member country have a priority to build a robust institutional framework that guarantees the rule of law, property rights protection and democratic accountability. This is a prerequisite for achieving economic stability and predictability of the business environment as well as for sustainable and socially inclusive economic growth needed for upgrading their stock markets from "frontier" to "emerging markets" status in the ever-increasing complexities and risks in the global economy.

The experience with Bulgaria and its membership for 11 years now in the EU with existing harmonized EU legal framework, but not adequately implemented in practice, and not strengthened enough regulatory institutional capacities is indicative of the insufficient adequacy of the ongoing financial integration endeavours of its capital market in the EU (that is, "in the middle of nowhere" – still being a market classified in the MSCI standalone market indexes category) in the context of the current challenges and the future to the global economy. This fact is borne out by the ongoing EU recommendations in the course of continuous monitoring of Bulgaria (2018) to improve

the judicial system, reducing corruption levels and guaranteeing the democratic environment.

In this sense, the way forward for the Western Balkans countries aspiring for EU membership in the future calls for comprehensive improvement and strengthening of institutional structures, opening of their economies through WTO membership and conclusion of free trade agreements with diversified trading partners with a view to their subsequent successful integration into global trade chains and boosting the competitiveness and innovation potential of their businesses. Overcoming ever-increasing macroeconomic, institutional, technological, climatic, etc. challenges, complexities, and risks facing the economies and stock markets of the Western Balkan countries requires an integrated approach for active co-operation and involvement of national, regional and international stakeholders (market and institutional ones) to successfully move from status of peripheral/frontier to emerging stock markets in the Western Balkans in the medium to long term.

Acknowledgments:

The author acknowledges thankfulness to Bulgarian Fulbright Commission, American University, Washington DC, and Economic Research Institute at the Bulgarian Economy of Sciences for the realization of the respective research project relating to South-Eastern Europe and testing the empirical framework on Latin American stock markets. This publication solely reflects the views of the author.

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APPENDIX

Table 1A

Results from Cointegration Engle-Granger test on the relationship between institutional factors and market capitalization in Republic of North Macedonia

	coefficient	std. error	t-ratio	p-value	ADF test
const	70.9119	11.6978	6.062	0.0090 ***	
d_Macedonia_Political stability	−16.0702	5.3401	−3.009	0.0572*	p-value 0.02059
d_Macedonia_Control of corruption	−212.593	38.5925	−5.509	0.0118**	p-value 0.007642
d_Macedonia_Regulatory quality	−92.7460	58.5087	−1.585	0.2111	p-value 0.04814
d_Macedonia_Voice and accountability	217.463	35.9453	6.050	0.0091***	p-value 0.02308
d_Macedonia_Government effectiveness	−106.528	22.1976	−4.799	0.0172**	p-value 0.04749
d_Macedonia_Rule of law	−168.945	44.3594	−3.809	0.0318**	p-value 0.01405
time	−7.76476	1.43680	−5.404	0.0124**	

Mean dependent var. −0.660909	S.D. dependent var 23.20573
Sum squared resid. 116.0957	S.E. of regression 6.220818
R-squared 0.978441	Adjusted R-squared 0.928137
Log-likelihood −28.56918	Akaike criterion 73.13837
Schwarz criterion 76.32153	Hannan-Quinn 71.13183
rho −0.244714	Durbin-Watson 2.412253

Source: author's calculations

Table 2A

Results from Weighted Least Squares test on the relationship between macroeconomic factors and market capitalization in Republic of North Macedonia

WLS, using observations 2006-2017					
Dependent variable: d_Macedonia_MC					
Variable used as weight: Macedonia_MC					
	coefficient	std. error	t-ratio	p-value	ADF test
d_Macedonia_FDI	8.29854	2.29402	3.617	0.0686*	p-value 0.02266
d_Macedonia_Domestic_Credit/GDP	−6.60894	2.41832	−2.733	0.1119	P-value 0.01378
d_Macedonia_RIR	11.0199	6.49815	1.696	0.2320	p-value 0.001056
d_Macedonia_GDP growth	6.66124	1.84209	3.616	0.0687*	p-value 0.005921
d_Macedonia_Inflation rate	1.98737	6.11684	0.3249	0.7761	p-value 0.0002093
d_Macedonia_Gross_Savings/GDP	0.208819	2.45405	0.08509	0.9399	p-value 0.004843
d_Macedonia_Gross_Capital Formation/GDP	13.8725	3.88361	3.572	0.0702*	p-value 4.333e-06
d_Macedonia_Trade/GDP	−0.704408	0.430211	−1.637	0.2432	p-value 0.005437
d_Macedonia_Broad_Money/GDP	9.56882	2.67942	3.571	0.0702*	p-value 1.435e-07

Statistics based on the weighted data:			
Sum squared resid	3674.287	S.E. of regression	42.86191
Uncentered R-squared	0.985604	Centered R-squared	0.986577
F(9, 2)	15.21410	P-value(F)	0.043170
Log-likelihood	−47.57003	Akaike criterion	113.1401
Schwarz criterion	116.7211	Hannan-Quinn	110.8827
rho	0.339384	Durbin-Watson	2.318827
Statistics based on the original data:			
Mean dependent var	−0.660909	S.D. dependent var	23.20573
Sum squared resid	165.6856	S.E. of regression	9.101802

Source: author's calculations

Table 3A

Results from Autoregressive test on the relationship between institutional factors and market capitalization in Montenegro

Autoregressive Model Institutional Factors					
Cochrane-Orcutt, using observations 2006-2017					
Dependent variable: Montenegro_MC					
rho = -0.748847					
	coefficient	**std. error**	**t-ratio**	**p-value**	**ADF test**
d_Montenegro_Political_Stability	128.201	41.3163	3.103	0.0532*	p-value 9.183e-09
d_Montenegro_Control_Corruption	−121.144	44.4597	−2.725	0.0723*	p-value 4.741e-09
d_Montenegro_Reg_Quality	1423.16	144.058	9.879	0.0022***	p-value 0.002639
d_Montenegro_Voice_Accountability	−144.675	298.096	−0.4853	0.6607	p-value 0.02316
d_Montenegro_Gov_Effectiveness	1402.90	192.613	7.284	0.0053***	p-value 0.07818
d_Montenegro_Rule_Law	−1819.81	282.395	−6.444	0.0076***	p-value 0.07662
Statistics based on the rho-differenced data:					
Mean dependent var	82.78444		S.D. dependent var	7.730434	
Sum squared resid	1360.404		S.E. of regression	21.29479	
Uncentered R-squared	0.410297		Centered R-squared	-0.438264	
F(6, 3)	68.20638		P-value(F)	0.002692	
rho	0.175836		Durbin-Watson	1.643196	

Source: author's calculations

Table 4A

Results from Autoregressive test on the relationship between macroeconomic factors and market capitalization in Montenegro

Autoregressive Model Macroeconomic					
Prais-Winsten, using observations 2006-2017					
Dependent variable: d_Montenegro_MC					
rho = -0.971516					
	coefficient	**std. error**	**t-ratio**	**p-value**	**ADF test**
d_Montenegro_FDI/GDP	−1.14259	0.176579	−6.471	0.0231**	p-value 0.005132
d_Montenegro_Domestic_Credit/GDP	−4.62005	0.427960	−10.80	0.0085***	p-value 0.04083
d_Montenegro_RIR	7.77286	0.550317	14.12	0.0050***	p-value 0.03004
d_Montenegro_GDP growth	−0.448870	0.199815	−2.246	0.1537	p-value 0.02115
d_Montenegro_Inflation rate	3.73537	0.588020	6.352	0.0239**	p-value 0.004252
d_Montenegro_Gross domestic savings/GDP	−20.4102	1.70636	−11.96	0.0069***	p-value 2.104e-09
d_Montenegro_Gross domestic fixed capital formation/GDP	4.01852	0.425315	9.448	0.0110**	p-value 0.003879
d_Montenegro_Trade/GDP	−4.66327	0.428856	−10.87	0.0084***	p-value 0.01672
d_Montenegro_Broad_Money/GDP	2.87720	0.192889	14.92	0.0045***	p-value 0.0003991
Statistics based on the rho-differenced data:					
Mean dependent var	1.810000		S.D. dependent var	12.02071	
Sum squared resid	2.033435		S.E. of regression	1.008324	
Uncentered R-squared	0.998804		Centered R-squared	0.999263	
F(9, 2)	312.6043		P-value(F)	0.003193	
rho	−0.235054		Durbin-Watson	2.698498	

Source: author's calculations

Table 5A

Results from Co-integration Engle-Granger test on the relationship between institutional factors and market capitalization in Serbia

	coefficient	std. error	t-ratio	p-value	ADF test
const	−3.96613	4.99414	−0.7942	0.5104	
d_d_Serbia_Political stability	35.0901	58.8182	0.5966	0.6113	p-value 0.04342
d_d_Serbia_control of corruption	−388.296	92.6831	−4.189	0.0525*	p-value 0.00968
d_d_Serbia_Reg_Quality	−236.139	140.723	−1.678	0.2353	p-value 0.01369
d_d_Serbia_Voice and accountability	9.69607	49.4873	0.1959	0.8628	p-value 6.026e-05
d_d_Serbia_Gov_Effectiveness	114.748	72.1534	1.590	0.2527	p-value 0.007005
d_d_Serbia_Rule_of law	380.392	127.729	2.978	0.0967*	p-value 0.03726

Mean dependent var	−2.602222	S.D. dependent var	30.36600
Sum squared resid	343.0350	S.E. of regression	13.09647
R-squared	0.953498	Adjusted R-squared	0.813991
Log-likelihood	−29.15318	Akaike criterion	72.30637
Schwarz criterion	73.68694	Hannan-Quinn	69.32710
rho	0.088125	Durbin-Watson	2.731391

Source: author's calculations

Table 6A

Results from Co-integration Engle-Granger test on the relationship between macroeconomic factors and market capitalization in Serbia

	coefficient	std. error	t-ratio	p-value	ADF test
const	30.7587	15.2545	2.016	0.2931	
d_Serbia_FDI/GDP	−10.1993	6.84287	−1.491	0.3762	p-value 0.002805
d_Serbia_Domestic Credit/GDP	−11.1855	5.78668	−1.933	0.3039	p-value 0.00576
d_Serbia_RIR	−10.0509	4.05229	−2.480	0.2440	p-value 0.00239
d_Serbia_Inflation rate	−0.692476	5.59637	−0.1237	0.9216	p-value 0.003197
d_Serbia_GDP growth	21.9858	12.6037	1.744	0.3314	p-value 0.005972
d_Serbia_Gross domestic savings/GDP	−47.1891	19.5458	−2.414	0.2500	p-value 0.003789
d_Serbia_Gross fixed capital formation/GDP	−12.0146	9.55786	−1.257	0.4278	p-value 0.004128
d_Serbia_Trade/ GDP	−1.29214	1.68406	−0.7673	0.5834	p-value 0.00239
d_Serbia_Broad_Moneay/GDP	4.02287	5.20215	0.7733	0.5809	p-value 0.0005947

Mean dependent var	−3.326364	S.D. dependent var	16.68288
Sum squared resid	77.08813	S.E. of regression	8.779985
R-squared	0.972302	Adjusted R-squared	0.723022
Log-likelihood	−26.31712	Akaike criterion	72.63424
Schwarz criterion	76.61320	Hannan-Quinn	70.12607
rho	−0.238592	Durbin-Watson	2.378018

Source: author's calculations

Table 7A

Autoregressive Test (1st lagged order) on relationship of macroeconomic factors and market capitalization in Bulgaria

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	ADF test
const	−3.35501	2.01049	−1.6687	0.1938	
d_d_BG_FDI/GDP	−0.566335	0.532315	−1.0639	0.3654	p-value 0.009247
d_d_BG__Domestic__Credit/GDP	−2.77418	0.483171	−5.7416	0.0105**	p-value 0.008792
d_d_BG__Real__IR	1.90271	0.619902	3.0694	0.0546*	p-value 3.787e-05
d_d_BG__GDP__Growth	0.618107	0.578646	1.0682	0.3638	p-value 1.27e-05
d_d_BG__Inflation__GDP__Def	1.92374	0.735531	2.6154	0.0793*	p-value 3.619e-05
d_d_BG__GDSavings/GDP	2.52662	1.04069	2.4278	0.0935*	p-value 4.884e-05
d_d_BG__GFCF/GDP	−0.393706	1.13855	−0.3458	0.7523	p-value 0.002034
d_d_BG__Trade/GDP	0.294103	0.220353	1.3347	0.2742	p-value 0.0002402
d_d_BG__Broad__Money/GDP	1.39879	1.02259	1.3679	0.2648	p-value 7.561e-05

Mean dependent var	−0.227692	S.D. dependent var	17.63142
Sum squared resid	67.13296	S.E. of regression	4.730503
R-squared	0.982005	Adjusted R-squared	0.928021
F(9, 3)	26.27849	P-value(F)	0.010596
rho	0.360446	Durbin-Watson	1.956139

Source: author's calculations

Table 8A

Engle-Granger cointegration test on institutional variables and market capitalization in Bulgaria

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	ADF test
const	−0.0203305	3.47308	−0.005854	0.9955	
d_d_BG_Political Stability	−1.72380	22.8303	−0.07550	0.9417	p-value 0.0006526
d_d_BG__Control of Corruption	−1.15083	46.7868	−0.02460	0.9810 p	p-value 0.006687
d_d_BG__Regulatory Quality	−32.0102	45.5991	−0.7020	0.5026	p-value 0.008014
d_d_BG__Voice__Accountability	149.162	51.4645	2.898	0.0199**	p-value 5.49e-05
d_d_BG__Government Effectiveness	−8.29360	23.9767	−0.3459	−0.7383	p-value 0.0001524
d_d_BG__Rule__Law	7.00286	10.1659	0.6889	0.5104	p-value 7.684e-07

Mean dependent var	0.090000	S.D. dependent var	16.36385
Sum squared resid	1398.206	S.E. of regression	13.22028
R-squared	0.627031	Adjusted R-squared	0.347305
Log-likelihood	−55.29579	Akaike criterion	124.5916
Schwarz criterion	129.5479	Hannan-Quinn	124.5388
rho	−0.257618	Durbin-Watson	2.269098

Source: author's calculations

Table 9A

Heteroscedasticity correction test on institutional variables and market capitalization in Bulgaria

	Coefficient	*Std. Error*	*t-ratio*	*p-value*
const	1.42381	0.697144	2.0423	0.0804*
d_d_BG_Political_Stability_1	28.0564	5.68515	4.9350	0.0017***
d_d_BG__Control__Corruption_1	21.9204	9.10273	2.4081	0.0469**
d_d_BG__Regulatory__Quality_1	−19.6585	5.2941	−3.7133	0.0075***
d_d_BG__Voice__Accountabili_1	117.559	15.3295	−7.6688	0.0001***
d_d_BG__Government__Effecti_1	3.09286	6.22926	0.4965	0.6347
d_d_BG__Rule__Law_1	0.148718	1.14473	0.1299	0.9003

Sum squared resid	7.056942	S.E. of regression	1.004059
R-squared	0.969197	Adjusted R-squared	0.942795
F(6, 7)	36.70855	P-value(F)	0.000060
Log-likelihood	−15.06982	Akaike criterion	44.13964
Schwarz criterion	48.61304	Hannan-Quinn	43.72555
rho	−0.022299	Durbin-Watson	1.992683

Source: author's own calculations

ANALYSIS OF THE RELATIONSHIP BETWEEN TAX REVENUE AND GROSS VALUE ADDED IN THE ROMANIAN ECONOMY

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Abstract

Any government is interested in knowing, to a certain extent degree, the level of tax revenue at a given time in order to design public expenditures. On the other hand, this level of budget revenue is desirable to be sustainable, i.e. to be supported by the existing economic conditions at a given moment. One way to estimate the expected revenues is the relationship of the tax bases with the main macroeconomic indicators. It is assumed that the main source of tax is gross value added in the economy. This article examines the nature of gross value added links with the tax revenue, on the one hand, and with the tax bases of each category of tax, on the other hand, in order to identify the best predictors of tax revenue for Romania. The analysis was carried out using multiple time series regressions in the cases of Romania and the standard (benchmark) states (Germany, France, the United Kingdom and Italy), respectively regressions on cross-sectional data in the case of Member States of the European Union.

Keywords: tax revenue, macroeconomic analysis, public finance, econometric modeling, estimation

JEL Classification: H20, C51

1. Introduction

Securing budget revenues in a sustainable manner is the main concern of any responsible government. In the literature, the sustainability dimension is studied in complex macroeconomic models and is analyzed in relation with the most important factors defining an economy. From an operational perspective, economists are interested in the type of relationships that exist between tax revenues and macroeconomic or social indicators, in order to identify the best ways

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of evaluating and forecasting the level of public funds, within the timeframe for which they are based, and accordingly design fit for purpose public policies. Moreover, establishing the nature of a type of relationship between these macroeconomic aggregates may allow future development of top-down methodologies to assess the risk of not achieving a certain level of income. This study aims to evaluate the relationship between tax or budget revenue and gross value added in the economy (GVA). Why GVA? For a neutral observer, this relationship might appear to be a common one, and for a macroeconomist this kind of connection is easy to understand. Perhaps the lack of "evidence" is the reason why this relationship has not been studied at all in literature. The present study shows that things must be judged with caution, despite some existing empirical evidence.

In every economic doctrine on taxation, ranging from the two extremes, neoliberalism and statism, any state, however liberal or centralized it is, is interested in consolidating its revenue. And beyond fiscal policy changes, as a lever of intervention, it is interesting to what extent a state can secure a steady level of income. While the issue has been extensively dealt with in several papers, literature remains poor, primarily because of the very high interest in assessing the public spending mechanism and the presumption of (partial) neutrality of the level of taxation.

GVA is defined in national accounts as the production account's balance, measured as the difference between the value of goods and services (valued at basic prices) and intermediate consumption (measured at purchaser's prices) and is calculated before determining the consumption of fixed capital. Therefore, after deducting the depreciation, the net value is obtained. Therefore, GVA represents the newly created value in the production process of an economy. The very definition of this indicator reveals that there should be a causal link between GVA and tax or budget revenue and, moreover, an economically meaningful one. Firstly, the newly created value implies the accumulation of income at the level of the economic agents, which is the basis of taxation for the profit tax. Secondly, generating new value in an economy involves the payment of wage costs or other forms of remuneration for labor or capital, which in turn constitute the tax base for income tax and mandatory social contributions. Thirdly, as added value is created, money can be released in the economy in the form of wages or other income that go, even in part, into consumption, which in turn supports the creation of new value. Therefore, there should be

mutual influences between consumption and GVA, the first being a tax base for value added tax (VAT) and excise duties. If we also take into account the way microeconomic value added is calculated, we can deduce that there should be a close link between the two variables (tax revenues and GVA). It is worth mentioning that the macroeconomic analysis mainly studies the relationship between GVA and investments, the latter being considered as a generator of new value. From a strictly fiscal point of view, this type of relationship can be omitted. In a comprehensive analysis, however, the influence of interplay between investment (capital formation) and value added and the level of taxation on the achievement of a certain level of budgetary or fiscal revenues should provide an interested topic for study.

