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Resolving International Economic Problems with the Tools of Contemporary Econometrics

Edited by Krzysztof Beck

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Preface

Krzysztof Beck, Lazarski University

The present book shows the results of the work undertaken by the research group made of students of the Lazarski University in collaboration with the students of the Cracow University of Economics. The research group has been working since 2015 till 2018 under the patronage of Applied Economics Institute, and since 2019 under the patronage of the Department of Econometrics both led by doctor Krzysztof Beck. The main aim of the research group revolved around attempts of resolving problems of international economics with the use of the most modern econometrics tolls available.

Nowadays, we live in the world characterized by intensifying path of globalization and close links between social, political, and economic factors. This fact, with no doubts, contributes to the complexity of economic environment, posing new questions to answer and new tasks to resolve. Among others, the policy makers need to address issues such as international trade strategic policy under the condition of military conflicts and political instability, increasing inequality on the global and national scale, the threats of political populism, the consequences of supply-side shocks, and the way migration transforms national labor markets. Form this perspective, the role of the researcher cannot be limited to one discipline or area or interest; instead, one should be able to see the cross-dependencies between political, economic, and social environment in order to derive senseful conclusions and propose proper policy. At the same time, the reader would probably agree that modern economists should recognise their responsibility towards the society, which lies mainly in producing reliable results based on solid analysis. Unfortunately, the majority of contemporary research papers do not show any attempt to combine flexibility in terms of inter-disciplinary approach with uncompromisingly solid-based quantitative analysis.

The problem discussed above is not a new issue. For instance, Leontief (1982) concerns the tendency towards "formalization" of economic science, which implies deriving reasonable, yet inapplicable conclusions from the economic analysis.

> *Page after page of professional economic journals are filled with mathematical formulas leading the reader from sets of more or less plausible but entirely arbitrary assumptions to precisely stated but irrelevant theoretical conclusions...Year after year economic theorists continue to produce scores of mathematical models and to explore in great detail their formal properties; and the econometricians fit algebraic functions of all possible shapes to essentially the same sets of data without being able to advance, in any perceptible way, a systematic understanding of the structure and the operations of a real economic system* [Leontief 1982, p. 104].

Rubinstein [1995] also highlights the inconsistency between economic theories and reality. The very basic definition of economics states that it is the field of science dealing with efficient utilization of resources under the condition of their scarcity. Nevertheless, such an optimization is commonly analyzed from the purely theorical perspective and neglecting real-life aspects of economics. Albeit theoretical analysis is crucial at some stages of policy formulation, the primary aim of economics is still "achieving practical goals".

> *The issue of interpreting economic theory is, in my opinion, the most serious problem now facing economic theorists. The feeling among many of us can be summarized as follows. Economic theory should deal with the real world. It is not a branch of abstract mathematics even though it utilizes abstract tools. Since it is about the real world, people expect the theory to prove useful in achieving practical goals. But economic theory has not delivered the goods. Predictions from economic theory are not nearly as accurate as those by the natural sciences, and the link between economic theory and practical problems, such as how to bargain, is tenuous at best. Although I have never heard an economist seriously claim that the Nash bargaining solution is a good predictor of bargaining in real markets, this solution is a standard tool in modelling interactions among negotiators. Economic theory lacks a consensus as to its purpose and interpretation. Again and again, we find ourselves asking the question "Where does it lead?" [Rubinstein, 1995, p. 12].*

Lawson (2001) suggests that one of the ways to resolve this problem of modern economics is to apply the approach of instrumentationalism described by Karl Popper (1963). The latter author argues that any theory "should be interpreted as an instrument, and nothing but an instrument, for the deduction of predictions of future events (especially measurements) and for other practical applications [Popper 1963, p. 111].

The discussion presented above under no condition attempts to criticize the practice of applying sophisticated statistical/mathematical tools in the field of economic analysis. Nevertheless, it is crucial to account for the complexity of social and economic environment instead of ignoring them for the sake of obtaining more elegant solutions. What is more, although theoretical analysis is crucial for economics, one should not forget this science had been developed for the sake of resolving practical problems.

The papers presented in this issue are related to different topics. Nevertheless, they have something in common: all the authors attempt to resolve the crucial international economics problem from the perspective of inter-disciplinary approach and using sophisticated statistical methods. Although these researchers can be referred as the first serious studies conducted by the university students, all of them maintain high standards of academic honesty and quality of the analysis.

Since the development of New Trade Theory in the 1980's (see Krugman 1985), concept of strategic trade policy has been intensively discussed. The main idea is that by imposing or eliminating barriers to trade, a policy maker can reinforce desirable economic development course. Nevertheless, in order to implement a proper policy, one should be able to define the existence and direction of crucial causal links. The first paper in this issue (authored by I. Okhrimenko) is related to international trade, namely – to the determinants of bilateral trade in Europe with strong emphasis put on institutional factors. The paper was primarily motivated by the ongoing political crisis in Ukraine and decreasing power of Russian Federation as of the regional economic hegemony. Nevertheless, the results are pretty uniform and applicable to the entire European region. The first reason of why the research is worth attention is a complexity of analyzed variables as well as a significant number of observations included. The author attempts to test the validity of various international trade determinants based on the complex and coherent literature review involving the fundamental theories of international trade (such as Neoclassical theories, New Trade Theory, and Gravity Model) as well as more recent applied researchers related to the topic. Such an approach ensures the uniformity of results as well as unbiasedness of the analysis. In addition, the author is interested in the cultural dimensions of international trade, attempting to discover whether "institutional gap" plays the role of comparative advantage, thus facilitating international trade, or the barrier to trade, thus causing negative effect on the volume of bilateral trade between post-communist countries and European Union Member States. Although the former hypothesis had been already discussed in economic literature, there is very limited number of attempts to test it empirically, especially based on such a big number of observations and using the sophisticated method of Bayesian

Model Averaging. Therefore, although accounting for the political, social, and institutional factors, the research demonstrates the outstanding quality of quantitative analysis together with reliable results and their senseful interpretation.

During the recent decades, political liberalization and economic integration both contributed to the increasing volume of migration flows. For European Union Member States, which are characterized by the high level of development, thus being quite attractive destination for the migrants, this issue is of the great importance. Although the question of registered and unregistered migration is quite ethically sensitive (or, maybe, because of this fact), it requires consistent and unbiased analysis in order to reveal the benefits and costs of the intensifying migration inflows to the European Union. Y. Areshka tries to transfer the issue of immigration from the dimension of political debates to the space of economic analysis. The author presents a solid theoretical and empirical background, describing the most important demographical trends in the European Union. The research questions of the paper concentrate on the effects of immigration on volume of social benefits spending (as populist discourse often claims immigrants create a sort of "fiscal burden" for the hots countries) as well as on whether employing foreign labor force diminishes employment opportunities for the native population. The author applies Bayesian Model Averaging, incorporating the significant number of observations as well as the wide range of variables. The results of the analysis show that al least one argument of the advocates of national labor market protectionism is completely invalid and cannot be justified empirically.

With no doubts, the attitudes towards inequality would heavily depend on one's political beliefs, cultural and institutional background, as well as perception of justice. While the advocates of income redistributive policies argue that higher degree of income equality ensures more inclusive process of economic production together with faster economic growth, those, who maintain the opposite point of view, state that reinforcing income equality negatively affects incentives to undertake risky activities and accumulate human capital. The majority of papers concentrate on the chosen aspects of income inequality implications, such as gender inequality, access to higher education, willingness to participate in the labor market, etc. The studies related to the fundamental question of how income inequality affect economic growth usually present the controversial results, depending on the geographical region and chosen proxy for inequality. The paper authored by T. Martynenko proposes more sophisticated approach. The author initiates the research with comprehensive literature review, presenting the most important ideas in the field, together with the most recent and influential ones (for instance, famous Piketty's *Capital in the XXI century*). Therefore,

the article is worth attention even for the reader, who is rather not familiar with this hot topic. A wide range of inequality measures is incorporated, including GINI coefficient as a measure of aggregate inequality, measures for inequality in terms of health services provision, access to education, and in terms of human capital as well as concentration of wealth indicators (83 regressors in total). Using the method of Bayesian Models Averaging and analyzing representative sample of national economies for the period of 30 years, the author managed to derive the uniformly applicable results shedding some new light on the causal relationship between income inequality and economic growth.

GDP growth is the basic parameter to analyze when one tries to assess whether the economy is "doing well", and the scope of determinants of economic growth is one of the fundamental problems of economic science. Why are some countries rich, while the other countries are poor? What policy can public authorities implement in order to facilitate economic growth? Unfortunately, nowadays, is quite common to design economic policy in accordance with the prevailing political believes or economic paradigm. And, as the reader would probably guess, such polies are hardly successful.

Although it is extremely difficult to define the answers to fundamental questions mentioned above, the paper authored by A. Semak definitely contributes the field of development economics. The author concentrates on the complex range of economic growth determinants, including factors arising from economic, financial, and cultural environment. The author presents the results of empirical study accompanied by policy advices, including international trade and foreign direct investment regulations as well as most prioritized areas for government investment. The paper can be referred as a good example of how reasonable policy advices should be formulated.

The effect of the natural resources endowment on economic development is the additional area of interest of modern economics. From this perspective, one can come up with countries suffering from the "natural resources curse" and heavily dependent on the oils exports. Nevertheless, the price of oil, which is a primary input in numerous industries, affects all the economies on the global scale. The research presented by Y. Skakun concentrates in the structural analysis of the effect of oil prices volatility on the fundamental macroeconomic variables. The author applies a relatively new method of Structural Autoregressive analysis, which is extremely suitable for determining the effects of any type of economic shocks. Besides the commonly tested hypotheses about positive effect of oil price shock on GDP growth through direct output and fiscal policy transmission mechanisms channels and negative effect of oil shocks on GDP growth through inflationary transmission mechanism channel, the author poses the question about

how the quality of institutional environment affects the resistance of the economies to the exogenous supply-side shocks.

The final paper (authored by L. T. de Oliveira Doboszewski) presented in this issue is dedicated to the relationship between political business cycle and presidential popularity in the United States. Although traditional economic theory mostly neglects political factors when discussing the patterns of business cycle fluctuations, the theory of political business cycles elaborated by the author allows analyzing this issue from the new perspective. The reader would probably agree that socially optimal outcome may be quite different from the outcome maximizing utility of the governing party. The latter goal can be achieved through increasing the probability of re-election, which, in turn, depends on economic environment signals for the electorate. The majority of dynamic macroeconomic models dealing with defining the general equilibrium assume that economic agents are perfectly rational and tend to maximize their lifetime utility. Nevertheless, this assumption can hardly be justified by empirical evidence: in reality, people think rather in the short-run perspective, and their predictive abilities are not perfect as well. Therefore, in order to increase the probability of re-election, the incumbent government would attempt to ensure short-run economic growth, which often contradicts long-run economic growth objectives. The author manages to prove the strong effect of political objectives on economic environment, thus shedding some new light on determinants of business cycle fluctuations. Although the topic is relatively rare in economic literature, the methodology applied by de Oliveira Doboszewski can be successfully used by analysts and policymakers in order to predict the dynamics of fundamental macroeconomic variables; therefore, it is definitely worth your attention.

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Defining the Determinants of International Bilateral Trade in Europe Using the Method of Bayesian Model Averaging

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Abstract

The purpose of the research is to define the main factors affecting the patterns of the international bilateral trade in Europe. The particular emphasis is put on the institutional gap between the states and its role in shaping the trade patterns in the region. Recent political crisis in Ukraine, current military conflict with Russia, and the subsequent aggravation of political and economic relations between the EU and Russia highlighted the necessity of rethinking the strategic course Ukraine, and, optionally, the range of post-communist non-EU-integrated states, faced. The paper concentrates mainly on the analysis of possibility of post-communist states to choose the path of closer trade cooperation with Western Europe in general and with the EU in particular.

In order to find out if such a possibility is realistic, the author constructs a set of variables, based on the commonly recognized theories explaining the phenomenon of international trade (Ricardian Model, Neoclassical Model, New Trade Theory, and Gravity Model); also, the variables, denoting the existence or absence of possible barriers to trade (global and regional trade organizations with different extent of trade liberalization, common currency union), are inserted. The additional range of factors describes the depth of the institutional gap between the trade partners, denoting all possible combinations of counties according to their institutional set (post-communist EU-integrated with post-communist non-EU-integrated, two originally European states, originally European and post-communist non-EU-integrated state etc.) The results of the estimation give evidence that the opportunity cost of the closer trade cooperation with Europe (for instance, arising of the barriers to trade with CISFTA) is quite low, while the gains are significant. It is important to mention, however, that the low level of per capita income in Ukraine is a serious concern requiring attention from the side of authorities, as "GDP per capita distance" variable was proved to have a negative effect on the volume of bilateral trade.

As some positive spillovers of the research, the author managed to prove that the intensity of the international trade depends on the level of liberalization and that institutional gap between trade partners can be treated as a source of comparative advantage, thus encouraging closer cooperation between them. In addition, the most appropriate formulations of the relative endowment variables, which possess the higher level of explanatory power and are therefore the most suitable for the relative studies, were defined.

Introduction

The recent political crisis in Ukraine and the current war conflict with Russia taking place in the Eastern regions of the former country served as the catalyzer for exacerbating political divisions and the deterioration of economic relations between Ukraine and Russian Federation, as well as between Russia and EU. "The Russian Federation's role in the Ukraine conflict has seriously affected EU-Russia relations. Consequently, some of the activities [economic, political, cultural, and common defense cooperation] are at a halt and sanctions have been adopted" (http://europa.eu, 12.15.2015).

The expected result of such a tendency is the necessity of reconsidering the current path of development and political integration Ukrainian policy makers face or should face in the near future. Leaving aside the political, legal, and cultural aspects of the problem, the author is going to concentrate mainly on the question whether Ukraine as well as other post-communist non-EU-integrated countries can switch successfully to more intensive trade cooperation with Western Europe.

Kim and Sokhey [2013], based on the case study on the trade between Russian Federation and a range of CEE former centrally planned economies, state that trade liberalization can be motivated by the desire to decrease the dependence on the regional power. The ultimate aim of the research is to find out if such a change in the trade policy, undertaken by Ukraine, will contribute to the intensity of bilateral trade the country is engaged in. For this purpose, it is crucial to define the main factors influencing the volume of the international trade in the European region and to compare the potential costs and benefits Ukrainian economy may face as a result of changing the course.

The first chapter of the paper ("Literature Review and Theoretical Background") is devoted to the discussion of the fundamental theories explaining the patterns of international trade; namely, the concepts observed are Ricardian Model, Neoclassical Model, New Trade Theory, and Gravity model. Apart from

the pioneering studies, the author looks through the further elaborations of different authors in order to analyze the validity of the theories presented as well as to define the proper formulation of models/variables. The role the institutions play in determining the patterns of international trade is also highlighted.

"Methodology" section provides the reader with an in-depth description of the data and variables chosen, as well as with the discussing the general features and the validity of the processing data method elaborated. The choice of the variables emerges from the preceding chapter, and the way they are formulated is explained in details. The unquestionable advantages of the method applied (Bayesian Model Averaging) are its superior robustness in comparison with other methods and the fact it allows testing several forms of the variables at the same time, thus enabling us to find out the most suitable one.

In the final chapter, "Conclusions and Suggested Implications of the Research", main findings are incorporated. General conclusions concerning the robustness of the variables tested as well as concerning the direction in which they affect trade, are derived. And, what is more important, the potential costs and benefits Ukrainian economy will face on the road of closer trade cooperation with the counties from the Western part of the region are analyzed; additionally, some suggestions concerning the increasing the efficiency of such a policy are mentioned.

1. Literature Review and Theoretical Background of the Research

1.1. Theories of International Trade

1.1.1. The Theory of Comparative Advantage

The Theory of Comparative Advantage is one of the basic concepts attempting to explain the reasons behind the international trade as well as its mechanism. The theory was first pioneered by David Ricardo, British political economist, and presented in his book *On the Principles of Political Economy and Taxation* (1817).

Chapter *On Foreign Trade* is devoted to justifying the idea of the usefulness of international trade; according to the author, "No extension of foreign trade will immediately increase the amount of value in a country, although it will very powerfully contribute to increase the mass of commodities, and therefore the sum of enjoyments" (1817). David Ricardo defends his point of view, providing the reader with the numerical example of beneficial trade of two commodities between two countries: England and Portugal, assuming that the former is more

efficient in producing cloth, while the latter is more efficient in producing wine. It is important to mention that the author introduces neither the term "efficiency" nor the term "comparative advantage"; state is considered to be more efficient and to have a comparative advantage in producing certain commodity if producing one unit of this commodity requires smaller number workers engaged than producing other commodity. The author believes that the state should export the good it produces more efficiently: "England may be so circumstanced, that to produce the cloth may require the labour of 100 men for one year; and if she attempted to make the wine, it might require the labour of 120 men for the same time. England would therefore find it her interest to import wine, and to purchase it by the exportation of cloth" (1817). Analogously, if Portugal needs 80 labourers to produce wine, and 90 to produce cloth, this country should export wine for exchange of cloth. Ricardo also underlines the fact that Portugal produces both the commodities at smaller cost that England does; he argues that in these circumstances, it would be more beneficial for both the producers and consumers from both countries to move all the capital and labour from England to Portugal. However, he highlights the barriers for free capital movement as well as limited mobility of labour, which makes the idea mentioned above a devitalized one and proves the usefulness of trade. The author clearly shows that the exchange of goods is beneficial for both the countries, as it enables them to consume more cloth and wine than they would consume in case of the absence of exchange (1817). It is important to mention that Ricardo puts a great emphasis on the importance of the difference in technologies for the international trade; according to him, in case both the states start to produce all types of goods equally efficiently, "the trade must immediately cease" (Ricardo, 1817).

To make an intermediary conclusion, the pioneering work on the Theory of Comparative Advantage highlights the difference in the technologies as the crucial factor of international trade. This implies that the country can export goods to another one even if the former produces both the commodities at the higher cost than the latter, provided that the opportunity cost of the good exported, expressed in the amount of the second commodity, is smaller than the opportunity cost of this good the second country faces. Additionally, the author imposes the restrictions of the absence of capital and labour mobility.

Since 1817, the concept has been significantly reorganized and sophisticated, which contributed to its explanatory power; in particular, Dornbush *et al*. [1977] introduce the model with continuum of goods (1977). They state that under the assumptions of many-commodity Ricardian model, the constant labour unit requirements of the home and foreign country, that can produce n commodities, are $(a_1,...,a_n)$ and $\left(a_1^*,\ldots,a_n^*\right)$, respectively. Commodities are indexed

in such a way that relative unit requirements are ranked in the order of diminishing comparative advantage of the home country: $\frac{a_1^*}{a_1} > \ldots > \frac{a_j^*}{a_j} > \ldots > \frac{a_n^*}{a_n}$. When introducing a continuum of goods, the authors similarly index commodities on an interval [0; 1] in accordance with the diminishing comparative advantage of the home country. Variable z denotes each of the commodities on the interval, for which the labour unit requirements denote $a(z)$ and $a^*(z)$ in home and foreign country, respectively. The authors, therefore, introduce the function A, which describes the relationship between the labour unit requirements and the index of the good, and which value, according to the assumptions described above, is decreasing in z: $A(z) = \frac{a^*(z)}{a(z)}, A'(z) < 0$.

Dornbush *et al*. (1977) highlight the fact that the quantity of the goods produced at home and in foreign country depends on wages; and, as it was originally proved by Ricardo (1817), the country will efficiently produce a certain commodity if its unit labour cost of producing this commodity is less than the labour unit costs of the foreign country or equal to it. The authors conclude that the range of product home country produces ($\dot{z}$) can be defined as $A^{-1}\omega$, where ω is the ratio of foreign and home wage level or $\frac{\omega^*}{\omega}$. The relative price of the commodity produced in terms of any other commodity is equal to the ratio of home unit labour costs to the foreign unit labour cost. Demand function is assumed to be homothetic, with the constant shares of expenditure on each of the goods produced. Function of the demand side, defined as B, depends on the range of goods produced homely, and on the relative income. The intersection of the A and B function determines the equilibrium relative wage and the number of goods produced home and abroad. The authors prove the positive impact of the increase of relative size of the trade partner on home economy, which is to increase both the quantity of goods imported and the relative wages of home labour force theoretically. Additionally, they highlight the negative impact of taxes on the volume of international trade, as they are likely to transform the previously traded goods to non-traded.

Balassa (1963) examines the patterns of the export between USA and UK and third markets in 28 production sectors through constructing the regression model and concludes that there is a high correlation between the productivity

in a particular sector and a share of this product in a country's export, which supports the previously discussed models. However, the author states that the relationship between inter-industry wages and the export shares is weak and inconclusive, thus refusing the statement that cheap wages can contribute to the international competitiveness of the country.

Golub and Hsieh (2000) apply similar method of testing validity of the Ricardian model, taking the bilateral trade balances and export ratios between USA and Japan, Germany, UK, France, Italy, Canada, Australia, Korea, and Mexico as a dependent variables, and unit labor cost and productivity as explanatory ones. The results suggest that unit labour cost and relative productivity explain the USA bilateral trade patterns quite successfully.

1.1.2. Neoclassical Theory of Trade

The foundation of the Neoclassical Theory was developed by Eli Heckscher (1919), who highlighted the issue of the unequal distribution of the benefits of trade among different social groups. His elaboration was later applied and interpreted by Bertil Ohlin (1967), who formulated explicitly the concept, which is known as the Hechscher-Ohlin Theorem. The presuppositions posed by the authors differ from the framework of the Theory of Comparative advantage in two key respects. First, in contrast to the Ricardian Model, which considers labour to be the only factor of production, Hechscher and Ohlin hypothesize the existence of at least two of them (labour and capital), which allows for discussing the effects of trade on income distribution among different social groups. In addition, the authors assume the state of technologies to be the same across the world.

Hechscher and Ohlin prove theoretically that the country will export the commodity, production of which uses intensively the factor the state is relatively abundant with. The commodity is, for example, capital-intensive if the ratio of capital to labour engaged in the production of this commodity is higher than analogous ratio associated with the other commodity. The country is capital-abundant if the ratio of capital to labour in the country is higher than the ratio the other country is characterized by (note, please, that the model is $2\times2\times2$, which means two countries, two commodities, and two goods).

Stolper and Samuelson (1941) contributed to the analysis, developing the following proposition: if a price of a commodity rises, the reward to the factor used intensively in the production of this commodity rises as well. Based on that, Samuelson (1948) highlights the possibility of the factor prices equalization between two countries as a result of trade, attributing the crucial role to the

extent to which commodity mobility can substitute for the factor mobility. The author, however, provides a detailed explanation why such an effect of the international trade can be hardly observed in the reality:

> *First, there is the important fact that commodities are never perfectly mobile. Transportation costs always exist and serve as obstacles to profitable trade. The whole theory of location of industry is based upon this basic fact. The second reason for persisting factor-price differences in the face of commodity mobility is more difficult to describe, being rather complex and technical. If, (a) different regions of the world are extremely different in factor endowments, or (b) the different commodities use factors of production in almost the same proportions, complete (rather than only partial) geographical specialisation of production may result. In this case, factor prices need not be equalized.* (Samuelson, 1948)

The empirical tests of the validity of the Neoclassical Model of Trade (particularly, of the Heckscher-Ohlin Theory, which is directly related to the international trade patterns of the states) gives contradictory results. Leontief (1954) observed export composition of USA in period from 1947 and obtained a surprising finding: being one of the most capital-abundant countries in the world after WWII, USA exported mainly labour-intensive goods, which does not match the patterns assumed by H-O model. This inconsistency, which is commonly referred as Leontief paradox, initiated a discussion concerning the extent to which HO Theory is able to explain the patterns of international trade.

Bowen *et al*. (1987) state that the way original model is formulated is not appropriate for empirical tests: "The Heckscher-Ohlin (H-0) hypothesis is most widely understood in its two-good, two-factor form: a country exports the commodity which uses intensively its relatively abundant resource. Tests of this hypothesis have been inconclusive for two reasons. First, the three pairwise comparisons required by this two x two model cannot be made unambiguously in a multifactor, multicommodity world" (p. 805).The authors also mention that the approach Leontief (1954) undertakes is not appropriate for testing the theory: "The classic test of H-O hypothesis…compares the capital per man embodied in a million dollars' worth of exports with the capital per man embodied a million dollars' worth of imports…Moreover, Leontief's study uses data on trade and factor input requirements but not factor endowments and, in addition, his data are only for the single country"(Bowen *et al*., 1987, p. 792).However, having tested several alternative models (H-O-V model with N variables, for instance) and ways of measurement, they did not come up with satisfactory results: "The

Heckscher-Ohlin model does poorly, but we do not have anything that does better. It is easy to find hypotheses that do as well or better in a statistical sense, but these alternatives yield economically unsatisfying parameter estimates" (Bowen *et al*., 1987, p. 805).

1.1.3. New Trade Theory

New Trade Theory suggests the crucial role of the increasing returns to scale for explaining the specialization patterns of countries, and, subsequently, the volume of trade between them; name of the concept suggests that it is to replace "old" theories, which emphasize the difference in factor endowment or technologies and assume the perfectly competitive markets and constant returns to scale. In fact, the concept has been acquiring more and more importance over the last decades. According to Pautola,"…international trade has been slowly moving toward trade among similar countries and toward trade in similar goods rather than trade between very different industrial sectors" (1995, p. 7).

The theory has developed thanks to the elaboration of different authors: for example, Balassa explained the post-war intensification of trade between industrial nations by scale economies (1967). The formal model was formulated by Krugman (1979), who applied and modified the model of monopolistic competition developed by Dixit and Stiglitz (1977). The author clearly demonstrates that under the assumptions of monopolistic competition, increasing returns to scale, and the labour as the only factor of production, the labour force growth would lead to the decrease of the average cost producers face and, subsequently, to the decrease of the market price of the commodity produced. He argues that even in case there are two countries identical in tastes and technologies, the trade between them would exist and be beneficial, as it would enable them to extend their markets, thus allowing for the economies of scale exploitation. Additionally, the author highlights so-called "home market effect": given the high level of labour mobility, bigger regions (or countries) tend to be more efficient in production due to the effect of labour force size discussed above. Perdikilis and Kerr (2000) emphasize the importance of the institutional and country-specific variables, such as quotas, tariffs etc. for determining the volume of intra-industry trade.

Fidrmuc (1999) attempts to verify the theory, observing the patters of trade between EU and Central Eastern European states in the period 1995–1997. The author finds out that the CEE countries, which are the most actively engaged in the intra-industry trade with EU (such as Slovenia and the Czech Republic), are

characterized by the highest level of economic advance and the industrial similarity with EU states. This evidence can be treated as a proof of the validity of the New Trade theory.

1.1.4. Gravity Model

The theory was originally developed by Dutch economist Jan Tinbergen; in 1962, he published a work devoted to the discussion the main tendencies in international trade as well as to the designing the optimal trade policy. The author highlighted the fact that the exchange of goods is more intensive between the neighboring countries than between the countries from different regions; additionally, he emphasized the role of the former colonial relationships and cultural tights. The original model was based on purely empirical observations; however, Anderson (1979) proves that the model can be based on the properties of expenditure system.

According to the Gravity Model, the volume of bilateral trade is proportional to the product of the GDP of two trade partners, and inversely proportional to the distance between them. Silva and Tenreyro (2006) mention the traditional, which takes the following form: $T_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}$, where T_{ij} denotes the volume of trade, Y_i and Y_j stand for GDP of country i and country j, respectively, D_{ij} stands for the distance between partners (or, more broadly speaking, for all the factors that may possibly disrupt the trade), and α_0, α_1, α_0 are unknown parameters (p. 642). Additionally, the authors present the logarithmic form of the equation commonly used for empirical estimations:

$$\ln(T_{ij}) = \ln(\alpha_0) + \alpha_1 \ln(Y_i) + \alpha_2 \ln(Y_j) + \alpha_3 \ln(D_{ij}) + \ln(n_{ij}),$$

where n_{ij} is an error term (p. 642).

Kimura and Lee (2006) test empirically the significance of chosen variables for predicting the volume of exchange both of services and of commodities. According to their findings, the explanatory power of the Gravity Model, being sufficient in both cases, is higher for services than for goods. The geographical proximity is significant, but plays a more important role in determining the services trade, while the fact of existence of the common border affects mostly exchange of goods. Common membership in the regional trade arrangements and the level of economic freedom both affect trade positively.

1.2. Character and Quality of Institutions and the Patterns of International Trade

According to North, "Institutions are the humanly devised constraints that structure political, economic, and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct) and formal rules (constitutions, laws, property rights" (1991, p. 97). One of the aims of the research is to find out if in the context of the specific features of the past and contemporary political system in European region and the institutional mindset of the nations tend to influence the direction and volume of international trade.

This relationship between the character of political regime and the level of trade liberalization was discussed, for instance, by Frye and Mansfield (2003), who observed this effect on the post-communist economies, which experienced the process of market transformation. The authors provide the reader with different points of view concerning the relationship between the type of the political regime and the extent of trade liberalization. Specifically, they bring the arguments in favour of the idea that autocratic governments are more likely to conduct the reforms: they are not bound by the time horizons, imposed by free and fair elections, and can therefore pursue long-term strategy and neglect the opinion of the electorate. Nevertheless, the authors prove empirically that the extent to which the regime is democratic (they use the fragmentation of power as the proxy of this variable) affects positively the volume of international trade. Therefore, the volume of bilateral trade should be expected to be dependent on the level of political freedom within the economy.

Belloc and Bowles (2009) treat the difference in the institutional patterns of the countries as the source of comparative advantage. Under such assumptions, institutional divergence between the trade partners encourages the bilateral trade. Levchenko (2009) proves the fact institutions affect trade and poses the question about how exploitation of comparative advantage, which emerges out of the institutional gap, affects both of the sides. According to his conclusions, North (this term denotes countries with more advanced institutions) enjoys the benefits of cooperation, while the effects of the trade on South (countries characterized by the inferior quality of institutional constraints) are contradictory.

2. Methodology

2.1. Variables and Statistical Data

In order to address the research question, it is necessary to determine the main factors that affect the volume of bilateral trade across the European continent. The total number of state formations in Europe is 51, which implies the existence of 1275 unique pairs of countries. However, due to the constraint of the data availability, the final number of observations was narrowed to 752. The period of observation is seven years and covers 2005-2011 years inclusively (although the trade statistics is available for the period of nine years, for some of the crucial for the analysis variables, the data for years 2012 and 2013 are omitted); all the data are of annual frequency.

The dependent variable is the total volume of the bilateral trade between the particular pair of the countries, or the sum of export and import of one of the countries in the pair with respect to the other one ($TRADE = E_{i,j} + I_{i,j}$). The trade statistics was accessed from the official IMF web site; unfortunately, there are serious discrepancies in the data: for the same pair, there are two different values, depending on the country reporting. In order to eliminate these discrepancies, only one reported value was taken; the choice depended mainly on the data availability through the period of observation, as well as on the reliability and quality of the source (for example, in a pair Germany-Belarus, the former is prejudiced to be characterized by more unbiased statistical office).

The choice of the explanatory variables to be tested emerges out of the discussion of the most commonly referred international trade theories, which were presented in the previous chapter. Following the same logical order, the first variable is productivity gap, which was recognized as the crucial factor for international trade by David Ricardo (1817). According to OECD manual (2001), one of the ways to assess the productivity is dividing quantity index of gross output by the quantity index of labour index. The unquestionable advantage of this method is the easiness of accessing data and calculations; the possible drawback is possibility of misinterpreting the factors influencing the variable, as productivity calculated in this way reflects both the quality of human capital and the level of technological advance (p. 14).

For the purpose of the research, the GDP at constant prices and PPP, divided by the total number of people employed is used (already calculated values were taken from the World Bank web site). Although the choice of the productivity variables well as the output and input indices used may not be the most suitable in the context of research, it is the only type of data, available for all the countries observed.

Under the framework of the Ricardian model, the greater the difference in technologies of two states, the greater the total value of the bilateral trade. In order to measure the productivity gap between states, the following variables were inserted: absolute value of the difference between productivity indicators of two countries in a pair, ratio of the indicators, and the log of the ratio; the last variable is constructed by analogy with endowment variables of Baxter and Kouparitsas (2011) (authors, in turn, refer to Easterly and Levine (2001).

Variables are denoted as PRODUCTIVITY_DIFFERENCE $\left(\text{calculated as} \left|P_i - P_j\right|\right)$, PRODUCTIVITY_RATIO $\left(\text{calculated as} \left[\frac{\max(P_i, P_j)}{\min(P_i, P_j)}\right]\right)$, and LOG_PRODUCTIVITY_RATIO $\left(\left[\frac{\max(P_i, P_j)}{\min(P_i, P_j)}\right]\right)$, respectively.

According to the Neoclassical Model, the trade between countries should be explained by the differences in relative endowment. The choice of the endowment factors to be tested was narrowed to three main types of input: land, capital, and labour. Land endowment variables formulation was suggested by Baxter and Kouparitsas (2011). There are the absolute value of the logarithm of the ratio of the arable land per worker endowments of the countries

$$\left(\text{LOG\_LAND\_PER\_WORKER\_RATIO} = \left|\ln\left[\frac{\max\left(L_i/W_i, L_j/W_j\right)}{\min\left(L_i/W_i, L_j/W_j\right)}\right]\right|\right)$$

and the log of the product of the relative endowments

$$\left(\text{LOG\_LAND\_PER\_WORKER\_PRODUCT} = \ln\left[L_i/W_i \times L_j/W_j\right]\right).$$

Additional variables added were the difference of the land-labour proportions, which was suggested by Lay and Zhu (2006)

$$\left(\text{LAND\_PER\_WORKER\_DIFFERENCE} = \left|L_i/W_i - L_j/W_j\right|\right),$$

and the ratio of them

$$\left(\text{LAND\_PER\_WORKER\_RATIO} = \frac{\max\left(L_i/W_i, L_j/W_j\right)}{\min\left(L_i/W_i, L_j/W_j\right)}\right).$$

All the data necessary were accessed from the World Bank official web site; information about the amount of arable land available in the country can be obtained through multiplying the arable land per capita by the total population. As far as the data concerning the total number of people employed within the economy are unavailable, the values of the variable were calculated on the basis of the indicators disposable and according to the way these indicators were calculated: the total ratio of people of age of 15–64 and 65+ years was calculated, then multiplied by the size of population, and, finally, multiplied by the employment rate.

The additional set of endowment variables involves the different forms of the relationship between the capital-per-labourer ratios of the two countries. This variable, as the name suggests, describes the proportion of the capital and labour endowments within the economy; it was calculated as the total value of capital within the economy divided by the total number of people employed. The total value of capital was accessed indirectly through the computing data, published by the World Bank (to be more precise, by multiplying the value of GDP by the gross capital formation indicator, expressed as the percentage of GDP). The set includes the natural logarithm of the product of ratios

$$\left(\text{LOG\_CAP\_PER\_WORKER\_PRODUCT} = {K_i}/{W_i} \times {K_j}/{W_j}\right)$$

ratio of them

$$\left(\text{CAPITAL\_PER\_WORKER\_RATIO} = \frac{\max\left({K_i}/{W_i}, {K_j}/{W_j}\right)}{\min\left({K_i}/{W_i}, {K_j}/{W_j}\right)}\right),$$

and natural logarithm of the ratio

$$\left(\text{LOG\_CAP\_PER\_WORKER\_PRODUCT} = {K_i}/{W_i} \times {K_j}/{W_j}\right).$$

The concepts that have been discussed define the differences between trading partners – either in technologies or in relative endowments – as the key determinants of trade. In contrast, New Trade Theory recognizes the similarity between the countries as the engine of international trade, as it was described in the preceding section. The additional variable to be inserted is GDP per capita difference $\left(\text{GDPPC\_DIFFERENCE\_ABSOLUTE} = \left|GDPPC_i - GDPPC_j\right|\right)$. According to Tarasov and Munich (2010), poorer countries are characterized by less intensive trade than developed ones; the authors explain such a trend by the

worse access to market. However, there is an additional interpretation of the impact of "GDP per capita distance" variable on the trade intensity; Durkin and Krygier (2003) prove that the difference in per capita income of countries disrupts the intra-industry trade between them. Therefore, the difference between GDP per capita indicators of trading partners should negatively affect the volume of trade, according to New Trade Theory. The dataset *GDP per capita, PPP (constant 2011 international $)* was accessed from the World Bank official web site.

To proceed to the next group of variables, the primary factors, recognized as influential by the pioneer of Gravity Model of Trade, are GDP product and distance between the countries. These variables, therefore, were inserted, denoted as GDP_Product and DISTANCE, respectively (due to the fact, trade volume is expressed in nominal terms, the nominal GDP was used as well; the distances between countries were accessed from www.freemaptools.com site).

However, there are other factors, which are likely to encourage or disrupt the bilateral trade. Glick and Rose (2002) state that the existence of common border between trade partners and the currency union membership have a significant positive effect on the international trade. These variables are of a binary from: for example, common border variable (COMMON_BORDER) takes value 1 in case countries in a pair share common border and 0 otherwise (land and maritime borders are both taken and are not distinguished between).

In Europe, the Euro area is the only currency union; therefore, in order to estimate the influence of currency union membership, the following dummies are applied: the first one (EUA_EUA) takes value of 1 in case both countries are members of Euro area, and 0 otherwise; the second dummy (EUA_NEUA) takes value 1 in case one country in a pair belongs to currency union, and the second one does not; otherwise, the value of the dummy is equal to 0. The variables were constructed in such a form for the purpose of observing how the fact the state belongs to the currency union tends to influence its bilateral trade patterns with the countries out of the union, or vice versa.

As it was already discussed, Perdikilis and Kerr (2000) prove that quotas and tariffs cause a negative effect on the volume of intra-industry trade; these factors are expected to be minimized within any type of the regional trade organizations (free trade areas, custom unions etc.). There are several regional trade agreements with different levels of liberalization: EU, EFTA, CEFTA, and CISFTA; in addition, WTO was added as the global trade organization (one can find the list of the members of each of the organizations mentioned in the Appendix 3). Due to the multicollinearity problem, which interfered the analysis, the total number of variables was narrowed to six. Dummy EU_EU takes value 1 id both trading nations belong to EU and 0 otherwise; binary variable NEU_EU takes value 1 if

one country belongs to EU, and second does not. Dummies CIF_CIF, CEF_CEF, and WTO_WTO are of value 1 if both partners are members of CEFTA, CISFTA, and WTO, respectively; in opposite case, these variables take the value of 0. Variable WTO_NWTO takes value of 1 if a pair is constituted by the countries, one of which is in WTO and the other is not, and the value of 0, otherwise. In addition, a variable COMMON_FTA, which incorporates the information about the membership in the free trade areas in Europe or similar formations, was inserted. In case countries out of a pair are both members of the EU, EFTA, CISFTA, or CEFTA, the variable takes value 1 and value 0, otherwise.

At this point, the author would like to discuss a set of the variables, which are to describe the differences in the character and quality of institutions across the European region and are hypothesized to have impact on the volume of bilateral trade. According to Hodson, "Institutions are the kinds of structures that matter most in the social realm: they make up the stuff of social life. The increasing acknowledgement of the role of institutions in social life involves the recognition that much of human interaction and activity is structured in terms of overt or implicit rules" (2006, p.22). The term is quite complex and includes both official and well-structured constraints, such as legal system, as well as uncodified and unofficial rules, such as customs, traditions etc. Numerous authors underline the crucial difference between the post-communist European countries and those, which have not experienced this form of political power, in different respects: growth capacity (Katchanowski, 2014), degree of economic and political freedom (Peev and Mueller, 2014) etc. In other words, the difference between the character of institutions in post-communist and in the rest of European states is commonly recognized.

In the preceding section, the issue of how institutions of the trading partners affect the successful cooperation has been already touched. Unlike most of the authors who have observed this problem concerning the post-communist states, the author of this research is not interested in finding out the set of particular features of the transition and post-transition economies, which may affect the trade. Unfortunately, the set mentioned seems to be too complex and includes factors, which are extremely hard to measure (the reader may come up with the term "mentality" at this point). As it was already stated, the purpose of this research is to formulate the receipt for authorities concerning the optimal trade policy choice. From this standpoint, it does not matter which institutional factors may enhance or discourage international trade; the aim is to check if the institutional set nations are characterized by affects the trade significantly and in what direction.

In order to find out this pattern, all the countries observed are divided into three groups, depending on their past and current path of development. The first

one includes post-communist states, which have chosen the European integration path (e.g. those, which are either EU Member States, candidates to membership or potential candidates; the information was accessed from the EU official web site). The second group represents the rest of post-communist states (for instance, Russia, Ukraine, Belarus). Finally, there are economies, which have never been under the communist power (Germany is included in this group, as there are no data concerning the East and West Germany separately). The abbreviations denoting the groups are PCE, PCNE, and E, respectively. The countries in a pair create one of the following combinations: PCE_PCNE, PCE_E, PCNE_E, PCNE_PCNE (the pair PCE_PCE was omitted in order to avoid perfect multicollinearity). Each of the combinations enumerated represents dummy variable, which takes value of 1 in case pair is of the type mentioned in the name of the variable, and value of 0, otherwise.

The effect of the variables enumerated is difficult to determine at this point. As it was discussed in section 2.2, there is the evidence of the positive relationship between the level of trade liberalization and the level of political freedom (Frye and Mansfield, 2003); under this assumption, the variable E_E should be the most influencing among the range, then PCE_E, and so on. However, if the institutional gap can be treated as a source of comparative advantage of the partners (Belloc and Bowles, 2009), the pair PCNE_E should be expected to be characterized by more intensive bilateral trade in comparison with other pairs.

In order to be able to subject the data BMA procedure, they need to be transformed from the panel to the cross-sectional form. For this purpose, for each of the variables, the average value for the period of 2005-2011 was taken. Dummies are translated from the qualitative into quantitative form (for example, in case both partners in a country pair are Member States, and one of them entered EU in 2007, the value of the averaged variable is 0,71: this reflects the number of years pair fits the parameter out of the total period of observation).

To conclude, the total set of bilateral trade factors to be tested involves 22 variables, chosen in accordance with the theories of international trade, discussed in the preceding chapter. In addition, inserted 5 so-called "institutional" variables were inserted, assuming a gap between the former communist states and the rest of countries in the region. As Baxter and Kouparitsas (2011) did, the author constructs three models in order to check the joint effect of gravity variables and M-variables and the effect of each group separately, as the authors state that statistical significance of economic determinants of trade strongly depends on the fact of inclusion of gravity variables.

2.2. Data Processing Method

The entire methodology of the research undertaken is Bayesian Model Averaging procedure, aimed at reducing the uncertainty concerning the form of the model. A problem with an econometric regression construction arises when there are numerous potential explanatory variables; in particular, one may wonder which particular variables should be added and how important they are. The procedure that is going to be applied allows to define the variables with the greatest explanatory power and assign the proper sign of the coefficient to each of them. The procedure estimates all the possible combinations of the potential explanatory variables, or 2^k models, where k denotes the number of potential variables; for instance, there are 134 217 728 possible versions of the model with both non-gravity and gravity variables inserted (the model is discussed in the next chapter).

Rafrey and Zheng (2003) state that the predictive performance of the Bayesian Model Averaging (BMA) was proved to be superior in comparison with other methods, namely graphical analysis, linear regressions, binary regressions, and semi-parametric regressions (Rafrey and Zheng, 2003, p. 931).

Detail explanation of Bayesian model averaging can be found in Beck (2017a, 2017b, 2018a, 2018b and 2018c). Zeugner (2011) provides the explanation of theoretical foundation of the method, starting with presenting the application of the Bayes Theorem:

$$p(M\gamma|y,X) = \frac{p(y|M\gamma,X)p(M\gamma)}{p(y|X)} = \frac{p(y|M\gamma,X)p(M\gamma)}{\sum_{s=1}^{2k} p(y|Ms,X)p(Ms)}$$

(Zeugner, 2011, p. 2).

$p(y|X)$ denotes the integrated likelihood (the measure is constant over all the possible models). The posterior model probability $P(M\gamma|y, X)$ (probability that the variable should be inserted into the model after the procedure of estimation) is proportional tothe marginal likelihood of the model $p(y|M\gamma, X)$.

"Renormalization then leads to the PMPs and thus the model weighted posterior distribution for any statistic θ (e.g. the coefficients β):

$$p(\theta|y,X) = \sum_{\gamma=1}^{n} p(\theta|M\gamma,y,X)p(M\gamma|X,y)$$

The model prior $p(M\gamma)$ has to be elicited by the researcher and should reflect prior beliefs". (Zeugner, 2011, p. 2). For the purpose of the research, the uniform model prioris taken.

Zellner's g-prior is an objective prior for the regression coefficients in the multiple regression. Handbook, written by Zeugner (2011) suggests the use of the

"unit information prior", which sets g = N and attributes about the same information to the prior as is contained in one observation, as the most appropriate method.

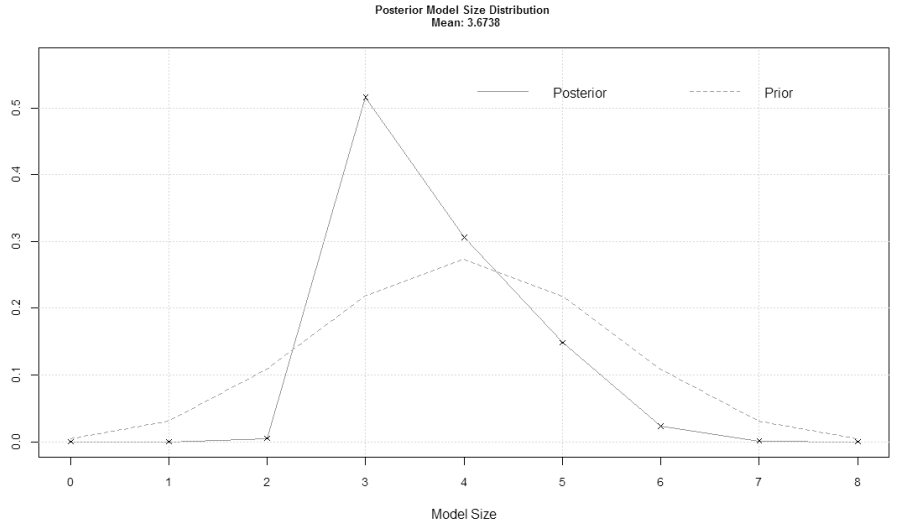
3. Results and Discussion

3.1 Effect of the Gravity Variables

The first model to be tested includes solely gravity variables, as it was already mentioned in section 2.1. Namely, they are GDP_Product, DISTANCE, and COMMON.BORDER. As the importance of colonial ties and cultural distance was emphasized by Tinbergen (1962) in his pioneering work, as well as in the further elaborations of different authors, so-called "institutional variables", discussed in the sections 1.2 and 2.1, are also inserted.

Graph 3.1.1 represents the Posterior Size Distribution; it shows that although the model prior implies symmetric distribution around $k/2 = 4$, updating it with the data results in posterior, which takes the maximum of explanatory power when the number of variables is 3.

Graph 3.1.1. Prior and Posterior Model Size Distribution of the Model with Gravity Variables (number of explanatory variables on horizontal axis, P on vertical axis).



Source: author's elaboration.

Table 3.1.1. Posterior Inclusion Probability, Posterior Mean, Posterior Standard Deviation, and Probability of the Positive Coefficient on Condition of Inclusion of the Gravity Variables.

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior SD	P(+)
GDP_Product	**1.00**	**0.000000000000009**	**0.00**	**1.00**
COMMON.BORDER	**1.00**	**9439854000.00**	**1542948000.00**	**1.00**
E_E	**0.98**	**4251386000.00**	**1280440000.00**	**1.00**
DISTANCE	0.34	-319836.70	513876.60	0.00
PCNE_E	0.18	446497500.00	1128379000.00	1.00
PCE_PCE	0.08	-220939200.00	959391200.00	0.00
PCE_PCNE	0.05	-70077870.00	497174200.00	0.00
PCE_E	0.05	-32216470.00	442333700.00	0.54

Source: author's elaboration.

The first column (PIP) of the Table 3.1.1 represents the posterior inclusion probability. The prior probability (e.g., before the analysis) that given variable should be inserted into the model is 0.50. Therefore, the variable should be characterized by PIP, higher than 0.50 (or to be present in more than 50% of the possible variations of the model) in order to be recognised as the robust one. There are three such variables: GDP_Product, COMMON.BORDER, and E_E; this information is in line with what is presented in

Graph 3.1.1**.** All of the variables have positive coefficients in 100% of the models they are present in. Therefore, the product of GDP, existence of common border between countries, as well as the fact both nations belong to so-called "originally European" group, have positive impact on the volume of bilateral trade.

Posterior Mean provides information about the strengths of the effect variables discussed have on the trade between European states. The measure displays the weighted average of the coefficients of the variable given over all the model variations tested, including those in which the variable was omitted, assuming 0 coefficient in this case.

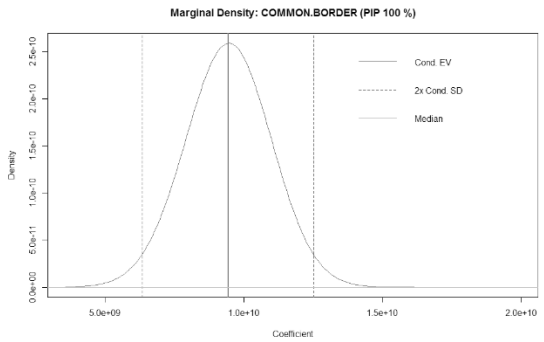
In particular, increase in the GDP_Product by one billion of U.S. $ will cause the increase in the volume of trade by 0.000009U.S $ (both values are nominal). The existence of the common land or maritime border between trade partners is likely to imply 9439854000.00 U.S.$ difference in the value of bilateral trade

comparing to states that do not share border. The "originally European" countries tend to trade on average 4251386000.00 U.S $ more than the PCE_PCE group, taken as the reference point. This gives the evidence in favor of Frye and Mansfield (2003): as the pair E_E involves the most politically liberalized countries, a strong positive relationship between the level of democracy and the intensity of trade can be assumed.

Interesting fact to mention is that although DISTANCE variable affects trade in Europe negatively, the effect it causes is not statistically significant, which contradicts the evidence obtained by Tinbergen (1962). The possible explanation for this phenomenon is the relatively small size of the European region and the fact the trade within a single continents observed.

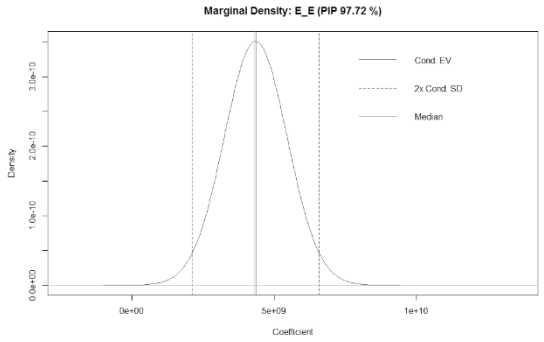
Information concerning the posterior distribution of the coefficients of the robust variables is incorporated in Graphs 3.1.2 – 3.1.4. It is clearly visible that coefficients of all the variables fall in the positive range.

Graph 3.1.2. Marginal Density Distribution of the COMMON.BORDER Variable



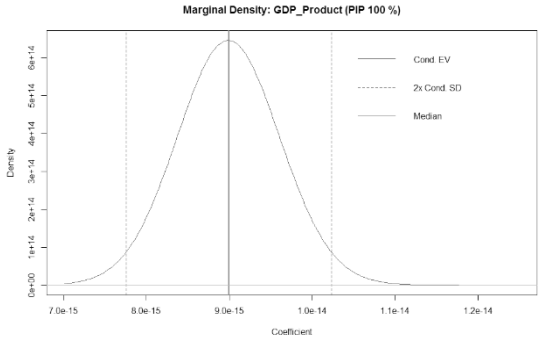
Source: author's elaboration.

Graph 3.1.3. Marginal Density Distribution of the E_E Variable



Source: author's elaboration.

Graph 3.1.4. Marginal Density Distribution of the GDP_Product Variable

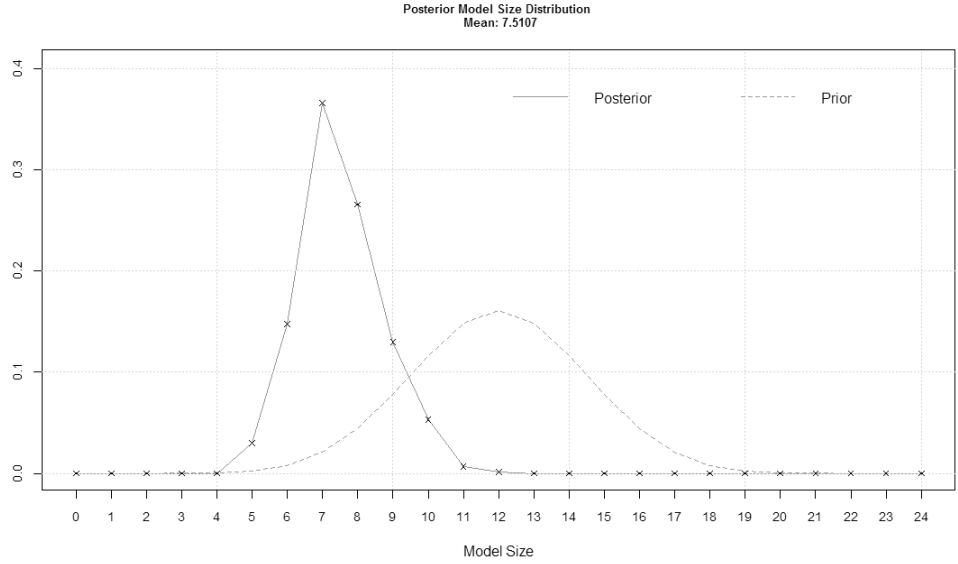


Source: author's elaboration.

