LAPPEENRANTA UNIVERSITY OF TECHNOLOGY

School of Business and Management

Finance / Master's Degree in Strategic Finance and Business Analytics (MSF)

Master's thesis

On the crossroads between Europe and Asia: Is Ukraine more economically integrated with European Union or Russian Federation?

Author: Shved Oleksandr

Supervisor & the 1st examiner: Postdoctoral researcher Jozsef Mezei

The 2nd examiner: Associate professor Sheraz Ahmed

ABSTRACT

Author	Oleksandr Shved
Title	On the crossroads between Europe and Asia: Is Ukraine more economically integrated with European Union or Russian Federation?
Faculty	LUT, School of Business and Management
Major:	Strategic Finance and Business Analytics
Year:	2017
Master's Thesis:	Lappeenranta University of Technology 74 pages, 2 figures, 17 tables
Supervisor:	Postdoctoral researcher Jozsef Mezei
The 2nd examiner:	Associate Professor Sheraz Ahmed

Keywords:	Vector Auto regression model (VAR), Cointegration tests, Impulse responses, Granger causality, Economic integration.

In the recent decades, the integration process of economies has been increasingly important in the present age of globalization. This issue becomes an important problem for economies that are located between two different economic unions and facing the decision on which one to join. In this thesis, the cointegration effects and short-run and long-run linkages are investigated between economies of European Union and Ukraine on one side, and Ukraine and Russian Federation on the other side. To understand this problem, empirical data is collected comprising of the most important macroeconomic indicators describing the economies considered in the study. By applying two popular time series econometric techniques (vector autoregressive model and cointegration technique), we examine a short-run and long-run relationship between interest rate, consumer price index, unemployment rate, GDP and trade

balance ratio in all analyzed countries: European Union, Ukraine and Russia from 2001 to 2016 Q3. Empirical findings of the thesis can be summarized as follows. First of all, there exists a long-run cointegration effects between analyzed economies, however a number of cointegration vectors is different between analyzed countries. Secondly, mostly unidirectional Granger causality was observed, which shows that one economy has strong influence on another country economy. Thirdly, impulse responses analysis shows the strength of the influence of the one economy to another one.

ACKNOWLEDGEMENTS

I would like to thank my thesis supervisor Postdoctoral researcher Jozsef Mezei for his help, expertise and overall good advises that helped me to write the thesis. Also, I would like to thank Associate Professor Sheraz Ahmed and Postdoctoral researcher Jan Stocklasa for the help with selection of the topic and analysis of the data.

Moreover, I want to give special thanks to my relatives, who helped me when I needed it the most. Without you I won’t be able to make it so fast.

Table of Contents

1. Introduction

Present era is mostly characterized by the high level of globalization on different levels, especially when considering it from economical point of view. Worldwide economies tend to integrate and to form bigger areas with common markets for goods and services and long-run strategic goals in order to gain benefits from more possibilities, and also gain from more markets available for them. However, to create an efficient integration for all its participants, the candidates for such integration should be well-prepared, and be sure that they have reached necessary level of development of their own markets and internal processes in comparison with their potential partners.

Current President of Ukraine Petro Poroshenko has stated clearly that Ukraine is committed to join the European Union (EU), and that he aims that country will apply for EU membership by 2020 (Balmforth and Zinets 2014). EU membership offers a number of benefits for the new country and joining is conditional, because several political and economic criteria should be met, which are necessary to successfully integrate the new joiner with all the rest member countries of the EU. This kind of integration, however, represents incompatibility with current ties between Ukraine and Russia and, as a consequence, fuels a conflict between Western and Eastern world. Will Ukraine ever become a member of EU or not will mainly depend on the solution of the conflict.

Membership in EU is strongly dependent on the successful adherence of a number of economic and political criteria settled by the Copenhagen European Council in 1993, known as the Copenhagen criteria (1993). Political criteria consist of the achievement of stability of democratic institutions, dedication to human rights, adherence to the rule of law, and respect and protection for minorities living in the country. Economic criteria consist of maintaining a smooth-functioning market economy which is able to sustain the pressure of competition of the Union's market forces.

Against this backdrop of criteria necessary to become EU member, Ukraine was a priority country for the EU as a part of its program of European Neighborhood Policy (ENP) and also the program of Eastern Partnership (EaP). When the ENP consists of the EU's closest

neighbors countries and the EaP is targeted only at the eastern neighborhood countries, both programs are motivated by the EU's objective to cooperate and integrate closer on political and economic level with surrounding nations. Moreover, both these programs represent integration, which depends on the actual values declared in the Copenhagen criteria.

While full membership of Ukraine was not secured, the signing of the last sections of the EU-Ukraine Association Agreement on June 27, 2014, demonstrates commitment of Ukraine to become closer economically and politically integrated with European Union (BBC 2014). This agreement consists of the specific economic agenda described in the Deep and Comprehensive Free Trade Area (DCFTA) which should give Ukraine a necessary framework needed to meet the EU economic goals of having more open and more harmonized trade relationships. Ukraine signed this agreement with motivation and a hope to achieve continuous economic development, sustainability and future prosperity.

Having a GDP of €13,920,541 million in 2014, the all 28 EU countries comprised a united market which was the largest economic region in the world, even bigger than the US (Eurostat, 2015). Despite of the 2008-2009 world financial crisis, the EU has still left the main trading partner for Ukraine. Therefore, closer economic integration which lowers trading costs with the biggest market in the world might bring serious economic benefits for the country.

Economic benefits contain the tariffs removal that leads to reduction of the costs and increasing of trade activity, which have to more than just compensate any lost tariff revenues. Next, by opening up to freer trade should cause a stronger competition among firms and make a potential for improving the productivity and efficiency of Ukrainian industries. Finally, the more harmonized Ukrainian industries will be with other EU member countries, the more fresh and more improved business environment in the country will be (Cohen 2007).

While the benefits mentioned above are mainly economic, naturally many consider integration with EU as receiving important political benefits also. For major part of Ukrainian population moving closer to integration with EU demonstrates (Huhne 2014) steps on the way to independence and greater democratic freedoms for the nation. Nevertheless, exists some part

of population that still feel great ties to Russia, and Russia is quite far from being indifferent to the actions of Ukraine.

Joining the European Union is not so simple and easy as just signing an agreement because Ukraine currently still has plenty of ties with Russia which have significant historical roots. The relationships between Ukraine and Russia (Calamur 2014) are similar and might be compared with the relationships between the United States and the United Kingdom. Ukraine's ties to Russia begin much earlier than the beginning of Russian empire in the early 18th century and many scholars consider Ukraine to be the place of the birth for the regional Orthodox Christian church.

Most Ukrainians can fluently speak both Ukrainian and Russian, however mainly in the eastern and southern parts of the country where Russian is prioritized as the main spoken language and where influence of Russia is the strongest. Among other ties are the popularity of the Russian media in Ukraine, ties within a families and the fact that many Ukrainians are working in Russia, and especially in the Moscow region (Calamur 2014).

The geographic size of Ukraine and its' location also made it a strategic point of interest for Russia from the military side, as the country represents a buffer region that separates Russia from the Western world and NATO. Additionally, Ukraine's Republic of Crimea was a home of dislocation of the Black Sea fleet whose naval base is located in the port of Sevastopol.

Ukraine also has many important connections with Russia on the economic level. Significant part of Ukraine's Soviet-era industry is tightly interconnected with Russia and therefore losing the competition in the European markets, probably the strongest economic connection is in the energy sector. Approximately 80% of Russian monopolist Gazproms' exports of piped gas depend on European market and around 50% of that supply goes via pipelines in Ukraine. And Ukraine by itself was consuming around 16% of the Gazprom's gas exports (Marson 2015). As the most important export of Russia and a very important source of the revenues, it is crucial not to lose its influence in Ukraine.

These mentioned linages have given reasons for Russia to encourage Ukraine to become a member of its own Eurasian Economic customs union which consists of Kazakhstan, Belarus, and Armenia (Henley 2014). At this point Ukraine was squeezed in a conflict between the interests of Western and Eastern powers. The choice of the closer economic and political integration with the EU was considered as an attempt to offend Russia and Eurasian customs union. The summary of the main advantages and disadvantages of the relationships of Ukraine with both EU and Russian on economic and political level is presented in Table 1.

Table 1. Summary of relationships of Ukraine with EU and Russia

	Economic level		Political level	
	advantages	disadvantages	advantages	disadvantages
European Union	- One of the most important trading partners and markets for Ukraine; - EU imports a lot of Ukrainian raw materials and resources and exports machines and different high quality production; - EU invests a lot in the firms, projects and economy of Ukraine	- Ukrainian goods mostly are not competitive on EU market; - Economy of Ukraine needs to be modernized in order to fit European standards; - Lack of investments from EU due to unstable political and economic situation in the country	- Multiple agreements about cooperation between EU and Ukraine on political and economic level; - Support from EU to Ukraine on political level, especially valuable during the Crisis; - Recognition of sovereign status of Ukraine and help in order to stop Russian aggression towards Ukraine	- Absence of unified position within EU countries regarding Ukraine, which often delays adoption of important decisions; - Ukrainian law and economy still need to be improved a lot in order to fit EU standards; - Corruption in Ukraine frighten EU members and stops them from tighter cooperation
Russian Federation	- The biggest trading partner and biggest market for Ukrainian goods before the crisis begun; - The biggest amount of FDI received from Russia; - Tight economic connections, Ukrainian good are competitive at Russian market	- High dependence of Ukrainian industries on Russian gas; - High dependence on Russian investments; - Big share of Ukrainian export goes to Russia and any change in politics effect significantly Ukrainian firms	- Multiple agreements about cooperation with Russia on political and economic level	- Multiple conflicts on trade level between countries before the Crisis; - Presence of Russian Black Sea fleet in Crimea; - Annexation of Crimea in 2014; - Numerous violations of the political agreements with Ukraine; - Support of pro-Russian rebels on the East of Ukraine

Therefore, based on the observations mentioned above it can be seen that Ukraine strongly interrelated with its neighbors, which are two of the world's biggest economies: European Union and Russian Federation. Moreover, during the last years Ukraine has been trying to cooperate more with EU and integrating into the union by adjusting its laws, policies and products to the EU standards. However, presently it is not clear whether the integration with former Soviet republics and Russia may be more beneficial in economic and politic sense for

the country. This problem still remains quite interesting and not answered completely. For this reason, the investigation of current role of Ukraine in relationships with European Union and Russian Federation, and the type of influence of EU and Russian Federation on Ukrainian economy is so relevant today and needs deeper empirical exploration.

When referring to integrations between equity markets on the international level, scholars mainly examine the cross-country interactions for short-run and long-run periods. Moreover, they not only investigate the return causality linkages, but also volatility spillovers effects (Adler & Sosa 2012). The obtained results concerning dynamic links between analyzed stock markets are important for a number of reasons. Firstly, the fundamental statement of Capital Asset Pricing Model (CAPM) says that the market risk of the asset is impossible to eliminate. Thus, whether investors' risk is possible to be diversified through investing in the multinational equities strongly depends on the different stock markets degree of co-movements, which exists among them. Second of all, if there is returns causality between different stock indices, investors can improve their trading strategies to receive profit even during the financially turbulent periods. Thirdly, information about volatility spillover effects helps to price options and also to make optimal portfolios. The discovery of volatility spillover is useful especially during financial crises, and applied for hedging strategies and value at risk. Finally, knowledge about the integration between countries helps to observe the potential for the financial contagion for different policy makers and also to control international capital flows, and additionally to create an effective regulative actions with a goal of stabilization of international financial system (Xu & Sun 2010).

Although some contributions exist studying the interconnections between matures and emerging financial markets, they are focused more on the transmission mechanisms during the normal times than the turbulent times. Besides the linkages between the emerging and developed markets, the recent studies begin to pay much more attention to the macroeconomic integrations between the countries by applying a vector auto-regression (VAR) framework.

In this research work the focus is on understanding how data about the macroeconomic performance of Ukraine, as observed through major macroeconomic indicators, is influenced

by the economic performance of the European Union economic performance on the one side and Russian Federation on the other side.

The talks about Ukraine joining EU or EEU have been around at the moment for more than 10 years. The vector of economic and political integration of the country has been changing few times starting from 2001, when the actual talks about integration into one of the unions has been started.

We seek to contribute to the existing literatures about this issue in the way, that this thesis provides a compressive analysis about the macroeconomic interactions between European Union, Ukraine and Russian Federation. However, as the starting point and motivation for this research we will see that the related literatures about Russia, Ukraine and EU do not consider all three parties in the analysis. Mostly all papers review the relationship only between two parties. In contrast, this thesis observes these interactions, checks the impulse response from the shocks appeared in one economy (EU or Russia) to the economy of Ukraine. Moreover, we will look at the Granger causality between all the countries. Therefore, this thesis fills this gap of comparative analysis between all three parties and provides analysis of the most recent data time series. To summarize, the main objective of this thesis is to understand the complex dynamics characterizing the impacts and interrelatedness of European Union and Russian Federation with Ukraine.

The thesis is organized as follows. In the second chapter a literature review is presented and discussing the chosen topic and models that are used in the paper, culminating in the hypotheses that will be tested in the empirical analysis. Chapter 3 describes the methodology that is used in the research. The fourth chapter introduces the data and basic descriptive analysis conducted on this data. Chapter 5 explains the results of the conducted research. Finally, the thesis is concluded with a summary and discussion of the results.

2. Background of the research and its hypotheses

In this chapter, we will discuss the literature which can shed the light on the main aspects of our research. Therefore, the previously conducted researches and articles written on such topics as cointegration, spillover effect in economics, integration processes of Ukraine and integrational processes in the world, vector auto-regressive models in economics. Moreover, in this chapter presented hypotheses to be tested.

2.1 Processes of integration in EU and Eurasian union

Integrational processes in Europe have begun on July 23, 1952, when France, Italy, West Germany, Netherlands, Belgium and Luxembourg have created European Coal and Steel Community (Coman 2014). This was a starting point in creation of the present time European Union.

In 1992, all memberss of the European Community signed the Maastricht Treaty and officially created the European Union. In 1994, Austria, Finland, Norway and Sweden held a referendum about EU membership and on 1995, Austria, Finland and Sweden have become EU members. Most Norwegians voted against and Norway did not join EU (Coman 2014).

On October 9, 2002, the European Commission recommended the ten candidate countries for joining EU in 2004, Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Cyprus and Malta (Coman 2014). The population of these 10 countries was about 75 million; their joint GDP measured by purchasing power parity - roughly 840 billion US dollars, approximately equal to the GDP of Spain.

On May 1, 2004, all ten mentioned above countries became members of the European Union. The next enlargement took place on January 1, 2007, where Bulgaria and Romania joined the European Union. Next and so far the last was Croatia. It has become the 28th member of the EU on July 1, 2013 (Coman 2014). A referendum in the UK on its exit from the European Union was held on June 23, 2016, with a majority of participants voting to leave.

Ukraine has been working a lot on establishing closer connections with the European Union and its members. In a way, Ukraine even now can be considered as a country very well integrated into Europe. Ukraine not only developed its own economic interests with the EU, and currently it is a member of the Council of Europe since 1995, the OSCE since 1992, the Energy Community since 2011 and has been subject to the European Human Rights Court's rulings since country has ratified the European Convention of Human Rights in 1997 (Pinchuk 2015).

The policy of European integration is a natural consequence of Ukraine's independence. Its origins are rooted in the history of Ukrainian people and recognizing the right to live in a democratic, economically developed, socially oriented country. The main goal is to create massive internal transformation by the conditions for entry into the European community of developed countries.

After gaining state independence in 1991, Ukraine established its economic ties with the former Soviet republics and pushed guidance primarily to building relationships with states formed on the post-Soviet space (CIS, GUAM). However, the need to introduce new technologies, integration into the world economy, and the need to find new markets for Ukrainian producers of goods and services forced Ukrainian leadership to multi-vector foreign policy declaration, in order to establish Ukrainian presence in all the geopolitical processes, was according to the available Ukrainian national interest (Klimenko et al. 2013). In most such interest is present in the process of European integration.

The European Commission office in Ukraine was opened in the center of Kyiv in September 1993. On December 1, 2009, (the Lisbon Treaty has entered into force) the European Commission office turned into the European Union office in Ukraine (Dragneva & Wolczuk 2016).

Due to the enlargement policy, the EU was a common border with Ukraine on May 1, 2004, when ten countries joined the Union, including Ukraine's neighbors: Poland, Hungary and Slovakia (Wolczuk 2004).

Over the years, the legal basis of relations for both the EU and Ukraine was the Partnership and Cooperation Agreement signed on June 14, 1994 (entry into force on March 1, 1998). This agreement established cooperation on a wide range of political, trade-economic and humanitarian issues (Wolczuk 2004). Additionally, concluded a set of sectoral agreements and documents of international law, which states that there is cooperation between the EU and Ukraine. Ukraine cooperates with the EU in the framework of "Eastern Partnership", one of whose task is to prepare Ukraine for accession to the European Union.

In November 2013, at a summit in Vilnius was expected that Ukraine and the EU will sign an association agreement. However, suddenly Ukrainian government dramatically changed the rhetoric and on November 21, 2013, Ukrainian Cabinet of Ministers decided to postpone the preparation process of signing an agreement with the EU. Consequently, mass protests began throughout Ukraine. On March 21, 2014, the political part of the Association Agreement with the European Union has been signed. The economic part of this agreement concerning domestic and foreign policy was signed June 27, 2014 (BBC 2014). The discussions about the signing of other parts, including political and visa-free agreement are still going on.