At microeconomic level, determining and studying added value is an important step as this indicator reflects the ability of an economic entity to generate new value and to resume its work at higher levels of performance. Two methods of calculating the added value are known and used in corporate finance: the subtractive method and the additive method. By subtracting, the added value (VA) is determined by the formula:

VA = trade margin + production value of the exercise - value of consumption

This relationship shows that there should be a significant relationship at least between GVA and tax revenue from corporate taxation.

The additive method consists in applying the following formula:

VA = staff costs (including social contributions) + taxes (excluding VAT) + dividends + reinvested earnings + depreciation

This formula results, also, in a relationship between VAB and income from taxes and contributions, less VAT.

Taking into account both the macroeconomic and the microeconomic perspectives presented above, it may be assumed that there are causal and/or direct relationships between the two variables, GVA and tax revenues (as increases or decreases in the level of one generates increases or decreases in the level of the other).

2. Literature review

Perhaps the most extensive research on the determinants of tax revenue is the study of A.S. Gupta, Determinants of Tax Revenue Efforts in Developing Countries (Gupta, 2007), and is based on

regression models applied to panel data. The analysis is focused on identifying the main factors that can influence the tax collection capacity of a country. One of the most important findings of Gupta's study is that there are no "universal" recipes to assess a state's tax performance. The analyzed factors are: GDP per capita in current prices, share of agriculture in GDP, weight of imports in GDP, weight of state aid in gross national income, share of public debt in gross national income, tax revenues from goods and services (as a share in total revenues), tax revenues from taxes on income, profit and capital gains (as a share of total income), tax revenue from commercial activities, as well as tax revenue from exports (as a weight in total revenues), the highest marginal tax rate for individuals, the highest marginal corporate tax rate, the average tariff applied to trade between countries and institutional factors such as political stability, economic stability, corruption, law enforcement and governmental stability.

Concerns for identifying tax revenue determinants and understanding tax patterns and fiscal potential, especially in emerging economies, are not new (see Chelliah, 1971). At the beginning of the 1970s, the research effort was focused on explaining the differences in tax regimes (especially the differences in quotas and the differences in the weights that fiscal revenues hold in GDP in different countries). One of the strongest explanatory factors is the share of agriculture in GDP, and it is expected that as the share of value added in the agricultural sector increases, tax revenue will decrease due to the narrower tax base existing in this sector (Tanzi, 1992).

Vito Tanzi and Parthasarathi Shome (1992) find that the structure of the tax system is not relevant in an unstable macroeconomic environment; therefore, a certain tax regime will not be able to explain the variation in tax revenue under conditions of macroeconomic instability. From the point of view of these authors, but also of others (Gupta, 2007), the key factor in achieving a comfortable level of tax revenue is the level of corruption. Other authors, also using econometric modeling, find a direct relationship between gross value added in mining and tax revenue and an indirect relationship between gross added value in agriculture and these incomes, as well (Bahl, 1971). The direct relationship between the mining industry and tax revenue must be attributed to the very high share that this sector held in the seventh decade of the last century.

More recently, attention was directed to assessing performance in terms of tax collection by inspecting the elasticity of tax bases (Sobel

and Holcombe, 1996; Bruce et al., 2006; Fricke and Suessmuth, 2014; Koester and Priesmeier, 2017). Davoodi and Grigorian (2007) highlight the impact of institutional factors on tax revenues, the only macroeconomic factor being GDP per capita. Institutional factors are also analyzed in most of the papers on the relationship between tax revenue and GDP (Gupta, 2007; Tanzi, 1992; Le et al., 2008; Javid and Arif, 2012). Other authors study the reverse relationship between tax revenue and economic growth (Ofoegbu et al., 2016), respectively, between fiscal policy and economic output (Baum and Koester, 2011).

The study of Gobachew et al. (2018), one of the most recent in the field, considers macroeconomic factors only, in the case of Ethiopia. Based on the econometric modeling they found that structural factors, macroeconomic conditions (such as inflation rates) and external trade are levers that can improve tax revenue. It is also found that the inflation rate and the share of agriculture in GDP negatively affects tax revenue, while openness to foreign trade, the share of manufacturing and per capita income positively influence the level of tax revenue. Another recent study exclusively addresses the influence of structural and conjectural factors (Yi and Suyono, 2014), assessing the effect of the fiscal multiplier on both tax revenue and GDP, under the general hypothesis on the incompatibility between maximizing of tax revenue and consecutively maximizing the GDP.

Finally, Aizenman and Jinjarak (2009) analyze government expenditures as a potential determinant of tax bases.

These studies primarily focus on the relationship between GDP and tax revenue, even when contextual factors such as institutional ones are present. Thus, the link between gross value added in the economy and tax revenue is analyzed either indirectly (through economic output) or directly (by economic sectors), but we do not have an explicit picture of this type of relationship. This study aims to inspect the evolution of fiscal and GVA variables at different time points and across the EU as a whole, but in some selected countries.

3. Data and methodology

3.1. Description of the data

The following macro-variables have been taken into account, the values of which have been extracted from national accounts: gross value added (GVA), tax revenue, indirect tax revenues, direct income, gross operating surplus, compensation of employees, mixed income

and final consumption. In the case of Romania, these variables are tracked in time series, consisting in annual values of the indicators, for the period 1995-2017. As a "blank sample", values of those variables were used for each Member State of the European Union in 2017 (cross-sectional data). In addition, for the comparative analysis, four EU-level benchmarks have been considered, at which the highest level of GVA is recorded.

The data source was the European Commission's AMECO database. The extracted values were reconciled with the values in the national accounts published by Eurostat and the information regarding the tax revenue collected in Romania was confronted with the existing data at the level of the Romanian National Agency for Fiscal Administration and adjusted, where necessary.

Together with the primary variables, GVA and aggregate tax revenue, variables reflecting or approximating the tax bases of the main taxes were also considered, in order to assess their relationships with the GVA. At the same time, the link between GVA and the main categories of taxes (direct and indirect) was also assessed.

The macroeconomic aggregates considered as proxy tax bases are:

- Gross operating surplus (GOS) approximates the tax base for corporate tax;
- Compensation of employees approximates the tax base for wage tax and compulsory social contributions;
- Mixed Income approximates the tax base for income tax obtained by individuals in self-employment arrangements;
- Final consumption approximates the tax base for VAT and excises (generally for indirect/consumption taxes).

Total revenue from taxes is by far the main category of public revenue.

3.2. Method

Definitions and conceptualizations of Gross Value Added allow us to formulate hypotheses about the influence it may have on tax revenue. If we also take into account the neo-Keynesian theory regarding the relationship between output and tax, we can admit that the level of taxation does not significantly influence the achievement of a certain level of tax revenue. If the tax burden is increased, we expect an “eviction” effect and the compression of economic activity, due to higher potential tax bills. In the case of a reduction in the tax burden,

economic activity is expanding, leading to higher tax base, as economic expansion is achieved. Consequently, we can neglect the possible effect of fiscal policy changes in the analysis, considering only the link between GVA and these revenues.

In the light of the above, the following working hypotheses are formulated:

- There is a direct (positive) link between GVA and tax revenue;
- The level of taxation is neutral with respect to this relationship;
- GVA significantly determines the achievement of a certain level of tax revenue, ceteris paribus;
- Considering the above assumptions, we expect revenue to be higher as GVA increases.

If the hypotheses are confirmed, it is possible to identify, using the GVA criterion, what economic sectors or categories of taxpayers can provide or generate higher tax revenue or, in correlation with the level of tax compliance, may pose a lower or higher risk in terms of budget revenue.

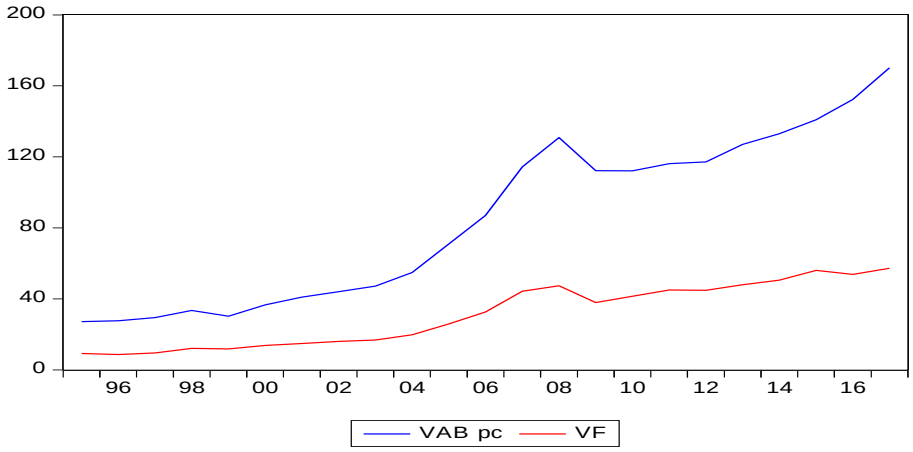
For studying the nature and significance of some relationships, the most appropriate method is classical regression modeling and Granger causality analysis.

4. Results and discussions

4.1. The link between GVA and tax revenue

The central hypothesis of this study is that there is a relationship of determination between GVA and tax revenue, a hypothesis based on economic theory. At the level of Romania, the two variables co-vary, but the difference between the values of the two tends to increase over time (Figure 1). For the past years (2015-2017), a quasi-exponential increase in GVA may be observed, contrasting with the steep slowdown in tax revenue growth.

Figure 1
Evolution of GVA and tax revenue over 1995-2017 (annual data)

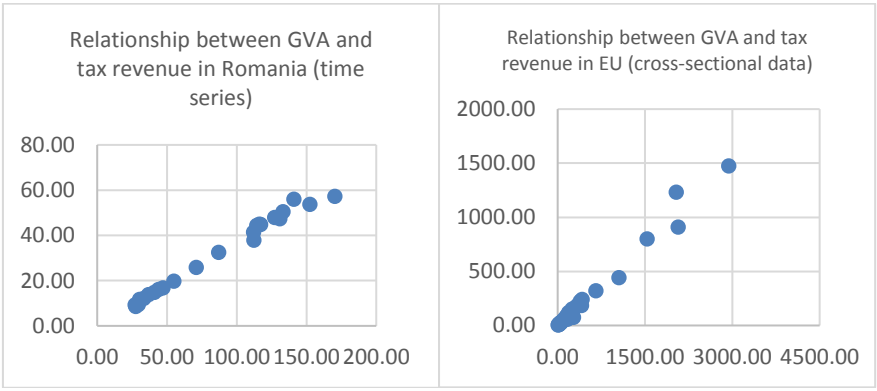


Note: VAB pc = GVA in current prices; VF = tax revenue

Source: AMECO database and own computations

These most recent developments indicate a possible rupture of economic logic or, more precisely, a possible refutation of the hypothesis.

Figure 2
Correlation between GVA and tax revenue (Romania, 1995-2017 and EU, year 2017)



Source: AMECO database and own computations

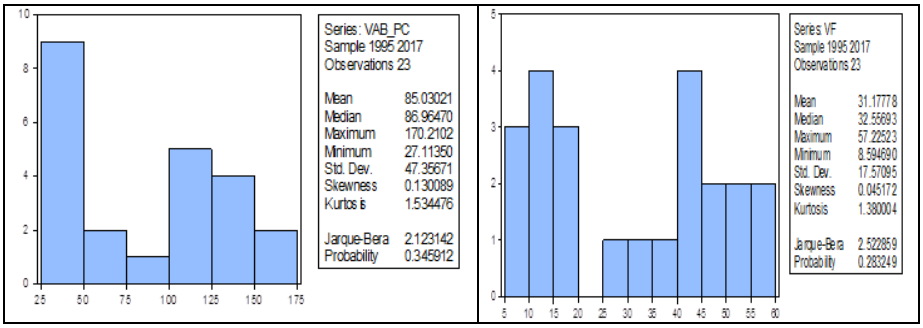
Variables GVA and tax revenue are strongly correlated, and a positive and linear relationship exists between the two (Figure 2).

Correlation coefficients are 99.35% for Romania (time series) and 99.03% for the European Union (cross-sectional data).

Residues of the two variables appear to be normally distributed, the probability associated with the Jarque-Bera test being 28% and 34% respectively (Figure 3).

Figure 3

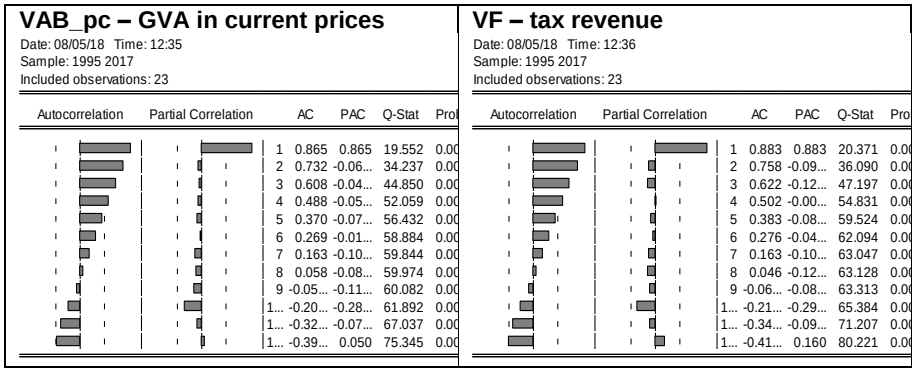
Descriptive statistics for the GVA and tax revenue for Romania



Both distributions present positive asymmetries and are platikurtic. The distribution of the tax revenue variable tends to be perfectly symmetrical. At the same time, both series are non-stationary. The two series are serially auto correlated (Figure 4), with very high correlation coefficients up to lag 4.

Figure 4

Auto correlation function for the variables GVA and tax revenue



Both the VAB (GVA in current prices) series and the VF series (tax revenue) have a steady trend. Therefore, the Augmented Dickey-

Fuller ADF test is applied using constant parameter and linear trend equation (see Table 1, in the Appendix).

The GVA values series has a probability of 24.4% to be non-stationary and to have a unitary root. Also, the tax revenue series has a probability of 39.1% to be non-stationary. The series were staged by level one differentials. The first evaluations were carried out in level and linear series (log) as well. The results generated by these regression models are shown in Table 2 and 3 (in the Appendix).

It can be noticed that regardless of the form of the variable (linearized or logarithmic), valid models (statistical probability F is 0) confirm the causal link, where the coefficient of regression is statistically significant, and the coefficient of determination is extremely high. Obviously, since the series is not stationary, the DW test value indicates an autocorrelation error. However, assessing the relationship between the two variables in the linear form is important. All model validation elements, except for DW, are statistically significant. For estimation and forecasting, staging of variables is required. In Table 4 (in the Appendix) there are the results generated by the regression model between the first order differentials of the two variables.

The regression model developed across EU data (see Table 5, in the Appendix) also confirms the close causal link between GVA and tax revenue.

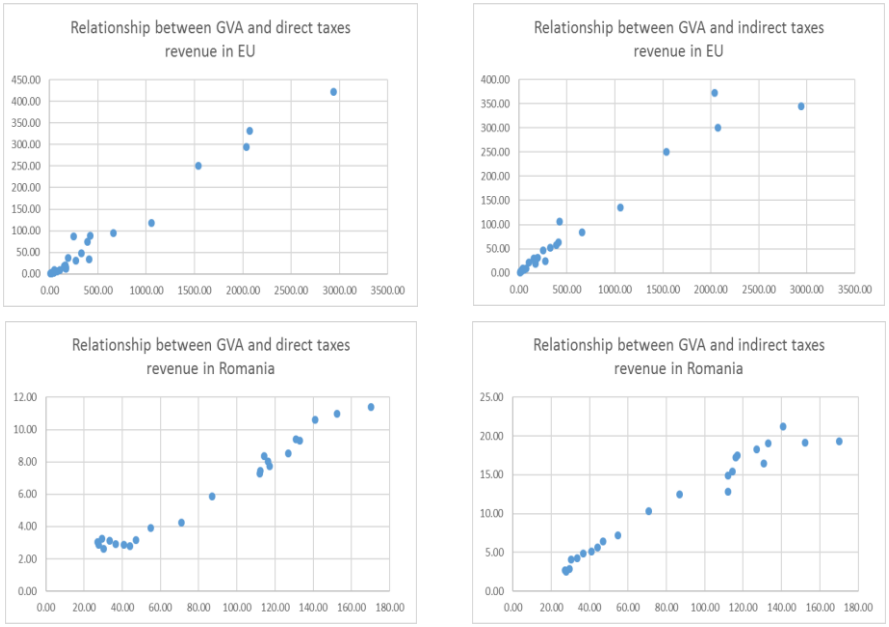
This result requires a careful analysis of the gross value added relationship with the different tax categories, as well as with the tax bases for the respective categories.

4.2. Patterns of variation by tax category

A first step is to inspect the nature of the relationship between GVA and tax revenue by tax category. Although the co-ordinates show generally linear forms of simultaneous evolution of the two types of variables, thus confirming the central hypothesis, it can be noticed that in the case of Romania both the relationship between GVA and direct taxes, as well as between GVA and indirect taxes tend to get out of the existing EU pattern. At least in the case of direct taxes, the link gets a polynomial form. At the level of the benchmark countries (Germany, the United Kingdom, France and Italy), the links of GVA with both categories of tax revenue are perfectly linear. Therefore, in the case of Romania, we have an atypical situation. GVA will not be a good predictor for tax revenue.