3.2. Effect of the Non-Gravity Variables

The range of variables tested excluded GDP_Product, DISTANCE, and COMMON.BORDER. As Graph 3.2.1 suggests, the optimal number of variables to be inserted in the model is 7 out of 24.

Graph 3.2.1. Prior and Posterior Model Size Distribution of the Model with Non-Gravity Variables (number of explanatory variables on horizontal axis, P on vertical axis).



Source: author's elaboration.

Table 3.2.1. Posterior Inclusion Probability, Posterior Mean, Posterior Standard Deviation, and Probability of the Positive Coefficient on Condition of Inclusion of the Non-Gravity Variables

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior SD	P(+)
EUA_EUA	**1.00**	**9481087000.00**	**2692569000.00**	**1.00**
GDPPC_DIFFERENCE_ABSOLUTE	**1.00**	**-242607.50**	**56113.33**	**0.00**
LOG_LAND_PER_WORKER_PRODUCT	**1.00**	**2916436000.00**	**665626700.00**	**1.00**
E_E	**0.96**	**6460621000.00**	**1997591000.00**	**1.00**
PCNE_E	**0.57**	**2700925000.00**	**2709482000.00**	**1.00**
LOG_CAP_PER_WORKER_RATIO	**0.50**	**1818501000.00**	**2032231000.00**	**1.00**
EU_EU	0.41	1824053000.00	2422274000.00	1.00
PRODUCTIVITY_RATIO	0.41	997683900.00	1472680000.00	1.00
COMMON_FTA	0.37	1477563000.00	2326916000.00	0.97
EUA_NEUA	0.25	823123900.00	1596317000.00	1.00
NEU_EU	0.14	188273100.00	986247100.00	0.75
PCE_E	0.13	-242271900.00	1075535000.00	0.23
PCE_PCNE	0.11	-43069740.00	810431600.00	0.51
LAND_PER_WORKER_RATIO	0.11	-27693620.00	103275200.00	0.00
LOG_PRODUCTIVITY_RATIO	0.10	2753851.00	1965739000.00	0.69
WTO_WTO	0.10	220804900.00	85468610000	1.00
PRODUCTIVITY_DIFFERENCE	0.08	-1208.89	38837.88	0.52
CAPITAL_PER_WORKER_RATIO	0.08	22358590.00	88198130.00	1.00
LOG_LAND_PER_WORKER_RATIO	0.06	-61162160.00	326237900.00	0.00
PCNE_PCNE	0.04	-12637040.00	722271400.00	0.45
CEF_CEF	0.04	-154144600.00	1665975000.00	0.03
LOG_CAP_PER_WORKER_PRODUCT	0.02	4907219.00	108144400.00	0.70
CIF_CIF	0.02	-13713890.00	690599200.00	0.35
LAND_PER_WORKER_DIFFERENCE	0.01	-29565030.00	354396900.00	0.00
LAND_PER_WORKER_DIFFERENCE	0.01	-29565030.00	354396900.00	0.00

Source: author's elaboration.

Out of the whole range, the following variables proved to be significant: EUA_EUA, GDPPC_DIFFERENCE_ABSOLUTE, LOG_LAND_PER_WORKER_PRODUCT, E_E, PCNE_E, and LOG_CAP_PER_WORKER_RATIO. The results support the hypothesis that currency union membership facilitates the trade between members, as variable EUA_EUA is present in all the possible models, being characterized by the positive coefficient. On average, Euro area members trade 9481087000.00 U.S. $ more with each other than the counties than the pairs of countries, constituted by the states out of the Euro area.

The difference between GDP *per capita* of the trade partners seems to have great influence on the trade intensity. Variable GDPPC_DIFFERENCE_ABSOLUTE is present in all the models; the probability it causes positive effect is 0. As Table 3.2.1 suggests, one dollar increase in the difference (expressed in the constant prices PPP U.S.$) implies 242607.50 U.S. $ decrease in the volume of trade between the states (expressed in nominal U.S. $).

LOG_LAND_PER_WORKER_PRODUCT is robust in 100% of the model variations tested and causes the positive effect in all of them. As Baxter and Kouparitsas (2011) state, this variable has an interesting property; obviously, the higher relative land endowment of one of the counties, the higher the value of the variable, but in addition, the variable takes greater value if the relative endowments of the states are close to be equal. It is visible, therefore, that countries tend to trade more if their relative arable land endowments are similar, which implies a contradiction between the evidence obtained and the Neoclassical Theory of Trade assumptions.

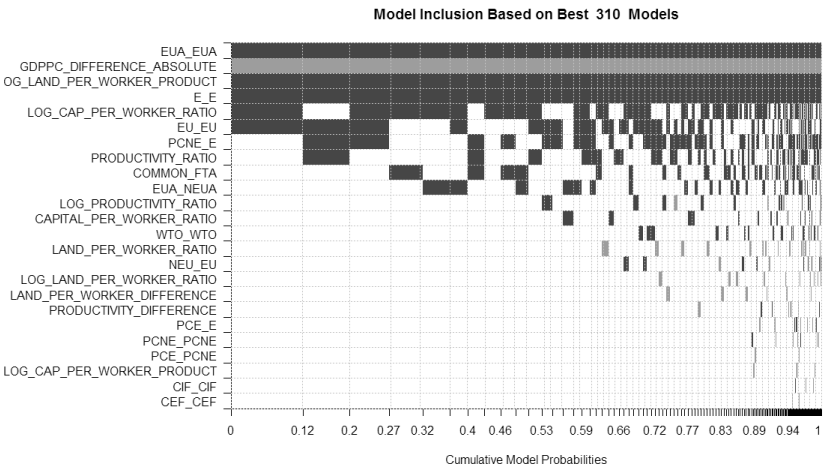
As in the model presented in section 3.1, the effect of the E_E variable is robust and positive; however, the posterior mean measure is higher. The robustness and the positive value of coefficient of PCNE_E variable prove the conclusions, derived by Belloc and Bowles (2009). Institutional gap between the countries out of PCNE_E pair creates a source of comparative advantage for each of the countries; according to our estimation, the fact of the being a member of the pair implies 2700925000,00 U.S. $ more intensive trade than PCE_PCE pair. The interesting fact to mention is that these two variables are the only robust out of the whole so-called "institutional" range.

Logarithm of the ratio of capital-labour relative endowments (LOG_CAP_PER_WORKER_RATIO) is present in about 50% of the possible model variations, taking the positive coefficient in all of them. **Such a result is in line with the Neoclassical Theory framework: the higher the difference in relative endowments of the trading countries, the higher the volume of bilateral trade**.

It is also worth mentioning that membership in regional and global trade agreements does not have as strong effect on the bilateral trade as it could be expected; EU_EU is the only factor that affects the explanatory variable more or less noticeably.

As it was have already mentioned, BMA procedure allows to test a wide range of variations of the models; each of them involves some range of variables. Graph 3.2.2 represents the statistics concerning the variables inserted in the models and the sign of the coefficient of the variables. The models are sorted according to the Cumulative Model Probability, or the explanatory power of the model. Obviously, the measure diminishes: CMP of the first model solely is 0.12, while CMP of the two best models is 0.2.

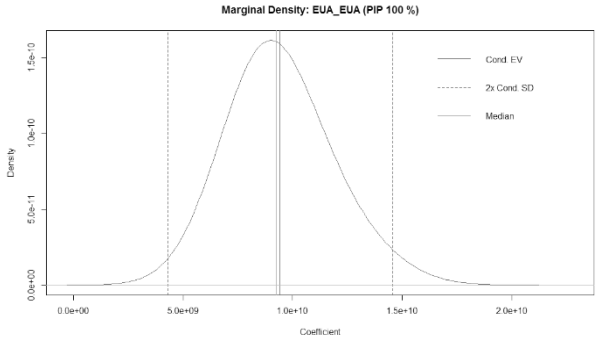
Graph 3.2.2. Model Inclusion and Sign of the Coefficients Statistics (on the Basis of 310 Best Models Tested) for Non-Gravity Variables.



Source: author's elaboration.

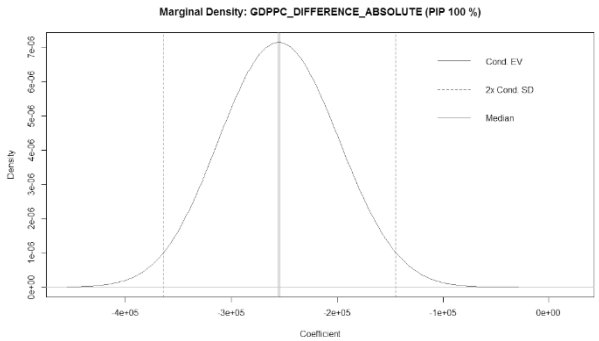
Posterior distribution of the coefficients (Graphs 3.2.3–3.2.7) shows that all the variables, except GDPPP_DIFFERENCE_ABSOLUTE, fall in the positive range; the results of coefficient are, therefore, robust.

Graph 3.2.3 Marginal Density Distribution of the EUA_EUA Variable



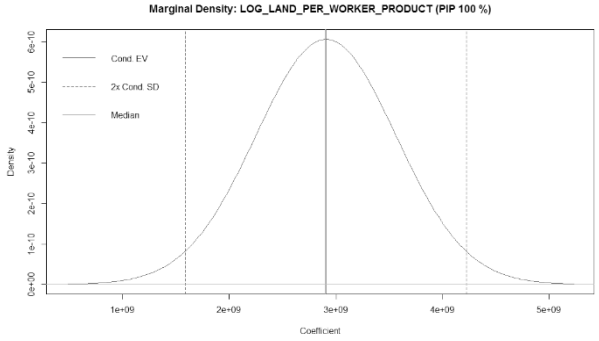
Source: author's elaboration.

Graph 3.2.4. Marginal Density Distribution of the GDPPC_DIFFERENCE_ABSOLUTE Variable



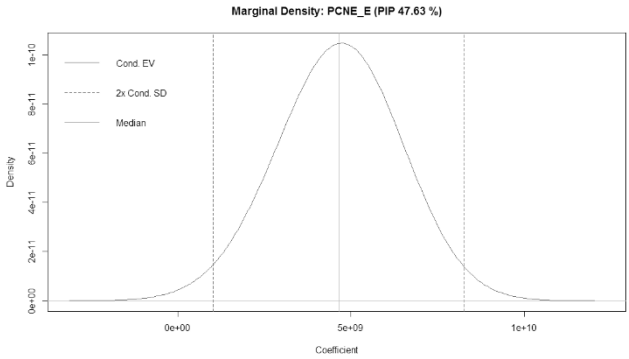
Source: author's elaboration.

Graph 3.2.5. Marginal Density Distribution of the LOG_LAND_PER_WORKER_PRODUCT Variable



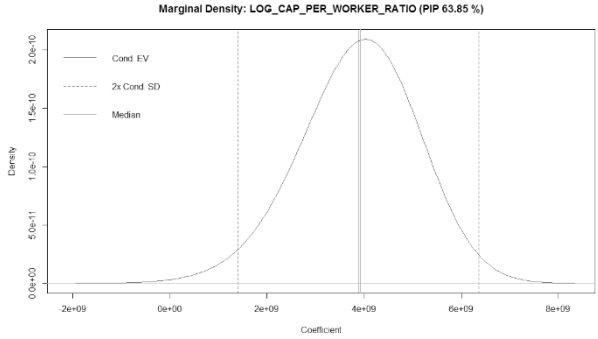
Source: author's elaboration.

Graph 3.2.6. Marginal Density Distribution of the PCNE_E Variable



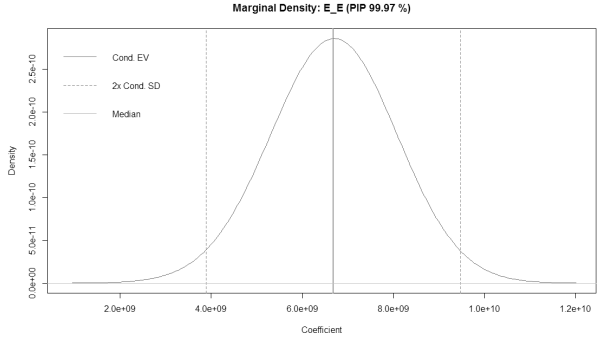
Source: author's elaboration.

Graph 3.2.7. Marginal Density Distribution of the LOG_CAP_PER_WORKER Variable



Source: author's elaboration.

Graph 3.2.8. Marginal Density Distribution of the E_E Variable

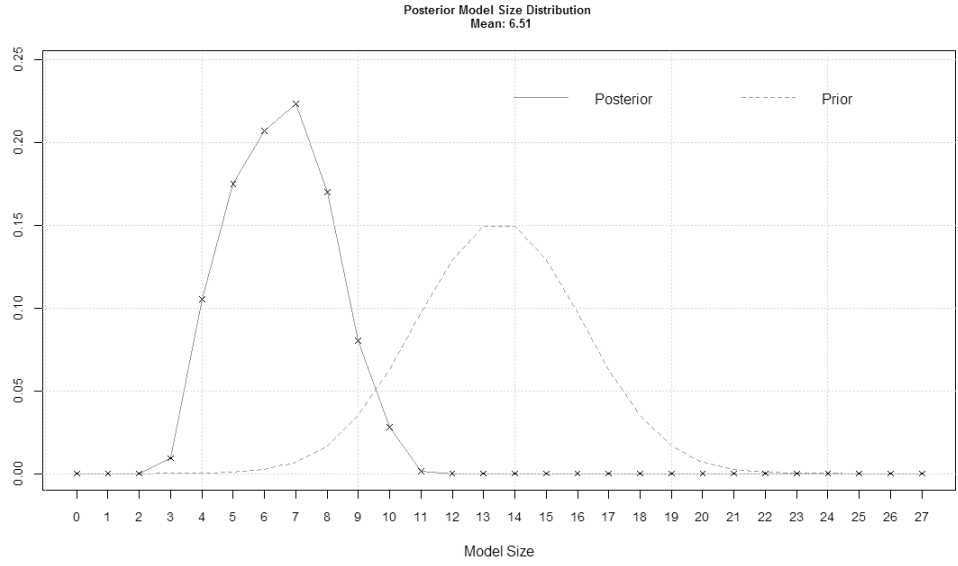


Source: author's elaboration.

3.3. Joint Effect of Gravity Variables and Non-Gravity Variables

The Graph 3.3.1 represents the Posterior Model Size Distribution of the model and shows that the model, which contains both gravity and M groups of variables, takes maximal explanatory power, when the number of variables is equal to five, despite the fact the mean of the prior is between 13 and 14 ($k/2 = 13{,}5$).

Graph 3.3.1. Prior and Posterior Model Size Distribution of the Model with Gravity and Non-Gravity Variables Inserted (number of explanatory variables on horizontal axis, P on vertical axis).



Source: author's elaboration.

Table 3.3.1. Posterior Inclusion Probability, Posterior Mean, Posterior Standard Deviation, and Probability of the Positive Coefficient on Condition of Inclusion of the Gravity Variables and Non-Gravity Variables.

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior SD	P (+)
COMMON.BORDER	1.00	9685397000.00	1484359000.00	1.00
EUA_EUA	1.00	9842696000.00	2159714000.00	1.00
GDP_PRODUCT	1.00	0.000000000000009	0.000000000000001	1.00
LOG_LAND_PER_WORKER_ PRODUCT	0.79	1409494000.00	905749100.00	1.00

Variable	Posterior Inclusion Probability	Posterior Mean	Posterior SD	P (+)
EUA_NEUA	**0.60**	**1789893000.00**	**1696961000.00**	**1.00**
GDPPC_DIFFERENCE_ABSOLUTE	0.39	-47218.49	66473.03	0.00
LOG_CAP_PER_WORKER_RATIO	0.39	921316200.00	1362176000.00	1.00
E_E	0.20	543778900.00	1249862000.00	1.00
PRODUCTIVITY_RATIO	0.15	203016000.00	582542000.00	1.00
PCE_E	0.11	-140592900.00	589792600.00	0.11
WTO_WTO	0.10	-8260605.00	435858100.00	0.33
NEU_EU	0.09	55759900.00	402295300.00	1.00
PCNE_E	0.09	186391600.00	727820100.00	1.00
LOG_CAP_PER_WORKER_ PRODUCT	0.08	-63704240.00	269009800.00	0.06
DISTANCE	0.06	-35400.38	171299.00	0.00
CEF_CEF	0.06	-84217790.00	1600030000.00	0.00
LAND_PER_WORKER_DIFFER-ENCE	0.06	-18943530.00	491409300.00	0.27
COMMON_FTA	0.05	13356900.00	320536200.00	0.81
LOG_PRODUCTIVITY_RATIO	0.05	85942760.00	687956800.00	0.91
LOG_LAND_PER_WORKER_ RATIO	0.04	-2240265.00	173651400.00	0.15
PRODUCTIVITY_DIFFERENCE	0.04	2366.34	19423.38	0.88
CAPITAL_PER_WORKER_RATIO	0.04	4273222.00	34842220.00	0.85
EU_EU	0.04	36297400.00	355672200.00	0.82
PCNE_PCNE	0.03	-106346900.00	803355800.00	0.00
LAND_PER_WORKER_RATIO	0.03	-3003188.00	39101740.00	0.01
CIF_CIF	0.02	-17150750.00	546508100.00	0.00
PCE_PCNE	0.01	-5370316.00	158016800.00	0.00
PCE_PCNE	0.01	-5370316.00	158016800.00	0.00

Source: author's elaboration.

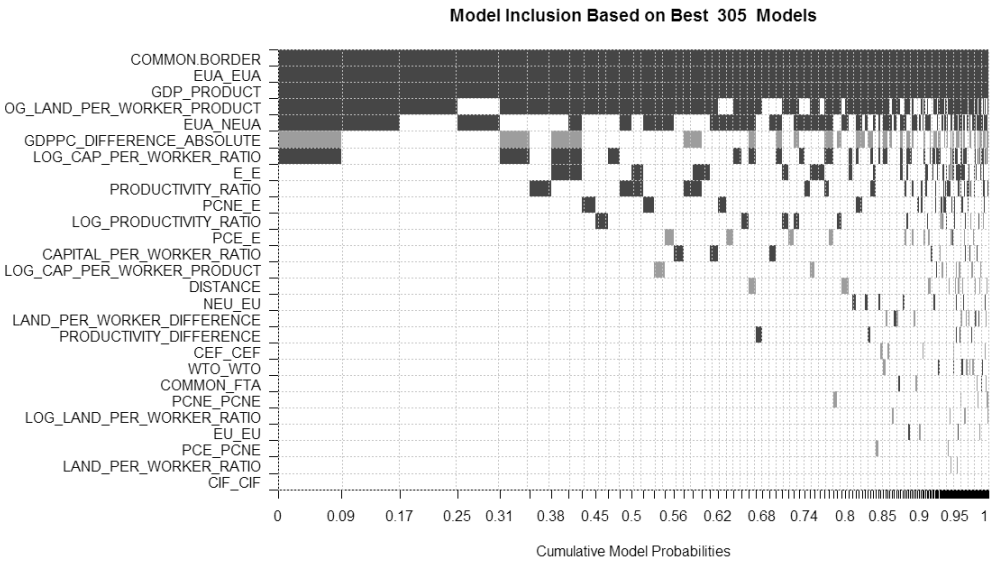
The COMMON.BORDER and GDP_Product variables are present in all the possible models, being characterized by the positive coefficient. According to the estimation, on average, the fact two trading partners share the border implies 9685397000,00 U.S.$ bigger volume of bilateral trade in comparison with those country pairs, which do not share common border. The effect of one billion U.S. $ increase in GDP product causes 0,000009 U.S. $ increase in the volume of trade.

As it was predicted, if both partners are members of the common currency area (Euro area, in our case), they trade more, as variable EUA_EUA is robust and has a positive coefficient in all the models it is presented. As the Post Mean measure shows, on average, pair, in which both partners are Euro area members, trades by 9842696000,00 U.S. $ more than the pair, in which both countries are out of the currency union. The author would also like to underline that the fact of being a member of Euro area does not seem to disrupt the trade with the states out of the currency union, as the variable EUA_NEUA causes robust and positive effect on the trade, being present in about 60% of the models. The average of the coefficient the variable is characterized in all the models tested, is 1789893000,00, which implies that pair EUA_NEUA pair trades on average 1789893000,00 U.S. $ more, than the pair in which both countries are out of the Euro area.

LOG_LAND_PER_WORKER_PRODUCT variable, as in the model presented in the section 2.2, is robust (as it is presented in 79% of the models) and affects trade positively; if the variable increases by 1, the volume of bilateral trade increases by 1409494000,00 U. S. $.

Analogously to the preceding sub-section,Graph3.3.2 illustrates the statistics concerning the inclusion of variables into the models tested and the sign of the coefficients, which has been already discussed.

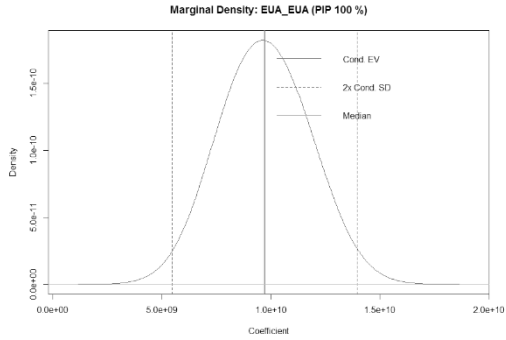
Graph 3.3.2. Model Inclusion and Sign of the Coefficients Statistics (on the Basis of 310 Best Models Tested) for Gravity Variables and Non-Gravity Variables.



Source: author's elaboration.

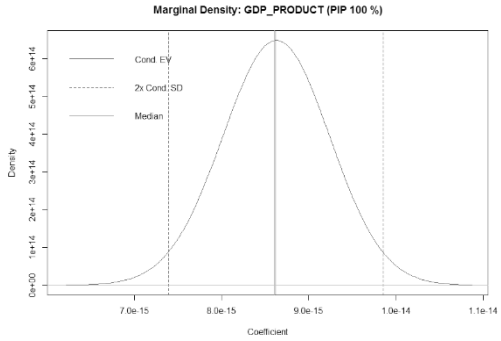
Marginal density distribution of the robust variables, presented in the Graphs 3.3.3–3.3.6 shows that coefficients of the variables fall into the positive range.

Graph 3.3.3. Marginal Density Distribution of the EUA_EUA Variable



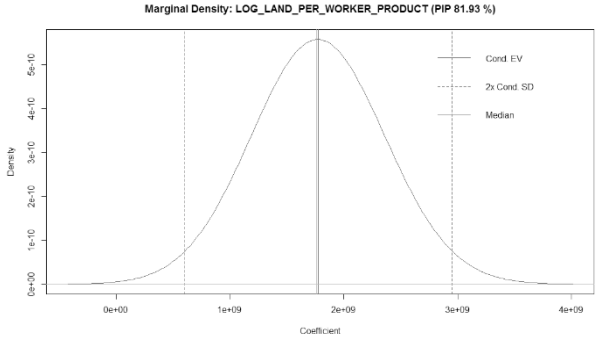
Source: author's elaboration.

Graph 3.3.4. Marginal Density Distribution of the GDP_Product Variable



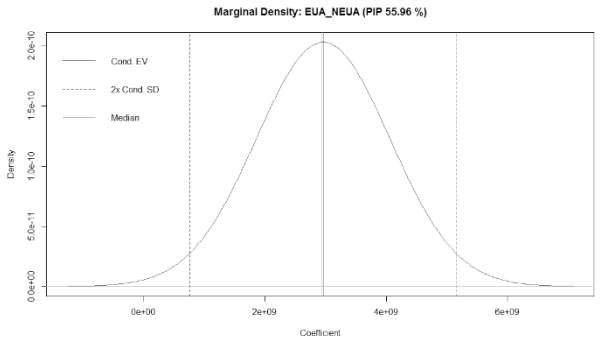
Source: author's elaboration

Graph 3.3.5. Marginal Density Distribution of the LOG_LAND_PER_WORKER Variable



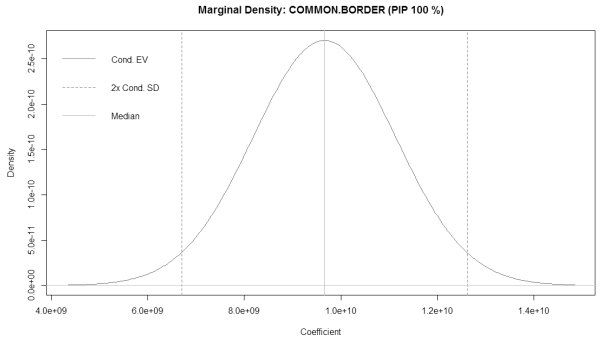
Source: author's elaboration.

Graph 3.3.6. Marginal Density Distribution of the EUA_NEUA Variable



Source: author's elaboration.

Graph 3.3.7. Marginal Density Distribution of the COMMON.BORDER Variable.



Source: author's elaboration.

3.4. Results and Discussion: General Notes and Conclusions

Three models, which included gravity variables, non-gravity variables, and both groups, were observed. Such a method was suggested by Baxter and Kouparitsas (2011), who state that gravity variables tend to take the explanatory power of the other variables, narrowing the range of the robust factors.

Gravity variables were chosen analogously to Baxter and Kouparitsas (2011). The product of nominal GDP, distance between the states, common border variable, and the range of so-called "institutional" variables were inserted. Out of this set, there were three robust factors: product of GDP, the fact two counties share either land or maritime border, as well as the fact both countries belong to "originally European" group. All the varaibles are characterized by positive coefficients.

Testing Non-Gravity variables solely allowed to extend the number of important variables. Paricularly, the author managed to prove that common currency union membership causes positive effect on the trade. In addition, it was deirved that the difference in income per capita countries are characterized by iscourages the trade, in line with the New Trade Theory. The positive sign of the coefficient of the LOG_LAND_PER_WORKER_PRODUCT variable implies that the difference in relative arable land – labour endowmnets discourages bilateral trade, which contradicts with the Neoclassical Model and supports the New Trade Theory. However, the positive value of the log of ratio of capital per worker proportions shows that capital-labour endowments dissimilarity encourages trade, in line with the H-O proposition. The author also proved the importance of "institutional" variables and found out that out of the entire set, there are two types

of pairs of countries, which tend to trade more with respect to other states: two "originally European" countries and a pair, in which one country belongs to this group, and the other is post-communist and not integrated to EU. It provides the evidence in favor for two propositions concerning the effect of institutional gap on the bilateral tarde: the most liberalized states tend to trade more, and differences in institutional set may be traeted as a source of the comparative advantage of nations, thus encouraging exchange of goods and services between them.

In the model with both groups of variables inserted, GDP product and common border remain robust and keep the positive sign of cefficient, as in the model with solely gravity variables. And, as in the previous model, the log of product of land-labor endowmnets and currency union membership is among the set of important variables. In addition, countries that are out of the Euro area tend to trade more with countries from the currency union rather than with those that are out of the union as well.

The results of theresearch support both for the New Trade Theory (as GDP per capita difference affects trade negatively, and the equality of land-labour endowmnets affects it positively), and for Neoclassical Model (as the gerater log of ratio of capital-labour proportions encourages trade). However, the LOG_LAND_PER_WORKER_PRODUCT variable is more robust, as it remains in this range both in the models with non-gravity variables solely and in the model with both gravity and non-gravity variables. Therefore,the evidence in favor for the statement that trade patterns of European countries can be described by New Trade Theory is more reliable.

It is worth mentioning that there is not any variable out of the range, describing the relationship between the productivity indicators of the trading partners, which was proved to be robust. Thereby, the Ricardian Model fails to explain the patterns of bilateral trade, at least in the context of our research.

Due to the specific features of the method used, the author also managed to find out the most suitable formuation of the variables. For example, the commonly used in the similar studies difference in endowmets variables are much less robust than the natural logs of relative endowments product or log of relative endowments ratios.

4. Conclusions and Suggested Implications of the Research

The aim of the research conducted was to evaluate the effect of the closer trade cooperation between Ukraine and Western European region. For this purpose, the authordefined the main factors which determine the patterns of trade in Europe,

or, more precisely, the variables which have the robust effect on the volume of bilateral trade between European counties.The choice of the variables to be tested emerged out of the four basic concepts, aimed at explaining the phenomenon of international trade: the Ricardian Model, Neoclassical Model, New Trade Theory, and Gravity Model. The features of the method chosen allowed to construct a set of sub-variables in order to choose the most suitable formulation. The subsets inserted involved the bilateral productivity measures (absolute value of the difference of productivity indicators of two countries, the ratio of them, as well as the natural log of the ratio), relative arable land-labour endowments (absolute value of the difference of the endoments, ratio of the endowments, natural log of the ratio, and the natural log of the product of the relative endowments), and the subset of relative capital-labour endowments, constructed analogously to the land-labour endowments variables (excepting the difference of the endowments). "GDP per capita distance" variable was added as the proxy of difference in the level of development of counties in the pair, according to the New Trade Theory. The range of gravity variables included GDP product, distance, and common border dummy. In order to characterize the effect regional and global trade organisations and common currency areas cause on the bilateral trade in Europe, the author designed binary variables, denoting the following concerns: if both countries belong to EU, if countries constitute a pair, in which one country belongs to EU, and the other does not, if both counties belong to CISFTA, if both countries belong to CEFTA, if both counties are WTO members, if conties constitute a pair,in which one country is WTO member, and the other is not, if both counties are in Euro area, and if counties constitute a pair, in which one country is in Euro area, and the other is not.

Baxter and Kouparitsas (2011) test gravity, non-gravity, and both groups of variables separately, as the gravity variables tend to diminish the statistical significants of other factors. Gravity variables inserted in the first model involved GDP product, distance, and common border dummy. In addition, the set of variables, denoting the institutional gap between trade partners, was added. In this context, three factors were proved to have a strong effect: GDP product, common border, and the fact both countries in the pair belong to the so-called "originally European" group (all three variables have a positive coefficient). Distance, which is commonly considered an influencial determinant, appeared not to be robust (however, it is charcterized by the negative coefficent). The behaviour of institutional factors is in line with our conclusions, derived from the elaboration of Frye and Mansfield (2003) (the most liberalized states should be characterized by the most intensive bilateral trade).

However, in the model, which included only non-gravity variables, there are two robust institutional variables: E_E and PCNE_E. The results provide the

evidence in favor of both the approaches concerning institutional gap, discussed in section 2.2. Belloc and Bowles (2009) argue that the difference in the institutional sets the counties are characterized by may be a source of comparative advantage of trade partners, thus encouraging bilateral trade. The fact PCNE_E variable is robust reinforces the hypothesis, as the countries out of this pare represent two opposite poles in the context of mentality and institutions.

The natural log of the product of relative arable land – labour endowments is also significant, having a positive effect on the explained variable in all the model variations it is present in; therefore, the similarity of relative land-labour endowmets of the partners encourages the intensity of trade. In opposite, the robustness and positive coefficient of the log of ratio of relative capital-labour endowments supports the traditional Neoclassical Model hypothesis that the unlikeness of capital-per-worker ratios of two countries is an imporatnt determinant of international trade. The author also managed to prove that the difference in income per capita affects the dependent variable negatively; such a result is in line with the New Trade Theory framework. In addition, it is visible that the common currency area eliminates the barriers to trade, as Euro area membership favors the bilateral trade between the members. In the model estimating the joint effect of gravity and non-gravity variables, common border, GDP product, the fact both countries belong to Euro area, and the log of the relative land–labour endowmets product remained robust factors. A new variable in the range of influencial determinants of trade was EUA_NEUA, and its positive coefficient shows that the pair of counties, in which one is in the Euro area, and the second does not, has an advantage over those pairs, in which both counties are out of the Euro area.

The results of the estimation provide the evidence both for the New Trade and Neoclassical Model validity; however, there is no productivity varaible that was robust in any out of the three models tested. This proves that the Ricardian model fails to explain the patterns of the international trade in the European region.

The results obtained allow to derive a conclusion concerning the possibility of Ukraine, as well as of the range of post-communist states from European region, to switch to the path of closer cooperation with the Western Europe countries in general, and with the EU in particular. Potential CISFTA entering seems to cause weak and ambigous effect on the explained variable, thus making no sense. The productivity gap does not cause a robust effect on the bilateral trade, while the difference in relative capital-labour endowments is a favoring factor; in addition, it is visible that for countries out of the Euro area, in terms of trade cooperation, it is more promising to trade with EA members. The evidence obtained supports the idea that the difference in the institutional constraints can be treated as the

source of comparative advantage and to encourage bilateral trade as well. However, the low level of per capita income implies a problem for the dealings with Western Europe and requires more attention from the side of policymakers.

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Influence of Immigration on Employment of Native Workers and Social Protection Expenditures of the European Union Member States

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Abstract

The purpose of this work is to investigate potential impacts immigrants have on the employment of native population and expenditures on social protection of a given Member State of the European Union. In the light of the ongoing massive influx of refugees and asylum seekers in the EU, there may emerge a number of concerns among both individual governments and native citizens of these countries.

The research involves examination of panel data for 17 countries for the time span of 2002–2012, which was predetermined by the limited availability of data. Applied methodology combines 2 approaches. The first stage of analysis is based on Bayesian Model Averaging (BMA) that incorporates selection of the most relevant regressors using the concept of Posterior Inclusion Probabilities (PIP). Following the assortment of the independent variables, the scope of the possible effects of immigration is estimated using Panel Ordinary Least Squares (OLS) regression in conjunction with Fixed/Random Effects Approach.

The final conclusions of the research state that the null hypothesis of immigrants having positive influence on the employment of native workers is rejected due to the fact that results are negative and statistically significant. The second null hypothesis that affirms negative impact of foreigners on social protection expenditures cannot be neither accepted nor rejected. There is no ultimate result due to the fact that the regressor corresponding to the number of refugees in the host country turns out to be statistically insignificant.

Concluding remarks contain a joint overview of empirical estimations' output conditional on previously observed migration waves in the European Union Member States. Several recommendations for further analysis, ways to improve and extend the research, as well as future immigration policies were suggested.

Introduction

The European Union is currently experiencing a migration crisis due to the drastically large number of incoming refugees. Political instability in the world "forces" people to move to foreign countries, and the EU is playing the role of a giant so-called "host country" for them. Apart from wars (the main reason for migration for Syrians, Afghans, Iranians), there are lots of migrants from Western Balkans countries who migrate because of political, social and economic instability. Those who are moving from their country of origin for the latter reason are more likely to seek jobs, avoid unemployment and poverty in host countries.

Immigration processes have multiple channels through which they can affect the economy and labour market of the receiving country. These usually include the wage determination of workers, structure and composition of the labour market, public spending, and even saving patterns of population. However, this research would rather focus on the main concerns that are usually associated with increased influx of foreigners: changes in the employment rates of the native workers and public finances, i.e. changes in the state expenses that come from the influence of in-migrants' activity.

In the light of the today's refugees' crisis and rather high rates of asylum seekers the European Union (EU) faces, the issue needs to be given more attention now. In order to clearly demonstrate potential effect immigrants may have on a host country, 17 Member States of the European Union were chosen. The selection of these particular countries was mainly predetermined by the availability of data. Nevertheless, the group of examined countries in the research includes 5 main receiving states in terms of incoming foreigners, i.e. France, Germany, Spain, Sweden, and Germany as defined by de la Rica *et al.* (2013). The analysis of potential effect of migration crisis is also crucial for the EU Member States as they choose corresponding policies.

Even assuming that in the long run, there will be another large wave of remigration, the European Union should try to make as much of the suddenly increased labour force as possible, alongside with protection of the national economy.

The research question of the thesis can be formulated in the following way: does the increased inflow of migrants has a potential to influence the host country in terms of employment of natives and cause changes which the former might bring to the scope of social protection expenditures? As the research question contains two logical parts, the corresponding hypotheses were defined as follows: 1) higher rates of immigration to EU will provide more employment opportunities for native workers, thus positively influencing the employment rates of

residents; 2) higher rates of immigration to EU will cause increase in expenses of the public sector, in particular, of social protection programs.

Most commonly used methodologies for immigration analysis usually imply OLS, 2SLS or Probit estimations. In this paper empirical estimations have been obtained by combination of two methodological approaches. As the chosen explained variables are object to influence of multiple factors, which makes extraction of appropriate and the best-fitting variables a formidable task. The methodology used to overcome the issue is Bayesian Model Averaging (BMA) that solves the problem of uncertainty associated with inclusion of certain explanatory variables. After BMA analysis, the Ordinary Least Squares (OLS) regression for the panel of 17 countries for the time span of 2002–2012 was performed. The generalized results of two methodological paths show that the increase in the immigrants' population in a host country causes statistically significant changes only in one of the examined response variables, i.e. *Total employment of citizens of the reporting country that are 15–64 years old*, which was used to approximate the employment of native population. For another dependent variable (*Total expenditures on social protection*), deviations in the number of foreigners' in the receiving country proved to be statistically insignificant.

The following chapters will mainly focus on the importance of the migrants' influxes throughout history, on migration waves, and on defining a typical immigration country. Chapter 2 will be devoted to the review of previously done research and highlighting the main channels through which foreigners are able to influence demographical structure of the native population, their employment status and changes in public expenditures, revenues and the pension system. All information about the data used in the research alongside with the theoretical models used in estimations can be found in Chapter 3. The next chapter will incorporate results of empirical estimations and their interpretations relatively to the stated hypotheses and initial research question. Chapter 5 embodies main conclusions for the examined countries with further policy recommendations.

1. Immigration within EU throughout History. The Problem of Ageing Population

1.1. Migration Waves

European countries were subject to a number of migration waves throughout history. Each of the movements was different in its nature and size, and each led to particular impacts on economies and population of the today's EU Member

States. The first influx took place in the post-war period of 1945–1950. There were observed migration flows both within and inside Europe as the majority of people had moved to the countries of their ethnical background. Moreover, the beginning of the cold war created a climate of political and economic separation for European countries. As stated by Dustmann and Frattini (2011), Germany was the country that most evidently had been affected by migration.

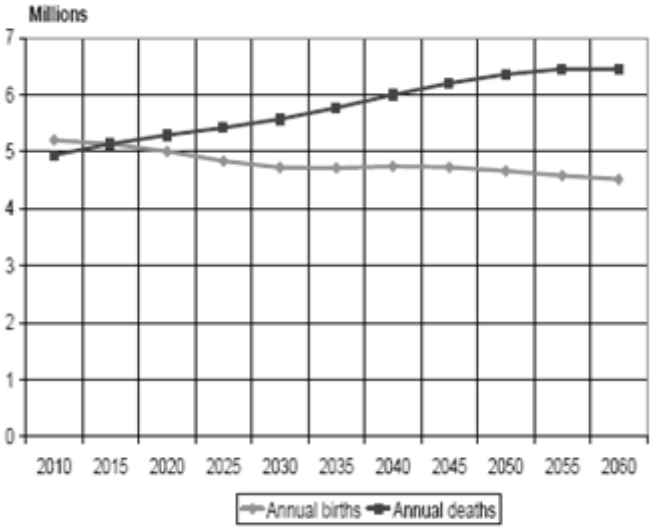
The following change in the migration patterns was caused by economic expansion alongside with the prominent shortage of labour force in several countries during 1950s–1970s. From the economic point of view, it equals the potential slowdown in economic development of any state as labour is one of the most important factors of production. In order to handle the scarcity of native workers "guest workers" program was introduced. It led to the outflow of citizens of Southern European and Mediterranean countries to states where cheap labour force was needed (for example, Germany). According to the terms of the signed bilateral contracts, foreigners were expected to re-migrate back to their home countries; however, many of them opted against it. The program was terminated by the oil crisis and overall economic downturn of 1973. By settling down in host countries, immigrants initiated the 3rd wave of migration (1973–1985) known as "family reunification". The movement is peculiar in its nature as the majority of incoming foreigners were not economic migrants but rather family members of earlier accepted guest workers. These two waves made a major contribution to today's heterogeneity of the European population in terms of ethnical background. The most distinguishing example is an enormous influx of Turkish workers to Germany, which created the largest diaspora of foreigners in the receiving country.

The fall of the Berlin Wall and instability of socio-political environment of Balkan states had led to an increase in the number of asylum-seekers and refugees coming to European countries. The former waves implied mainly movement of ethnical immigrants, but the changes in the late 1990s induced movements of aliens across countries. Thus, earlier effective immigration policies became inappropriate. This conclusion was affirmed by the intra-EU migration from newly accessed A8 Member States in 2000s. The case of migration of Polish citizens to the UK was very prominent during that period.

1.2. Ageing Population

Many EU countries are facing ageing or even double ageing of population nowadays. According to projections of the Eurostat, the number of deaths is expected to increase further, and, on the contrary, the number of births – to decrease.

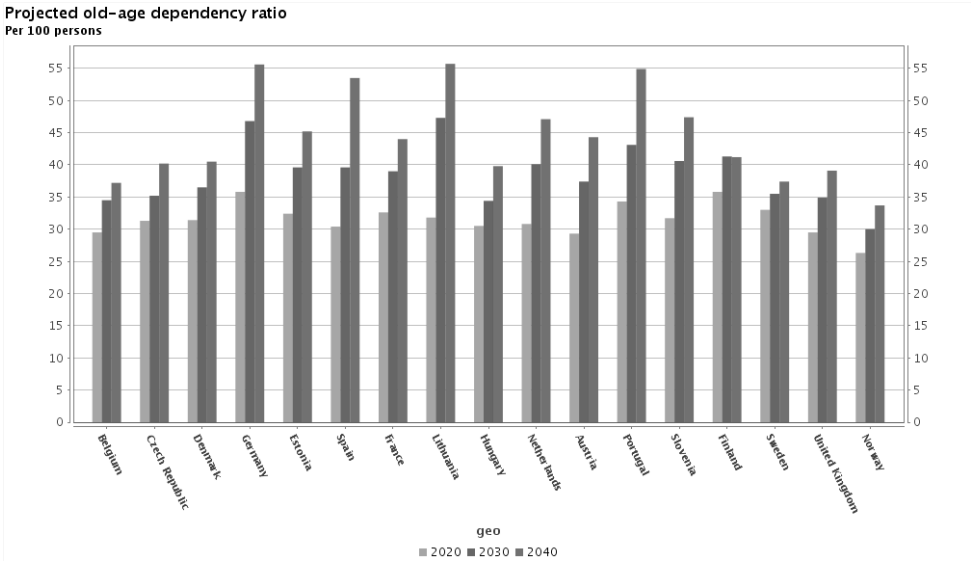
Figure 1. Births' and deaths' projections



Source: Eurostat, EUROPOP2008 convergence scenario.

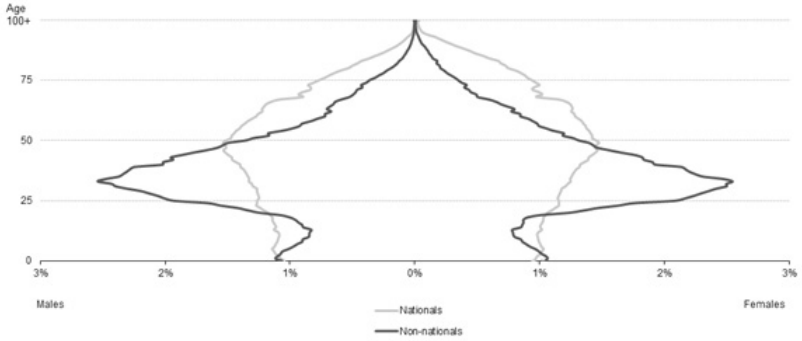
Moreover, people aged 65 and lower are presumed to constitute around 23 million. From this point of view, immigration may be beneficial to the economy as it will increase the working age population and soothe the sharp anticipated drop. As for today, the majority of asylum seekers, refugees and immigrants are originated from the Third World countries (Syria, Afghanistan, Iraq, and Libya). According to Ulrich (1994), immigrants who come from these countries are characterized by high fertility rates; hence, the short-run effect can offset the ageing of the national population in Germany. Zimmermann (2009) states that the immigrants will naturally become highly demanded on the labour markets within the EU-15 area in the nearest future as they can prevent substantial changes in the dependency ratios (ratio between population of 65+ y.o. and working-age population of 15-64 y.o.; Eichhorst *et al.*, 2011). The projections by the Eurostat indeed anticipated increase in the ration in all of the countries analysed in this paper (Figure 2). Moreover, as defined by Eichhorst *et al.* (2011), one of the responses to the demographic changes includes accepting and integrating immigrants. When looking at the age structure of natives and foreigners (Figure 3), the two groups seem to balance each other out. Nevertheless, over time foreigners are likely to experience the same ageing process due to assimilation.

Figure 2. Projected old-age dependency ratio



Source: Eurostat.

Figure 3. Age structure of EU population



Source: Eurostat.

2. Literature Review

2.1. Impact of Immigration on Employment Status of Native Workers

There are multiple channels and determinants that are needed to be taken into consideration when studying the employment effects of immigration. Despite

numerous studies, there is no ultimate conclusion on whether the impact is positive, negative or neutral. Research conducted by Borjas (1987a), Shmidt *et al*. (1994) shows that if immigrants are substitutes to natives, then the inflow of migrants may reduce the wage and hence increase the total employment. On the other hand, if the two groups have rather complementary relationships, then a higher level of in-migration will increase residents' productivity, wages and even the number of future employment opportunities. By using Granger causality test, Boubtane *et al*. estimated that immigration and unemployment do not possess Granger causality, which they explain by the "coexistence of sustainability and complementarity between migrants and residents". Moreover, previous experience and education of foreigners often decreases the degree of substitution.

The research conducted by D'Amuri and Peri (2012) for the longitudinal cross-sectional data for 14 European countries has concluded that immigration is not the reason for decline in the employment rates of natives, but rather induces a change in the structure of the labour market via creation and destruction of jobs.

Using Roy model (Roy, 1951) adapted by Borjas (1987) in order to estimate the impact of the immigrants, Schmidt (1994) has determined that the effect is minor in case of the USA but rather drastic in case of Germany. The disparities in the wage determination process along with employment tend to be different among countries. As a result, some of the national workers may be forced into unemployment because of substantial influx of foreigners; that will give a stimulus to labour unions to restrict the flow of migrants.

The impact of foreigners is determined by the level of professional skills they possess with respect to the natives and the demanded on the labour market. As it was shown by Kahanec and Zimmermann (2009), if the foreigners are classified as high-skilled workers, they are expected to decrease inequality in terms of wages, and increase career opportunities and living standards for the entire population of the given country. As the mobility of population increases, the competition among destination countries for the high-skilled foreign labour increases alongside. Razin *et al*. (2010) argue that 85% of all immigrants that are considered to be unskilled move to European countries; whereas the main competitor of Europe, USA, manages to attract more than a half of educated foreigners.

Another study by Akay *et al*. (2012) estimates that higher immigration rates induce "highly significant and positive effect on well-being of natives". By using a Probit model with several linear models, they have proved that natives observe welfare gains.

Cattaneo *et al*. have found out that increase in the share of immigrants in the European countries leads to 0.8–1.1% higher probability that a native worker will

upgrade his job in the next 2–4 years to a better paid and higher ranked one. It is explained by the fact that natives prefer competition avoidance in complementary jobs (manual and routine-intensive ones), so they upgrade their job status. In this way, immigrants create opportunities and increase demand for higher-occupational jobs that can usually be filled by natives. That effect has been considered positive, significant, and stable; it is expected to be stronger in the long run.

2.2. Impact of Immigration on Public Finance

Due to the negative changes in the demography of the EU, the pension costs are expected to increase the strain on the government spending. Immigrants can be viewed as both potential beneficiaries and contributors to public sector of the country. For example, Walmesley and Winters (2003) argue that even a slight contraction of the barriers migrants face can develop "large welfare benefits to the global economy". On the other hand, in a political economy equilibrium, even if migrants contribute more to public assistance than consume, the volume of their input is not necessarily sufficient to support the benefit ratio immediately (assuming that capital inflows are not enough to peg factor prices); hence, natives are worse-off (Razin and Sadka, 1999).

The effect of in-migration on the country depends on whether the economy may absorb newcomers without any significant structural changes. According to Preston (2014), the decision-making process in public finances depends on two issues: "preferences of the population which determine the rates of taxation" and the way the government spends its revenue. As the matter of fact, incoming migrants represent a new source of both revenue and cost for the services of state provision. For example, Boeri (2010) argues that immigrants to Scandinavian countries are less likely than natives to contribute fiscal gain; nevertheless, the opposite is true for Austria, Germany, Spain and the UK. However, the revenue immigrants bring is determined by the income they earn in the host country as well as on personal characteristics like skills and "labour market choice" (Boeri, 2010). The peculiarity of the effect immigrants have on public sector is that it strongly depends on time because of the ageing of people. The government should keep track of the age structure of the native and foreign population: today's possible gain is very probably to turn into cost in the near future. Researchers usually divide the lifetime of a person into 3 periods:

1. when one requires education and is a "cost";
2. when one is working and paying taxes, hence, he or she brings revenue fort the state;

3. when one is retiring and claiming pension which means more expenditures of the government.

Such a framework implies that even though immigration is a good tool for quick expansion of the labour force (the 2nd group), in the short run, in the light of ongoing situation of ageing population, it will drastically increase the 3rd group in the long run. Predicted population growth may be just not enough to pay the necessary amount of taxes for pensions' provision. Still, such logic is only applicable if the foreigners decide to stay in the host country after retirement; however, if they don't, it may bring substantial gains for public budget.

Razin *et. al* (2010) have developed a two-period overlapping generations model with division of population into low- and high-skilled individuals. The research's estimations show that natives benefit from higher migration independently from the skills of foreigners via an increased tax base for a given period.

According to OECD (OECD, 2014), immigrants are beneficial for the host economy as they usually receive less in the form of benefits than they pay in taxes and social contributions. However, the degree of contribution depends on the characteristics of the incoming people: the country of origin, age of arrival, labour market status and the longevity of the residence in the host country. From another perspective, migrants fall under the definition of the vulnerable group of people who have little space to build up their pension entitlements. Such a tendency is explained by the fact that the majority of them receive benefits (usually, unemployment benefits), but their prior-to-migration education level islower on average when compared to natives, and shorter time-span spent in the EU Member States, decrease their aptitude for state social assistance (Eichhorst *et al.*, 2011).

Foreigners have also an indirect channel of fiscal influence through "reshaping" savings patterns of natives. 2009 Ageing Report projects decline in the benefit ratio (average gross public pension benefit with respect to average gross wage). Therefore, citizens are likely to adapt to the expected situation by increasing their savings for retirement in order to smooth deviations in their living standards over lifetime. Nevertheless, studies that use panel data analysis show that in reality upon retirement elderly population experiences a decrease in the level of consumption. Hence, as the number of elderly people increases, domestic demand as well as aggregated consumption may fall even lower, especially in the light of low inflation rates. The phenomenon of declining consumption over a person's lifetime is referred to as a "Retirement Consumption Puzzle". Nevertheless, Battistin *et al.* (2009)and Hurd and Rohwedder (2008) claim that the drop in consumption is in line with life-cycle theory. Additionally, involuntary retirement lowers the degree of anticipated contraction of spending (Smith, 2006).

According to Galor and Stark (1990), original motivation for migration plays a crucial role in the choice of the saving pattern, i.e. higher probability of remigration causes higher propensity to save (Bauer, Sinning, 2005). Immigrants usually have lower precautionary savings due to remittances they send back to home countries (Amuedo-Dorantes, Pozo, 2002). According to Kirdar (2010), people who come to Germany tend to save substantial amounts upon their arrival to the country to take the most of their purchasing power when going back to their home countries. In terms of Pension Insurance (PI) system, age is an important determinant: older immigrants have shorter contribution periods due to lower wages and the part of their work life spent as unemployed. In comparison to the Unemployment Insurance (UI), age is insignificant, despite high unemployment rates of immigrants. Kirdar explains the finding by the fact that returned migrants made high contributions to UI on average.

By definition, foreigners represent a different ethnic background; thus, they enhance the level of impact of fractionalization. It implies the degree of heterogeneity of immigrants' population. The importance of fractionalization lies in the particular preferences and incomes of various ethnic groups and their impact on several characteristics of labour market institutions. The effect is usually difficult to estimate, which makes it quite problematic to "pool resources together to provide public goods" (Kim, 2006).

One of the tools that can be implemented by individual governments of Member States of the European Union is the counterfactual policy which implies cash payments for unemployed arrives conditional on remigration. Kidar (2010) states that given high immigrants' unemployment in Germany, giving one-time bonuses instead of extended unemployment benefits may be a successful policy. His findings estimate that such a policy would be totally ineffective to all immigrants regardless of their country of origin. However, as the structure and characteristics of migrants in Germany are undergoing changes, it would make sense to continue the analysis further.

A less evident but important change that can bring fiscal benefit to a country can be done in terms of loosening or tightening restrictions for entering immigrants. By employing cross-sectional data for 14 EU and 12 OECD members and grouping them into free-migration and policy-controlled pairs, Cohen and Razin (2008) have found out that in countries with "free migration" policy the generosity of welfare state adversely impacts the skill structure of immigrants. However, other findings state that loosening limitations for incoming foreigners may benefit the state economy through diminishing fiscal burden caused by retirement of baby boomers in a minor way (Lee, Miller, 2000).

3. Data and Methodology

3.1. Data

The conducted research uses annual panel data for 17 countries that covers the time period of 2002–2012. In order to construct more comprehensive model and increase the degree of accuracy of the results several EU member states have been selected with the assumption that the ultimate result will be relatively the same. It is quite a challenging task to obtain the data for all desired regressors to perform tests for time-series data which explains the panel structure. Additionally, it gives more thorough results, as by definition it maximizes the number of individual observations. The chosen group of the countries does not incorporate observations for all Member States as the matching data for them have numerous missing values, thus making the estimation less thorough. Another shortcoming of the available data arises when estimating the model for influence on natives' employment. There is no differentiation between levels of skills possessed by foreigners in the paper. Thus, the results can turn out to be quite general.