However, Ukraine not only cooperates with EU. During the time after the country has proclaimed independence, it has been involved in the integrational processes with the post-Soviet countries as well. In Belarus, on December 8, 1991, Belarus, Russia and Ukraine formed Commonwealth of Independent States (CIS). On December 21, 1991, in Alma-Ata (Kazakhstan), the agreement on formation of the CIS signatories and other states was signed, effectively stopping the Soviet Union (Adomeit 2012).

In 1995, Belarus, Kazakhstan and Russia began working on formation of the Customs Union (CU), signed an agreement on the Customs Union between Russia and Belarus.

This process has been continuing and in 1996, when Belarus, Kazakhstan, Kyrgyzstan and Russia signed an agreement about making an integration more deep in the economic and humanitarian areas. Among the main goals of integration, they announced the creation of a single economic space, providing functioning of the single market for goods, services, capital and labor. Moreover, it was announced that will be developed common transport, energy and

information systems. In furtherance of these agreements in 1999, Belarus, Kazakhstan, Kyrgyzstan, Russia and Tajikistan created the Customs Union and Common Economic Space, under which decided to finish the formation of the Customs Union and the creation on its base of the Single Economic Space. Ukraine has been offered a membership in the Union as well. However, Ukrainian authorities utilized policy of temporization in regards to the integration (Klimenko et al. 2013).

In 2000, Belarus, Kazakhstan, Kyrgyzstan, Russia and Tajikistan, in order to improve interaction processes of integration and cooperation in various fields, have created the Eurasian Economic Community (EurAsEC). In 2006, Uzbekistan has become a member of EurAsEC (Adomeit 2012). Priorities of the new international union were determined to increase the efficiency of interaction and integration development.

As the next step in 2003, Belarus, Kazakhstan, Russia and Ukraine, based on the concept of multi-level integration within the CIS, signed an agreement on the Single Economic Space in order to make conditions for stability and efficiency of the national economic development and improve living standards of the population (Lukianenko 2005).

In August 2006, informal summit of heads of states - members of the Eurasian Economic Community, took place in the city of Sochi. It was decided to intensify the formation of the Eurasian Customs Union with further possible accession of Kyrgyzstan and Tajikistan. Based on the agreements reached at the summit, Belarus, Kazakhstan and Russia in October 2007, signed an agreement about the single customs territory and formation of the Customs Union. Ukraine still did not take very active part in these integration processes, however remained closely cooperated with each country from the Union (Klimenko et al. 2013).

On November 18, 2011, Belarus, Kazakhstan and Russia signed a declaration on Eurasian economic integration and identified the January 1, 2012, as the date of commencement of the Common Economic Space, which ensured freedom of movement of the goods, services, capital and labor. Heads of three states declared that the development of the Customs Union and Common Economic Space should lead to creation of Eurasian Economic Union. On the same day - November 18, 2011, Presidents of these three countries signed the Treaty on the

Eurasian Economic Commission that was the only permanent regulatory body for the Customs Union as well as for Common Economic Space. Eurasian Economic Commission has begun working on February 2, 2012 (Dragneva & Wolczuk 2016).

On December 19, 2011, the Supreme Eurasian Economic Council decision number 9 put into effect from January 1, 2012, international treaties that form the Single Economic Space (Adomeit 2012). The implementation of these and other international treaties and agreements about macroeconomic, fiscal and competition policy, on the structural reforms of the labor markets, capital, goods and services and on establishment of Eurasian networks in energy, transport and telecommunications, defined as the basis of creation on January 1, 2015, the Eurasian Economic Union (EEC).

On May 29, 2014, in Astana, Belarus, Kazakhstan and Russia signed an agreement on the CU in transformation to the EEC on January 1, 2015. At the signing ceremony were also present the presidents of Armenia and Kyrgyzstan. Kazakh politicians said that EEC did not have a goal to be a political bloc, but solely economic union. By October 2014, this treaty had been approved by parliaments of all three states. On October 9, 2014, additional agreement to enlarge the EEU to Armenia was signed. The next EEC member – Kyrgyzstan signed this treaty on December 23, 2014, and became a sixth member of the Eurasian Union on August 6, 2015 (Dragneva & Wolczuk 2016).

The Ukrainian government and President during that time have been involved into the discussions about Ukraine joining this Eurasian Economic Union. Ukraine had been invited to join the Union, however during that time the population of Ukraine has been divided on pro-European part and pro-Russian, where each part wanted to pursue a desirable vector of integration. As one of the reasons of the rejection to sign mentioned above agreement with EU in November 2013, was desire of the President of Ukraine to change integration vector and to join Eurasian Union (Marson 2015).

Table A1 (Appendix A) illustrates the most significant dates and event for European and Eurasian integration processes.

2.2 Review of the previous literature

2.2.1 Review of the literature about integration of Ukraine in EU and Eurasian Economic Union

The considered major trends of the world development impact the social-economic Ukrainian development, while being manifested by the deterioration by the problem with energy supply and increasing energy carrier prices, increasing national economy openness and enhancing its participation in the globalization processes, financialization and dollarization of the economy, strengthening of the conflict between the real and the virtual economies, increasing gross external debt of the country and emerging situation of Ukraine being caught in a debt trap. A really serious threat to Ukraine lies in the aggravation of the population social inequalities, current demographic situation which shows signs of depopulation, degradation and marginalization (Mandybura 2010), as well as strong migratory processes.

Starting from the very beginning when Ukraine gained independence in December 1991, country has vacillated between the West and East or more precisely between European Union and Russian Federation for political and economic integration. Until recent years, neither side had offered much for Ukraine, but during the last few years, all the things have heated up. Ukrainian intention to sign an Association Agreement for economic and political integration with the EU has created a furor in Russia, which is now trying to prevent Ukraine from alignment with the EU. Russia has imposed trade sanctions against EU and Ukraine in response to the sanctions imposed against Russia and still pursues an intense confrontation (Kmin 2015).

Geo-economic determination of Ukraine is one of the most important problems in the context of national development (Lukianenko 2005), successful resolution of which requires careful studying of the impact of the major global trends on Ukraine's economy under the present conditions. Certain challenges have been faced by Ukraine in the global trend of multi-polar world establishment process, manifested by the problem of the developing integration processes with countries from both European and Eurasian Unions. In this context it should be noted that the importance of simultaneous access to two very powerful European and Eurasian markets was highlighted in the work by Professor Shnyrkov (2012). Considerably interesting

are the results of calculations that were performed jointly by Ukrainian and Russian scientists as regards to the benefits of cooperation with the Eurasian Union (Ivanter et al. 2012). This research claimed that if Ukraine will possibly avoid engaging in the integrational processes within the post-Soviet area than it will lead country to the conservation of its current sectoral breakdown and, as expected result, to the possible slowdown in the growth of Ukrainian economy because of the impossibility to enhance growth of its export. Additionally, it was mentioned that if Ukraine joins the CIS free trade agreement with the current exceptions, it would have no appreciable influence on foreign trade within CIS, and also on the growth rate of the economy of Ukraine, or the economic structure of the country. In essence, Ukraine's joining the CIS FTA in that format, according to the researchers, could be seen as the saving of its status quo with almost insignificant positive changes in economy. If Ukraine would join the SES it will mean that, because of trade effects, its GDP would exceed the baseline GDP by 1% till the end of the predicted time period. Together with technological integration and acceleration of cooperation linkages taken into account, the economic effect could be expected to reach around 6-7% of GDP till 2030. If that scenario happened, till the end of the forecasted period, GDP of Ukraine would be expected to exceed its GDP, comparing with the scenario that avoids this integration with the SES by around 6-7%. Moreover, the actual share of mechanical engineering in Ukraine's GDP was expected to increase from 6% to 9%. Additionally, the share of equipment and machinery in the total production of Ukraine was forecasted to become approximately 6% by 2030 and the share of these categories in Ukraine's exports to the SES countries around 20%. Encourage of cooperation in the aircraft manufacturing would increase turnover in this sector as well. Speaking about the cumulative structure of the exports of Ukraine to the SES, the share of aircraft equipment was expected to increase up to 7% till 2030. Share of the shipbuilding products in exports of Ukraine to the SES countries was forecasted by Eurasian Development Bank to climb to around 1.2%. During the period of 2011–2030, the total positive effect of this integration option on the economy of Ukraine was estimated at around $219 billion measured in the prices of 2010 (Ivanter et al. 2012).

It should be mentioned that foreign scientists have been writing both about Russia's role strengthening, considering the country as one of the future Eurasian leaders, and on improving

efficiency of cooperation between the Eurasian continent countries, which in their opinion, would in the future result in the policy of the Eurasian Union influencing the European Union policy and even that of the United States and China (Adomeit 2012).

The most important task for Ukraine lies in its provision with energy resources, especially – with Russian natural gas. The second important task for Ukraine is to ensure production and export of products with a significant added value. According to Radzievska (2014), accomplishing these two tasks is related to cooperation with the Eurasian Union. Some certain interest may also be posed by transition to the own currencies in terms of Ukraine cooperating with those countries (the correlation between the Ukrainian hryvnia and the Russian ruble given, as well as impact of the financialization trend). For Ukraine, the particular importance is vested in the impact of the trend implying currently existing uni-polar world transformation into a fairer multi-polar world, with the core countries of the nowadays uni-polar world having implemented and supporting the neoliberal model of globalization.

Dragneva & Wolczuk (2016) describe policy of Ukraine towards Russia beginning with independence in 1991, which has been characterized by a predicament: how to save its independence while Ukraine's economy is heavily dependent on Russia, which had an intention for Ukraine to participate in their own integration projects. In the paper they argued that only through understanding of the difficulties and possible controversies in the positioning of Ukraine towards Russia can be obtained a complete and clear picture of Ukrainian commitment to integration projects of Russia. Their article periodically investigates responses of Ukraine to Russian projects and illustrates the strategy for Ukrainian elites to receive economic benefits with the minimization of the commitments. As result, they showed that Russia still remains a very influential country for Ukraine, and still has a number of instruments to influence the country on political, economic and military levels. Russian-Ukrainian relations will stay to be profoundly antagonistic and unsteady. As result, the costs for Ukraine will remain to be very high, speaking not just about the lost lives, dislocation and significant economic downturn. Nevertheless, despite the massive level of caused distress and the slow pace of the reforms in Ukraine, Ukraine is aimed to lessen some few more indicators in order to depend less economically on Russia.

Shumska (2013) observed possibilities of application of theory of optimal currency zones for evaluation of integration processes of Ukraine and justification of the choice of current direction (countries-partners and currencies). She suggested the main integration criteria. Also has been conducted analysis of major macroeconomic indicators, which characterized development of integration processes followed by basic criteria of the theory of optimal currency zones. A calculation and comparison of volatility, mutual real exchange rate volatility and correlation of real sector, money supply, inflation, the relative sizes of economies and bilateral trade were done. Additionally, they studied the readiness for integration, and in the future the possibility of monetary union Ukraine with CIS countries (Russia, Republic of Kazakhstan, Belarus) and the countries of the Eurozone.

The authors of another significant report (Vinokurov et al. 2012) indicated that structural change was associated with current development of the biggest economies within the former Soviet Union (Russia, Ukraine, Belarus, and Kazakhstan), because the potential for significant growth of economy based on the current exports of raw materials and outdated manufacturing factories is near to exhaustion. It is the first time during the last 20 years, where the research has formulated set of inter-industry analytical and forecasting models for these mentioned above four major economies in the region. It should be noticed, that their work has utilized a single unified methodology for the intra-industry analysis. Utilizing of this approach, have allowed researchers to create the model of common economic dynamics and structural changes, and to receive estimates for the possible integrational strategies on the territories of post-Soviet area.

But there are some special features regarding the recent studies of Ukrainian market: strong influence of the unstable political situation in economy, integration into European market and the results of that integration, and the recent military conflict and Crimean annexation altogether with its impact to Ukrainian, Russian and other markets and economies. Moreover, cointegration effect between the countries on the macroeconomic level has been studied as well but the main subject of investigation was two-sided interconnection between Ukraine and European Union (Pinchuk 2015). In this research has been constructed VAR model which included such variables as: GDP per capita, GDP annual growth rate, volume of foreign direct

investments from EU to Ukraine and imports and exports. Moreover author checks impulse responses and variance decompositions. They showed tendency if the system to equilibrium in the long-run, also variance decomposition analysis showed that intensity of interconnection between Ukrainian and EU economies has increased over the last 5 years. Confirmation of interconnection between Ukraine and EU, as well as intensification of such relationship after 2009 are the important results of the model, which has practical significance because empirically shows effectiveness of the official Euro integrational vector of Ukraine.

The paper of Wolczuk (2004) examined progress and necessary conditions for Europeanisation process in one of the Union's new neighbors from the Eastern Europe. Paper argued that Ukraine has been looking for integration with the European Union, however Europeanisation-extensive changes to the institutions and policies in the country at the domestic level corresponding to EU's more or less explicit so-called 'normative targets' did not take place. It was despite the fact that this was a model of already proven utility which was experienced while it was implemented in East and Central European countries. Article aimed to understand the reason why the progress of Ukrainian integration with the EU had been limited to foreign policy agreements through analyzing: first, the role of the sources of Ukrainian policy towards the EU at the mass and elite levels; secondly, the possible reasons for present inability of Ukraine to reflect its 'European choice' in the real reforms on domestic level. And finally, necessary conditions under which such a shift from declarations to the actual actions and reforms in former Soviet non-EU countries might happen, have been found with extrapolation from the insights, taken from the studies about the EU's eastern enlargement in the context of the Union's new European Neighborhood Policy.

Chalyi (2012) described both option of possible integration for Ukraine. He concluded that both integration processes — the result of the Association Agreement which leads Ukraine to economic integration and political association with the European Union, and Russian increased attempts to drag Ukraine closer to the Customs Union — were happening at the same time, with the increase of their pace later on. As a consequence, he expected the end of Ukrainian continuous “multi-vector” policy in near future. Author said that country has to determine its prioritized model of integration, because a possible further delay will weaken the

ability of the country to make its own decision, and will not have those decisions being influenced with external forces. He says that Ukraine has left a quite short amount of time to finally choose the strategic model for own civilizational development. European and Eurasian models of development certainly have their pluses and minuses. But author concluded that the strategic benefits in long-run of the integration in EU exceed all the tactical, benefits of Eastern integration in a short-run. For all main areas — political, socio-cultural economic, security and energy — the movement towards the EU corresponds to national interests of Ukraine.

In general, Ukraine can be identified as an emerging economy, which relatively recently has switched to the market economy and therefore has a quite young stock market. Ukrainian stock market has begun its activity in 1996, and since that time relatively few studies of the market performance were conducted, especially comparing with the US stock market. Mostly all these studies were performed by Ukrainian scholars (Wolczuk 2004).

Speaking about the Ukrainian Crisis, there are few researches that investigate it from different points of view. Kmin (2015) investigated influence of Ukrainian Crisis on the sample of selected stock markets. He aimed to analyze behavior of the investors, which faced extreme situations. Additionally, he aimed to find if selected indices (UX, WIG Ukraine, MICEX, MICEX Financials, MICEX Oil and Gas,) followed any kind of patterns and whether this kind of social and political crisis impacted these indices. Article has number of conclusions: only WIG Ukraine index in the long-run was impacted significantly in the negative way; indices that were located in the countries involved directly into events tend to be immune to the events outcome.

Other paper that reflects the influence of Ukrainian military conflict on the Russian stock market performance was the study conducted by Hoffman and Neuenkrich (2015). Authors performed an event study for all types of events connected with the Ukrainian military conflict. The estimation results confirmed initially established assumption about significant impact of Ukrainian military conflict-connected events on the stock market performance.

Litra (2016) described the perspectives of Ukraine for Eurasian integration and observed three most important possible alliances for the country: EU, EEU and China's Silk Road initiative or OBOR (One Belt, One Road). In his research author observed the relationship between the country and following organizations and suggested the possible ways for both parties to obtain more from the cooperation.

2.2.2 Review of the studies about cointegration

Cointegration effect between countries, economies and unions has been largely studied by different researchers in the literature. In the following several examples of such as studies are presented; the studies are conducted by different scholars across the world.

Ceylan (2006) in his study examined the long-run financial integration of the second-round candidate countries' with stock markets of the EU and the US during the Accession Process. Low pair correlations between analyzed markets implied opportunities for portfolio diversification, with correlation being a short-term measure. Stock market interconnection in the long-run was examined by utilizing Johansen (1990) cointegration approach, which indicated that there was no long-run connection between stock markets of the EU and US and the second-round countries. In his analysis of Engle-Granger causality test (Brooks 2002) presented proof of a casual flow on Croatian stock market from American and European equity markets and on stock market of Bulgaria from Turkish stock market that suggests a short-run lead-lag relationship among them. Results of his study indicated that the completion of negotiations concerning the EU joining with Romania and Bulgaria, and also ongoing negotiations with Turkey, and Croatia did not yet result in the finalized financial integration of these countries with the EU market. They still offered quite significant opportunities for diversification in the long-run for the American and European investors.