Figure 5

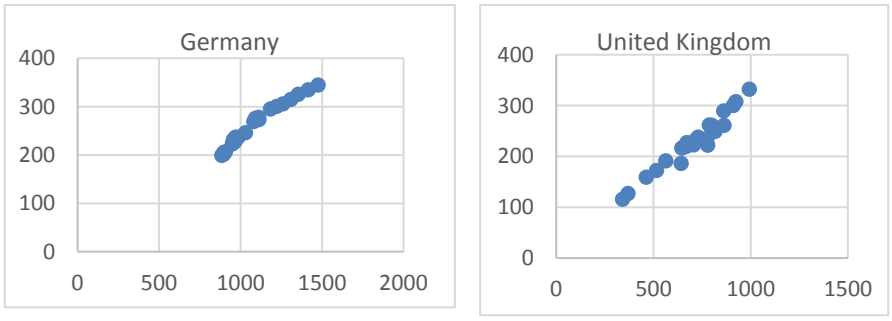
Correlation between GVA and revenue from direct and indirect taxes in the EU (year 2017, cross-sectional data) and in Romania (time series, 1995-2017)

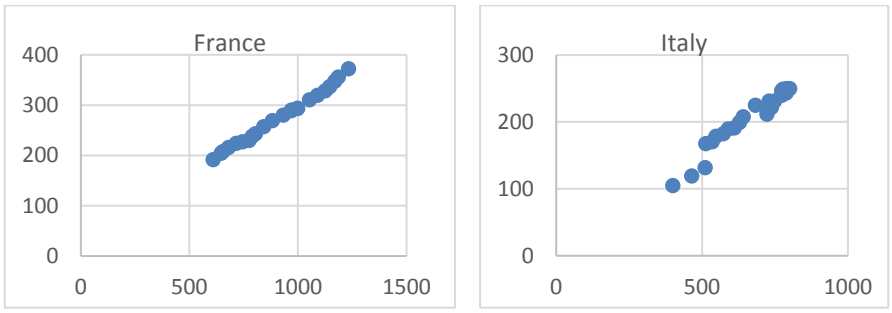


Source: AMECO database and own computations

Figure 6

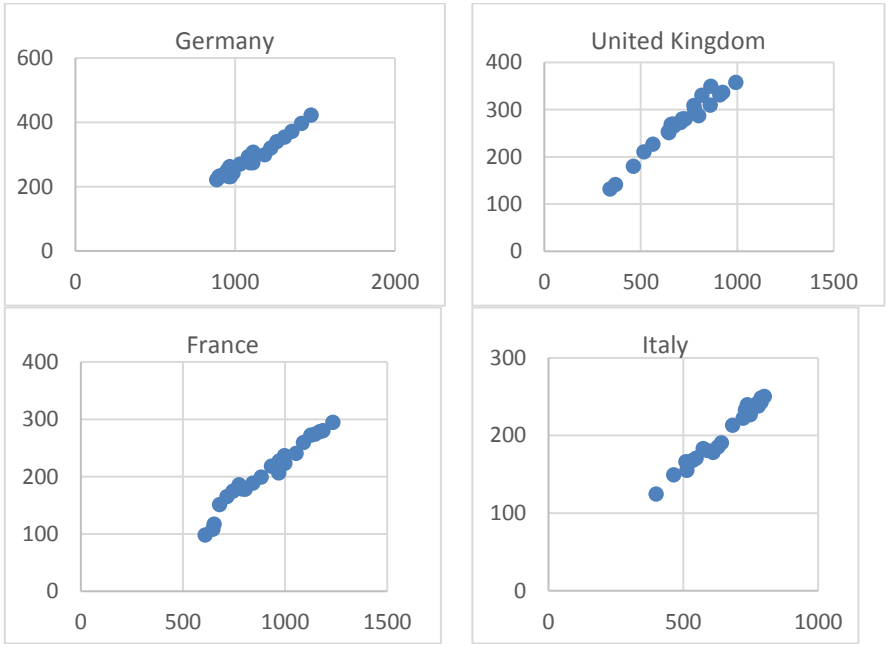
Correlation between GVA and revenue from indirect taxes in the benchmark countries (time series 1995-2017)





Source: AMECO database and own computations

Figure 7
Correlation between GVA and revenue from direct taxes in the benchmark countries (time series 1995-2017)



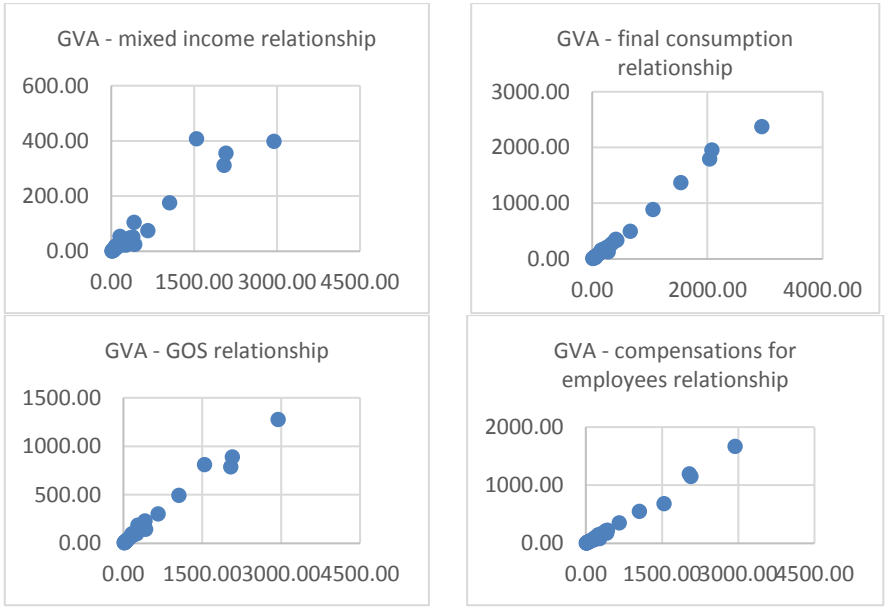
Source: AMECO database and own computations

4.3. The relationship between GVA and tax bases

At the European Union level, the linkage between GVA and tax bases is confirmed, with the exception of mixed income (Figure 8).

Figure 8

Correlation between GVA and tax bases at EU level



Source: AMECO database and own computations

In the case of Romania, the linearity of the link between the GVA and the tax bases, including mixed income (possible inflections of the simultaneous evolution of GVA and mixed income), is also confirmed, being also somewhat in line with the disruptive evolution between these variables at EU level (Figure 9).

Figure 9
Correlation between GVA and tax bases in Romania (time series)

Source: AMECO database and own computations

It is also important to determine whether there is a causality within these links. In order to assess the influence of the tax bases on the total tax revenues and on the GVA, two econometric models (multiple regression) were generated, the results being presented in Table 7 and Table 8 (see the Appendix), and the Granger causality between the tax bases and GVA was tested (see Table 9, in the Appendix).

The variables were designated as follows:

- COMP – compensation of employees
- Cons – final consumption
- EBE – Gross Operating Surplus
- VENIT_MIXT – mixed income achieved at the household level
- VAB_PC – gross added value in current prices
- VF – total tax revenue

The two models show that the only predictor for both GVA and tax revenue is consumption (statistically significant coefficient), and in the case of tax revenue, mixed income may be accepted as a predictor for a significance threshold of 5%.

Although the regression models indicate the final consumption variable as the only predictor for GVA (regression coefficient is statistically significant for a significance threshold below 1%), the Granger causality is not verified. The test was performed for lags 2, 3 and 4, with only the relevant results being selected. There is causality between the GOS (EBE) and GVA variables, as well as between the employee compensation variable and GVA, the latter at lag 2. The relationship GVA - compensation of employees is also bidirectional for a 10% significance threshold (Table 9, Appendix). Broadly, it can be admitted that GOS (EBE) and compensation of employees significantly influence GVA. The link between GOS (EBE) and GVA seems to be rather negative (Table 9, Appendix). Consumption remains a good predictor for GVA. In short, the tax bases, with the exception of mixed income, influence the achievement of gross value added in the economy. Therefore, tax revenue can be assessed through GVA, but in the case of Romania some adjustments are needed to mitigate or, on the contrary, to highlight the impact of circumstantial or institutional factors.

5. Conclusions

This article looks at the evolution of tax revenue for the first time in terms of Gross Value Added (GVA), which is considered a proxy variable for tax bases rather than GDP, unlike most approaches that analyze the link between tax revenue and GDP. GVA simultaneously captures both the influence of existing economic conditions at one time and the variation of the basis on which different tax regimes are applied. Furthermore, the relationship between tax revenues and GVA has been assessed with the tax bases of each tax category, so that variation patterns and reliable predictors of tax revenue can be identified.

Although the GVA and tax revenues (as a whole) variables are almost perfectly correlated, and the regression analysis indicates a causal link between the two, where tax revenue is the dependent variable (adjusted coefficient of determination is 68%), the Granger causality is not verified in any sense of the implication between the two

variables in the case of Romania. However, it should be noted that for Romania the coefficient of regression is 0.3579, very close to the value of regression coefficient (cross-section data) at European level - 0.3686. Both models of regression confirm the existence of a positive causal relationship between GVA and tax revenue. Under these circumstances, we can expect that the EUR 1000 increase in gross added value will increase tax revenue by 360 euros. However, level estimates and Granger's causality check after staging variables, signal a possible skew of the model. In the first step, attention was focused on identifying patterns of variation according to tax categories, taking as a benchmark the links established between GVA and tax revenue of different tax categories in the countries with the highest gross added value from the EU, namely Germany, France, the United Kingdom and Italy. In all these countries except Italy, the link between the variables considered is perfectly linear, which corresponds to the economic model. In the case of Romania, the links between the GVA and the categories of taxes (direct and indirect) are not linear. This situation reveals that, in reality, atypical evolution in Romania does not correspond to an economic reality, but rather to other causes. One of the causes can be tax evasion. In the second step, the relationship between the GVA and the tax bases was assessed.

The GVA link with the tax bases is perfectly linear, with the exception of mixed income, but this variation pattern is similar to the one existing at the level of the European Union. Therefore, from an economic point of view, Romania does not register atypical developments from the perspective of this type of relationship. Verifying the Granger causality for each GVA relationship with the tax bases shows that there is only a determination between GVA and GOS (EBE), and between GVA and compensation for employees. The causal relationship GVA - compensation for employees is even bidirectional for a materiality threshold of 10%. In the case of mixed income, an absence of direct causality was expected, but no causal relationship between GVA and consumption was verified, although the linkage is perfectly linear. Based on two multiple regression models, the link between GVA and tax bases was assessed, on the one hand, and the link between tax revenues and tax bases, on the other. From these models it was found that GVA variation is only explained by final consumption, in circumstances where the Granger causality was not verified in this case. Also, the variation in tax revenue is explained only by the change in final consumption, which can be attributed to the fact

that more than 50% of the state budget revenue comes from indirect taxes.

In short, atypical variations in Romania are not economic in nature, but are due to other factors, one of which may be tax evasion. The causal link between GOS (EBE) and compensation of employees on the one hand and GVA on the other hand is due to the fact that the tax bases mentioned are, by definition, included in the GVA but at the same time these tax bases do not explain variation in GVA and tax revenue as a whole. Final consumption is a very good predictor for both GVA and tax revenues as a whole, but no strict causality between these two variables is identified, which can be attributed to the very large share of imports in final consumption.

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APPENDIX

Table 1

ADF test for the variables GVA and tax revenue

Null Hypothesis: VAB_PC has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.704987	0.2443
Test critical values:	1% level	-4.467895	
	5% level	-3.644963	
	10% level	-3.261452	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: VF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=6)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.353094	0.3912
Test critical values:	1% level	-4.440739	
	5% level	-3.632896	
	10% level	-3.254671	

*MacKinnon (1996) one-sided p-values.

Table 2

Assesment of the relationship, in level, between GVA and tax revenue

Dependent Variable: VF
Method: Least Squares
Sample: 1995 2017
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.168491	0.887527	-0.189843	0.8513
VAB_PC	0.368649	0.009166	40.21828	0.0000

R-squared	0.987183	Mean dependent var	31.17778
Adjusted R-squared	0.986573	S.D. dependent var	17.57095
S.E. of regression	2.036020	Akaike info criterion	4.342812
Sum squared resid	87.05292	Schwarz criterion	4.441551
Log likelihood	-47.94234	Hannan-Quinn criter.	4.367645
F-statistic	1617.510	Durbin-Watson stat	1.136489
Prob(F-statistic)	0.000000		

Table 3

Assesment of the relationship, in log, between GVA and tax revenue

Dependent Variable: LOG(VF)
Method: Least Squares
Sample: 1995 2017
Included observations: 23

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.169449	0.083089	-14.07465	0.0000
LOG(VAB_PC)	1.036336	0.019285	53.73675	0.0000

R-squared	0.992780	Mean dependent var	3.247132
Adjusted R-squared	0.992436	S.D. dependent var	0.672497
S.E. of regression	0.058487	Akaike info criterion	-2.757094
Sum squared resid	0.071835	Schwarz criterion	-2.658355
Log likelihood	33.70658	Hannan-Quinn criter.	-2.732261
F-statistic	2887.639	Durbin-Watson stat	0.993960
Prob(F-statistic)	0.000000		

Table 4

Assesment of the relationship, in differential, between GVA and tax revenue

Dependent Variable: D(VF)
Method: Least Squares
Sample (adjusted): 1996 2017
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.147010	0.581001	-0.253029	0.8028
D(VAB_PC)	0.357970	0.052254	6.850628	0.0000

R-squared	0.701185	Mean dependent var	2.181371
Adjusted R-squared	0.686245	S.D. dependent var	3.945811
S.E. of regression	2.210202	Akaike info criterion	4.510553
Sum squared resid	97.69986	Schwarz criterion	4.609739
Log likelihood	-47.61608	Hannan-Quinn criter.	4.533918
F-statistic	46.93110	Durbin-Watson stat	1.825343
Prob(F-statistic)	0.000001		

Table 5

Assessment of the relationship between GVA and tax revenue at EU level, in 2017 (cross-sectional data)

Regression Statistics	
Multiple R	0.993571074
R Square	0.987183479
Adjusted R Square	0.986573168
Standard Error	2.036019887
Observations	23

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6705.189311	6705.189311	1617.510142	2.34318E-21
Residual	21	87.05291662	4.145376982		
Total	22	6792.242228			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.168490599	0.887526782	-0.189842834	0.851255333	-2.014203584	1.677222385
X Variable VAB	**0.368648679**	0.009166197	40.21828119	2.34318E-21	0.349586529	0.387710828

Table 6

Granger causality between GVA and tax revenue (in differential)

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	21	0.17576	0.6800
DVF does not Granger Cause DVAB_PC		0.19065	0.6676

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	20	0.48719	0.6237
DVF does not Granger Cause DVAB_PC		0.11747	0.8900

Lags: 3

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	19	0.86066	0.4879
DVF does not Granger Cause DVAB_PC		0.24189	0.8655

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	18	1.58694	0.2591
DVF does not Granger Cause DVAB_PC		1.32039	0.3336

Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	17	1.02557	0.4782
DVF does not Granger Cause DVAB_PC		1.06421	0.4618

Lags: 6

Null Hypothesis:	Obs	F-Statistic	Prob.
DVAB_PC does not Granger Cause DVF	16	1.11345	0.5051
DVF does not Granger Cause DVAB_PC		0.56442	0.7478

Table 7

Multiple regression model between GVA and tax bases in Romania (stationary series)

Dependent Variable: D(VAB_PC)
Method: Least Squares
Sample (adjusted): 1996 2017
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.259021	0.545378	0.474938	0.6409
D(COMP)	0.237391	0.221131	1.073529	0.2980
D(CONS)	0.961199	0.158557	6.062166	0.0000
D(EBE)	-0.025263	0.071172	-0.354960	0.7270
D(VENIT_MIXT)	0.281491	0.223228	1.261003	0.2243

R-squared	0.959100	Mean dependent var	6.504395
Adjusted R-squared	0.949476	S.D. dependent var	9.230083
S.E. of regression	2.074693	Akaike info criterion	4.494220
Sum squared resid	73.17399	Schwarz criterion	4.742184
Log likelihood	-44.43642	Hannan-Quinn criter.	4.552633
F-statistic	99.66128	Durbin-Watson stat	1.500032
Prob(F-statistic)	0.000000		

Table 8

Multiple regression model between tax revenue and tax bases in Romania (stationary series)

Dependent Variable: D(VF)
Method: Least Squares
Sample (adjusted): 1996 2017
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.311272	0.473541	-0.657328	0.5198
D(COMP)	-0.328644	0.192004	-1.711655	0.1051
D(CONS)	0.485610	0.137672	3.527299	0.0026
D(EBE)	-0.008950	0.061797	-0.144827	0.8866
D(VENIT_MIXT)	0.486571	0.193824	2.510369	0.0225

R-squared	0.831273	Mean dependent var	2.181371
Adjusted R-squared	0.791573	S.D. dependent var	3.945811
S.E. of regression	1.801415	Akaike info criterion	4.211738
Sum squared resid	55.16662	Schwarz criterion	4.459702
Log likelihood	-41.32912	Hannan-Quinn criter.	4.270151
F-statistic	20.93862	Durbin-Watson stat	1.984141
Prob(F-statistic)	0.000002		

Table 9

Granger causality between GVA and tax bases in Romania

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
DVENITMIXT does not Granger Cause DVAB_PC	18	0.23088	0.9141
DVAB_PC does not Granger Cause DVENITMIXT		0.59324	0.6764
Null Hypothesis:	Obs	F-Statistic	Prob.
DEBE does not Granger Cause DVAB_PC	**18**	**8.08257**	**0.0047**
DVAB_PC does not Granger Cause DEBE		0.72890	0.5943
Null Hypothesis:	Obs	F-Statistic	Prob.
DCONS does not Granger Cause DVAB_PC	18	2.33980	0.1332
DVAB_PC does not Granger Cause DCONS		1.55981	0.2657

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DCOMP does not Granger Cause DVAB_PC	20	3.39906	0.0606
DVAB_PC does not Granger Cause DCOMP		**5.16655**	**0.0196**

THE PENSION FORMULA IN ROMANIA – INEFFICIENCIES AND POSSIBLE SOLUTIONS[1]

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Abstract

The introduction of the correction index in the mechanism of determining pension benefits in Romania in 2013 has led to an inefficient formula which generates differences between the incomes received by pensioners with the same level of contributions depending of the year of retirement. This paper reveals the mechanism through which these inefficiencies are generated, their consequences and analyzes the formula proposed by a new pension law against this issue. We conclude that the new formula has the potential to solve this problem, but with a relevant budgetary cost and emphasize the challenge between balancing the costs generated by the change of the formula and the objective of increasing the value of the pension point, while dealing with the sustainability of public finances.

Keywords: public pensions, inequity, Romania

JEL Classification: H55, J11, J26

1. Introduction

The main objective of a pension system is to protect the elderly people against poverty, as well as to provide the necessary resources and conditions for them to live a decent and economically independent life. In the majority of the states, retirement income comes from redistributive public systems, based on intergenerational solidarity (pay as you go).

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[1] *A preliminary version of this paper has been presented at the 17th edition of the International Finance and Banking Conference FI BA 2019 which took place in Bucharest, Romania on March 28-29, 2019.*

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In recent years, the rapid pace of population ageing led to a significant increase in the number of pensioners. Moreover, the European Commission's projections show that, due to changes in the population structure, by 2070, people over 65 years will represent almost 44% of the total population in the EU, increasing with 9 pp compared to 2016. Consequently, the ratio between the population aged over 65 years and population aged between 15 and 64 years (old-age dependency ratio) will increase from 29.6% in 2016 to 51.2% in 2070. In the case of Romania, the total population estimated for 2070 is 14.98 million, and the old-age dependency ratio is 52.8%. The increase of longevity and the retirement of the baby-boom generation (the generation born after the Second World War) will have significant economic effects that will materialize in reducing the potential of economic growth and pressures on public finances, especially at the level of the pension system.

The slowdown in economic growth, budgetary deficits, financial instability and high unemployment rates represent difficulties that could prevent pension systems from fulfilling their mission. Hence, is necessary for states to develop and implement appropriate measures to adapt pension schemes to economic and demographic conditions which are constantly changing. An efficient pension system must prevent a dramatic drop in the income on retirement, provide a correct level of the benefits related to realized contributions, not encourage retirement of individuals as long as they are fit to work, provide incentives for employees to contribute at the level of the fair salary, but the most important principles to be respected are long-term adequacy and sustainability.