Another issue worth mentioning lies in the nature of immigration flows. Even though the majority of foreigners came to receiving countries on legal terms with officially documented status of migrants, there is still a share of those who did not fulfill official requirements. For example, in 2008, 0.4–0.8 % of total population and 6.7–13.2 % of total foreign population within the EU are undocumented migrants (Kovacheva and Vogel, 2009). Following this logic, the problem should be more relevant in case of incoming refugees, as the data on them has been used as a proxy for the inflow of foreigners.

As the area of research interest lies in the labour market and fiscal determinants, the data obtained is quite restricted which affected the choice of cross-sections used. The full list of the variables used in the regression, their abbreviations and units of measurement can be found in internet appendix (Sources: Eurostat database; World Bank database). Some of the variables have been excluded due to close interrelations or similarity of their meaning with others, independently from BMA estimations.

As the paper is involved in estimating the influence of foreigners on two economic aspects of a host country for immigrants, both dependent and independent variables will be different. *Total employment of citizens of the reporting country that are 15-64 years old* is the explanatory variable for the first regression. It includes information within the reference week about the number of people who work for pay, profit or family gain independently from the amount of hours worked; or people who were not permanently absent from work due to a number of substantial reasons (Eurostat). The second independent variable

that corresponds to the interest in the fiscal impact is *Total expenditures on social protection*. It measures "all interventions from public or private bodies intended to relieve households and individuals" that are perceived as being at either of the following risks: sickness/health care, disability, old age, survivors, family/children, unemployment, housing and social exclusion (Eurostat). As immigrants are expected to be in need for state help in at least half of these risks, it was assumed that this is the best possible measurement that can be used, taking into account the degree of available data.

The data that represents the changes in foreigners over time comparatively to the total population of a given country corresponds to the number of refugees by the country of asylum. One of the reasons for such a decision is that, on average, refugees are likely to demonstrate the most significant influence on both of the variables of interest; they may be responsible for the changes in the structure of social expenditures, alongside with influencing the labour markets, as receiving countries are usually interested in fast foreigners' integration. Foreigners that are considered to be refugees (*Refugee*) are those who were rewarded the humanitarian status under the 1951 Convention Related to the Status of Refugees or its 1967 Protocol. These people are object to temporary protection (World Bank). Other independent variables include *GDP*, *Total population*, *Total receipts from taxes and social contributions*, *Foreign population*, *Compensations of employees*, *Employed persons with tertiary education*, *Self-employed persons*, *Tax rate for a single person without children (67% of AW)*, *R&D expenditures*, *Gross disposable income of households, Thousands of hours worked in all NACE activities, Total general government expenditure,* and their *Final consumption expenditure*.

In order to provide a more coherent and consistent empirical estimation, all of the variables except for one have been formed by using the Eurostat database. The data that contains information on the changes in the number of refugees has been obtained from the World Bank database, as it has provided my research with the needed number of observations.

3.2. Methodology

There are two commonly used methodological approaches applied to estimate the influence of immigrants on the level of employment. One of them, developed by Altonji and Card (1991) and Borjas *et al*. (1997), is referred to as *spatial correlation approach* thus implied analysis of changes on regional level. *Structural skill-cell correlation approach* (Borjas, 2003) where workers are distinguished basing on their skills and education is another one used by researchers. As both

of the approaches require rather detailed and hardly obtainable data, this paper was based on quite an unconventional methodology.

It is fairly difficult to assess which regressors have major impact on the variables of interest, i.e. employment of natives and expenditures on social protection, as there are a lot of them. In order to make the empirical estimation more accurate to choose true regression model and include "open-endedness" of the theory behind them (Brock, Durlauf, 2001), there has been applied a special case of Bayesian Averaging of Classical Estimates, Bayesian Model Averaging (BMA), which uses "Zellner's *g* prior" as an information criterion about the degree of pre-estimation uncertainty (Leamer, 1978; Sala-i-Martin *et al.*, 2004). The BMA uses ordinary least squares (OLS) estimates in order to present minimum prior information of measured variables as well as their distribution. The sum of the obtained posterior weights of the model with regressors is referred to as Posterior Inclusion Probability (PIP). It reflects the importance of an exposure variable on the regressand (-s) in a given model. The measurement is assumed to be very effective in case of "policy making, inference and prediction" (Doppelhofer, Weeks, 2009). More detail explanation of Bayesian model averaging can be found in Beck (2017a, 2017b, 2018a, 2018b and 2018c).

The general form of the regression model I will be using in my research is the following:

$$y_j = \alpha_j + \beta_j X_j + \varepsilon_j \quad (1)$$

where *yj* is a vector of dependent variables, *j* (*j*=1, 2,..,m) stands for the number of the examined model, α_i represents a constant, β_j is a vector of unknown parameters which points to the effects of the variables included in the regression model, X_j is a matrix of independent variables, and ε_j stands for the vector of residuals which are considered to be normally distributed $\varepsilon \sim N(0, \sigma^2 I)$ with variance σ^2 and conditionally homoskedastic.

Depending on the number of considered independent variables, the model space will differ: a model with *K* exposure variables will yield up to 2^K possible model combinations. Another idea of BMA is that in each considered model M_j all controlled variables are assigned with certain values depending on whether they are relevant or not. Those values are represented by the binary vector (k×1) $\varphi = (\varphi_1, \varphi_2, ..., \varphi_K)$, where a zero value stands against inclusion of a regressor, and one – otherwise.

Assuming that the model contains a lot of independent variables; it creates a potentially large model space. The parameters may be obtained by merging all aspects of uncertainty via estimating a posterior density $P(\beta \mid M_j, y)$:

$$P(\beta \mid y) = \sum_{j=1}^{2^K} P\left(\beta \mid M_j, y\right) * P\left(M_j \mid y\right) \quad (2)$$

$P\left(\beta \mid M_j, y\right)$ in the expression above represents the conditional distribution of β for a model M_j, whereas $P\left(M_j, y\right)$ shows a posterior model probability (PMP) that covers the uncertainty of posterior distribution. Using Bayes' rule it can be re-written as

$$PMP = p\left(M_j \mid y\right) = \frac{I\left(y \mid M_j\right) * p\left(M_j\right)}{p\left(y\right)} \quad (3)$$

$$P(\beta \mid y) = \sum_{j=1}^{2^K} P\left(\beta \mid M_j, y\right) * P\left(M_j \mid y\right) \quad (4)$$

Thus, the weight (PMP) can be acquired and it appears to be proportional to the product of the marginal likelihood $I\left(y \mid M_j\right)$ and prior model probability $p\left(M_j\right)$.

By normalizing the weights relatively to the set of all possible models one can modify them into probabilities:

$$P\left(M_j \mid y\right) = \frac{I\left(y \mid M_j\right) * P\left(M_j\right)}{\sum_{j=1}^{2^K} I\left(y \mid M_j\right) * P\left(M_j\right)} \quad (5)$$

In order to use BMA, a prior structure for parameters is needed to be established as well. Normal distribution of the slope coefficient β with zero mean and variance of $\sigma^2 V_{oj}$ is represented below:

$$P\left(\beta \mid \sigma^2, M_j\right) \sim N\left(0, \sigma^2 V_{oj}\right) \quad (6)$$

The pre-estimation V_{oj} matrix is assumed to be proportional to the sample covariance:

$$V_{oj} = (g_0 X_j' X_j)^{-1} \quad (7)$$

that includes g_0 prior parametersuggested by Zellner (1986) which stands for the presence of model uncertainty. Even though there are 9 distinct tested representations of g prior, I will be using the unit information prior (UIP) which defines g_0 as $1/n$ where n stands for the number of regressors. Hence, additional observations carry an extra unit of information on values of β; as the number of observation increases the value of the prior approaches zero.

The prior probability for a model includes the assumption of the same pre-estimation inclusion probability for all variables via using uniform priors and

using the same hyper-parameter. In case of [0;1] β-distribution, the probability of models of any size is exactly the same; hence, the prior probability of inclusion yields to 0.5. The value originates from the expected model size, i.e. *K/2* and the probability of inclusion of regressors *K* in the model [*(K/2)/K= 0.5*].

$$P\left(M_j\right) \propto \Gamma\left(1+k_j\right)*\Gamma\left(\frac{K-Em}{Em}+K-k_j\right) \quad (8)$$

The forthright method of calculating the unconditional mean and variance of β-s is unrelated to the size of the model and can be written as:

$$PM = E\left(\beta_i \mid y\right) = \sum_{j=1}^{2^K} P\left(M_j \mid y\right) * \hat{\beta}_{ij} \quad (9)$$

where $\hat{\beta}_{ij} = E(\beta_i \mid y, M_j)$ stands for the OLS estimator of slope β in a given model M_j. The slope's posterior standard deviation is given by:

$$PSD = \sqrt{V\left(\beta_i \mid y\right)} =$$
$$= \sqrt{\sum_{j=1}^{2^K} P\left(M_j \mid y\right) * V\left(\beta_j \mid y, M_j\right) + \sum_{j=1}^{2^K} P\left(M_j \mid y\right) * \left[\hat{\beta}_{ij} - E(\beta_i \mid y, M_j)\right]^2} \quad (10)$$

where $V\left(\beta_i \mid y\right)$ stands for the conditional variance of a given model.

As the paper is focused on further advice for policy making, the most important BMA statistic is PIP (posterior inclusion probability). It indicates whether the controlled variable x_i is compatible in explaining the response variable conditional on the data, but unconditional on the model space ($\varphi_i = 1$ if the variable should be included):

$$\left(x_i \mid y\right) = \sum_{j=1}^{2^K} I\left(\varphi_i = 1 \mid y, M_j\right) * P\left(M_j \mid y\right) \quad (11)$$

Upon applying the BMA for all of the explanatory and explained variables a "true" model that includes the most appropriate regressors of the highest PIPs can be defined:

$$= \beta_0 + \beta_1 x_i + \quad (12)$$

where stands for the vector of the variables of interest, is the vector that represents all of the regressors used, $_0$ is the intercept, β_1 is a vector with regression coefficients and u_i is the error term.

Afterwards, the analysis will proceed with two OLS regressions for the matching dependent variables and use either Fixed or Random Effect specification for

both cross-sections and periods in order to determine whether the immigrants impose statistically significant effects on my variables of interest.

Panel OLS regression will conduct regression analysis for the following function in general form:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \ldots + \beta_k X_{kit} + u_{it} \quad (13)$$

where *i* represents cross-sectional units (countries, in my model), *t* is a time identifier, *X* and *Y* stand for vectors of independent and dependent variables, respectively. Classical assumption incorporates non-stochastic error term that follows normal distribution $E(u_{it}) \sim N(0, \sigma^2)$. However panel data structure is often object to correlated error terms within both units (here: countries) and time as it can include unobserved time constant variable ε_i and error term that is uncorrelated with al regressors. Hence, the equation (13) will be more appropriate to re-write as:

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \ldots + \beta_k X_{kit} + \omega_{it} \quad (14)$$

where

$$\omega_{it} = \varepsilon_i + u_{it} \quad (15)$$

ε_i stands for the latent or unobserved constant over all periods of time t, i.e. cross-section error, whereas u_{it} represents time varying idiosyncratic error term (Gujarati, 1995). Summing up these two parameters one gets a composite error term that is typical for panel data estimations.

In order to eliminate the problem, the Hausman test will be performed aiming to estimate which approach to use further, i.e. Fixed or Random Effect. The Fixed Effects method is used to transform the model through exclusion of unobserved error term. However, Random Effects approach melds the data by partial "demeaning" of each variable and making more stringent assumption of non-present bias. Moreover, unit root tests for all of the variables will be performed in order to estimate whether the potentially observed changes are permanent or transitionary. The homogeneous (with common unit root process) test assumes common autoregressive structure for all of the series (Levin *et al.* 2002) and has a null hypothesis of a unit root, respectively. In order to test for unit root in panel data, there will be used PP Fisher Chi-square statistics which combines p-values individual cross-sectional unit root tests. The null hypothesis is the same as in the common unit root process.

4. Empirical Estimations

There were nine regressors tested for the dependent variable of *Total employment of citizens of the reporting country that are 15–64 years old* and 10 for *Total expenditures on social protection* by using Bayesian Model Averaging. The variables included in the full list but not tested in the final BMA were forgone as they showed low values of PIPs or were closely related to each other, whereas the kept variables in primary tests with various combinations of regressors were relevant for the model.

Even though in the final OLS regressions the panel data is used, it is impossible to perform BMA for this type of data because of technical restriction of the used software for the sampling. In order to somehow approximate the results, the cross-sectional data for 17 countries for the year of 2011 was employed: the data for this period contained maximum observations for all of the prior regressors. The main focus of the research is limited to the usage of a uniform prior. Nevertheless, adoption of the random prior and comparison of both results can serve as a determinant of robustness. Assuming there is no much of a change in inclusion probabilities in prior relevant variables obtained, estimations are robust for the regressors of relatively high PIPs, whereas the opposite is true for those that possess lower PIP coefficients.

Taking into consideration the binary representation of all models included, the regressors have been chosen for later analysis; those that are indicated as relevant in at least one of the 5 best models possible have been kept for OLS regressions.

4.1. Results of Bayesian Model Averaging (BMA)

4.1.1. Total Employment of Citizens of the Reporting Country

The output of BMA using the uniform prior shows that when the dependent variable is *Total employment of citizens of the reporting country that are 15–64 years old* is represented in the table 1.

Table 1. Coefficient Results of BMA with Dependent Variable *Total employment of citizens of the reporting country that are 15–64* years old when using a Uniform Prior

Variable	PIP	PostMean	Post SD	Cond.Pos.Sign
ThousHoursT	0.6374	0.0003	0.0003	1.0000
ConsExp	0.3135	0.0034	0.0158	0.7622
RealDispInc	0.3081	0.0039	0.0140	0.8958
GDP	0.2679	0.0015	0.0066	0.8826
GenGExp	0.2456	-0.0008	0.0085	0.4839
RDExp	0.2354	0.0105	0.1005	0.7952
Refug	0.2244	0.0011	0.0085	0.7870
TertT	0.2055	0.6724	6.2250	0.7887
TaxSingle	0.2042	-0.9372	57.3973	0.5793
Mean	2.642		Model g-Prior	Uniform
Modelspace	512			

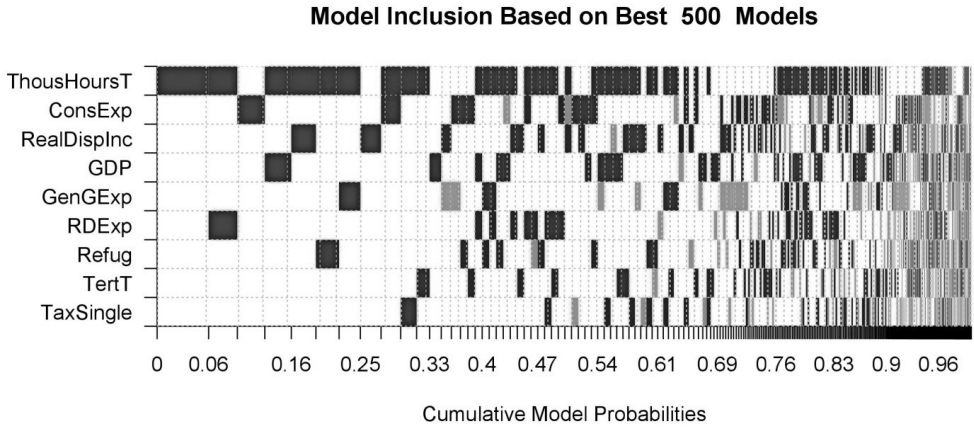
Source: author's estimations by using BMS package in R software.

In the model, *Thousands of hours worked in all NACE activities*, *Final consumption expenditures by the households, Gross disposable income of households,* and *GDP* regressors have comparatively large coefficients. This is an indication of potential importance of the dependent variable in the model: 63.7%, 31.4%, 30.1%, and 26.8% of all posterior model mass lies within models that contain mentioned variables, respectively. However, the PIPs of the rest of the regressors, i.e. *Refugee population, Total intramural R&D expenditure, Total general government expenditure, Employees with a second job and tertiary education* and *Tax rate on a single person without children (67% of AW)* seem to be of approximately the same importance and should be included in around 20-25% of all posterior model mass.

The 5th column (Cond. Pos. Sign.) presents the "posterior probability of a positive coefficient expected value conditional on inclusion" or, in other words, a "sign of uncertainty" (Doppelhofer, Weeks, 2009). The values for all of the independent variables for this determinant are in the range of [0.5; 1], hence, they have a positive impact on the variable of interest in the majority of regarded models. A more comprehensive overview of the sign of uncertainty is reflected

in the graph below, where the blue colour corresponds to a positive coefficient and red – to negative, and white corresponds to non-inclusion; the horizontal axis is used for scaling the models by their PIPs and the vertical axes lists used explanatory variables.

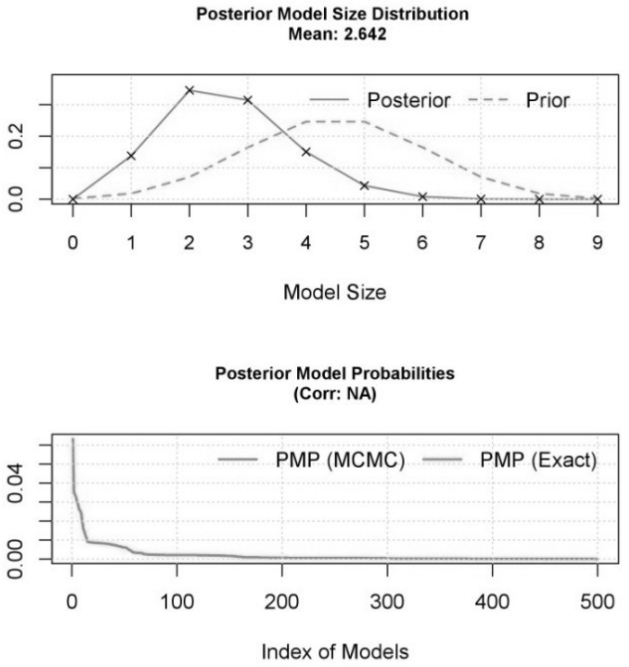
Figure 4. Model Inclusion Based on Best 500 Models with Dependent Variable *Total employment of citizens of the reporting country that are 15–64* years old when using a Uniform Prior



Source: author's estimations by using BMS package in R software.

Another characteristic of the model with a given explained variable is prior and posterior distribution. Prior distribution is always a symmetric one around the value $K/2=5$, where K stands for the number of regressors. Nevertheless, after performing the BMA, posterior distribution turns out to be skewed to the models that contain 2 or 3 regressors. Such a tendency towards more parsimonious models is a potential indicator for consideration of other priors besides the used uniform one. The chart below displays the absence of the dissonance between iteration count frequencies and analytical PMPs as it contains perfect degree of convergence. By using the Markov chain Monte Carlo method (MCMC), the analysis has been allowed to achieve samples from an arbitrary posterior density, approximate the expectations of quantities of interest, and the method assured the convergence to the desired distribution under broad conditions.

Figure 5. Posterior Model Size Distribution and PMP with Dependent *Variable Total employment of citizens of the reporting country that are 15–64* years old when using a Uniform Prior



Source: author's estimations by using BMS package in R software.

Taking into account the results of posterior model size distribution, the random prior has been used in order to check the results for robustness depending on whether the results will be substantially different from the ones with uniform prior. The coefficient results for the most relevant variables did not deviate much; however, *Refugees' population, Total intramural R&D expenditure, Total general government expenditure, Employees with a second job and tertiary education* and *Tax rate on a single person without children (67% of AW)* regressors are included in almost a half of posterior mass models). As suggested by Ley and Steel (2009), random prior is less tight as it lowers the risk of unintended aftermath from using a particular prior model size, which leads to a much smaller model sized (2.642 comparatively to 1.7458), hence, many variables of initially low degree of relevance become even less important. Nevertheless, the results that were accumulated when using uniform prior will be used further in order to obtain a more comprehensive view on the model that is of a bigger size and

considers the most important for the research independent variable *Refugees' population* as rather relevant.

In order to sort through the remaining regressors, one can take a look at the binary representation for 5 best performing models. According to Table 2, the final regression for the variable of interest in this case should include *GDP, Total intramural R&D expenditure, Thousands of hours worked in all NACE activities, Final consumption expenditures by the households, Gross disposable income of households*. Even though *Refugees' population* does not appear in the best performing models it, will still be incorporated in the OLS regressions.

Table 2. Best Performing Models with Dependent Variable *Total employment of citizens of the reporting country that are 15–64 years old* when using a Uniform Prior

	Model 80	**Model 84**	**Model 1**	**Model 180**	**Model 82**
GDP	0.0	0.0	0.0	1.0	0.0
ThousHoursT	1.0	1.0	0.0	1.0	1.0
Refug	0.0	0.0	0.0	0.0	0.0
GenGExp	0.0	0.0	0.0	0.0	0.0
TertT	0.0	0.0	0.0	0.0	0.0
TaxSingle	0.0	0.0	0.0	0.0	0.0
RDExp	0.0	1.0	0.0	0.0	0.0
RealDispInc	0.0	0.0	0.0	0.0	1.0
ConsExp	0.0	0.0	1.0	0.0	0.0
PMP (Exact)	0.0632	0.0353	0.0338	0.0325	0.0302
PMP (MCMC)	0.0632	0.0353	0.0338	0.0325	0.0302
Model g-Prior	Uniform				

Source: author's estimations by using BMS package in R software.

4.1.2. Total Expenditures on SocialPprotection

After testing the response variable *Total expenditures on social protection* with a uniform prior, the following coefficients were obtained:

Table 3. Coefficient Results of BMA with Dependent Variable *Total expenditures on social protection* when using a Uniform Prior

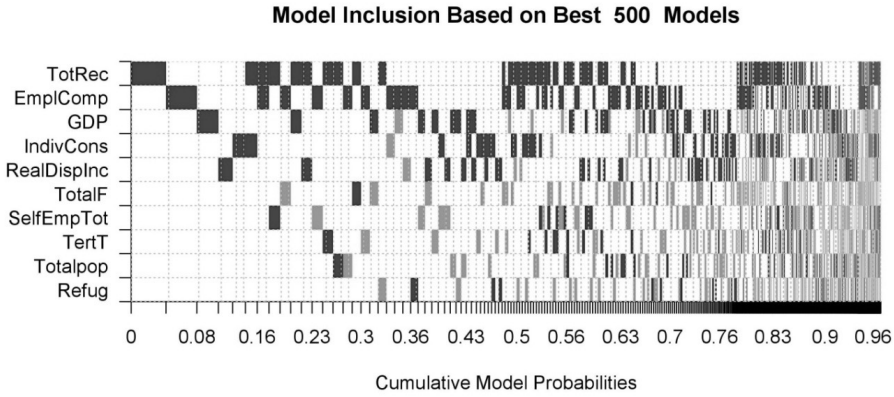
Variable	PIP	PostMean	Post SD	Cond.Pos.Sign
TotRec	0.3953	0.2101	0.3874	1.0000
EmplComp	0.3628	0.2454	0.6179	1.0000
GDP	0.2983	0.0352	0.2537	0.7204
RealDispInc	0.2611	0.0432	0.2819	0.6944
IndivCons	0.2598	0.0395	0.2473	0.7591
SelfEmpTot	0.2298	-4.1333	35.1764	0.3193
TotalF	0.2289	-0.0028	0.0128	0.0901
TertT	0.2129	-12.2089	153.3702	0.3607
Totalpop	0.2122	0.0000	0.0027	0.4058
Refug	0.1993	-0.0043	0.1296	0.2947
Mean	2.6603		Model g-Prior	Uniform
Modelspace	1024			

Source: author's estimations by using BMS package in R software.

In this case, there are three prominently important regressors: *Total receipts form taxes and social contributions, Compensation of employees* and *GDP*; those account for 39.5%, 36.3% and 29.8% of all posterior model mass that includes the variables. The output is quite similar to the first performed BMA for another dependent variable as the remaining predictor variables, i.e. *Actual individual consumption, Gross disposable income of households, Total population, Self-employed persons from15–64 y.o., Foreign population on 1 January, Refugees' population* and *Tax rate on a single person without children (67% of AW),* share almost the same PIP of 20–25%.

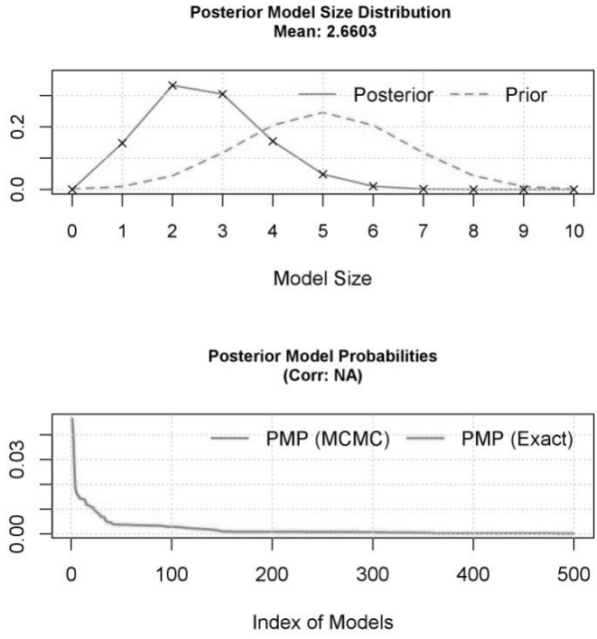
Distinctively from previous estimations, the regressors in this model have various channels of influence on the dependent variable of expenditures. The 5th column indicates that apart from *Total receipts from taxes and social contributions, Compensation of employees, GDP, Actual individual consumption* and *Gross disposable income of households,* the remaining regressors have rather negative influence as their values are lower than 0.5. Complete overview is reflected in the chart below where one can clearly see the 'sign uncertainty' and measurement of models by their posterior inclusion probabilities.

Figure 6. Model Inclusion Based on Best 500 models with Dependent Variable *Total expenditures on social protection* when using a Uniform Prior



Source: author's estimations by using BMS package in R software.

Figure 7. Posterior Model Size Distribution and PMP with Dependent Variable *Total expenditures on social protection* when using a Uniform Prior



Source: author's estimations by using BMS package in R software.

The next step included checking whether the uniform prior is appropriate for the BMA for the explained variable. Once more, instead of being dense around the prior mean of 5, the posterior distribution deviates to 2–3 regressors. Via

using the MCMC sampling, the Exact and MCMC posterior model probabilities converge and show no sign of discord.

Due to the fact that output of posterior model size distribution is not dense around its mean, the prior was loosened by substituting it on a random one. Upon implication of the prior, the mean of the model decreased from 2.6603 to 1.6144 and the proposed number of regressors to be included yielded to 1. *Total receipts from taxes and social contributions, Compensation of employees* and *GDP* kept the characteristics of high posterior inclusion probability, whereas the other variables experienced the decline in the coefficient by nearly 50%. As for the final decision, the research will stick to using the results acquired when using the uniform prior for the same reasons as in the 1st BMA.

The binary representation for the five best performing models is reflected in the following table. It states that *GDP*, *Total receipts form taxes and social contributions*, *Actual individual consumption*, *Compensation of employees,* and *Gross disposable income of households* are the most relevant regressors for the model.

Table 4. Best Performing Models with Dependent Variable *Total expenditures on social protection* when using a Uniform Prior

	Model 100	Model 10	Model 200	Model 2	Model 20
GDP	0.0	0.0	1.0	0.0	0.0
TotRec	1.0	0.0	0.0	0.0	0.0
Totalpop	0.0	0.0	0.0	0.0	0.0
TotalF	0.0	0.0	0.0	0.0	0.0
IndivCons	0.0	0.0	0.0	0.0	1.0
EmplComp	0.0	1.0	0.0	0.0	0.0
SelfEmpTot	0.0	0.0	0.0	0.0	0.0
Refug	0.0	0.0	0.0	0.0	0.0
RealDispInc	0.0	0.0	0.0	1.0	0.0
TertT	0.0	0.0	0.0	0.0	0.0
PMP (Exact)	0.0449	0.0397	0.0277	0.0185	0.0165
PMP (MCMC)	0.0449	0.0397	0.0277	0.0185	0.0165
Model g-Prior	Uniform				

Source: author's estimations by using BMS package in R software.

However, the *Refugees' population* regressor will still be included in order to proceed with the stated second hypothesis of the research and perform the OLS regression to estimate the effect of refugees on the given explained variables.

4.2. Results of Ordinary Least Squares (OLS) Regression

4.2.1. Total Employment of Citizens of the Reporting Country

Using the results of BMA estimations, the following two models were constructed. The first one corresponds to testing the first stated hypothesis of the research:

$$\begin{aligned} Total employment of citizens of the reporting country, 15-64\ y.o._i \\ = \beta_1 + \beta_2 GDP_i + \beta_3 Total intramural R\&D expenditure_i \\ + \beta_4 Thousands of hours worked in all NACE activities_i \\ + \beta_5 Refugees' population_i + u_i \end{aligned}$$

As it was previously mentioned in the methodology, panel data structure faces problems with unit root and unobserved constant presence. Thus, prior to the OLS regression, I performed the unit root test for common and individual unit root processes. The results show that all of the variables contain individual unit root process as P-value exceeds the 0.05 value. Upon applying first differences, there is no longer sign of the non-stationary process except for the variable *Compensation of employees,* the P-value of which is on the margin of rejecting unit root. Nevertheless, the analysis will proceed with the 1st differences when executing OLS regression. For easier and more comprehensive interpretation of results, the models were transformed into log-log form, so that the coefficients will stand for the percentage change in the dependent variable caused by a 1% increase/decrease in any of the regressors.

The initial results of the OLS regression are presented in the table below.

Table 5. OLS Regression for the Dependent Variable *Total employment of citizens of the reporting country that are 15–64 years old*

Dependent Variable	**DLOG(TOTEMPREP)**			
Periods included	10			
Cross-sectionsincluded	17			
Total panel observations	169			

Dependent Variable	DLOG(TOTEMPREP)			
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
C	-0.001413	0.001387	-1.018319	0.3100
DLOG(GDP)	0.016280	0.024686	0.659507	0.5105
DLOG(RDEXP)	0.020896	0.015073	1.386281	0.1675
DLOG(THOUSHOURST)	0.530018	0.047886	11.06827	0.0000
DLOG(REFUG)	-0.008622	0.003701	-2.329300	0.0211
R-squared	0.632357	Mean dependent var	0.000880	
Adjusted R-squared	0.623390	S.D. dependent var	0.020815	
S.E. of regression	0.012774	Akaike info criterion	-5.853724	
Sum squared resid	0.026759	Schwarzcriterion	-5.761123	
Log likelihood	499.6396	Hannan-Quinncriter.	-5.816145	
F-statistic	70.52119	Durbin-Watsonstat	1.749757	
Prob (F-statistic)	0.000000			

Source: author's estimations by using EViews package.

Due to the fact that there is a certain probability of latent cross-sectional error term in the model, the Hausman test with null hypothesis stating that random effects are appropriate in a given model was performed. The results of the test for the first regression suggest that Random Effects approach would be more appropriate as the P-value=0.0913, which accepts the null hypothesis.

Table 6. Hausman Test for the Model with Dependent Variable *Total employment of citizens of the reporting country that are 15–64 years old*

		Chi-Sq. Statistic	**Chi-Sq. d.f.**	**Probability**
Test summary		8.006303	4	0.0913
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var (Diff.)	Probability
DLOG(GDP)	0.030788	0.019303	0.000043	0.0793
DLOG(RDEXP)	0.017185	0.020083	0.000089	0.7591
DLOG(THOUSHOURST)	0.501844	0.524278	0.000664	0.3840
DLOG(REFUG)	-0.011208	-0.009155	0.000002	0.1190

Source: author's estimations by using EViews package.

The final OLS regression with Random Effects to "demean" each variable can be performed to determine the impact of the regressors on *Total employment of citizens of the reporting country that are 15–64 years old*.

Table 7. OLS Regression for the Dependent Variable *Total employment of citizens of the reporting country that are 15–64 years old u*sing Random Effects

Dependent Variable	**DLOG(TOTEMPREP)**			
Periods included		10		
Cross-sections included		17		
Total panel observations		169		
Method		Panel EGLS		
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
C	-0.001474	0.001470	-1.002218	0.3177
DLOG(GDP)	0.019303	0.024206	0.797473	0.4263
DLOG(RDEXP)	0.020083	0.015121	1.328157	0.1860
DLOG(THOUSH-OURST)	0.524278	0.047699	10.99145	0.0000
DLOG(REFUG)	-0.009155	0.003646	-2.510859	0.0130
Effects Specification	S.D.	Rho		
Cross-section random	0.002092	0.0276		
Idiosyncratic random	0.012420	0.9724		
Weighted Statistics				
R-squared	0.636547	Mean dependent var	0.000779	
Adjusted R-squared	0.627683	S.D. dependent var	0.020601	
S.E. of regression	0.012570	Sum squared resid	0.025913	
F-statistic	71.80695	Durbin-Watson stat	1.803066	
Prob (F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.632276	Mean dependent var	0.000880	
Sum squared resid	0.026765	Durbin-Watsonstat	1.745660	

Source: own estimations by using EViews package

t-Statistics indicate that out of 4 regressors only 2 are statistically significant. In case the number of *Thousands of hours worked* increases by 1%, the *Total Employment of Citizens of the Reporting country* will also increase by almost 0.52%. The result is quite predictable as the number of hours and employment rates are closely related and determine each other to some extent. *Refugees' population* variable turned out to be statistically significant at 5% level. Hence, if the population of refugees increases by 1% in a given country, it will experience decrease in employment of 0.009%. The effect does not seem to be drastic; however, from a statistical point of view, it is relevant. The estimated impact of the regressor on the explained variable is not in line with my initial hypothesis that an enhanced influx of migrants creates more employment opportunities for residents and consequently increases their employment rates. Additional statistics presented in the regression output are R^2 and R^2 adjusted. Both of them indicate that the model explains near 63% of the variation in the data; the result is moderate and rejects the problem of potential spurious correlation. Moreover, a slight increase in the value of adjusted can be seen after using Random Effects. Thus the second model has higher explanatory power.

4.2.2. Total Expenditure on Social Protection

The next OLS regression is aimed to detect whether the *Refugees' population* has statistically significant impact on the *Total expenditure on social protection*.

$$\begin{aligned} &\textit{Total expenditure on social protection}_i \\ &\quad = \beta_1 + \beta_2 \textit{Total receipts from taxes and social contribution}_i \\ &\quad + \beta_3 GDP_i + \beta_4 \textit{Compensation of employees}_i \\ &\quad + \beta_5 \textit{Refugees' population}_i + u_i \end{aligned}$$

The results acquired after execution of the regression without Fixed/Random effects' approaches are reflected in the following table. The regressor of my interest appears to be insignificant for the explained variable.

Table 8. OLS Regression for the Dependent Variable *Total expenditures on social protection*

Dependent Variable	**DLOG(TOTEXP)**		
Periods included	10		
Cross-sections included	17		

Dependent Variable		**DLOG(TOTEXP)**		
Total panel observations		170		
Variable	**Coefficient**	**StandardError**	**t-Statistic**	**Probability**
C	0.027330	0.002962	9.226497	0.0000
DLOG(GDP)	-0.649488	0.139843	-4.644412	0.0000
DLOG(TOTREC)	0.085664	0.100642	0.851171	0.3959
DLOG(EMPLCOMP)	1.130630	0.107320	10.53515	0.0000
DLOG(REFUG)	0.006858	0.009212	0.744418	0.4577
R-squared	0.595794	Mean dependen tvar	0.049677	
Adjusted R-squared	0.585995	S.D. dependent var	0.049921	
S.E. of regression	0.032121	Akaike info criterion	-4.009669	
Sum squared resid	0.170236	Schwarz criterion	-3.917439	
Log likelihood	345.8218	Hannan-Quinncriter	-3.972243	
F-statistic	60.80203	Durbin-Watsonstat	1.479917	
Prob (F-statistic)	0.000000			

Source: own estimations by using EViews package.

Notwithstanding, being aware of potential presence of unobserved cross-section constant, the Hausman test will be used once again. Its results suggest that with P-value being equal to 0.0359, the null hypothesis of Random Effects is rejected.

Table 9. Hausman Test for the Model with Dependent Variable *Total expenditures on social protection*

		Chi-Sq. Statistic	**Chi-Sq. d.f.**	**Probability**
Test summary		10.286085	4	0.0359
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Probability

DLOG(GDP)	-0.677786	-0.649488	0.000232	0.0631
DLOG(TOTREC)	0.095642	0.085664	0.000135	0.3910
DLOG(EMPLCOMP)	1.106250	1.130630	0.000419	0.2337
DLOG(REFUG)	0.000448	0.006858	0.000009	0.0308

Source: own estimations by using EViews package.

Using OLS regression with Fixed Effects for both cross-section and period, the following yields were obtained.

Table 10. OLS Regression for the Dependent Variable *Total expenditures on social protection* with Fixed Effects

Dependent Variable	**DLOG(TOTEXP)**			
Periods included	10			
Cross-sectionsin cluded	17			
Total panel observations	170			
Method	Panel Least Squares			
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
C	0.029003	0.002979	9.734608	0.0000
DLOG(GDP)	-0.677786	0.138645	-4.888650	0.0000
DLOG(TOTREC)	0.095642	0.099857	0.957793	0.3397
DLOG(EMPLCOMP)	1.106250	0.107720	10.26965	0.0000
DLOG(REFUG)	0.000448	0.009551	0.046867	0.9627
R-squared	0.645543	Mean dependent var	0.049677	
Adjusted R-squared	0.597965	S.D. dependent var	0.049921	
S.E. of regression	0.031653	Akaike info criterion	-3.952770	
Sum squared resid	0.149284	Schwarz criterion	-3.565406	
Log likelihood	356.9854	Hannan-Quinncriter.	-3.795582	
F-statistic	13.56806	Durbin-Watsonstat	1.663404	
Prob (F-statistic)	0.000000			

Source: own estimations by using EViews package.

Out of included 4 explanatory variables, 2 are statistically significant according to the t-statistic values. If the *GDP* increases by 1%, total expenditures on social protection are expected to decrease by 0.68%. Such a tendency seems to be reliable as one would expect that with the overall economic growth of the country, average population will experience some welfare gains; hence, it will demand less of the social protection. Another relevant variable that is significant at 1% level is *Compensation of employees*: 1% increase in the regressor is expected to lead to 1.1% increase in the dependent variable. The outcome may be explained by the fact that the state may decide to spend more on it instead of social protection in order to suppress potential unemployment and motivate people for better performance in exchange for financial remuneration. The *Total receipt from taxes and social contribution* regressor is statistically insignificant; one of the explanations for such an outcome is its deterministic relations with dependent variable.

Refugees' population predictor is another insignificant variable of the regression; hence, the number of refugees at a given country does not influence *Total expenditures on social protection*. Basing on the output, the matching initial hypothesis of my research cannot be either accepted or rejected, as the impact is not statistically significant. The explanatory power of the model is reflected by the value of R^2. In this estimation, it explains approximately 64% of the variation in the data. Despite that fact, adjusted R^2 remained relatively the same which indicates that the application of Fixed Effects did not change much in terms of model's explanatory power.

5. Conclusion

The conducted research attempted to estimate whether the incoming refugees to the countries of the European Union have a potential to enhance changes in the employment rates of native workers and in the state spending on social protection by using the Bayesian Model Averaging in combination with OLS regression.

Despite the common belief that immigrants, and especially refugees, represent a fiscal burden for the receiving country, the results obtained in estimations prove that there is no statistically significant observable effect. The outcome is in line with previously done research inferences managing foreigners and changes in fiscal policy (OECD, 2014). Consequently, the second stated hypothesis cannot be either rejected or accepted. Nevertheless, a statistically insignificant variable may also imply that even though the number of refugees within the country may increase, they are not the ones who are responsible for decreases or increases in

expenditures on social protection. It is likely that there are other variables that are of higher impact on the explained variables which were not included in my model. Another explanation of refugees' insignificance may be strong presence of ethnical fractionalization, which makes it quite challenging to efficiently provide public goods for foreign population within the host country.

On the other hand, the first hypothesis of positive influence of immigration on employment opportunities of resident workers is rejected. According to the estimated coefficients, *Refugees' population* is a statistically significant regressor; its increase causes the opposite change in the employment of natives. Even though the results seem to be reliable, they can be the product of not sufficiently detailed data. In theoretical models, immigrants' influence on the residents' employment status is strongly dependent on the skill composition of both groups of the population, as well on the demand for particular abilities by the labour market. There is no distinction between high- and low-skilled immigrants in the research, as all of them were combined in one group. According to the results, assuming that natives are higher-skilled workers, then negative impact of refugees may actually indicate that incoming people possess high skills as well, thus enhancing competition on the labour market and making resident workers worse-off. From another perspective, as for today, the refugees are coming from the Third World countries and that fact decreases the likelihood of them being higher-skilled labour force. In spite of the fact that the estimated impact is significant, its scope is rather minor and that may offset main concerns of the population about immigration to their home countries on their future labour force status.

The scarcity of data predetermined the analyzed models in many ways, including the choice of variables and the number of observations. Consequently, another way to improve the research is to use more detailed data for a longer time span, preferably specific to each country to acquire more precise estimations.

The recommendations that can be drawn out of this research include bringing more attention to creation of suitable immigration policies in the ongoing refugees crisis. Moreover, more detailed information about the skills' composition, i.e. demand and supply, on the domestic labour market should be gathered and constantly updated in order to match the needs of the national economy. A more thorough analysis of the abilities, experience and educational background of incoming people should be done in order to benefit the national economy. Depending on the prevailing level of skills of individual Member State of EU, governments may either argue for introduction of more or less tight restrictions for particular groups of people. Thus, each country will be able to attract those immigrants that are potentially beneficial to its unique economic and demographic

situation. As for the strains on the fiscal policy definition, immigrants are not the main concern, so its formulation should be based on the overall state of the economy and needs of the average population. Conditional on the fast integration of foreigners into the labour market, it is reasonable to assume that the negative impact on residents may be diminished. Individual governments of EU countries need to bring more attention to other impacts of immigrants and refugees that are hard to measure, i.e. ethnical and cultural differences with national population. In the light of today's events, these are the factors that require immediate regulations, including enhancement of integration and acceleration of assimilation of foreigners, assuming the state is looking forward to hosting more immigrants.

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Inequality and Growth: a Bayesian Perspective

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Abstract

The following paper discusses the role of economic inequality as a determinant of long-run growth. It starts with an extensive overview of the literature on the phenomenon of inequality in general, tracing the roots of such an issue to the works of classical economists and following with the analysis of its development until recently. Decomposition of economic inequality by types and measures alongside with the works on relationships of these with long-run growth are being discussed as well. The absence of consensus among the latter is evident, as ambiguous and often contradictory results are reported. This paper discusses potential treatment for one of the main problems causing such a kind of ambiguity to arise, namely model uncertainty. It is proposed to employ a technique known as BMA, introduced to economic growth literature by Sala-i-Martin *et al.*(2000) and used for the evaluation of robustness of the potential growth determinants. The author extends the original dataset accompanying the aforementioned study to include various measures of inequality and performs BMA estimation in a similar manner. The obtained results indicate that, for a given set of specifications and variables, none of the types of economic inequality is proved to be a significant determinant of growth during the period of 1960-1996. The reason for this, among others, could be the irrelevance of inequality for economic performance, as stated by neoclassical paradigms, but also its historically low levels during the analyzed period or "lagged" nature of its effects. Due to several methodological limitations and data unavailability, the author is unable to provide a conclusive interpretation of such an outcome and insists on considering it as a ground for future improvements rather than a final result of the analysis. The proposals for the former are outlined in the final part of the paper and include manipulations with model priors as well as improvement of author's dataset.

Introduction

The Financial Crisis of 2008 was a very special one in a sense of what problems it brought to light, exposing the global society to the most serious welfare downturn since the times of the Great Depression. A number of issues in economic and financial disciplines that has been started to be taken for granted such as, for instance, ever expanding housing markets were faced with thorough examination and reconsideration. In some cases, these were the issues left outside the economic research frontier for decades. This, perhaps, could be viewed as one of the few, if any, positive developments brought by the crisis.

One that has followed recent developments in aforementioned disciplines, should have, undoubtedly, noticed the reemergence of the topic of economic inequality. Following 2008 and, especially, 2011, the year when "Occupy Wall Street" movement took place, this issue has received extensive attention from scientists, businesses, policy makers, and, most importantly, the general public. Even in the US, which is widely acknowledged as one of the developed countries historically having the weakest public sentiments towards policies aimed at income redistribution, the attitudes have changed dramatically. A poll of the public opinion performed by Riffkin (2014) indicates that more than twice as many Americans (45% as of 2014) are now dissatisfied with opportunities for social mobility comparing to 2001 (22%). Moreover, two out of three are unhappy with income and wealth distribution in the society (Riffkin 2014).

Inequality has been a trending topic among economists as well. After the prolonged exclusion from the mainstream of economic research, there was a renaissance, to some extent, in terms of the influence and number of works published in the field during the last 7 years. These, however, have not settled down the disagreement regarding the role and desirability of inequality for the economic well-being of our society. The latter has been troubling the minds since, perhaps, the dawn of economic discipline and finding response in various fields beyond it, politics especially. After all, communism, one of the most influential and radical political doctrines in history, encompassed works on inequality and distribution of income in its ideology.

Given all of the above, the lack of consensus on the role of such phenomena and a desirable response to it is of no surprise, giving all the normative considerations surrounding the topic. What exists is the analogical situation regarding the positivistic judgement regarding not the effects of inequality, but the mere existence of the latter. The reasons for this are numerous, and strong evidence is provided by both sides of the debate.

This paper aims to deliver two kinds of outcomes. The first one is an overview of economic inequality's theory development, starting as early as during the times of Adam Smith and finishing with most recent works in the field. The goal of this discussion, presented in Chapter 1, is to made readers aware of the reasons for inequality to earn the attention it has received recently as well as to describe the nature and origins of the disagreement mentioned above.

Another intended outcome of this thesis is to introduce and test the method allowing addressing the latter. The focus of this paper is the determination of the effect of different kinds of inequality on long-run economic growth expressed in terms of per capita GDP growth. While such a choice is dictated mainly by data availability, it is possible to replicate the estimations performed in this study to analyze inequality's (or other phenomena's) impact on literally any indicator. This is achieved by applying the procedure known as Bayesian Model Averaging (BMA) on the dataset of economic growth determinants introduced in Doppelhofer *et al*. (2000). The methodology of such an approach is described in Chapter 2; data and its sources are presented in Chapter 3, while results are reported in Chapter 4.

1. Literature Review

This section attempts to provide the overview of current developments in the theory of economic inequality and its connection to long-run growth. Its first and second parts focus on the former, followed by the review of literature discussing the latter.

1.1. The Origins of the Theory of Economic Inequality

The theory of income distribution has been an integral part of economics since its very origins. In the works of classical authors, one can already find at least three vital elements that can provide ground for its formalization and acknowledgement as an economically important process. These are the sources of income inequalities, the description of the actual process of earnings distribution, and the impact of such developments on the economy and/or society.

As it is noted by Guidetti and Rehbein (2014), Adam Smith in his *Wealth of Nations* introduces the first of the latter three, describing distribution of value added among three classes: rentiers, workers and capitalists, or, in other words, among individuals that differ with respect to their sources of income (Smith 2007).

The work of David Ricardo, the next milestone of economic thought, depicts the second that is the distribution of profits in the economy (Pasinetti 1977). Following Smith's notion, Ricardo himself states that in the long-run steady state profits are equal to zero and output is distributed among rents and wages according to their marginal products. However, the analysis of Ricardo's framework performed by Pasinetti (1977) proves that in the process of adjustment towards such a steady state there exists a "distributive conflict between rents and wages".

Perhaps the most influential piece of research on economic inequality from those times belongs to Marx (1867), who has developed the theory presenting, among other, the ultimate effect of differences in income sources and distribution (being the third element mentioned above). In the analytical framework developed by Marx (1867), capitalists, owing the major part of factors of production, are able to earn the "surplus value" from workers' activities, which leads to "exploitation" of the latter. Such a process is assumed to inevitably cause the collapse of both social and economic systems for political reasons (Marx 1867). Without discussing the implications and consequences of the latter, it is obvious that Marx's analysis has been decisive for the formalization of the theory of inequality, presenting it as an integral part of the economic process, not only influencing its outcomes, but also being the main determinant of its self-subsistence.

Thus, the presence of inequalities in the distribution of output has been already identified and acknowledged in the works of classical economists. However, the eventual development of economic tradition has set this issue on the periphery of research frontier. The author would suggest that the major role in this should be attributed to the popularization of the theory of marginal returns to factors of production, especially by Wicksell (1893), which led to the general acceptance of the fact that each factor, including labor and capital, is being paid its marginal product in production of final output. The latter statement was developed and formalized to be presented under the name of Marginal Productivity Theory of Distribution (MPTD) in an iconic *The Distribution of Wealth: A Theory of Wages, Interest and Profits* by Clark (1908).

Relying on the framework outlined by these models, it could be stated that markets ensure "fair and just" distribution, which, no matter how heterogonous, should not be corrected. Any views that doubted this were at risk to be perceived as dangerous and populistic. Perhaps the best summary of general attitude towards the issues of income redistribution until recently is provided by Lucas (2004):

> *Of the tendencies that are harmful to sound economics, the most seductive, and in my opinion the most poisonous, is to focus on questions of distribution*

[…] The potential for improving the lives of poor people by finding different ways of distributing current production is nothing compared to the apparently limitless potential of increasing production.

The dominance of the views such as that of Lucas has led to the fact that overwhelming majority of works on long-run growth has not discussed the issue of economic inequalities, at least explicitly. This gives birth to the following question: "What justifies the rejection of the theory of marginal returns or at least its neoclassical interpretation and makes us to assume that inequality does indeed deserve the attention it has received lately?" An answer to this has been already given by a number of critics of neoclassical theory, who have both theoretically and empirically questioned perhaps each and every assumption of the latter. The debate between neoclassical economists and members of other schools on the validity of models that dominate modern economics is a material for a couple of books itself. Here, however, the author wishes to specify several works that are especially illustrative for subjects undertaken in this paper.

There exist two types of views, which provide the ground for inclusion of inequality in mainstream of economic research. The first one is essentially a critique of MPTD, proving that markets tend to fail in ensuring the factors of production with payments equal to their marginal products. One of the most comprehensive works on this matter belongs to Pullen (2009). His book *The Marginal Productivity Theory of Distribution: A Critical History* summarizes the writings on the MPTD of some 40+ authors from the period of more than 50 years and includes criticism of numerous assumptions Clark's model relies on. (Pullen, 2009). One of the most intuitively understandable and simple is that of Chamberlain (1933). It relies on the lack of perfect competition in real economy (the proof of this, appearing in studies on endogenous growth and appropriability, will be discussed in subsequent sections) and studies the distribution of payment to factors of production in the opposite case, that is monopoly. The analytical framework developed by Chamberlain (1933) yields the result that labor tends to receive less compensation to marginal revenue generated by it, while capital enjoys the opposite. Moreover, there exists the cohort of researchers that rejects the existence of marginal product and, thus, the whole neoclassical theory in the first place. A relatively recent piece from Moseley (2014) provides a decent number of argument in favor of this (Piketty 2004).

The second type of research does not reject the MPTD, at least not as a whole, and attempts to work in its framework instead. Without doubt, the brightest example in this category would be Piketty's *Capital in the Twenty-First Century* (2004), where he extensively exploits the version of neoclassical Howard-Domar-Solow

model to demonstrate how the distribution of income happens under specified assumptions. To be completely honest, one must mention that the author still refuses the absolute validity of MPTD. As Milanovic (2013) states it in his review of the book, "Piketty is indeed critical of a blind belief that marginal returns always set the price for labor and capital, but these arguments are not developed and come in the form of *obiter dicta*". This work is, undoubtedly, crucial for understanding current developments in the theory of economic inequality and it will be revisited several times throughout the rest of the paper.

Thus, the brief overview of even the earliest and most basic developments in the economic discipline provides fertile soil for the debate about the place of inequality in it. As it was illustrated, such an issue can be traced back to the earliest economic theories, even though its authors have not provided for it explicitly. At the same time, the critique of MPTD developed from the latter has challenged the long-dominant neglect towards inequality. The author would cautiously suggest that later sections of this study would allow enriching this debate with some new arguments and findings.

1.2. Types and Measures of Economic Inequality

In order to follow the above-stated aims of this work, one should turn to review of the literature describing in great detail types and measures of economic inequality. The structure of the rest of this section follows Dabla-Norris *et al.* (2015) in referring to, perhaps, the most commonly cited and broadest types of inequality, that is inequality of outcomes and inequality of opportunities.

1.2.1. Inequality of Opportunities

The works of Dworkin (1981a, 1981b), Arneson (1989) and Cohen (1989) provide the general philosophical ground for the development of the concept of inequality of opportunities (Brunori *et al.*, 2013). These works introduce the division in inequalities produced by "efforts", which is deemed normatively acceptable, and "circumstances", which cannot be controlled by the individual and should be ideally eliminated. (Brunori *et al.*, 2013).

The same works also provide a quick illustration on difficulties in developing the proper measure for inequality of opportunities. This argument is developed in more detail in the work of Brunori *et al.* (2013), where the authors also present a methodology of measuring the latter with the help of Index of

Economic Opportunity (IEO) and Human Opportunity Index (HOI).These measures, although suffering from their own problems, can be considered as the most pronounced with regard to "aggregate" inequality of opportunities.

Several types of such inequality, however, have received specific attention from researchers alongside with separate measures developed to describe them. One of the most studied and developed among these is the concept of intergenerational mobility, that is being the ease with which the person being born in the family belonging to a particular group in income distribution, for instance quantile, can transfer to another group during his/her life-time.