Another interesting paper by MacKinnon, Haug & Michelis (2000) utilized systems-based cointegration techniques developed by Johansen (1990) in order to identify which of the EU states could successfully create Economic and Monetary Union (EMU), on the basis of

nominal convergence criteria long-run behavior, which lay down in the Maastricht treaty. The core twelve EU countries have been analyzed altogether. Such indicators as long-term interest rates, nominal and real exchange rates, and deficits of government budget were analyzed each for the co-movements between the twelve countries and different subgroups of these countries. The findings of the research explain that not all of the 12 original states of the EU could potentially create a successful EMU over time, until some few countries would make significant adjustments.

Herzer (2014) investigated a long-term relationship between unionization and income inequality for a chosen sample of 20 countries. The article used heterogeneous panel cointegration techniques, and it was found that (a) unions had, on average, a negative effect on income inequality in a long-run, (b) there was considerable heterogeneity across countries in the effects of unionization on income inequality (in about a third part of cases the effect was positive), and that (c) long-run causality run in both directions, which suggested that, on average, an increase in unionization reduced the income inequality and that, in turn, higher inequality brought the lower unionization rates.

In his research Metwally (2010) tried to check, if a long-term relationship exists between each member of GCC countries total trade with non-GCC countries, and the intra-trade of each member country of the GCC Custom Union. According to him, if this relationship exists, it would assume that two variables over time do not drift too far from each other, which implied that intra-trade relative magnitude between GCC countries did not change significantly during the past few years. However, if there was no proof of the cointegration at intra-trade of each member country with other GCC members and its total trade with non-GCC states, that would suggest that two variables could drift away from each other more as the time goes. In the research author used unit root test of stationarity, Engle-Granger test for cointegration and the Johansen-Juselius cointegration test. The mentioned tests were conducted on the quarterly data for the period of 1982-2005. According to the conducted Engle-Granger cointegration test, the null hypothesis of no cointegration could not be rejected between each GCC member intra-trade and its total trade with non-GCC states. But null hypothesis of no cointegration was rejected for all GCC members except Oman, according to the Johansen-Juselius method. Thus,

for Kuwait, Qatar, Bahrain, United Arab Emirates and Saudi Arabia, intra-trade with GCC countries seems to converge with total trade with non-GCC countries.

The paper of Mlodowski (2015) focused on the monetary policy stance and its development of a selected sample of the resource-based economies for period from 1981 to 2013. The GCC countries shared quite many similar features in the underlying regime solutions for exchange rate. According to author, they are followed by some explicit economic integration initiatives. It happened, that because of financial crisis after 2008, many integrational processes there have been reversed, or even stopped. Empirical research tried to shed light on the extent to which these processes in the nominal sector have been evolving. In order to make it, the monetary policy stance correlation was measured. Using the statistical data obtained from the World Bank database, it was possible for author to investigate a significant convergence in the monetary policy stance between all, except one GCC country. In his article attention was drawn to a broader picture of the region that potentially can benefit from the common market. But, not all of GCC states seemed to be suited well for economic integration in the nominal sector. Significant divergence for the whole covered period has been shown by Bahrain.

Considerably critical review of cointegration process was demonstrated in the work of Guisan (2001), which emphasized few limitations of approach that he used to test the causality relationships in Econometrics. Author presented how cointegration tests can be applied for the relationship between such rates as GDP and Private Consumption for 25 OECD countries during the time period of 1960-97, and the results confirmed those limitations and the convenience to give more emphasis to another alternative approaches, like mixed dynamic models and specification tests.

Bayoumi and Eichengreen (1997) developed a procedure used for application of the core implications of the optimum currency areas (OCA) theory, and found that actual relation between characteristics of OCA and the observed exchange rates behavior seems to be sufficient enough for supporting of the simple forecasts. Accordingly, they operationalized this theory by creating an OCA index for the European countries. Their findings have coincided with the popular handicapping of the Maastricht stakes with one country exception -

France. The following finding was the symbiotic relation between the economic and monetary integration.

Alesina, Barro and Tenreyro (2002) evaluated whether some “natural” common currency areas emerge from the careful empirical investigation. They used their own developed framework, as a theoretical background. The paper discussed the broad development of the sizes of the country, number of currencies and currency areas in the period after World War II. They reviewed their own developed theoretical model implications, which they used as guidance for empirical investigation. Moreover, they discussed how the evidence of inflation rates, trade flows, and the associations of price with output fluctuations across countries identifies optimal currency areas. Also paper addressed the question of how trade flows and the price and output associations would change as countries adopt other countries’ currencies.

Integration processes in European Union were widely explored by different economists, and the most significant empirical researches are represented in the works of Von Hagen & Neuman (1994) and Stanoeva (2001). Both articles stressed the question of readiness of Europe for common currency. Papers concluded that union among Germany, France and their smaller neighbors would be viable. However, monetary union should be postponed until more adjustments in countries policies are done. Evaluation of potential of Ukrainian integration in different directions was point of interest of such researchers as: Savchenko, Rebryk and Kazarinov (2012) and Drobyshevsky & Polevoy (2004). Both papers described integration processes in Post-Soviet countries. Moreover, they identified theoretical criteria of optimal currency area, which identify the most significant benefits and costs received from the currency integration within the CIS area. Papers also present conducted analysis if the even single from the CIS states match the existed criteria of an OCA with Russia’s participation in it.

2.3 Review of previous studies studies about VAR models

Over three decades ago, a new macroeconometric framework was provided by Christopher Sims (1980) that promised a lot: vector auto regression models (VARs). Univariate auto

regression consists of single equation, single-variable linear model where variable's current value explained with its own lagged values. VAR is a *n*-equation, *n*-variable linear model, where each variable is explained with its own lagged values, and also current and past values of the remaining *n*-1 variables are added. It is quite simple framework, which gives a systematic way for capturing rich dynamics in the multiple time series, and the statistical tools which came with VAR models were easy to use and interpret. According to Sims (1980) and other scholars, which argued in a series of early influential papers, VARs promised to provide a very coherent and quite credible approach to the data description, forecasting, policy analysis and structural inference.

Vector auto regression (VAR) model has appeared to be one of the most flexible, successful, and easy to use econometric models for multivariate time series analysis. It is naturally extended univariate autoregressive model to the dynamic multivariate time series. VAR model has proven multiple times that it is especially useful for description of the economic and financial time series dynamic behavior, and also for forecasting. Superior forecasts are often provided by the model from the univariate time series models and elaborates various simultaneous equations models based on theory. VAR models provide quite flexible forecasts, because these forecasts can be made conditional in the future on the potential ways of specified variables in the model.

Additionally to forecasting and data description, VAR model is also used for policy and structural analysis. In structural analysis, are imposed certain assumptions on the causality structure of the given data under investigation, and summarized the resulting causal impacts of the unexpected innovations or shocks to specified variables on the variables in the model.

The mentioned above impacts are usually concluded with the impulse response functions and also forecast error variance decompositions. Mei, Liu and Jing (2011) constructed a multi-factor dynamic VAR forecast system model of GDP by selecting six most important economic indicators, which included the fiscal revenue, social retail goods, investment in fixed assets, tertiary industry output, secondary industry output, and employment rate, based on the data from the Shanghai region in China. The analysis showed that the significance of their model is

high and the obtained results show that the relative forecast error is quite small; leading the authors of the research to conclude that the VAR model has a considerable practical value.

Clarida and Friedman (1984) used in their research a VAR model and forecast of the United States short-term interest rates for time period from April 1979 to February 1983. Linear constant-coefficient VAR model has been generated for estimation of the quarterly data probability structure for the period before October 1979, which included 6 important United States macroeconomic factors into consideration. According to the results, the short-term interest rates in the US were "too high" since October 1979. Because, based on their VAR model, the predicted results of conditional and unconditional forecasts were lower than the actual United States short-term interest rates during observed period.

The main inventive study about unconventional monetary policy effectiveness at zero lower bound was made by Gambacorta, Hofmann & Peersman (2012). These researchers estimated a structural panel VAR, where they analyzed monthly data from eight countries during the time period since the very beginning of the recent world financial crisis. Authors have used central bank assets as a measure of the unconventional monetary policy. They included four variables into their VAR benchmark specification: real GDP, CPI, stock market volatility of the national stock market index and central bank assets.

Schenkelberg and Watzka (2011) in their research also used structural VAR approach in order to study real effects of the quantitative easing when zero lower bound was binding the economy. They use solely data from Japan starting from the year 1995. It was examined various VAR models and also they included the following variables in the benchmark VAR: Consumer price index, industrial production index of Japan, reserves and the 10-year yield Japanese government bonds. Also has been estimated additional specification where the VAR model contains also the Japanese Yen real effective exchange rate against other currencies. They also found out that quantitative easing shock raises the output temporarily and that the actual effect on inflation is not very significant. These are similar findings to which Gambacorta, Hofmann & Peersman (2012) came in their study as it was mentioned above. Schenkelberg & Watzka (2011) also proposed that Japanese quantitative easing in the

economic activity stimulation was successful at zero lower bound in the short-term and that it also did not lead to the actual increase of inflation.

The paper written by Sun, Heinz and Ho (2013) used the Global VAR (GVAR) model which was suggested by Pesaran et al. (2004), in order to investigate the cross-country interconnections between euro area states, other developed European economies (including Nordics, UK), and also the Central, Eastern and Southeastern European (CESEE) countries. Significant innovation of their work was the fact that they used combined financial and trade weights in order to capture the very close financial and trade interconnections of the CESEE states with developed Western European countries. Findings have shown strong co-movements in the interest rates and in output growth, but weaker interconnections between the real credit growth and inflation within Europe. Meanwhile the euro area remains to be the dominant source of the economic impacts, there are also quite interesting sub-regional interconnections, for instance, between the Baltic and the Nordic countries, and a small but very notable influence of CESEE states on the rest of the Europe.

Canova and Ciccarelli (2006) in their research estimated as well a multi-country VAR model. They described a methodology used for estimation of the coefficients, for testing of the specification hypotheses and for conduction of the policy exercised in the multi-country VAR models including cross-unit interdependencies, coefficients time variations and unit specific dynamics. The framework of their analysis was Bayesian: a prior flexibility reduced model dimensionality and put structure on the time variations; methods of the Markov Chain Monte Carlo (MCMC) were applied in order to receive posterior distributions; marginal likelihoods were used to investigate the fit of different specifications of data. Conditional forecasts and impulse responses have been received from the output of MCMC method. Shock transmission across G7 countries has been investigated as well.

Another paper written by Canova and Ciccarelli (2013) provided a panel VAR models overview that can be applied in finance and macroeconomics. Paper discussed what the distinctive features of panel VAR models are, for what these models are mostly used, and how to derive them from the economic theory. Moreover, it described how to estimate these models and how to perform shock identification, and also compared panel VARs with the other

methods given in the literature to deal with involving heterogeneous units dynamic models. And finally, research showed how to possibly deal with structural time variation and illustrated the challenges, which they give to the scholars interested in the analyzing cross-unit dynamics interdependences in heterogeneous setups.

Pinchuk (2015) in her paper explored current place of Ukraine in relationship with European Union, and defined level type of influence, which make interactions with EU on Ukrainian welfare. The stated goal has been reached through investigation of interrelations between Ukrainian welfare, EU economic growth, volumes of trade between these regions and investments from European Union to Ukrainian economy. Mentioned tasks have been done by using the econometrical instruments of analysis for multifactor relationships, in particular with vector auto regression (VAR) modeling. On the basis of the quarterly data of GDP per capita of Ukraine, EU GDP growth, amounts of foreign direct investments from EU to Ukraine, import and export of EU - Ukraine, VAR-model was built. The main hypothesis was the confirmation of positive interrelations between economic growth of EU and welfare of Ukraine. Also impulse functions demonstrated the system tendency to balance in long-run period, and variance decompositions of main factors of the model showed increase of interdependence between Ukrainian and European economies in the last five years. Confirmation of existence of actual interrelationship between economies of EU and Ukraine, and raising dynamic of such relation are important results of the model, which have significant practical value as far as they provide empirical evidence of the effectiveness of the official course of Ukraine regarding European integration.

In his research Matkovskyy (2012) utilized the GVAR models and applied them to Ukraine and its neighbor-countries: Poland, Belarus, Russia Federation, Georgia, Turkey, Bulgaria, Romania, Moldova, Hungary and Slovakia. Research aimed to identify and then to forecast linkages between these countries, evaluate import-export flows, find out the mechanism of the Ukrainian response to unemployment and inflation shocks, and also of the shocks of transmission mechanism to the economy of Ukraine. Results of the research have shown relative resistance of Ukrainian economy to the outside shock concerning two important macroeconomic indicators: inflation and unemployment rates. Analysis has shown essential

delay in reaction to the shock: from the observed sample which consisted of 40 quarterly data points the lag forms approximately 20-25 quarterly data points, depending on the source and kind of shock. This can be explained by accumulation effect of Ukrainian economy as a result of the “hands-on” approach in management, absence of shock resistant mechanisms because negative reaction on the shock actually exists.

2.4 Hypotheses to be tested

In our research we will try to illustrate the major point of interest, which is to understand the influence of major economic partners to the economy of Ukraine and also macroeconomic spillover effect of European Union and Russian Federation to Ukraine. The first part of the research is aimed to show whether Ukrainian economy correlates to changes in the macro indicators of European Union. According to this, the aim is to check whether economic and financial policies of EU have an impact on economies of the neighborhood countries, specifically on Ukraine in present thesis. To investigate this relationship specifically interesting considering that fact that talks are keeping going on regarding Ukrainian integration in the European Union.

The second part of the research is aimed to understand whether Ukrainian economy correlates to changes in the macro indicators of Russian Federation. In the research, we will check whether the economic and financial policies of Russian Federation have an influence on the economy of Ukraine. To check this relationship is even more interesting when taking into account that fact that talks still keep on going about the possible integration of Ukraine with EU and the possible benefits Ukraine lost after rejecting the proposal to join Eurasian Economic Union.

One could potentially also examine the influence of Ukrainian Crisis on the economy and stock returns in Ukraine, but previous researches have shown strong negative influence of the Crisis on the Ukrainian stock market and economy in general (Kmin 2015).

Taking into account previously written literature related to research problem, the following hypotheses can be formulated for the research:

H1: Ukrainian economy strongly correlates with the economy of EU and macroeconomic changes in EU policy have strong influence to Ukrainian economic policy.

H2: Russia Federation influences the economy of the country significantly and decisions made by this country impact significantly economy of the country.

3. Methodology

This paper investigates the dynamic linkage between Ukraine, Russia and European Union during the last 15 years. Therefore, various econometric analysis methods were applied, including tests for presence of unit root, Johansen cointegration test, Granger-causality test and impulse responses analysis. Unit root tests were conducted at the very beginning, because the stationarity of a time series is the basic requirement for all other techniques. Johansen cointegration test measures the relationships between the macro indicators in the long-run while the other three tests (variance decomposition, impulses analysis and Granger-causality) are used to analyze the short-run aspects. When the cointegration is found, this implies that even if a set of the variables is non-stationary, they will never drift apart in the long-run. And vice versa, if there is a lack of cointegration, they will not have any links in the long-run. Accordingly, if cointegration exists, other following tests (Granger-causality test and impulse response analysis) should be built on the error-correction model. If there is no cointegration, then analysis should be based on the regression of the first differences of the time series by applying a standard VAR framework. The Granger-causality test identifies causality direction while the impulse responses analysis tests the speed and durations of the interactions between macro variables.

3.1 Unit root and stationary tests

Many different time series might include trend or non-stationary behavior. Especially evident these characteristics are in the economic and financial time series, such as stock market indices and macro indicators. If time series contain unit root, until this series combined with some other series with unit root to create a stationary cointegration relationship, the regressions which have involved these series might cause the spurious regression. Several various methods can be performed in order to investigate the stationarity of time series data. However, the most popular approaches are Augmented Dickey-Fuller (ADF) test, Phillips-Perron test (PP) for non-stationarity and Kwiatkowski, Phillips, Schmidt, and Shin (Kwiatkowski et al. 1992) test for stationarity. Because of the fact that ADF and PP tests usually offer the same conclusion, we only perform in our analysis the ADF and KPSS tests.

3.1.1 Unit Root Test - Augmented Dickey-Fuller (ADF) test

Augmented Dickey-Fuller (ADF) test was created by Dickey and Fuller (Fuller 1976). There exist 3 main versions of the test which can be used to check if the time series is non-stationary for the presence of the unit roots in the time series.

1. Test for a unit root

$$\Delta y_t = \varphi^* y_{t-1} + \sum_{i=1}^{p-1} \varphi_i \Delta y_{t-1} + u_t \tag{1}$$

2. Test for a unit root with drift

$$\Delta y_t = \beta_0 + \varphi^* y_{t-1} + \sum_{i=1}^{p-1} \varphi_i \, \Delta y_{t-1} + u_t \tag{2}$$

3. Test for a unit root with drift and deterministic time trend

$$\Delta y_t = \beta_0 + \varphi^* y_{t-1} + \sum_{i=1}^{p-1} \varphi_i \Delta y_{t-i} + \beta_1 t + u_t \tag{3}$$

where y_t denotes the log value of macro variable or log return of macro indicator at time period t and $\Delta y_t = y_t - y_t{-}1$. β_0 is the drift term, t is linear trend term and u_t is the error term.

$$H_0: \varphi^* = 0 \quad \text{Non} - \text{stationary}$$
$$H_1: \varphi^* < 0 \quad \text{Stationary}$$

Null hypothesis for this test is that a time series does contain a unit root (non-stationary process) against the alternative of no unit root. In order to check if the unit root is present in time series, we need to calculate the T-statistic $\tau = \frac{\varphi^*}{\sqrt{var\,(\varphi^*)}}$ and then compare it with the corresponding critical value at the different significance level. If the null hypothesis is rejected, this means that a series y_t which includes drift, trend or none of those, does not contain a unit root.