The main objective of this study is to show the inefficiencies of the current formula for calculating pensions in Romania and its consequences on the equity principle and also to analyze if the formula proposed by the new pension law solves current problems. The novelty of the study is represented by the fact that this in-depth analysis of the current pension formula in Romania and of its consequences is the first of its kind. We expect that our arguments and conclusions to be of great interest for Romanian public authorities and the Romanian citizens in a broad sense.

The remaining of this paper is organized as follows: the next section performs a broad characterization of the key issues regarding the pension system in Romania, section 3 reviews the literature dealing

with fundamental principles of a public pension system in general, and section 4 contains the case study while the final section concludes.

2. Characterization of the pension system in Romania

The Romanian pension system operates in accordance with Law no. 263/2010 on the unitary pension system, as subsequently amended and supplemented. It is structured on three pillars:

- First pillar – the public pension system which function according to the following principles: redistribution, uniqueness, mandatory contributions, equal rights and social solidarity; it aims at ensuring a minimum standard of living and preventing poverty for pensioners;
- Second pillar – mandatory, privately managed pensions; this component aims to provide a better standard of living in accordance with the period worked;
- Third pillar – voluntary, privately managed pensions, that are based on savings of the people who want a higher retirement income.

The three pillars system was recommended by the World Bank (1994) in the report entitled “Averting the Old Age Crisis”. In 2005, two other components were introduced, justified by the fact that a multi pillar system has a greater ability to achieve the objectives. Additionally, this approach is more efficient in reducing the economic and demographic risks faced by pension systems.

In Romania, the standard retirement age is 65 years for men and 63 years for women (for women this target is set to be achieved progressively by 2030). The minimum contribution period is 15 years and the full contribution period is 35 years. There is possible to grant early retirement with a maximum of 5 years before reaching the legal age, if the individual has contributed at least 8 years longer than the statutory period. Individuals who do not meet this criterion receive partial early retirement, being penalized for each year of unpaid contribution. In addition to these forms, is also granted an invalidity pension when the person loses at least half of the work capacity and a survivor pension for children (up to the age of 16 or 26 under certain conditions) and / or for the insured's spouse. The current level of the replacement rate for regular pensioners calculated as average pension over average net salary in the economy is about 43%.

3. Fundamental principles of a public pension system

As mentioned above the pension systems must be, first and foremost, adequate and sustainable. Chybalski (2015) identified four dimensions for efficiency of a pension system: pension adequacy, the distribution of GDP, the influence on the labor market and the administrative costs. According to the literature, an adequate system implies the adequacy of retirement income. Banks et al. (2005), Holzmann and Hinz (World Bank, 2005) analyzed the adequacy of the pension system by means of two approaches: the absolute level and the relative level (the replacement rate of the working period's income) of the pension. The European Commission introduced a third perspective, the period of retirement. The studies have shown that an adequate level of pension income protects against old age poverty and ensures that living standards are maintained after retirement. Holzmann and Guven (2009) analyze the replacement rate as "an useful instrument for quantification the adequacy of pension benefits, because they represent benefits reported to the income before retirement, thus indicating the degree to which income is replace at pension". Chybalski (2012) noted that the adequacy of pension system takes into account the income, the degree of poverty and the "differentiation of pensioners' material situation by gender.

Concerning the replacement rate of income, it is specified that it should take into account several factors such as: access to housing and medical care, the propensity of individuals to save, the level of economic development of the country and the level of the average income in the economy. In the literature, a replacement rate between 40% and 55% is foreseen to maintain consumption smooth. A higher replacement rate than this level is unstainable as it implies very high contribution rates. The European Commission also expects that in the future, the concerns of pension systems will increase the focus on reducing the replacement rates.

Sustainability of the pension system refers to its long-term financial soundness. The design of the pension system must be realized in such manner that unexpected measures (increase of contribution rates, diminishing future benefits or significant increase of budgetary expenditures on pensions) are not necessary in order to fulfill their obligations in line with economic developments. At the same time, sustainability is closely related to the ratio workers – pensioners, which mean that pension systems must be able to cope with the aging

of the population without exerting any major pressure on public finances. The ageing report of the European Commission shows that pension expenditures will rise by 0.8 pp of GDP during the period 2016-2040 and will decrease by 1 pp of GDP during the period 2040-2070. In Romania, this expenditure aggregate will increase by 0.7% of GDP between 2016-2070.

In order to comply with the two principles, greater attention should be paid to following aspects when designing the pension systems: setting the legal retirement age, discouraging early retirement, modality (formula) for calculating the pension, predictability, flexibility and simplicity of the system to be understood by the population.

Setting the standard retirement age

Estimates of decreasing fertility and rising life expectancy have led to the need to establish a close link between the minimum retirement age and life expectancy, which has materialized in most countries in the world by raising the standard retirement age. This ensures a longer contribution period that contributes significantly to the sustainability and adequacy of pensions. Schwan and Sail (2013) show that higher degree of sustainability and adequacy of pension system can be achieved when linking retirement ages with future increases in longevity. At the same time, the legislative process for determining the retirement age should take into account the analysis of the ratio between the time spent in the labor market and the retiring period. The work in the field shows that the appropriate number of years spent on retirement should be less than 15. Financial resources generated from a shorter retirement period help to meet the current pension systems objectives.

Reducing early retirement and encouraging participation in the labor market

Early retirement of the population for various reasons results in lower contributions and negatively affects the old-age dependency ratio, which has a significant impact on the viability and adequacy of pensions (OECD, 2005a; OECD, 2015). The lower incomes that early retirees would receive may prevent the primary objective of pension systems to protect against poverty in old age (Queisser and Whitehouse, 2005).

Researches have shown that staying within the labor market as many years as possible contributes to maintaining, even improving, future replacement rates. Early retirement leads to a reduction in the level of savings, with the income of individuals being much lower. At the same time, there are also disadvantages that limit the access of the beneficiaries to social security and medical care. In many cases, early exit from the labor market was justified by the release of jobs for the benefit of young people, but this would only be correct if the jobs in the economy were fixed. Studies have shown that reducing the average retirement age in developed countries did not entail a reduction in the unemployment rate.

In order to reduce early retirement, states must take measures and incentives to encourage people to work for as long as possible: adapting jobs for older workers, the possibility of part-time work while retiring, to provide greater support for the re-employment of people who lose their jobs at an age close to retirement. A very important aspect is investment in the health system. Early disease prevention leads to a reduction in the number of early retirements due to illness.

Method of calculating pensions

The efficiency of a pension system is given by the level of benefits relative to paid contributions, relationship established through the pension formula. Holub (2010) show that the pension income can be determined by two approaches. One way shows that the retirement income can be calculated using a formula based on pension points. Another way to determine the retirement benefits is to apply a percentage to a base derived from the average income from the reference period (contribution period). The two methods of calculation set the reference period of contribution (how the income will be replaced) and the income taken into account when calculating pension benefits.

The sustainability of pension systems can be improved by actuarial adjustment techniques and by changing the way in which the accumulated contributions are valorized and indexed. Valorization refers to the multiplication of previous income by an index to adjust it with salary and price changes which occurred during the reference period. In the case of redistributive pension schemes, the indexation rate represents a profitability rate perceived by the population. Barr and Diamond (2006) pointed out that this rate is set by politicians, so could be the promise of the pension system. But there is also the real rate of

return that can be equated with the concept of internal rate of return because it ensures the balance between the assets and liabilities of the pension system. The difference between the two rates is a risk measure as it expresses the difference between the authorities' promises and the real capacity of the pension system.

Therefore, a formula for calculating pension income should encourage payment of contributions in correlation with the correct salary and for as long as possible. It also needs to be equitable so that those who contribute more to the social security budget benefit from a higher pension (the inclusion of penalties in the formula for calculating pensions for early retirement could reduce the number of such cases). The method of calculating the pension must be predictable. In this respect, benefits must be clearly established by law and adjusted with inflation, salary and interest rates.

4. Case study

The current formula for determining pension benefits in Romania is inefficient and is generating inequities between pensioners with the same level of contributions depending on the year in which they retired. Thus, the principle of equal pay for equal contributions is violated. This is due to the fact that the current formula links the valorization of the pension points accumulated during the active life with the gross average wage prevailing in the economy 2 years before retirement while the indexing of pensions which are already in payment is based on the increase in the pension point decided by the Government. All the above implications can be derived from the current formula for determining pension benefits:

$$Pension = Adjusted\ annual\ score * Pension\ point\ value$$

$$Annual\ adjusted\ score = Annual\ average\ score * Correction\ index$$

$$Pension = Annual\ average\ score * Correction\ index * \\ * Pension\ point\ value$$

Where the average annual score is determined by summing the pension points earned during the active life and dividing them to the full contribution period, respectively 35 years with this level being attained for women progressively by 2030, the pension point value is the one decided by the Government and the correction index is a factor introduced in the pension's law in 2013. This correction index is

determined as follows: according to art. 170 of Law 263/2010 it is equal to 43.3% of the gross average salary at the level of the entire economy (in practice for data availability reasons the gross salary is taken with a lag of 2 years, for example for 2016 the reference is 2014) / the value of the pension point / (1 + average annual inflation rate for 2011 - 5.79%, respectively). Briefly, the correction index is equal to about 41% of the gross average wage prevailing 2 years ago divided by the value of the pension point.

Thus, it can be seen from the first formula that the initial pension benefit is not equal to the product between the annual average score and the value of the pension point. Moreover, by the way the correction index is calculated the initial benefit is totally separated from the value of the pension point.

$$Pension = Adjusted\ annual\ score * pension\ point\ value =$$

$$= Annual\ average\ score * \frac{43.3\%\ of\ the\ gross\ average\ salary\ at\ economy\ level}{\frac{pension\ point\ value}{1.0579}} * pension\ point\ value =$$

$$= Annual\ average\ score * \frac{43.3\%\ of\ the\ gross\ average\ salary\ at\ economy\ level}{1.0579}$$

Thus, the initial benefit when an individual is retiring is determined by multiplying the average annual score with about 41% of the gross wage prevailing 2 years before the year of retirement. The increase in the value of pension point is used only for indexing pensions which are already in payment. In order to point the significant consequences on the equity principle of determining pension benefits we will consider an example of an individual who obtained an average annual score of 1 during the active life and retired during 2014-2019. We will compare afterwards the benefit for an individual who retired in 2019 compared to the pension of the individual whore retired in the previous years and whose initial pension determined initially based on the gross average wage as explained above was indexed with the increase in the pension point.

Table 1

The benefits of an individual who obtained an average annual score of 1 point and retired during 2014-2019

Year	Gross average earnings	Pension point value	Correction index according to the law	Annual adjusted score for an individual with 1 pension point	Initial pension	Current pension (indexed with the increase in the pension point)	% initial pension / gross average earnings	Benefi pensior 2019 pensior t
2012	2063	732.8						
2013	2163	762.1						
2014	2328	790.7	1.07	1.07	846.05	1177	41.01%	1.121
2015	2555	830.2	1.07	1.07	888.31	1177	41.07%	1.121
2016	2815	871.7	1.09	1.09	950.15	1199	40.81%	1.100
2017 1 Jan	3223	917.5	1.14	1.14	1045.95	1254	40.94%	1.052
2017 1 July	3223	1000	1.14	1.14	1140.00	1254	44.62%	1.052
2018 1 Jan		1000	1.15	1.15	1150	1265	40.85%	1.043
2018 1 July		1100	1.15	1.15	1265	1265	44.94%	1.043
2019 Jan-Aug		1100	1.2	1.2	1320	1320	40.96%	1

Source: own calculations based on National Institute of Statistics, National House for Pension and Other Social Insurance Rights and National Commission for Strategy and Prognosis data

Thus, it can be observed that the initial pension represents about 41% of the gross average earnings from 2 years ago regardless of the value of the pension point. It can also be noted that a retired person who earned an average 1 point average has a different pension today, depending on the year of retirement. Thus, someone who retired in 2019 has a pension with about 12.15% higher than a retired in 2014, with 10% higher than someone who retired in 2015 and with 4.35% higher compared with a person who retired a year ago. This issue became evident in July 2017 when the correction index had to become 1.05 as a result of the increase in the pension point, but the Parliament by derogating from the pension law maintained it to the value of 1.14. If he did not do so, the pension of someone who would have retired after July 1st 2017 would have been $1.05 * 1000 = 1050$ similar to the

existing pension before indexing and less than that of a retired pensioner January-June 2017, and whose pension was indexed on July 1st by 9%. This is because the initial pension is about 41% of the gross average earnings, and the rise in the pension point only affects pensions in payment. Those who retired more recently benefit from the fact that wages grew faster than the pension point, which affects the formula. Moreover, the current formula for calculating pensions is not only likely to create distortions, but they have the potential to increase over time as shown by the increasing gap between the benefit received by an individual who retired in 2019 and one who retired earlier. The bigger the gap between the wage dynamics and the pension point, the greater will become the differences between pensioners with the same annual score but with a different retirement year. Although the introduction of the correction index did increase all pensions compared to the previous situation, it has done it in a way in which some pensioners have greater advantages and these advantages are not constant in time.

Currently, the Parliament approved a new pension law which is expected to entry into force on September 1st 2021 which changes substantially the formula based on which pensions are determined. The proposed formula is as follows:

$$Pension = Number\ of\ points * Value\ of\ the\ reference\ point$$

Where the number of points is determined by summing all yearly points accumulated during the active life and the value of the reference point is a new variable similar from a conceptual point of view with the current pension point. In fact, the new pension law establishes the value of the reference point as the pension point divided by 25. In essence, compared to the current situation instead of calculating an average annual score by dividing total points to the full contribution period now total points are considered and the reference point now designates a value for an annual point instead for an average point throughout the contribution period. Also, the correction index is being eliminated and the full contribution period is now being reduced to 25 which will generate an advantage for workers with longer contributions periods. The reduction of the full contribution period from 35 years to 25 represents an advantage of about 1.4 in index terms for an individual who worked for 35 years but this advantage is diminished by

the elimination of the correction point currently at a level of 1.2, resulting of a net advantage of 1.17 in index terms or 17%.
In order to compare the consequences of the new formula we will continue the previous example by considering again a pensioner with an average annual score of 1 who worked for a period of 35 years, thus having a total number of points equal to 35. The value of the reference point is given by the current value of the pension point of 1100 divided by 25, respectively 44 RON. In the next table, we determined the pension of a pensioner who retired during 2014-2019 and the increase compared to the current situation needed in order to ensure the convergence.

Table 2

Value of pension according to the new formula

Year of retirement	Current pension	Pension according to the new formula	Increase in pension
2014	1177	1540	30.84%
2015	1177	1540	30.84%
2016	1199	1540	28.44%
2017	1254	1540	22.81%
2018	1265	1540	21.74%
2019	1320	1540	16.67%

Source: own calculations based on National House for Pension and Other Social Insurance Rights data

It can be observed that now a pensioner with an equal number of total points will now receive the same benefits irrespective of the year in which he retires. Thus, this formula has the advantage of being more efficient not suffering from the vices of the current one which were described above. Moreover, as the new formula will be applied also to current pensioners, following a process of pension recalculation, the current inequities will be eliminated.

The new formula, although it solves largely of the problems generated by the current one has also some costs. Compared to the current situation the pensions will be higher, with percentages varying from 0% to 31%, the pensioners disadvantaged by the current formula receiving higher increases, generating significant budgetary costs.

Although the examples considered in the table may suggest that all pensioners will benefit from increased benefits, it is not the case for individuals with lower contributions periods than 25 years whose pensions will not change. It has to be mentioned that older pensioners which retired in a period when the retirement age was smaller will now be disadvantaged compared to individuals which retired more recently when retirement age and the full contribution period are set at a higher level. But it can be argued that individuals, who worked for longer periods of time, even if that was generated by the legislation governing pensions, are also entitled to higher benefits.

5. Concluding remarks

The current formula for determining pension benefits in Romania is inefficient and generates inequities between pensioners with the same level of contributions depending on the year of retirement. Moreover, these differences are significant and have the potential to increase in time if wages are growing faster than pensions. This situation was generated by the introduction of the correction index in 2013 which broke the link between the initial pension and the value of the pension point, with the initial pension benefit being *de facto* linked with the average wage at the level of the economy registered 2 years before retirement. Although, the introduction of the correction index did benefit all pensioners, it has also generated the inequities described above. The new pension law, which is envisaged to entry into force on September 1st 2021, also contains a new formula, which from a conceptual point of view will solve future inequities and also the ones created by the current formula. This will help the pension system in Romania to fill the gap between current and best practices in this field. However, the new formula comes with a budgetary cost with all pensions set be higher, with a percentage varying from 0% to 31%, the pensioners disadvantaged by the current formula receiving higher increases. The Government has to deal with the challenge of balancing the costs generated by the change of the formula and the objective of increasing the value of the pension point, while dealing with the sustainability of public finances.

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CONTAGION PATTERN IDENTIFICATION THROUGH MINIMUM SPANNING TREES DURING THE ASIAN FINANCIAL CRISIS

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Abstract

Complexity in financial markets is slowly overwhelming canonical statistical modelling. With global crises which stemming from contagion effects becoming more frequent, new tools for financial distress transmission capture are needed. Graph theory, with its branch on minimum spanning trees can help researchers better represent the numerous multivariate and asynchronous interactions that suddenly manifest during moments of market panic. Under the current research, a novel graphical methodology is employed for the description of the 1997 Asian financial crisis. It is shown that market sentiment can have an interpretable image through the use of correlation based minimum spanning trees, a useful tool for policy makers and risk managers alike.

Keywords: correlation matrix, graph theory, minimum spanning tree

JEL Classification: C10, C18, C14, C38, C88

1. Introduction

Systemic risk can be expressed as the probability that a financial market suffers a catastrophic collapse due to a chain of events that arise locally and propagate globally in an interlinked system (De Bandt & Hartmann, 2000). Government finance is nowadays exposed to international debt markets and through this medium, public liabilities are traded between global financial institutions. With liabilities comes the risk of default and when this risk manifests itself, financial stress spreads through world markets in chain reaction. The current paper tries to address the problem of representing and understanding the propagation patterns of contagion through the use of minimum

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spanning trees. Its use case pertains to the Asian financial crisis of 1997-1998 due to the global reach that systemic risk gained at that specific time. By first engulfing the eastern and south-eastern parts of Asia and the spreading across the world to Russia and the American continent, the currency crisis that took place will always be a vivid reminder of the dangers of panic in an asymmetric informational environment.

Throughout this research multiple points about the Asian financial crisis will be discussed like its historical timeline, the economic and behavioral causes that lead to the crisis. As a technical tool for investigation, the minimum spanning tree was chosen. It represents a geometrical construction emerging from graph theory with custom applicability to the understanding of interconnected complex systems. Stepping into the temporal dimension of the study, three periods were chosen with respect to the crisis (ante, intra, post), in order to present the topology of market interactions on Asian currency markets.

2. Origins and context of the crisis

Tracing the path of what lead to the Asian crisis requires us to move backwards into history, to the decades of the 80's and 90's when South-East Asia experienced a period of rapid growth sustained by large capital inflows. During this period, the economies neighboring the Indonesian Archipelagoes and the South China Sea managed to lift a large part of their population from poverty and become important producers of manufactured goods. Nonetheless, these swiftly attained benefits came with hidden costs, typical of a "fast-track capitalism" (Weisskopf, 1992) implemented in countries that moved towards market economy status without an appropriate institutional infrastructure.