The importance of the issue is both positive and normative in nature. The implications of the latter are discussed in Fehr and Schmidt (1999), Fehr and Gachter (2000), Fehr and Fischbacher (2003) as well as Cappelen *et al*. (2010) in the context of the normative aspect of inequality of opportunities in general. The former has been discussed by number of authors who studied the effects of intergenerational mobility on different aspects of economic development, while some of them have also linked it to a chosen measure of "aggregate" inequality, such as GINI coefficient. For instance, Piketty (2014) has discussed this issue in the scope of his "Rastignac's dilemma", and Stiglitz (2012) has also placed a lot of attention on it in his *The Price of Inequality: How Today's Divided Society Endangers Our Future*. Corak (2012) is the example of work of the second kind, in which the author develops the relationship between intergenerational earnings mobility and GINI, which would be later popularized as "Great Gatsby Curve" by Krueger (2012). The majority of the authors who wrote in this field has come to a conclusion that various measures of intergenerational mobility do demonstrate positive correlation with GINI coefficient, which can be considered an indicator of autoregressive nature of inequality, reproducing itself at even greater amounts if left unaddressed.

The measures of such an issue generally refer to the strength of relationship between several studied generations' positions in income distribution. The variations of the latter can be found in the above-mentioned Corak (2012) (intergenerational earnings mobility) and Stiglitz (2012) (intergenerational transmission of income). Also, Brunori *et al*. (2013) state that indices such as IEO and HOI, due to their high correlation with other measures, can be used to derive conclusions about the level of intergenerational mobility.

Another kind of inequality of opportunities that has received a lot of attention in the literature, is inequality of human capital. The literature attributes the main role behind the process of such a kind of inequality development to various kinds of education. This can be discussed in the form of either traditional educational system (Becker 1964; Mincer 1974) or alternative ways of skills' acquisition,

such as on-the-job training (Acemoglu and Pischke 1998, Acemoglu and Pischke 1999). Either kind can have both a positive and negative correlation with aggregate measures of inequality, depending on a number of factors such as the structure of educational system, the cost of schooling, the level of governmental expenditures in this sphere, the incentives for individuals to invest in education etc. (Dabla-Norris *et al*. 2015).A theoretical framework explaining these can be found in Mincer (1958) and Becker and Chiswick (1966), where the authors develop human capital model of distribution, implying a positive correlation of educational and income inequality, while at the same time leading to ambiguity regarding the effects of the increase in educational attainment on the latter. The bottom line is that education and the process of human capital accumulation can both be reinforcing and counteracting to the inequality of human capital, which is generally deemed to be positively correlated with income inequality.

Inequalities in levels of human capital and access to education are generally measured with standard indicators for the respective phenomena, such as a fraction of population with the certain number of years spent on schooling or certain educational level achieved. However, there also exist specific indicators such as Education GINI (Castello-Climent and Domenech, 2014), indices of accessibility (cost) of schooling or intergenerational changes in educational levels.

Last but not least, the inequality of opportunities can also arise from the process of economic growth, as certain changes in the structure of the economy would adversely affect certain groups of the society. The group of works covering this type of "structural inequality" is indeed numerous and diverse. Without doubt, the first one to be mentioned is an influential paper by Kuznets (1955), in which he mentions industrialization or simply technological process, urbanization, the shift from the agricultural to non-agricultural sector, development of new industries and demographical factors as sources for increasing inequality in incomes. Goldin and Catz (2007) alongside with Autor *et al*. (2007) and Goos *et al*. (2009) describe how the latter is being increased by skill-biased technical change, which causes transfer of job places from routinized, non-cognitive, middle-skilled sectors to those using technology extensively and thus requiring fewer and better-skilled workers. Dabla-Norris *et al*. (2015) point to the potential of financial globalization to increase income inequality alongside the already stated factors. Finally, the list of authors who wrote on the topic should include Piketty (2014), who has also put down some arguments regarding the change in sources of income at the very top of distribution over time and the importance of the structure of labor-market institutions. However, perhaps his biggest contribution with regard to structural inequality is the development of theoretical framework under which the relative value of rate of growth, including technological one,

with respect to interest rate is a primary factor that determines long-run dynamics in level of income inequality.

Dabla-Norris *et al.* (2015) also mention health and financial services among already discussed types of inequality of opportunities. The former is stated to prevail in developing countries, based on the measures of infant mortality and access to skilled medical personnel, which reveal striking differences among quantiles. The effect of such kind of the inequality in developed countries is much less pronounced, even though a significant effect of income on life expectancy exists even there (Dabla-Norris *et al.*, 2015). The latter, which is financial services, follows the very same pattern, as in developing countries less than 20% of adults belonging to bottom 40% of income distribution have an account in formal financial institution. Obviously, such underdevelopment of the financial sector makes it relatively hard for the majority of population to start a business or finance their current needs, including housing and education (Dabla-Norris *et al.*, 2015).

1.2.2 Inequality of Outcomes

The main "subcategories" found in literature covering this topic are inequalities in income and wealth (Dabla-Norris *et al.* 2015). Arguably, the best summary of everything achieved so far in studying the dynamics and characteristic of income inequality alongside with data on its changes during as much as the last 100 years could be found in Piketty (2014). The examination of the issue on the level of separate income deciles and top-groups of income earners (i.e 1%, 0.1%) as well as international comparisons receives particular attention. Similar developments are discussed in Lakner and Milanovic (2013), Krugman (2014), Piketty and Saez (2011), Atkinson,Piketty, and Saez (2011) and others. One should not forget about the analysis of poverty, which can be found in OECD (2011) and Autor (2014), being an integral part of income inequality.

There exists a separate class of the works discussing measures of income inequality. The fundamental one is Cowell (1995), who provides a comprehensive overview of methodologies used in the latter as well as general principles of precise and unbiased indicators on the issue. The most widely used measures of income inequality, including well-known GINI coefficient, are based on Lorentz curve. This approach is presented in much detail by Bellu (2005). It is important to distinguish between market and net measures, as the latter account for effects of taxes and transfers (Ostry *et al.,* 2014). Other commonly used approaches are Coefficient of Variation (Cowell 1995), Theil Index (Bellu 2006a), and measures connected to the share of income that would need to be sacrificed in order to bring complete equality into society, i.e. Atkinson's and Hoover's Indices (Bellu 2006b). A somewhat different methodology, the overview of which can be found in Milanovic (2013), is used to measure income inequality on global rather than

national level. Finally, the other side of the coin, that is regional rather than national-level data set has been recently presented by Galbright (2012) alongside with a wide set of other, previously uncharted measures of economic inequality.

While income inequality measures the differences in individuals' financial "flows", or simply incomes, wealth inequality accounts for "stock", or, in other words, disparities in the accumulation of financial assets of various kinds. Undoubtedly, the most fundamental and comprehensive piece of research on this issue belongs, once again, to Piketty (2014). The author presents both an overview of the dynamics in wealth inequality, the same as the above-mentioned for income, and a discussion on measures of this phenomenon, including such a specific as the share of bequest in the economy and concentration of ownership of capital. A traditional such measure is GINI coefficient with respect to wealth, however (Dabla-Norris *et al.*, 2015). A quick summary of the developments presented in the book is that wealth inequality surpasses one in income twofold in both developed and developing countries (Dabla-Norris *et al.,* 2015), while capital has become the most important source of prosperity at the top part of income distribution (Piketty, 2014).

As one can now clearly see, inequality takes a lot of shapes and comes from a number of different sources. The next section provides the overview of current developments in the literature regarding the attempt to relate each of this to the dynamics of long-run economic growth.

1.3 Links Between Inequality and Long-run Economic Growth

As it was shown in the first section, the theoretical ground for connecting inequality with growth emerges already from the works of classical economists. The same is true for more recent developments in the field of economic growth, starting from the neoclassical theories that appeared the middle of 20th century.

The obvious cornerstone of these is the works of Harrod (1939), Domar (1946), and Solow (1957). The Harrold-Domar model reveals the importance of the saving rate, which determines the level of investment that, in turn, is a primary source of economic development (Gallo, 2002). Solow's model, building on such a framework, goes further, introducing diminishing returns to capital and, eventually, making technology the main source of long-run growth (Solow, 1957). Further developments in this theoretical framework described by Ray (1998) widen the notion of technological progress to incorporate the concept of human capital, influencing formation of the latter.

These two drivers of economic development described above – the level of saving/investment and the pace of technological progress – have provided the link connecting inequality with growth and allowing it to be incorporated into the theoretical framework on the latter. This comes from the fact that income distribution determines saving and investing decisions of individuals, including investment in human capital (Galor and Zeira, 1993). Obviously, the same logic provides theoretical ground for relating inequality to later works of Paul Romer (1986) and his theory of "endogenous growth", as well as "Lucas-Uzawa model" (Been-Lon, 1997), as both of these employ the notions of human capital and technological progress extensively.

One way or another, the works mentioned above follow what is described by Gallo (2002) as "neo-classical" views on the nature of income distribution, attributing the major role in this process to marginal productivity of factors. Keynesian economics, on the other hand, support the differences in marginal propensities to save as primary factor affecting distribution. (Gallo, 2002). A bright example of this class of works is provided by Nicholas Kaldor (1956), who develops the model of the economy consisting of two classes of workers and capitalists, from which only the latter is net savers and, consequently, economic growth requires income distribution to be biased towards this group. The latter statement finds evidence in the works of Cline (1975), Knight (1976), Bigsten (1983), and Ferran (1997). The last one proves this formally, deriving the equation showing the effect of changes in relative propensity to save of the two classes on the distribution of income.

Especially interesting from the philosophical point of view and thus deserving a separate mention are the works which present inequality as a source or at least a necessary condition for economic growth. This includes, but is not limited to works on the theory of appropriability and endogenous growth. The former encompasses a group of works that supports imperfect competition as a vital component in the process of innovation and technological development, covering among others such issues as monopoly rents, diffusion of technology, and property rights. The best-recognized authors and their respective fundamental works from this area are Schumpeter (1950), Arrow (1962) and Teece (1986). Winter (2006) provides a convenient summary, which sheds light on main ideas and propositions of each of the above.

The theory of appropriability also resonates in the works on endogenous growth, including Romer (1986), who is arguably one of the most influential authors in this area. One proof of this can be found in Romer (1994), where the author mentions monopolistic rent on discoveries and the so-called "Schumpeterian models". Moreover, Romer (1987) puts forward an additional argument

justifying inequality's presence in the economy. He refers to specialization, which can be treated as a special source of "structural inequality" mentioned in previous section, and important role played by it in the process of endogenous growth. Another example of work where authors acknowledge the link between appropriability and growth is Grossman and Helpman (1994).

Some less mainstream theories also provide ground for inequality to be considered as a cause of economic growth. Just a couple of examples are Colman and Nixson (1988) and Forbes (2000). The authors of the former argue that Lewis model (Lewis, 1954), which describes the process of economy's modernization, "gives support to the argument that increasing inequality is not only an inevitable effect of economic growth, but also a necessary condition for growth", while Forbes (2000) provides some empirical evidence on the relationship between inequality and growth, finding a positive correlation among these phenomena, but only in short and medium-term.

Without exaggeration, an iconic work from this field belongs to Simon Kuznets (1955), where he supports the existence of an "inverted U" curve on the plane where the degree of economic development is plotted on the horizontal axis and the level of inequality on the vertical one.

Perhaps one of the most interesting facts is how such a curve has actually become, citing Gary Fields (1988), "one of the greater ironies in the history of thought on economic development", lacking almost any empirical support, but, nonetheless, sparking furious debate among economists. Kuznets himself has admitted that his paper "… is perhaps 5 percent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking" (Kuznets, 1955). A number of authors have, nevertheless, attempted to provide lacking empirical evidence for this hypothesis. Both them and their opponents are still unconvinced by what the other side has put forward and the debate continues up until now.

The concept of inverted-U curve is criticized and supported on both theoretical and empirical grounds. Gallo (2002) provides a convenient overview of these. To mention just a few most pronounced works, Fei-Rains (1964) expands theoretical grounds for Kuznets justification of rising inequality on the basis of the above-mentioned Lewis model; Saith (1983) criticizes methodological aspects of works which provided empirical evidence on Kuznets curve using cross-country regressions; Fields (1988) in his own overview of developments on the issue confirms Saith's critics and states that the national structure of the economy and implemented policies rather than per capita GDP level are the true factors influencing the level of inequality. More recent works on the topic include among others influential papers of Barro (2008), who finds some support for Kuznets curve

existence, and Gallup (2012), who strongly opposes the methodology based on cross-country regressions used in the latter and in a number of other works. The approach based on panel data for growth within each country over the period of time, followed by Gallup himself, finds no support for Kuznets curve.

Arguably, the most popular and discussed fundamental piece on relationship of inequality and growth recently is, of course, Piketty (2014). Among numerous aspects of this issue mentioned in the book, Kuznets curve also finds its place. The author agrees with the existence of purely empirical phenomenon described by the inverted-U hypothesis, but dismisses it on the theoretical ground, which, in turn, emerges from the Piketty's own fundamental contribution to the theory of inequality and growth connection, which was already referred to in previous section. The author postulates that dynamics in distribution of income is determined by rate of return on capital (r) and rate of growth of the economy (g). If r exceeds g, both income concentration and inequality will increase and vice versa. A clear and simple explanation of this framework can be found in Milanovic (2013).

Piketty's book also presents a number of sources and factors which link inequality to growth. Some examples are concentration of incomes on the top of distribution, a share of bequests in the economy, and the structure of income sources for different parts of income distribution. As it is aptly noticed by Milanovic (2013), "…Piketty's theory of income concentration can be called a *political theory* (…) because the main forces that shape concentration of incomes are political: wars, high taxation, and inflation". One way or another, his developments in inequality of growth are undoubtedly one of the most, if not the most, debate-provoking and discussed theories recently developed in the field.

Finally, in light of recent developments on financial markets, the importance of which has been revealed by 2008 financial crisis, two very special works cannot go unmentioned. The first one is James Galbraith (2012), in which one can find both a critique of the traditional views such as Kuznets curve as well as completely new theoretical developments, such as the introduction of the financial link between inequality and growth. The second work mentioned above belongs to Rajan (2010), and its main implication is a so-called "Rajan hypothesis", which states inequality as one of the main sources of Financial Crisis.

It can be concluded that, even living aside considerations of normative nature, any kind of consensus is yet to be reached. Researches developed up to date present generally ambiguous results regarding the effect of both aggregate inequality and its specific types on the process of economic growth.

It can also be stated that majority of works mentioned in this section are suffers from at least one of the following issues:

1. Limited geographical scope, which may produce biased or not applicable on a broader scope results (this is true for Thomas Piketty (2014),with his focus on several developed economies)
2. Limited time frame of the analysis, which may produce results and conclusions biased by specific economic events (the brightest example is Kuznets (1955).
3. Reliance on a particular model of long-run growth, exposing the results to same critique as of the model itself (all works reemploying the concept of MPTD)

The proper methodology to address the latter has been developed inside the field of long-run economic growth theory quite a long time ago. The first treatment for "model uncertainty" was proposed as early as 1983 by Leamer (1983). Extreme bounds analysis, proposed by him, was applied for cross-country growth regression by Levine and Renelt (1992). The results of such an approach have, however, indicated that hardly any of the analyzed variables proved to be "robust", which made critics suggest that imposed bounds were too strict for any potential determinant to pass (Sala-i-Martin, 1997). The eventual development of computational powers has allowed Sala-i-Martin (1997) to propose improved methodology in his iconic article.

The possibility to perform extensive calculations such as those done by Sala-i-Martin (1997) has led to the introduction of more data analysis and statistical driven frameworks in the field of economic analysis. Sala-i-Martin, Doppelhofer and Miller (2000) have put forward the so-called Bayesian Average of Classical Estimates (BACE), derived from Bayesian Model Averaging (BMA), while Doppelhofer and Weeks (2009) alongside with Ley and Steel (2007) have independently introduced Jointness measures. The combination of these techniquesallows to draw conclusions on robustness of the effect of particular variable on long-term growth as well as relationships (complementary or substitutional) among the regressors. Neither of the above-mentioned works has, however, analyzed inequality measures.

As such, it can be clearly seen that the aforementioned theoretical framework, even though not yet applied in studies on economic inequality, includes especially suitable tools for development of the analysis that would be both free of flaws created by the traditional approach as well as being capable of addressing the fundamental question of what specific kind of economic inequality, if at all, influences long-run economic growth. This paper aims to perform exactly this kind of analysis, at least at its preliminary form.

2. Methodology

The proneness of most works studying the effect of inequality on long-run growth to critique comes, among other issues mentioned in the previous section, from the phenomenon known as model uncertainty. The latter arises as an inevitable by-product of standard statistical approach and can be illustrated as follows: imagine a scenario under which the researcher analyzing the above-mentioned relationship has accounted for every potential problem, such as heterogeneity, endogeneity, non-normality etc. in his/her model specification. The dataset used for this analysis also covers significantly heterogenous set of countries for long enough period. Altogether, it can be stated that "… [model] fits the data reasonably well and … the parameter estimates are sensible" (Hoeting *et al.* 1999). Such a procedure, as it is pointed in Hoeting *et al.* (1999), provides a reasonable comparison to the generally applied standard statistical practice, the results of which are then used to approximate the strength of relationships between dependent and independent variables. (Clyde, n.d.). Such an approach can be found in numerous studies presented above (e.g. Ostry *et al.,* 2014; Dabla-Norris *et al.,* 2015), but can be hardly deemed as entirely satisfactory. The reason for this is the way explanatory variables are usually chosen, as the set of potential regressors is significantly larger than those present in the regression. This implies that researcher would make a set of assumptions on what exact variables are going to be present in the model (let us denote this model as ***M1***). The critique of the logic behind these assumptions is often the main argument against the validity of all the eventual results produced. The latter becomes even more persuasive if there exists such set of variables, other than those used in the initial model, which possesses all the properties of the ***M1***, but provides different results. This is not an uncommon situation, as Hoeting *et al.* (1999) mentions the number of examples. The latter study alongside with Brock and Durlauf, (2001) may also be referred to by the curious reader to learn more about model uncertainty issues.

Until late 1980's, such a problem has been rarely addressed, as alternatives boiled down to proposals of model specifications based on different, but similarly arguable logical assumptions. Fortunately, since then the advancements in statistical science and computational powers have made it possible to practically apply procedure known as Bayesian Model Averaging (BMA), providing a solution to issue of model uncertainty. In what follows, the author would briefly discuss such theoretical framework's basic assumptions and notions relevant to the procedures executed in subsequent sections. For a detailed overview of BMA, one may consult Sala-i-Martin, Doppelhofer and Miller (2000), which is widely acknowledged as a cornerstone study on BMA application for analysis of

the determinants of long-run growth, Zeugner and Feldkircher (2015), which describes the package designed for BMA analysis in R used in this paper, and Hoeting *et al*. (1999) alongside with Clyde (n.d.), Draper (n.d.), George (n.d.), Hoeting (n.d.), which constitutes a comprehensive overview of BMA application in economic frameworks.

The structure of BMA theory overview along with its statistics and Jointness measures were prepared based on Beck (2017a, 2017b, 2018a, 2018b and 2018c).

BMA analyses the set of the models of the following form:

$$y_j = \alpha_j + \beta_j X_j + \varepsilon_j \quad (1)$$

Where y_i denotes a vector of observations of the dependent variables, α_j – a vector of constants, β_j – a vector of coefficients, X_j – a matrix of independent variables, ε_j – a vector of error terms (which are assumed to be independent, normally distributed and conditionally homoscedastisic), and j ($j = 1, 2,\ldots$) *n*serves as the model index.

In contrast to the classical econometric approach, BMA analysis is performed on the whole set of potential regressors *X*, assessing the probability of each of them to be present in "true" model. For this purpose, each model M_j is assigned with binary vector ($K\times1$) $\varphi = (\varphi_1, \varphi_2, \ldots, \varphi_K)$, where *K* denotes the number of potential regressors and φ_i takes on the value of 1 if the corresponding regressor is present in the model and 0 otherwise.

In order to assess the above-mentioned probabilities, BMA makes usage of Bayesian statistics, which, in contrast to classical ones, allows to combine information coming from data and prior assumptions made by researcher, essentially making a judgement on the validity of the latter. All the subsequent analysis in this framework builds on Bayes Theorem, defined as follows:

$$P(\beta \mid y) = \sum_{j=1}^{2^K} P\left(\beta \mid M_j, y\right) * P\left(M_j \mid y\right) \quad (2)$$

As it is explained in more detail in Sala-i-Martin, Doppelhofer and Miller (2000), BMA essentially follows with a special case of the above-mentioned theorem, as it assesses the probability of each separate coefficient β_j to take non-zero value given the information provided by data *yi*. Thus, Bayes Theorem can then be rewritten in the following form:

$$PMP = p\left(M_j \mid y\right) = \frac{l\left(y \mid M_j\right) * p\left(M_j\right)}{p\left(y\right)} \quad (3)$$

As it is evaluated in Sala-i-Martin *et al.* (2000) and Zeugner and Feldkircher (2015), rather than estimating the probabilities of separate coefficients taking on non-zero values, BMA examines all the possible combinations of regressors constituting set *X*. Thus, a more correct way of formulating such procedure's outcomes would be the introduction of Posterior Model Probability (PMP). This notion serves to denote the probability of model M_j to be the "true" model giving the data *y*:

$$P\left(M_j \mid y\right) \propto l\left(y \mid M_j\right) * P\left(M_j\right) \quad (4)$$

$l(y|M_j)$ in this case denotes the model specific marginal likelihood, which is the probability of model M_j, consisting of some set of regressors *X*, to produce data *y*.

The procedures described above allow utilizing information provided by the data itself, unconditional on researcher's assumption. However, the reason for BMA to be favored by the growing number of scientists comes from the fact that in addition to such, an undoubtedly precious for its "objectivity" tool it also allows for flexibility and customization of the process according to priory set assumptions. The latter is possible thanks to what is known in BMA as "information prior", being essentially a specification of model's probability distribution function according to researcher's beliefs and theoretical assumptions. In order to manipulate the structure of such a distribution, proportionality coefficient of variance and covariance, known as g prior parameter is used. The concept was first introduced by Zellner (1986) and can be presented as follows:

$$P\left(y\right) = \sum_{j=1}^{2^K} l * P\left(M_j\right) \quad (5)$$

V_{oj} stands for the variance of coefficients β, $(X_j'X_j)^{-1}$ is a variance-covariance matrix of potential regressors, and *g* stands for g prior parameter. The latter can take on literally any form to accommodate researcher's purposes. There exist, however, most commonly used ones, whose features, pros and cons are discussed in Fernández, Ley and Steel (2001). Readers can also consult the latter for further in-depth discussion on *g* priors.

Last but not least, the results of BMA estimation are sensible to priory specified model size distribution. One of the most common approaches (uniform prior density function) is to assume equal probability among all models, which equals $1/2^K$ and, thus, expected model size to be $K/2$. Such an approach, however, comes with its own pros and cons, which is also true for its alternatives. In general, three types used most often are uniform, binominal and beta-binominal distributions. For further discussion on such a kind of priors one may consult Ley & Steel (2009).

Being provided with the data of the form (1) and having chosen a suitable g prior and prior model size distribution, BMA procedure implies examining every model, each corresponding to separate combination of regressors, and calculating four measures, namely Posterior Inclusion Probability (PIP), Posterior Mean (PM), Posterior Standard Deviation (PSD), and Posterior Probability of Positive Sign defined as follows, respectively:

$$P\left(M_j \mid y\right) = \frac{I\left(y \mid M_j\right) * P\left(M_j\right)}{\sum_{j=1}^{2^K} I\left(y \mid M_j\right) * P\left(M_j\right)} \quad (6)$$

$$P\left(\beta \mid \sigma^2, M_j\right) \sim N\left(0, \sigma^2 V_{oj}\right) \quad (7)$$

$$V_{oj} = (gX_j' X_j)^{-1} \quad (8)$$

$$g = \frac{1}{\max\left(n, k^2\right)} \quad (9)$$

PIP is, perhaps, the most important of those, providing information on whether the probability of a given regressor to be present in the "true" model passes the threshold, which depends on the kind of information prior employed. For instance, Uniform Information Prior (UIP) places such threshold at 0.5 level, equally for every potential regressor. Thus, in case $P(x_i|y) > 0.5$, x_i can be assumed to be a "true" determinant of dependent variable. Interpretation of PM and PSD is identical to mean and standard deviation reported from classical econometric estimation, for instance, OLS. Finally, Posterior Probability of Positive Sign shows the probability of β_j to take on positive value.

It is worth highlighting a specific feature of BMA procedure, which, until late 1990s, made it difficult to implement such an approach. Given an already mentioned vector $(K \times 1)$ $\varphi = (\varphi_1, \varphi_2, ..., \varphi_K)$ or, in other words, K number of potential regressors, one should examine 2^K models in order to calculate all the aforementioned statistics. Even with a relatively small set of $K = 20$, the number of visited regressions rises above 1 million. Obviously, this requires substantial computational powers or techniques that would allow decreasing number of visited regressions. The latter have indeed been developed, including Occam's Window and Markov Chain Monte Carlo Model Composition, to name just a few. Evaluation on this and a number of other developments in the field can be found in Madigan and Raftery (1994, 1996), Madigan et. al. (1997) Furnival and Wilson (1974), Madigan and York (1995), George and McCulloch (1993).

Finally, extension of BMA technique known as Jointness measures allows researchers to assess the type of information carried in each of the variable, which is returning complementary, substitutional or neutral relationship between each pair of potential regressors. This allows to adjust data eliminating variables causing substantial degrees of multicollinearity, as well as to draw fruitful inferences about reinforcing/counteracting powers in the model. There exist two kinds of such measures, developed by Doppelhofer and Weeks (2009) and Ley & Steel (2009). Reader is advised to refer to these works for detailed methodology on such measures.

It can be concluded that BMA constitutes an exceptionally powerful data-driven theoretical framework, which is especially suitable to address the problem of model uncertainty, providing the tools which utilize both information embodied in raw data as well as that specified by researcher's prior beliefs.

Obviously, BMA's traits serve perfectly for the analysis of economic inequality as a determinant of long-run growth. This paper aims to develop and perform exactly such a kind of analysis. As it was already mentioned, hardly any work would provide a better starting point for this purpose than Sala-i-Martin, Doppelhofer and Miller (2000) as its dataset has been designed specifically for such a type of research and has proved its quality in a number of other works employing BMA. The author of this paper decided to follow this path as well, especially provided the problem of limited geographical framework mentioned in the previous section.

Sala-i-Martin, Doppelhofer and Miller's (2000) dataset, which is described in more detail in the subsequent section, was complemented by 16 variables serving as proxies for different types of aggregate and specific economic inequality. These were chosen from the initial set of 162 variables, which can be accessed on https://www.researchgate.net/publication/317370498_INEQUALITY_AND_GROWTH_A_BAYESIAN_PERSPECTIVE_Dataset and further discussed in subsequent section. The choice was dictated by multicollinearity among variables referring to the same type of inequality as well as data availability. The latter comes from the fact mentioned in Sala-i-Martin, Doppelhofer and Miller (2000), being that BMA requires as "balanced" dataset as possible. For instance, the original dataset covering 139 states was estimated only on 88, as BMA algorithm dropped some of observations containing missing data (Sala-i-Martin, Doppelhofer & Miller, 2000). The addition of 16 variables to the original dataset allowed this number to be above 50 in every estimation performed by the author, providing, thus, a reasonably high count of the degrees of freedom.

Also, Sala-i-Martin, Doppelhofer and Miller (2000)'s dataset has not been updated since the time of article's publication, unfortunately. As such, the time

frame of the analysis was limited to 1960–1996 period. Implications of this are discussed in the Results of BMA Application, and it could be stated that drawing more definite conclusions on the effect of inequality's dynamics on growth would require bringing the data on the rest of the potential determinants up to date.

The estimation was carried out using BMS Package for R (Zeugner & Feldkircher 2015), employing expected model size equal to 20 variables and UIP g prior. Each estimation accounted for $3 * 10^7$ iterations and $3 * 10^6$ burn-ins, ensuring correlation coefficient > 0.9 between analytical and simulated PIP in each case. These values of prior allowed to be consistent with what has been performed in Sala-i-Martin, Doppelhofer and Miller (2000), while also remaining feasible for computational powers of author's hardware. In order to account for potential diffusion of information due to multicollinearity between different types of inequality, 17 different datasets were estimated. One of these consists of 68 variables from Sala-i-Martin, Doppelhofer and Miller's (2000) original dataset and all of 16 variables introduced by the author, 84 in total. The PIP in such a case equals 0.241. The other 16 consist of same 68 variables and each of the newly introduced variables separately, the PIP in such case being equal to 0.294. Finally, Jointness measures were calculated on the set consisting of 84 variables. In each of the above cases, the variable labeled as GROWTH in Sala-i-Martin, Doppelhofer and Miller (2000), referring to Average Growth of GDP per Capita at PPP during the period of 1960-1996, was used as a dependent one. The code for replication of these operations in R is available at https://www.researchgate.net/publication/317370815_INEQUALITY_AND_GROWTH_A_BAYESIAN_PERSPECTIVE_Code?_iepl%5BviewId%5D=gihY0zKTRSuov2T1eV2YTLfv&_iepl%5Bcontexts%5D%5B0%5D=projectUpdatesLog&_iepl%5BtargetEntityId%5D=PB%3A317370815&_iepl%5BinteractionType%5D=publicationTitle.

The next chapter elaborates on data used during the above-mentioned estimations, while the subsequent one reports the results.

3. Data and Sources

Data used for BMA estimation consists of two parts, which are the dataset accompanying the Doppelhofer and Weeks (2009) and variables introduced by the author. The former is, in fact, the same dataset used in Sala-i-Martin, Doppelhofer and Miller (2000), but available in the electronic form for download. The link to this can be found in Bibliography section, while the files itself are accessible at https://www.researchgate.net/

publication/317370498_INEQUALITY_AND_GROWTH_A_BAYESIAN_PERSPECTIVE_Dataset.The dataset encompasses 68 positions, which includes Growth of GDP per Capita at PPP and 67 variables found most often in economic literature to be robust determinants of the latter. All of these are represented by average values for the period of 1960-1996 and cover 139 countries. A more detailed description of each variable, its source as well as list of states included in the dataset are also available in Sala-i-Martin, Doppelhofer and Miller (2000), as well as under the above-mentioned link.

Variables introduced by the author refer to the main types and measures of inequality discussed in Chapter 1. In process of constructing such "supplementary dataset", one has gathered information on 162 variables, grouped in 12 categories, across 255 nations. The analyzed period consists of years 1960 to 1996, or the latest/earliest data point from this timeframe available. While only a minor part of this was used in actual estimations due to reasons discussed in Chapter 2, the author perceives this effort to combine the aggregated data available from different open sources as a potential starting point for future research. It is indeed striking to what extent such data is currently hard to access and how limited the scope covered by it is. While the situation is much better for the US and other major economics, hardly any study addresses directly the dynamics of specific types of economic inequality on substantial cross-national level and during long enough period. Reader can refer to https://www.researchgate.net/publication/317370498_INEQUALITY_AND_GROWTH_A_BAYESIAN_PERSPECTIVE_Datasetfor illustration and complete list of the variables analyzed.

To bring the dataset to its more "balanced" version, as mentioned in Sala-i-Martin, Doppelhofer and Miller (2000), and to decrease multicollinearity among variables referring to the same kind of economic inequality, 16 variables were chosen in such a way as to provide the largest possible number of data points as well as types of inequality in the dataset. The number of states was also decreased to 139 reported in Sala-i-Martin, Doppelhofer and Miller (2000).

Table 1 provides a detailed explanation and sources for 16 variables used in BMA estimation, while the results of the latter are discussed in the next chapter.

Table 1. List of variables used in BMA estimation

Variable	Description	Serves as proxy for	Source
gini_market	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg	Agregate Inequality	SWIID Version 5.1, July 2016
gini_market_95ub	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer)	Agregate Inequality	SWIID Version 5.1, July 2016
gini_market_95lb	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer)	Agregate Inequality	SWIID Version 5.1, July 2016
health_exp	Health expenditure per capita, PPP (constant 2011 international $)	Inequality of health services' provision	World Bank from World Health Organization Global Health Expenditure database, 2017
adul_lit	Adult Literacy Rate, % of population aged 15+	Inequality in access to schooling	Euromonitor International from UNESCO/national statistics, 2017
medage	Median Age of Population	Inequality of health services' provision	Euromonitor International from national statistics/UN, 2017
fert	Fertility Rates	Inequality of health services' provision	Euromonitor International from UN/Eurostat/World Bank/national statistics, 2017
death	Death Rates	Inequality of health services' provision	Euromonitor International from UN/Eurostat/World Bank/national statistics, 2017
life_exp	Life Expectancy at Birth	Inequality of health services' provision	Euromonitor International from World Bank/Eurostat/UN/national statistics, 2017
rkna	Capital stock at constant national prices (in mil. 2011US$)	Degree of industrialization	Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer, 2015
csh_i	Share of gross capital formation at current PPPs	Degree of industrialization	Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer, 2015

Table 1. (continued)

hcap	Index of human capital per person, based on years of schooling and returns to education	Inequality of human capital	Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer, 2015
D1	Decile 1 share of total income	Concentration of wealth	World Income Inequality Database (WIID), Version 3.4, 2017
D5	Decile 5 share of total income	Concentration of wealth	World Income Inequality Database (WIID), Version 3.4, 2017
D10	Decile 10 share of total income	Concentration of wealth	World Income Inequality Database (WIID), Version 3.4, 2017
gini_wiid	GINI coefficient as reported by the respective source in WIID	Agregate Inequality	World Income Inequality Database (WIID), Version 3.4, 2017
gini_ds	GINI index (Deininger and Squire (1996))	Agregate Inequality	Deininger and Squire, 1996
ins_fin	Insurance and financial services (% of service exports, BoP)	Financial Sector Development	World Bank from International Monetary Fund, Balance of Payments Statistics Yearbook and data files, 2017

Source: author's elaboration.

4. Results and Implications

Table 2 presents the result of BMA estimation for the set of 84 variables described previously, reporting PIP, Posterior Mean, Posterior Standard Deviation, and Conditional Positive Sign Probability. The bottom of the table also includes other statistics described in Chapter 2. 21 variable defined as "robust" in Sala-i-Martin, Doppelhofer and Miller (2000) are highlighted in bold and italics.

Table 2. Results of BMA estimation, GROWTH as a dependent variable, 83 regressors

		PIP	Post Mean	Post SD	Cond.Pos.Sign	Idx
CONFUC	***Fraction Confucian***	0,9689	0,0580816	0,01804	0,99998517	9
MINING	***Mining Share of GDP***	0,90832	0,0459331	0,02113	0,99991967	37
ECORG	Capitalism	0,90783	0,0039195	0,00196	0,99993519	15
SAFRICA	***Sub-Saharan Africa Dummy***	0,905	-0,019902	0,00937	0,00018387	55
BUDDHA	***Fraction Buddhist***	0,90432	0,0178641	0,00793	0,99972841	5
NEWSTATE	Timing of Independence	0,86596	-0,006504	0,00333	0,00204952	39
GEEREC1	Public Education Spending Share of GDP	0,69106	0,3112738	0,27327	0,99588412	21
CIV72	Civil Liberties	0,64395	-0,00991	0,00857	0,00421677	7
HINDU00	Fraction Hindu	0,63279	0,0279077	0,02623	0,99526471	28
PI6090	Average Inflation 1960-90	0,60068	-0,000147	0,00015	0,00089676	45
SPAIN	***Spanish Colony***	0,53287	-0,006655	0,00725	0,00726582	59
GVR61	***Government Consumption Share of GDP***	0,47661	-0,021297	0,14059	0,11727527	25
TROPICAR	***Fraction of Tropical Area***	0,46653	-0,011273	0,01454	0,02184298	62
LANDLOCK	Landlocked Country Dummy	0,43896	0,0032784	0,00454	0,99608874	32
GGCFD3	Public Investment Share of GDP	0,438	-0,040342	0,05479	0,00409195	22
DENS60	***Population Density***	0,43182	5,844E-06	8,1E-06	0,99435945	10
ABSLATIT	Absolute Latitude	0,42816	-0,000264	0,00035	0,04268866	1
GDPCH60L	***Initial Income (Log GDP in 1960)***	0,3834	-0,002197	0,00338	0,0101446	20
csh_i	Share of gross capital formation at current PPPs	0,37352	0,0183088	0,02713	0,98104159	76
LANDAREA	Land Area	0,36711	-6,16E-10	1E-09	0,04706779	31
OPENDEC1	Openness 1965-74 ((Exports + Imports)/GDP)	0,34693	0,0070713	0,01168	0,91704056	41
SCOUT	Outward Orientation	0,34506	-0,001638	0,00298	0,09569179	56
H60	Higher Education Enrollment	0,34446	-0,025633	0,04434	0,01950154	26
MUSLIM00	***Fraction Muslim***	0,34187	0,0039424	0,00927	0,82368991	38
AVELF	***Ethnolinguistic Fractionalization***	0,33702	-0,003364	0,00572	0,05020511	3
MALFAL66	***Malaria Prevalence***	0,31083	0,0025642	0,00446	0,98942884	36
HERF00	Religion Measure	0,28781	0,0028445	0,00525	0,97947467	27
GOVSH61	Government Share of GDP	0,28754	-0,02636	0,14042	0,30312523	24
RERD	***Real Exchange Rate Distortions***	0,28288	-1,45E-05	2,7E-05	0,01573953	53
hcap	Index of human capital per person, based on years of schooling and returns to education	0,246	-0,001854	0,00458	0,09767895	77
TROPPOP	Fraction Population In Tropics	0,23558	0,0025128	0,00571	0,90853829	63
D1	Decile 1 share of total income	0,22922	0,0007212	0,00163	0,97554592	78
DENS65C	***Population Coastal Density***	0,21119	-5,62E-06	1,4E-05	0,07209268	11
WARTIME	Fraction Spent in War 1960-90	0,2028	0,0020244	0,00521	0,91722292	64
health_exp	Health expenditure per capita, PPP (constant 2011 international $)	0,1974	2,558E-07	3,5E-06	0,53762531	71
GDE1	Defense Spending Share of GDP	0,18824	0,0406712	0,1565	0,93685509	19
ENGFRAC	English Speaking Population	0,17968	-0,000889	0,00314	0,14472442	16
COLONY	Colony Dummy	0,1788	-0,001662	0,00475	0,10083885	8
PROT00	Fraction Protestant	0,17698	-0,001261	0,00418	0,12275769	52
P60	***Primary Schooling Enrollment***	0,17611	0,0022173	0,00643	0,90509728	44
gini_market_95lb	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, bottom 5% of income distribution	0,17479	0,0078399	0,55083	0,93399768	70
CATH00	Fraction Catholic	0,16779	0,0005261	0,00383	0,71207068	6
POP60	Population in 1960	0,16341	3,327E-09	2E-08	0,75861832	49
LAAM	***Latin America Dummy***	0,14925	-0,001009	0,00381	0,1599711	30

Table 2. (continued)

rkna	Capital stock at constant national prices (in mil. 2011US$)	0,14132	8,8E-11	3,3E-10	0,8462	75
SIZE60	Size of Economy	0,13568	-0,0002	0,00082	0,23156	57
SQPI6090	Square of Inflation 1960-90	0,13519	3,9E-08	9,9E-07	0,46844	46
gini_market	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard	0,12772	-0,0155	1,10165	0,76496	68
YRSOPEN	***Years Open 1950-94***	0,11572	-0,0006	0,00249	0,10112	66
TOTIND	Terms of Trade Ranking	0,11315	-0,001	0,00432	0,12637	61
adul_lit	Adult Literacy Rate, % of population aged 15+	0,11171	-8E-06	5,9E-05	0,3254	72
medage	Median Age of Population	0,11129	6,5E-05	0,00043	0,64918	73
LHCPC	Hydrocarbon Deposits	0,10922	3,9E-05	0,00018	0,81912	33
GOVNOM1	Nominal Government Share of GDP	0,109	-0,001	0,01862	0,4615	23
death	Death Rates	0,10865	-5E-05	0,00045	0,46986	74
ZTROPICS	Tropical Climate Zone	0,10837	-0,0006	0,00258	0,15751	67
OTHFRAC	***Fraction Speaking Foreign Language***	0,10647	-0,0002	0,00144	0,2945	43
OIL	Oil Producing Country Dummy	0,10486	-0,0005	0,0027	0,20695	40
ORTH00	Fraction Orthodox	0,10465	-0,0009	0,00375	0,03921	42
EAST	***East Asian Dummy***	0,10248	0,00061	0,00294	0,79731	14
DPOP6090	Population Growth Rate 1960-90	0,10102	0,02111	0,11638	0,80438	13
gini_market_95ub	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, top 5% of income distribution	0,10014	0,00777	0,55082	0,49418	69
ins_fin	Insurance and financial services (% of service exports, BoP)	0,09998	1,4E-05	0,00013	0,66325	83
WARTORN	War Participation 1960-90	0,09801	-0,0002	0,00104	0,23189	65
PRIEXP70	Primary Exports	0,09532	-0,0005	0,00243	0,12813	51
EUROPE	European Dummy	0,0951	-7E-05	0,00302	0,49724	17
D5	Decile 5 share of total income	0,09372	-6E-05	0,00078	0,34327	79
LT100CR	Fraction Land Area Near Navigable Water	0,09307	-0,0002	0,0018	0,32699	35
LIFE060	***Life Expectancy***	0,09054	-8E-06	0,0001	0,32641	34
D10	Decile 10 share of total income	0,08932	9,5E-06	0,0001	0,70909	80
AIRDIST	Air Distance to Big Cities	0,08897	4,1E-08	2,4E-07	0,81573	2
DENS65I	Interior Density	0,0881	3,3E-07	4,3E-06	0,65419	12
POP1560	Fraction Population Less than 15	0,08726	0,00192	0,01498	0,67902	48
POP6560	Fraction Population Over 65	0,08678	0,00344	0,03326	0,66108	50
BRIT	British Colony Dummy	0,08354	-0,0001	0,00094	0,27385	4
IPRICE1	***Investment Price***	0,08175	-1E-06	1,1E-05	0,27166	29
PRIGHTS	Political Rights	0,08085	2,4E-05	0,00032	0,6382	47
FERTLDC1	Fertility	0,08018	0,00012	0,0026	0,57901	18
SOCIALIST	Socialist Dummy	0,07999	-0,0003	0,00208	0,18253	58
TOT1DEC1	Terms of Trade Growth in 1960s	0,07723	-0,0005	0,01116	0,37067	60
REVCOUP	Revolutions and Coups	0,07658	8,6E-05	0,00186	0,59617	54
gini_ds	GINI index (Deininger and Squire (1996))	0,06734	-2E-06	5,2E-05	0,42103	82
gini_wiid	GINI coefficient as reported by the respective source in WIID	0,06466	-9E-08	4,9E-06	0,5122	81

Mean no. regressors	Draws	Burnins	Time	No. models visited	Modelspace 2^K	% visited
21.9723	3,00E+07	3,00E+06	52.74533 mins	5224737	9.7e+24	5.4e-17
% Topmodels	**Corr PMP**	**No. Obs.**	**Model Prior**	**g-Prior**	**Shrinkage-Stats**	
0.47	0.9396	58	fixed / 20	UIP	Av=0.9831	

Source: author's elaboration based on Sala-i-Martin, Doppelhofer and Miller (2000) and performed in RStudio.

The obtained PIPs suggest a rather inconclusive outcome. 31 variables are defined to belong in a "true" model, in contrast to 21 variables suggested by the results obtained by Sala-i-Martin, Doppelhofer and Miller (2000). Moreover, this subset includes some indicators reported as no-robust in the latter, and vice versa.

Variables which PIPs allow to suggest their significance in both cases are Fraction Confucian, Mining Share of GDP, Sub-Saharan Africa Dummy, Fraction Buddhist, Spanish Colony Dummy, Government Consumption Share of GDP, Fraction of Tropical Area, Population Density, Initial Income (Log GDP in 1960), Fraction Muslim, Ethnolinguistic Fractionalization, Malaria Prevalence, Real Exchange Rate Distortions. The posterior means and standard deviations of these are highly comparable to what has been obtained by Sala-i-Martin *et al*. (2000). The signs are also the same, except for Malaria Prevalence, whose sign is, surprisingly, positive.

Variables such as Capitalism, Public Education Spending Share of GDP, Fraction Hindu, Civil Liberties, Landlocked Country Dummy, the Share of Gross Capital Formation at Current PPPs, Openness, and Religion Measure are defined as significant determinants, affecting the growth positively. This is in line with economic theory except for Fraction Hindu, Landlocked Country Dummy, and Religion Measure. The strength of the impact from the latter is rather weak; however, Public Investment Share of GDP, Absolute Latitude, Land Area, Outward Orientation, Higher Education Enrollment, Government Share of GDP, and Index of human capital are significant and have negative posterior mean, which in some cases is rather against the expectations, but replicates what is also obtained by Sala-i-Martin, Doppelhofer and Miller (2000).

The author finds the following conclusion appropriate: the introduction of various inequality measures has, undoubtedly, affected the results of Sala-i-Martin, Doppelhofer and Miller's (2000) baseline estimation, and, thus, following BMA theory, introduces a new kind of statistically significant information into the model; however, due to incompatibility of significant number of variables' signs with general economic assumptions, the author would assume some kind of data deficiency, which results in significant "noise" that BMA is unable to overcome. The obvious candidate for such role is multicollinearity, since different proxies for inequality types would essentially describe strongly interrelated phenomena.

To introduce the treatment for this problem, it was decided to exclude certain variables that embody basically the same kind of information. Namely, gini_ds,gini_wiid,D5,D1,gini_market_95lb, andgini_market_95ub were dropped. The results of estimation excluding these variables are reported in Table 3.

Table 3. Results of BMA estimation, GROWTH as a dependent variable, 77 regressors

		PIP	Post Mean	Post SD	Cond.Pos.Sign	Idx
CONFUC	***Fraction Confucian***	0,95552	0,0541249	0,01783	0,99999798	9
MINING	***Mining Share of GDP***	0,94656	0,0618123	0,02302	0,99999813	37
NEWSTATE	Timing of Independence	0,91943	-0,007183	0,00294	0,00137814	39
BUDDHA	***Fraction Buddhist***	0,87662	0,0184226	0,00896	0,99972413	5
GDPCH60L	***Initial Income (Log GDP in 1960)***	0,84166	-0,0072595	0,00431	0,00016559	20
HINDU00	Fraction Hindu	0,83661	0,0389706	0,0212	0,99872562	28
GVR61	***Government Consumption Share of GDP***	0,83046	-0,0717863	0,16837	0,02658342	25
ECORG	Capitalism	0,8296	0,0028137	0,00172	0,99992751	15
CIV72	Civil Liberties	0,73436	-0,0091542	0,00676	0,00018188	7
MUSLIM00	***Fraction Muslim***	0,64231	0,0146212	0,01282	0,9921944	38
P60	***Primary Schooling Enrollment***	0,62901	0,0147848	0,01323	0,99845763	44
GGCFD3	Public Investment Share of GDP	0,62031	-0,0424926	0,03984	0,00148368	22
PI6090	Average Inflation 1960-90	0,58324	-0,0001478	0,00017	0,0013793	45
SAFRICA	***Sub-Saharan Africa Dummy***	0,55049	-0,0095873	0,01047	0,00176163	55
GEEREC1	Public Education Spending Share of GDP	0,53525	0,183841	0,24841	0,99660735	21
DENS65C	***Population Coastal Density***	0,50269	3,93E-06	4,5E-06	0,97657815	11
OPENDEC1	Openness 1965-74 ((Exports + Imports)/GDP)	0,5017	0,006012	0,00704	0,97774252	41
HERF00	Religion Measure	0,47529	0,0070451	0,00865	0,99104069	27
RERD	***Real Exchange Rate Distortions***	0,42021	-2,797E-05	3,8E-05	0,00293271	53
GOVSH61	Government Share of GDP	0,30917	-0,0210193	0,16597	0,38743541	24
H60	Higher Education Enrollment	0,29021	-0,0237347	0,04493	0,02506717	26
LAAM	***Latin America Dummy***	0,24553	-0,0026525	0,00678	0,1368225	30
DPOP6090	Population Growth Rate 1960-90	0,22995	0,1399085	0,3293	0,93828285	13
medage	Median Age of Population	0,22642	0,0002818	0,00071	0,95238877	71
MALFAL66	***Malaria Prevalence***	0,21961	0,0014354	0,00337	0,95101138	36
AVELF	***Ethnolinguistic Fractionalization***	0,20537	-0,0018352	0,00441	0,01715679	3
DENS60	***Population Density***	0,19934	2,147E-06	5,5E-06	0,98193616	10
D10	Decile 10 share of total income	0,1926	-6,219E-05	0,00016	0,0541592	76
SQPI6090	Square of Inflation 1960-90	0,19049	2,182E-07	1,5E-06	0,53932898	46
hcap	Index of human capital per person, based on years of schooling and returns to education	0,18926	0,0014728	0,00444	0,84209574	75
POP60	Population in 1960	0,18285	8,59E-09	2,8E-08	0,79894152	49
GDE1	Defense Spending Share of GDP	0,17993	0,0440025	0,18409	0,91542805	19
TROPICAR	***Fraction of Tropical Area***	0,17892	-0,0012132	0,00346	0,08483065	62
LANDAREA	Land Area	0,17191	-2,213E-10	6,5E-10	0,04738631	31
WARTIME	Fraction Spent in War 1960-90	0,16491	0,0018573	0,00659	0,7759651	64
EUROPE	European Dummy	0,16213	0,0004573	0,00497	0,69015924	17
death	Death Rates	0,14564	-0,000123	0,00052	0,21967276	72
csh_i	Share of gross capital formation at current PPPs	0,13059	0,0025142	0,00846	0,96912947	74
REVCOUP	Revolutions and Coups	0,12866	-0,0009281	0,00348	0,14270491	54
SIZE60	Size of Economy	0,12797	-0,0001989	0,00085	0,19375372	57
IPRICE1	***Investment Price***	0,12726	-4,771E-06	1,9E-05	0,134634	29
WARTORN	War Participation 1960-90	0,12627	-0,0003753	0,0013	0,02720296	65
ZTROPICS	Tropical Climate Zone	0,12563	-0,0006602	0,00313	0,1841209	67
health_exp	Health expenditure per capita, PPP (constant 2011 international $)	0,12551	6,636E-07	2,6E-06	0,887984	69

Table 3 (continued)

GOVNOM1	Nominal Government Share of GDP	0,12527	0,00429	0,02032	0,85978	23
OIL	Oil Producing Country Dummy	0,12519	-0,0008	0,00312	0,11259	40
SPAIN	***Spanish Colony***	0,1207	-0,0006	0,00295	0,23077	59
PRIEXP70	Primary Exports	0,12044	-0,0008	0,00333	0,10149	51
POP1560	Fraction Population Less than 15	0,10785	0,00296	0,02003	0,67361	48
POP6560	Fraction Population Over 65	0,10603	0,00826	0,04421	0,84493	50
rkna	Capital stock at constant national prices (in mil. 2011US$)	0,10451	5E-11	2,9E-10	0,7511	73
SCOUT	Outward Orientation	0,1031	-0,0003	0,00109	0,08638	56
CATH00	Fraction Catholic	0,10212	8,7E-05	0,00284	0,69513	6
ENGFRAC	English Speaking Population	0,10038	-0,0005	0,00205	0,0942	16
LIFE060	***Life Expectancy***	0,09374	1,9E-05	0,00011	0,82997	34
ABSLATIT	Absolute Latitude	0,09155	6,6E-06	5,7E-05	0,71965	1
EAST	***East Asian Dummy***	0,09137	0,00053	0,00265	0,86983	14
adul_lit	Adult Literacy Rate, % of population aged 15+	0,09096	3,8E-06	5,4E-05	0,68753	70
COLONY	Colony Dummy	0,09041	-0,0003	0,0019	0,18525	8
OTHFRAC	***Fraction Speaking Foreign Language***	0,08866	0,00022	0,00114	0,88359	43
TOT1DEC1	Terms of Trade Growth in 1960s	0,0861	-0,0019	0,0132	0,20433	60
TOTIND	Terms of Trade Ranking	0,0855	4,4E-05	0,00318	0,61142	61
PROT00	Fraction Protestant	0,08519	-0,0004	0,00284	0,15796	52
FERTLDC1	Fertility	0,08488	6E-05	0,00318	0,44025	18
PRIGHTS	Political Rights	0,08358	6E-05	0,00041	0,7211	47
ORTH00	Fraction Orthodox	0,08252	-0,0007	0,00361	0,08331	42
BRIT	British Colony Dummy	0,08161	-0,0001	0,00098	0,22822	4
gini_market	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard	0,0788	-4E-06	6,5E-05	0,39174	68
AIRDIST	Air Distance to Big Cities	0,07336	1,9E-08	2E-07	0,70126	2
YRSOPEN	***Years Open 1950-94***	0,0718	-0,0002	0,00178	0,29151	66
LHCPC	Hydrocarbon Deposits	0,07051	1E-05	0,00011	0,56816	33
LANDLOCK	Landlocked Country Dummy	0,06794	0,00014	0,00116	0,80421	32
SOCIALIST	Socialist Dummy	0,06728	-4E-05	0,00203	0,45087	58
LT100CR	Fraction Land Area Near Navigable Water	0,06679	-0,0001	0,00129	0,38626	35
ins_fin	Insurance and financial services (% of service exports, BoP)	0,06569	3,5E-07	0,0001	0,45951	77
TROPPOP	Fraction Population In Tropics	0,0654	-1E-04	0,00149	0,34073	63
DENS65I	Interior Density	0,0606	1,2E-07	2,7E-06	0,63675	12

Mean no. regressors	**Draws**	**Burnins**	**Time**	**No. models visited**	**Modelspace 2^K**	**% visited**
20,7606	2,08E+01	2,08E+01	20,7606	20,7606	1,50E+23	3,70E-15
% Topmodels	**Corr PMP**	**No. Obs.**	**Model Prior**	**g-Prior**	**Shrinkage-Stats**	
0,72	0,9715	61	fixed / 20	UIP	Av=0.9839	

Source: author's elaboration based on Sala-i-Martin, Doppelhofer and Miller (2000) and performed in RStudio.