3.1.2 Stationary Test - Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test

To avoid the limitation that ADF test always has a low power, Kwiatkowski, Phillips, Schmidt, and Shin (Kwiatkowski et al. 1992) proposed an alternative approach - the test for stationary or KPSS test.

The null hypothesis of KPSS test is that time series is stationary against the alternative hypothesis of the presence of a unit root.

The KPSS test is a Lagrange multiplier test and the test statistic can be computed by firstly regressing the dependent variable on a constant or a constant and a time trend t. And then save all the OLS residuals ε_t and compute the partial sums $s_t = \sum_{s=1}^{t} \varepsilon_s$ for all t. Further the test statistic is given by Verbeek (2004):

$$KPSS\ LM = \sum_{t=1}^{T} \frac{{S_t}^2}{{\hat{\sigma}_\varepsilon}^2} \tag{4}$$

Where $S_t = \sum_{s=1}^{t} \varepsilon_s$ and ${\hat{\sigma}_\varepsilon}^2$ is the error variance estimated from the following regression

$$y = \alpha + \varepsilon_t \text{ Or } y_t = \alpha + \beta_t + \varepsilon \tag{5}$$

In my paper, both the ADF test and KPSS test are conducted to check whether the same conclusions can be achieved. When the results are conflicted, KPSS test is preferred due to the limitation of ADF test. Main assumptions, benefits and limitations of ADF and KPSS tests are shown in the Table 2.

Table 2. Main assumptions, benefits and limitations of ADF and KPSS tests

Type of test	Assumptions	Benefits	Limitations
ADF	It is augment version of Dickey-Fuller test for a larger and more complicated set of time series models. Tests the null of a presence of unit root in a time series sample	The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence. By including lags of the order *p* the ADF formulation allows for higher-order autoregressive processes.	Not likely to be used for small time series samples.
KPSS	Tests a null that an observable time series is stationary around deterministic trend against the alternative of a unit root.	KPSS-type tests are intended to complement unit root tests. The series is expressed as the sum of deterministic trend, random walk, and stationary error, and the test is the Lagrange multiplier test of the hypothesis that the random walk has zero variance.	The absence of a unit root in test is not a proof of stationarity but, by design, of trend-stationarity

3.2 Vector autoregressive (VAR) models

The vector autoregressive (VAR) model is suggested by Sims (1980) and is named as the extension of the univariate autoregressive model to the multivariate time series. Moreover, the VAR model is useful to capture the dynamic behavior of financial and economic data.

The simplest case is the bivariate VAR (1) model which has two variables $[y_{1t}, y_{2t}]$. The current values depend on the previous values of y_{1t} and y_{2t} and error terms. It can be expressed as:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix} + \begin{pmatrix} \beta_{11} & \alpha_{11} \\ \alpha_{21} & \beta_{21} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} \qquad (6)$$

Where u_{1t} is a white noise term with E $(u_{it}) = 0$, $E\ (u_{1t}\ u_{2t}) = 0$.

The system illustrated above can also be extended to include g variables $y_{1t}, y_{2t}, \ldots y_{gt}$, and each current value depends on the various combinations of the previous k values of g variables and error terms.

Since scholars do not need to specify which of the variables are endogenous or exogenous, the VAR model has proved to be one of the most flexible, successful, and easy to use models for the multivariate time series analysis. One problem need that can be noticed is how to determine the optimal lag length of VAR model. Generally, two approached are used more often. One way is the likelihood ratio test, and the other is the information criteria, such as like Akaike's (AIC) and Schwarz's Bayesian Information Criteria (SBIC). The optimal lag length is selected by maximizing LR, or minimizing the information criteria. However, the information criteria method is more powerful than LR. If AIC and SBIC provide contradictive lag length, SBIC criteria is preferred. The reason is that SBIC will deliver the correct model with fewer lags, while on average AIC will select a model with too many lags.

Among main advantages of VAR models are: their easy implementation; possibility to test any linear restriction with VAR model, either in one equation or across equations, with the standard t and F-statistics; possibility to conduct Granger causality test and impulse responses analysis with variance decomposition. However, VAR models have as well some limitations. They are often criticized because these models do not demonstrate the underlying structure of the economy. When the innovations provided by model are contemporaneously correlated, the

impulse response functions will be dependent on the order of the variables. No certain rules exist on how to select the order of the variables. Economic theory might shed some light, but eventually the choice of ordering will depend on the questions that the researcher aims to answer.

3.3 Cointegration test

If we regress the non-stationary variable *X* on the non-stationary variable *Y*, the "spurious regression" may arise, which leads to incorrect estimation results. However, there exists one exception, that is, if two or more variables are non-stationary, however a linear combinations of them are stationary, then these variables are said to be cointegrated.

Cointegration is an econometric approach which applied to investigate the correlation between non-stationary time series variables. Practically, many economic time series which have a unit roots (non-stationary) move together during the time, although the considered variables may drift away from equilibrium for a while, there exist some forces on the series, which make them converge upon some long-run value. Test of cointegration can be done either with two-step Engle-Granger residual-based test or by utilizing Johansen approach (Brooks 2002).

3.4 The Johansen Technique Based on VARs (Brooks 2002)

The Johansen approach is more generally applicable than two-step Engle-Granger since it is a procedure for testing for cointegration of two or more time series, each of which is integrated to order one I(1). In other words, the Johansen approach allows more than one cointegrating relationships exist.

The Johansen cointegration tests and estimations are carried out by restricting a VAR model. Suppose that a number of n variables ($n \geq 2$) are non-stationary and integrated to order one -

I(1), and they are thought to be cointegrated. A VAR model with *k* lags containing these variables could be set up:

$$Y_t = \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \cdots + \beta_k Y_{t-k} + u_t \quad (7)$$

where *Yt* is an *N* ×1 column vector of dependent variables, which are integrated to the order of one. u_t notes an *N* ×1 column vector of innovations.

The premise to utilize the vector autoregressive model is that all variables in the system should be stationary. Thus, in order to be able to use the Johansen test, the VAR above should be transformed in vector error correction model (VECM) by the reason that VECM releases the requirement of stationarity for the data. VECM contains first difference terms and cointegration relationships and can be written as below:

$$\boldsymbol{\Delta Y_t = \Pi Y_{t-k} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \cdots + \Gamma_{k-1} \Delta Y_{t-k-1} + u_t} \quad (8)$$

Where $\Pi = (\sum_{i=1}^{k} \beta_i) - I_n$ and $\Gamma_i = (\sum_{i=1}^{j} \beta_i) - I_n$ (9)

The long-term cointegration matrix of Π determines the set of cointegrating vectors, say, r. Therefore, Johansen test focuses on the examination of coefficient matrix Π. Two matrices α (N×R) and β (N×R) are defined, and the coefficient matrix Π is a product of α and β, i.e. Π =α ∗β ′. If there exists a long-run equilibrium, all the $\Delta Y_{t-i} = 0$, and setting the error tem, u_t , to the expected value of 0 will leave $\Pi Y_{t-k} = 0$. So, we test of cointegration between different variables by looking at the rank of Π via its eigenvalues. The rank of a matrix is equal to the number of its eigenvalues, which are different from zero. The eigenvalues are denoted by λ_i. When the variables are not cointegrated, the rank of Π will not be significantly different from zero, i.e. $\lambda_i = 0$ (Brooks 2002).

Johansen and Juselius (1990) suggest the trace test and the maximum eigenvalue t-statistics in making inference of the number of cointegrating vectors, which are formulated as:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\hat{\lambda}_r) \quad (10)$$

and

$$\lambda_{max}(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1}) \quad (11)$$

where r is the number of cointegration vectors under the null hypothesis, T is the size of sample, and λ is their eigenvalues. The null hypothesis of at most r cointegrating vectors against the alternative of more than r cointegration vectors is tested with trace statistics. The test's null hypothesis of r cointegration vector against the alternative of r+1 is tested through maximization of eigenvalues statistic.

While applying the Johansen approach, one usually faces a problem of the selection of deterministic elements of the model, such as if deterministic components, i.e. a constant or a time trend, are contained in levels of data or cointegration equation. It is very important because cointegration tests can be sensitive to the empirical specification of the deterministic component and the distribution of the test statistics is different for each possible combination.

One way is to plot the data, which would give some intuitive ideas for us. But sometimes the graph of the data provides little information about how to select the deterministic components. In this kind of situation, Pantula principle (Johansen 1992) is applied in order to find the appropriate deterministic factors for the each model, which is summarized as below.

There are five different assumptions, according with Matlab 2016b options:

Model 1: There are no intercepts or trends in the cointegrating relations and there are no trends in the data;

Model 2: There are intercepts in the cointegrating relations and there are no trends in the data;

Model 3: There are intercepts in the cointegrating relations and there are linear trends in the data;

Model 4: There are intercepts and linear trends in the cointegrating relations and there are linear trends in the data;

Model 5: There are intercepts and linear trends in the cointegrating relations and there are quadratic trends in the data.

In practice, model 1 and model 5 are rarely used. We only consider the model 2-4. It is easy to find that the model 2 is most restrictive and model 4 is least restrictive.

The Pantula principle involves the estimation of all three models and the presentation of the results from the most restrictive hypothesis (r = number of the cointegrating relations = 0 and Model 2) through the least restrictive hypothesis (r= number of variables entering the VAR–1 = n –1 and Model 4). The process of Pantula principle starts from the most restrictive model, with no deterministic components, the rank statistic is compared with its corresponding critical value. If the model is rejected, one continues to the model with a restricted intercept in the cointegration equation. If this model is still rejected, we keep going to the model with an unrestricted constant and linear trend. If the model is again rejected, the procedure needs to be repeated to the next rank. The test will be stopped when the null hypothesis is not rejected at the first time (Irandoust and Ericsson 2004).

3.5 Granger causality test

Granger causality in a way is different from the normal causality. For example, the causality from A to B indicates that A causes B directly. Granger causality is an econometrics tool that based on the standard F-test framework in order to determine whether one variable is useful in prediction of the future values of another variable. A variable X Granger-causes Y if the past changes of X could help to predict current changes of Y. If X Granger-causes Y and not vice versa, then this process is known as unidirectional causality. If X Granger causes Y and Y also Granger causes X, it can be said that there is a bi-directional causality between them (Brooks 2002).

When we conduct Granger causality tests, two cases should be considered depending on presence of cointegration between variables.

(a) If the variables are not cointegrated, the following VAR estimation equations in the first differences are tested.

$$\Delta Y_t = \sum_{j=1}^{n} b_j \Delta X_{t-j} + \sum_{j=1}^{n} c_j \Delta Y_{t-j} + u_{t-1} \tag{12}$$

$$\Delta X_t = \sum_{j=1}^{n} b_j^* \Delta Y_{t-j} + \sum_{j=1}^{n} c_j^* \Delta X_{t-j} + u_{t-1}^* \tag{13}$$

(b) If the variables are cointegrated, the following error correction models (ECM) are tested.

$$\Delta Y_t = \sum_{j=1}^{n} b_j \Delta X_{t-j} + \sum_{j=1}^{n} c_j \Delta Y_{t-j} + \varphi e_{t-1} + w_t \tag{14}$$

$$\Delta X_t = \sum_{j=1}^{n} b_j^* \Delta Y_{t-j} + \sum_{j=1}^{n} c_j^* \Delta X_{t-j} + \varphi e_{t-1}^* + w_t^* \tag{15}$$

Let ΔY_t and ΔX_t denote the stock returns of country x and country y, respectively. e_{t-1} and e_{t-1}^*, are the lagged residuals from two equations in case (a). The null hypothesis for the Granger-causality test in the above equations is *X* does not cause *Y* (all $b_j=0$); the alternative is *X* causes *Y* (at least one $b_j \neq 0$ and all $b_j^* = 0$). If the null hypothesis is rejected, the conclusion is obtained that *X* Granger-causes *Y* (Roca 1999).

The main reason to use ECM for testing the causality between cointegrated variables is that the regressing on the variables cointegrated on the first differences could lead to misspecification error.

It also should be noted that Granger-causality really reflects only correlation between the current value of the variable and the previous values of all others. It does not necessarily mean that movements of one variable cause movements of another (Brooks 2002). Moreover, although causality in VAR checks if the current value of variable *X* could be explained by the past values of variable *Y*, it still does not explain the sign of the relationship or how long these effects last. However, all needed further information will be given by impulse responses analysis.

3.6 Impulse responses analysis

Generally, an impulse response function indicates the reaction of any dynamic system in response to some external changes. In particular, VAR‘s impulse responses mainly investigate the reaction of dependent variables to shocks from each independent variable. The unit impulses accumulated effects are measured with appropriate summation of the coefficients of the impulse response functions (Lin 2006). However, Lutkepohl and Reimers (1992) stated that analysis of the traditional impulse response requires orthogonalization of the shocks. And the results differentiate with the order of the variables in the VAR model. The higher correlations between the residuals are, the more important the ordering of the variable. Aiming to overcome this problem, Pesaran and Shin (1998) developed the generalized impulse response functions that adjust the impact of the different ordering of the variables on the impulse response functions. The generalized impulse responses usually are plotted by using historical patterns of correlations. Our research only shows the graph of each macroeconomic variable in response to different shocks. It doesn‘t refer to any calculation about the generalized impulse response functions.

However, if VAR models include more equations or more lags, it is hard to study the effects of external shocks on the variables. In order to show the interactions between the equations, variance decompositions analysis should be applied.

4. Data and preliminary analysis

4.1 Data selection and design

Our research was divided into two parts in order to check both hypotheses. The data for the analysis was extracted from Eurostat (ec.europa.eu/eurostat), National Bank of Ukraine (NBU) official website (www.bank.gov.ua) and Central Bank of Russia (CBR) official website (www.cbr.ru). We used the most significant data of macroeconomic variables and their changes for both EU and Ukraine as well as for Russia and Ukraine.

The analysis included the rates of GDP, interest rate, unemployment rate, Consumer Price index and balance of trade for all three parties: EU, Russian Federation and Ukraine. These indicators are called lagging indicators. They shift only after the economy changes. Even though they do not typically show where the economy is going, they reflect how the economy of the country changes during the time and can help to identify the long-term trends. Moreover, publication of these indicators and their changes has the strongest impact on the stock market of the country and its currency.

The analyzed period contained last 15 years quarterly period data, the reasonable time period since the actual talks regarding the integration of Ukraine into one of the following unions (from 2001 to 2016 Q3) have begun.

The real GDP index is used to measure the volume pf the economic activity of analyzed countries. The OECD defines GDP as "an aggregate measure of production which is equal to the sum of the added gross values of the all resident and institutional units that engaged in the production (plus all taxes, and minus any subsidies, on products that are not included in the value of their outputs). Because only yearly and quarterly data of GDP are available, we had to use quarterly data to receive more accurate estimates.

Consumer Price Index (CPI) reflects changes in the price level of the market basket of consumer goods and services purchased by the households.

CPI is a statistical estimate that based on using the prices of a sample of representative items, the prices for which are collected periodically. Various sub-indices and sub-sub-indices are estimated for different categories and sub-categories of goods and services, that are combined in order to create the overall index with weights representing their shares in the total of the consumer expenditures, which covered by this index. CPI is one of the several price indices that most of the national statistical agencies compute. The percentage change in the index is used as a measure of inflation on the annual basis.

Unemployment rate is basically defined as the percentage of the total labor force which is currently unemployed but actively looking for job and willing to work.

Interest rate index indicates the borrowing cost that is charged from commercial banks and other financial institutions by the central bank of the country for money that this central bank lends to them.

Trade balance or balance of trade is the index that shows the difference between an import and export of the country for a given period of time. Trade balance is the largest component in the balance of payments of the country. Index is measured in billions of US dollars.

4.2 Preliminary analysis

Table 3 shows the descriptive statistics for all variables for the time period from 2001 to 2016. Each of the 15 variables has 63 observations which are the quarterly data points.

The mean, standard error and standard deviation values change a little in the variables for all three analysis parties, however in the GDP high values for the mean, standard deviation and standard error can be observed. This is caused by the GDP index, where ware analyzed original GDP ratios, measured in the billions of home currency units.

The values between -2 and +2 for kurtosis and skewness can be considered as acceptable in order to prove the fact that data is normally distributed (George & Mallery 2010). According

to the results of descriptive statistics, kurtosis and skewness are within acceptable interval for all the variables, except Ukrainian interest rate, with a kurtosis value of 4,23 and skewness of 2,12.

In the multivariate methods, the normality (normal distribution) is one of the most important assumptions. In order to assess the normality of data, Jarque-Bera normality test has been conducted. The null hypothesis of the test that the data in vector *X* is normally distributed and has an unknown mean and variance at 5% significance level. As we can see from the test, null hypothesis has been confirmed for Russian GDP and interest rate, and at 10% significance for the rest of indicators for Russia. For Ukraine at 5% significance null has been rejected for unemployment rate and GDP, but GDP has not been rejected at 10% significance. For European Union null was confirmed for GDP and Trade balance and on 10% for CPI and interest rate. Normality of EU unemployment rate has been rejected.