At the start of the 1980's, the US monetary and fiscal policies were marked by a fundamental change of direction, with Paul Volker at the head of the Federal Reserve. Targeting inflation and trying to avoid stagflation, the FED steadily raised key interest rates from 11% to 17.6% (Walsh, 2004). On the fiscal front, the Reagan administration tried to encourage growth and private initiative by reducing government spending along with tax and regulation cuts and by managing the quantity of money in the economy (Blanchard, 1987). Cumulatively, all of these measures gradually lead to an appreciation in interest rates, followed by an inflow of capital into the US and an investment

speculative bubble (Bergsten, 1984). But as any economy inevitably reverts to equilibrium, the balance was struck by the overvaluation of the US dollar with reference to the currencies of the major G7 countries and also to Asian and Latina America countries. Facing losses in commercial competitiveness, the US was slowly sliding towards a position where it would have to manage both a budget deficit and a current account deficit, a situation termed as "twin deficits" (Abell, 1990). In an effort to restore macroeconomic equilibrium, the US engaged in a coordinated international effort to devalue the dollar. Consequently, in September 1985, the Plazza Accord was signed by the five richest countries in the world, the US, Japan, Germany, France and Great Britain. It was then agreed that coordinated action would be taken to devalue the dollar with respect to the Japanese yen and the deutsche mark. As planned, the dollar lost approximatively 50% of its value to the yen by 1987 followed by gains in the trade balance of the US by 1991 (Frankel, 2015). In Europe, the European Rate Mechanism was adopted to protect against currency market volatility with no effect on intra-union trade (Belongia, 1988), whilst Japan faced export competitiveness deterioration due to a doubling in the yen's real value. Faced with the prospect of recession, the Bank of Japan came up with a fiscal stimulus package that restarted the economy but also spurred real-estate speculation and sub-optimal credit allocation.

Moving into the 1990's two bubbles, a real-estate and stock market one, burst in Japan. Because of the reorientation of banks away from corporations a towards real-estate loans, the traditional Japanese business environment was altered. Constrained by the US, Japan deregulated its financial sector, opening it to outside competitors and investors. Fundamental shifts were also done to the monetary policy by renouncing the objective of growth and focusing towards an unnecessary inflation targeting. History shows that the Japanese government overreacted to the Plaza Accord risks by sustaining a budget surplus at the expense of corporate profits. As a side effect the stock market collapsed, infecting the real-estate sector (Pigeon, 2000) and starting a period of prolonged stagflation, also known as the "lost decade" (Hayashi, 2002). This was when Japanese and "newly industrialized countries" (Schmiegelow, 1992) corporations relocated important production capacities to the emerging economies of South-East Asia.

In the wake of the Plaza Accord, Japanese corporations understood that it will be long before the yen depreciates. Unable to

maintain market share through sacrificing profits alone, entire production branches had to be reorganized and transferred abroad. For example, Japanese yearly foreign direct investment in South-Est Asia grew from one billion USD in the first half of the 80's, to a sustained six billion in the 90s (Ishida, 1998). Profiting from a young population with an insured secondary education level and a constant flow of engineers (Felipe, 2006), Asian industrialized countries were able to maintain their international share in export markets. So successful was this regional expansion that Japan's trade balance shifted from deficit to surplus in less than a decade. Discussing about the opportunity of creating a regional free trade zone with the yen at its core, (Kwan, 1994) measured that the export of heavy machinery and components to ASEAN countries tilted the Japanese current account from a 9.4 billion USD deficit in 1985 up to a 0.l billion USD surplus. Other economies joined this trend, like those of Taiwan and Hong Kong. Nonetheless, working conditions worsened in Japan where there were less permanent jobs and salary purchasing power decreased1.

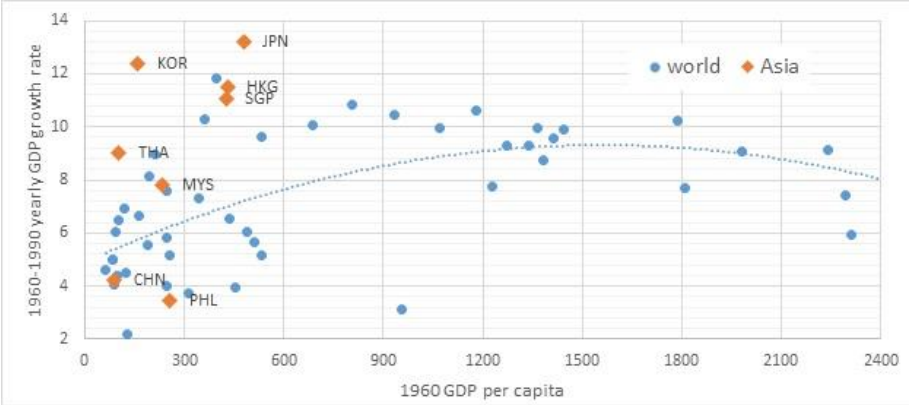
3. "Fast-track capitalism" and its hidden cost

Traditionally, emerging East Asia sustained a business model characterized by low wages, an underdeveloped finance sector and significant state intervention. The advent of large capital inflows opened the spectrum of better financing options and real growth. But, as any coin has a flipside, the ease of access to capital triggered an expansion in monetary mass, a deterioration of the current account, inflation and the overvaluation of the national currency. In a detailed report investigating the link between public policy and economic growth, the World Bank (WB) coined the term "Asian miracle" as the ability of the emerging economies in the region to lift large portions of the population out of poverty (Birdsall, et al., 1993). Looking at the period between the 1960 and 1990, the WB identifies twelve Asian nations with GNI higher than the emerging world's average. Of these, five were called "Asian tigers", Hong Kong, South Korea, Singapore, Taiwan and China, alongside the "newly industrialized economies"(NIE) like Indonesia, Malaysia and Thailand. The report mentions that absolute poverty in the NIE decreased three times while life expectancy increased considerably as a result of accelerated but equally distributed growth.

[1] *https://www.economist.com/finance-and-economics/2013/03/09/waging-a-new-war*

Figure 1

Yearly GDP growth against 1960 GDP per capita



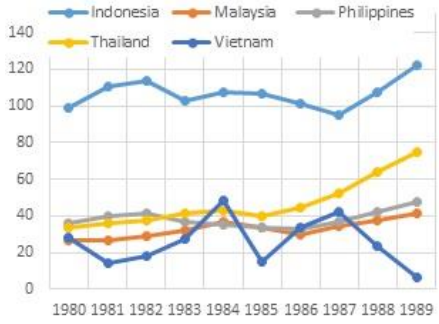
Source: World Bank

Sustained by yearly GDP growth rates of impressive magnitude for three decades, the technocrats of Asian economies had institutionalized a development patter based on massive inflows of foreign capital. Once on board the "globalization bandwagon" South-East Asia became subject to the ups and downs "fast-track capitalism", where growth rates 7% to 10% year on year were based not on internal savings but on investments from outside the country (Bello, 1999).

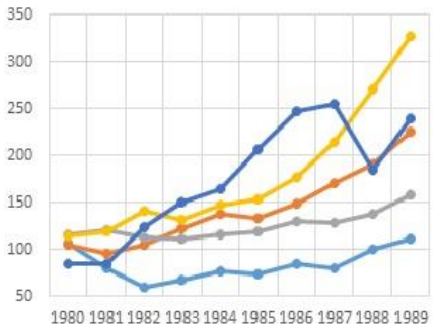
Aside from the external factors, elements of own public policy encouraged the substitution of imports by internal manufacturing and later on developed into a commercial strategy. Policy makers marched full on towards encouraging exports through different measures like: protection of internal markets, export loans, tax exemptions for all imports used by exporting companies, tax cuts, and devaluation of the national currency. Together, these actions produced results that increased real exports more than 800% between 1970 and 1997 in the Sout-East Asia region (Redding, 2003).

Figure 2

a. GDP *(current prices, USD billions)*



b. Volume of exports *(1980=100)*



Source: World Bank

This is not to say that ASEAN countries were traditionally isolated. On the contrary, in 1983, East-Asian intratrade represented 10% of world trade and 67% of the Pacific region trade (Petri, 1993). Due to the later expansion of world trade these percentages dropped to 7% and 40% respectively in 1990. Trade links had positive externalities into the investment flow towards the regional emerging economies, with NIE and Japan encouraging local business owners to join their global strategies. As such, the corporate industrial net spread amongst numerous production location in the region focusing on subcomponent manufacturing and assembly with imports of equipment and machinery, coming mostly from Japan. As side effects of this accelerated integration through expansion, inflationary pressures on salaries and real estate appeared, putting a strain on the existing physical infrastructure (Athukorala, 2006).

With easy access to external financing, the newly liberalized economies accumulated debt both on public and private sector balance sheets, through the intermediation of the financial sector. For example, sovereign debt in the Asia-pacific region grew from 204 billion USD in 1987 to 411 billion in 1994 (Tang, 1995), equivalent to an annual rate of growth of 7.5%.

Among other causes for the crisis it is worth mentioning the institutional and legal model adopted by Asian societies. Unlike western societies where business is done through arm-length transactions, subject to international law, Asian systems of relationships were based on prestige, personal connections. This type

of interaction created opaque monopolies, closed to outside competition. In a review about the legal bindings in business transactions in Asia, (RAJAN & ZINGALES, 1998) points out that foreign investors did not have guarantees that their money was allocated efficiently. Under such circumstances, many opted for frequently renewed, short term commitments, ready to retire their investments in case of financial distress. Of course, that moment finally came and when it did, the regional relationship-based networks absorbed the shock in its entirety.

In an analysis about the role of government institutions in contributing to the crisis, Joseph Stiglitz highlights three types of stimuli that encouraged short term debt in foreign currency (Stiglitz, 1998):

1) Pegging the national currency to the US dollar: though adverted as a means to control inflation, the adoption of fixed exchange rates in some Asian countries was meant to reassure investors that their assets would not loose values if they decided to pull out. Stock markets benefited from this regime as cross market migration could be done without exposure to currency risk.

2) Sterilization of capital inflows: a common response against national currency overvaluation following large inflows of foreign currency lies in the accumulation of reserves. Buy buying the excess foreign currency, the quantity of money in the economy grows, thus spurring inflation. Sterilization of these interventions can be achieved by raising the key interest rate. But, by making access to credit inside the country more difficult, central banks determined companies to look outside for financing.

3) Liberalization of capital accounts: less opened countries, with a lack of transparency of the financial sector, were less affected by the Asian crisis

We cannot say with certainty if the accumulation of debt in Asia was part of a broader strategy for industrial expansion. What is certain is that multiple disequilibria accumulated in the real economy like: the over expansion of the banking sector, highly leveraged investment in real-estate, an increase in government deposit guarantees (McKinnon, 1996). With such an accumulation of speculative investment, the sudden withdrawal of foreign capital can hurt internal savings and generate widespread bankruptcies. Therefore, there is a risk that local banks and credit networks might be dismantled, rendering human capital irrelevant (Calvo, 1998).

In the period preceding the crisis, the macroeconomic situation worsened in most Asian economies. In Thailand, the current account deficit rose from 5.7% in 1993 to 8.5% in 1996 due to overwhelming debt for private companies that had done bad investments in the real-estate sector (Corsetti, 1999).Foreseeing a potential crisis, Indonesia progressively raised interest rates up to 5% in 1997 and was in theory well suited to face the fore coming financial turmoil reserves of 20 billion USD and a current account surplus of 900 million USD. Despite this a large number of national corporations had borrowed in USD and the Bank of Indonesia was reluctant to raise interest rates further for fear of rupiah overvaluation. Moving on to South Korea one could observe that the family corporations (chaebol), composing the backbone of the countries industry, were engulfed in borrowing spree with the purpose of gaining international market share. Due to the close cooperation between the government and private corporations, financial controls and regulations were relaxed which, with time, resulted in a debt to equity ratio of almost 500% for the largest 30 corporations in South Korea in 1997 (Koo, 2001).

4. Chronology of the crisis

1997	January	Hanbo Steel corporation goes bankrupt, defaulting on its debt obligations, the first South-Korean chaebol to collapse in a decade
1997	February	Somprasong, a large real-estate developer in Thailand is forced into bankruptcy by its creditors
1997	March	A second South-Korean conglomerate, Sani Steel, defaults on its debt repayments
1997	May	Japan hints at possibly raising interest rates to prevent a yen devaluation. This announcement changed the perspective of international investors which decided it was a good moment to pull out of the region. All regional currencies are dumped, forcing the Thailand, the Philippines and Malaysian government to intervene through interest rate hikes, bailout packages for banks or restrictions on real-estate loans.
1997	June	Licenses are revoked for 16 major financial institutions in Thailand.
1997	July	Realizing it cannot support the currency peg, Thailand allows the baht to float, which immediately loses 20% of its value. A similar drop is incurred by the Malaysian ringgit after the government adopts a managed float regime for its currency
1997	August	Indonesia becomes the last economy to renounce its currency peg. The IMF intervenes for the first time in the crisis by granting a 3.9 billion dollars load to Thailand
1997	September	National banks in the region sterilize their open market operations in an effort to segregate their internal money markets from external ones.
1997	October	Contagion spills over from the currency markets to the capital markets of Hong Kong, Taiwan and US. The Dow Jones index registers its biggest historical drop of 544 points.

1997	November	New loan arrangements are offered by the IMF to Indonesia and South Korea, with the condition that countries adopt structural adjustment policies. Though reassured for a short period, financial markets anticipate the fore coming tax raises and continue to attack the regional currencies.
1997	December	The Korean Won and Indonesian ringgit maintain their downward trend.
1998	January	Structural reforms announced by South Korea, Thailand, and Indonesia target non-performing banks, opening them to foreign investors. Government spending is severely cut. Markets start to regain confidence.
1998	April	The IMF secures a third loan arrangement with Indonesia in exchange for the phase out of food and fuel subsidies
1998	August	Fiscal policy across the Asian region becomes stricter, with tax and interest rate hikes discouraging speculation.
1998	December	American banks are asked by the FED to restructure the sort term loans offered to Asian banks

Source: *Bloomberg, Financial Times and other media outlets of the time*

5. Graphs as a tool for navigating complex financial networks

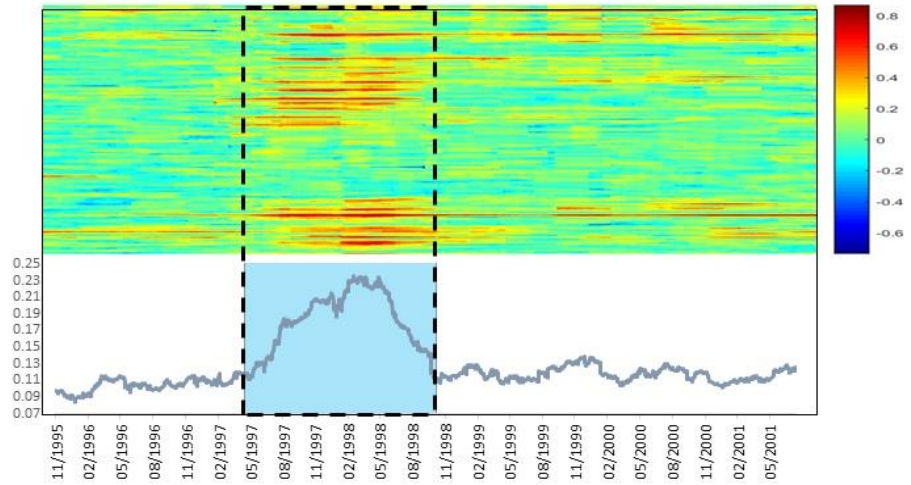
Complexity emerges from the interaction of numerous entities abiding by local rules and yet, producing a higher order behavior. One tool for visualizing and understanding complex systems is the graph, an abstract mathematical construct defined by nodes connected by edges, describing the direction and intensity of interactions in the system.

5.1. Data set

As dataset, daily forex returns were chosen, for 17 USD currency pairs involved in the Asian crisis, with a time frame spanning from November 1995 to December 2001. The currency symbols are: JPY, AUD, CNY, HKD, INR, IDR, MYR, NZD, PHP, RUB, SGD, ZAR, KRW, CHF, TWD, THB, TRY. For the correlation coefficients, daily logarithmic returns were used. By calculation rolling 100 day rolling window correlations, a color map representation can highlight periods of sustained global interactions. For example, figure 3 depicts the correlation indices evolution for all currency bivariate combinations. Most of the correlations do not exceed on average an absolute value of 0.1, except for the crisis period when they start growing in May 1997, reaching a climax in March 1998 and then returning to normal levels by the end of the year. Taking into account the chronology of the crisis, it looks like statistical correlations emulate well the historical description of the events and their corresponding market actions.

Figure 3

Absolute correlations for bivariate currency combinations



Source: IMF

5.2. Distance measures for graph construction

A graph is a dynamic map of interactions and like any map, it relies on the accurate measurement of distances. Economics deals with causality measures or, in the absence of causality with statistical correlations. As such, the correlation matrix is often the preferred choice for describing the hierarchical structure of multivariate systems. Aggregating and analyzing bivariate correlations between financial time series can lead to the discovery of stable interdependency connections or to the side lining of those sporadic interactions determined by false signals.

If the Pearson correlation index is to be used as a distance measure, it would need to respect a set of axiomatic rules that derive from the concept of topological distance Given two points in space X and Y, d(X,Y) represents the distance between the point if:

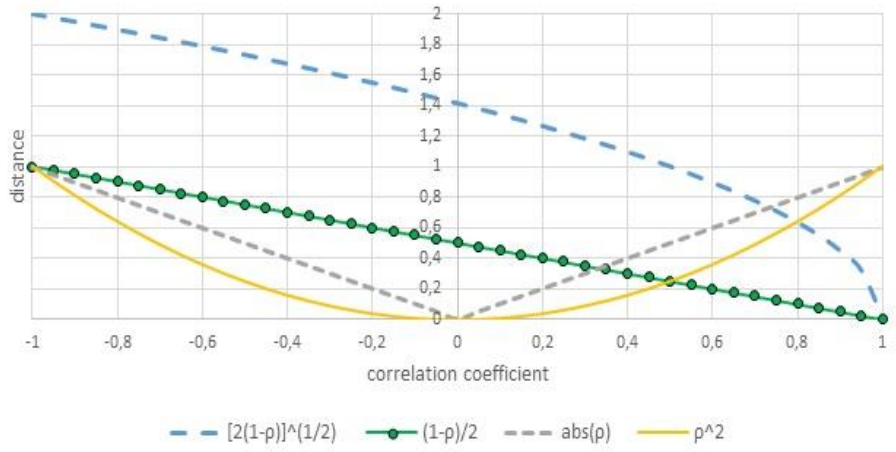
1. $d(X,Y) \geq 0$ — distance cannot be negative
2. $d(X,Y) = 0 \approx X = Y$ — distance is zero for overlapping points
3. $d(X,Y) = d(Y,X)$ — distance is symmetric
4. $d(X,Z) \leq d(X,Y) + d(Y,Z)$ — distance is additive

In light of the above restrictions, (Mantegna, 1999) proposes a distance measure for financial returns, derived from the Pearson correlation coefficient $\rho_{XY} = cov(X,Y)/\sigma_X\sigma_Y$ under the form $d = \sqrt{2(1-\rho_{XY})}$. Other measures based on correlation coefficients can also be utilized. Figure 4 shows multiple distance shapes based on correlation coefficient transformation. Some measures are symmetric with respect to the correlation coefficient sign. Mategna's distance takes sign into account, exponentially converging to zero when correlation converges to 1.