It appears that such a kind of manipulation has led to more sensible outcomes, indeed. First of all, the number of variables passing PIP's significance

threshold has dropped to 22. Spanish Colony Dummy, Fraction of Tropical Area, Population Density, Ethnolinguistic Fractionalization, and Malaria Prevalence are no longer significant, while Primary Schooling Enrollment and Population Coastal Density, being significant in Sala-i-Martin, Doppelhofer and Miller (2000), became such in a given dataset too. The rest of the variables from this subset is still the same, with signs and other statistics now perfectly comparable with the result of aforementioned work.

Other significant and positive determinants of growth are Fraction Hindu, Capitalism, Public Education Spending Share of GDP, Openness, and Religion Measure; significant and negative determinants are Timing of Independence, Civil Liberties, Public Investment Share of GDP, Average Inflation, Government Share of GDP, and Higher Education Enrollment. Such results are in line with what is usually reported in literature, except for Civil Liberties and Higher Education Enrollment, but, once again, these variables' signs are negative in Sala-i-Martin, Doppelhofer and Miller (2000) as well. Thus, none of newly introduced measures have appeared to be robust determinants of growth during the referred period.

In order to fully account for multicollinearity, 16 more estimations were performed, as described in Chapter 2. Tables 4 and 5 report the two including most widely cited measures of inequality, namely GINI coefficient and the share of total income belonging to 10^{th} decile.

As it can be observed, the results of such estimations are very much comparable to those of baseline study, but with the lower number of significant variables. This is also true regarding signs and posterior means of all of the latter also reported as such in Sala-i-Martin, Doppelhofer and Miller (2000). Additional measures that are reported as significant determinants are Openness, Government Share of GDP, Political Rights in case of GINI, and Primary Exports in case of D10. All except the first one have negative signs.

The other 14 estimations of this kind yield 11 to 17 significant variables, with Table 6 presenting the statistics on the number of estimations in which each variable was found to be significant. The highest value of the latter is reported for the same variables found to be significant in Sala-i-Martin, Doppelhofer and Miller (2000), with all the same signs and comparable posterior means. The only author's variables found to be significant when introduced separately are Median Age of Population and Death Rates, both referring to inequality of health services' provision. The most likely reason for this, however, is endogeneity, as improvement in these indicators can be stated to come as a result of economic growth rather than its driver.

Table 4. Results of BMA estimation, gini_market as a dependent variable

		PIP	Post Mean	Post SD	Cond.Pos.Sign	Idx
GDPCH60L	***Initial Income (Log GDP in 1960)***	0,99131	-0,012029	0,00323	0	20
P60	***Primary Schooling Enrollment***	0,94432	0,0248602	0,00943	1	44
SAFRICA	***Sub-Saharan Africa Dummy***	0,79499	-0,014332	0,00946	0,00015623	55
DENS60	***Population Density***	0,60039	1,107E-05	1E-05	0,99984327	10
GOVSH61	Government Share of GDP	0,57182	-0,0359	0,06274	0,00456677	24
TROPICAR	***Fraction of Tropical Area***	0,54063	-0,006691	0,00717	0,00216724	62
EAST	***East Asian Dummy***	0,51296	0,0075116	0,00849	0,99830266	14
DENS65C	***Population Coastal Density***	0,4778	3,733E-06	4,5E-06	0,99348894	11
MINING	***Mining Share of GDP***	0,46653	0,022644	0,02795	0,99995649	37
OPENDEC1	Openness 1965-74 ((Exports + Imports)/GDP)	0,39247	0,0044452	0,00644	0,99579719	41
LAAM	***Latin America Dummy***	0,3722	-0,004464	0,00695	0,02814016	30
PRIGHTS	Political Rights	0,3306	-0,000757	0,00126	0,00115354	47
CONFUC	***Fraction Confucian***	0,30527	0,0113272	0,01983	0,99990577	9
GVR61	***Government Consumption Share of GDP***	0,29342	-0,011092	0,05885	0,08280458	25
YRSOPEN	***Years Open 1950-94***	0,273	0,0030018	0,00575	0,99952906	66
COLONY	Colony Dummy	0,25411	-0,00203	0,00414	0,0048802	8
RERD	***Real Exchange Rate Distortions***	0,21222	-1,47E-05	3,4E-05	0,00005796	53
GGCFD3	Public Investment Share of GDP	0,19407	-0,012236	0,03029	0,01300779	22
BUDDHA	***Fraction Buddhist***	0,1917	0,0027652	0,00689	0,98992537	5
PRIEXP70	Primary Exports	0,17949	-0,001949	0,00511	0,0212666	51
CATH00	Fraction Catholic	0,17382	-0,001983	0,00565	0,03918016	6
FERTLDC1	Fertility	0,16368	-0,001932	0,00561	0,0202706	18
MALFAL66	***Malaria Prevalence***	0,15823	-0,001386	0,00409	0,02886421	36
LIFE060	***Life Expectancy***	0,15732	8,262E-05	0,00024	0,98632388	34
PROT00	Fraction Protestant	0,14879	-0,001966	0,00608	0,0222785	52
GOVNOM1	Nominal Government Share of GDP	0,14618	-0,005904	0,0184	0,03318989	23
EUROPE	European Dummy	0,1359	0,0010861	0,00452	0,81083991	17
MUSLIM00	***Fraction Muslim***	0,13463	0,0012328	0,00422	0,94663249	38
POP60	Population in 1960	0,13394	4,684E-09	1,5E-08	0,97943788	49
AIRDIST	Air Distance to Big Cities	0,12385	-1,09E-07	3,9E-07	0,05033522	2
HINDU00	Fraction Hindu	0,1238	0,0020214	0,00732	0,94441596	28
ECORG	Capitalism	0,11524	0,0001537	0,00056	0,98242696	15
NEWSTATE	Timing of Independence	0,09897	-0,000181	0,00097	0,18954238	39
ABSLATIT	Absolute Latitude	0,09016	-8,37E-06	7,4E-05	0,30877013	1
GDE1	Defense Spending Share of GDP	0,08979	-0,001884	0,05705	0,21193902	19
SPAIN	***Spanish Colony***	0,08779	0,0002985	0,00239	0,69465484	59
OTHFRAC	***Fraction Speaking Foreign Language***	0,08657	0,0003055	0,00152	0,92547408	43
SIZE60	Size of Economy	0,08519	6,206E-05	0,00055	0,69041086	57
GEEREC1	Public Education Spending Share of GDP	0,08434	0,0137081	0,08114	0,92901106	21
gini_market	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard	0,08218	-1,25E-05	8,3E-05	0,1567553	68
IPRICE1	***Investment Price***	0,08134	-2,66E-06	1,4E-05	0,06168764	29
POP6560	Fraction Population Over 65	0,0809	0,0063441	0,03789	0,84470194	50
LANDAREA	Land Area	0,07923	-3,7E-11	3,4E-10	0,27923442	31
CIV72	Civil Liberties	0,07641	-0,000292	0,00229	0,31450366	7
BRIT	British Colony Dummy	0,07216	0,0001012	0,00111	0,62452683	4
H60	Higher Education Enrollment	0,07191	-0,001867	0,01288	0,15343201	26

Table 4. (continued)

POP1560	Fraction Population Less than 15	0,07161	0,00113	0,01375	0,61858	48
DPOP6090	Population Growth Rate 1960-90	0,06802	0,00656	0,09813	0,56332	13
TROPPOP	Fraction Population In Tropics	0,06801	-2E-05	0,00197	0,47623	63
LHCPC	Hydrocarbon Deposits	0,06578	1,1E-05	0,0001	0,76617	33
OIL	Oil Producing Country Dummy	0,06487	-8E-05	0,00172	0,41635	40
REVCOUP	Revolutions and Coups	0,0645	-0,0003	0,00212	0,10337	54
LANDLOCK	Landlocked Country Dummy	0,0641	-0,0002	0,00116	0,08333	32
LT100CR	Fraction Land Area Near Navigable Water	0,06376	-4E-05	0,00141	0,44169	35
TOT1DEC1	Terms of Trade Growth in 1960s	0,06241	-0,0005	0,0115	0,36774	60
SOCIALIST	Socialist Dummy	0,06108	-0,0002	0,00174	0,08505	58
AVELF	***Ethnolinguistic Fractionalization***	0,06085	-9E-05	0,00163	0,37822	3
ZTROPICS	Tropical Climate Zone	0,06075	8,2E-06	0,0017	0,54609	67
HERF00	Religion Measure	0,05958	5,9E-05	0,00185	0,49745	27
TOTIND	Terms of Trade Ranking	0,0585	-0,0001	0,00234	0,3723	61
SCOUT	Outward Orientation	0,05705	-6E-05	0,00068	0,24237	56
PI6090	Average Inflation 1960-90	0,05673	6,9E-07	2,9E-05	0,53137	45
WARTORN	War Participation 1960-90	0,05594	2,9E-05	0,00073	0,59737	65
ENGFRAC	English Speaking Population	0,05575	-6E-05	0,00132	0,34861	16
SQPI6090	Square of Inflation 1960-90	0,05575	-2E-08	3,6E-07	0,34068	46
WARTIME	Fraction Spent in War 1960-90	0,05539	2,6E-05	0,00206	0,53951	64
ORTH00	Fraction Orthodox	0,05487	-0,0002	0,00286	0,22924	42
DENS65I	Interior Density	0,05222	3,6E-08	3,1E-06	0,53371	12

Mean no. regressors	**Draws**	**Burnins**	**Time**	**No. models visited**	**Modelspace 2^K**	**% visited**
13.1191	3,00E+07	3,00E+06	57.01946 mi	6169823	3,00E+20	2.1e-12
% Topmodels	**Corr PMP**	**No. Obs.**	**Model Prior**	**g-Prior**	**Shrinkage-Stats**	
1,4	0.9926	76	fixed / 20	UIP	Av=0.987	

Source: author's elaboration based on Sala-i-Martin, Doppelhofer and Miller (2000) and performed in RStudio.

The implications of the results described in this Chapter are numerous and, while providing some insight on inequality factor in long-run growth, raise more questions for future research. The conclusion based solely on BMA results may be that supporters of the neoclassical doctrine were right indeed and inequality does not affect long-run economic growth. Examination of the broader picture, however, allows identifying a number of issues suggesting that this may not be the case.

Firstly, the inclusion of inequality measures does affect the results of Sala-i-Martin, Doppelhofer and Miller (2000), at least employing the priors chosen by author. The latter, as noted in Chapter 2, have been mostly dictated by computational powers of author's hardware and should be compared against other BMA

Table 5. Results of BMA estimation, D10 as a dependent variable

		PIP	Post Mean	Post SD	Cond.Pos.Sign	Idx
GDPCH60L	***Initial Income (Log GDP in 1960)***	0,99773	-0,012913	0,00299	0	20
SAFRICA	***Sub-Saharan Africa Dummy***	0,95346	-0,019371	0,00719	0,00000353	55
P60	***Primary Schooling Enrollment***	0,94304	0,0224429	0,00885	1	44
DENS60	***Population Density***	0,63967	1,2E-05	1E-05	0,99997337	10
GOVSH61	Government Share of GDP	0,58794	-0,036031	0,04617	0,00570641	24
MINING	***Mining Share of GDP***	0,4794	0,0232432	0,02788	0,99998894	37
OPENDEC1	Openness 1965-74 ((Exports + Imports)/GDP)	0,47023	0,0053639	0,00661	0,9974309	41
TROPICAR	***Fraction of Tropical Area***	0,45526	-0,004744	0,00604	0,00216813	62
DENS65C	***Population Coastal Density***	0,44837	3,395E-06	4,3E-06	0,99090933	11
EAST	***East Asian Dummy***	0,3744	0,0044508	0,00669	0,99726151	14
LAAM	***Latin America Dummy***	0,36584	-0,003707	0,0058	0,01566655	30
CONFUC	***Fraction Confucian***	0,35722	0,0132474	0,02048	0,99997975	9
GVR61	***Government Consumption Share of GDP***	0,34802	-0,017349	0,04305	0,04573757	25
BUDDHA	***Fraction Buddhist***	0,30436	0,0051386	0,00907	0,99835296	5
PRIEXP70	Primary Exports	0,30211	-0,003936	0,00695	0,00293458	51
GGCFD3	Public Investment Share of GDP	0,26186	-0,01771	0,03501	0,00344934	22
FERTLDC1	Fertility	0,25381	-0,003389	0,00697	0,0030079	18
COLONY	Colony Dummy	0,24384	-0,001922	0,00404	0,00891014	8
YRSOPEN	***Years Open 1950-94***	0,20359	0,0019543	0,00463	0,99737614	66
RERD	***Real Exchange Rate Distortions***	0,17514	-1,04E-05	2,7E-05	0,00031479	53
PRIGHTS	Political Rights	0,15622	-0,000265	0,00077	0,0151703	47
EUROPE	European Dummy	0,14083	0,0011186	0,00408	0,86808909	17
GOVNOM1	Nominal Government Share of GDP	0,14034	-0,005359	0,01708	0,02416832	23
POP6560	Fraction Population Over 65	0,13824	0,0184934	0,05969	0,9711544	50
POP60	Population in 1960	0,137	4,573E-09	1,5E-08	0,98713429	49
CATH00	Fraction Catholic	0,13344	-0,001141	0,00407	0,04665952	6
NEWSTATE	Timing of Independence	0,11032	-0,000239	0,00103	0,12526447	39
REVCOUP	Revolutions and Coups	0,10894	-0,000913	0,00342	0,00655909	54
PROT00	Fraction Protestant	0,10872	-0,001062	0,0043	0,03594805	52
AIRDIST	Air Distance to Big Cities	0,10491	-7,91E-08	3,3E-07	0,07842383	2
ECORG	Capitalism	0,10403	0,0001187	0,00047	0,97645215	15
IPRICE1	***Investment Price***	0,09756	-3,67E-06	1,6E-05	0,03213471	29
SPAIN	***Spanish Colony***	0,0974	-0,000395	0,00232	0,20163483	59
GEEREC1	Public Education Spending Share of GDP	0,09735	0,0162136	0,07415	0,95055719	21
MUSLIM00	***Fraction Muslim***	0,09665	0,0005623	0,00275	0,86794508	38
LIFE060	***Life Expectancy***	0,09426	3,198E-05	0,00015	0,92394567	34
SIZE60	Size of Economy	0,08881	7,866E-05	0,00055	0,74645866	57
BRIT	British Colony Dummy	0,0827	0,0002181	0,00124	0,82643995	4
ABSLATIT	Absolute Latitude	0,08044	-2,83E-06	6,1E-05	0,43036165	1
LANDAREA	Land Area	0,07932	-2,81E-11	3,3E-10	0,33226581	31
D10	Decile 10 share of total income	0,07872	-1,22E-05	7,5E-05	0,11661373	68
GDE1	Defense Spending Share of GDP	0,07848	-0,001965	0,03774	0,24942393	19
POP1560	Fraction Population Less than 15	0,07749	-8,1E-05	0,0143	0,41809256	48

Table 5. (continued)

SQPI6090	Square of Inflation 1960-90	0,05879	-2,13E-08	3,6E-07	0,32567319	46
PI6090	Average Inflation 1960-90	0,05874	1,69E-07	2,9E-05	0,48731671	45
AVELF	***Ethnolinguistic Fractionalization***	0,0577	-4,42E-05	0,0015	0,43625745	3
ENGFRAC	English Speaking Population	0,05647	-0,000105	0,00132	0,25373828	16
WARTORN	War Participation 1960-90	0,05618	4,778E-05	0,0007	0,69286061	65
HERF00	Religion Measure	0,05589	-1,39E-06	0,00157	0,45776571	27
WARTIME	Fraction Spent in War 1960-90	0,05569	0,0001319	0,002	0,71133622	64
SCOUT	Outward Orientation	0,05381	-3,24E-05	0,0006	0,3188875	56
DENS65I	Interior Density	0,05173	-5,47E-08	3E-06	0,42931815	12

Mean no. regressors	**Draws**	**Burnins**	**Time**	**No. models visited**	**Modelspace 2^K**	**% visited**
13.1877	3,00E+07	3,00E+06	53.91044 mins	6181952	3,00E+20	2.1e-12
% Topmodels	**Corr PMP**	**No. Obs.**	**Model Prior**	**g-Prior**	**Shrinkage-Stats**	
1,1	0.9839	76	fixed / 20	UIP	Av=0.987	

Source: author's elaboration based on Sala-i-Martin, Doppelhofer and Miller (2000) and performed in RStudio.

specifications, e.g. those employed in the above-mentioned study or proposed by Fernández, Ley and Steel (2001).

Second, it should be noticed that inclusion of inequality into the set of potential repressors has altered the results of Sala-i-Martin, Doppelhofer and Miller (2000) quite significantly. For example, in the substantial number of estimations Government Share of GDP, Nominal Government Share of GDP, and Public Investment Share of GDP has proved to be robust. Given that all of these variables are influenced by tax revenue, which, in turn, may serve as an indication for the extent of redistribution in the society (it is not always the case, to be honest, but consider the example of Scandinavian countries), it can be considered that, perhaps, inequality may influence growth indirectly, by determining the set of determinants entering the "true" model. Moreover, as it can be proved by examination of Jointness measures for a given dataset (available at https://www.researchgate.net/publication/317370598_INEQUALITY_AND_GROWTH_A_BAYESIAN_PERSPECTIVE_Jointness_measures), all of the newly introduced variables have strong substitutive relationships with each other. Thus, altering the set of potential regressors may produce changes in the results.

Another issue not to be left unnoticed is the fact that data constraints have put the analysis in the timeframe during most part of which there was no substantial changes in the level of inequality which started to increase rapidly in certain economies only around 1990. This can be observed referring to Figures 1 to 3, which demonstrate the share of top percentile in total income during the period of 1910-2010 for blocks of Anglo-Saxon countries, Japan and the Continental Europe.

Table 6. Variables' significance

Variable	Description	Significant in (out of 15)
GDPCH60L	***Initial Income (Log GDP in 1960)***	15
P60	***Primary Schooling Enrollment***	15
MINING	***Mining Share of GDP***	14
SAFRICA	***Sub-Saharan Africa Dummy***	14
TROPICAR	***Fraction of Tropical Area***	13
DENS60	***Population Density***	13
DENS65C	***Population Coastal Density***	13
EAST	***East Asian Dummy***	13
CONFUC	***Fraction Confucian***	12
LAAM	***Latin America Dummy***	8
OPENDEC1	Openness 1965-74 ((Exports + Imports)/GDP)	7
GOVSH61	Government Share of GDP	7
GVR61	***Government Consumption Share of GDP***	6
YRSOPEN	***Years Open 1950-94***	6
GOVNOM1	Nominal Government Share of GDP	6
GGCFD3	Public Investment Share of GDP	5
MUSLIM00	***Fraction Muslim***	5
RERD	***Real Exchange Rate Distortions***	5
BUDDHA	***Fraction Buddhist***	4
PRIEXP70	Primary Exports	4
IPRICE1	***Investment Price***	4
PRIGHTS	Political Rights	3
ABSLATIT	Absolute Latitude	1
COLONY	Colony Dummy	1
CATH00	Fraction Catholic	1
medage	Median Age of Population	1
death	Death Rates	1
ECORG	Capitalism	0
NEWSTATE	Timing of Independence	0
GEEREC1	Public Education Spending Share of GDP	0
CIV72	Civil Liberties	0
HINDU00	Fraction Hindu	0
PI6090	Average Inflation 1960-90	0
SPAIN	***Spanish Colony***	0
LANDLOCK	Landlocked Country Dummy	0
csh_i	Share of gross capital formation at current PPPs	0
LANDAREA	Land Area	0
SCOUT	Outward Orientation	0
H60	Higher Education Enrollment	0
AVELF	***Ethnolinguistic Fractionalization***	0
MALFAL66	***Malaria Prevalence***	0
HERF00	Religion Measure	0

Table 6 (continued)

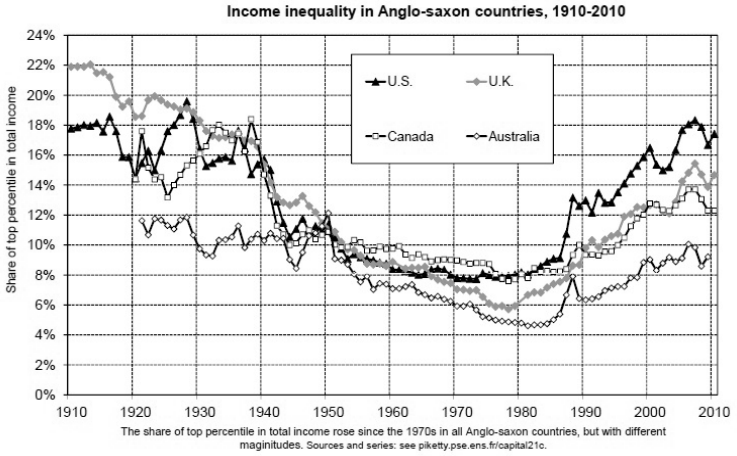
hcap	Index of human capital per person, based on years of schooling and returns to education	0
TROPPOP	Fraction Population In Tropics	0
D1	Decile 1 share of total income	0
WARTIME	Fraction Spent in War 1960-90	0
health_exp	Health expenditure per capita, PPP (constant 2011 international $)	0
GDE1	Defense Spending Share of GDP	0
ENGFRAC	English Speaking Population	0
PROT00	Fraction Protestant	0
gini_market_95lb	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, bottom 5% of income distribution	0
POP60	Population in 1960	0
rkna	Capital stock at constant national prices (in mil. 2011US$)	0
SIZE60	Size of Economy	0
SQPI6090	Square of Inflation 1960-90	0
gini_market	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard	0
TOTIND	Terms of Trade Ranking	0
adul_lit	Adult Literacy Rate, % of population aged 15+	0
LHCPC	Hydrocarbon Deposits	0
ZTROPICS	Tropical Climate Zone	0
OTHFRAC	***Fraction Speaking Foreign Language***	0
OIL	Oil Producing Country Dummy	0
ORTH00	Fraction Orthodox	0
DPOP6090	Population Growth Rate 1960-90	0
gini_market_95ub	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, top 5% of income distribution	0
ins_fin	Insurance and financial services (% of service exports, BoP)	0
WARTORN	War Participation 1960-90	0
EUROPE	European Dummy	0
D5	Decile 5 share of total income	0
LT100CR	Fraction Land Area Near Navigable Water	0
LIFE060	***Life Expectancy***	0
D10	Decile 10 share of total income	0
AIRDIST	Air Distance to Big Cities	0

Table 6 (continued)

DENS65I	Interior Density	0
POP1560	Fraction Population Less than 15	0
POP6560	Fraction Population Over 65	0
BRIT	British Colony Dummy	0
FERTLDC1	Fertility	0
SOCIALIST	Socialist Dummy	0
TOT1DEC1	Terms of Trade Growth in 1960s	0
REVCOUP	Revolutions and Coups	0
gini_ds	GINI index (Deininger and Squire (1996))	0
gini_wiid	GINI coefficient as reported by the respective source in WIID	0

Source: author's elaboration based on Sala-i-Martin, Doppelhofer and Miller (2000) and performed in RStudio.

Figure 1. Income inequality in Anglo-Saxon countries, 1910–2010

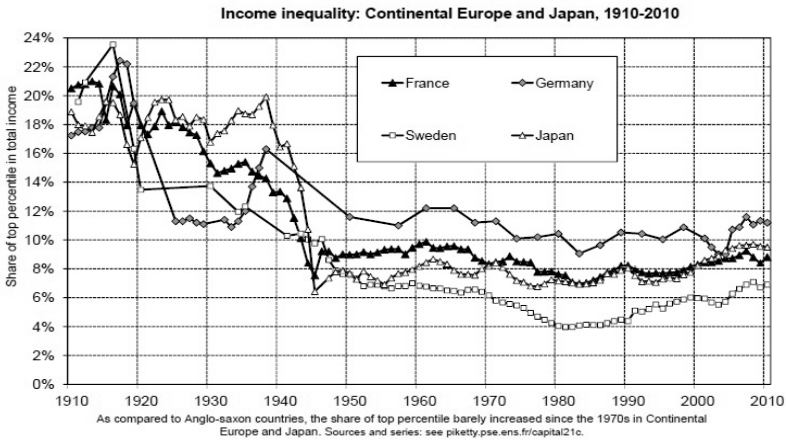


Source: Piketty, 2014. NUMER STRONY W ŹRÓDLE!

The need for Sala-i-Martin, Doppelhofer and Miller's (2000) dataset update to include recent data and eventual reestimation of the results is obvious, especially given the arguments regarding the role of this exact period of low inequality in post-war growth put forward by Thomas Piketty (2014).

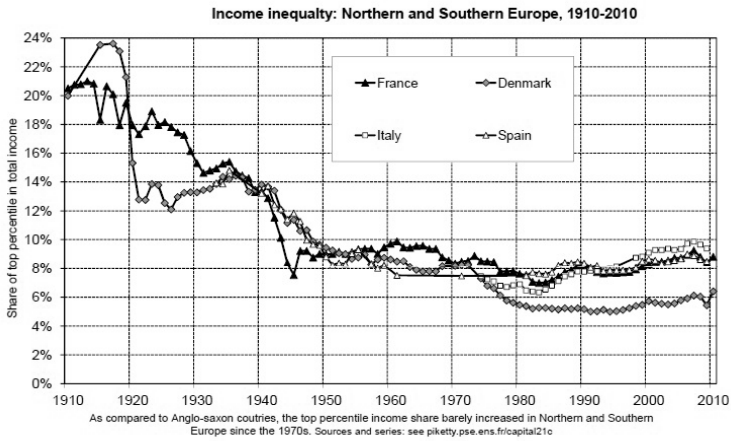
Moreover, the nature of certain types of inequality, as it was presented in Chapter 1, is such that not all of its consequences may have immediate effects, but rather result in the deterioration of welfare of the next generations through inequality of opportunities, lack of social mobility, and accumulated debts. Enlargement of dataset's time frame would allow to account for such a kind of "lag", which may not be entirely covered by 36 years presented currently.

Figure 2. Income inequality: Continental Europe and Japan, 1910–2010



Source: Piketty, 2014.

Figure3. Income Inequality: Northern and Southern Europe, 1910–2010



Source: Piketty, 2014.

Finally, the fact of non-robustness of inequality measures as growth determinants during the period of 1960–1996 may present a rather fruitful outcome if the results would prove to be different on a longer scale. In such a case, the hypothesis may be put forward regarding the average level of inequality observed during 1960–1996 to be the "optimal", which is such not to affect growth adversely.

It can be concluded that the results of BMA estimation have indicated non-robustness of inequality as a determinant of growth during 1960–1996,

provided the kind of priors and data used. However, the inclusion of new variables in the Sala-i-Martin, Doppelhofer and Miller's (2000) dataset has altered the outcomes reported in the article and, thus, suggest that inequality does impact the choice of optimal variables by BMA application, which is also proved by Jointness measures. This as well as methodological limits and data unavailability provide numerous directions for future research and improvement of the results obtained.

5. Conclusion

This study has discussed the history of the development of economic inequality's theory, its current state, and its relationship to the theory of long-run economic growth. The overview of literature on these topics reveals that, even though the phenomenon of inequality has been studied for more than a century, there currently exists no widely accepted consensus on how, if at all, inequality affects long-run economic growth. Majority of the works in the field are criticized for one or several of the following reasons: limited geographical scope, limited time frame and flawed theoretical assumptions.

While the former two emerge as a product of relatively poor data coverage of the topic, the latter is often a product of what is known as model uncertainty. Author has put forward the proposal for addressing this kind of an issue, employing BMA method proposed by Sala-i-Martin, Doppelhofer and Miller (2000). For this purpose, the dataset developed by them was extended by the addition of 162 variables, referring to different proxies of both aggregate economic inequality and its specific types, of which 16 were chosen for actual estimations.

The obtained results provide rich soil for further improvement and evaluation. None of the inequality measures introduced into the dataset has been determined as significant, even though a number of different combinations of these were analyzed. On the one hand, such outcomes suggest the absence of inequality's effect on growth, providing support for neoclassicals' views on the issue. On the other hand, the author has identified the number of factors which may potentially alter the results or its interpretation. These include methodological specifications, limited time frame of the analysis coinciding with historically low and stable levels of inequality, and lagged nature of the effects of such phenomenon. Finally, despite non-robustness of inequality measures as determinants of growth, the presence of the latter in the dataset has altered the results obtained by Sala-i-Martin, Doppelhofer and Miller (2000), suggesting the presence of its influence on the other regressors and calling for its thorough examination.

To conclude, the author considers this paper to have reached its aims, outlining the problems preventing researchers from reaching the consensus on inequality's nature and consequences, as well as building the ground for potential solution to one of these. The extension of the proposed approach may provide strong evidence on the role of one of the most disputed topics among economists and society in general.

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Economic Development. Determination of Factors Causing the "Great Divergence"

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Abstract

The following paper discusses the determinants that are crucial for economic enhancement of both developing and developed nations. It starts with a detailed overview of the main theoretical findings related to the factors contributing to making economies rich. Specifically, the author highlights the versatility of opinions concerning the areas of industrial or financial sectors that need to be improved for an economy to maximize its chances of becoming developed.

The review of literature is followed by the discussion of methodological techniques that were implemented to modify the sample consisting of 42 countries each entitled with 12 variables ranging from 1980 to 2014 that it is usable for econometric analyses. In particular, panel data and logistic regressions were performed. The former was executed to determine the factors that cause rich and poor countries to deteriorate, stagnate or progress, while the latter was done to establish the regressors that increase the probability of a deteriorating country transforming into a progressed one.

The outcome of the estimation was prevailingly in line with the theoretical findings outlined at the beginning. It was concluded that the lack of foreign direct investment, volatile currency and poorly developed domestic production were the main causes for the deterioration and stagnation of economic progress. Alternatively, it was established that the accumulation of capital stock and positive dynamics of both export and human capital typically increased the chances of an economy to improve the quality of life of its citizens.

Introduction

Throughout the course of history, the world has always been divided into two parts: rich and poor. Unequal distribution of world's resources started with geographical locations that countries were initially entitled with. Hence, the main

reason behind regional disparities used to be narrowed down to the accumulation of natural resources like gold and iron. As industrial revolution disseminated worldwide, production capacity became one of the leading determinants of an economy's wellbeing. Currently, the accumulation of human capital and financial foundations are the driving force of economic progress.

Despite the fact that humankind has made a step forward by directing policy initiatives towards narrowing the gap between rich and poor, the number of developing countries sill considerably outweighs the number of the developed ones. Thus, the question of what makes economies rich remains relevant today. There has been an extensive range of economic growth theories created and refined over the years that were essentially aimed at determining the factors influencing economic progress. Chapter 1 is dedicated to presenting the main theoretical findings that discuss the origins of these theories and elaborate on the reasons behind the phenomenon of "Great Divergence".

Given the ongoing debate regarding the main drivers of economic growth, the author decided to conduct own econometric analyses using two different types of regressions: panel data and logistic. Based on the sample of 42 countries bundled with 12 explanatory variables ranging from 1980 to 2014, the aforementioned regressions were performed. Before running regressions, the sample was adjusted according to own methodology techniques described in Chapter 2. Panel data regressions were conducted to determine the variables that caused rich and poor countries to deteriorate, stagnate or progress over analyzed time-period.

Alternatively, logistic regressions were aimed to illustrate the factors that maximize the probability of economic development and minimize the chances of deterioration. Estimation results are presented and elaborated on in Chapter 3.Thus, the following hypothesis was formulated based on the estimation results:
***H_0*: Deterioration, stagnation, or progress of economies is caused by different economic factors**

Consequently, this paper aims to establish the areas of industrial, production and financial sectors that a typical economy should focus on to maximize its likelihood of progressing in terms of standard of living. The main findings and summarizing remarks are reported in Conclusion.

1. Literature Review

1.1. Determinants of Economic Growth

The study of what makes economies grow has been at the core of economics since the discipline's inception in the late 19th century. A worldwide famous and profound "Wealth of Nations" written by Adam Smith (1776), the founding father of economics, was the first academic masterpiece that emphasized the importance and magnitude of this phenomenon.Since that time, many enlightening studies were conducted to establish the set of robust variables, dynamics of which would have an impartial impact on the development and dissemination of economic growth all over the world. The methodology used by the vast majority of economists consisted of running cross-sectional regressions of the following form:

$$\gamma = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + u \quad (1)$$

where γ stands for the vector of economic growth rates and X_1, …, X_n are the vectors of explanatory variables.

The concern once advanced by Sala-i-Martin (1997), arguably one of the most influential authors in this area, was that despite knowing the structure of a "true model" (1), many researchers were still uncertain what regressors X_n were to be inserted in there. Unsurprisingly, this ambiguity still exists due to the emergence of different schools of thoughts, which will be discussed in more detail in thesubchapter to follow (1.2 Economic growth models).

Nevertheless, Sala-i-Martin (1997) proceeded to conduct an experiment involving 59 variables, out of which only 21 appeared to be robust. Among those, there were religious, political, investment and regional variables. The initial set of regressors was inspired by the works of Levine and Renelt (1992) and Barro and Lee (1993), with the former being the first who introduced extreme-border analysis (EBA) of the following form:

$$\gamma = \beta_0 I + \beta_m M + \beta_z Z + u \quad (2)$$

where γ represents per capita GDP growth, I is the set of variables always included in the regression, M stands for the variable of interest and Z is a set of variables identified as potentially important from the past studies. This methodological approach yielded that initial GDP per capita, investment share and population growth were the crucial deterministic factors influencing economic development.

As for Doppelhofer *et al*. (2000), the most robust determinant of long-term economic growth is the initial level of real GDP per capita. Moral-Benito (2007), however, suggests that "investment price", "air distance to big cities" and

"political rights" are the most significant explanatory variables when it comes to determining economic growth (p. 16). Diamond (1997), in turn, deduces to highlight geographical position as the main driver of economic performance. Dewan and Hussein (2001), using panel-data approach with the sample of 41 developing countries, concluded that openness of trade, low inflation and labor force growth are all vital for economic development. In the 21st century, the era of high technologies and innovations, new determinants of economic growth slowly emerge, diluting the importance of conventional economic factors. As Arvanitidis and Petrakos (2008) point out, political freedom and institutional quality are the variables that stand on the same level of robustness as human capital index and FDI inflows. Leon-Gzalez and Vinayagathasan (2013), using Bayesian approach for 27 Asian economies, state that country's investment ratio is positively correlated with economic growth, while government consumption expenditure is correlated negatively. Henceforth, Upreti (2015)concludes that life expectancy and the abundance of natural resources are the leading drivers of transformation of developing economies into the developed ones.

1.2. Economic Growth Models

Despite the fact that the results, research methods and modeling techniques may differ, most experts share a common goal: defining factors causing economic growth. The main reason behind this is straightforward: economic development is an undisputable determinant of living standards and human welfare. Hence, this subchapter is dedicated to historical overview of the economic growth models; starting from the ancient "Mercantilism" model and finishing with the contemporary endogenous-based AK model. Before the invention of banknotes, gold was the main currency people used as a means of exchange. Thus, "Mercantilism" growth model was centered around the vague principle of gold accumulation: the more gold a country possessed, the more likely it was to succeed. The first classical model was introduced by Adam Smith in "Wealth of Nations" (1776), where he mentioned that income per capita growth was driven by "*the state of the skill, dexterity, and judgment with which labor is applied in any nation*".

Malthus (1803) and Ricardo (1817) developed Smith's model and incorporated technological change into it. Moreover, they assumed that increasing inputs would lead to diminishing returns; however, this assumption further yielded the result that population growth would overcome world's capacity to feed itself. This bewildering outcome alongside rather poor progress in the field of growth-modeling inspired the works of Harrod (1939) and Domar (1946).

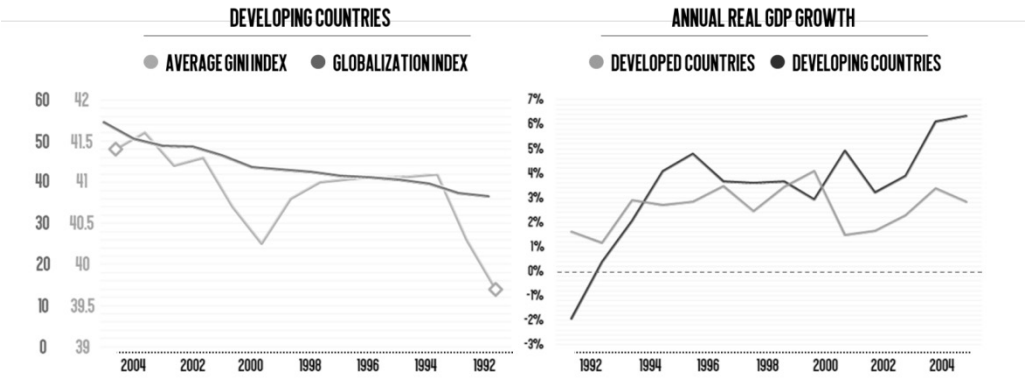
Specifically, Harrod-Domar (HD) model focuses on the importance of investment. It assumes that the growth of real GDP is a function of the savings rate. Shaw (1992) was among many experts that criticized the HD model for sanctioning *"the importance of capital accumulation in the quest for enhanced growth"*. In spite of having a great number of flaws (variables expressed only in real terms, aggregate structuring, unrealistic assumptions and etc.), HD model remains one of the groundbreaking elements in the theory of economic growth.

Undoubtedly, one of the focal points in any discussion of economic growth is the Solow growth model that puts an emphasis on the technology, making it the main determinant of long-term growth (Solow 1957). Neoclassical framework, being the underlying basis of Solow model, exploits a notion of perfect substitution of capital to labor to achieve steady-state growth, which already stands out as a farfetched assumption itself. As Romer (1996) highlights, Solow model simply takes the behavior of the main driving force (technology) as given. Further developments in the area were demonstrated by Romer (1986) and Lucas (1990). Romer (1986), being dissatisfied with the nature of exogenously-driven models, developed an unprecedented type of modeling called "endogenous". As the name suggests, long-run growth was derived from within the model rather than from exogenous regressors. The well-known "product" of endogenous growth theory is AK model (A – technology, K – capital). In particular, the main property of the model is that it works in the absence of diminishing returns to capital, which makes it more practicable than exogenously-based models. Subsequently, AK model holds innovation, technology and human capital accountable for contributing the most to economic growth.

Endogenous growth modeling is prevailingly criticized for its inconformity with the empirical data. Specifically, it fails to explain the phenomenon of conditional convergence which states that developing economies tend to grow at a faster pace than developed. Nevertheless, Barro and Sala-i-Martin (2003) revere the concept of endogenous growth theory and project it to be the bridge to the land of new ideas in the field of economic growth. Despite the diversity of different schools of thought emerging over the course of history, what is being sporadically scrutinized is the set of the benefits that countries (and especially people)tend to enjoy whilst experiencing period of expansion. As it was once pointed out by Jack Kemp, a well-known American politician, *"Economic growth doesn't mean anything if it leaves people out"*(Kondracke and Barnes 2015). If a country is not capable of sustaining the benefits that come as a bundle of economic and population growth, there is no point in aspiring to study the determinants that would "heat up" the economy. In particular, the results stemming from the work of Barro and Sala-i-Martin (2003) proclaim higher living standards as

an immediate aftermath of a surging economic development (p. 6). Nonetheless, empirical observations do not correspond to the aforementioned conclusion (Figure 1). People living in developing countries, in spite of enjoying higher growth rates compared to developed economies over a 14-year period, are now facing more unequal distribution of income than it was in the 1990s.

Figure 1. Developing and developed economies. Gini index and GDP growth



Source: author's elaboration based on World Bank National Accounts Data & UNDP calculations.

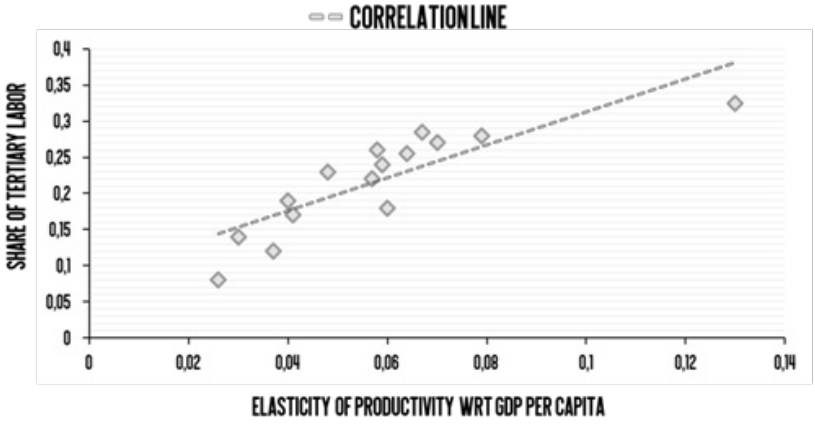
1.3. Rich-poor Gap

More accurately, the scope of the inconsistency of theory with empirics was expressed by North (2001), *"If we know about what makes countries rich and what makes them poor, why do we have poverty in the world? … something very fundamental is missing"* (p. 320). In other words, humanity is still struggling to explain why some economies are technologically advanced, while others are tremendously poor. In spite of the triviality of the question, there is no definite answer that would end an ever-going discussion concerning the measures that need to be implemented to allocate global wealth equally across the world. North (2001) is, however, quick to assert that "something very fundamental" is institutions. It goes without saying that institutions dictate the way society exists and enhances. Their predominant mission is to regulate incentives so as to assure a fair distribution of resources within nations and even continents. The quality of institutions is often perceived as an objective criterion for the evaluation of economy's credibility. Lehne *et al*. (2014) find that both political and socio-economic institutions are long-term determinants of a country's growth rate. Economies with fundamentally sound institutions have higher chances of attracting

investment and preventing "brain drain". Felipe *et al*. (2010) argue that achieving sustained growth comes with producing and exporting certain commodities with specific characteristics embedded in them. In the study consolidating 779 exported goods and 154 countries, it was depicted that the countries with an export basket containing a prevailing share of "good" commodities enjoy high standards of living and an above-average level of GDP per capita, whilst the nations having an export basket encompassing a major share of "unsophisticated goods" are in the so-called "economic trap". What is more, rich countries are predisposed to having a 'highly skewed' distribution of proximities in the product space meaning that it is easy for a rich country to jump across products in the group of goods requiring the same producing capabilities (p. 13). Rightfully so, a gradual build-up of producing capabilities stands among the main drivers of capital accumulation and growth in real wages.

As far as Shikher (2014) is concerned, whatever country manufactures and sells abroad is a function of domestic post-secondary educated human capital. Subsequently, there is an observable relationship between a share of these type of workers and comparative advantages across nations. The theoretical denouements of both Shikher (2014) and Cabrales (2011) are supported empirically by a positive correlation between the elasticity of productivity with respect to GDP per capita and shares of labour with at least some tertiary education (Figure 2). Hanushek (2013) follows this type of reasoning and advances to claim that *"Differences in economic growth across countries are closely related to cognitive skills … which is a key to alleviating poverty in developing countries"* (p. 19).

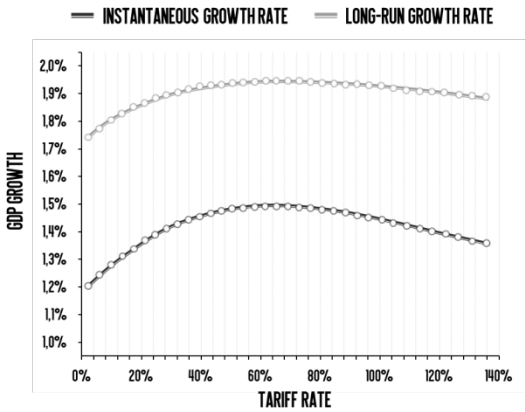
Figure 2. Education intensity and comparative advantage.



Source: author's elaboration based on Shikher (2014)

Krugman and Obstfeld (1997) and Stiglitz (1998) attempt to explain the divergence in economic growth between developed and developing nations by referring to the concept of "trade openness": having high or low barriers towards international trade. Their preconception is predicated on the data promulgated empirically by multinational institutions like the World Bank and International Monetary Fund (IMF). Krueger (1998), in particular, dwells on the relevance of "outer-oriented" trade to the economic performance. Stiglitz (1998) and Fischer (2000) agree that the integration in the world trade system brings many benefits, including per-capita income growth and increase in the number of destinations for country's exports. Rodriguez and Rodrik (2001) extended the boundaries of the topic even further by developing a theoretical model elaborating on how a small open economy with "learning-by-doing" is expected to behave depending on different variations of the import tariff (p. 269). The model was designed to capture the implications of growing trade restrictions (expressed by import tariff) on economic development. In both cases (instantaneous and long-run), GDP growth increases until tariff rate reaches a critical point, causing GDP growth to start diluting.

Figure 3. Growth rate of GDP at World prices.



Source: author's own elaboration based on Rodriguez and Rodrik (2001).

According to Rodrik *et al*. (2004) and Temple (1999), there has not been any question with greater relevance and structural importance to policy making than to perceive what is to be done to minimize the gap between rich and poor countries. Deaton (2013) concludes that the gap has not shrunk since the 1950s. In fact, with respect to some indicators, it has even exacerbated.

1.4. Impediments Restraining Developing Economies from Becoming Developed

Starting from the middle of the 20th century, the globalization index has been on its rise. Especially throughout the latest two decades, developing countries have been intensively engaged into the worldwide integration (see Figure 1). Despite having unprecedented tempos of enhancements in trade policies and political culture, the number of developing countries still far outweighs the number of developed.

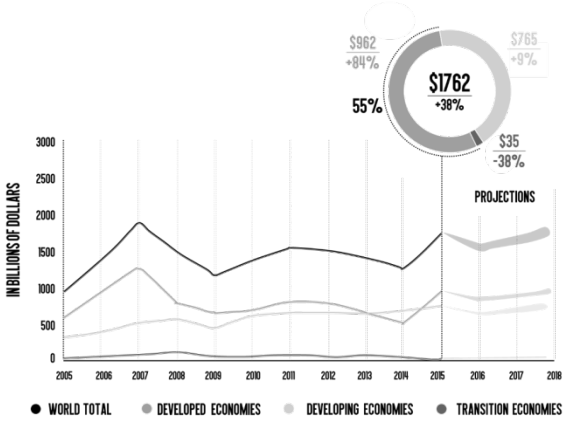
This issue was first tackled by Lucas in his seminal paper (1990). He questioned the validity of the neoclassical theory that espouses the flow of capital from rich to poor countries. Assuming a common production function and diminishing returns to capital, *"…new investment will occur only in the poorer economy, and this will continue to be true until capital-labour ratios, and hence wages and capital returns, are equalized"* (p. 92). This inconsistency of theory with reality has become known as the Lucas Paradox. Apparently, the paradox undermined the goal of all post-war economic initiatives that were amounted to stimulate growth in developing countries,which inevitably caused a major resonance in economic communities. However, Alfaro, Kalemli-Ozcan and Volosovych (2008) (AKV) managed to "solve" the paradox by accounting for the quality of institutions. In a cross-country regression model, they regress the average capital flows per capita on the log of initial income per capita. Among all the theoretical explanations, they observe that the variable of an institutional quality makes the coefficient of the log of initial income per capita insignificant, which makes Lucas Paradox "disappear". Nevertheless, Azémar & Desbordes (2013) argue that the model presented by AKV is not robust enough to evaporate Lucas Paradox since the coefficient of the log of initial income per capita remains statistically insignificant. One year later, Herrmann and Kleinert (2014) claim that *"Lucas Paradox is not an important phenomenon in international economics"* (p. 28).

Thus, there is still no concurrence in academic communities when it comes to the Lucas Paradox, yet empirical data suggests that FDI flows to developed nations significantly exceed flows to developing ones (Figure 4). Specifically, 45% of the global FDI inflows are attributed to developing and transition economies, which is a major breakthrough for fighting inequality, still the growth rates of FDI inflows coming to developed economies are incomparable to the numbers associated with developing nations.

Despite the absence of consensus when it comes to Lucas Paradox, the majority of economists agree on the importance of FDI for transcending country's economic state. Both Kant (2016) and Schularick and Steger (2008) highlight

that policies aimed at encouraging FDI inflows give nations higher chances of reducing income gaps and starting to prosper economically. Albeit the difference in institutional quality between poor and rich countries is lower now than it was in the historical period, the effectiveness of foreign capital being invested domestically has not seen drastic change.

Figure 4. Global FDI inflows by group countries.



Source: author's own elaboration based on World Investment Report (2016).

Summing up, it is worth being noted that there is probably no more relevant issue challenging modern economists that to understand what causes economies to grow. From the subchapters outlined above, it becomes evident that the determinants of growth have been altering over the course of history: starting with geographical position accompanied by natural resources and finishing with institutional quality bundled with human capital. What is more, endogenous growth theory, being the most recent advancement in the field of economic development, happens to be far superior to its "predecessors" but still possess some flaws

Undeniably, "Great Divergence" is one of the unresolved problems that the world is only yet to tackle. The number of developing countries suffering from brain-drain and poverty greatly outweighs advanced economies. Henceforth, this paper aims to estimate the factors that increase the probability of an economy to progress and enhance its standard of living.

2. Methodology & Data Analysis

2.1 Methodology Composition

Considering the specifics of the thesis and the aims it aspires to pursue, the methodology chapter is composed of two parts:

- *Panel data regression*

This method serves as the most appropriate tool when it comes to a simultaneous scrutiny ofboth cross-section and time-series data. Bearing in mind that this thesis has a purpose of exploring the interconnection between developing and developed economies, panel data analysis comes in handy. In particular, panel regressions will facilitate the search for the most significant variables that contributed to poor and rich countries:

- o Deterioration
- o Progress
- o Stagnation

- *Logit models*

Logit regression is structured to analyze the determinants of the regression where the dependent variable can only be presented in a binary form (e.g. 0 or 1).

$$F\left(x'\beta\right)=\frac{e^{x'\beta}}{1+e^{x'\beta}}=\frac{\exp\left(x'\beta\right)}{1+\exp\left(x'\beta\right)} \quad (3)$$

Thus, the nature of this model is ideal for estimating the probability that a developing country will fall into a concrete category with specific peculiarities (i.e. developed country) bearing in mind the dynamics of specific factors (i.e. regressors).

2.2. Panel Data Regressions

2.2.1. Benchmarks

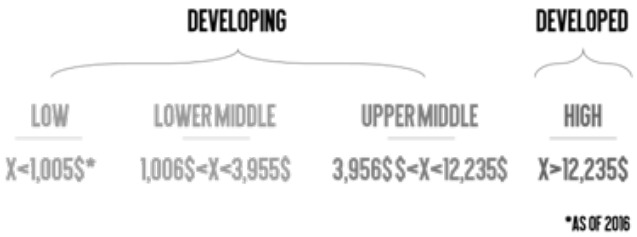
It is of crucial importance to establish a statistical measure that would separate developing countries from the developed ones. Currently, there is an extensive range of criteria that are used as a benchmark for classifying economies into various groups.

Real GDP *per capita* is an objective metric that not only considers the size of the "pie" (economy's GDP), but also takes into account a number of "slices"

(economy's population). Despite the fact that this metric is conventionally used for comparing the standard of living across countries, it does not account for the distribution of wealth within societies; which undoubtedly makes it an imperfect measure of the quality of life worldwide.

The World Bank is one of the first institutions that started grouping countries into different blocks based on the aforementioned criterion.Starting from 1970, there have been 4 income groups.

Figure 5. Classification of countries by real GDP per capita according to World Bank.

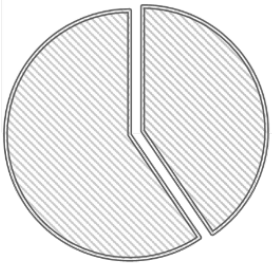


Source: author's own elaboration based on World Bank Country and Lending Groups (n.d.).

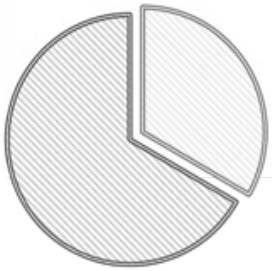
The dataset prepared for both panel data regressions and logit models incorporates 42 countries with the depended variable represented by real GDP *per capita* (2011$ constant) ranging from 1980 to 2014. Hence, the first step would be to filter the sample according to the aforementioned layout (Figure 5). What is more, it would be helpful to see how the composition of the blocks changed over time. The beginning and end of the sample were taken as extreme points for the comparison. World Bank classification boundaries were adjusted using GDP deflator with 2011 as a base year to account for the inflation and introduce comparability. Judging by the sample-structure, it can be deduced that the share of developed countries increased meaning that some countries that used to be characterized as "developing" in 1980, successfully migrated to a higher class of developed economies throughout a 34-year period. This trend implies that developing countries have managed to adjust their economies to the environment of the 21st century that calls for the need of industrial diversification and development of alternative energy sources.