Table 3. Descriptive statistics for macro indicators

	Mean	Standard Error	Standard Deviation	Kurtosis	Skewness	Jarque-Bera	Probability
Unemployment, RU	6,87	0,16	1,33	-0,87	0,38	3.6250	0.0885
GDP, RU	11009,15	446,94	3547,529	-1,33	0,36	5.9661	0.0394
CPI, RU	89,63	4,62	36,71	-0,93	0,34	3.5420	0.0918
Interest rate, RU	12,09	0,64	5,11	1,34	1,52	26.7361	0.0018
Trade balance, RU	10,79	0,585	4,64	-1,2	-0,05	3.8133	0.0818
Unemployment, UA	8,29	0,18	1,46	-0,32	0,61	0.1736	0.5000
GDP, UA	2392,396	196,779	1561,188	-0,32	0,615	4.1901	0.0705
CPI, UA	87,83	5,82	46,25	0,15	-0,12	11.6641	0.0116
Interest rate, UA	10,86	0,68	5,44	4,23	2,12	83.4909	0.00001
Trade balance, UA	-2,65	0,57	4,57	1,37	-1,39	22.8289	0.0026
Unemployment, EU	9,581	0,179	1,422	-0,89	0,232	2.7376	0.1430
GDP, EU	2354,18	12,895	102,35	-0,958	-0,533	5.3531	0.0471
CPI, EU	90,57	0,965	7,65	-1,33	-0,2	5.0066	0.0524
Interest rate, EU	1,828	0,175	1,392	-1,003	0,39	4.3006	0.0675
Trade balance, EU	5,485	1,08	8,576	-0,19	0,761	6.0064	0.0390

The inter-item correlations of variables are a precondition for the multivariate analysis methods. Tables 4, 5 and 6 show the correlations between each pair of variables measured with Pearson's correlation coefficient. With the correlation analysis one can test whether the variables are in any relation with each other and thus capable of measuring and determining the phenomenon that is being explored. A variable with no correlation with any other variable should be removed because alone it does not have any explanatory value. In the analysis, correlation level from 0.40-0.65 is considered to be a medium correlation, 0.65-0.80 a high correlation, and over 0.8 a very high correlation. The correlation matrices show that all variables have at least some noticeable correlations with other variables. In the following chapters the main features of the variables will be summed up in line with the categories.

Ukraine – European Union. The macro variables and their correlation between European Union and Ukraine presented in the Table 4. As we can see from the table, EU interest rate has a negative correlation with all of the variables, where's it strongly correlates with EU unemployment (-0.88), Ukrainian GDP (-0.75) and CPI (-0.76). EU CPI highly correlates to Ukrainian GDP (0.93) and CPI (0.87), and its own GDP (0.88) as well. Medium correlation here observed with EU unemployment and trade balance. EU unemployment does not have any strong correlations, just medium level with EU trade balance (0.59), Ukrainian CPI (0.61) and GDP (0.63). European Union GDP highly correlates with Ukrainian GDP (0.83) and with Ukrainian CPI index (0.78). Trade balance of EU has medium level of correlation with all the variables of Ukraine except its trade balance, where correlation is considered as week. Also here should be mentioned the highest level of correlation in whole table between Ukrainian CPI and Ukrainian GDP (0.95).

Table 4. Correlation between European Union and Ukraine

	Interest rate, EU	*CPI, EU*	*Unemployment, EU*	*GDP , EU*	*Trade balance, EU*	*Interest rate, UA*	*CPI, UA*	*Unemployment, UA*	*GDP, UA*	*Trade balance, UA*
Interest rate, EU	1									
CPI, EU	-0,77	1								
Unemployment, EU	-0,88	0,73	1							
GDP, EU	-0,46	0,88	0,35	1						
Trade balance, EU	-0,63	0,49	0,59	0,26	1					
Interest rate, UA	-0,14	0,18	0,07	0,19	0,49	1				
CPI, UA	-0,76	0,87	0,61	0,78	0,68	0,51	1			
Unemployment, UA	-0,14	-0,21	0,20	-0,43	0,40	0,43	0,07	1		
GDP, UA	-0,75	0,93	0,63	0,83	0,62	0,34	0,95	-0,07	1	
Trade balance, UA	-0,05	-0,35	0,00	-0,42	0,33	0,27	-0,10	0,52	-0,27	1

Ukraine – Russia. The Table 5 shows the correlations of variables between Ukrainian and Russian macro indicators. Quite interestingly here that 3 Ukrainian macro indicators (interest rate, unemployment and trade balance) don't have high level of correlation with Russian macro indicators. Here can be observed only medium level of correlation between unemployment rate of both countries (0.46) and also medium level of correlation between Ukrainian unemployment rate with Russian interest rate and trade balance, also between Ukrainian trade balance and Russian trade balance and unemployment rate. Ukrainian CPI strongly correlates with Russian CPI (0.97) and Russian GDP (0.81). Moreover, Ukrainian GDP has highest level of correlation with Russian CPI (0.97) and Russian GDP (0.93). Logically, we can see strong correlation between Russian CPI and GDP indexes (0.90).

Table 5. Correlation between Ukraine and Russia

	Interest rate, UA	*CPI, UA*	*Unemployment , UA*	*GDP , UA*	*Trade balance , UA*	*Interest rate, RU*	*CPI, RU*	*Unemployment , RU*	*GDP , RU*	*Trade balance , RU*
Interest rate, UA	1									
CPI, UA	0,51	1								
Unemployment ,UA	0,43	0,07	1							
GDP, UA	0,34	0,95	-0,07	1						
Trade balance, UA	0,27	-0,10	0,52	-0,27	1					
Interest rate, RUS	0,11	-0,62	0,51	-0,70	0,37	1				
CPI, RUS	0,36	0,97	-0,05	0,97	-0,19	-0,75	1			
Unemployment , RUS	-0,06	-0,64	0,46	-0,77	0,40	0,69	-0,74	1		
GDP, RUS	0,14	0,81	-0,16	0,92	-0,37	-0,73	0,90	-0,83	1	
Trade balance, RUS	-0,11	0,41	-0,50	0,52	-0,45	-0,79	0,57	-0,66	0,68	1

European Union – Russia. As well correlation between Russian Federation and European Union was checked here. As result, we can see that Russian unemployment highly negatively correlates with EU CPI index (-0.81) and GDP (-0.80). Russian interest rate follows the same pattern as unemployment rate, however correlation coefficients slightly higher for CPI (-0.84) and GDP(-0.85). The correlation with Russian CPI index is also quite high. For example, Russian CPI index strongly correlates with interest rate (-0.81) of EU, its CPI (0.96) and GDP (0.84). With other unemployment and trade balance there are presented medium level correlations. Correlation between Russian GDP and EU macro indicators is medium for all of them except CPI index, where variables have a strong correlation (0.94). And Russian trade balance has medium level correlation with European Union's unemployment rate (0.49) and strong level of correlation with EU's CPI index (0.73), and GDP (0.71).

Table 6. Correlation between Russia and EU

	Interest rate, EU	*CPI, EU*	*Unemployment, EU*	*GDP, EU*	*Trade balance, EU*	*Interest rate, RU*	*CPI, RU*	*Unemployment, RU*	*GDP, RU*	*Trade balance, RU*
Interest rate, EU	1									
CPI, EU	-0,77	1								
Unemployment, EU	-0,88	0,73	1							
GDP, EU	-0,46	0,88	0,35	1						
Trade balance, EU	-0,63	0,49	0,59	0,26	1					
Interest rate, RU	0,62	-0,84	-0,55	-0,85	-0,13	1				
CPI, RU	-0,81	0,96	0,71	0,84	0,64	-0,75	1			
Unemployment, RU	0,44	-0,80	-0,42	-0,81	-0,43	0,69	-0,74	1		
GDP, RU	-0,73	0,94	0,73	0,77	0,55	-0,73	0,90	-0,83	1	
Trade balance, RU	-0,37	0,73	0,49	0,71	-0,03	-0,79	0,57	-0,66	0,68	1

In sum, the correlation matrices confirm that there is a large variety of correlations between the variables. Each variable correlates at least to some extent with other variables, which gives a reason to keep all the variables in the analysis. There were no surprising results provided by correlation tables, however it seems like trade balance has the lowest correlations with other variables in the chosen data sample. It can be a possible result of the fact that some other variables not selected for analysis might correlate stronger with the trade balance.

5. Estimation of the results and discussion

5.1 Unit root test and Stationary Test

Non-stationary data in most cases is unpredictable and cannot be forecasted or modeled. The obtained results, by using time series with unit root may be spurious in the way, that these results might show a relationship between a two variables, in a way that one of them does not really exist. With a goal to obtain reliable and consistent results, the data with unit root should be transformed to the stationary data.

A stationary time series are not really dependent on the time, at which these series was observed. Therefore, the time series with seasonality or with trends cannot be called stationary — the trend and seasonality would influence the value of the time series during different points in time. On the other side, a stationary series that follows white noise pattern — does

not have any significant role when you actually observe it; this white noise should approximately look quite the same during any period of time.

So the transformation of the data can help to remove unit root from the series and make them stationary. Logarithms transformations can help to make stable the variance of the time series. Another way to remove unit root – differencing, can help to make stable the mean of the series and remove changes in the level of the time series, therefore, eliminate trend and seasonality from data.

Logarithm transformation is not used here, because data sample has a lot of zero values. So our data sample can be transformed into the stationary data by differencing (subtract Y_{t-1} from $Y_{t,}$ and take the difference Y_t - Y_{t-1}) correspondingly to $Y_t - Y_{t-1} = \varepsilon_t$ or $Y_t - Y_{t-1} = \alpha + \varepsilon_t$ and which turns the data sample into difference-stationary.

Figure 1 represents graphical presentation of the plots of original time series of unemployment rate for Ukraine, European Union and Russia in comparison with the corresponding first differences of the same rates plots. As we can see, while in original time series of unemployment rate for all three parties we can observe upwards or downwards trends and graphs don't cross the mean frequently, then with differencing of the data, we can see the change in the data structure, where trends disappear and graphs cross the mean very often. It is a good graphical representation of the comparison of non-stationary and stationary data series.

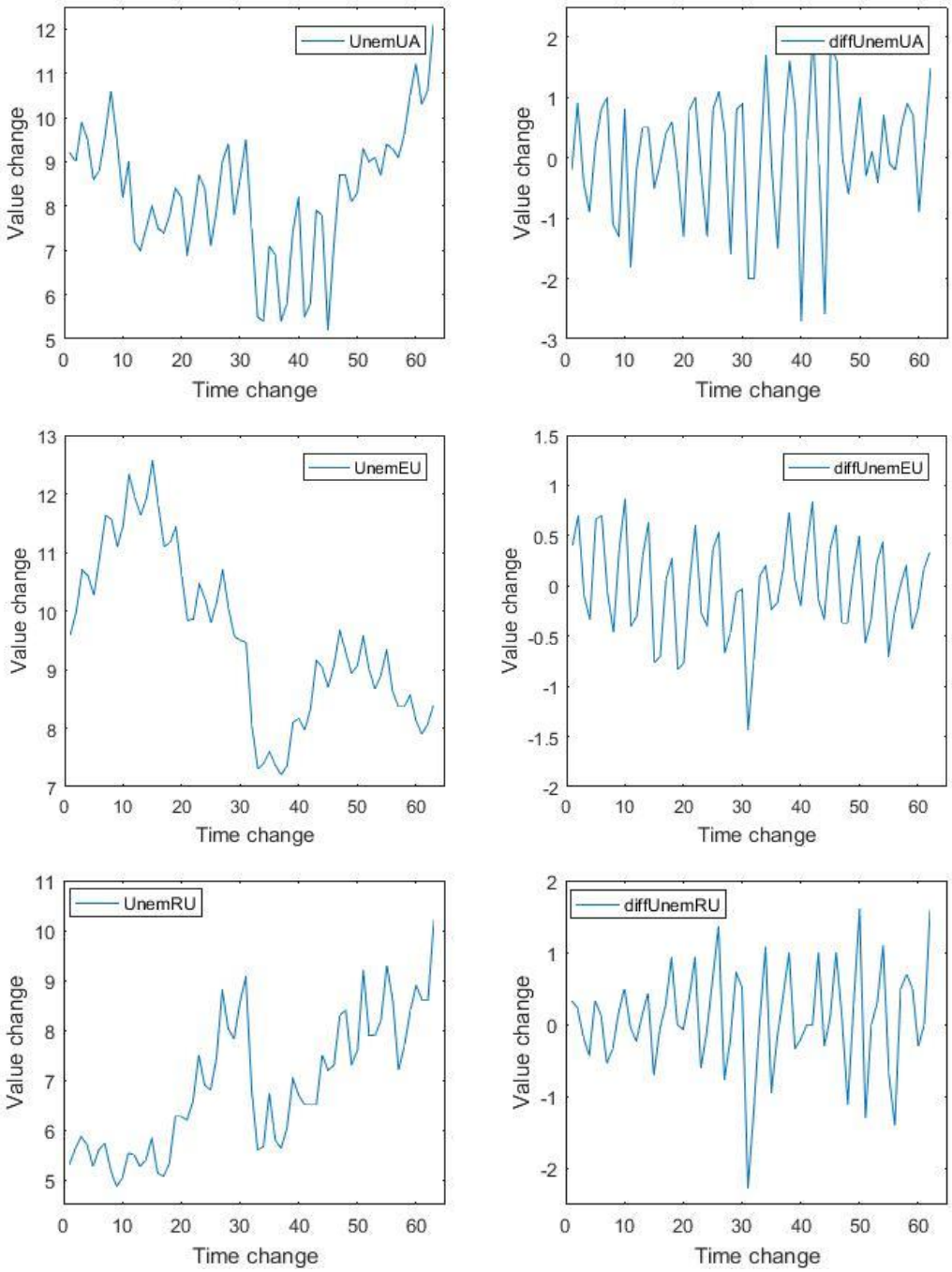


Figure 1. Comparison graphs of original data series and its first differences

Before investigating the interconnections among different macro variables, the Augmented Dickey-Fuller (ADF) test and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test are used to check the stationary properties of the original variables and first differences variables.

ADF tests' null hypothesis is that the unit root is present in the series, and on the other side the null hypothesis is stationary for the KPSS test. Therefore, KPSS test is performed to confirm the results of ADF test. However, if these two tests are contradicted, results of KPSS test are preferred.

Results of the stationarity and unit root tests are presented in the Table 7. Firstly, we analyze the results of ADF and KPSS tests for original time series. In terms of ADF test including constant term, all original series except Ukrainian trade balance, the null hypothesis of a unit root presence cannot be rejected. But for trade balance of Ukraine, the null hypothesis of non-stationarity is rejected at the 1% significance level. In terms of ADF test including constant and trend terms, for Ukrainian GDP and trade balance we can reject null at 1% significance level, also at 5% for Russian trade balance. In terms of KPSS tests including constant and/or trend terms, for all level series except Ukrainian unemployment rate, the null hypothesis of stationary process can be rejected at 1% significance level, and for constant series of Ukraine's unemployment at 5% significance. However, for all first differences series under ADF test including constant term, the null hypothesis of the presence of unit root at the 1% significance level can be rejected. For all return series under KPSS test including constant term, we cannot reject the null hypothesis of data stationarity, except GDP of European Union, where null has been rejected at the 5% significance level.

Table 7. Stationarity tests

Tests for stationarity for original data				
Ukraine				
Indicator	**ADF (constant)**	**KPSS (constant)**	**ADF (constant and trend)**	**KPSS (constant and trend)**
Unemployment	-0.9364	0.8326**	-2.6209	0.8878**
GDP	1.5664	0.3981**	-6.1502**	5.7845**
CPI	4.7556	0.6844**	-2.3684	5.3753**
Interest rate	-1.6840	0.5230**	-0.7315	0.8995**
Trade balance	-3.4709**	0.5542**	-4.3477**	1.0573**
Russia				
Indicator	**ADF (constant)**	**KPSS (constant)**	**ADF (constant and trend)**	**KPSS (constant and trend)**
Unemployment	-1.3587	0.1911*	-3.4101	3.7600**
GDP	0.5264	0.3036**	-3.8498	5.5785**
CPI	11.7088	0.9617**	-2.0604	6.1592**
Interest rate	2.8606	1.1120**	-0.7502	4.3902**
Trade balance	-0.6872	0.6413**	-3.5018*	3.2581**
European Union				
Indicator	**ADF (constant)**	**KPSS (constant)**	**ADF (constant and trend)**	**KPSS (constant and trend)**
Unemployment	0.0930	0.5612**	-2.3795	3.8688**
GDP	2.9676	0.8555**	-1.0134	4.7749**
CPI	4.8724	0.9617**	-3.0874	6.2847**
Interest rate	1.3228	0.4405**	-1.2773	4.1827**
Trade balance	-0.6685	1.3035**	-2.3748	2.8568**
Tests for stationarity on data at first differences				
European Union				
Indicator	**ADF (constant)**	**KPSS (constant)**		
Unemployment	-6.7010**	0.1102		
GDP	-3.2640**	0.1852*		
CPI	-7.6564**	0.0583		
Interest rate	-4.7951**	0.1433		
Trade balance	-12.349**	0.0267		
Ukraine				
Indicator	**ADF (constant)**	**KPSS (constant)**		
Unemployment	-7.9345**	0.0213		
GDP	-8.3765**	0.0279		
CPI	-4.4454**	0.1279		
Interest rate	-5.9000**	0.0874		
Trade balance	-10.1474**	0.0142		
Russia				
Indicator	**ADF (constant)**	**KPSS (constant)**		
Unemployment	-7.6806**	0.0305		
GDP	- 9.3391**	0.0220		
CPI	-2.7524**	0.0864		
Interest rate	-5.3070**	0.0573		
Trade balance	-7.0265**	0.0463		

* (**) denotes rejection of the null hypothesis at the 5% (1%) significance level

Critical values for ADF tests (Constant)
1% level = -3.58
5% level = -2.93

Critical values for ADF tests (Constant+trend)
1% level = -4.14
5% level = -3.49

Critical values for KPSS tests (Constant)
1% level = 0.739000
5% level = 0.463000

Critical values for KPSS tests (Constant+ trend)
1% level = 0.216000
5% level = 0.146000

Conducted tests illustrate that all analyzed level series are non-stationary, and that all first differences series are stationary. In other words, it appears that all level series are integrated to the order of one, I(1).