For the current study, a custom distance measure was derived by the formula (1-ρ)/2. The shape of the distance is fully linear with respect to the correlation coefficient, fluctuating between 1 and 0 for correlations of -1 and 1 respectively.

Figure 4

Correlation coefficient derived distance measures



Source: Author's calculations

5.3. Minimum spanning trees

Representing the matrix of correlation in graph form is in itself not very informative. Every time series is more or less correlated to all others and so the graph becomes just a visual representation of a correlation table. By constructing the minimum spanning tree(MST) from the graph, a structural system of dependencies is revealed, which still guards a global view on the data set but is in turn more informationally efficient. A minimum spanning tree is defined as the set

of edges in an undirected graph that connects all the nodes, with no cycles and a minimum sum of edge weight. Applied for correlation-based distances, the MST shows what chained path causality might borrow to, propagate a shock, from one variable to another. Employing the word “causality” is not done in the statistical model based sense of (GRANGER, 1969) causality, but more in the context of contagion spreading through a network of dependencies.

In the research literature, MST’s have been previously used to explain complexity in financial networks. (Bonanno G. e., 2003) proves in a comparative study of MST extracted from stock market and synthetically generated data, that market models are not able to capture the hierarchical structures inherent to real market data. In a later development of this observation, (Bonanno G. e., 2004) proposes that MSTs be used for assessing the informational relevance of factor models, beyond their averaging statistical properties. On a more practical side (Tabak, 2010) looks at the emerging hierarchies on the Brazilian stock exchange, noticing clustering effects in the MST based on industry and economic sector criteria. Incorporating the temporal dimension into analysis, (Coelho, 2007) challenges the modern portfolio allocation approach of (Markowitz, 1952), after showing that correlation based MSTs vary in shape and structure with time. MSTs have also been called upon in the understanding of the Asian financial crisis, when (Jang, 2011) used correlation matrices to highlight a spatial dispersion in dependencies between countries in the period preceding the crisis. Also, in the sphere of time varying MSTs, (Onnela, 2003) does a link survivability study on stock market data for NYSE, between 1980 and 1990. He shows that in general the topology of MSTs is constant, with contraction around the 19’Th of October stock market crash, also known as Black Monday.

5.4. Minimum spanning tree representation

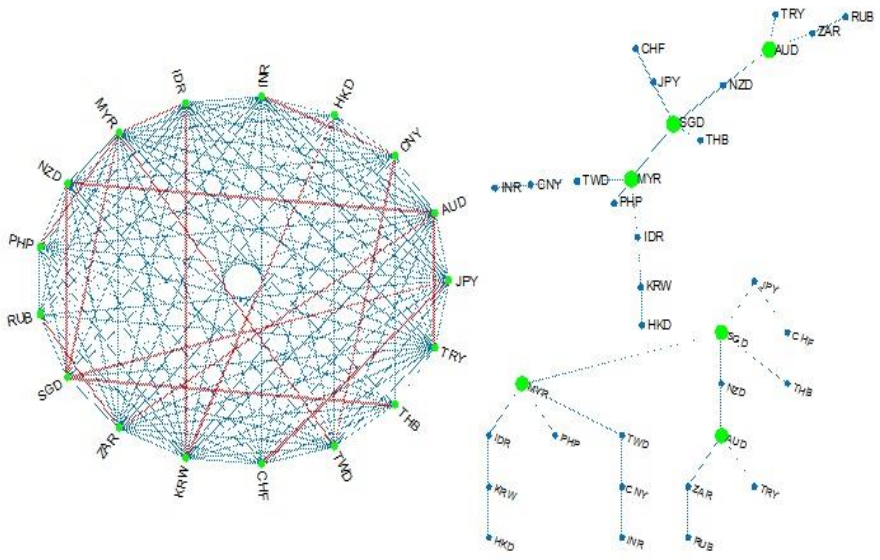
One of the problems with graphs produced from correlation matrices is the high number of edges. For n variables there are n(n-1)/2 possible connection, a quadratically increasing quantity. For example, under the current paper dataset, for 17 currency pairs there are 136 unique combinations of two. Faced with such a high number of relationships to analyze, we ask ourselves which are the most relevant for the systems behavior. We also know that on currency markets, some pairs are deemed “majors”, due to their high trading

volume. Do these pairs matter more in the market landscape? Or do crisis episodes reveal regional clusters with higher influence?

Figure 5 is a representation of a pairwise distance matrix derived from correlation coefficients between 17 currency pairs. The full connected graph representation is overwhelmed with edges that can confuse any human observer. By highlighting the MST, complexity is reduced and relevant connections emerge. Taking only the MST and representing through force directed placement (FRUCHTERMAN & REINGOLD, 1991) or through layered levels (BARTH, JÜNGER, & MUTZEL, 2004), one is able to understand the hierarchical dependencies in the data. Under the present example the Singapore dollar, the Australian dollar and the Malaysian ringgit are influence intermediaries. Possible explanations are that the first two currency pairs are highly traded in the region and worldwide, whilst the third one suffered severe devaluation during the crisis and was at the origin of contagion.

Figure 5

Multiple topological representations of the MST (circle, force, layered)



Source: Author's calculations

6. Minimum spanning tree analysis of the Asian financial crisis

In order to observe the evolution of the MST in the vicinity of the crisis events, 100 day rolling window correlations were computed for all combinations of currency pairs. By taking the correlations and transforming them into distances by the formula (1-ρ)/2, MST are obtained for each observational 100 day window. Even though the MST is constructed from a different distance matrix each period, as the correlation coefficient remain relatively stable from day to day, it is acceptable to locally compare the total edge weight sum as a measure for total tree dispersion. As such, the plot of these consecutive edge distances offers hints about market cohesion in time

Figure 6

Total edge weight sun in the MST for consecutive periods

Source: Author's calculations

Figure 6 shows that total distance in the MST drops starting with the year 1997, when the crisis occurred. As correlations across the region become more significant, economies come closer together in the view of market participants. Three distinct periods are isolated, according to the total MST cohesion measure:

1) Build-up of distress and collapse (April 1996-August 1998) – the MST structure becomes denser due to a generalized increase in correlations

2) Economic recovery (August 1998-September 1999) – increase in MST dispersion following a regain of market confidence in the Asian region

3) Post crisis calm (September 1999 – December 2001) – cross-country correlations might vary, but on average the region is stable

Selection of the three time frames vas done visually by taking the minimum and maximum values of the total edge sum in the MST.

6.1. Estimation results

a) Build-up of distress and collapse (April 1996-August 1998)

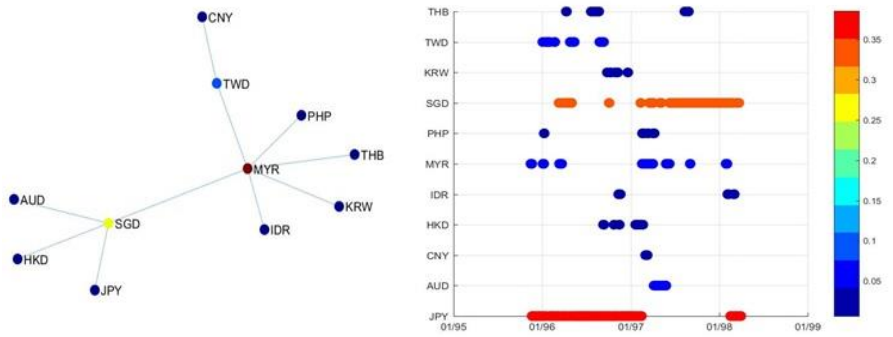
Considering the correlations for the complete period 1996-1998, the topological analysis (fig.7a) suggests the existence of two distant sets of currency pairs at a distance sufficient to allow their discrimination. The first set consists of AUD (Australian Dollar), HKD (Hong Kong Dollar) and JPY (Japanese Yen), centered around SGD (Singapore Dollar). It should be noted that the Singapore Dollar was pegged to the GBP (British pound) till 1970 and after it was under a managed float based on a US dollar-dominated currency basket. So we can consider SGD as a regional approximation of the US dollar. The second set consists of CNY (Chinese Yuan), TWD (New Taiwan Dollar), PHP (Philippines peso), THB (Thai Baht), KRW (Korean won), IDR (Indonesian rupee) concentrated around MYR (Malaysian ringgit). The centrality measure that designates the Singapore dollar and the Malaysian ringgit as central currencies should not be interpreted as an absolute indication of their domination, but rather as the measure of maximum similarity with the currencies of their own group, an average of the evolutions of the other variables.

Moving from the topological analysis to the interpretive synthesis, we understand that the graph managed to classify the currencies depending on the degree of industrial development and the opening to trade of the represented economies, despite the fact that these characteristics were not incorporated into the algorithm. Here is an indication of the usefulness of modern methods of viewing and interpreting large data sets. The MST method produced useful informative content without the researcher issuing a subjective initial hypothesis and then testing it quantitatively.

Focusing on the node hierarchy (Figure 7b), it is observed that for the 100-day correlation, the SGD and MYR dominance is equal to JPY and TWB respectively. The topology of node relations remains relatively constant, but at different times, the central nodes are interchangeable in a group (a core) of similar currencies.

Figure 7

a. MST **b. Evolution of node centrality in the graph**



Source: Author's calculations

From a historical point of view, Japan resisted the crisis due to the world's largest currency reserves at that time. Australia had exported less to the region but at the same time the cost of imports had diminished, especially for raw materials whose production had increased, countries in difficulty trying to compensate their losses. In fact, liquid capital migrated from developing countries to economies in the region that have a tradition of banking and a consolidated rule of law.

Violent rebalancing in the forex markets was due to the currency management by central banks through controlled floatation or even fixation against the US dollar in the case of Thailand, Indonesia or Malaysia. But for these open economies, which liberalized their capital account, withdrawals and speculative attacks forced them to raise short-term interest rates, and when this mechanism no longer had effect, they let the currency fluctuate freely, triggering rapid devaluation.

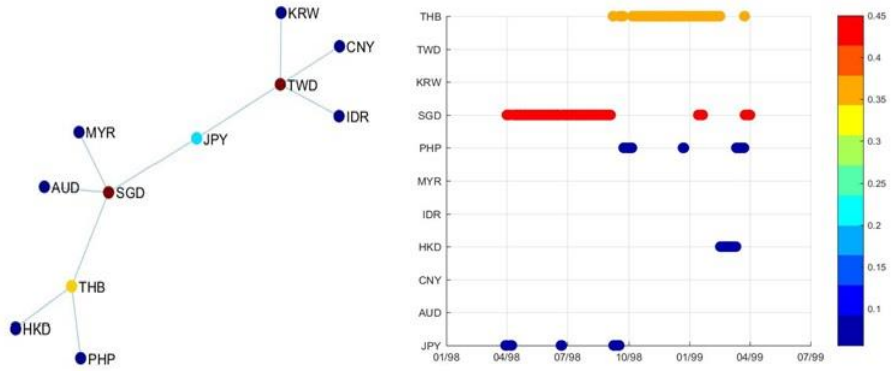
b) Economic recovery (August 1998-September 1999)

In the second period, characterized by a sustained increase in intra-node spacing, currency pairs become more disparate, the role of central nodes being taken by THB, SGD, JPY and TWD for correlation over the entire period (Figure 8a). From the perspective of the mobile correlation window, the interconnected node role is preserved by THB and SGD (Figure 8b). The topological representation also takes into account the distances between the nodes. The largest distance is

between the set of HKD and PHP and the set consisting of KRW, CNY and IDR.

Figure 8

a. MST **b. Evolution of node centrality in the graph**



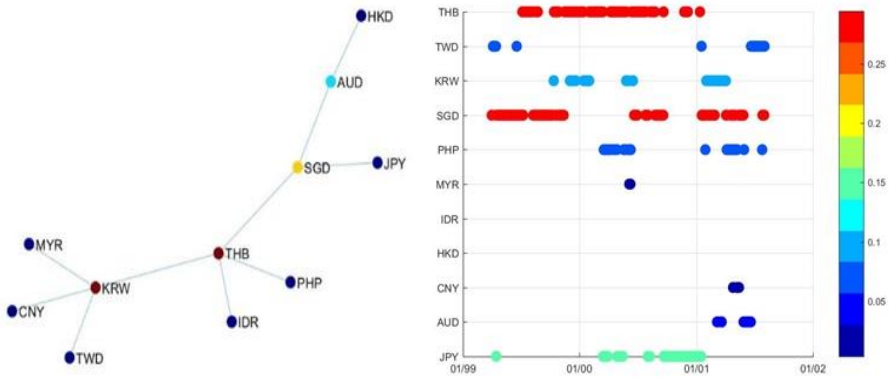
Source: Author's calculations

In this case, pegged currencies that or who were heavily linked to the US economy, either through commerce or foreign investment, crowded into a distinct area of the graph, whilst those more dependent on the regional economy retained group cohesion. After the initial shock of the crisis, the IMF and the US intervened to support the Asian countries and save Russia from defaulting. In 1999, most economies stabilized their financial situation after their public debt exceeded 150% of GDP.

c) Post crisis calm (September 1999 – December 2001)

Figure 9

a. MST **b. Evolution of node centrality in the graph**



Source: Author's calculations

The Asian crisis also had beneficial effects for disciplining the affected economies, most of them developing rapidly after the end of the crisis. IMF aid packages, the restructuring of the economy, the liberalization of the exchange rate and the return of capital together with us prudential rules in the banking system, all these measures have contributed to nearly a decade of commercial recovery and an increase in average incomes in the region. The topological analysis is similar to the exit period of the crisis, demonstrating that the Asian region is differentiated according to the degree of integration into the global economy, but in times of crisis, this discrimination fades away and the capital withdraws to those savings reserves, HKD, JPY and AUD.

7. Discussion

Multivariate modelling of time series will always be prone to over parametrization and in the current international financial landscape complexity cannot be avoided. The present research brings forward graph theory as a helping tool for statisticians in choosing which type of modeling approach to take when dealing with high dimensional data. By looking at the Asian financial crisis from the perspective given by minimum spanning tree, one can understand that market sentiment is highly polarized in times of financial distress. Investor opinion tends to gravitate around a binary view of safe haven

currencies versus compromised currencies in times of crisis. The view reverts to a more geographical segregation mapping when no immediate threats are foreseen.

Minimum spanning trees can become a trustworthy tool for policy makers and risk managers in the analysis of complex financial systems. With characteristics that blend the dimensionality reduction of principal component analysis and shock analysis of impulse response functions, MSTs can prove highly informative. Through their capacity of efficiently extracting information from correlation matrices and plot causality paths between multiple variables, MSTs should be a first-choice option when dealing with shock propagation in financial networks.

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TESTING THE VALIDITY OF FAMA FRENCH FIVE FACTOR ASSET PRICING MODEL: EVIDENCE FROM TURKEY[1]

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Abstract

Fama and French introduced a five-Factor Asset Pricing Model (FF5), adding a new perspective to asset pricing models in the literature in 2015. The aim of this paper is to investigate the validity of Fama French (2015) Five Factor Asset Pricing Model for 18 companies whose shares are listed in Istanbul Stock Market Sustainability Index. According to obtained findings, the coefficient of the profitability factor, from the new variables added to the three-factor model to build the FF5 asset pricing model, was positive and statistically significant, whereas the coefficient of investment factor was not statistically significant. As a result of the study covering 1995Q1-2017Q3 period, there was not enough evidence that the FF5 Model was valid for Istanbul Stock Market Sustainability Index. In this context, the model will not be beneficial for investors in the estimation of the returns of the companies in the Istanbul Stock Market Sustainability Index.

Keywords: Fama French, Five-Factor Model, Asset Pricing, Istanbul Stock Market Sustainability Index.

JEL Classification: C23, G12

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[1] *This paper is extended version of presented report at the 22nd Finance Symposium on 10-13 October 2018, Yanışlı, Mersin, Turkey.*

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1. Introduction

Until the 1950s, the investors thought they could reduce the risk of their portfolios by increasing the number of securities in the portfolio. Hary Markowitz (1952), the founder of modern portfolio theory, determined that the risk can be reduced by bringing together the securities with negative correlation. Although he took a serious step towards the calculation of risk and return, he did not make any judgments on how to determine the relationship between these two variables.

Sharpe (1964), Lintner (1965), and Mossin (1966) discussed how to determine the relationship between risk and return with different studies through Capital Assets Pricing Model (CAPM). Markowitz demonstrates how investors create effective portfolios, on the other hand, CAPM reveals how financial assets are priced in effective market conditions. The Arbitrage Pricing Model was introduced by Stephen Ross (1976) to eliminate the missing variables such as the only independent variable in CAPM, normal distribution of returns, necessity of market portfolio, borrowing from risk free interest rate, and single term assumption. Arbitrage pricing theory has been seen as a new development stage in asset pricing literature, and it has been believed that multiple variables affect the return on assets thanks to this model.

The criticism of the arbitrage pricing model is that the aforementioned factors have not been fully defined. In this regard, the studies carried out in the following years have been designed to determine what are these factors. One of the most important research in asset pricing literature is the three factor model of Fama and French (1992, 1993, 1996). According to this model, the return of a stock is affected by the size of the company and the B / M ratio as well as the market risk premium. Compared to smaller companies, larger companies have lower returns. On the other hand, firms with higher B / M have higher returns.

One of the most recent asset pricing models up to this point was created by adding profitability and investment factors to the three factor model by Fama-French (2015). This new model is called Fama-French Five Factor Model (2015).

The number of studies conducted at the international level investigating the Five Factor Model is very low. In addition, there is no study examining the Turkish market in terms of aforementioned issues except the study of Acaravcı and Karaömer (2017). Moreover, the first

study examining the FF5 model on a sectoral basis for Turkish stock market is the motivation of this study when compare to study of Acaravcı and Karaömer (2017). The purpose of this study is to investigate the validity of the five-factor model in Borsa Istanbul Sustainibilty Index. In this context, the findings of turkey where is developing country on a sectoral basis will also provide a valuable contribution to other developing countries.

In the first part of the study, general explanations about the subject is given. Empirical findings on FF5 model in the literature are presented in the following second section. In the third part, the data and the methods used are explained. In the fourth section, the empirical findings are explained, and the fifth section includes the general evaluation and the conclusions.