Figure 6. Categorization of sample-countries by World Bank metrics

DEVELOPING			DEVELOPED	
1980				
low	low-middle	upper-middle	high	
x < 480	480 < x < 1941	1941 < x < 6000	x > 6000	
Bangladesh	Bolivia	Albania	Australia	Israel
China	Philippines	Chille	Austria	Italy
India	Thailand	Colombia	Belgium	Japan
	Zambia	Dominican Republic	Canada	Malta
		Ecuador	Cyprus	Netherlands
		Jamaica	Denmark	New Zealand
		Malaysia	Finland	Norway
		Nigeria	France	Portugal
		Poland	Germany	Spain
		Turkey	Greece	Sweden
			Iceland	United Arab Emirates
			Ireland	United Kingdom
				United States



DEVELOPING			DEVELOPED	
2014				
low	low-middle	upper-middle	high	
x < 1046	1046 < x < 4126	4126 < x < 12735	x > 12735	
Bangladesh	Bolivia	Albania	Chille	Ireland
	India	China	Poland	Israel
	Nigeria	Colombia	Turkey	Italy
	Philippines	Dominican Republic	Australia	Japan
	Zambia	Ecuador	Austria	Malta
		Jamaica	Belgium	Netherlands
		Malaysia	Canada	New Zealand
		Thailand	Cyprus	Norway
			Denmark	Portugal
			Finland	Spain
			France	Sweden
			Germany	United Arab Emirates
			Greece	United Kingdom
			Iceland	United States



Source: author's elaboration based onWorld Bank Country and Lending Groups (n.d.).

2.2.2. Categorization

Due to the fact that the composition of 4 groups (created according to the classification of the World Bank) has not changed considerably over the years, it requires an alternative categorization of the sample that would make both panel data regressions and logit models insightful enough. Rightfully so, the dataset was allocated first into 2 groups (1980 and 2014) that were then divided into 6 equal sub-groups in an ascending order. Each country was assigned a specific numeric

code that identified whether the country had managed to leave its sub-group over the period of 34 years:

- (-2) – a country moved 2 groups down
- (-1) – a country moved 1 group down
- 0 – a country remained in its group
- (+1) – a country moved 1 group up
- (+2) – a country moved 2 groups up
- (+3) – a country moved 3 groups up

What is more, samples based on the classification above were used to run solely panel data regressions. Considering the nature of logistic regressions that require the transformation of depended variable into a binary form, the classification was limited to 3 groups that were later assigned with specific numeric codes:

- (-1) –countries that deteriorate
- (0) – countries that stagnated
- (+1) – countries that progressed

3.2.3 Determinants of growth

The variables pertaining to economic growth were mostly taken from the academic works presented in Chapter 2 (Literature review). The justification for the majority of regressors comes from the works of Doppelhofer, Miller and Sala-i-Martin (2000) and Barro and Lee (2003). Needless to say, the prevailing share of determinants are taken from financial and trade sectors being the most robust drivers of economic development in most countries. Alongside economic indicators, there are variables related to the social aspects of any country. The aforementioned factors are prompted by Son and Kakwani (2004).

Apart from this, education cannot be omitted when it comes to the discussion of what makes economies grow. In particular, human capital accumulation appears to be one of the leading prospects on the agenda for the most nations in the 21st century. Contributions of Fernandez &Mauro (2000) demonstrate the extent to which human capital is interconnected with economic growth. The full list of variables bundled with descriptive statistics is illustrated in Table 1.

Table 1. Regressors used for panel data and logistic regressions

Nr	Factors	Units of measurement, symbol	Empirical application	Expected sign	Data source
REGRESSAND	Real GDP *per capita*	US$ constant 2011, rgdp_2011			Penn World Table 9.0
1	Capital stock	US$ constant 2011, cp_sk	Doppelhofer, Miller & Sala-i-Martin (2000)	+	Penn World Table 9.0
2	Exports	2011 US$, export	Doppelhofer, Miller & Sala-i-Martin (2000)	+	World Bank data
3	Official exchange rate	LCU per 2011 US$, exchange	Habib, Mileva & Stracca (2016)	(?)	Penn World Table 9.0
4	Foreign Direct Investment	current US$, fdi	Khaliq (2007)	+	World Bank data
5	Inflation	CPI, cpi	Gokal & Hanif (2004)	-	World Bank data
6	Expense	% of GDP, expense	Doppelhofer, Miller & Sala-i-Martin (2000)	+	World Bank data
7	Energy imports	% of energy usage, enrg	Doppelhofer, Miller & Sala-i-Martin (2000)	+	World Bank data
8	School enrollment	% of net, enrl	Barro & Lee (1993)	+	World Bank data
9	Human capital	index, hc	Fernandez & Mauro (2000)	+	Penn World Table 9.0
10	Death rate	per 1000 people, death	Doppelhofer, Miller & Sala-i-Martin (2000)	-	World Bank data
11	Life expectancy	years, life_exp	Barro & Lee (1993)	+	World Bank data
12	Population growth	annual %, pop	Barro & Lee (1993)	(?)	Penn World Table 9.0

Source: author's elaboration.

2.2.4. Standardization

Before proceeding to the estimation of the models, all the data was standardized to introduce comparability of the coefficients. This transformation will allow determining which of the regressors has the strongest impact when it comes to the variation of the regressand. Standardization was done using the following formula:

$$Z_i = \frac{X_i - \mu}{\sigma} \quad (4)$$

where: Z_o – standardized variable, X_i – unstandardized variable, μ – mean, σ – standard deviation

2.3. Logit Models

2.3.1 Sample Composition

Since the nature of logit modelling requires the construction of dependent variable in a binary form, 2 samples were assembled for the analysis.

Sample#1 comprises two types of countries: ones that deteriorated and ones that progressed. The former group was assigned with the value of *0*, while the latter one was assigned with *1*meaning that the country allocated in one group or another was assigned with a specific binary value that was duplicated across the entire time-dimension (from 1980 to 2014). Thus, the regression will illustrate the variables that make the transition from deteriorated to progressed most probable. In other words, the logit model will show what kind of regressors are most crucial for deteriorating economies when it comes to increasing their chances of economic enhancement in future.

Sample#2 includes the following types of countries: ones that stagnated and ones that deteriorated. The first group was assigned with *0*, while the second group was assigned with *1*. Hence, the regression will depict the determinants that worsen economic growth, making countries deteriorate over time. Alternatively, the regression will also report on the variables that minimize the risk of economic downturn.

3. Results and Interpretations

3.1. Panel Data Regressions

All the regressions were performed in EViews, applying the OLS (ordinary least squares) with either fixed or random effects' specification for the estimation of the variables listed in Table 1. There will be 3 separate regressions based on 3 different samples that were generated using the classification mentioned in Subchapter 3.2.2 (Categorization):[1]

- GROUP (-1) – countries that deteriorated
- GROUP (0) – countries that remained unchanged
- GROUP (+1) – countries that progressed

The construction of 3 different samples allows for the detection of determinants that would have an impartial impact on the type of transformation a given group of countries has undergone. Particularly, a common regressand was used in all the regressions: real GDP *per capita*(2011$ constant). Subsequently, coefficients assigned to each standardized variable would identify the strength of its impact on the variation of the regressand. Furthermore, all the variables will be undergoing Unit root test to check for stationarity or non-stationarity.

3.1.1 Group (-1)

This group includes 351 observations with a sample of 10 countries ranging from 1980 to 2014. Regressing Real GDP*per capita* (rgdp_2011) on the explanatory variables listed in Table1 yielded the following equation:

$$\begin{aligned} \textbf{\textit{D(RGDP\_2011)}} &= 0.01 - 0.05*D(ENRL) - 0.03*CPI + \\ &+ 0.06*D(EXCHANGE) - 0.05*D(EXPORT) \\ &+ 0.02*D(FDI)\ \ 0.67*D(EXPENSE) \\ &+ (5)\ 0.2*D(RGDP\_2011(-1)) + [CX=R, PER=F] + \in \end{aligned}$$

where: D(X)[2] – first difference function for variable X, D(D(X)) – second difference function for variable X, RGDP_2011 (-1)[3] – lagged endogenous variable

[1] There were also 2 additional samples: GROUP (-2) and GROUP (+3). Since both of these groups happen to contain only one country, the regressions would not be representative of the whole spectrum of alike countries.

[2] First or second difference function is assigned to the non-stationary variables that possess unit root in either levels or the 1st difference.

[3] Regressand RGDP_2011 was lagged to tackle the potential presence of autocorrelation in the model.

RGDP_2011, [CX=R, PER=F][4] – indication that random effects specification was used for cross-sectional analysis and fixed effects specification was used for periodical analysis, respectively, ϵ – an error term

The reasoning behind incorporatingsome fixed effects specification for periodical analysis is motivated by the fact that throughout the observed time-period (1980–2014), the countries followed approximately the same patterns in terms of business cycles (i.e. recessions or expansions). Thus, it would be fair to assume that group means are fixed, and individual-specific effects are correlated with independent variables as well. Estimation results of the panel data regression are depicted in Figure7. As it can be seen, variables were allocated into 2 groups: significant and insignificant. The latter were removed from the model due their insignificance at 10% level.

Figure 7. Estimation results. Group (-1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004337	0.009574	0.452998	0.6509
CPI	-0.033289	0.014793	-2.250287	0.0252
D(EXCHANGE)	0.071031	0.022494	3.157768	0.0018
D(EXPORT)	-0.055404	0.025287	-2.190999	0.0292
D(FDI)	0.017756	0.008492	2.090817	0.0374
D(EXPENSE)	0.683791	0.065470	10.44433	0.0000
D(RGDP_2011(-1))	0.197061	0.072145	2.731450	0.0067
Removed D(DEATH)	-0.001309	0.008191	-0.159872	0.8731
Removed D(CP_SK)	0.526071	0.235226	2.236453	0.6261
Removed HC	-0.028168	0.047693	-0.590600	0.5553
Removed D(ENRG)	-0.022703	0.012344	-1.839220	0.6670

SIGNIFICANT

INSIGNIFICANT

Effects Specification	S.D.	Rho
Cross-section random	0.000000	0.0000
Period fixed (dummy variables)		
Idiosyncratic random	0.104280	1.0000

Weighted Statistics			
R-squared	0.659328	Mean dependent var	0.079999
Adjusted R-squared	0.613514	S.D. dependent var	0.166048
S.E. of regression	0.103229	Sum squared resid	3.090276
F-statistic	14.39125	Durbin-Watson stat	2.058151
Prob(F-statistic)	0.000000		

Source: author's elaboration based on Table1 and Eviews estimation results.

Both adjusted R-squared (0.61) and F-statistic (14.39) indicate the presence of acceptable goodness of fit. Apart from this, Durbin-Watson statistics (D-W) equals 2.05. Applying the rule of thumb ($1.7 < \text{D-W} < 2.0$), given D-W would

[4] Decision to use mixed effects' specification was motivated by the results of Hausman Test.

imply the absence of autocorrelation. Since the depended variable used in the regression has been lagged, D-W statistic loses its relevancy. Instead, Durbin-h test must be applied:

$$h^* = \hat{p}\sqrt{\frac{n}{1-n\left(Var\left(\hat{\alpha}\right)\right)}} \quad (6)$$

where: $\hat{p}$ – coefficient on lagged depended variable, $Var\left(\hat{\alpha}\right)$ – variance of lagged depended variable, n – number of observations

Using the formula above, h^* equals 69.17. Thus, applying the rule of thumb (69.17 > 2.0), there is no autocorrelation in a given model. Since all the variables were standardized before the regression, the interpretation of coefficients demonstrated in equation (4) is as follows: if regressor (X) increases by 1 standard deviation, on average, the regressand increases by C(X)[5] standard deviation units.

All the variables, except for *EXPORT*, seem to possess the signs that are in conformity with the theoretical works presented in Table 1. A negative sign of *EXPORT* can be justified in the following way. Since the sample consists of the countries that deteriorated over a 34-year period, it may be assumed that opening borders made their domestic producers exposed to foreign competition meaning that foreign producers specializing in the low value-added goods simply squeezed domestic producers out from the market, which, in turn, caused GDP *per capita* to be negatively influenced by the dynamics of exports.

Thus, judging by the value of coefficients, the following factors had the strongest impact on the stagnation of sample-countries:

- Expense (as % of GDP) – (+0.68)
- Exchange rate (as ratio of domestic currency to American dollar) – (+0.07)
- Inflation (as CPI) – (-0.03)

4.1.2. Group (0)

This group includes 736 observations with a sample of 21 countries ranging from 1980 to 2014. Regressing Real GDP per capita (rgdp_2011) on the explanatory variables listed in Table1 yielded the following equation:

$$\begin{aligned} \textbf{\textit{D(RGDP\_2011)}} = {} & 0.01 + 1.97*D(D(CP\_SK)) + 0.02*D(EXCHANGE) + \\ & 0.01*D(FDI) + 0.52*D(EXPENSE) + \\ & 0.24*D(RGDP\_2011(-1)) - (7) \\ & 0.01*DEATH - 0.02*POP - 0.04*LIFE\_EXP + [CX=F, PER=F] \end{aligned}$$

[5] C(X) – value of coefficient (X).

where: [CX=F, PER=F][6] – indication that fixed effects' specification was used for cross-sectional analysis and fixed effects' specification was used for periodical analysis respectively

Results of the estimation are depicted in Figure8. Analogically to the previous model, insignificant explanatory variables were removed from the regression leaving only significant ones. As it can be seen, adjusted R-squared (0.62) and F-statistic (20.44) indicate the presence of acceptable goodness of fit. h* statistics equals 7.42. Comparing it to the rule of thumb (7.42 > 2.0), no autocorrelation can be detected.

POP and *LIFE_EXP* are the variables that happen to possess a negative sign. The interconnection between economic development and population growth has long been a controversial topic in economics. In this case, high birth rates may have been the reason for diverting scarce capital away and slowing down GDP growth.

As for the value of coefficients, the following determinants caused sample-economies to remain in their respective sub-groups over a 34-year period:

- Capital stock (as US 2011$) – (+1.97)
- Expense (as % of GDP) – (+0.52)
- Life expectancy (as number of years) – (-0.04)

Figure 8. Estimation results. Group (0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012205	0.006732	1.812922	0.0703
D(D(CP_SK))	1.975674	0.237204	8.329014	0.0000
D(EXCHANGE)	0.017521	0.009554	1.833964	0.0671
D(FDI)	0.005848	0.003115	1.877368	0.0609
D(EXPENSE)	0.520671	0.046623	11.16758	0.0000
D(RGDP_2011(-1))	0.237573	0.037904	6.267744	0.0000
DEATH	-0.015084	0.005681	-2.655321	0.0081
POP	-0.025984	0.013700	-1.896598	0.0583
LIFE_EXP	-0.042088	0.023183	-1.815435	0.0699
Removed D(ENRG)	0.000969	0.008777	0.110386	0.9121
Removed CPI	-0.006267	0.006801	-0.921411	0.3572
Removed HC	-0.007633	0.012420	-0.614557	0.5391
Removed D(ENRL)	-0.014248	0.009835	-1.448771	0.1479

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Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.660032	Mean dependent var	0.083627
Adjusted R-squared	0.627757	S.D. dependent var	0.145140
S.E. of regression	0.088552	Akaike info criterion	-1.926539
Sum squared resid	4.955846	Schwarz criterion	-1.526823
Log likelihood	728.5457	Hannan-Quinn criter.	-1.771954
F-statistic	20.44999	Durbin-Watson stat	2.079182
Prob(F-statistic)	0.000000		

Source: author's elaboration based on Table1 and Eviews estimation results.

[6] The decision to use mixed effects' specification was motivated by the results of Redundant.

4.1.3 Group (+1)

This group includes 316 observations with a sample of 9 countries ranging from 1980 to 2014. Regressing Real GDP per capita (rgdp_2011) on the explanatory variables listed in Table1 yielded to obtaining the following results:

$$\textbf{\textit{D(RGDP\_2011)}} = 0.03 + 1.89*D(D(CP\_SK)) + 0.03*D(EXPORT) - 0.01*POP + 0.64*D(EXPENSE) + 0.01*D(CPI) + [CX=F, PER=R] \quad (8)$$

where: [CX=F, PER=R][7] – indication that fixed effects specification was used for cross-sectional analysis and fixed effects specification was used for periodical analysis, respectively.

Results of the panel data regression is depicted in Figure 9. Analogically to the previous model, insignificant explanatory variables were removed from the regression, leaving only significant ones. Judging by an adjusted R-square (0.68) and F-statistic (50.76), the model has an acceptable level of goodness of fit.Durbin-Watson statistics (D-W) equals 1.71. Applying the rule of thumb ($1.5 < D\text{-}W < 2.0$), given D-W would imply the absence of autocorrelation.

Figure 9. Estimation results. Group (+1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030894	0.007257	4.257336	0.0000
D(D(CP_SK))	1.896997	0.256863	7.385251	0.0000
D(EXPORT)	0.032970	0.015413	2.139187	0.0333
POP	-0.013558	0.005975	-2.269147	0.0240
D(EXPENSE)	0.638177	0.064129	9.951420	0.0000
D(CPI)	0.012791	0.004946	2.585894	0.0102
Removed D(DEATH)	-0.002013	0.006939	-0.290112	0.7719
Removed D(FDI)	0.003875	0.005454	0.710394	0.4781
Removed HC	0.008840	0.013003	0.679877	0.4971
Removed D(ENRG)	0.010334	0.009635	1.072599	0.2844
Removed D(ENRL)	-0.002404	0.013993	-0.171777	0.8637

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Effects Specification	S.D.	Rho
Cross-section fixed (dummy variables)		
Period random	0.021388	0.1240
Idiosyncratic random	0.056860	0.8760

Weighted Statistics			
R-squared	0.699876	Mean dependent var	0.093650
Adjusted R-squared	0.686089	S.D. dependent var	0.101873
S.E. of regression	0.057077	Sum squared resid	0.921949
F-statistic	50.76490	Durbin-Watson stat	1.710091
Prob(F-statistic)	0.000000		

Source: author's own elaboration based on Table1 and Eviews estimation results.

[7] The decision to use mixed effects' specification was motivated by the results of Hausman Test.

The signs of all factors are in line with the theoretical approaches outlined in Table 1. The following regressors are most robust when it comes to helping sample-economies progress over time:

- Capital stock (as US 2011$) – (+1.89)
- Export (as % of GDP) – (+0.03)
- Expense (as % of GDP) – (+0.63)

3.2. Logit Models

All the logistic regressions were performed in Stata 14.2 applying random effects' specification for the estimation of the variables listed in Table 1. In line with the previous subchapter, a common regressand was used in all the regressions: real GDP *per capita*(2011$ constant). However, it was first transformed into a binary form according to the criteria mentioned in subchapter 3.3.1 (Sample composition).

3.2.1. Interpretation of coefficients & marginal effects

Logit models are executed using the maximum likelihood method, which makes coefficients of the regression uninterpretable with respect to magnitude. However, the sign each coefficient is assigned with has a particular meaning: an increase in regressor *X* either increases or decreases the likelihood that regressand *Y* is equal to 1. For instance, if regressor *X* possesses a positive sign, then an increase in *X* makes the outcome of *Y=1* more likely. Conventionally, marginal effects are used to assess the impact of the regressors. In particular, marginal effects identify the change in probability of *Y=1* given a one-unit change in regressor *X*.

$$\frac{\partial p}{\partial x_j} = F\left(x'\beta\right)\beta_j \quad (9)$$

Since marginal effects depend on the specific value of X, it is a common practice to estimate marginal effects at the mean:

$$\frac{\partial p}{\partial x_j} = F\left(\overline{x}'\beta\right)\beta_j \quad (10)$$

4.2.2 Sample#1

This sample includes 21 countries (each entitled with 12 regressors ranging from 1980 to 2014) that were allocated into 2 binary groups:

- 0 – economies that deteriorated
- 1 – economies that progressed

Regressing a binary regresand on the explanatory variables listed in Table 1 yielded the following results:

$$Log\left(\frac{P_p}{1-P_p}\right) = -7.23 + 0.08*EXPORT - 0.01*CPI + 0.01*HC - 0.008*POP \quad (11)$$

Estimation results are illustrated in Figure10.As before, variables were grouped into significant and insignificant. The sings of all coefficients are in conformity with theoretical findings. Specifically, exports and accumulation of human capital, if are to show positive dynamics, make deteriorating countries more likely to progress in the future. On the contrary, consumer price index and population growth, if increasing over time, are expected to worsen the chances of economic development.

As for the marginal effects, it is worth being mentioned that exports represent the factor that has the strongest impact on the probability of economic progress. If regressors were to increase by 1 unit, the probability of a deteriorating country transforming into a progressing one would change in the following manner:

- Exports – increase by 2%
- HC – increase by 1.4%
- CPI – decrease by 1%
- POP – decrease by 0.01%

3.2.3 Sample#2

This sample includes 31 countriesthat were allocated into the following binary groups:

- 0 – economies that stagnated
- 1 – economies that deteriorated

Regressing a binary regressand on the explanatory variables listed in Table 1 yielded the following results:

$$Log\left(\frac{P_p}{1-P_p}\right) = 0.02*CPI - 0.26*CP\_SK - 0.07*FDI + 0.06*POP \quad (12)$$

Figure 10. Estimation results. Sample#1.

```
Random-effects logistic regression              Number of obs      =       735
Group variable: id                              Number of groups   =        21

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =        35
                                                              avg =      35.0
                                                              max =        35

Integration method: mvaghermite                 Integration pts.   =        12

                                                Wald chi2(4)       =     18.74
Log pseudolikelihood  = -13.471892              Prob > chi2        =    0.0009

                                  (Std. Err. adjusted for 21 clusters in id)
------------------------------------------------------------------------------
             |               Robust
        code |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         pop |  -.0089378   .0046935    -1.90   0.057    -.0181369    .0002613
          hc |   .0145288   .0051078     2.84   0.004     .0045177    .0245399
         cpi |  -.0103651   .0067202    -1.54   0.123    -.0235363    .0028062
      export |   .0855864   .0281738     3.04   0.002     .140806    .0303669
       _cons |   -7.23802   5.440155    -1.33   0.183    -17.90053    3.424487
-------------+----------------------------------------------------------------
    /lnsig2u |   6.805493   .3498598                      6.119781    7.491206
-------------+----------------------------------------------------------------
     sigma_u |   30.04652   5.256034                      21.32522    42.33453
         rho |   .9963691   .0012657                      .9928177    .9981677
------------------------------------------------------------------------------
```

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```
Conditional marginal effects                    Number of obs      =       735
Model VCE    : OLS

Expression   : Linear prediction, predict()
dy/dx w.r.t. : pop hc cpi export
at           : pop             =   -9.34e-16 (mean)
               hc              =   -.0000673 (mean)
               cpi             =    5.63e-18 (mean)
               export          =    .0080231 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         pop |  -.0010488   .0046935    -1.90   0.057    -.0181369    .0002613
          hc |   .0024658   .0051078     2.84   0.004     .0045177    .0245399
         cpi |  -.0014167   .0067202    -1.54   0.123    -.0235363    .0028062
      export |   .0204085   .0281738     3.04   0.002     .140806    .0303669
------------------------------------------------------------------------------
```

Source: author's elaboration based on Table1 and Stata 14.2 estimation results.

Results of the estimation are shown in Figure11.The sings of all coefficients are in conformity with theoretical findings. In particular, consumer price index and population growth, if are to show positive dynamics, make stagnating countries more likely to deteriorate in the future. Alternatively, foreign direct investment and accumulation of capital stock, if are to increase over time, are expected to lower the chances of deterioration.

Figure 11. Estimation results. Sample #2

```
Random-effects logistic regression              Number of obs     =      1,053
Group variable: id                              Number of groups  =         31

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =         33
                                                              avg =       34.0
                                                              max =         34

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(4)      =      23.07
Log pseudolikelihood  = -21.025092              Prob > chi2       =     0.0001

                                  (Std. Err. adjusted for 31 clusters in id)
------------------------------------------------------------------------------
             |               Robust
      L.code |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         pop |    .060562   .0175317     3.45   0.001    -.0949234   -.0262005
         fdi |   -.0777194    .02028    -3.83   0.000    -.1174675   -.0379712
       cp_sk |    -.261236   .0855665    -3.05   0.002    -.4289433   -.0935287
         cpi |    .0250528   .0194635     1.29   0.198     -.013095    .0632006
-------------+----------------------------------------------------------------
      /lnsig2u |   9.480283   .1146008                      9.255669    9.704896
-------------+----------------------------------------------------------------
     sigma_u |   114.4504   6.558055                      102.2923    128.0535
         rho |   .9997489   .0000288                      .9996857    .9997994
------------------------------------------------------------------------------
```

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```
Conditional marginal effects                    Number of obs     =      1,053
Model VCE    : OLS

Expression   : Linear prediction, predict()
dy/dx w.r.t. : pop fdi cp_sk cpi
at           : pop             =     .048813 (mean)
               fdi             =    .0464274 (mean)
               cp_sk           =    .0988886 (mean)
               cpi             =   -.0457628 (mean)

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         pop |   .0020461   .0175317     3.45   0.001    -.0949234   -.0262005
         fdi |  -.0057913    .02028    -3.83   0.000    -.1174675   -.0379712
       cp_sk |   -.004394   .0855665    -3.05   0.002    -.4289433   -.0935287
         cpi |    .002685   .0194635     1.29   0.198     -.013095    .0632006
------------------------------------------------------------------------------
```

Source: author's own elaboration based on Table1 and Stata 14.2 estimation results.

As for the marginal effects, it is worth being mentioned that foreign direct investments happen to be the determinant that has the strongest impact on minimizing the probability of economic slowdown. If regressors were to increase by 1 unit, the probability of stagnating economy transforming into a deteriorating one would change in the following manner:

- FDI – decrease by 0.5%

- CP_SK – decrease by 0.4%
- CPI – increase by 0.2%
- POP – increase by 0.2%

Hence, based on the executed models, it can be predicated that economies striving for economic development and enhancement of standard of living should focus on maximizing capital stock, attracting foreign direct investment, promoting export, improving the level of human capital, while minimizing consumer price index and diluting population growth. In other words, based on the estimation results reported by both panel data and logistic regressions, the null hypothesis established in Chapter 1 cannot be rejected.

4. Conclusion

From the review of literature pertaining to the concepts and history of economic development, it was concluded that the issue of "Great Divergence" was still relevant in this day and age. The proportional balance between the number of developing and developed nations is only to be established, since the distribution of world's resources is prevailingly concentrated in rich countries, leaving developing economies overboard. Undeniably, the study of what makes economic development possible is of great importance for minimizing the "Great Divergence". Thus, the predominant premise of this paper was to determine the factors that contributed to the positive dynamics of the standard of living measured by real GDP *per capita*. Using the sample of 42 countries and 12 explanatory variables ranging from 1980 to 2014, both panel data and logistic regressions were performed for this exact premise.

From the estimation results, it can be derived that the shortage of foreign direct investment, a volatile currency and lack of export promotion are the main causes behind the deterioration and stagnation of economic progress. Countries characterized by the aforementioned specifics are less likely to move in the development ladder. Alternatively, it was established that the accumulation of capital stock supported by positive dynamics of both exports and human capital typically increase the chances of an economy to maximize its economic growth.

Summing up, it is worth being mentioned that this paper has covered the aims it set at the beginning: determination of factors causing economies to grow. Estimation results of both panel data and logistic regressions were clearly reported and commented on, which facilitated the process of acceptance of the hypothesis outlined at the beginning of this paper.

Based on the estimation results, the following policy initiatives can be recommended for developing countries to promote economic growth in the future:

1. Simplification of tax system for export-oriented development.
2. Promotion of higher education as a way of improving the level of human capital.
3. Reduction of tax barriers for foreign capital to engage flows of investments.
4. Restriction on money injections to maintain low level of inflation.
5. Creation, development and promotion of domestic foundations to prevent "brain-drain".

Subsequently, the author suggests extending both the sample and number of regressors for the sake of conducting a much thorough investigation into the issue of economic development. In particular, the author was unable to run an ordinal logistic regression due to empirical and technical limitations, which would undeniably enrich the findings with more insightful information regarding the mechanisms that developed countries used to maintain and enhance their national well-being.

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Transmission Mechanisms of Oil Price Shock and its Effect on Output

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Abstract

In this thesis, Structural Vector Autoregressive Model (SVAR) has been used in order to analyse the extent to which oil price shock can effect GDP growth through inflationary, direct-output and fiscal policy transmission mechanisms. The results have shown that growth rate of oil price due to the oil price shock tends to fluctuate in the first five years. Therefore, the same effect is observed in the behaviour of foreign direct investment and investment which tend to fluctuate in the first six years after the shock. A high growth rate of inflation is observed for five years but later it is stabilising. Also, I have found that the quality of institutions may cause expenditures to decrease; however, I may conclude that this is not the essential factor.

Subsequently, oil price shock negatively affects output only in nominal terms for the first three years; later, the situation stabilised, which is confirmed by the constant positive growth rate of GDP. Therefore, a direct output and inflationary transmission mechanisms bring positive effect on GDP growth. The effect of the fiscal policy transmission mechanism is ambiguous as due to the fluctuations in the oil price, the volume of governmental expenditures may be changed severely. This, consequently, may bring dramatic changes in GDP growth.

Introduction

Oil is a commodity that plays the central role in the world economic development as it is used as an input in vast number of productions (around six thousand goods). Therefore, any changes of the oil price in the energy market may affect the supply of oil and consequently the production of goods. That may tremendously affect macroeconomics in both positive and negative ways.

Unpredicted fluctuations in the supply of oil are the main source of the uncertainty. These may deteriorate economic growth as it is not clear what kind

of exogenous shock can be provoked by an immediate change in the supply and respectively the price of oil. Henceforward, the issue of the oil price shock has become extremely important as there was a need for broader understanding of the effects oil shock can bring to the economic performance of the country. In 1970s, the first oil price shocks were observed in much detail in order to find ways of mitigation of the negative effects. In the research, Hamilton (1983) has discovered that all of the increases in the oil prices were followed after US-post war recession pointing that oil prices to a large extent negatively affected economic position of the country.

Later on, following the idea of Hamilton, studies (Kilian, 2009a; Brown and Yucel, 2002a), have developed transmission channels of the oil price shocks effects on the economy. Their main conclusions are that oil price may not only affect GDP directly but through lots of other macroeconomic variables. Moreover, oil price fluctuations may affect some of the variables immediately (short run) while the rest – postliminary (long run).

However, oil price fluctuations are one of the most challenging issues for countries, companies which are heavily dependent on oil export. This is because oil revenue has a unique feature in the governmental expenditure structure due to the fact that at times of high oil prices the country tends to develop very rapidly (extra income coming from the oil export); the opposite is true, in the case of low oil price, revenue immediately falls which bring negative effects on the economic development. The more the country is dependent in its fiscal policy on oil revenues, the more it is vulnerable to unexpected shocks as governmental spending cannot be decreased in the short run, leading to the dramatic and instantaneous increase in the governmental debt. This effect of the oil price shocks on the fiscal policy may constitute yet another transmission channel for the case of oil exporting countries because sustainable fiscal policy is one of the triggers of the economic growth. However, there are oil abundant countries like Norway, whose performance is better than others even at times of low oil prices, which triggers discussions about the importance of the institutions predetermining the structure of the governmental spending and the distribution of the oil revenue (El Anshasy, 2014).

These have laid the base for the motivation for my research as it is important to analyse the effect high volatility and huge uncertainty of the oil price fluctuation may bring. The issue is central for the countries which are to a great extent dependent on the revenue coming from oil production. Forty-one biggest oil-exporting countries have been chosen in order to observe a comprehensive sample of countries and be able to study the effect of the oil price fluctuations on the countries no matter which income level they are, as the shock may harm not only low-income countries but high-income ones as well.

Discussion of the possible effects oil price fluctuations may bring to the oil-exporting counties triggers the main research question: To what extent can oil price shock affect GDP growth through inflationary, direct output and fiscal policy transmission channels?

The main objective of the dissertation is to empirically analyse three transmission channels through which economic performance of oil-exporting countries may be affected. These are the following: direct output effect where GDP directly increases due to higher oil rent; the inflationary effect which affects GDP through consumer price index, inflation, investment and foreign direct investment changes (discussed by Brown and Yucel, 2002); and fiscal policy effect which influences GDP growth through the quality of institutions and governmental spending.

Based on my objectives, I have established the following hypotheses to be tested:

H1: Oil price shock positively affects GDP growth through direct output and fiscal policy transmission mechanisms channels.

H2: Oil price shock negatively affects GDP growth through inflationary transmission mechanism channel.

H3: Quality of institutions do predetermine governmental final consumption expenditures.

The thesis is organized as follows: the first chapter, on literature review, will describe the transmission channels of the effect of the oil price increase form the theoretical point of view. The second chapter will be devoted to the data description where I will specify the data collection process and data specification. The third chapter will be dealing with the model specification. I will be describing the derivation of the Structural Vector Autoregressive (SVAR) model that is based on the VAR model – a set of the reduced form of simultaneous equations. The fourth chapter will show empirical results' estimations and discussions. I will construct impulse responses and variance decompositions of the endogenous variables in order to test for my hypothesis. Results of the models estimations will be followed by conclusions and further recommendations.

1. Theory and Literature Review

1.1. Oil Price Shock Effects on Output

The major contribution to the study of the transmission mechanisms was brought and discussed by Hamilton (1983) who has tackled the issue of the essence of

the oil shocks which heated up the debate of the effect of oil prices fluctuations on output. His finding showed that oil prices are nonlinear in terms of the effect on the economic activity of the country because oil price increases are much harder to predict than oil price decreases and the strength of the former are higher in terms of the effect on the countries' performance. As a result of these changes, Hamilton (2008), Huntington (1998), Mork (1994) have stated that oil price shocks have the major effect on consumer disposable income which will reduce the consumption of energy-intensive commodities such as automobiles due to the fact tht increased oil prices will induce petrol prices as well. Therefore, bigger share of households' income will have to be spend on gas. However, people will try to cut petrol usage and one of the solutions would be to switch to less energy-intensive industries. This, will cause the shift of the production from oil-intensive to less oil demanding commodities.

The same conclusion has been derived by Kilian (2009a) who has also confirmed that purchasing power of households will be reduced due to higher oil prices which will cause people to use less energy. However, by distinguishing the effect of the loss of consumers' purchasing power on different sectors, Kilian (2009b), concludes that in the motor vehicle service demand for the vehicles has dramatically decreased due to the increase in energy prices; that is why there was a shift from large energy-inefficient cars to smaller ones, more efficient in terms of energy consumption, which confirms Hamilton's (1988) findings. With regard to other sectors of the economy, Kilian (2009b, 2010) has observed a decline in the spending on travel and tourism, clothing, shoes, transportation costs, services such as telephone services, personal care, dry-cleaning; health expenditures which are not covered by the insurance and expenditures on education as a kind of the investment, especially in form of private schools or other trainings have declined as well.

There are four major factors responsible for the decline in the purchasing power. The first is discretionary income factor where households have less disposable money as energy costs increased making energy consumption not decrease, at least in the short run. The second factor is the uncertainty which causes consumers to postpone their current consumption as they are not sure about the future price of oil. Uncertainty factor was to the bigger extent studied and proved by Bernanke (1983). The next factor is precautionary saving one where consumers knowing about uncertainty of future will postpone the consumption not only of durables but also of different kinds of expenditures (Kilian, 2010). The fourth factor is operating cost effect which claims that due to the uncertainty effect, the production of energy-intensive commodities will be reduced (Hamilton, 1988, 2003).

1.2. Transmission Channels of Oil Price Shocks

In a broader scope, the transmission channels of the oil price shocks were described by Brown and Yucel (2002a, 2002b). They have derived six major channels which are:

- The supply-side shock effect that on the effect of the industrial production which require extensive use of oil in their production. A positive oil price shock leads to immediate increase in the cost of production and, conjointly, to decrease in the profit from the oil production industry. That leads to losses in the short run; however, the common long run response is to decrease costs of production through the cut of the number of employees. That will cause decrease in the employment rates till the moment when workers are able to find jobs in other industries.
- The inflation effect appears due to the increase in the cost of oil production and price level which is induces the cost of living. Higher inflation will cause people to increase their expectations in terms of the future inflation which will drive up inflation even higher.
- The real balance effect is another channel of transmission which accounts for the effect of increased money demand. As it causes an increase in the interest rates, monetary policy authorities will decide whether to adjust for the inflation or not. However, in case monetary authorities do not introduce higher interest rates, these will decrease investment and output.
- The sector adjustment effect is analyses the consequences of the oil price increase within the industry, as in the case of higher oil price profits of all industries will decrease leading to lower investment level and no potential perspective for future growth. However, this effect is hard to predict due to the specific characteristics of every country and industry.
- The unexpected effect is the uncertainty factor described by Kilian (2010), which corresponds to the changes in household behaviour due to the unpredictability of the oil prices fluctuations.
- The wealth transfer effect (Dohner, 1981) is responsible for the redistribution of the purchasing power parity from oil importing to oil exporting countries so that oil demand in the oil exporting countries is augmented.

1.3. Institutions

Taking the perspective of these countries that are mostly dependent on oil revenue, the channel of fiscal policy appears (apart from six transmission channels discussed by Brown and Yucel (2002a, 2002b)). Fiscal policy channel works

through the changes in the governmental revenue in the situation of the oil shock. Therefore, as governmental revenue is a part of GDP, negative oil shock causes a decrease in the variable and vice versa, causing fluctuations in the economic growth of oil-exporting countries. Nonetheless, the extent to which each country can be affected are different. This issue is complex and quite controversial, and there are different opinions on the crucial factors which affect the growth of oil exporting countries.

Collier and Goderis (2007) as well as Frankel (2012) have discovered main factors which can affect oil-exporting countries' economic growth. These are volatility of the commodity prices, 'resource curse' phenomenon, institution conformation, conflict of interest and political economy, income inequality, and excessive public debt.

Excessive public debt channel works in the situation of high oil price when the oil exporting country has more borrowing capacity which, in turn, leads to higher volumes of borrowing. This, however, at times of oil price decrease, causes international debt accumulation to be unsustainable. All in all, some oil-exporting countries countries face dramatic decrease in spending and economic growth (El Anshasy, 2012; Hausmann and Rigobon, 2002).

In fact, high polarization of countries causes the marginal effect of the increasing prices of the specific commodity to be lower and decrease net foreign asset inflow (lower private investment and higher governmental revenue|). According to Arezki (2010), these findings are consistent with the voracity effect, i.e. the idea which states that the higher the share of the government, the bigger the governmental revenue because less private companies are operating in the oil industry. This effect may lead to the deterioration of the current account balance (Lane and Tornell, 1998).

The channel of volatility of the commodity prices leads to lower governmental revenue of oil exporting countries when oil prices are lower and high profits at times of booms. El Anshasy (2012) has investigated the relationship between oil price volatility and changes in governmental revenue and has concluded that negative oil price shock deteriorates economic growth in the short run. However, in the long run, after the adjustment of the fiscal policy, negative oil shock does not affect the performance of the country.

The same conclusions were derived by Husain *et al.* (2008) who have investigated the dependence of the oil price fluctuations effects on the economic development in oil exporting countries; they have tested for the possible channels through which oil prices can affect economic growth and have come to the conclusion that the negative oil price shock affects mostly governmental revenue. Howbeit, adjustments to fiscal policy can eliminate these negative effects.

"Dutch Disease" is another reason making oil-exporting countries underperform due to the natural resource abundance. After the analysis of 30 oil-exporting countries which have more than 25% of total revenue coming from oil export, Lopez-Murphy (2010) has suggested, the difference in the performance at times of negative oil shock is due to the former pattern under which the country has been govern. Governmental revenue, when oil price is high, can be used in order to be saved or in order to increase governmental expenditures. Also, relations between total expenditures as a percentage of GDP and non-oil expenditures showed that at times of positive oil price shock, expenditures on non-oil sector were much lower. This accounts for the fact that during times of oil price booms, the biggest part of expenditures have been spent on the oil production and development of that sector. That provokes the idea of the "resource curse" or "paradox of plenty" phenomenon, which claims that a country is actually under developing of the non-oil sectors due to high resource abundance (Lopez-Murphy, 2010).

Also, research conducted by Sachs and Wraner (1995) supports the "resource curse" phenomenon as well. They have investigated the effects of the debt crisis in 1980s in Latin America and East Asia and have come to the conclusion that Latin America which is resource abundant was affected negatively while East Asia did not.

H. Mehlum *et al.* (2006) have claimed that the quality of institutions is a predetermined factor in terms of whether resource abundance is a curse or a blessing because their findings have showed that countries with bad quality of institutions suffer from the resource curse and vice versa. However, all in all, resource curse may not be a problem only in the situation when oil abundant countries are able to manage well their resources (El Anshasy, 2014) (do not only concentrate on the development of oil industry).

Institutional conformation which accounts for the extent of openness of the economy, concentration of trade, income inequality, level of corruption, freedom of press, ability to implement laws, rules, and regulations properly, define objectives set by the government constitute another transmission channel which define quality of institutions. Therefore, the better the quality of institutions, the better the country is able either to mitigate the effect of higher oil price or to accommodate higher oil revenue more efficiently. Researches have stated that quality of institutions is the main factor affecting the growth during negative oil shock.

In the research conducted by Rodrik (1998), the author has investigated the countries of Latin America and Middle East in order to find the reasons of the drop in their development after 1975. His findings have showed that as these

regions have been becoming more integrated; they have been getting more sensitive to new kinds of shocks such as the level of inequality, ethnic fragmentation, underdevelopment of governmental rules, laws and regulations. In cursive, the conclusion is that institutional, governmental rules, laws, social insurances development and improvement are important factors in mitigating the consequences of oil price fluctuations.

Supporting this idea, Isham *et al*. (2004) have showed that countries which are rich in natural resources tend to do worse due to the lower prices of the commodity as the extensive part of revenue from the export of that commodity was reduced; however, the quality of institutions affects the force with which the economy will be hurt. Fedesarrollo (2013) has checked the relations between oil price shocks and the level of institutions development and proved that the quality of institutions can mitigate the effect of the negative oil prices as well. Also, proper implementation of rules and laws can help to avoid "resource curse" phenomenon (Mehlun, 2006).

Therefore, all the factors constitute fiscal policy transmission channel. In the situation of the decrease of the oil price, lower governmental revenue will come from oil export instantaneously because biggest part of government revenue of oil abundant countries come from oil export. That will increase public debt of the country because governmental expenditures cannot be adjusted right away. In this situation, the quality of institutions and the governmental rules will predetermine the future response of the government to oil shock. Under the circumstances of well developed institutions, it can be assumed that the country has been saving part of the revenue coming from oil in the funds. Stored wealth in funds will allow to cover some part of governmental expenditures by the wealth stored in funds so that governmental expenditures are at the pre-negative oil shock level. Therefore, economic growth will not be affected. However, in the case of corruption and underdevelopment of institutions, there may not be any possibilities to maintain the same level of governmental expenditures and the only way will be to cut them in order not to allow the accumulation of the debt in the country. Lower governmental expenditures will lead to lower output in the country and worsening of the economic situation, so that it is even harder to stabilize the country's economic situation. The issue of the effects of the oil price shocks on the growth of the oil-exporting countries is complex. Effectiveness of the accumulation and use of revenue coming from oil export and the quality of institutions are two the most important factors affecting the growth of oil-exporting countries. However, these factors cannot affect economic growth directly but only through fiscal policy governance (El Anshasy and M. S. Katsaiti, 2013).

1.4. Data Specification

Therefore, based on the described theory, I have decided to combine those approaches in order to be able to analyse the effects of the oil price shocks from different perspectives simultaneously.

Three main channels I am going to analyse are the following: inflationary, direct output, and fiscal policy. Inflationary transmission channel will be adopted from Brown and Yucel (2002a). Direct output is the channel I have created on my own due to the fact that there is no such SVAR analysis found. Fiscal policy channel, to the biggest extent, is analysed through the use of different methodologies. Therefore, SVAR methodology may bring more to the understanding of the fiscal channel behaviour at times of oil prices shock. Also, it will be useful when comparing the results from three analysed channels.

All the assumptions of the short-run interrelationships will be formed on the macro scale (effects on major macroeconomic variables) from the perspective of the oil-exporting countries as the research is aimed at analysing countries which are rich in oil commodity. Figure 2 shows graphical representation of the interrelationships to be estimated.

The first channel is the direct output that analyses the direct effect of oil price (LCOILP) increase on the GDP (LGDP) through Rent, Trade and oil export (LEXPORT). From the oil-exporting country perspective, an increase in oil prices will immediately lead to the higher oil rents (Arrow I) as the value of the production is increasing due to higher price of oil, therefore increasing marginal revenue. Thereupon, in the short run, trade will increase (Arrow II) by raising the value of export conjointly with possible increase in volume leading to higher oil export (Arrow III) inducing positive GDP growth (Arrow IV).

The next channel is fiscal policy governance (variables to be estimated are GDP growth (LGDP), governmental expenditures (LEXPEND), Polity, and oil price (LCOILP)) where in the short run higher oil prices decrease the public debt (Arrow A.1) due to the increase in exogenous effect of trade (Arrow A.2). Increased value of oil export gives an opportunity to repay the debt as an instantaneous effect will not let governmental expenditures to adjust simultaneously. However, in case institutions (Polity) are well developed and the country manages to save oil revenue in reserves (Funds), the government will not have to change their consumption behaviour. (Arrow B). The second option is of low quality of institutions (Polity) (Arrow C), which will lead to the higher level of expenditures because funds will not be able to finance lacking revenue (Arrow D). This will lead to the instable position of the country. Countries will not be able to recover fast. In that situation, higher governmental expenditures will stimulate economic growth (Arrow E). The same results were drawn by Ravnik and Zilic

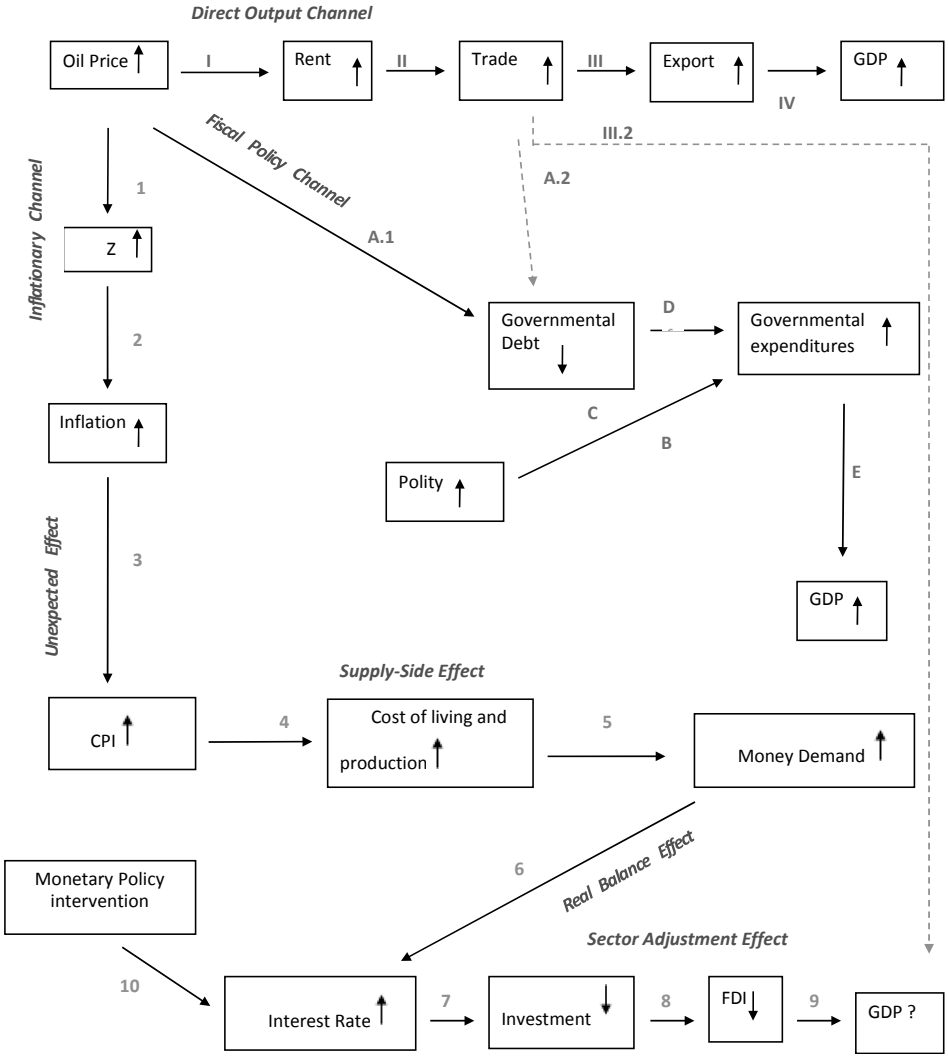
(2010) proving that the quality of institutions helps to stabilize expenditures in a short period of time and not to be predetermined by the oil shock. However, Dizaji (2012) has shown that in the heavily oil-dependent countries the contribution of oil prices to the expenditures is significant in the long run.

The third channel of transmission is inflationary one (Brown and Yucel, 2002a), where the interrelationships between oil price (LCOILP), inflation (INFL), gross capital formation (LINV), foreign direct investment (FDI), GDP growth (LGDP) and Trade as an exogenous variable will be discussed. From the Aggregate Supply and Aggregate Demand (AS-AD) framework (Blanchard, 2010b), oil prices as part of the production cost appear in the z – "catchall" variable of the AS equation $P = (1 + m)P^e f(u,z)$. Respectively, in case oil prices will increase, z will increase as well (Arrow 1). Another consequence coming from the AS equation is that the higher the cost of manufacturing, the higher the price of manufactured goods leading to the overall increase in prices – INFL (Arrow 2). Respectively, the higher price level affects consumer price index in the same direction (Arrow 3). This effect is depicted by the leftward shift of the AS curve to point E_z. However, as the price level is increased, people's expectation about the future prices will be higher, which will trigger the higher expected price level and, as a result, drive up the price level even higher leading to yet another shift of the AS curve to the left to new equilibrium point E_a.

However, higher INFL and consumer price index lead to the increased cost of living (Arrow 4), which in turn increases money demand in the country (Arrow 5). That will shift money demand curve to the right to point A_z and lead to higher interest rate in the country. (Arrow 6). According to the results obtained by Alom (2011) positive effect of oil price increase cause interest rates to increase by 9% and it takes approximately 3 years to stabilize.

Therefore, higher interest rates will discourage investors as it is not attractive to invest causing capital outflow which decreases INV and FDI (because the are a part of the investment) (Arrow 7 and 8). As a result, lower investment stipulates GDP growth (Arrow 9). However, the CB can use monetary policy tools in order to manipulate interest rates so that negative effect on investment and output is mitigated or eliminated. (Arrow 10). However, another exogenous effect may come from the increased Trade occurring in the output channel, positively affecting GDP growth as well (Arrow III.2). Therefore, the overall effect can become ambiguous.

Figure 1. Transmission Channel Mechanisms of Oil Price Shock



2. Data specification

2.1. Data and Sources

I have collected the data for 41 oil-exporting countries in the period of 1990–2012. The choice of this period was shaped by fact of the data availability as some oil-related figures and values on fiscal performance have begun to be recorded only recently. Howbeit, variety of countries will allow me to have no reduction

in the degrees of freedom. Therefore, in order to produce accurate and comprehensive estimations of the effects of three chosen oil price shocks transmission mechanisms I have chosen following macroeconomic variables:

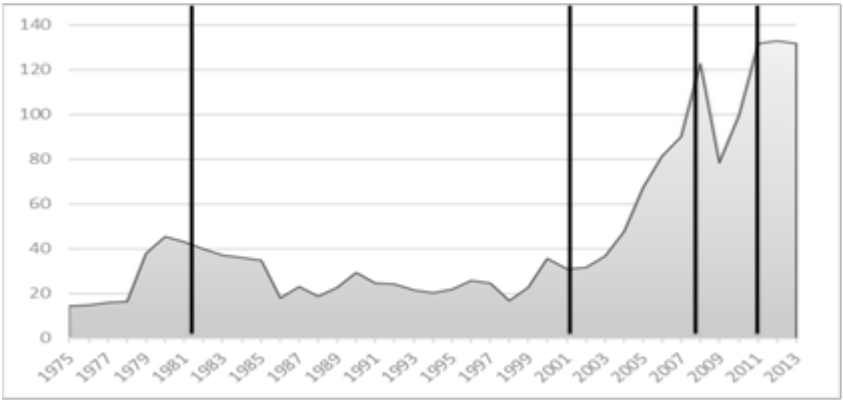
- The consumer Price Index (INFL) which is calculated as the percentage annual growth of consumer purchasing power, hence determining the inflationary or deflationary economic situation in the country. The data have been obtained from World Bank Database;
- The Logarithm of the Oil Price (LCOILP) is the spot current yearly Brent prices of oil expressed in dollars per barrel which is calculated as the average price for the year. As the value of the Brent oil price will be the same for every country throughout time, I have decided to multiply it by the official exchange rates of local currencies per dollar in order to receive values in local currencies. Among three the most popular oil prices, Brent Blend, West Texas Intermediate (WTI) and Dubai/Oman oils, I have chosen Brent since its price is the benchmark for the oil price index of other prices despite the fact that WTI is as valuable as Brent one. Also, Brent oil is of higher quality and is more esteemed than Dubai/Oman. The logarithmic functional form of Brent oil price will help me to assess the growth rates of the oil price but not the change in its value. The following data have been taken from OPEC Annual Statistics Bulletin 2015;
- Logarithm of the Gross Domestic Product (LGDP) shows the total value of the production of all final goods and services produced in the country for a specific period of time. GDP is measured in the local currency. The data have been collected from the IMF GFS Yearbook. Additionally, I have taken the logarithm of GDP;
- Gross Domestic Product growth rates (GDPG) is the value of the total value of the production of all final goods and services produced in the country for a specific period of time expressed in the yearly percentage growth rates. The data have been collected from OECD National Accounts;
- The Logarithm of the Gross Fixed Capital Formation (LINV) is the value of the fixed assets acquainted by the business sector and government excluding disposal of fixed assets. So, in such a way, gross fixed capital formation shows the volume of new investment in the country. The data on Gross Fixed Capital Formation have been obtained from the OECD National Accounts and is calculated in the percentages of obtained values;
- Oil Rent (Rent) is expressed as the difference between the value of the oil production at the world oil prices and the cost of the oil extraction. In cursive, oil rent measures possible profit obtained from the oil extraction. Variable is measured in the percentages of GDP; the data have been collected from World Bank Database;

- The logarithm of the Governmental final consumption expenditures (LEXPEND) is expressed in the local current currency. Final governmental expenditures include all of the expenses for all of the operational needs of the government in order to provide goods, services and social transfers (wages and salaries, social benefits, grants, compensation for employees, dividends) to the country. The data on current government expenditures have been obtained from International Monetary Fund, Government Finance Statistics Yearbook (IMF GFS);
- Polity (Polity) is a categorical variable ranging from (-10) (strong autocratic political regime) to (+10) (strong democratic) and representing the extent to which the level of institutions in the country and the political regimes are well-developed. Nonetheless, there are also values of (-88), (-77) and (-66) which show extreme cases of autocracy. Polity data have been obtained from the Polity IV dataset which is widely used in the political science researches as it helps to measure the level of the corruption, civil right, executive power and quality of institutions which was created by Ted Robert Gurr – a specialist in the political conflicts and instability. Currently, Polity IV Datasets (2014) are sponsored by the Political Instability Task Force (formerly State Failure Task Force). This is a US government-sponsored projects aimed at the creation of the information on political conflicts. Polity is calculated by the substitution of the autocracy indicator (autoc) from the democracy one (democ). Democ and Autoc are artificialy created variables which have been constructed and estimated by Polity IV specials using decision trees. Democ and Autoc take into account three major components The first one is the quality of institutions which are expressed in the ability of the correct implementation of law, rules, regulations and objectives set by the government in the country along with its fulfilment by the citizens. Second component is the presence of the executives constraints in order to make sure that corruption does not take over downfalling rules, objectives which are set up in the country endeavouring at the overall welfare increase. The third one is the aptitude to obtain civil rights in the everyday citizens' life so that they do have an opportunity to be able to express their opinions, have freedom and be protected by the law;
- Trade (Trade) as the measurement of the country's economic activity shows the volume of export and import as the percentage of GDP. The data have been obtained from the OECD National Accounts;
- Oil Export (LEXPORT), the last variable to be used in the research, shows the volume of oil sold to other countries measured in barrels of oil exported per day. In order to be able to precisely interpret the empirical results, values have been transformed into the logarithmic scale (growth rates). The data whave been taken from OPEC Annual Statistics Bulletin 2015.