5.2 Cointegration between Ukraine, EU and Russia: the Johansen Test

5.2.1 Lag length selection in VAR models

Firstly, before conducting the Johansen test, we need to select appropriate lag length for VAR model and identify its deterministic components.

The choice of lag length depends mostly on the information criteria, because Likelihood ratio test have a lot of restrictions. If the results showed by two criteria contradict with each other, SBIC is preferable as more reliable criteria. Maximum suggested lag length for the VAR model is given by Matlab software.

Table 8. VAR lag length suggestion

Lag length	VAR (1)	VAR (2)	VAR (3)
AIC	2.1972	1.9254	**1.3160**
BIC	2.9629	3.1698	3.0390

The results of VAR lag length suggestion are illustrated in Table 8. AIC information criteria suggest VAR models with three lags, but SBIC selects only one lag. Therefore, the optimal lag length for the model is one based on AIC. However, previously it was mentioned that SBIC is preferable, but in this case the values for AIC and SBIC criteria are quite different and AIC suggest the optimal lag length with the lowest criteria value. Therefore, should be analyzed VAR model with a three lag length.

5.2.2 Deterministic components in the Johansen test—Pantula Principle

Table 9 shows the results of estimating Models 2-4 that are given below. Here, the Pantula Principle was applied. Let us consider the first cointegration model between EU and Ukraine. Starting with the most restrictive model, null is rejected for all three models until it comes to

number of cointegration r=5. Here, the trace test statistic in Model 2 is 65.0879 which is below its critical value 76.9721 at 5% significance level. Therefore, the null hypothesis of no cointegration cannot be rejected. Moreover, this is actually the first time when the null is not rejected. Thus, it can be concluded that there is at least 4 cointegration vectors. Also, at least 4 cointegration vectors have been found between EU and Russia, and for the relationship between Ukraine and Russia it is 3 cointegration vectors. For all considered options model 2 is preferable and most suitable for the Johansen cointegration test.

Table 9. Pantula principle

	EU-UA			**RU-UA**			**RU-EU**		
No cointegration	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
0	460.2651	450.9922	542.0748	412.9271	407.9833	500.6394	437.2260	432.5297	539.9722
1	343.3350	334.1023	401.6199	300.3170	295.5723	364.5862	316.8527	312.9151	390.4285
2	234.0557	225.6304	284.8784	215.0734	210.5695	252.3254	231.8828	228.7137	271.0831
3	159.1870	155.1505	191.5854	139.0843	136.7541	176.0266	163.9462	161.0472	195.6401
4	110.0297	106.3105	125.8941	**88.4983**	86.6852	124.0882	108.7772	105.8898	127.9766
5	**65.0879**	61.5075	81.0640	54.2601	52.6229	74.0247	**64.8045**	62.0015	77.9512
6	39.5876	36.1680	51.2706	35.1810	33.6564	41.9265	37.6905	35.4763	48.1077
7	20.8800	18.0910	28.2446	21.9073	20.3877	25.4441	15.9297	14.2722	22.8067
8	9.4700	6.7413	13.5658	9.3466	8.3032	13.3596	8.9337	7.4069	9.7100
9	3.9347	2.1637	3.3865	2.4926	1.4536	6.0112	2.3489	1.2676	2.8571

5.2.3 The Johansen test results

The results of Johansen cointegration test are illustrated in Table 10 and suggesting that cointegration between all the pairs of analyzed countries exists. It is quite reasonable and expected result, because countries are cooperating to a large extent with each other, and as we could observe the linkages between them are quite strong. These results indicate that there is no lack of long-term integration between these economies and all countries cointegrate with each other to some extent.

Table 10. Johansen test for cointegration at 95% confidence level

EU – Ukraine					
N 0f coin	lags	Trace	Critical	Max-eigen	Critical
4	3	65.0879	76.9721	25.5003	34.8057
Russia – Ukraine					
N 0f coin	lags	Trace	Critical	Max-eigen	Critical
3	3	88.4983	103.8476	34.2382	40.9568
EU – Russia					
N 0f coin	lags	Trace	Critical	Max-eigen	Critical
4	3	64.8045	76.9721	27.1140	34.8057

5.3 Checking of the model assumptions: heteroscedasticity, normality

It is also necessary to check where tested model is adequate and reliable. This can be done either with the formal tests or by inspecting plots of the residuals. Formal tests for autocorrelation in residuals, non-normality and conditional heteroscedasticity are briefly discussed below.

Autocorrelation is checked with Ljung-Box Q-test for residual autocorrelation, normality is checked with Jarque-Bera test, and finally, conditional heteroscedasticity, with Engle test for residual heteroscedasticity.

So, according to the results of conducted tests, we can conclude that null for Jarque-Bera, that residuals are normally distributes is rejected for Ukrainian GDP, EU unemployment rate and trade balance, Russian interest rate and Russian unemployment rate. Speaking about the autocorrelation, here the null is that residuals are not autocorrelated. And for all the variables the null cannot be rejected. And for the last one, the Engle heteroscedasticity test the null hypothesis is that there are no conditional heteroscedasticity in residuals. And for all variables, except Russian GDP, the null is not rejected, which means that heteroscedasticity in residuals is absent.

Therefore, it can be concluded, that the analyzed VAR (3) model is good enough and adequate in providing of reliable and valid results for this analysis. The tables for the tests results are presented in Appendix B (Table B1, B2, B3).

5.4 Granger causality test

In the long-run, there is cointegration between Ukraine and EU economies. However, there is possibility that these analyzed two variables are not cointegrated in the long-run, but short-run causal interconnection might exist there. These short-run interconnections can be investigated by the Granger Causality Analysis.

Appendix C (Tables C1, C2 and C3) presents the results of Granger causality tests among all combinations of macro variables of analyzed countries. Here can be observed strong influence of EU macro indicators to Ukrainian macro indicators. All EU macro indicators Granger caused respective macro indicators of Ukraine, except EU trade balance which Granger caused only Ukrainian CPI. However, despite that fact that this causality is unidirectional, the interest rate of Ukraine Granger cause trade balance of EU and Ukrainian unemployment rate also Granger cause EU trade balance.

Quite same direction of Granger causality can be observed between Ukraine and Russia. The Granger causality here as well quite unidirectional, and as in the case with EU, Russian macro variables Granger cause the respective Ukrainian indicators. But here Ukrainian unemployment rate Granger causes Russian trade balance and CPI.

For the last pair of analyzed countries reported Granger causality between European Union and Russia, results of tests can be seen in Table C3 (Appendix C). The same direction of Granger causality can be observed as it was in case with EU – Ukraine test. EU macro indicators Granger caused respective Russian macro indicators. However, trade balance of EU did not Granger cause macro indicators of Russia, but the reverse situation can be seen here. All analyzed Russian macro indicators Granger caused EU trade balance.

5.5 Impulse responses analysis

Although Granger Causality test reports the source of spillovers among different macro indicators of the country, it doesn‘t reveal the actual sign of the relationship or how long these spillover effects would last. So with a goal to obtain more details and understand them impulse responses analysis was conducted.

Figure D1 (Appendix D) illustrates the generalized impulse response functions: impulse response of Ukrainian macro variables to the shock equal of one standard deviation in the variable, where this shock was introduced. Based on the results of previous analysis, the

figures of impulse response for all variables are reported, based on significant results in Granger causality tests.

The shock introduced in the EU interest rate has especially significant negative results for GDP and trade balance of Ukraine. Shock introduced in the interest rate of Russia has lower impact on Ukrainian macro variables; however it has negative effect for Ukrainian trade balance and positive for interest rate. Shocks introduced in CPI of EU and Russia has controversial impact on Ukrainian macro indicators, but again, the shock in the European index has stronger impact then in Russian. The shock in EU CPI has positive impact on Ukrainian GDP and unemployment rate in the beginning. But after the positive change in GDP then it takes downward direction. Moreover, it has negative effect for the trade balance and interest rate of Ukraine. The shock introduced in Russian CPI has negative effect for GDP, trade balance and unemployment rate of Ukraine, whereas positive effect for interest rate. The shock in EU unemployment positively effects Ukrainian CPI and GDP, however, for interest rate it fluctuates between positive and negative, and solely negative effect on trade balance of Ukraine. Shock in Russian unemployment had slightly negative effect on Ukrainian trade balance, but later it changes to positive and dyes away with a time. Positive impact it has on GDP and again, interest rate of Ukraine. Impulse response of the shock in GDP of European Union apparently is the strongest in this group. Positive effect it has only on CPI and unemployment, but then it changes to negative effects in all the variables, especially strong dropdown in Ukrainian GDP rate. Shock introduced in Russian GDP did not have such significant influence as in GDP of EU. It has slightly negative effect for Ukrainian CPI and positive for trade balance and interest rate. Shock in EU trade balance had slightly negative effect on trade balance of Ukraine and positive on its' interest rate. Trade balance of Russia and shock introduced in it did not have such a strong impact, however slightly negative impact on Ukrainian GDP can be mentioned.

Generally, variance decomposition generally offers quite similar information compared to the impulse response, but it is often applied for the forecasting purposes.

6. Conclusions

Over the last decades globalization and internationalization processes are strengthening within world economies, and especially in the Europe. Linkages between developed and emerging economies are more apparent than before.

This paper explores the short-run and long-run dynamic interconnections between Ukraine and European Union on the one side, and Ukraine and Russian Federation on the other side during time period starting from 2001 and to 2016. Furthermore, this study not only observes the causality relationships, but also correlation and cointegration effects. Firstly, long-run relationship between analyzed economies represented with their most significant macro indicators, which have been investigated by utilizing the Johansen cointegration test. Further, Granger causality tests were applied to check the return spillover effects among different macro indicators of analyzed countries. Finally, more insights about the Granger causality was given by generalized impulse response analysis. The above analyses use the quarterly data indices, which were measured in percentage or by billions of the local currency, for instance, Euro, Ukrainian hryvnas, US dollar and Russian rubles.

The results of the Johansen cointegration test show that there are long-run relationships on macro level between Ukraine, EU and Russia. However, the number of cointegration vectors between EU and Ukraine is bigger than between Ukraine and Russia. Therefore, it can be assumed that in the long-run cooperation between EU and Ukraine will be only strengthening. Most likely, cooperation with Russia will become just weaker. This result is confirming the results obtained by Chalyi (2012), where he says that cooperation with EU in long-term is more beneficial for Ukraine.

Granger causality test results were not surprising. Firstly, the reasons that there are Granger causality effects from EU to Ukraine, except trade balance of EU, the maturity, strength and power of EU economy and close relationships between European Union countries and Ukraine. On the one hand, while Ukrainian economy has started its own functioning as an economy of independent country, EU already existed and different kind of agreements already existed between its members, helping them to develop interconnections between each other

and with other countries, and to increase volumes and quality of production. Moreover, the crisis within Ukraine and unstable political and economic situation, tight linkage with CIS countries, especially, with Russia, as the main trading partner for the country for a long period of time, economy mostly based on raw materials exports, and many other factors caused the strength of Granger causality. Also, it is quite surprising that bidirectional causality found between Ukraine and EU and that EU trade balance did not Granger cause any of Ukrainian macro indicators, except CPI index. But it can be explained, that the volume of trade between countries is not that big and, therefore, it does not have much strength.

For the second case of Granger causality, between Russia and Ukraine it could be observed quite similar relationship, where Russian macro variables Granger caused respective macro indicators of Ukraine. It's not surprising that this unidirectional Granger causality can be observed here. Due to the reasons mentioned above in this paper and tight interconnections between countries and their economies. Moreover, the size of the Russian economy is much bigger than size of Ukrainian economy, therefore this way of causality can be observed.

Granger causality tests results between EU and Russia were quite surpising. Several possible reasons could explain the results of the test for EU and Russia. Firstly, Russia and EU are quite big and important trading partners for each other. But the main exports from Russia to EU countries are mostly gas, oil and different raw materials, whereas EU exports to Russia full specter of goods and products. The direction of causality, where EU macro indicators have unidirectional causality to Russian macro indicators can be explained with the mentioned above reasons. Moreover, in the light of recent news this direction of causality can be observed as well. After the beginning of Ukrainian conflict, the sanctions were imposed against Russia and Russian companies from European Union. In response to the sanction from EU, Russia has imposed sanctions against European companies. However, the sanctions against Russia had stronger impact for Russian economy then sanctions from Russia, imposed against EU, which is consistent with the results of Kmin (2015) and Hoffman & Neuenkrich (2015).

Impulse responses analysis confirms the results of Granger causality tests and shows that EU economy and its changes has stronger impact on Ukraine then Russian economy does have. It

contradicts to papers of Radzievska (2014) and Ivanter et al. (2012), which say that influence of Russia to Ukrainian economy is the strongest and that cooperation between countries should only strengthen in the future, as without it, the economy of Ukraine will experience significant dropdown. However, the results of the tests is confirmed by Pinchuk (2015), who said that interconnections between EU and Ukraine have significantly increased over the years since 2009, and showed the effectiveness of the chosen integrational vector chosen by Ukraine.

In summary, the economies of Ukraine, Russia and EU are strongly cooperating with each other and cointegrated with each other in the long-run. The limitations of the research concern mainly the available data. Analysis results might be more precise if monthly data would be used instead of quarterly data. More macro variables included into analysis could give also more accurate results. Also, it might be good to include EU member countries, in order to see the interconnections on the country level. In case of adding more countries into analysis, VAR model can be turned into the Global VAR (GVAR) or other type of VAR model, depending on analyzed variables and the aim of the study.

However, the results of the analyses give an interesting basis for a further study. The causality between EU with Russia and Ukraine is quite interesting. Taking into account the results analysis, it can be suggested that Ukraine needs to enhance the level of cooperation with EU, as it has more significant impact on Ukrainian economy then Russia does. It can be also predicted, that cooperation between Ukraine and EU will only become tighter in the future, and cooperation between Ukraine and Russia will only become weaker. Dragneva & Wolczuk (2016) predict also decrease of Ukrainian economy dependency on Russia and decrease in cooperation level between countries. These trends have as well as economical, as political background. Probably the turning point in the creation and strengthening of these trends has become the Revolution in Ukraine in 2014 (Calamur 2014) and the Crisis which followed after that. Recent few years had determined the choice of European integration, made by people of Ukraine in favor of the return to the new form of Soviet Union.

References

Adler, G. and Sosa, S. 2012. Intra-Regional Spillovers in South America: Is Brazil Systemic after All?. *IMF Working Paper 12/145* (Washington: International Monetary Fund).

Adomeit, H. 2012. Putin's 'Eurasian Union': Russia's integration project and policies on post-Soviet space. *Neighbourhood policy paper. A Project of the German Marshall Fund: Center for International and European Studies*, No.4;

Alesina, A., Barro, R. and Tenreyro, S. 2002. Optimum Currency Areas. *NBER Working Paper*. No 9072.p 49.

Balmforth, R. and Zinets, N. 2014. Ukraine president sets 2020 as EU target date, defends peace plan. [online]. [Accessed 23 February 2017] Available at http://www.reuters.com/article/us-ukraine-crisis-president-idUSKCN0HK0OL20140926

Bayoumi, T. and Eichengreen, B. 1997. Ever Closer to Heaven? An Optimum Currency Area Index for European Countries. *European Economic Review*. Vol. 41, No 3. p.761–770.

BBC.com 2014. EU signs pacts with Ukraine, Georgia and Moldova. [online]. [Accessed 23 February 2017]. Available at http://www.bbc.com/news/world-europe-28052645

Brooks, C. 2002. "Introductory Econometrics for Finance." *United Kingdom: Cambridge University Press*

Calamur, K. 2014. Why Ukraine Is Such A Big Deal For Russia. [online]. [Accessed 23 February 2017]. Available at http://www.npr.org/sections/parallels/2014/02/21/280684831/why-ukraine-is-such-a-big-deal-for-russia

Canova, F. and Ciccarelli, M. 2006. Estimating multi-country VAR models. *IMF working paper series*, No 603

Canova, F. and Ciccarelli, M. 2013. Panel Vector autoregressive models. *IMF working paper series*. No 1507

Ceylan, O. 2006. A Co-integration Analysis Approach to European Union Integration: The Case of Acceding and Candidate Countries. *European Integration online Papers (EIoP)* Vol.10, N°7

Chalyi, V. 2012. Ukraine Between Two Paths of Integration. *Foreign Policy and Civil Society Program*. German Marshal fund of United States

Clarida, R. & Friedman, B. (1984). The Behavior of U.S. Short-term Interest Rates since October 1979. *The Journal of Finance*, 39(3), 671-682.