2. Previous empirical studies

The number of studies investigating the Five Factor Model was relatively few in 2015, there has been increasing interest in the following years. One of the first studies belongs to Nguyen et al. (2015). In their study investigating the FF5 model, the authors explained that the new asset pricing model had a greater clarity of explanation for anomalies than traditional CAPM and three-factor model. In a similar study, Chiah et al. (2016) examined the Australian market and found that five factor models could explain the asset pricing anomalies more strongly than the three-factor model. Çakıcı (2015) showed that the results of the five factor model for North America, Europe and other global markets were similar to the five factor model results for US stock markets. On the other hand, as a result of the analysis, it was seen that these two new factors did not have a high degree of explanatory power in Japan and Asia Pacific portfolios. Mustafa and Ali (2016) stated that FF5 was better in explaining volatility than previous pricing models in their study of Norwegian markets. Dhaoui and Bensalah (2016) examined the New York Stock Market and found that the FF5 model had a standard validity. Chen et al. (2017) examined the FF5 model for the Chinese market. According to the results, FF5 model was found to be more sensitive to fluctuations in stock prices than FF3 model. In another study examining Chinese markets, Guo et al. (2017) used the factor spread test and found that the investment factor was not statistically significant between July-1995 and June-2015 and between July-1997 and December-2013. Lin (2017) examined Chinese markets

for the period 1997-2015 and found that the profitability factor was statistically valid but the investment factor was not. In their study using GMM and covering 12 different sectors to test the FF5 model of Fama and French, Racicot and Rentz (2017) found that each variable was of high importance. Huynh (2017) applied the FF5 model for Australian markets. The findings indicated that investment and profitability variables played an important role, but a better asset pricing model should also be investigated. Jiao and Lilti (2017) compared the Chinese and American markets by using multiple regression models, and found that profitability and investment factors in China did not have a very high explanatory power compared to American markets. Yang et al. (2017) tested the validity of the FF5 model by taking three different samples of five factors (Global, North America and USA). The study using the EGARCH model proved the validity of FF5 model. In their studies covering monthly data for the period 2005-2016, Acaravcı and Karaömer (2017) found that the FF5 model was valid for Borsa İstanbul. Mosoeu and Kodongo (2017) examined the developing countries. According to the findings, FF5 model could explain the portfolio returns in emerging markets, but it was not sufficient to explain the average returns of the global portfolio. In all countries, except India and South Korea, the market risk factor was statistically insignificant.

Finally, a lot of work was carried out in 2018 about. Zhang et. al. (2018) investigated the Chinese A-share Market and determine that FF5 model has explanation ability less than three-factor model. Dirxy and Peter (2018) examined the five factor model does for German stock market. According obtained findings, new factors have added significant explanatory power to the analysis. The summary of the transmitted to this stage studies in the literature is presented in Appendix 1.

When the studies are evaluated in general, it is obvious that the validity of the FF5 model is lower in the studies conducted on the Asian region, while it is higher in the European and US markets. In other words, an investor who uses the ff5 model in the Asian region has the opportunity to generate more than normal returns, while an investor in the European region will not be able to obtain the return. Thus, it is intended to determine whether Turkey stock market has a quality closer to Europe or Asia markets in terms of market condition and market structure. The main purpose of the study is to investigate the validity of FF5 model in Turkish markets, located right in the middle of

the Asian and European markets, and contribute to the relevant literature.

In the following sections of the study, the data used and the details of the FF5 model were firstly presented, and then the empirical findings were introduced. After that, the results were discussed and recommendations for future studies were presented.

3. Data and methodology

This study was carried out on 18 companies whose shares were listed in the Borsa İstanbul Sustainability Index during the period 1995Q1 -2017Q3. In the mentioned period, finance sector companies traded in the Sustainability Index were excluded from the scope of the study due to their different balance sheet structures. In order to determine whether the Five Factor Asset Pricing Model developed by Fama and French (2015) is valid in Borsa Istanbul Sustainability Index, a dataset covering 91 quarterly period which consisted of the unbalanced panel of the 18 companies traded in the index was used. The data used in the study were obtained from Finnet Electronic Publishing Data Communication platform. The dependent and independent variables used in the study as well as the symbols shown during the study period and the possible effects of these variables on the return of firms are presented in Table 1.

Table 1

Definitions, Symbols and Possible Effects of Independent Variables

Variables	Symbols	Definitions	Possible Effects
Panel A: Dependent variable			
Company's risk premium	$R_{it} - R_{Ft}$	Company Return - Risk Free Interest Rate	
Panel B: Independent Variables			
Market Risk Premium	$R_{Mt} - R_{Ft}$	Market Return - Risk Free Interest Rate	None
Size	LNSMB	The natural logarithm of Market Value	-
Value	HML	B/M ratio	+
Profitability	RMW	EBIT / Total Assets ratio	+
Investment	CMA	Active Growth Rate	-

Except the size, the other variables presented in Table 2 were used in the raw state during the analysis as they were proportional. In order to avoid return volatility, the natural logarithm of the market value representing the size variable was taken.

Descriptive statistics on the variables of our study are given in Table 2. There were 1576 observations for each variable in our unbalanced panel data set. It was seen that the company's risk premium variable had a negative average. The negative average shows that the company's returns were lower than the interest rate (the interest rate on treasury bills). The maximum value of the company's risk premium was 2.7762 while the lowest value was -0.9527. The fact that the standard deviation value of the company's risk premiums was higher than the average value indicates that the difference between companies was important.

Table 2

Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Min	Max	Obs
$R_{it} - R_{ft}$	-.0006	-.0140	.324	-.952	2.77	1576
$R_{Mt} - R_{Ft}$	-.024	-.015	.22	-.79	.62	1576
LNSMB	20.38	20.58	2.017	7.426	24.51	1576
HML	.6698	.5555	.5162	.0088	5	1576
RMW	.1791	.049	.8297	-13.42	9.19	1576
CMA	.4433	.26	.615	-.50	9.00	1576

Correlations between the variables in our study and the variance inflation factor (VIF) values are presented in Table 3. VIF determines how much the variance is inflated. The variances of the estimated coefficients are inflated when collinearity exists. When the correlation values were analysed, it was seen that the correlation between the Company's Risk Premium and the Market Risk Premium variables was positive and statistically significant at 1% significance level. The coefficient between these two variables had the highest correlation value of 0.68. When the correlation coefficients between the explanatory variables in the analysis were examined, there were no coefficients greater than 0.80 critical value suggested by Gujarati and Porter (2009). Therefore, it can be stated that there was no problem of

multiple linear regression between variables. In addition, the VIF values based on panel OLS regression in the table confirmed the findings. All VIF values were found to be less than 5.

Table 3

Correlation Matrix and Variance Inflation Factor (VIF) Values

Variables	1	2	3	4	5	VIF
(1) $R_{it} - R_{ft}$						
(2)$R_{Mt} - R_{Ft}$	0.68***					0.96
(3) LNSMB	0.15***	0.18***				0.82
(4) HML	-0.07***	-0.00	0.13***			0.95
(5) RMW	0.02	0.03	-0.05**	0.06***		0.99
(6) CMA	-0.03	-0.14***	-0.38***	-0.22***	-0.01	0.81

*Note: *** p<0.01, ** p<0.05.*

The aim of this study was to determine whether the five-factor asset pricing model developed by Fama and French (2015) was valid for 18 companies listed in the Borsa Istanbul Sustainability Index between 1995 and 2017. For this purpose, the regression model, which is expressed by Equation (1), is estimated:

$$R_{it} - R_{ft} = a_0 + b\,(R_{Mt} - R_{Ft}) + s\,SMB_{it} + h\,HML_{it} + r\,RMW_{it} + c\,CMA_{it} + \varepsilon_{it} \quad (1)$$

Where R_{it}, R_{ft} and R_{Mt} indicate company return, risk free interest rate, market return, respectively. The dependent variable $R_{it} - R_{ft}$ in the model refers to company risk premiums. Company returns (R_{it}) are calculated by subtracting the previous quarter's price from the the quarterly prices of the companies' shares and by dividing into the previous quarter's price ($R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$). Risk free interest rate (R_{Ft}) is calculated by converting annual interest rates of the shortest-term treasury bills issued in quarterly periods into quarterly interest rates. ε is the error term, and the subscripts i in the equation shows the company and t shows the time period.

Here, the first term shows the market risk premium, the second term is the SMB scale effect (size effect), that is, the big firms and the small firms have different returns. The third term demonstrates the HML value effect, that is, B/M ratio differs from firm to firm and this

affects the stock return. In addition to the classical three-factor model, Fama and French (2015) added two new factors to the model.

From these two new factors, RMW refers to the profitability factor and CMA refers to the investment factor. The profitability factor, which is not included in the three-factor model of Fama French (1992, 1996), and added to the five factor model as it is thought to have an effect on the company's return, is expected to be in a positive relationship with the firm return, whereas investment factor is expected to have a negative relationship with the firm return. That is to say, firms with higher profitability will have higher returns, while firms with higher levels of investment are expected to have lower returns.

4. Empirical findings

In order to analyse the Five Factor Asset Pricing Model developed by Fama and French (2015), firstly the stasis in the series should be examined. However, unit root process in panel time series models is divided into two according to whether there is cross-section dependence in series. First-generation panel unit root models (Levin, Lin and Chu, 2002; Harris and Tzavalis, 1999; Breitung, 2000; Hadri, 2000; Im, Pesaran and Shin, 2003; Choi, 2001; Maddala and Wu, 1999) did not take into account the cross-section dependence. On the other hand, second generations of panel unit roots (Taylor and Sarno, 1998; O'Connel, 1998; Breuer, McNown and Wallace, 2002; Phillips and Sul, 2003; Moon and Perron, 2004; Bai and Ng, 2004; 2010; Pesaran, 2007) took into consideration the cross-section dependence. Hence, the cross-section dependence between the series in the model was first tested using the CD test recommended by Pesaran (2004).

The results of the cross-section dependence test are shown in Table 4.

Table 4

Cross-Section Dependence Tests

Variable	CD-Test Statistics	Probability Values
$R_{it} - R_{ft}$	62.36***	0.000
$R_{Mt} - R_{Ft}$	116.69***	0.000
LNSMB	105.80***	0.000
HML	66.24****	0.000

Variable	CD-Test Statistics	Probability Values
RMW	24.35***	0.000
CMA	59.58***	0.000

Note: *Probability values are asymptotic normal distribution values.H_0 hypothesis shows that there is no cross-section dependence and the alternative hypothesis shows that there is -section dependence. *** H_0 hypothesis is rejected at 1% significance level.*

Pesaran (2004) CD test results showed that there was cross-section dependence in series. For this reason, considering the cross-section dependence of the series for the stability of the series, second generation panel unit root test was used in our study. Pesaran (2007), Im, Pesaran and Shin (2003) expanded the panel unit root test taking into account the cross-section dependence. Pesaran (2007) included the delayed values and first differences of the cross-section averages of the series as a factor in the model, allowing the coefficient of the autoregressive variable of Dickey-Fuller regression to be heterogeneous. This test is also referred to as ADF (CADF) test, extended via cross-section dependence. While the null hypothesis of the model showed that all units forming the panel contained unit roots, the alternative hypothesis indicated that some units were stationary. In the unit root test, CADF t-statistics of each series could be compared with the critical values presented by Pesaran (2007).

For the stability of the whole panel, CADF t statistics of the units were averaged, and Im, Pesaran and Shin (2003) (CIPS) test statistics were presented by extending with cross-section dependence. The CIPS test statistics of the series are presented in Table 5. Because only the Market Risk Premium series did not change between the units, Extended Dickey-Fuller (Dickey and Fuller, 1981) and Phillips-Perron tests (Phillips and Perron, 1988) were applied and the stability results of the series were presented in Appendix 2 in order not to disturb the flow.

Table 5

CIPS Panel Unit Root Test Statistics

Variable	Delay Numbers			
	0	1	2	3
$R_{it} - R_{ft}$	-20.56***	-20.078***	-14.167***	-9.957***
LNSMB	-7.812***	-5.711***	-4.966***	-5.07***

HML	-7.725***	-3.876***	-2.477***	-1.818**
RMW	-14.143***	-11.267***	-8.066***	-4.71***
CMA	-13.329***	-11.593***	-11.181***	-11.816***

*Note: The model contains only the invariable. Test statistics show Zt-bar statistics. H_0 hypothesis shows that the series has unit roots. ***, ** and * indicate that H_0 hypothesis was rejected at 1%, 5% and 10% significance level (*** p <0.01, ** p <0.05, * p <0.1). Critical values are provided by Pesaran (2007).*

Pesaran (2007) CIPS test results showed that the series used in the study were stable in level values. The H_0 hypothesis which expressed the entire panel contained unit root (I (1)) was rejected. Series was stable at level values. Therefore, the study continued with the level values of the series.

F-test and Breusch-Pagan LM test were used to determine the appropriate estimation of the model. The F test result showed that the most consistent estimator against the fixed effects estimator was the pooled Pooled Ordinary Least Squares estimator. In addition, the result of the Breusch-Pagan LM test demonstrated that the most consistent estimator against random effects estimator was the POLS estimator. Heteroscedasticity related to the model, autocorrelation and cross-section dependence tests were performed. According to the results of the Wooldridge autocorrelation test, the H_0, hypothesis suggesting that there was no first-degree autocorrelation in the model, was rejected. The findings showed that the autocorrelation problem in the model was important. According to Breusch-Pagan / Cook-Weisberg and White test for heteroscedasticity, H_0 hypothesis, suggesting that error terms had equivalent variance, was rejected. The findings showed that there was a problem of heteroscedasticity in the model. In addition, cross-section dependence of the model was examined by Pesaran test. According to the results of the Pesaran CD test, the H_0 hypothesis, suggesting that there was no cross-section dependence in the model, was rejected. As the model had cross-section dependence, it is important to use estimators that take cross-section dependence into account. Accordingly, the results of the specification tests, there were dependence problems between autocorrelation, heteroscedasticity and cross-section units in the model. For this reason, Driscoll-Kraay estimator developed by Driscoll and Kraay (1998) and producing standard errors resistant to these three problems was used in the study. The results are presented in Table 6. In addition to the estimation results of Equity (1), the effect of the market value variable

representing the size of the companies on the company risk premium was positive and statistically significant at 1% significance level. This result showed that as the market value of the companies increased, their returns also increased, and they obtained more than the risk-free interest rate. This result was not compatible with the expectations of the Five Factor Asset Pricing Model.

The estimated coefficient of the B/M ratio calculated by the proportion of the book value to the market value was found to be negative and significant at 5% significance level. As the B/M ratio of companies increased, their returns decreased. Enterprises with a higher B/M ratio offered lower returns to their investors. The findings obtained for the B/M variable which included the size variable also contradicted the expectations of the FF5 model.

The effect of profitability variable calculated as EBIT / Total Assets on company returns was positive and significant at 10% significance level. As expected, the return of the enterprises working with high profitability was also high. This result was compatible with the findings of Lin (2017).

Although the effect of the asset growth rate which refers to investment on the return of the companies was positive, it was not statistically significant. The findings for the investment, the fifth and last factor, also did not meet the expectations in the model.

Lastly, the fixed term is significant in model. This means that these factors did not explained the variations in excess returns of observed companies. This is meant that other variables can be added to further improve the model established for the turkey.

However, these results were similar to those of Guo et al. (2017) and Lin (2017).

Table 6

Analysis of the Results

Explanatory Variables	Coefficients	Driscoll / Kraay Standard Errors	Probability
$R_{Mt} - R_{ft}$	0.955358***	0.0558	0.000
LNSMB	0.012934***	0.0042	0.003
HML	-0.03959**	0.0165	0.019
RMW	0.006561*	0.0035	0.070
CMA	0.042305	0.0260	0.108
Fixed term	-0.23581**	0.0919	0.012

Diagnostic Tests	Results
F-test statistics	1.20
Breusch-Pagan LM test statistics	0.03
Autocorrelation Test	
Wooldridge Autocorrelation Test	15.47***
Heteroscedasticity Tests	
Breusch-Pagan / Cook-Weisberg test	194.5***
White test	189.13***
Cross-section Dependence	
Pesaran CD test statistics	10.686***
R^2-value	0.48
F- value	74.24***
Number of Observations	1576
Number of Companies	18

*Note: *, **, *** represent the level of significance at 10%, 5% and 1% significance levels.*

5. Concluding remarks

The data belonging to the period of 1995Q1-2017Q3 was used in the study investigating whether Five - Factor Asset Pricing Model of Fama and French (2015) is valid for the companies in the Istanbul Stock Market Sustainability Index. Driscoll-Kraay estimator, developed by Driscoll and Kraay (1998), and producing resistant standard errors was utilized.

Estimation results show that: (i) firms with higher market value offer higher returns to their investors. (ii) On the other hand, as B/M of the enterprises increases, their returns lower. (iii) Finally, enterprises with high profitability provide higher returns to their investors. These effects can be compared with the original article in which the Five Factor Asset Pricing Model was introduced by Fama and French (2015) which stated that enterprises with high market value offer lower returns, and as B/M of the enterprises increases, their returns also increase. They also expressed that when the profitability of the companies increases, their returns also increase, and if investments of the companies increase, their returns decrease. In the study, the size

and value factors were in contrast to the expected results. In the profitability factor, the results were compatible with the Fama-French model. The results of the investment variable were not statistically significant.

As a result, there is not enough evidence regarding whether the Five Factor Asset Pricing Model of Fama and French (2015) is valid on the companies listed on the Borsa Istanbul Sustainability Index. The results of this study are similar in many studies such as Çakıcı (2015), Guo et al. (2017) and Lin (2017) in literature review.

In future studies, the validity of the FF5 model for other indices of the Istanbul Stock Market should also be investigated to reach a more general judgments about market opportunities in Turkey. In addition, analyses were carried out using a model that did not take into account structural breaks. In further studies, the findings that will be obtained by using methods that take into account the structural breaks to consider the political and economic events may lead to more accurate results.

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APPENDIX 1

Literature Review

Author	Data (Frequency)	Sample	Econometric Methodology	Empirical Findings
Nguyen et al. (2015)	Aug 2007 to July 2015 (daily and monthly)	Vietnam	Regression	It is explained that the new asset pricing model had a greater clarity of explanation for anomalies than traditional CAPM and three-factor model.
Chiah and et al. (2016)	Jan 1982- Dec 2013 (monthly)	Australia	Regression, GMM	Five factor models could explain the asset pricing anomalies more strongly than the three-factor model.
Çakıcı (2015)	July 1992 - Dec 2014 (monthly)	North America, Europe, USA	Regression	Five factor model for North America, Europe and other global markets were similar to the five factor model results for US stock markets.
Mustafa and Ali (2016)	2002-2011 (monthly)	Norway	Regression	FF5 was better in explaining volatility than previous pricing models.
Dhaoui and Bensalah (2016)	July 1965 to Sep 2015 (monthly)	New York	Regression	FF5 model has a standard validity.
Chen and et al. (2017)	Different market sentiment periods	China	traditional covariance matrix	FF5 model was found to be more sensitive to fluctuations in stock prices than FF3 model.
Guo et al. (2017)	July 1995 – Dec 2013. (monthly)	China	GRS Tests	Investment factor was not statistically significant between July-1995 and June-2015 and between July-1997 and December-2013.
Lin (2017)	1997 to 2015 (monthly)	China	Regression	Found that the profitability factor was statistically valid but the investment factor was not.
Racicot and Rentz (2017)	Data of Fama and French	12 different sectors	GMM	They found that each variable was of high importance.
Huynh (2017)	1990–2013 (monthly)	Australia	Regression, GMM	The findings indicated that investment and profitability variables played an important role, but a better asset pricing model should also be investigated.
Jiao and Lilti (2017)	July 2010 to May 2015 (monthly)	China and America	Regression	It is found that profitability and investment factors in China did not have a very high explanatory power compared to American markets.
Yang et al. (2017)	Jul. 1990 - Feb. 2017 (monthly)	North America and USA	EGARCH	The FF5 model has been proven to be valid.
Acaravcı and Karaömer (2017)	July 2005 - June 2016 (monthly)	Turkey	Regression	They found that the FF5 model was valid for Borsa İstanbul.
Mosoeu and Kodongo (2017)	01 Jan 2010 - 25 Nov 2016 (monthly)	Developing countries	GMM	FF5 model could explain the portfolio returns in emerging markets, but it was not sufficient to explain the average returns of the global portfolio.
Zhang et. al. (2018)	May 2005 - April 2015 (monthly)	Chinese A-share Market	Regression	FF5 model has explanation ability less than three-factor model
Dirxy and Peter (2018)	2002-2017 (monthly)	Germany	Regression	New factors have add significant explanatory power to the analysis.