2.2. Descriptive Statistics

In order to empirically observe whether there are some drastic changes in the main macroeconomic variables, I have divided my data into the periods of lower and higher oil prices (negative and positive oil price shock from oil-exporting country perspective) (Figure 1). The first period will be of the positive oil shock from 1975–1981 where the price of oil was increasing due to the stabilization after the World War II where the US production reached its peak together with the stabilisation of the Arabic region production. The second one is the negative oil shock which was observed in 1982–2001 due to the Iran-Iraq war and export instability of the Arab region. 2002–2008 is the period of the positive oil shock with a historic peak of 136.31 dollars per barrel in June 2008 followed by a slight decline in 2009 because of global financial crisis. The last observed period of positive oil shock is 2010–2013.

Figure 2. Historical Oil Prices



Source: Data based on IMF IFS.

Such division will allow me to compare and observe the possible pattern of the volatility of the GDP growth, interest rates, the level of wages and salaries which are part of expenditures, export, import; oil-related variables such as oil price, crude oil production, and reserves.

Table 1 summarizes the results for all the countries in the sample. As it was observed by Hamilton (1983) and Kilian (2010), GDP growth tends to increase in the period of positive shocks and decrease in the period of negative ones due to revenue windfalls. Lower GDP in the period of negative oil shock causes slightly higher governmental expenditures as a percentage of GDP. This leads to the conclusion that the value of expenditures may not change throughout time.

Table 1. Macroeconomic Figures and Growth

	Positive Oil Shock (1975-1981)	Negative Oil Shock (1982-2001)	Positive Oil Shock (2002-2008)	Negative Oil Shock (2009)	Positive Oil Shock (2010-2013)
GDP Growth (in %)	4,96	3,30	6,44	1,60	4,52
General government final consumption expenditure (% of GDP)	16,73	17,51	16,19	18,03	16,36
Wage and salaried workers, total (% of total employed)	82,60	69,06	67,54	65,93	64,47
Inflation, consumer prices (%)	16,06	27,26	7,74	5,76	7,77
Imports of goods and services (% of GDP)	56,57	72,06	185,00	269,79	387,75
Exports of goods and services (% of GDP)	35,90	53,88	105,65	120,46	632,61
Oil rents (% of GDP)	27,05	17,03	23,85	19,16	21,09
Crude oil reserves (m b)	19479,81	32554,54	42071,37	45967,29	49092,95
Crude oil production (1,000 b/d)	1530,03	1307,26	1529,26	1549,37	1623,03
Brent spot crude oil prices ($/b)	21,84	20,55	57,39	71,54	104,18

Source: Data based on World Bank Database.

At time of lower GDP growth, expenditures do constitute bigger part of GDP composition. Wages and expenditures are constantly decreasing throughout time despite the fact of changing oil prices. The fact that the countries are becoming more technology-oriented may be the reason for such a constant decrease.

Inflation tend to rise till 2001 and the reason for that may be lack of experience in the proper management of the monetary policy instruments (Blanchard, 2010a). However, recent years show the positive relation between oil prices and inflation, which is in line with the inflationary effect explained by Brown and Yucel (2002b).

Oil rent measures the profit from oil export by differencing marginal revenue and marginal cost. In the situation when the price of oil increases, marginal revenue increases respectively, as oil is the main output obtained from the production, keeping the same level of marginal cost (because the amount of oil produced does not change and cannot be changed immediately). This suggests that the positive oil shock leads to high oil rent and vice versa.

Despite the fact that oil price has been changing, it is still increasing with time. Also, positive effect of oil price increase can be depicted by differencing export from import (net export) (Table 2). This shows that at times of high oil price, as in the period of 2010-2013, export is exceeding import many times leading to the windfall on the economy of the oil-exporting countries.

Figure 3. Net Export

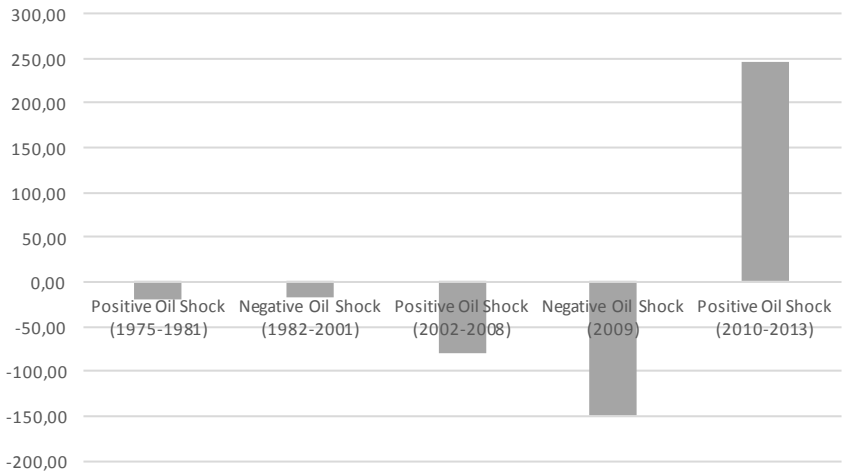


Table 3 shows the descriptive statistics of the variables to be estimated. GDP grows on average by 3.6%; however, these values range from minimum values of -25% to maximum +33% growth per year suggesting that output fluctuates a lot.

Table 2. Descriptive Statistics

	GDP	POLITY	EXPEND	OILP	FDI	INV	INFL	GDPG	EXPORT	RENT
Mean	5.27E+13	-0.238043	8.02E+11	46.38948	1.22E+12	22.95897	88.94618	3.591221	1268.159	14.76861
Median	7.28E+11	5.000000	4.09E+10	28.43600	5.70E+09	20.87410	5.557541	3.772396	547.9049	9.714363
Maximum	2.41E+15	10.00000	2.62E+13	111.6200	6.37E+13	219.0694	26765.86	33.73578	7556.760	70.34887
Minimum	3.34E+09	-88.00000	15007872	12.71300	-9.88E+11	0.000000	-31.56591	-24.70000	9.285479	-2.517254
Std. Dev.	2.35E+14	16.86982	2.44E+12	33.93689	4.68E+12	16.52891	947.8566	4.767065	1614.200	14.51157
Observations	943	943	943	943	943	943	943	552	552	552

The same is true for the INFL, which is extremely volatile and sensitive to the economic changes as minimum and maximum values varies dramatically. This leads to conclusion that countries of different income level and economic development respectively are included in the sample and any economic fluctuations do affect the level of prices dramatically. The average price of the oil is 46.4 dollars per barrel with the highest value of 111.62 dollars for 2008. Additionally, mean value of rent shows that 15% of the GDP comes in the form of the oil export.

Polity, which is a categorical variable, shows that countries which are in the observed sample have a mean of -0.3 showing that on average countries do not have strictly democratic (+10) or autocratic (-10) regimes and the quality of institutions may not be highest

3. Model Specification

3.1 Model Specification

In order to identify short-run effects of oil price shock on inflationary, direct output, and fiscal policy transmission channels, I will construct three structural vector autoregressive models (SVAR) for each analysed channel. VAR model is a set of the reduced form of simultaneous equations in order to identify possible interrelationships relations between variables. The model has been presented by Sims (1980) and is defined as follows:

$$Y_t = c + \sum_{i=1}^{p} \theta_i Y_{t-i} + \beta X_t + \varepsilon_t$$

where ε_t stands for normally distributed residuals; $\varepsilon_t \sim N(0,1)$; $Y_t = (y_{1t} + y_{2t} + y_{3t} + \ldots + y_{nt})$ is a vector of n endogenous variables at time t; c is an intercept; θ_i represents the matrix of $n \times n$ coefficients, X_t represents exogeneous variables which may be included into the model with β – coefficient vector of exogenous variables. In order to make the system simpler, I will retransform it to the n-variables case:

$$\begin{aligned} Y_{1t} &= c_1 + \theta_{111} Y_{1t-i} + \theta_{112} Y_{2t-i} + \theta_{113} Y_{3t-i} + \ldots + \theta_{11n} Y_{nt-i} + \theta_{211} Y_{1t-i} + \ldots \\ &\quad + \theta_{21n} Y_{2t-i} + \ldots + \theta_{n11} Y_{1t-i} + \ldots + \theta_{n1n} Y_{nt-i} + \beta X_{1t} + \varepsilon_{1t} \end{aligned}$$

$$\begin{aligned} Y_{2t} &= c_2 + \theta_{121} Y_{1t-i} + \theta_{122} Y_{2t-i} + \theta_{123} Y_{3t-i} + \ldots + \theta_{12n} Y_{nt-i} + \theta_{221} Y_{1t-i} + \ldots \\ &\quad + \theta_{22n} Y_{2t-i} + \ldots + \theta_{n21} Y_{1t-i} + \ldots + \theta_{n2n} Y_{7t-i} + \beta X_{2t} + \varepsilon_{2t} \end{aligned}$$

$$\vdots$$

$$Y_{nt} = c_7 + \theta_{1n1}Y_{1t-i} + \theta_{1n2}Y_{2t-i} + \theta_{1n3}Y_{3t-i} + \ldots + \theta_{1nn}Y_{nt-i} + \theta_{2n1}Y_{1t-i} + \ldots + \theta_{2nn}Y_{2t-i} + \ldots + \theta_{nn1}Y_{1t-i} + \ldots + \theta_{nnn}Y_{nt-i} + \beta X_{nt} + \varepsilon_{nt}$$

So that:

$$Y_t = \begin{bmatrix} y_{1t} \\ y_{2t} \\ y_{3t} \\ y_{4t} \\ . \\ . \\ y_{nt} \end{bmatrix}; c = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ . \\ . \\ c_n \end{bmatrix}; \theta_k = \begin{bmatrix} \theta_{k11} & \theta_{k12} & \theta_{k13} & \theta_{k14} & . & . & \theta_{k1n} \\ \theta_{k21} & \theta_{k22} & \theta_{k23} & \theta_{k24} & . & . & \theta_{k2n} \\ \theta_{k31} & \theta_{k32} & \theta_{k33} & \theta_{k34} & . & . & \theta_{k3n} \\ \theta_{k41} & \theta_{k42} & \theta_{k43} & \theta_{k44} & . & . & \theta_{k4n} \\ . & . & . & . & . & . & . \\ \theta_{kn1} & \theta_{kn2} & \theta_{kn3} & \theta_{kn4} & . & . & \theta_{knn} \end{bmatrix}$$

$$\beta = \begin{bmatrix} \beta_{1t} \\ \beta_{2t} \\ \beta_{3t} \\ \beta_{4t} \\ . \\ . \\ \beta_{nt} \end{bmatrix}; \varepsilon = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ . \\ . \\ \varepsilon_{nt} \end{bmatrix}$$

In the situation, the VAR is stable, we can simplify the system by transforming it into moving average form:

$$Y_t = \alpha + \sum_{i=0}^{\infty} \delta_i Y_{t-i} + \sum_{i=0}^{\infty} \varphi_i \varepsilon_{t-i}$$

where all past values of Y_t were substituted; α is an intercept; δ_i represents the dynamic multiplier functions and φ_i represents impulse-response functions (IRFs) at horizon i. After all transformations, VAR model can be estimated based on the OLS method because it is unbiased and efficient (Enders, 2003).

Furthermore, as Sims (1980) has defined the model through the Cholesky decomposition of orthogonalized reduced-form disturbances, where VAR can be retransformed into the lag operator:

$$A(L)Y_t = \varepsilon_t$$

However, as the lag term can be used only on the right side of VAR, it is impossible to observe the relationships between variables as the covariance matrix of the residuals is not correlated. Thus, SVAR methodology has a better economic fit and it gives an opportunity to estimate economic shocks using theory and get the economic interpretative function of the impulse response. That is why, it is important to impose structural restrictions which can be obtained from

the Cholesky factorization, which will help to get orthogonal (structural) components of the error term in order to get generalized non-recursive orthogonalization of the error terms expressed in the B matrix. In order to do that, matrix B is introduced to the VAR model, so that:

$$B_0 Y_t = \alpha + \sum_{i=0}^{\infty} B_i Y_{t-i} + \mu_t$$

where B_0 represents $n \times n$ matrix which should not be an identity one because in that case SVAR model will be simplified to the reduced VAR form; μ_t is an $n \times 1$ vector of residuals which are uncorrelated white noise series. Adding the matrix B, VAR can be transformed into:

$$BA(L)Y_t = B\varepsilon_t = \mu_t$$

where μ_t stands for the innovation term. Having that $n \times 1$ vector of residuals which are uncorrelated white noise series which are already identified by ε_t by the A matrix SVAR model can be written as (Lutkepohl, 2007):

$$A\varepsilon_t = B\mu_t$$

where ε_t stands for the observed residuals and μ_t are unobserved structural innovations (shocks). Also, as structural innovations are orthonormal (orthogonal and unit matrix), restrictions on matrices A and B are put that:

$$A\sum A' = BB'$$

Having $2n^2$ unknown elements in both matrices, $n(n+1)/2$ restrictions are already applied in the matrix A as it is a unit one. For the sake of full identification of the model $n(n\text{-}1)/2$, additional structural restrictions have to be put on the matrix B, using economic theory.

In cursive, estimation results of matrices do not show the comprehensive interpretation of the interrelationships between estimated variables. Main tools to be used are impulse response function (IRF) and variance decomposition analysis (VDC). IRF defines the dynamic effect of shock of a particular variable on the other one, whereas VDC shows the variance of forecast error in a given variable to self-shock and to other variables (Brown and Yucel, 2002a; Lutkepohl, 2007). More detailed information about SVAR models can be found in Beck and Janus (2013, 2014 and 2016).

4. Empirical Estimation Results

4.1. Inflationary Transmission Channel SVAR Model Estimations

In order to estimate inflationary transmission mechanism of oil price shock, I will be using LGDP, INFL, LINV, LCOILP as endogenous variables and Trade as an exogenous one. Before the beginning of the empirical estimation of the oil price shock effects, I have tested chosen variables for the unit root, so that they are stationary. I have been using Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979) to check for the individual unit root for every country and every variable. Likewise, I have conducted panel unit root tests of common unit root by Levin, Lin & Chu (Levin, Lin and Chu, 2002) as well as individual Im, Pearsan and Shin (Im, Pearsam and Shin, 2003), ADF and PP (Phillips and Perron, 1988). Results have shown that INFL is stationary at levels while LGDP and LOILP are stationary at first differences. Therefore, I will be using the first differences of these variables in SVAR estimations.

Seven lags of the VAR model have been selected based on the Akaike, Hannan-Quinn, Schwarz information criterions and final prediction error selection. Figure 3 shows the graphical representation of the unit circle with no roots lying outside the unit circle suggesting that VAR is stable. Additionally, there is no autocorrelation at the fourth lag order (Figure 4). However, estimated VAR suffers heteroscedasticity and normality problems.

Figure 3. Unit Root Test

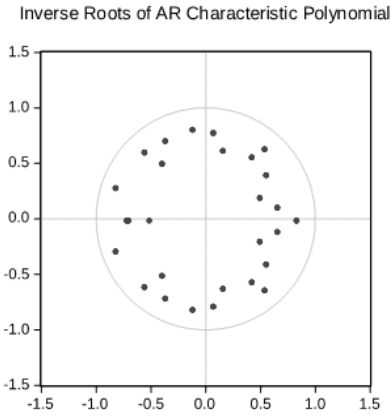


Figure 4. Serial Correlation LM Test

VAR Residual Serial Correlation LM Test
Null Hypothesis: no serial correlation at l
Date: 03/27/16 Time: 22:08
Sample: 1990 2012
Included observations: 525

Lags	LM-Stat	Prob
1	53.24333	0.0000
2	54.48775	0.0000
3	48.90301	0.0000
4	22.32739	0.1329
5	65.27382	0.0000
6	19.44362	0.2463
7	27.37256	0.0375
8	56.04703	0.0000

Probs from chi-square with 16 df.

In order to identify the structural vector autoregressive model, I will build reduced-form vector autoregressive model in order to identify channels of transmission of oil price shock. The results obtained from the VAR model define that Trade as an exogenous variable affects only LGDP as it was predicted in a positive

way. However, the effect is marginal. Therefore, putting restriction on the estimated VAR defines the following SVAR equation:

$$B_0 Y_t = \alpha + \sum_{i=0}^{\infty} B_i Y_{t-i} + \mu_t$$

After the transformation of the SVAR model into the matrix form, I have obtained:

$$\tilde{Y}_t = \begin{bmatrix} \theta_{111} * LGDP & \theta_{112} * LINV & \theta_{113} * INFL & \theta_{114} * LCOILP \\ \theta_{221} * LGDP & \theta_{222} * LINV & \theta_{223} * INFL & \theta_{224} * LCOILP \\ \theta_{331} * LGDP & \theta_{332} * LINV & \theta_{333} * INFL & \theta_{334} * LCOILP \\ \theta_{441} * LGDP & \theta_{442} * LINV & \theta_{443} * INFL & \theta_{444} * LCOILP \end{bmatrix}$$

where $\tilde{Y}$ stands for the vector of endogenous variables with subscript t.

As A matrix is an identity one, this allows me to have $4(4+1)/2=10$ restrictions. For the extra 4^2-$10=6$ restrictions of the B matrix, I will use the economic theory. Another important point to notice is that the sequence of variables is important because there are possible $2^4 = 16$ different orders of endogenous variables. As it is hard to estimate all these orders, variables will be placed by the period of their occurrence in the matrix.

I will assume that oil price can be affected only by oil prices because in the short run LGDP, LINV and INFL cannot have the direct effect on the variable as there is no direct relationship. It would take time for an effect to come into force which is out of the scope of the short-run restrictions. This conclusion gives me three restrictions to the B matrix (i.e. $\theta_{441} = \theta_{442} = \theta_{443} = 0$). However, the vice versa is not true because I assume that oil price shock has an immediate effect on other variables.

Three next restrictions will be put on INFL where LINV and LGDP do not promptly affect INFL as in order to affect it through LINV, variable should firstly affect LGDP which in its turn will immediately affect money demand, interest rates and only afterwards inflation. Therefore, the effect is achieved in the long run e.g. $\theta_{331} = \theta_{332} = 0$.

Also, I assume that $\theta_{221} = 0$ meaning that LGDP does not affect LINV in the short run due to the fact that only change in interest rates can have an instant effect on inflation.

In order to have intuition behind interrelationships, I have also performed Granger causality test. Figure 5 summarizes the results obtained. Therefore, LCOILP Granger cause LGDP, LINV and INFL. Also, LGDP Granger cause INFL and LINV. Granger causality test has also confirmed that LINV Granger cause

LCOIL, INFL. However, the effect of LINV on LCOILP and INFL on LGDP were not taken into the consideration as tis effect is observed in the long run.

Figure 5. Granger causality test results

INFL → LGDP	INFL → LINV
LINV → LGDP	LGDP → INFL
LCOILP → LGDP	LCOILP → INFL
LCOILP → LINV	INFL → LCOILP
LGDP → LINV	LINV → LCOILP
LGDP → LCOILP	

Having defined 6 additional restrictions, I will put them into the final form of the B matrix which is going to be estimated.

$$B_0 = \begin{bmatrix} NA & NA & NA & NA \\ 0 & NA & NA & NA \\ 0 & 0 & NA & NA \\ 0 & 0 & 0 & NA \end{bmatrix}$$

The results of SVAR model estimation obtained are the following:

$$B_0 = \begin{array}{c} \\ \textbf{D(LGDP)} \\ \textbf{D(LINV)} \\ \textbf{INFL} \\ \textbf{D(LCOILP)} \end{array} \begin{bmatrix} \textbf{D(LGDP)} & \textbf{D(LINV)} & \textbf{INFL} & \textbf{D(LCOILP)} \\ 0.017151*** & 0.005098*** & 0.000872 & -0.001944*** \\ 0.000000 & 0.142039*** & -0.023953*** & 0.009109 \\ 0.000000 & 0.000000 & 8.587031*** & -1.495042*** \\ 0.000000 & 0.000000 & 0.000000 & 0.226922*** \end{bmatrix}$$

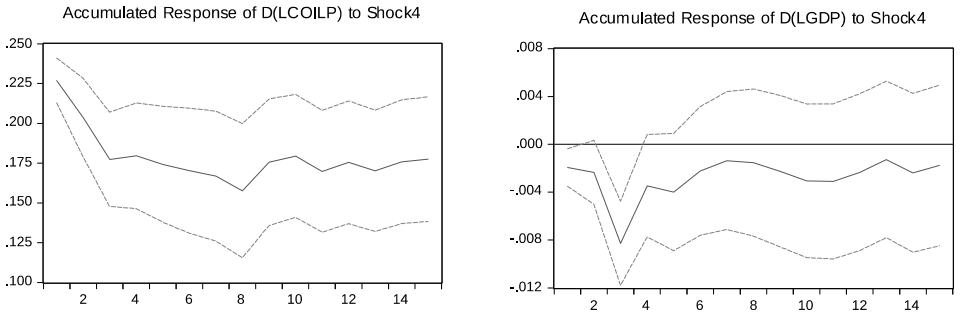
Note: *** significance at 1% level.

The results of the SVAR estimation show that LCOILP positively affects LCOILP, LINV. However, investment coefficient is insignificant. Also, the results show negative relationship with LGDP and INFL which is in line with the expected results. Therefore, in order to comprehensively estimate the effect of the oil price shock. I will construct an impulse response function in order to see the dynamics of the effect of the oil price shock on other variables.

Figure 6 shows that oil price growth tends to fluctuate in the first 10 periods (years) which may account for the change in the demand and supply of oil in the country. However, in 10 years, the price is stabilising. The positive effect of the oil

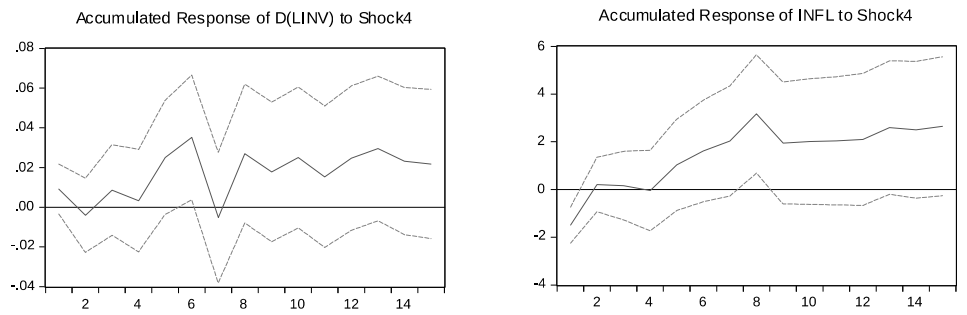
price increase can be observed in the impulse response of LGDP which is moving in the same direction together with the oil price growth. The peak of the decline in the LCOILP growth rates in the 3d period is associated with a drop in LCOILP, which is in line with the supply side effect (Brown and Yucel, 2002b) where the cost of oil dependent industries production increases significantly. This leads to the necessity to decrease them, which can be achieved through lower amount of employees. As a result, there is observed higher unemployment and lower GDPG. However, with time, as workers are able to find new jobs, the situation is stabilising and GDPG starts to grow. Therefore, LCOILP and LGDP show high interrelationships.

Figure 6. Impulse Response of LCOILP and LGDP to Oil Price Shock



The negative effect is shown in terms of LINV, where an increase of oil prices in the first period leads to the decrease in LINV in the second one and to the increase in LFDI at that period (Figure 7). INFL is constantly increasing as it has been predicted, however at the lower growth rate with time. Research by Aanye (2012) has also shown that INFL has a positive response to the oil price increase, which is diminishing in 4 years. The author has also assumed that such a response to the change in INFL may be contributed to the decrease in the consumption due to the uncertainty effect described by Kilian (2009b).

Figure 7. Impulse Response of LINV and INFL to Oil Price Shock



Similar research of Tang et al (2009) have analysed the inflationary transmission channel effect of oil price shock in case of China and have come to the conclusion that an increase in oil price negatively affects investment and positively interest rate and inflation. Also they have concluded that it takes much longer for the supply side (direct output) channel to recover compared to the effect of interest rate and investment.

Figure 8. Variance Decomposition

Variance Decomposition of D(LGDP):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.018019	90.59722	8.004377	0.234131	1.164270
2	0.019206	86.97156	9.516478	2.440958	1.071002
5	0.021851	67.40717	16.63107	2.945721	13.01604
10	0.022643	65.71734	17.37313	3.795322	13.11420
15	0.022782	65.02586	17.59172	3.779334	13.60308
Variance Decomposition of D(LINV):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.144332	0.000000	96.84757	2.754082	0.398345
2	0.149431	3.639592	90.51450	4.690512	1.155396
5	0.154056	4.235527	85.70636	6.176979	3.881132
10	0.168144	5.305157	75.42134	5.697794	13.57571
15	0.170161	5.468733	74.35549	6.054342	14.12143
Variance Decomposition of INFL:					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	8.716207	0.000000	0.000000	97.05794	2.942063
2	8.916835	0.100686	0.114529	93.33200	6.452786
5	9.097649	1.075553	0.744611	90.54170	7.638140
10	9.707080	6.737115	2.377684	80.68492	10.20028
15	9.786532	7.082725	2.964167	79.62020	10.33291
Variance Decomposition of D(LCOILP):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.226922	0.000000	0.000000	0.000000	100.0000
2	0.231330	2.133259	0.267352	0.354501	97.24489
5	0.243610	7.196627	1.083374	2.821124	88.89888
10	0.245934	7.358334	1.189522	3.485439	87.96670
15	0.246815	7.441554	1.384974	3.519466	87.65401

Variance decomposition, which assesses the portion of the variation of each variable in the composition of one of the variables, shows that oil price shock explains part of the variation of each of the variables apart from the variables' shock on itself (Figure 8). Therefore, the chain of causation can be built based on the results obtained: variance decomposition of INFL shows that 6.4% of the variation in the INFL is explained by the LCOILP in 2 years after the oil price shock

and by 7.6% in 5 years. Therefore, the next endogenous variable of the inflationary transmission mechanism to be discussed is LINV where 3.8% of the variation is explained by LCOILP shocks in 5th period. LGDP's variation is explained by 9.5% in 2 years and 17% in 10 years by the change in LINV and 13% in LCOILP in 5 years. Therefore, this leads to the conclusion that LCOILP has an impact on LGDP through inflationary transmission mechanism channel.

4.2. Direct Output Transmission Channel SVAR Model Estimations

The next channel to be discussed is the direct effect of the oil price shock on the output. Therefore, GDPG, Rent, LOILP, LEXPORT and Trade will be estimated. Due to the lack of data, only 23 countries will be taken into this sample (Figure 9).

Figure 9. List of Countries

Countries		
Algeria	Colombia	Oman
Angola	Congo	Russian Federation
Australia	Ecuador	Saudi Arabia
Bahrain	Egypt	United Kingdom
Brazil	Kazahstan	United States
Brunei	Malaysia	Venezuela
Canada	Mexico	Trinidad and Tobago
China	Norway	

The internet appendix show the results of the individual ADF (Dickey and Fuller, 1979) unit root test along with the panel common unit root by Levin, Lin & Chu (Levin, Lin and Chu, 2002) and individual Im, Pearsan and Shin (Im, Pearsam and Shin, 2003), ADF, PP (Phillips and Perron, 1988) unit root tests which suggest that LEXPORT and LOILP are stationary at first differences. Also, four lags of the VAR model have chosen according to Schwarz and Hannan-Quinn information criterions.

Estimated VAR is stable as there are no unit roots lying outside the unit circle. There is no serial correlation at the fourth lag order; however, as in the first model, I do face the problems of heteroscedasticity and normality.

Based on VAR model I have constructed the following SVAR matrix:

$$\tilde{Y}_t = \begin{bmatrix} \theta_{111} * GDPG & \theta_{112} * TRADE & \theta_{113} * LEXPORT & \theta_{114} * RENT & \theta_{115} * LCOILP \\ \theta_{221} * GDPG & \theta_{212} * TRADE & \theta_{223} * LEXPORT & \theta_{224} * RENT & \theta_{225} * LCOILP \\ \theta_{331} * GDPG & \theta_{312} * TRADE & \theta_{333} * LEXPORT & \theta_{334} * RENT & \theta_{335} * LCOILP \\ \theta_{441} * GDPG & \theta_{412} * TRADE & \theta_{443} * LEXPORT & \theta_{444} * RENT & \theta_{445} * LCOILP \\ \theta_{551} * GDPG & \theta_{512} * TRADE & \theta_{553} * LEXPORT & \theta_{554} * RENT & \theta_{555} * LCOILP \end{bmatrix}$$

Figure 11. Unit Root Test

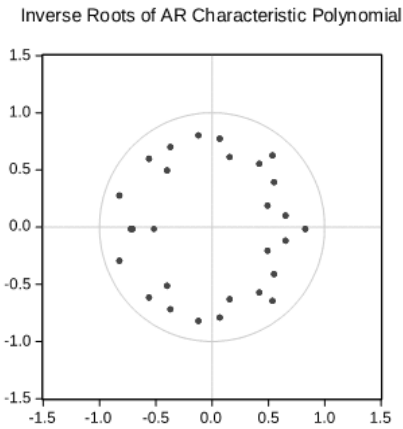


Figure 10. Serial Correlation LM Test

VAR Residual Serial Correlation LM Test
Null Hypothesis: no serial correlation at l
Date: 03/10/16 Time: 19:12
Sample: 1990 2012
Included observations: 479

Lags	LM-Stat	Prob
1	117.8094	0.0000
2	79.89423	0.0000
3	51.77513	0.0013
4	31.05684	0.1871
5	39.52445	0.0326
6	43.96409	0.0109
7	25.05903	0.4591
8	54.65375	0.0005

Probs from chi-square with 25 df.

Where unit matrix is A with $5(5+1)/2=15$ imposed restriction. Therefore I, have to put $5^2 - 15 = 10$ additional retrictions based on the economic theory and the period of the occurrence of the variable as there may be $2^5 = 32$ possible orders of endogenous variables.

Therefore, as in the first SVAR model, I will restrict $\theta_{551} = \theta_{552} = \theta_{553} = \theta_{554} = 0$ as none of the endogenous variables can affect oil prices in the short run. Later, I will restrict $\theta_{332} = \theta_{442} = 0$ because I assume that general changes in the volume or values of export and import do not mean that exactly oil-related part of export will be affected, consequently having an effect on oil rent and export of oil immediately. I assume that Trade has an impact on oil-related variables only in the long run. The next restriction will be put on the effect of LEXPORT on Rent as the change in the amount of barrels sold does not mean the change in the oil rent as it can be compensated with the higher price of oil, especially in the short run. Therefore, $\theta_{443} = 0$. The last three restrictions ($\theta_{221} = \theta_{331} = \theta_{441} = 0$) will be put on the interrelationships of GDPG on Rent, LEXPORT and Trade as any shock which may affect GDP growth will not have an immediate effect on oil export and oil rent respectively because these variables will be affected through the chain of effects caused by the shock on GDP. Also, Granger causality test (Figure 12) confirms that LCOILP Granger cause Trade, and Rent is Granger caused by LEXPORT and LCOILP. GDPG Granger cause LCOILP was not estimated due to the fact of that this relationship exists only in the long run. However, there are some significant relations which were restricted to be zero due to the fact that their effect appears in the long run.

Figure 12. Granger Causality Test Summary

Therefore, having derived restriction B matrix will have the following form:

$$B_0 = \begin{bmatrix} NA & NA & NA & NA & NA \\ 0 & NA & NA & NA & NA \\ 0 & 0 & NA & NA & NA \\ 0 & 0 & 0 & NA & NA \\ 0 & 0 & 0 & 0 & NA \end{bmatrix}$$

The results of the estimation are the following:

$B_0 =$

	GDPG	D(TRADE)	D(LEXPORT)	D(RENT)	D(LCOILP)
GDPG	3.804909***	-0.149989	0.296383*	0.528601***	-0.599637***
D(TRADE)	0.000000	9.873452***	0.130548	4.624863***	0.503577
D(LEXPORT)	0.000000	0.000000	0.181739***	-0.000422	0.004598
D(RENT)	0.000000	0.000000	0.000000	4.277978***	-0.726406***
D(LCOILP)	0.000000	0.000000	0.000000	0.000000	0.445324***

Note: *** significance at 1% level.

The results of the estimation show that despite the expectations of the positive effects of LCOILP on GDPG and Rent, there are actually negative one. Therefore, it is important to analyse the impulse response function.

Impulse response function (Figure 13) shows the pattern of constant increase in oil price fluctuation throughout time. Therefore, as oil rent is highly dependent on the oil price, it tends to move in the same direction together with the increase in trade; however, trade's growth rate is slower due to the fact that it does also include export and import of other goods and services.

Also, GDP growth shows negative growth in the first period, which is in line with the supply side effect (Brown and Yucel, 2002b) discussed in the inflationary transmission mechanism channel, where higher unemployment causes GDPG to decrease from the micro perspective of oil-intensive industries. Therefore, I may assume that the first response of the oil price increase will cause GDPG to decrease. However, with the time, as workers are able to find new jobs, the situation stabilises and GDPG starts to grow in the second period; additionally,

higher oil price will accelerate economic growth Also, there is no effect of the oil price change on export of oil as it is complicated to switch to less oil-intensive industries or production and decrease the supply of oil in the short run.

Figure 13. Impulse Response of LCOILP, Rent and Trade to Oil Price Shock

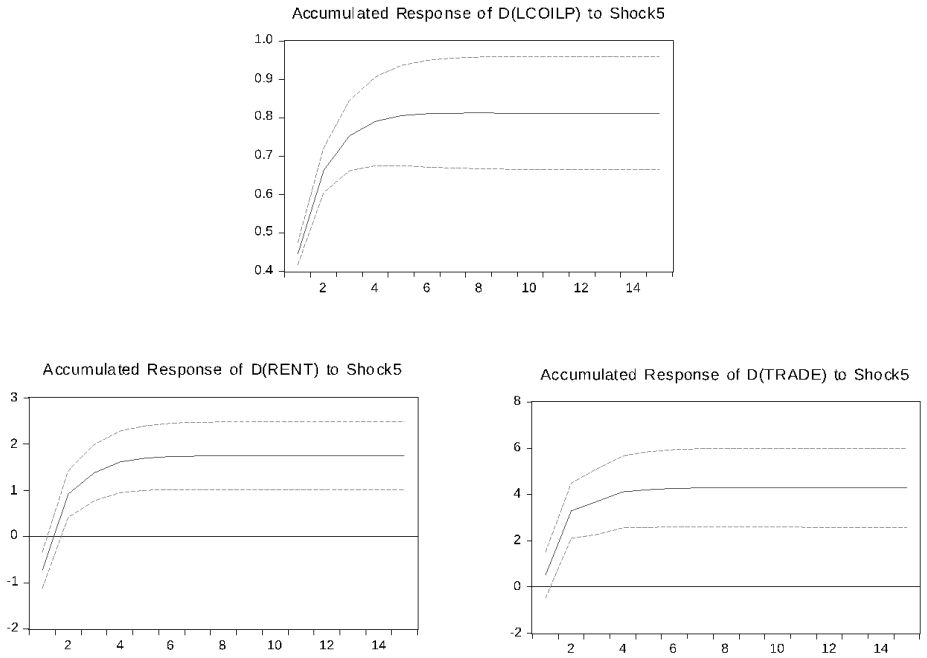
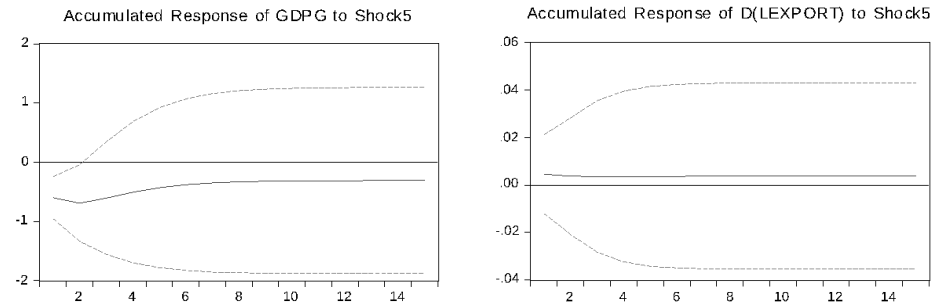


Figure 14. Impulse Response of GDPG and LEXPORT to Oil Price Shock



Variance decomposition (Figure 15) of the oil price shock (Shock 5) shows that in 5 periods, 15.5% of the variation in Rent is explained by oil prices. Therefore, 17% of the change in Rent explains the change in Trade conjointly with 6% of the change in oil prices. Therefore, these overall effect leads to the explanation of 2% of the variation of GDPG due to the the change in Rent and LCOILP,

which confirms that there is a positive relationship between the oil price shock and GDPG growth rates through the direct output channel. However, oil export does not depend on the oil price due to the fact that there still exist oil-intensive commodities which cannot be replaced and the need to use and consequently export oil cannot vary much because of oil price fluctuation.

Figure 15. Variance Decomposition

Variance Decomposition of GDPG:						
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	3.902135	95.07887	0.147746	0.576904	1.835063	2.361419
2	4.450735	95.07699	0.114880	0.974054	1.976028	1.858046
5	4.651438	94.94358	0.109736	1.187903	1.951596	1.807185
10	4.655635	94.92332	0.109591	1.194708	1.950025	1.822351
15	4.655639	94.92327	0.109591	1.194717	1.950022	1.822403
Variance Decomposition of D(TRADE):						
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	10.91536	0.000000	81.82049	0.014304	17.95237	0.212841
2	11.79484	0.009781	76.47387	0.015942	17.73009	5.770314
5	11.86177	0.091998	76.24694	0.030711	17.67950	5.950845
10	11.86241	0.098908	76.23918	0.030773	17.67833	5.952814
15	11.86241	0.098926	76.23916	0.030774	17.67833	5.952814
Variance Decomposition of D(LEXPORT):						
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	0.181797	0.000000	0.000000	99.93548	0.000538	0.063979
2	0.183321	0.037746	0.018188	99.87340	0.005573	0.065090
5	0.183374	0.065073	0.018889	99.84499	0.005918	0.065133
10	0.183375	0.065758	0.018889	99.84426	0.005932	0.065160
15	0.183375	0.065758	0.018889	99.84426	0.005932	0.065161
Variance Decomposition of D(RENT):						
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	4.339212	0.000000	0.000000	0.000000	97.19755	2.802445
2	4.709404	0.072687	0.267780	0.255473	84.78954	14.61452
5	4.749339	0.437295	0.311629	0.271602	83.39201	15.58746
10	4.750187	0.465758	0.311544	0.271816	83.36344	15.58745
15	4.750189	0.465823	0.311544	0.271819	83.36338	15.58744
Variance Decomposition of D(LCOILP):						
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Shock5
1	0.445324	0.000000	0.000000	0.000000	0.000000	100.0000
2	0.499543	0.893166	0.005036	0.193265	0.474993	98.43354
5	0.513252	2.273023	0.006377	0.208283	0.569717	96.94260
10	0.513532	2.364023	0.006396	0.209347	0.572143	96.84809
15	0.513532	2.364210	0.006396	0.209357	0.572145	96.84789

4.3. Fiscal Policy Transmission Channel SVAR Model Estimations

The third channel to be discussed is the effect of the fiscal policy on the output. Therefore, LGDP, LEXPEND, Polity, LOILP and Trade (exogenous variable) will be estimated. The internet appendix show the results of the individual ADF (Dickey

and Fuller, 1979) unit root test along with the panel common unit root by Levin, Lin & Chu (Levin, Lin and Chu, 2002) and individual Im, Pearsan and Shin (Im, Pearsam and Shin, 2003), ADF, PP (Phillips and Perron, 1988) unit root tests which suggest that LGDP, LEXPEND and LOILP are stationary at first differences. Also, five lags of the VAR model have been chosen according to Schwarz and Hannan-Quinn information criterion.

Estimated VAR is stable as all roots are lying inside the unit root circle and the model does not have autocorrelation in the first lag order (Figures 16 and 17). Heteroscedasticity and normality problems are also present in this VAR.

Figure 16. Unit Root Test

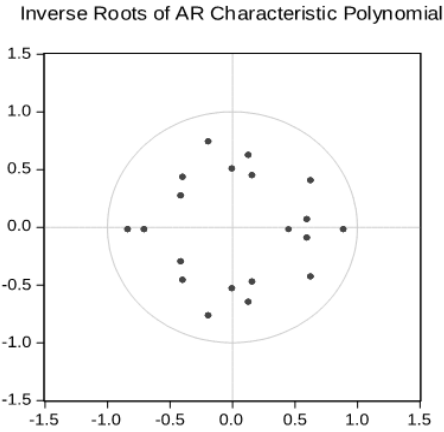


Figure 17. Serial Correlation LM Test

VAR Residual Serial Correlation LM Test
Null Hypothesis: no serial correlation at l
Date: 03/10/16 Time: 19:26
Sample: 1990 2012
Included observations: 680

Lags	LM-Stat	Prob
1	25.95353	0.0547
2	57.60236	0.0000
3	38.62246	0.0012
4	52.38499	0.0000
5	30.04756	0.0178
6	13.87060	0.6084
7	30.83663	0.0141
8	27.27769	0.0385

Probs from chi-square with 16 df.

Therefore, putting SVAR into the following matrix:

$$\tilde{Y}_t = \begin{bmatrix} \theta_{111} * LGDP & \theta_{112} * LEXPEND & \theta_{113} * POLITY & \theta_{114} * LCOILP \\ \theta_{211} * LGDP & \theta_{212} * LEXPEND & \theta_{213} * POLITY & \theta_{214} * LCOILP \\ \theta_{311} * LGDP & \theta_{312} * LEXPEND & \theta_{313} * POLITY & \theta_{314} * LCOILP \\ \theta_{411} * LGDP & \theta_{412} * LEXPEND & \theta_{413} * POLITY & \theta_{114} * LCOILP \end{bmatrix}$$

$4(4+1)/2=10$ restrictions are already imposed on matrix A and $4^2 - 10 = 6$ additional retrictions based on the economic theory and the period of the occurrence of the variable as there may be $2^4 = 16$ possible order of endogeneous variables.

Therefore, as in the first SVAR model, I will restrict $\theta_{441} = \theta_{442} = \theta_{443} = 0$ as oil prices cannot be affected by any endogenous variable in the short run. Also, I will restrict $\theta_{331} = \theta_{332} = \theta_{334} = 0$ as polity is the variable which can be treated partially as exogenous and it does not influence any of the variables, only predetermining the force of the effect of the interrelationships between variables. The last restriction will be put on $\theta_{221} = 0$ as LGDP does not affect LEXPEND in the short run. Also, Granger causality test (Figure 18) confirms the same

relationships to be estimated where LCOILP Granger cause LGDP, LEXPEND; LEXPEND Granger cause LGDP. However, the Granger causality of LCOILP, LEXPEND on Polity and Polity on LGDP on Polity have been restricted to be zero due to the fact that their effect is appearing in the long run.

Figure 18. Granger Causality Summary

LEXPEND → LGDP	LEXPEND → POLITY
LCOILP → LGDP	LCOILP → POLITY
LGDP → LEXPEND	LGDP → LCOILP
POLITY → LEXPEND	POLITY → LCOILP
LCOILP → LEXPEND	

Putting restriction into the following matrix:

$$B_0 = \begin{bmatrix} NA & NA & NA & NA \\ 0 & NA & NA & NA \\ 0 & 0 & NA & 0 \\ 0 & 0 & 0 & NA \end{bmatrix}$$

I have obtained the following results:

$$B_0 = \begin{array}{c} \\ \text{D(LGDP)} \\ \text{D(LEXPEND)} \\ \text{POLITY} \\ \text{D(LCOILP)} \end{array} \begin{bmatrix} \text{D(LGDP)} & \text{D(LEXPEND)} & \text{POLITY} & \text{D(LCOILP)} \\ 0.054273*** & 0.008673*** & 0.001764 & -0.006068*** \\ 0.000000 & 0.189891*** & 0.006506 & -0.005893 \\ 0.000000 & 0.000000 & 9.496244*** & 0.000000 \\ 0.000000 & 0.000000 & 0.000000 & 0.529914*** \end{bmatrix}$$

Note: *** significance at 1% level.

In terms of this transmission channel, I will be analysing two shocks: oil price shock and polity shock in order to observe fiscal variable response to the fluctuation in the oil price and development of qualities of institutions (polity shock).

Therefore, impulse response to oil price shock (Figure 19) bears the same negative effect on the LGDP as in the direct output channel discussed previously. Lower LGDP immediately depicts lower LEXPEND as it is part of the GDP composition. However, in 3 years after higher oil prices, there is an increase in the LGDP and LEXPEND.

Figure 20 analyses the effect of the polity shock on estimated variables. Therefore, positive polity shock brings constant further increase in the quality of institutions variable. Oil price response shows high volatility of oil prices;

Figure 19. Impulse Response of LCOILP, LGDP and LEXPEND to Oil Price Shock

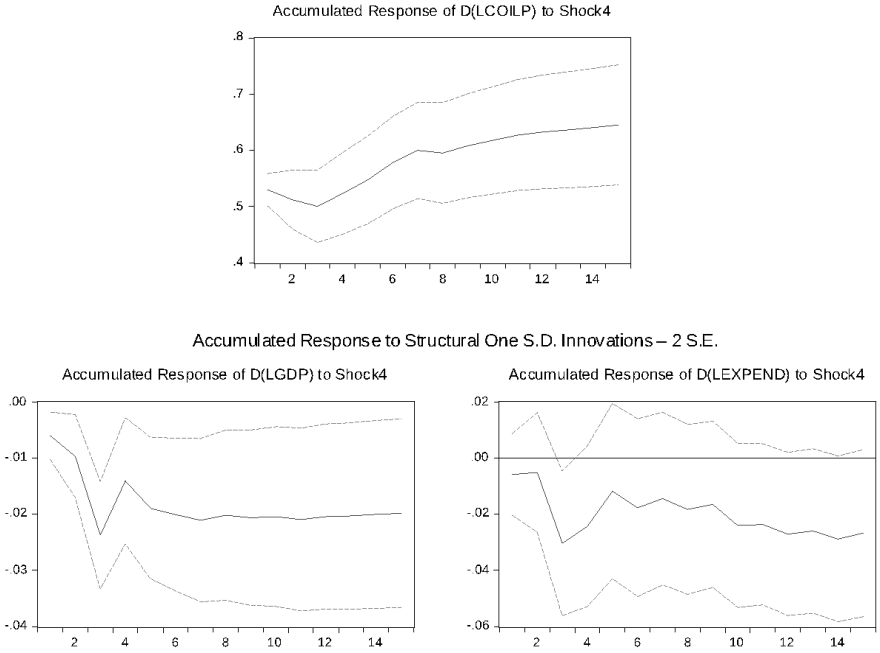
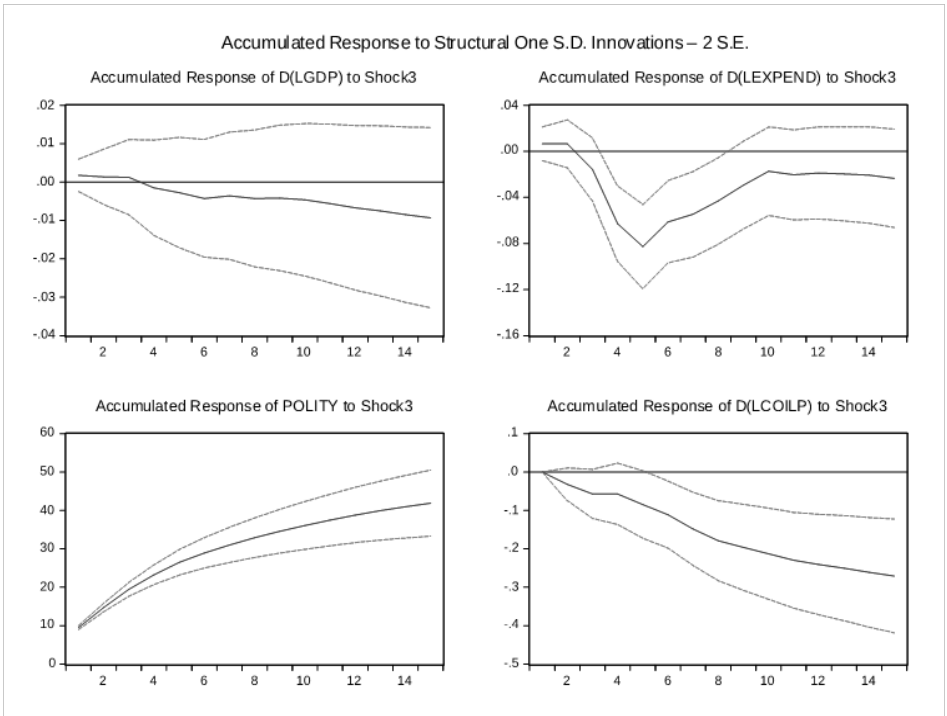


Figure 20. Impulse Response of LGDP, LEXPEND, Polity and LCOILP to Polity Shock



however, I do believe that polity is not the major factor affecting this volatility. With respect to the governmental expenditures, there is a significant decrease in the governmental expenditures. The reason may be that the country decides to either save revenue in funds or use them to repay the debt but definitely to decrease consumption. The peak of the reduction in governmental expenditures appears in 5 years after the quality of institutions have started to improve. GDP growth shows negative growth rates which may account for the fact that Table 2 shows that the mean value for Polity is (-0.23), which accounts for rather autocratic regimes in majority of countries. Therefore, an increase in polity may not dramatically improve the quality of institutions in the country leading to higher corruption associated with high oil windfalls.

Figure 21. Variance Decomposition

Variance Decomposition of D(LGDP):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.055324	96.23770	2.457472	0.101723	1.203105
2	0.058831	95.06631	3.396463	0.095194	1.442035
5	0.062371	87.15502	3.170812	0.320020	9.354146
10	0.062677	86.85875	3.389221	0.405406	9.346622
15	0.062722	86.74111	3.391357	0.516934	9.350601
Variance Decomposition of D(LEXPEND):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.190094	0.000000	99.78676	0.117140	0.096098
2	0.191907	1.761241	98.02808	0.114945	0.095738
5	0.203549	1.881564	88.44348	7.590639	2.084321
10	0.214405	2.664051	86.22866	8.965127	2.142164
15	0.215260	2.717277	86.16119	8.941328	2.180204
Variance Decomposition of POLITY:					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	9.496244	0.000000	0.000000	100.0000	0.000000
2	10.86679	0.160931	0.121653	99.64676	0.070659
5	13.22085	0.262685	0.951304	94.21632	4.569692
10	14.10329	0.627937	1.161386	92.34280	5.867875
15	14.39677	0.713734	1.150722	91.97337	6.162178
Variance Decomposition of D(LCOILP):					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
1	0.529914	0.000000	0.000000	0.000000	100.0000
2	0.534931	1.036061	0.360008	0.359910	98.24402
5	0.543618	2.468528	1.157641	0.826334	95.54750
10	0.548822	2.490132	1.197421	1.996045	94.31640
15	0.549697	2.500782	1.201485	2.224558	94.07317

Variance decomposition (Figure 21) shows that oil price explains the fluctuation in the variance only in the oil price itself. There is a minor effect appearing

on the GDP growth side by explaining 4% of the variation in LGDP due to the oil price shock in 5 years. Also, 2% of the variation in the oil shock is responsible for the change in LEXPEND. In terms of the quality of institutions, 7% of the variation in LEXPEND is explained by the change in Polity. Therefore, quality of institutions can predetermine the pattern of the expenditures in the country; however, this effect is not the most important one.