Cohen, A. 2007. Ukraine's Economic Benefits from Integration into the Euro-Atlantic Community. [online]. [Accessed 23 February 2017] Available at http://www.heritage.org/europe/report/ukraines-economic-benefits-integration-the-euro-atlantic-community

Coman, J. 2014. EU timeline: from destruction to steelmaking … to meltdown. 1945-2014: the evolution of a union that grew from the ashes of the Second World War. [online]. [Accessed 26 March 2017]. Available at: https://www.theguardian.com/world/2014/may/10/timeline-europe-eu-elections

Dragneva, R. & Wolczuk, K. 2016. Between dependence and integration: Ukraine's relations with Russia. *EUROPE-ASIA STUDIES* Vol. 68, No. 4, 678–698

Drobyshevsky, S. & Polevoy, D. 2004. Problems Associated with Creation of a Single Currency Zone in the CIS Countries. *Moscow, Institute of Transition Economies, Scientific works no. 80.*

Eurostat. Statistical data. 2016. [online]. [Accessed 23 February 2017]. Available at https://europa.eu/european-union/about-eu/figures/economy_en

Fuller, W. 1976. Introduction to Statistical Time Series. *New York: John Wiley and Sons*. ISBN 0-471-28715-6.

Gambacorta, L., Hofmann, B. and Peersman, G. 2012. The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis. *BIS Working Papers* 384.

George, D. & Mallery, M. 2010. SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 update (10a ed.) Boston: Pearson

Guisan, C. 2001. Causality and cointegration between consumption and GDP in 25 OECD countries: limitations of the cointegration approach. *Applied Econometrics and International Development. AEEADE.* Vol. 1-1

Henley, J. 2014. A brief primer on Vladimir Putin's Eurasian dream. [online]. [Accessed 23 February 2017]. Available at https://www.theguardian.com/world/shortcuts/2014/feb/18/brief-primer-vladimir-putin-eurasian-union-trade

Herzer, D. 2014. Unions and income inequality: a heterogeneous panel cointegration and causality analysis. *Helmut Schmidt Universität Hamburg, Department of Economics.* Working Paper No. 146

Hoffmann, M., & Neuenkirch, M. 2015. The pro-Russian conflict and its impact on stock returns in Russia and the Ukraine. *International Economics and Economic Policy*, 1-13.

Huhne, C. 2014. Protesters in Ukraine remind us of the priceless benefits of being EU members. [online]. [Accessed 23 February 2017] Available at https://www.theguardian.com/commentisfree/2014/feb/23/protesters-ukraine-priceless-benefits-european-union

Irandoust, M. and Ericsson, J. 2004. Are Imports and Exports Cointegrated? An International Comparison. *Metroeconomica*, *55*(1), pp. 49-64.

Ivanter V. et al. 2012. The Economic Effects of the Creation of the Single Economic Space and Potential Accession of Ukraine. *Eurasian Integration Yearbook 2012*, 19–42.

Johansen, S. and Juselius, K. 1990. Maximum Likelihood Estimation and Inference on Cointegration — with Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics, 52*(2), pp. 169-210.

Klimenko, I., Kharazishvili, Y., Sharov, O., Us, I. 2013. Ukraine in Integrational Processes at Postsoviet area: alternatives modeling, *NISD, analytical review,* 104.

Kmin, P. 2015. The influence of Ukrainian Crisis on selected financial markets. *University of Twente.*

Kwiatkowski, D.; Phillips, P.; Schmidt, P. and Shin, Y. 1992. Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root? *Journal of Econometrics, 54*, pp. 159-178

Lin, Y. 2006. Model selection and estimation in regression with grouped variables. *Journal of the Royal Statistical Society, Series B*, 68(1):49–67.

Litra, L. 2016. Ukraine: Perspectives on Eurasian integration. [online]. [Accessed 1 January 2016] Available at: http://www.ecfr.eu/article/essay_ukraine_perspectives_on_eurasian_integration

Lukianenko, D. 2005. Economic integration and global problems of today. – К.: KNEU, p. 4 [In Ukrainian].

Lutkepohl, H. and Reimers, H.-E. 1992. Impulse Response Analysis of Cointegrated Systems. *Journal of Economic Dynamics and Control*, 16(1): 53-79.

MacKinnon, J., Haug, A. & Michelis, L. 2000. European Monetary Union: A Cointegration Analysis. *Journal of International Money and Finance* 19(3):419-432

Mandybura, V. 2010. Political and economic aspects of modern social-class population structuring of Ukraine. *Ekonomichna Teoriya*. No. 2. p.16–30 [In Ukrainian].

Marson, J. 2015. In Ukraine, Economic Ties to Russia Are Hard to Break. [online]. [Accessed 23 February 2017]. Available at https://www.wsj.com/articles/in-ukraine-economic-ties-to-russia-are-hard-to-break-1431921181

Matkovskyy, R. 2012. Forecasting the Responses of Ukraine to Economic Shocks in the Neighbour-Countries: Global Vector Autoregressive Model \Ukraine-Neighbours. *North-West University, School of Economics, Chair of Economic Cybernetics and Innovation, DSPU*

Mei, Q., Liu, Y. & Jing, X. 2011. Forecast the GDP of Shanghai Based on the Multi-factors VAR Model. *Journal of Hubei University of Technology*, 26(3).

Metwally, M. 2010. Evidence of cointegration between intra-trade of each member with other members of the GCC Customs Union. *Journal of International Marketing and Marketing Research*.

Mlodkowski, P. 2015. Cointegration of Monetary Policy in GCC Countries as Measure of Economic Integration. *European Integration Studies* 2015/9

Pesaran, M. and Shin, Y. 1998. Generalized impulse response analysis in linear multivariate models. *Economics Letters* **58**: 17–29.

Pesaran, M., Schuermann, T. and Weiner, S. 2004. Modelling regional interdependencies using a global error correcting macro econometric model. *Journal of Business and Economic Statistics* **22**: 129–162.

Pinchuk, A. 2015. Modelling estimates of interconnections of the economies of Ukraine and EU. *Ekonomichna dumka*. 20, p. 60-65

Presidency conclusions: Copenhagen European Council. 1993. *(PDF). Europarl.europa.eu.* Retrieved 2017-02-21.

Radzievska, S. 2014. Global economic processes and Ukraine. *IEP*, № 20, (2014) pp.74 —98

Roca, E. 1999. Short-term and long-term price linkages between the equity markets of Australia and its major trading partners. *Applied Financial Economics* **9**(5): 501-511.

Savchenko, T., Rebryk, M. & Kazarinov, D. 2012. Economic Evaluation of Appropriateness of Currency Integration of Ukraine with the Main Post-soviet Countries. *Scientific journal of Ukrainian academy of NBU,* 2, 1–12.

Schenkelberg, H. and Watzka, S. 2011. Real effects of quantitative easing at the zero lower bound: Structural VAR-based evidence from Japan. *Cesifo Working Paper*, 3486.

Shumska, S. 2013. Optimum Currency Area Theory: Criteria and Analysis of Indicators That Characterize Integration Processes in Ukraine and Post-soviet Countries. *Ekonomichna teoriya (Economical theory),* 4, 47-61.

Shnyrkov, O. 2012. Priorities of Ukraine's free trade areas. *Bulletin of Taras Shevchenko Kyiv National University. International Relations*. – Issue 38/39/2012., p. 37–38 [In Ukrainian].

Sims, C. A. 1980. Macroeconomics and Reality. *Econometrica*, 48(1), 1-48.

Stanoeva, G. 2001. Theory of Optimal Currency Areas: an Application to Ten Central and East European Countries. *University Mintesquieu–Bordeaux IV.* p23

Verbeek, M. 2004. A Guide to Modern Econometrics. *Rotterdam: Johan Wiley& Sons*.

Vinokurov et al. 2012. Ukraine and the Customs Union. Comprehensive assessment of the macroeconomic effects of various forms of deep economic integration of Ukraine and the member states of the Customs Union and the Common Economic Space. *Centre for Integration Studies. Eurasian development bank*

Von Hagen, J. and Neuman, M. 1994. Real Exchange Rates between Currency Areas: How Far Away is EMU? *Review of Economics and Statistics.* No 76.p. 236–244.

Wolczuk, K. 2004. Integration Without Europeanisation: Ukraine and its Policy Towards the European Union. *SSRN Electronic Journal*

Xu, Y. & Sun, Y. 2010. Dynamic linkages between China and US equity markets under two recent financial crises. Master thesis. *School of Economics and Management, Lund University*

Appendix

Apendix A:

Table A1. Main integrational events in European Union and Eurasian Union

	1951	Treaty of Paris create European Coal and Steel community
	1957	Treaty of Rome creates Economic Community
	1973	Accession of Denmark, Ireland and UK
	1981	Accession of Greece
	1986	Accession of Portugal and Spain
Belarus, Kazakhstan and Russia create Commonwealth of Independent states	1991	
	1992	Maastricht treaty and official creation of EU
Belarus, Kazakhstan, Russia signed the first agreements on establishment of Customs Union	1995	Accession of Austria, Finland and Sweden
Belarus, Kazakhstan, Russia, Kyrgyzstan and Tajikistan signed the Treaty on the Customs Union and the Single Economic Space	1999	
Belarus, Kazakhstan, Russia, Kyrgyzstan and Tajikistan established the Eurasian Economic Community	2000	
	2002	Euro replaces 12 national currencies
Treaty on a Single Economic Space by Belarus, Kazakhstan, Russia and Ukraine was signed	2003	
	2004	Accession of ten countries; signing of Constitution
Uzbekistan Joined EurAsEC	2006	
Belarus, Kazakhstan and Russia signed an agreement to create a Customs Union between the three countries	2007	Accession of Bulgaria and Romania
	2009	Lisbon Treaty
Customs Union of Belarus, Kazakhstan, and Russia officially started to exist	2010	
Established the Eurasian Economic Space	2012	
	2013	Accession of Croatia
The presidents of Kazakhstan, Belarus and Russia signed the treaty on the Eurasian Economic Union. Later this year Armenia joined Union	2014	
Kyrgyzstan signed a treaty and became a member of the Eurasian Union	2015	
	2016	UK holds referendum to leave EU

Appendix B:

Table B1. Ljung-Box test for autocorrelation in residuals

p-Val IntEU	0.8843
p-Val CPI EU	0.7644
p-Val UnemEU	0.8007
p-ValGDP EU	0.3436
p-Val TradEU	0.3535
p-Val IntUA	0.7060
p-Val CPI UA	0.2004
p-Val UnemUA	0.4228
p-Val GDP UA	0.7786
p-Val TradUA	0.2638
p-Val IntRU	0.2907
p-Val CPI RU	0.8786
p-Val UnemRU	0.2994
p-Val GDP RU	0.7364
p-Val TradRU	0.7333

Table B2. ARCH test for heteroscedasticity in residuals

p-Val IntEU	0.2533
p-Val CPI EU	0.7504
p-Val UnemEU	0.1222
p-ValGDP EU	0.6437
p-Val TradEU	0.4008
p-Val IntUA	0.2546
p-Val CPI UA	0.2784
p-Val UnemUA	0.9008
p-Val GDP UA	0.5889
p-Val TradUA	0.8866
p-Val IntRU	0.5845
p-Val CPI RU	0.6798
p-Val UnemRU	0.8433
p-Val GDP RU	0.0156
p-Val TradRU	0.8323

Table B3. Jarque-Bera test for normality of residuals

Jbstat IntEU	3.5589
Jbstat CPI EU	0.7953
Jbstat UnemEU	1.9286
Jbstat GDP EU	38.2258
Jbstat TradEU	0.8170
Jbstat IntUA	3.3846
Jbstat CPI UA	1.8259
Jbstat UnemUA	8.1953
Jbstat GDP UA	0.3013
Jbstat TradUA	16.4619
Jbstat IntRU	6.6543
Jbstat CPI RU	0.2008
Jbstat UnemRU	10.697
Jbstat GDP RU	1.1125
Jbstat TradRU	2.9758

Critical value for Jbstat = 5.145 at 5% significance level

Appendix C:

Table C1. Granger causality test for Ukraine and EU

European Union - Ukraine				
null hypothesis	**F-statistics**	**pValue**	**cValue**	**Conclusion**
IntUA does not Granger cause IntEU	0,01462	0	0,6541	
IntEU does not Granger cause IntUA	68,39093	5,37E-40	1,5288	IntEU→IntUA
CpiUA does not Granger cause IntEU	0,00351	0	0,6541	
IntEU does not Granger cause CpiUA	284,96610	1,28E-58	1,5288	IntEU→CpiUA
UnemUA does not Granger cause IntEU	0,09403	0	0,6541	
IntEU does not Granger cause UnemUA	10,63504	2,83E-17	1,5288	IntEU→UnemUA
IntEU does not Granger cause GdpUA	188,23671	3,59E-53	1,5288	IntEU→GdpUA
GdpUA does not Granger cause IntEU	0,00531	0	0,6541	
TradUA does not Granger cause IntEU	0,00579	0	0,6541	
IntEU does not Granger cause TradUA	172,79489	4,75E-52	1,5288	IntEU→TradUA
IntUA does not Granger cause CpiEU	0,04586	0	0,6541	
CpiEU does not Granger cause IntUA	21,80676	1,24E-25	1,5288	CpiEU→IntUA
CpiUA does not Granger cause CpiEU	0,01101	0	0,6541	
CpiEU does not Granger cause CpiUA	90,86275	1,14E-43	1,5288	CpiEU→CpiUA
UnemUA does not Granger cause CpiEU	0,29490	1,98E-06	0,6541	
CpiEU does not Granger cause UnemUA	3,39103	1,98E-06	1,5288	CpiEU→UnemUA
GdpUA does not Granger cause CpiEU	0,01666	0	0,6541	
CpiEU does not Granger cause GdpUA	60,02014	2,56E-38	1,5288	CpiEU→GdpUA
TradUA does not Granger cause CpiEU	0,01815	0	0,6541	
CpiEU does not Granger cause TradUA	55,09644	3,19E-37	1,5288	CpiEU→TradUA
IntUA does not Granger cause UnemEU	0,03212	0	0,6541	
UnemEU does not Granger cause IntUA	31,13617	5,18E-30	1,5288	UnemEU→IntUA
CpiUA does not Granger cause UnemEU	0,00771	0	0,6541	
UnemEU does not Granger cause CpiUA	129,73580	2,65E-48	1,5288	UnemEU→CpiUA
UnemUA does not Granger cause UnemEU	0,20654	2,38E-09	0,6541	
UnemEU does not Granger cause UnemUA	4,84179	2,38E-09	1,5288	UnemEU→UnemUA
GdpUA does not Granger cause UnemEU	0,01167	0	0,6541	
UnemEU does not Granger cause GdpUA	85,69805	6,55E-43	1,5288	UnemEU→GdpUA
TradUA does not Granger cause UnemEU	0,01271	0	0,6541	
UnemEU does not Granger cause TradUA	78,66789	8,39E-42	1,5288	UnemEU→TradUA
IntUA does not Granger cause GdpEU	0,00003	0	0,6541	
GdpEU does not Granger cause IntUA	34475,02266	4,7E-122	1,5288	GdpEU→IntUA
CpiUA does not Granger cause GdpEU	0,00001	0	0,6541	
GdpEU does not Granger cause CpiUA	143647,88366	5,9E-141	1,5288	GdpEU→CpiUA
UnemUA does not Granger cause GdpEU	0,00019	0	0,6541	
GdpEU does not Granger cause UnemUA	5360,99179	2,1E-97	1,5288	GdpEU→UnemUA
GdpUA does not Granger cause GdpEU	0,00001	0	0,6541	
GdpEU does not Granger cause GdpUA	94887,79464	1,8E-135	1,5288	GdpEU→GdpUA
TradUA does not Granger cause GdpEU	0,00001	0	0,6541	
GdpEU does not Granger cause TradUA	87103,76346	2,5E-134	1,5288	GdpEU→TradUA
IntUA does not Granger cause TradEU	2,02055	0,003383	1,5288	IntUA→TradEU
TradEU does not Granger cause IntUA	0,49491	0,003383	0,6541	
CpiUA does not Granger cause TradEU	0,48493	0,002676	0,6541	
TradEU does not Granger cause CpiUA	2,06217	0,002676	1,5288	TradEU→CpiUA
UnemUA does not Granger cause TradEU	12,99361	1,59E-19	1,5288	UnemUA→TradEU
TradEU does not Granger cause UnemUA	0,07696	0	0,6541	
GdpUA does not Granger cause TradEU	0,73412	0,115123	0,6541	
TradEU does not Granger cause GdpUA	1,36218	0,115123	1,5288	
TradUA does not Granger cause TradEU	0,79972	0,192614	0,6541	
TradEU does not Granger cause TradUA	1,25044	0,192614	1,5288	