APPENDIX 2

Unit Root Test Results of Market Risk Premium

	ADF		PP	
	Fixed	**Fixed and Trend**	**Fixed**	**Fixed and Trend**
Market Risk Premium	-10.16927 (0.00)	10.55336 (0.00)	-10.15834 (0.00)	-10.54292 (0.00)

Note: Values in parentheses show significance.

THE IMPACT OF CAPITAL MARKET ON THE ECONOMIC GROWTH IN OMAN

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Abstract

This paper investigated the effect of capital market on Omani economic growth using real Gross Domestic Product (GDP) as representative for economic growth. The main objective of the paper is to scan the impact of Muscat Security Market (MSM) on economic growth in Oman. The data were collected from the different official MSM annual reports, Central Bank of Oman annual reports and the World Bank Development Reports. The technique applied involved the use of multiple regression analysis to find the influence of the capital market on the Omani GDP. The analysis so far confirmed that there is a positive relationship between capital market and economic growth in Oman for the investigated period. So, it is recommended that, Oman should place greater emphasis on financial sector development with special focus on capital market development to ensure economic growth.

Keywords: Muscat security market (MSM), Capital market, GDP, Central Bank of Oman.

JEL Classification: E2, E5, E6, G1

1. Introduction

Capital market is a market in which purchaser and merchant keep in deal of financial debentures (securities) like bonds, stocks, etc. to deficit economic units thus motivating capital creation and socio-economic improvement. The buying and selling is carried out by contributors such as persons and organization. Capital markets assist flowing excess funds from savers to organizations or firms which then

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invest them into productive use. Normally, this market deals generally in long-term securities.

Capital market composed of primary markets and secondary markets. Primary markets concern with trade of new issues of stocks and other securities, while secondary market concern with the exchange of existing or previously issued securities. An additional important separation in the capital market is done on the foundations of the nature of security traded, i.e. stock market and bond market. The capital market does not only work as a supply of finance for the government and industries but offer a broad series of socio-economic assistances to any country. By gather together funds for flowing it into productive investments, the market collects together those who have (savers) and those who need funds (investors) at generally viable prices and conditions acceptable to both parties, thus guarantee effective resource distribution as encouraging economic growth (Okereke-Onyiuke, 2008).

In the non-existence of capital market, industrial development would be hindered, since the money market is not considered to offer such funds. The accessibility of the secondary market like the stock market for example is a significant feature of the capital market, since investors are much willing to employing funds in so primary market if their properties are easily exchangeable into cash. Therefore, the stock exchange is the essential of capital market progress in any society (Okereke-Onyiuke, 2008).

Muscat Securities Market (MSM) is the only market where exchange of stock take place in Oman. It was founded mid-1988, to systematize and govern the Omani securities market and to contribute, effectually, with other institutions for laying down the foundation and infrastructure of the Oman's financial sector.

Later After ten years of uninterrupted growth, there was a necessity for a better operation of the market. Therefore, MSM has been updated by two Royal Decrees (80/98) and (82/98).

The Royal Decree (80/98) dated November 9, 1998, which promulgated the new Capital Market Law, provides for the establishment of two separate entities, an exchange, Muscat Securities Market (MSM), where all listed securities shall be traded, and the Capital Market Authority (CMA) - the regulatory. The exchange is a governmental entity, financially and administratively independent from the regulatory but subject to its supervision. Thus, the securities industry in Oman was well established to enhance investors'

confidence by developing and improving all the processes appertaining to the stock market.

As a continuing process in the development of the securities market, the MSM has developed its regulations to provide information and financial data relating to the performance of the Market and all listed companies directly to investors through a highly advanced electronic trading system. This will not only ensure transparency of dealings which is considered to be one of the main principles of fair trading but will encourage investors to make the right investment decision at the right time.

In the light of the above background, the question that would readily come to mind is whether or not capital market has significantly impacted on the growth of the Omani economy, given the enabling environment provided by the supportive democratic structure. Indeed, this is one question that past related empirical work has failed to answer. This study is therefore undertaken to satisfy this "curiosity" and hence fill the existing gap.

In spite of the prevalent belief that capital markets encourage economic activities which in turn prompts economic growth, the growth of the capital market in Oman is still very small in relation to the size of the economy. Relative studies of the Omani capital market with some countries in GCC area indicate that the Omani market is relatively very small. The strength of the advance of an economy is subject to on how competently the capital market makes its allocative function of capital. Thus, it is of greatest significance to scan the impact of the Omani capital market on the economic development of Oman.

2. Objectives of the Study

The leading objective of this study is to evaluate the influence of capital market on economic growth in Oman. To attain this, the paper will empirically examine the effects of market capitalization, all share index and total value of transaction (measures of capital market performance) on the gross domestic product throughout the time series considered and precisely, to: express the tendency of capital market over the years, specify the connections between capital market and economic growth (GDP as substitute) and give recommendations founded on the research findings.

Other objectives of the study try to scrutinize the following:

1. To recognize the effect of stock market progress on economic growth in Oman.
2. To examine that, is there any relationship survives among stock market advance and economic growth.
3. To identify the track and nature of the causality concerning stock market evolution and economic growth.
4. To examine the role of financial mediators on economic growth.

Hypotheses:

This study therefore tests the following hypotheses:

H0: The Capital market does not enhance economic growth

H1: The Capital market enhances economic growth

3. Methodology and Data Sources

The data collected for this paper are fundamentally time series data covering 1993 to 2015. The data obtained from the official Muscat Security Market, statistical bulletins and annual reports, central bank of Oman annual reports, and annual reports of the World Bank. Simple and multiple regression analysis will be used to draw the final results.

In determining the impact of the capital market on economic growth, we implemented the convectional method of using their alternatives. Thus, capital was substituted by the Total Market Capitalization (TMC), and Total Value of Stock (TVS), while economic growth was substituted by real Gross Domestic Product (GDP).

For this paper, we applied the statistical method of multiple regression approach which is like the one that adopted by Olawoye (2011) and Ewah et al (2009). Their findings conclude that economic growth is considerably affected by capital market indices. The functional relation of the model is given as:

$$GDP = f(TMC, TVS) \quad (1)$$

The model is specified as follows:

$$GDP = \beta 0 + \beta_1 TMC + + \beta_2 TVS + \mu \quad (2)$$

Where: GDP=Gross Domestic product TMC=Total Market Capitalization TVS=Total value of stock β 0, β 1, and β 2 = constant parameters and μ = the error term.

4. Literature Review

To explain how economic growth has directly influenced by capital market development, a significant review of plenty literature from different research studies are considered here. The relationship between economic growth and capital market development is realized from the viewpoint of a jointly causal relationship in the sense that, there are variables that can both influencing the development of capital markets and the growth of the economy simultaneously, where these effects in sequence can influence changes on the two. Echekoba *et al*., (2013) investigate the relationship between capital market and economic growth, when they examine the impact of capital market on the growth of the Nigerian economy under a democratic rule. Their study depends on time series data. The findings release that whereas total market capitalization and all share indexes exert positive influence on the GDP growth rate, the total value of stock has a negative effect on the GDP growth rate, and none is significant. Queen (2015) uses time series data from South Africa for the period (1971-2013) to examine the effect of capital markets on economic growth. The results showed that there is a direct relationship between economic growth and capital markets in South Africa. Moreover, the state should emphasis on variables that add to the growth of capital markets, such as the development of financial institutions. Sabariah and Norhafiza (2016) examines the impact of the stock market and the debt market on the Malaysian economy. They adopted Johansen-Juselius co-integration test which shows the presence of co-integrating link between real growth domestic product per capita, stock market and debt market. The stock market is found to reveals greater effect on the Malaysian economy compared to the debt market. Moreover, not like the debt market, the stock market is found to exercise uni-directional causality on the economy.

Torbira and Joshua (2017) examines how capital market development as a subsection of financial development has openly influenced economic growth of the Mexico, Indonesia, Nigeria and Turkey (MINT) countries using time series data for the period of 2000—2012. The outcomes show that number of registered financial securities is the most influencing capital market development measure on economic growth of the MINT as a group. This pointer was understood to be adverse and significantly linked to gross domestic product (GDP), but positive and significantly linked to gross fixed

capital formation and gross domestic savings ratios to GDP. Statistical proof in addition indicates that Indonesia is typically impacted positively by capital market development, particularly since it both rises gross fixed capital formation and gross domestic savings ratios. Araoye, *et al*., (2018) studied the effect of the stock market development on the nation's economic growth in Nigeria using time series data for 30 years from 1985 to 2014. The economic growth was represented by the GDP whereas the stock market represented by variables involved; market capitalization and market turnover ratio concerning size and liquidity. The empirical outcomes propose that the stock market is significant in determining economic growth in Nigeria adopting the error correlation model and it was found that the stock market has affected insignificantly on the economic growth.

Schumpeter (1911) contends that financial intermediation plays a key role in economic growth by improving productivity and technical change. Financial development impacts on economic growth through the raising and pooling of funds (allowing riskier investments to be undertaken); the allocation of resources to their most productive uses; effective monitoring of the use of funds; the provision of instruments for risk mitigation (especially for small and medium enterprises); and reducing inequality. These intermediaries become essential players in fostering technological innovation and economic growth. Hassan M. Kabir, Benito Sanchez and Jung-Suk Yu (2011) find a positive relationship between financial development and economic growth in developing countries. Moreover, short-term multivariate analysis provides mixed results: a two-way causality relationship between finance and growth and one-way causality from growth to finance for the two poorest regions.

Some studies like Bayar Yilmaz (2015), Ikikii Stephen and Nzomoi Joseph (2013), Ho and Odhiambo (2012), Arestis et al. (2001) and Levine and Zevorse (1996) have found that stock market development had a positive significant effect on economic growth while the Ake and Ognaligui (2010) found a negative or insignificant effect of stock market on economic growth.

5. Muscat Security Market and Gross Domestic Product (GDP) Trends

(1) Muscat Securities Market: (1989-1998): With the increase in the number of companies the Government believed in establishing

a regular market. Royal Decree No. 53/88 was issued establishing MSM and the actual inception of the market was in 1989.

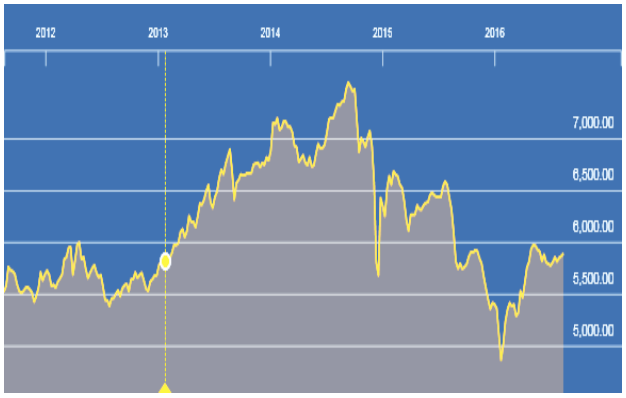
(2) Restructuring phase (1998 and thereafter): Royal Decrees were issued restructuring the capital market sector by dividing the functions of MSM into three entities namely the Capital Market Authority (CMA), MSM and Muscat Clearance and Depository Company (MCDC). CMA was established to act as independent regulatory body supervising the capital market.

Subsequently then, different types of financial instruments have been issued in the capital market of Oman by fresh and current business to finance product advance, new projects or common business extension. The capital market, no reservation, is essential to the level of progress and advance of the economy. Chinwuba and Amos (2011) observe that capital market is most important among institutions that perform in pushing a prostrate economy for growth and development.

Concerning Muscat Security Market's (MSM) performance in 2012, MSM was capable to change the low performance in 2011 by 16% to a small growth by 1.15%. Key pointers of the Market in 2012 propose increase in the number of traded shares and bonds and increase in the total value of trading. The Primary Market has shown notable increase in the matter of the value and number of issues particularly Islamic banks. Market value has increased by 13% to RO 11.7 billion and foreign ownership increased considerably to about 28%. The MSM's market capitalization stood at OR14.6bn ($37.8bn) at the end of 2014, up 3% year-on-year. This represented 30% of Oman's GDP. Listed companies – of which there were 117 in September 2015 – accounted for 64% of market capitalization in 2014. Closed companies – which number 189 – accounted for 28% and bonds, of which there were 21, for 8%. At the end of September 2015 market capitalization stood at OR14.6bn ($37.8bn). The financial sector was by far the largest by capitalization in 2014, accounting for 43% of the MSM's total market cap, followed by telecoms with 18%, power companies (10%), cement and building materials (8%), oil and gas marketing firms (6%), and food and refreshments (5%) (Figure 1).

Figure 1

The performance of MSM from 2012-2016



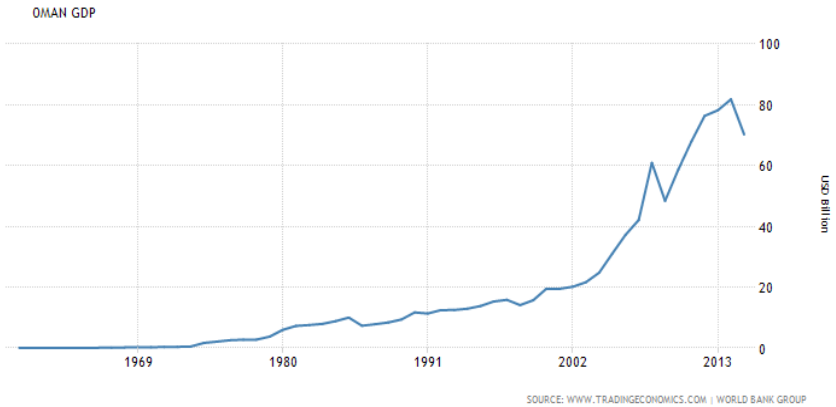
Source: Muscat Security Market Report 2016

Growth Domestic Product Trends:

The Gross Domestic Product (GDP) in Oman was worth 70.25 billion US dollars in 2015. The GDP value of Oman represents 0.11 percent of the world economy. GDP in Oman averaged 17.72 USD Billion from 1960 until 2015, reaching an all-time high of 81.79 USD Billion in 2014 and a record low of 0.04 USD Billion in 1960. GDP in Oman is reported by the World Bank Group (Figure 2 & 3).

Figure 2

The Gross Domestic Product (GDP) in Oman 1960-2015



Source: World Bank Group Report 2016

Figure 3

The Gross Domestic Product (GDP) in Oman 2006-2015

Source: World Bank Group Report 2016

6. Data analysis and Interpretation

The technique in the exploration was multiple regression econometric technique. The study started its analysis with Dickey-Fuller test, to confirm, the static variables so as to evade falsity of empirical result. The t-test was engaged to make certain the significance of each of the constant parameters, whereas the investigative test based on the coefficient of determination (R^2) was used to check for the goodness of fit of the model.

Multiple Regression Analysis

Table 1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.952[a]	.906	.896	3.25602	.906	91.320	2	19	.000

a. Predictors: (Constant), TVS, TMC

Table 2

ANOVAa

Model	Sum of Squares	df	Mean Square	F	Sig.

1	Regression	1936.281	2	968.140	91.320	.000[b]
	Residual	201.431	19	10.602		
	Total	2137.712	21			

a. Dependent Variable: GDP
b. Predictors: (Constant), TVS, TMC

Table 3

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	36.739	1.153		31.863	.000
	TMC	.856	.085	1.050	10.121	.000
	TVS	1.525	1.123	.141	1.357	.191

a. Dependent Variable: GDP

The regression equation is:

$$GDP = 36.739 + 0.856\ TMC + 1.525\ TVS + \mu \quad (3)$$

The synopses of the outcomes for the OLS model stated in equation (1) are shown in Table 3 below. As can be seen in Table 3, Omani Capital Market has direct and significant impact on economic growth; the coefficient of total market capitalization (TMC) is 0.856 which indicate that a change in TMC by 0.86% will lead to change economic growth by 1%. The t-statistic and p-value mounted at 10.121 and 0.000 respectively. This indicates that the TMC has positive and statistically significant (at 1%) impact on economic growth in Oman. The coefficient of total value of stocks (TVS) is 1.525 which indicate that a change in TVS by 1.5% will lead to change economic growth by 1%. The t-statistic and p-value mounted at 11.357 and 0.191 respectively. This indicates that the TVS has positive but statistically insignificant impact on economic growth in Oman, this is may be attributed to the small size of Muscat Security Market where few stocks are traded. In addition to that, the drop in the stock market as a result of the global financial crisis, that started in the United States of America in 2007. Most performance indices of the market were mainly negative in 2017 compared to the same period of the previous year as it is mentioned in the MSM annual report 2017. Total number of traded securities fell by 8% in 2017 compared to the previous year (2016) due

to the sharp fall in the number of traded bonds and Sukuk which fell sharply by more than 87% which is the highest among all the other indices. Both company and individual investors lost large amounts of their investment in the MSM. The value of the adjusted (R^2) and F-statistics mounted at 0.89 and 91.32 respectively. This point out that 89% of the total variation in GDP is attributed to the TMC and TVS. This also mean that the residuals (other factors than TMC and TVS) has an impact on economic growth by 11%.

7. Conclusions and Suggestion

The paper tries to discuss the relationship between capital market development and economic growth in Oman. The results have been generated by adopting multiple regression between the periods of 1993 to 2014, there are two explanatory variables (TMC and TVS) regressed against the dependent variable (GDP). The regression outcomes explain that TMC and TVS value contributed positively in GDP by 89.6 percent. The TMC and TVS have statistically significant influence on GDP.

The overall fitness of the model and the explanatory power of the model is much better, our results suggested that almost 90% variation has been explained by the independent variables since adjusted R^2 is 89.6%. It is suggested that developing countries should place greater emphasis on financial sector development with special focus on capital markets development to ensure economic growth.

Financial system should be regulated properly by the government. Efficiency of the capital market can be improved by financial innovation.

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