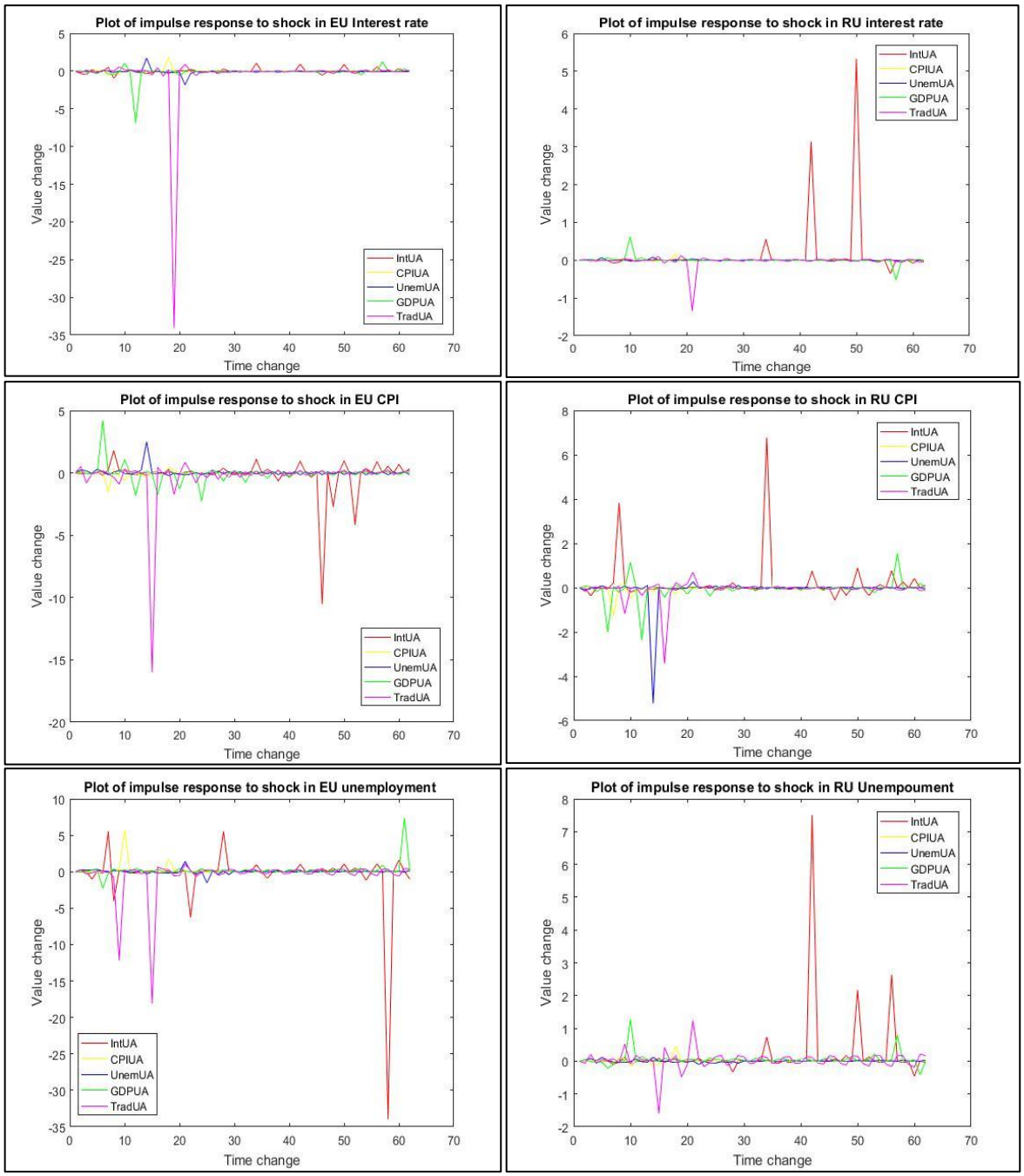
Table C2. Granger causality test for Ukraine and Russia

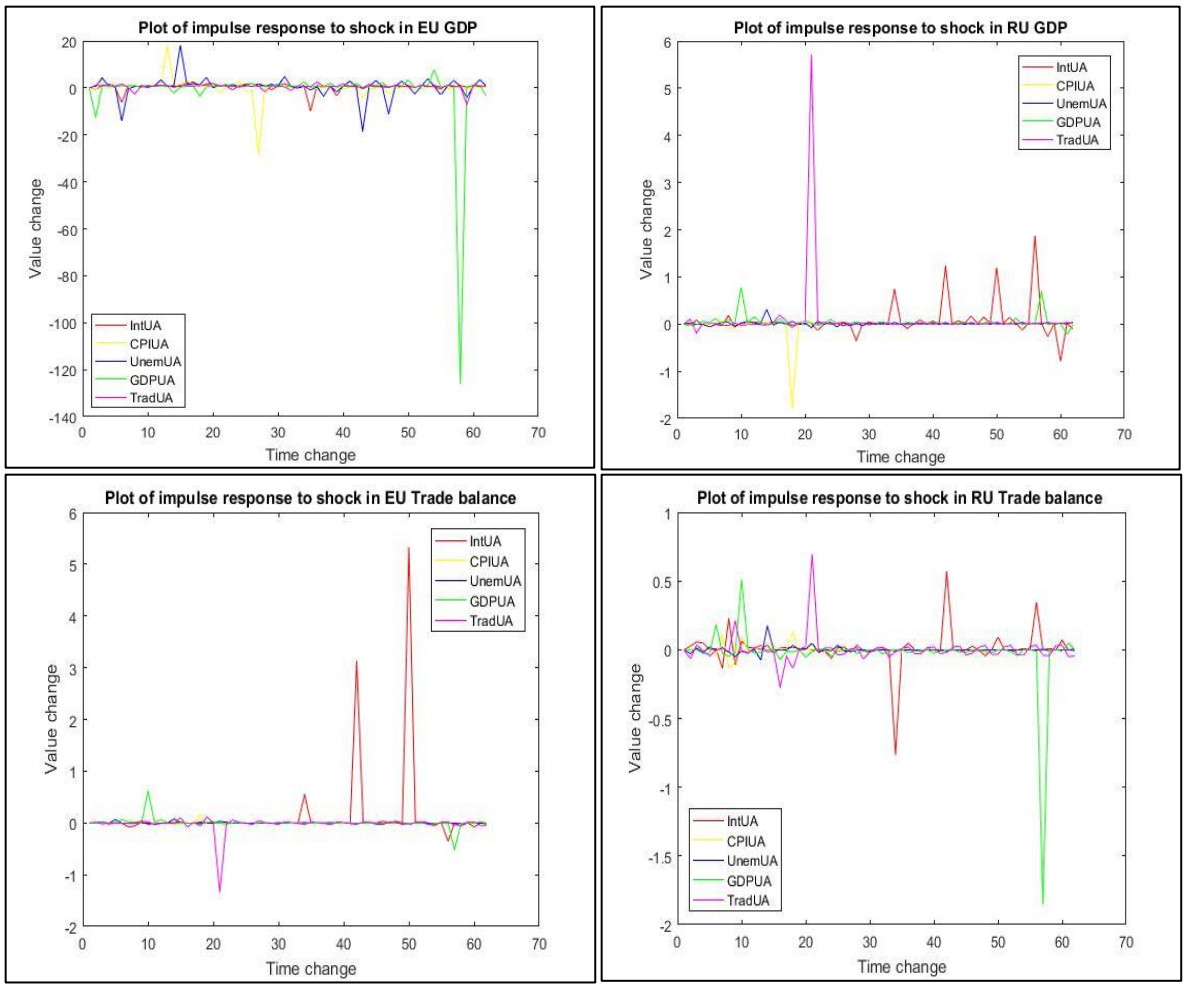
Ukraine - Russia				
null hypothesis	**F-statistics**	**pValue**	**cValue**	**Conclusion**
IntUA does not Granger cause IntRU	0,0958	0	0,6541	
IntRU does not Granger cause IntUA	10,4396	4,53E-17	1,5288	IntRU→IntUa
CpiUA does not Granger cause IntRU	0,0230	0	0,6541	
IntRU does not Granger cause CpiUA	43,4991	3,26E-34	1,5288	IntRU→CpiUA
UnemUA does not Granger cause IntRU	0,6160	0,030374	0,6541	
IntRU does not Granger cause UnemUA	1,6234	0,030374	1,5288	IntRU→UnemUA
GdpUA does not Granger cause IntRU	0,0348	0	0,6541	
IntRU does not Granger cause GdpUA	28,7337	5,14E-29	1,5288	IntRU→GdpUA
TradUA does not Granger cause IntRU	0,0379	0	0,6541	
IntRU does not Granger cause TradUA	26,3765	5,86E-28	1,5288	IntRU→TradUA
IntUA does not Granger cause CpiRU	0,2983	2,41E-06	0,6541	
CpiRU does not Granger cause IntUA	3,3527	2,41E-06	1,5288	CpiRU→IntUA
CpiUA does not Granger cause CpiRU	0,0716	0	0,6541	
CpiRU does not Granger cause CpiUA	13,9699	2,34E-20	1,5288	CpiRU→CpiUA
UnemUA does not Granger cause CpiRU	1,9181	0,006015	1,5288	UnemUA→CpiRU
CpiRU does not Granger cause UnemUA	0,5214	0,006015	0,6541	
GdpUA does not Granger cause CpiRU	0,1084	9,99E-16	0,6541	
CpiRU does not Granger cause GdpUA	9,2279	9,97E-16	1,5288	CpiRU→GdpUA
TradUA does not Granger cause CpiRU	0,1181	8,1E-15	0,6541	
CpiRU does not Granger cause TradUA	8,4709	8,13E-15	1,5288	CpiRU→TradUA
IntUA does not Granger cause UnemRU	0,0715	0	0,6541	
UnemRU does not Granger cause IntUA	13,9791	2,3E-20	1,5288	UnemRU→IntUA
CpiUA does not Granger cause UnemRU	0,0172	0	0,6541	
UnemRU does not Granger cause CpiUA	58,2471	6,19E-38	1,5288	UnemRU→CpiUA
UnemUA does not Granger cause UnemRU	0,4600	0,001426	0,6541	
UnemRU does not Granger cause UnemUA	2,1738	0,001426	1,5288	UnemRU→UnemUA
GdpUA does not Granger cause UnemRU	0,0260	0	0,6541	
UnemRU does not Granger cause GdpUA	38,4756	1,16E-32	1,5288	UnemRU→GdpUA
TradUA does not Granger cause UnemRU	0,0283	0	0,6541	
UnemRU does not Granger cause TradUA	35,3193	1,38E-31	1,5288	UnemRU→TradUA
IntUA does not Granger cause GdpRU	0,2054	2,11E-09	0,6541	
GdpRU does not Granger cause IntUA	4,8697	2,11E-09	1,5288	GdpRU→IntUA
CpiUA does not Granger cause GdpRU	0,0493	0	0,6541	
GdpRU does not Granger cause CpiUA	20,2908	9,2E-25	1,5288	GdpRU→CpiUA
UnemUA does not Granger cause GdpRU	1,3206	0,140149	1,5288	
GdpRU does not Granger cause UnemUA	0,7573	0,140149	0,6541	
GdpUA does not Granger cause GdpRU	0,0746	0	0,6541	
GdpRU does not Granger cause GdpUA	13,4032	7,01E-20	1,5288	GdpRU→GdpUA
TradUA does not Granger cause GdpRU	0,0813	0	0,6541	
GdpRU does not Granger cause TradUA	12,3037	6,62E-19	1,5288	GdpRU→TradUA
IntUA does not Granger cause TradRU	0,6625	0,055249	0,6541	
TradRU does not Granger cause IntUA	1,5095	0,055249	1,5288	
CpiUA does not Granger cause TradRU	0,1590	8,62E-12	0,6541	
TradRU does not Granger cause CpiUA	6,2898	8,62E-12	1,5288	TradRU→CpiUA
UnemUA does not Granger cause TradRU	4,2601	3,04E-08	1,5288	UnemUA→TradRU
TradRU does not Granger cause UnemUA	0,2347	3,04E-08	0,6541	
GdpUA does not Granger cause TradRU	0,2407	4,93E-08	0,6541	
TradRU does not Granger cause GdpUA	4,1548	4,93E-08	1,5288	TradRU→GdpUA
TradUA does not Granger cause TradRU	0,2622	2,45E-07	0,6541	
TradRU does not Granger cause TradUA	3,8139	2,45E-07	1,5288	TradRU→TradUA

Table C3. Granger causality test for EU and Russia

European Union - Russia				
null hypothesis	**F-statistics**	**pValue**	**cValue**	**Conclusion**
IntRU does not Granger cause IntEU	0,1526	3,44E-12	0,6541	
IntEU does not Granger cause IntRU	6,5511	3,44E-12	1,5288	IntEU→IntRU
CpiRU does not Granger cause IntEU	0,0490	0	0,6541	
IntEU does not Granger cause CpiRU	20,3986	7,94E-25	1,5288	IntEU→CpiRU
UnemRU does not Granger cause IntEU	0,2044	1,92E-09	0,6541	
IntEU does not Granger cause UnemRU	4,8924	1,92E-09	1,5288	IntEU→UnemRU
GdpRU does not Granger cause IntEU	0,0712	0	0,6541	
IntEU does not Granger cause GdpRU	14,0441	2,03E-20	1,5288	IntEU→GdpRU
TradRU does not Granger cause IntEU	0,0221	0	0,6541	
IntEU does not Granger cause TradRU	45,3062	9,92E-35	1,5288	IntEU→TradRU
IntRU does not Granger cause CpiEU	0,4787	0,002302	0,6541	
CpiEU does not Granger cause IntRU	2,0888	0,002302	1,5288	CpiEU→IntRU
CpiRU does not Granger cause CpiEU	0,1537	4,05E-12	0,6541	
CpiEU does not Granger cause CpiRU	6,5042	4,05E-12	1,5288	CpiEU→CpiRU
UnemRU does not Granger cause CpiEU	0,6410	0,042506	0,6541	
CpiEU does not Granger cause UnemRU	1,5600	0,042506	1,5288	CpiEU→UnemRU
GdpRU does not Granger cause CpiEU	0,2233	1,15E-08	0,6541	
CpiEU does not Granger cause GdpRU	4,4780	1,15E-08	1,5288	CpiEU→GdpRU
TradRU does not Granger cause CpiEU	0,0692	0	0,6541	
CpiEU does not Granger cause TradRU	14,4461	9,59E-21	1,5288	CpiEU→TradRU
IntRU does not Granger cause UnemEU	0,3353	1,65E-05	0,6541	
UnemEU does not Granger cause IntRU	2,9825	1,65E-05	1,5288	UnemEU→IntRU
CpiRU does not Granger cause UnemEU	0,1077	8,88E-16	0,6541	
UnemEU does not Granger cause CpiRU	9,2868	8,52E-16	1,5288	UnemEU→CpiRU
UnemRU does not Granger cause UnemEU	0,4490	0,001054	0,6541	
UnemEU does not Granger cause UnemRU	2,2273	0,001054	1,5288	UnemEU→UnemRU
GdpRU does not Granger cause UnemEU	0,1564	5,96E-12	0,6541	
UnemEU does not Granger cause GdpRU	6,3938	5,96E-12	1,5288	UnemEU→GdpRU
TradRU does not Granger cause UnemEU	0,0485	0	0,6541	
UnemEU does not Granger cause TradRU	20,6264	5,83E-25	1,5288	UnemEU→TradRU
IntRU does not Granger cause GdpEU	0,0003	0	0,6541	
GdpEU does not Granger cause IntRU	3302,3199	5,46E-91	1,5288	GdpEU→IntRU
CpiRU does not Granger cause GdpEU	0,0001	0	0,6541	
GdpEU does not Granger cause CpiRU	10282,6731	5E-106	1,5288	GdpEU→CpiRU
UnemRU does not Granger cause GdpEU	0,0004	0	0,6541	
GdpEU does not Granger cause UnemRU	2466,1814	4E-87	1,5288	GdpEU→UnemRU
GdpRU does not Granger cause GdpEU	0,0001	0	0,6541	
GdpEU does not Granger cause GdpRU	7079,4674	4,4E-101	1,5288	GdpEU→GdpRU
TradRU does not Granger cause GdpEU	0,0000	0	0,6541	
GdpEU does not Granger cause TradRU	22838,2841	1,3E-116	1,5288	GdpEU→TradRU
IntRU does not Granger cause TradEU	21,0938	3,13E-25	1,5288	IntRU→TradEU
TradEU does not Granger cause IntRU	0,0474	0	0,6541	
CpiRU does not Granger cause TradEU	6,7744	1,6E-12	1,5288	CpiRU→TradEU
TradEU does not Granger cause CpiRU	0,1476	1,6E-12	0,6541	
UnemRU does not Granger cause TradEU	28,2455	8,38E-29	1,5288	UnemRU→TradEU
TradEU does not Granger cause UnemRU	0,0354	0	0,6541	
GdpRU does not Granger cause TradEU	9,8395	2,02E-16	1,5288	GdpRU→TradEU
TradEU does not Granger cause GdpRU	0,1016	2,22E-16	0,6541	
TradRU does not Granger cause TradEU	3,0501	1,16E-05	1,5288	TradRU→TradEU
TradEU does not Granger cause TradRU	0,3279	1,16E-05	0,6541	

Appendix D:


Plot of impulse response to shock in EU Interest rate
Plot of impulse response to shock in RU interest rate
Plot of impulse response to shock in EU CPI
Plot of impulse response to shock in RU CPI
Plot of impulse response to shock in EU unemployment
Plot of impulse response to shock in RU Unempoument
Value change
Time change
IntUA
CPIUA
UnemUA
GDPUA
TradUA



Graph D1. Impulse responses plots