5. Conclusion

Oil price shocks have a dramatic impact on the gross domestic product growth rates both in the short and long run. This has been proved by the theoretical and empirical results. However, my research has been concerned with the consequences appearing in the short run, where I have defined three major channels to be discussed. The first one is the direct output transmission channel, where due to the fluctuation in the value of production and volume of export output can be changed. The next is inflationary transmission channel which was defined by Brown and Yucel (2002a), where increased cost of production causes increase in the inflation. Therefore, there has been observed an increase in interest rates, decreases in investment, foreign direct investment and decrease in GDP. The third is fiscal policy transmission channel which appears in the case of the oil-exporting countries whose main source of income is revenue coming from the oil export where through the decrease governmental expenditures GDP may decrease.

In all three mechanisms analysed, I have found that the growth rate of oil price due to the oil price shock tends to fluctuate in the first 5 years. Therefore, the same effect is observed in the behaviour of investment, which is volatile in the first 6 years after the shock in a like manner as oil prices. A high growth rate of inflation is observed in the first 5 years, but later it stabilises and the growth rate is kept at the approximately the same level.

Additionally, I have found that in the first three years after the oil price shock, there is a slight decrease in the growth rates due to the supply-side effect (Brown and Yucel, 2002a; Kilian, 2010), which works only in the short period of time as higher cost of production leads to higher unemployment and lower production in the country. Subsequently, oil shock negatively affects economy only in nominal terms as in 3 years the situation stabilises because of the constant positive growth rate of GDP due to the fact that workers have found new occupations. Oil rents and trade in the country have an extremely positive effect on the GDP growth as the response of the positive oil price shock of these variables is dramatic.

Therefore, a direct output transmission mechanism brings positive effect on GDP growth in a like manner, inflationary channel which was thought to bear a negative one. The effect of the fiscal policy transmission mechanism is ambiguous as due to the fluctuations in the oil price, the structure of the governmental expenditures may be changed dramatically. This, consequently, may bear striking changes in GDP growth.

Another finding is that due to changes in the oil price, governmental expenditures tend to fluctuate which shows the fragility of the relationships between the revenue coming from oil in highly oil-dependent countries and the volumes of the governmental final consumption expenditures which may affect GDP growth. Also, I have found that Polity, which is a proxy for the quality of institutions, may cause expenditures to decrease. Therefore, I cannot claim that any of my hypotheses was rejected or failed to be rejected.

The contribution of my research is the conjoint analysis of the possible consequences on the output growth coming from the change in inflation, investment, fiscal policy (governmental expenditures), the quality of institutions, oil rents and trade and their interrelationships due to the oil price shock as previous studies have been concentrating on the analysis of the smaller number of transmission channels.

After the simultaneous analysis of three transmission mechanisms, my overall conclusion is that inflationary channel which has been suggested to decrease GDP growth, negatively affect it only in the first four years. However, later, this negative effect is mitigated through the direct output and fiscal policy transmission channels due to the abundance in oil of analysed countries. Therefore, in the situation of the negative oil shock, my recommendations to the policy makers would be to target inflation rates as these are the trigger for the channel to negatively affect output growth. Also, in the case inflation rate is not possible to maintain, there should be a strong cooperation with the Central bank which should apply monetary policy tools in order to mitigate the possible increase in the interest rates and decrease in GDP through lower investment. All together, these actions will help to mitigate or eliminate the negative effect in the first four years.

This thesis can serve as a benchmark for the comparison and discussion of future studies applying Vector Error Correction, Bayesian VAR models or the same SVAR methodology. There is also a variety of channels and respectively variables to be included into the research in order to create the full picture of effects of vast number of transmission mechanisms of the oil price shocks. Also, the question of heteroscedasticity and normality of data is still not answered. However, maybe the longer sample of the national accounts will help to solve these issues.

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Political Business Cycles and Presidential Popularity: The United States Case

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Abstract

This paper attempts to establish a relationship between Political Business Cycles (PBCs) and presidential popularity using an empirical approach for the United States. Analyzing the U.S. case is interesting for this approach because of its majoritarily dual party context in presidential elections. The results obtained through the use of traditional OLS as well as ARDL models allow the visualization of conventional party behaviors which follow the expected intuition. The analysis focuses on the United States from Q1 1981 to Q3 2016.

Introduction

Political Business Cycle (PBC) theory makes a very clear case for the trade off that exists in the tight relationship between politics and economics. That is because while sound economic performance is most definitely a decisive factor for an incumbent's reelection the immediate needs of politics (reelections most precisely) tend to be more substantial than long run planning. This dichotomy exists because maximizing an incumbent's utility and maximizing social welfare are not necessarily done through the same economic policies. Political business cycle theory offers a different explanation to economic fluctuations when compared to traditional business cycle theory because it understands the politician's influence in policy making as crucial. This approach understands business cycle reoccurrences as a consequence of political issues instead of strictly economic mechanisms. Traditional approaches do not emphasize the impact of political aspects to the cycle's reoccurrence, with the neokeynesian treatment stressing market imperfections while the real business cycle approach focusing on technological shocks.

Although individual incumbent motivations may vary enormously the literature divides PBC theories into two groups. The first group is motivated by party

ideology while the second has ulterior motives, being driven by opportunism. PBC theory essentially opposes the view that incumbents main goal is to maximize social welfare.

The way expectations are formed is yet another difference between the theories. Earlier models assumed "simple minded" voters who only based their voting decisions on past experiences, thus having adaptive expectations. After the Lucas critique later models changed the way the voter was understood and incorporated rational expectations in the analysis.

The first article discussed is Nordhaus (1975)[8], in which the author lays the foundations for the PBC research agenda establishing an "Opportunistic Model with Adaptive Expectations" where politicians in power do not act in accordance with party ideology and manipulate the "policy menu" found on the Phillips Curve in an attempt to gain more votes and increase the chances of reelection. Following Nordhaus' seminal paper, Hibbs (1977) produces a "Partisan Model with adaptive expectations" as an answer to it, in which parties respect their ideology and have particular preferences in terms of the inflation – unemployment dichotomy when it comes to policy making. With the development of the Lucas Critique and the rational expectations theory follow Rogoff and Sibert (1988) with an "Opportunistic Model with rational expectations" where incumbents show their competency to the electorate by means of a "competency shock" as well as Alesina (1987) with a "Partisan Model with rational expectations" in which the author discusses the relationship between two parties with different inflation and unemployment targets in a repeated game.

The basic idea behind the Political Business Cycle is the notion that politicians in power have incentives to make use of expansionary monetary and / or fiscal policy in order to increase the chances of a reelection, thus making use of short run policies to create the illusion of economic growth. If such a strategy works the electorate would then be either tricked by political opportunism or be misinformed. What causes this illusion is a pre-election boom triggered by the described economic policies. The common voter[9] then enjoys the boom situation and rewards the politician with a vote, thus increasing the incumbent's reelection chances. Therefore, in this context good economic performance is rewarded while bad results attract punishment towards the chief of state. The unemployment rate, for example, may be used by the electorate to judge if the

[8] Among the authors who influenced Nordhaus in this area, the most clear to identify are Kalecki (1943) and Schumpeter (1945).

[9] Chappel and Keech (1988) make a distinction between naive and sophisticated voters, with the former being incapable of understanding the consequences of present economic policies in the future.

president is doing a good job, that is to say, the indicator acts as an informational shortcut to form an opinion on how the president is handling his job. Interestingly enough , the electorate tends to punish a high unemployment rate with lower approval ratings while a low unemployment rate is not necessarily rewarded. However, the way the "punishment" or "reward" mechanism works seems to be politically biased, although the results are varied: Hibbs (1977) shows how the unemployment rate tends to affect democrat voters the most when it comes to approval rating while republican voters are more concerned with stable inflation rates. Once again, in this analysis the reward or punishment mechanism is understood in terms of approval rates.

The models of Political Business cycles may be separated into four categories, thus establishing the type of policy used by politicians and the expectations of the voters. The policies may be of the opportunistic variety (in which the main incentive of the incumbent is the reelection itself, leaving little influence to the party's ideology to affect policy making) or of the partisan variety (in which the defining aspect of policy making is the ideology of the party). Expectations on the other hand may be adaptive or rational.

The early PBC models were influenced by Downs (1957) who emphasizes the "machiavellian" incentive of incumbents to stay in power, meaning the maximization of their own utility[10]. According to the author there is no reason to believe that politicians' main goal is to maximize social welfare. This is because defining social welfare is a difficult task in itself (as well as being dependent on each citizen's opinion and preferences) and even if a single definition was accepted the means to which it could be obtained would still be up to discussion. Finally considering the selfish incentive of incumbents there is no reason to believe that maximizing social welfare would be their priority.

Downs' main proposition is that the economic policies adopted by incumbents in a democratic system will favour the maintenance and perpetuation of their own mandates, without any alignment to a particular set of ideologies nor defending the interests of a particular group. In this sense politicians simply try to gather as many "consumers" as they can in terms of votes, as would happen in a regular market.

The main motivation of incumbents in this framework would be the attainment of selfish interests such as income and status with policy making simply being a way of obtaining these goals, in this manner *"parties formulate policies*

[10] Although overlooked by the literature, an early explanation of the consequences of politics in business cycles and its reoccurrence is found in Mises (1953).

in order to win elections, rather than win elections in order to formulate policies" (Downs 1957).

Downs understands that individuals vote for the incumbent that can potentially maximize their own utility. The way these expectations are formed is through past experiences and party behavior, where the individual compares propositions and actually implemented policies with their own preferences and needs. This understanding of voting behavior heavily influenced Nordhaus. Party ideology in this scenario works as a very straightforward way of directing one's vote to an incumbent without necessarily having a deep understanding of his or her propositions. In this sense voters may base their decision solely on party ideology which works as an informational shortcut, thus decreasing their information cost.

The goal of this paper is straightforward: given data restrictions the analysis will omit the Trump administration and investigate the period consisting of the years 1981–2016 (thus encompassing nine presidencies) in the U.S. through the lenses of PBC theory, hence assessing the occurrence of the cycle and evaluating whether presidential popularity has a significant influence on the occurrence of the cycle.

The hypotheses for this paper are the following. Fiscal instruments make it possible for incumbents to manipulate the electorate, therefore party behavior is expected to utilize such instruments for their own benefit (i.e. increase presidential popularity and run for reelection). In this manner party behaviour should therefore be clearly partisan or opportunistic. However, given the incentives of the democratic voting system basic intuition would suggest that opportunistic cycles would dominate over its partisan counterpart. Presidential popularity is expected to play a definitive role in the course of the cycle.

The methodology of this project consists of a theoretical discussion of the literature and components of Political Business Cycles as well as Vote and Popularity Functions followed an empirical exercise which attempts to assess the veracity of such theories.

Section 2 presents and discusses an overview of Political Business Cycle Theories including both adaptive and rational expectations model variants, Section 3 focuses on presidential popularity and its literature, Section 4 introduces an empirical analysis to test the PBC and presidential popularity relationship, Section 5 displays the regression results and Section 6 ends this paper with concluding remarks.

1. Political Business Cycle Models

1.1 Opportunistic Models with Adaptive Expectations

Nordhaus' model is heavily influenced by Downs in its opportunistic understanding of incumbents' behaviour (Nordhaus, 1975). The model proposes that an expansionary monetary policy will be used in the pre election phase in order to boost output and reduce unemployment. After the election a contractionary monetary policy would ensue in order to mitigate the inflationary boom caused by the previous policies, which would again increase unemployment and decrease output, thus creating the political business cycle.

According to the model politicians take advantage of the "policy menu" found on the Phillips Curve by boosting demand before election periods thus bidding up inflation rates and lowering unemployment levels. The cycle is established for after a successful reelection the incumbent will try to reverse the effects of the policy used previously. Finally these models take the voter for an individual who makes systematic errors period after period. Expectations are therefore adaptive.

According to the author the distinction between parties is given by their preferences in the inflation – unemployment trade off. Voters are guided by past policies and have "decreasing" memory in the sense that the most recent policies have a higher impact on the final vote decision. Not considering party ideology the voter then compares the economic conditions with his expectations and decides whether or not to punish the incumbent in terms of voting. Ideology would not play a role in the model since parties put more weight in reelecting themselves than in maintaining a coherent ideology throughout a mandate. In this framework therefore parties make policies to win elections: the maintenance of power is the key element.

The mechanism is graphically shown in Figure 1: The unemployment level is declining throughout the mandate until the reelection occurs. After winning the election the unemployment level then increases in order to contain inflation and inflationary expectation formation. As long as the marginal disutility of unemployment is higher than the marginal disutility of inflation a reelection is possible even with high inflation levels preceding the election.

The two main conclusions the model proposes are first, that policy making biased towards reelection ("partisan policy making") brings about lower unemployment and higher inflation than is optimal and second, that "optimal partisan policy" naturally leads to the reoccurrence of PBCs, with inflation control and high unemployment levels in the first years of the mandate and high inflation towards the election period.

Figure 1. Nordhaus's mechanism: Graphical Exposure

Source: Adapted from Nordhous (1975)

Nordhaus suggests the following alternatives to mitigate the reoccurrence of the cycle:

1-To have easier access to information as to allow voters to assess and penalize incumbents leading them to understand long run tradeoffs, which should eliminate short run cycles of political nature .

2-Designating economic policy making to individuals with no political affiliations in a similar manner that is done with monetary policy and central banking.

3-Eliminating short run tradeoffs by implementing effective policies thus nullifying politicians from taking advantage in decision and policy making. This is the analogy made by Nordhaus in "there is little doubt that if we could cure the disease, its symptoms would disappear" (Nordhous, 1975). An improbable solution given that there will always be tradeoffs considering the natural scarcity of resources.

4-Lastly it is possible to increase the participation base in policy making. This forces the government to negotiate with the opposition and other groups of interest as is done to a certain extent in the Legislative and Executive powers.

It is important to underline the relevance of strong institutions in order mitigate the reoccurrence of the PBC and punish parties using policy making seeking reelection. Limitation of discretionary power in electoral years and fiscal responsibility laws certainly play a role in mollifying the PBC.

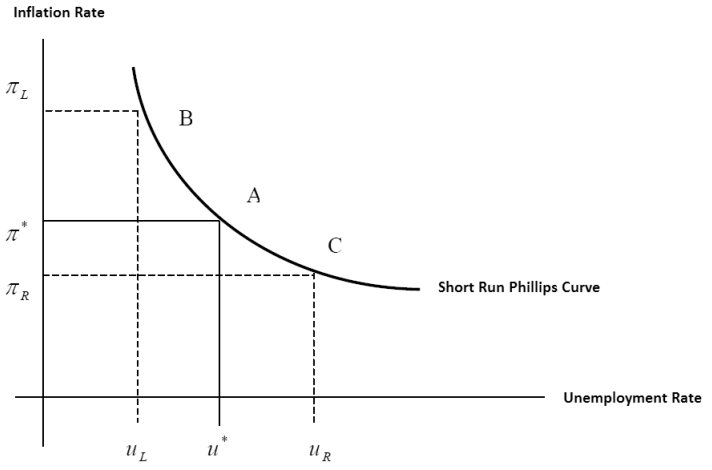
1.2. Partisan Models with Adaptive Expectations

Partisan models assume that party ideology does have an important role in policy making. After all a political party is composed of individuals who in principle share a particular set of ideas and values, it would therefore make sense that these characteristics do have practical implications rather than only having an idealistic meaning.

Hibbs (1977) sees the political business cycle as a natural consequence of party differences in policy making. As these parties alternate each other in power a different and opposing goal starts being pursued thus creating the reoccurrence of the cycle. Hibbs just as Nordhaus focuses on the Phillips Curve trade-off however, according to the author there are ideological reasons which explain preferences for parties on the right and left of the political spectrum for different inflation and unemployment combinations.

Parties on the left, often associated with low income groups, would have a preference for low unemployment and high inflation, while parties on the right, loosely identified with high income groups, would have the opposite preference: low inflation with higher unemployment. This is explained by low income groups often not having jobs while high income groups often have stable jobs and are more concerned with their purchasing power.

Figure 2. The Short Run Phillips Curve



Source: Adapted from Nordhous (1975)

Below is a graphical representation of the mechanism. The initial situation is found at point u^* with full employment. In case the right wing oriented party wins the election the inflation goal will be different, with its reduction being

a priority. This goal is obtained through contractionary economic policies, leading to point *C* with lower inflation level and higher unemployment. On the other hand if a left wing oriented party is successful at the elections the opposite process will ensue for the priority now is to reduce unemployment by means of expansionary economic policy, which leads to *B* with higher inflation level and lower unemployment.

Hibbs' empirical testing for the United States and Great Britain came to the conclusion that indeed right wing parties tend to put more emphasis on inflation control while the priority of left wing parties is to reduce unemployment. Additionally given the nature of the cycle, the more rotation there is in power between the two opposing political positions the larger will be the strength of the cycle and the fluctuations. The conclusion is that there is a cost associated with changing from one political spectrum to another which expresses itself in the reoccurrence of the cycle and instability.

1.3. Rational Expectations Models

The innovation brought by the Lucas Critique (1976) also influenced PBC theory, naturally. Individuals under the new framework are not limited to past experiences when it comes to forming their expectations in a voting scenario, instead they use all available information in the process, which happens to include the present economic policies. Policymaking now is limited for its effectiveness is dependent on surprising the population. The voter then is able to punish incumbents instead of rewarding those who take advantage of the cycle for he now is capable of understanding the deceptive opportunistic / partisan mechanism and the recession that follows the election period.

1.3.1. Opportunistic Models with rational expectations

Under this framework expectations are not based on past experiences, they are formed in accordance to future expectations which are then used in the decision making process, in other words the possibility of the electorate reacting to biased policy making is taken into account.

During the 1980s several authors attempted to adapt the traditional models of PBC with the rational expectations hypothesis. The opportunistic models with rational expectations attribute the existence of the cycles to the fact that there is asymmetry of information between voters and politicians with regards to

their competency. Since competence is private information, only the politician himself knows his potential. Voters observe the results of macroeconomic variables to assess the ruler's competence. In an attempt to exploit the information asymmetry politicians tend to act opportunistically to appear as competent as possible in each election, thus creating the political-economic cycles proposed by Nordhaus. The authors present different approaches to how rulers use macroeconomic instruments to demonstrate their competence to voters.

Persson and Tabellini (1990) suggest that the existence of political-economic cycles constitutes an adverse selection problem. Because of the information asymmetry between politicians and voters, the incumbent in power will seek the best macroeconomic results possible to signal their competence to voters, creating economic cycles.

This model was developed in a Keynesian framework, in which prices are sticky, thus allowing the existence of a short-term trade-off between inflation and unemployment. The ruler tries to show himself competent to reduce unemployment beyond its natural rate without raising the price level through monetary policy, directly controlled by policymakers. However, only the genuinely competent incumbents will succeed.

The PBC will be generated precisely because of this asymmetry of information. The rulers will try to appear competent, stimulating economic activity through monetary policy, near the elections. The genuinely competent incumbents will be able to raise the growth rate of the product beyond its natural level, but the incompetent will not. Since voters do not have information as to what type of politician is in power, they form their inflation expectations from the average of the competent (high) and the incompetent (low) inflation weighted by the probability of both occurring. Consequently, inflation in the election year will be above the expectations of voters if the politician is competent and below expectations if the incumbent is incompetent.

In Rogoff (1990) the existence of the PBC is due to information asymmetry between politicians and voters. It is necessary for the incumbent to signal its competence level by providing the largest level of public goods possible , in an attempt to raise voter's utility levels. Since voters are ignorant with regards to the incumbent's competence level, their opinion is built through said competence shock.

Individuals receive y units of goods which are financed by lump-sum taxation administrated by the current government. The main issue of this proposition is that only competent incumbents are capable of providing the same level of y goods with a smaller amount of taxation. Voters therefore use this mechanism as an indicator of the incumbent's competency and base their voting decision on it.

The shock works as follows: all individuals receive *y* units of goods at the beginning of each period which are consumed privately or used as inputs in the process of production of public goods. The production of public goods depends on the competence level of the incumbent. In this framework competence is directly linked to efficiency: more public goods are produced with lower taxation levels. In this sense it is possible to interpret "competency as administrative IQ" (Rogoff 1990).

It is important to stress the existence of a time difference when it comes to the production of goods, both consumption and public investment. The latter needs investment in the previous period in order for the government to supply public investment goods in the period *t*.

It is assumed that the incumbent's competency may change over time. A politician who becomes corrupted may very well devote fewer resources to public goods expenditure by diverting public money to his own interests. This resource diversion would be interpreted as lower competency in this framework. His skill could also increase during a fragile moment, for example, when it would be necessary to offer a similar amount of public goods with a lower budget and pressure might make him more skillful in the sense of suggesting more creative solutions to allocation problems.

Unfortunately a major consequence of this model is that only competent incumbents are able to generate the cycle, that is to say, it is precisely voting in the "best" candidate what triggers the reoccurrence of the budget cycle. This is because an incompetent incumbent is not capable of lowering taxes while increasing public spending , thus failing in concealing his true capacity from the electorate as well not getting reelected.

PBC models tend to assume that all macroeconomic policy making is controlled by only one governmental authority, which is not a very realistic assumption. Instead, monetary policy tends to be isolated from political influence by means of an independent central bank.

Based on this assumption Drazen (2000) proposes a model in which politicians formulate fiscal policy while an independent central bank minimizes the effect of political influence on monetary policy. However, although an incumbent cannot employ monetary policy to directly influence his reelection the central bank can still apply a monetary policy that better suits and accommodates the chosen fiscal policy.

The incumbent cannot influence macroeconomic aggregates before the election given that monetary policy is controlled by an independent central bank. This would be possible because of the presence of sticky prices and the consequence of monetary policy having real effects in the short run. Although

deprived of monetary policy he can still use fiscal policy to try to improve his reelection prospects: this could be achieved by pressuring the central bank to keep interest rates low so that it could contain the fiscal expansion. Although likely to work this strategy is extremely risky given the possibility of bad outcomes in the sphere of the institutional relationship between the incumbent and the central bank, which could bring future problems in the next mandate.

In conclusion, the model proposes that during an election year an incumbent will signal its type by utilizing expansionary fiscal policy. Assuming that the expansion had an effect on aggregate demand there will also be an effect on money demand, thus pushing interest rates up. The final effect in terms of the cycle will be money supply growth before the election period made possible by pressure put on the central bank as to refrain from increasing interest rates. Therefore, although there might be an expansion in the money supply during electoral years, the expansion is not a direct consequence of the incumbent's influence on monetary policy, but rather a result of the monetary authorities allowing interest rates accommodate the chosen fiscal policy. Monetary expansion and reelections therefore are correlated but there is not a casual relationship between the two variables.

1.4. Partisan Models with Rational Expectations

Taking rational expectations into account in the framework of partisan models means that economic policies will only have real effects on the economy if economic agents are caught by surprise, additionally the notion of parties pursuing different inflation and unemployment goals consistent with their agenda becomes problematic under the assumption of a stable short run Phillips curve.

Alesina (1987) discusses the relationship between two parties with different inflation and unemployment targets in a repeated game. Hibbs' approach is criticized for adopting adaptive expectations, which leads the electorate to being constantly fooled, and for ignoring the possibility of individuals in anticipating the government's behaviour.

The model assumes that the electorate fixes their nominal wages based on inflation expectations. The government then announces a low inflation policy. Considering that the electorate is rational, they fix their nominal wage as to eliminate any incentive for the government to increase inflation rates. Therefore the higher the degree of political turbulence, the higher the economic consequences will be. These fluctuations could be avoided in the long run if parties would come to an agreement on adopting common guidelines for policy making. The

author concludes that Republican administrations in the United States start with recessions while Democrat administrations have overall higher inflation rates.

One of the main aspects of Alesina's model is the uncertainty regarding the result of the election. Regardless of rational expectations voters are still surprised by the final outcome of an election and consequently the economic policies supported by the party. The model assumes that workers negotiate their respective wage levels with their employers in the previous year, taking into consideration the political scenario and consequently the probabilities of either the right or left winning, in periods preceding an election. That is, the model assumes that the electorate fixes their nominal wages based on inflation expectations.

Additionally, inflation expectations associated with each party are also acknowledged while discussing nominal wage levels: while not suffering from money illusion essentially all information available until the negotiation is used in the wage negotiation process.

The electorate thus fixes their nominal wages as to eliminate any incentive for the government to increase inflation rates.

What differentiates the left from the right party in the model is the variable prioritized in policy making and thus their own cost function. The priority of the right wing party would the maintenance of a stable inflation level, hence the preference for an inflation target of zero. On the other hand the most crucial variable for the left wing party is the output growth while respecting a particular inflation target c .

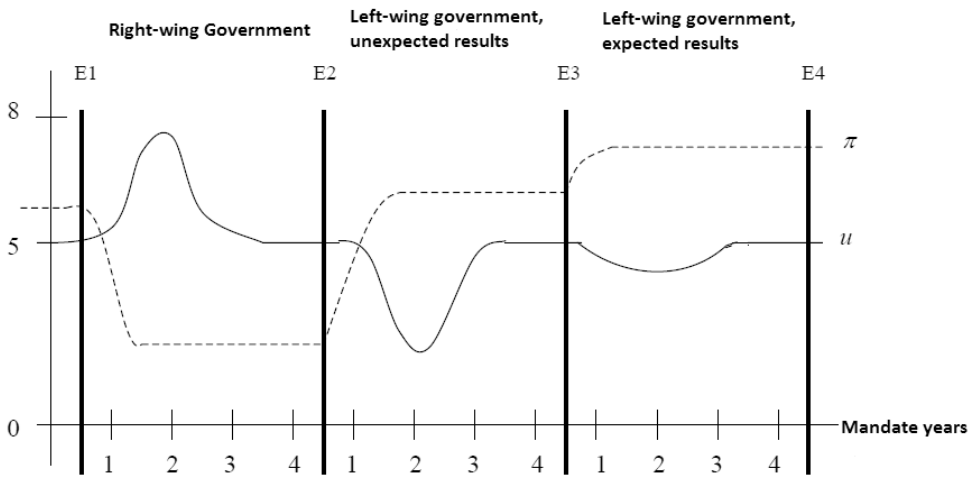
It is therefore possible to notice the importance of the inflation rate variable in the model. Alesina assumes that that the winning party is able to utilize its optimal inflation rate since the incumbent in this framework is capable of directly determining the policy instruments used. This way the party agenda, or ideology, is put into practice in terms of policy making.

Accordingly the growth rate of nominal wages given the negotiation process in periods before an election year will be determined by the inflation prospects associated with each party adjusted to their respective winning probabilities. Consequently the output variation in the model is given by how surprising an election result was to voters.

The mechanism is visually exposed in the graph below. The general assumption is that the right wing party will manage to win the election and stay in power for another mandate. This notion dictates the general inflation expectations for the next mandate, given the low inflation preferences of the party. Voters are then caught off guard when the left wing party wins the election, thus making it possible for the incumbent to put his partisan preferences into practice without having to deal with unpleasant consequences, this meaning: to expand

output and reduce the unemployment rate without causing the inflation rate to increase in the first mandate year. In the following year however the inflation rate increases as voters change their inflation expectations and consequently the unemployment level returns to its natural level. Finally, trying to repeat the same policy making strategy given the hypothetical situation that the left wing party stays in power in the next election round will result in different results when compared to the previous mandate. Higher inflation rates will ensue since the first year in power as well as a lower impact in the unemployment rate, assuming that their victory was expected by the electorate.

Figure 3. Alesina's mechanism: Graphical Exposure



Source: Adapted from Paldam (1996)

Therefore the higher the degree of political turbulence, the higher the economical consequences will be. Despite the unlikelihood of such proposition these fluctuations could be potentially avoided in the long run if parties would come to an agreement on adopting common guidelines for policy making.

1.5. A note on External Shocks in the Context of PBC Models

Rational voters do have the understanding that although an external shock may have consequences to the economy the incumbent party is not to blame. In addition to this there is the notion of "American individualism": insofar as Americans

have a tendency to take responsibility over their life as an individual and do not necessarily blame the government for misfortunes in their personal or professional lives.[15]

Non rational voters may be not be able to infer that the shock is indeed external and therefore is not the responsibility of the government therefore creating a negative opinion on it (in terms of voting or poll answering).

In this case rational voters would identify which party would be adequate to deal with the shock. A classic example would be a right-wing party for dealing with an inflationary shock and a left-wing party for dealing with a depression.

Whether opportunistic or partisan the cycle is very much summed by the fact that parties take advantage of a temporal trade off in terms of long run stability and short run political interests made possible by the very nature of the democratic regime: while the electorate vote with their own interests in mind (or their country's) politicians act in political terms, thus playing a game of power. This disparity of interests creates the framework for the existence of the PBC.

Finally as Nordhaus puts it :

"Whenever the electorate has an imperfect understanding of the nature of the trade-off, parties will be tempted to shift consumption from the future to the present as a way of increasing electoral support" Nordhous (1989).

2. Presidential Popularity

The popularity of a president is an extremely important variable which can make the mandate of any chief of state extremely difficult to handle. In administrative terms a low popularity rate can mean difficulties in passing legislation, for example (Choi *et al*. 2016).

Most data popularity data used on research comes from the Gallup Company[11]. Although the Gallup Company started collecting data about U.S. presidents' popularity in the late 1930s (Berlemann and Enkelmann 2012) such data was not used in the empirical research field until much later. In order to obtain the data survey participants in the Gallup poll are asked to answer the following question: "Do you approve or disapprove of the way [name of the president] is handling his job as president?". This particular question became standard from August 1937 onwards. The longevity of the time frame covered by the Gallup poll makes it the most used indicator used in presidential popularity research (Cohen 1999).

[11] www.gallup.com.

The research agenda on presidential popularity could be synthesized in the components of the Vote and Popularity function (VP functions), the idea behind this research programme being to find empirically what the determinants of presidential popularity are. The literature on the determinants of presidential popularity dates back to Mueller (1970) who presented the first contributions to popularity functions research as well as Goodhart and Bhansali (1970) presenting the first developments in the popularity function while Kramer (1971) put forth the first vote function.

Although there is much disagreement on the literature about which variables perform well in such regressions there are some issues which seem to be of less controversy. The variables that seem to directly influence and perform stably in terms of presidential popularity functions are the inflation and unemployment rates. When it comes to inflation it is generally accepted that low rates do not gather attention in terms of competency however when rates go over a certain threshold popularity tends to be affected negatively because the issue suddenly becomes an important point of discussion in national debates (Paldam 2008). This is summarized by the grievance asymmetry characteristic of voters, meaning that the reaction to a negative economic circumstance is much stronger compared to a positive one, leading to a natural cost of governance over time. The main results of the literature are presented in the table below.

Table 1. Main results in the VP Literature

Main Results Summary
The main dichotomy: Inflation and Unemployment Rates have the most impact on voters
Myopia: Voters do not have good memories, events up to one year before an election seem to have an impact
Retrospectiveness: The impact of past events seem to be higher than future expectations
Sociotropicness: It is not obvious that voters put their own interests before the country's well being
Low knowledge: Voters are uninformed about their country's economy
Grievance asymmetry: Bad events have a larger response compared to an equally good one
Cost of ruling: Popularity may be lost passively through the exercise of power

Source: Adapted from Paldam (2008)

When it comes to the voting process itself the factors that influence an individual's vote are abundant, according to Paldam (2008): voters do not resemble the

classic *homo economicus* in terms of rationality. The voting process is extremely sensitive to emotions and it is very easy for the electorate to be "possessed by animal spirits" (to put it in a Keynesian fashion), and simply follow the heard. Additionally, voters are short-sighted: that is to say, the time horizon taken into account when voting tends to be only the last year. Events that happened prior to this period tend to have a smaller impact in voting decisions. As a final remark voters also tend to be uniformed about the economy unless it happens to be a general election year, thus leading to the conclusion that the voting process is extremely sensitive and passionate.

The grievance asymmetry and the level of knowledge about the economy are also related to the media. Kelleher and Wolak (2006) show that the media tends to give preference to stories that focus on "presidential character or the state of the economy rather than to present issues of domestic or international policy". Therefore the surprise of suddenly learning that the unemployment or inflation levels are above "normal levels" is considerable and therefore penalized. This raises the question of the perception of data itself: in a sense a phenomenon does not influence public opinion until it becomes known. Therefore the sole existence of data (meaning it has been collected by an individual) is not enough to influence voters. This observation seems irrelevant because we live in a day and age where data itself is seen as trivial because of the ease of access to do it, however ignoring this detail removes the importance of the medium through which the data is brought to the public, possibly via a biased view: the media, encompassing the internet as well. Edwards, Mitchell, and Welch (1995) find that indeed the larger the emphasis put on a certain issue by the media the larger the impact is on the approval rating.

Volatility is also an important determinant of popularity. Gronke and Brehm (2002). show how war also tends to be important in the perception of a president. In the beginning of a conflict the popularity tends to increase as individuals are suddenly consumed by a "patriotic feeling" which implies the instinct of "something must be done", however as time go on and nerves come down the popularity of the war decision tends to decrease over time.

In conclusion , the electorate on average is composed of voters who mostly respond to inflation and unemployment rates changes (variations in the latter being easier to observe), short sighted in terms of being affected by past events, uninformed about the economy most of the time and finally prone to irrational behavior.

2.1. A Note on Coming to Terms with the Rationality Disparity between the PBC and VP Literatures

This section attempts to establish some fundamentals to come to terms with the very different conclusions that arise from the VP and PBC literature.

The main results found in the VP literature indicate the existence of a very different economic agent that is extremely far away from the usual notions of rationality. Unfortunately this very agent is the basis for the PBC models with rational expectations.

The disparity in term of rationality presented by the literature perhaps suggests that we should focus our attention on the *homo agens* rather than the *homo economicus*.

In Mises' (1990) view, economics doesn't deal with an *"imaginary homo economicus"* at all, but rather with *homo agens*: man "as he really is, often weak, stupid, inconsiderate, and badly instructed" (Mises 1990)[12].

The argument leads to the very definition of rationality employed by Mises and more broadly by the Austrians School of Economics. Rationality in Austrian terms refers to purposeful behavior that is, action guided by one's intelligence and limitations (Mises 1998).

The Austrians therefore do not deem violations of rational expectations or Bayesian axioms irrational. The proposition is that although external observers might judge that the means "A" or "B" to achieve a given goal are improper, therefore deeming said action as irrational, the individual still acts with purposeful, intentional behavior. That is, one acts (given one's cognitive and knowledge limitations) employing what one imagines to be the most appropriate means to achieve a certain goal. What makes the action rational therefore is the very notion that one sees a *causal* relationship between the means employed and the goal to be achieved.

Such different conclusions are a direct result of the methodology employed by the Austrians (Rothbard 1997)[13] and while mixing these ideas would incur in methodological pluralism[14], the potential results seem rather interesting.

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[12] Through the use of different methodology similar conclusions are put forth by Caplan (2000 and 2007).

[13] Two different "teams" exist within the Austrian tradition: the disciples of Mises, who employ the methodology presented and the followers of Hayek, who are more open minded with methodological issues.

[14] In the sense that the Austrian school is not a follower of the mainstream methodology in economics, i.e. "The Methodology of Positive Economics." Friedman (1953).

Turning the analysis to the voting context the most important issue to stress is that voting for X or Z because of "not so smart reasons" is not irrational whatsoever simply because it is necessary to respect the individual's understanding of what a good president is. Voting in a president or giving a positive answer in a popularity poll because the president is good looking while the economy is in bad shape is not irrational. To say so would necessarily imply that one is forcing one's preferences and priorities on another individual, thus judging her priorities and therefore deeming them irrational.

In the voting context it is necessary to understand that it is quite normal to have individuals voting with a different set of priorities than those with a "superior intellect" and that does not make their vote any less rational.

Therefore the idea that some individuals vote over and over again for a certain "ideal" or party or even candidate even though it has proven to take the same actions over and over again (thus going contrary to the initial expectation) should not be considered irrational in this framework

Finally, perhaps the research agenda on PBCs should turn its attention to the earlier models that understood voters as naïve actors, only this time having a different view on what precisely is and constitutes "irrational" behavior.

In the end the discussion about whether a given behavior is rational or not (as presented previously) matches nicely with Mises' proposition given that there is indeed a need to create an externally established standard convention on rationality itself when it comes to empirical data interpretation.

3. Data and Methodology

3.1. Data

The used data focuses on the United States from the time period 1981 to 2016. Analyzing the U.S.case is interesting for this approach because of its majoritarily dual party context in presidential elections. The data gathered allows the visualization of traditional party behaviors which follow the expected intuition, i.e. the Republican party (associated with the right) and the Democrat party (associated with the left) as well as the usual assumptions identified with each party's policy making decisions.

Social and Military Expenditure were used in percentages of GDP[15] because they are only available yearly rather than quarterly thus calculating the actual

[15] In accordance with Bove *et al*. (2016).

dollar value of the expenditures by each quarter's GDP could bias the results. Therefore their values are repeated of over the four quarters of each given year. Data on U.S. Social Expenditure was sourced from the OECD Social Expenditure Database (SOCX).[16] U.S. Military Expenditure was obtained from the Stockholm International Peace Research Institute (SIPRI). Federal government budget (in billions of USD) was retrieved from the St. Louis FRED database. President Job Approval rating was collected from the American Presidency Project which compiles data from the Gallup Poll. The question asked in the poll remained the same throughout the years analyzed. Unemployment Rate as a percentage of the labour force was sourced at the OECD database. Inflation Rate (Consumer Price Index – CPI) in percentage points was obtained from the U.S. Bureau of Labor Statistics.

Figure 4 . Approval Rate Time Series

Source: own computations. Software utilized: EViews 10

During the Reagan I and II administrations the president's popularity falls immensely in two different moments: first in the early stages of the mandate due to the introduction of restrictionary policies and second due to the "Iran Contra" scandal.

President George H. W. Bush experiences an approval boom in 1990 due to the Gulf War "success" but right afterwards the attention is brought back to the troubled economy which consequently leads to a huge popularity decline.

[16] Details on methodology and sources can be found at www.oecd.org/social/expenditure.htm.

Bill Clinton's administration was marked particularly by two scandals of sexual nature: the first in 1995 and the second in 1999, involving respectively Monica Lewinsky and Paula Jones. Interestingly both episodes did not affect Clinton's popularity immensely.

The George W. Bush I presidency sees a spike in popularity as the mandate begins due to the September 11 attacks on the World Trade Center's Twin Towers. However as the presidency advances (finally reaching George W. Bush II) the president's popularity is extremely affected due to his aggressive international policy which historically proved to be unpopular.

Table 2. Presidential Popularity: Summary Statistics

Presidential Popularity: Summary Statistics

President	Mean	Median	S.D.	Min	Max
Reagan I (1981 – 1985)	49.5	50.8	7.30	37.0	61.4
Reagan II (1985 – 1989)	56.1	55.0	7.01	45.8	65.5
George H.W. Bush (1989 – 1993)	59.5	63.2	13.6	35.3	78.6
Clinton I (1993 – 1997)	48.8	48.0	4.67	41.6	56.5
Clinton II (1997 – 2001)	60.2	59.6	2.83	55.2	65.2
George W. Bush I (2001 – 2005)	61.7	59.4	11.1	48.6	86.4
George W. Bush II (2005 – 2009)	36.8	34.9	6.64	28.0	51.6
Obama I (2009 – 2013)	49.3	47.4	6.25	42.0	63.3
Obama II (2013 – 2016)	46.1	46.2	3.37	41.8	51.2

Source: own computations. Software utilized: EViews 10

Barack Obama's presidency began with high approval ratings which soon began to decline assumingly due to the president's first policy announcements involving gun and immigration control amongst many other subjects. Alegations involving the president's ethnicity, religion and birthplace also played a role in

the declining approval rates. After recovering his approval rates fall once again in 2011 due to the Debt-ceiling crisis debates of the same year. The following period shows the president's reelection, which is followed by another decline in late 2013 due to the federal government shutdown in the same year.

The table shows the curious "Bush Curse": Presidents George H.W. Bush and George W. Bush managed to achieve both the highest and lowest approval rates in the period analyzed.

President George W. Bush had the highest approval rate in the time frame studied with an impressive 86.4 % in 2001 Q4, peaking at 89% at two different poll dates in the same year: September 22nd and October 14th. This result shows how much passion and "irrationality" goes into popularity polls answers, given that the results were assumingly extremely high due to intense patriotic feelings associated with the period.

George H.W. Bush also experienced very high approval rates: 78.6% in Q1 1991 and particularly so when taking individual polls into account. He reached 89% of approval in the March 3rd 1991 poll, mainly due to the military and diplomatic "success" of the Gulf War.

Interestingly, both father and son happen to be the lowest approved presidents in the period. George H. W. Bush obtained a mere 35.3% in Q2 1993 while George W. Bush had his lowest point in Q4 2008 reaching 28% of approval.

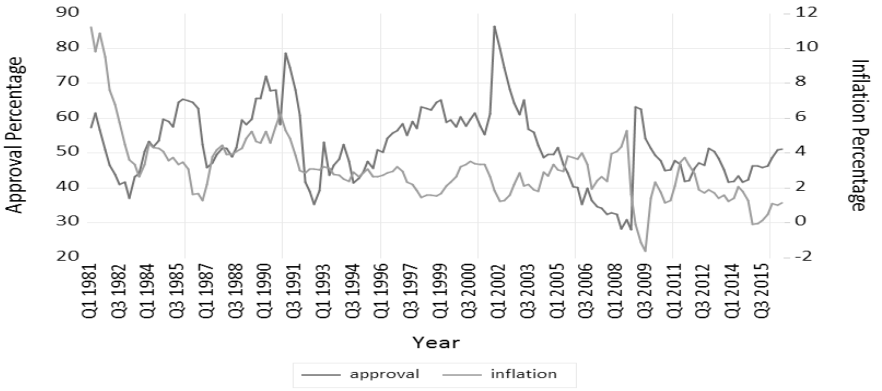
Figure 5. Approval and Unemployment Rates

Source: own computations. Software utilized: EViews 10

Concerning the relationship between unemployment and approval rates it is possible to infer visually a fairly stable inverse relationship up until 2008 when contrary to the expected intuition both variables start to move together in the

same direction. This is not necessarily a causal relationship because of the american political scenario at the time. George W. Bush finishes his mandate with the lowest approval rate in the time frame analyzed while Barack Obama emerges as a new hope in politics, representing ethnical minorities and the positive sentiment of a new comer to the democratic game.

Figure 6. Approval and Inflation Rates

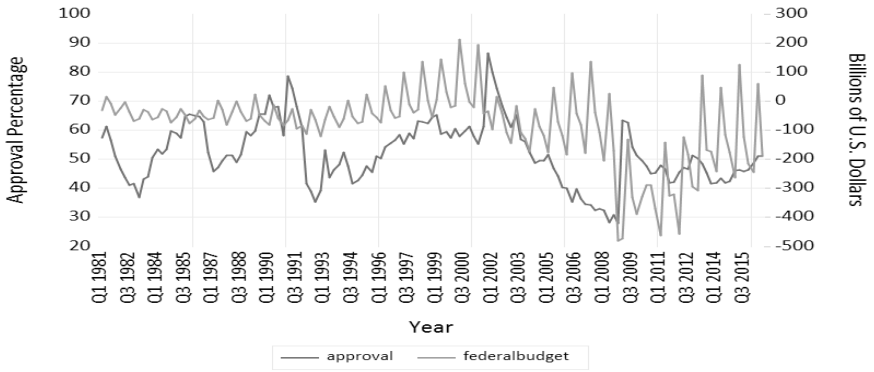


Source: own computations. Software utilized: EViews 10

The early 1980s saw the emergence of "Reaganomics" and a return towards more fiscally conservative policy making and economic measures. This is represented in by the inflation control in the early stages of the Reagan I administration, additionally as usual with the introduction of restrictionary measures the electorate reacts badly to such an economical programme and approval rates decline immensily. In 2008 the financial crisis brings about a deflation period and the rise in popularity due to the election of President Barack Obama.

The rest of the period is fairly stable and performs in accordance with the expectation that higher inflation implies higher president popularity.

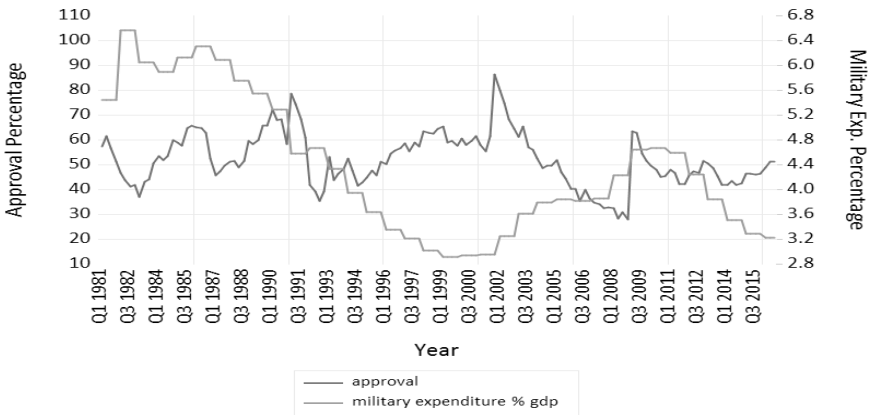
Figure 7. Approval and Federal Budget



Source: own computations. Software utilized: EViews 10

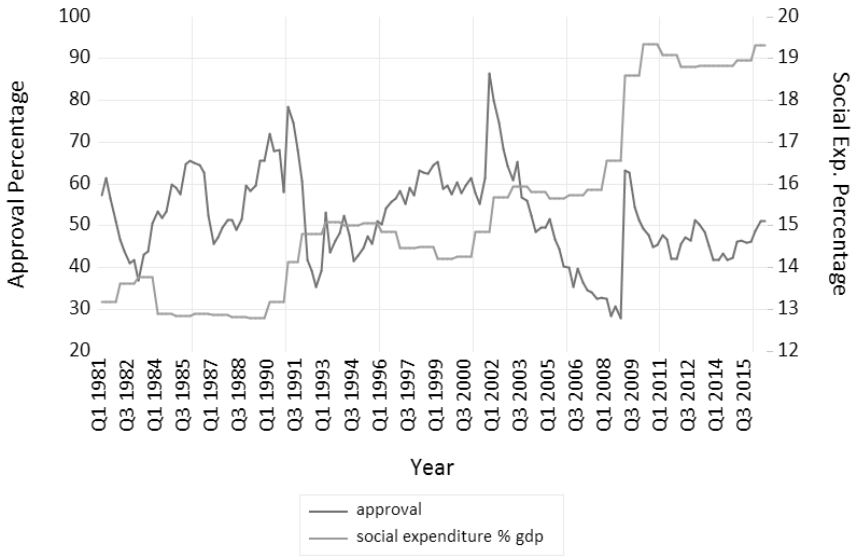
The year of 2008 is interesting for this graph given the reverse relationship between approval rates and federal budget: as the crisis hits the U.S. the budget worsens drastically and interestingly extremely high approval rates indicate the contentment of the electorate given the retirement of George W. Bush and the new presidency of Barack Obama.

Figure 8. Approval and Military Expenditure



Source: own computations. Software utilized: EViews 10

Figure 9. Approval and Social Expenditure



Source: own computations. Software utilized: EViews 10

The most important moment regarding Military Expenditure is definitely is the period that follows the attacks of September 11. The measures taken by President George W. Bush led to a spike in approval and increased Military Expenditure considerably after a period of yearly contractions since 1986.

Reagonomics led to a decrease in Social Expenditure in the 1980s. From then on the indicator performs in a fairly stable manner until the presidency of Barack Obama is reached, when Social Expenditure spikes and with it approval rates.

3.2. Methodology

The methodology employed is grounded on OLS regressions based on the standard fiscal PBC test presented by Drazen (2008) as well as specifications that take inspiration from the reaction functions found Golden and Poterba (1980) and the particular expenditure trade-off found in Bove *et al*. (2016).

Given the potentially dynamic nature of interactions between macroeconomic variables and approval rates, autoregressive distributed lag model (ARDL)

was also utilized. It allows for an automatic selection of the number of lags for the dependent variable and each of the independent variables based on an information criterion (Wickens and Breusch 1988). Additionally the dynamic specification can be transformed to a form of error-correction equation, which contains a long-run relation between the dependent and independent variables. The advantage of such a procedure is that it allows to ignore the exact order of integration of variables (more precisely, it allows for a test of cointegrating relationship that is robust to whether variables of interest are I(0), I(1) or mutually cointegrated) (Pesarn *et al*. 2001).

3.3. Variables

The independent variables are in quarterly form under the time frame Q1 1981 to Q3 2016, they include: the unemployment ($UNEMPL_n$) and inflation rate ($INFL_n$) acting as economic controls , quarterly dummy variables (Dq_n) controlling seasonal effects, an election dummy variable ($ELECT_n$) assuming a value of 1 in election years and 0 otherwise which accounts for opportunistic effects, a dummy variable ($DEMOCR_n$) which assumes a value of 1 if the incumbent is from the Democratic Party thus controlling for partisan effects and finally the $APPR_n$ variable which accounts for the percentage of positive approval support for the president.

The dependent variables include the following fiscal control variables $MILITARY_n$ accounting for military expenditure in percentage points of GDP, $SOCIAL_n$ regarding social expenditure in percentage points of GDP and $BUDGET_n$ with reference to the federal budget in billions of USD.

In the next estimated ARDL models the popularity threshold is tested with the inclusion of the $APPR\_HIGH_n$ and $APPR\_LOW_n$ Popularity variables, with the former accounting for a minimum of 60% of approval rate[17] and the later requiring a maximum of 30% of approval rate in the time series analyzed.

3.4. Theoretical Predictions

Prediction 1) To account for the existence of opportunistic effects the butter vs guns trade off used as political tool it is expected for the "$ELECT_n$" coefficient to be positive in the social expenditure model and negative in the military expenditure

[17] In accordance with the popularity estimations found in Frey and Schneider (1978).

model. The trade off therefore represents a shift in spending that is more appealing to voters. [18] On the other hand on the federal budget model it is expected for the "$ELECT_n$" coefficient to be negative as to indicate that the federal budget is moving towards a deficit during election years.

Prediction 2) To account for partisan effects in terms of preferred expenditure composition it is expected for the $DEMOCR_n$ coefficient to be positive in the social expenditure model and negative in the military expenditure model. This indicates that social expenditure is higher during Democrat administrations and military expenditure is higher during Republican administrations. With regards to the federal budget model it is expected to have a negative $DEMOCR_n$ coefficient as to indicate the more expansionary characteristic of the Democratic Party.

Prediction 3) For the economic control variables it is expected that increases in inflation rates would lessen expansionary policy while higher unemployment rates would have the opposite effect: to increase the expansionary tendency (thus leading to a possible budget deficit). Therefore for the federal budget model the expectation is to have a positive $INFL_n$ coefficient and a negative $UNEMPL_n$ coefficient.[19] The expectations are reversed for the military and social expenditure models: a negative $INFL_n$ coefficient and positive $UNEMPL_n$ coefficient.

Prediction 4) It is expected for the $APPR_n$ coefficient to be positive in the federal budget model as to indicate that higher popularity levels refrain the government from initiating expansionary policy.[20] The expectations are reversed for the military and social expenditure models: the expectation is to have a negative $APPR_n$ coefficient as higher approval rates should decrease military and social spending as the incentive to start expansionary policy is lower.

3.5. "Linear Regression" Specification

The regressions use fiscal variables as the dependent variable. The reason to give preference to fiscal rather than monetary variables is the fact that in accordance with Drazen (2001):

"Fiscal policy has real effects on economic activity even if anticipated. Moreover, it can affect voting behavior even if there are no aggregate effects" (Drazen 2001).

[18] In accordance with Bove *et al.* (2016).

[19] In accordance with Golden and Poterba (1980).

[20] In accordance with Frey and Schneider (1978).

The models build on the foundation found in the standard fiscal PBC test in Drazen (2008) and add military spending and social spending as a way to expose the "Guns vs Butter" trade off presented in Bove et al (2016). The idea is that the government faces a "guns vs butter" trade off in terms of military and social expenditure. Considering the fact that social expenditure has higher political impact during peaceful times than military spending, it would be expected that the trade off could show effects on PBCs as well as the timing and amount of the particular type of expenditure. Alongside the particular specification found in the "Guns vs Butter" trade off is a more traditional approach using the federal budget as a fiscal parameter to test for the effects of PBCs. A second type of specification is also tested, which includes the approval variable in order to test for any changes in the expected effects.

The specifications are:

Type 1:

$$\text{Measure of Fiscal Policy}_n = \beta_0 + \beta_1 \text{UNEMPL}_n + \beta_2 \text{INFL}_n + \beta_3 \text{DEMOCR}_n + \\ + \beta_4 \text{ELECT}_n + \varepsilon_n$$

Type 2:

$$\text{Measure of Fiscal Policy}_n = \beta_0 + \beta_1 \text{UNEMPL}_n + \beta_2 \text{INFL}_n + \beta_3 \text{DEMOCR}_n + \\ + \beta_4 \text{ELECT}_n + \beta_5 \text{APPR}_n + \varepsilon_n$$

Where Measure of Fiscal Policy: Military Expenditure, Social Expenditure and Federal Budget and the other variables are as defined in the preceding section. Periodic dummies for each quarterly are also added in the regressions in order to account for seasonality (visible especially in the federal budget series) .

3.6. "ARDL Modeling" Specification

In this framework we test the hypothesis presented by Frey and Schneider (1978) and Golden and Poterba (1980), which is the notion that governments might have a frame of reference in terms of popularity with which they decide whether or not to induce a PBC. In this framework governments might want to be extra cautious and induce a PBC even with high popularity levels , thus establishing the cycle as "insurance against political uncertainty". On the other end of the spectrum the government might be more assertive and interpret high popularity levels as a certain reelection prospect or understand low popularity levels as a signal to induce a PBC. However if the popularity is too low then it would be senseless to take chances with the PBC as the costs would be higher than the unlikely potential increase in popularity, which in any case would be insufficient to change reelection prospects.

This is done by means of an ARDL model which uses a fiscal variable (FED_BUDG) as the dependent variable as previously and includes the $APPR_n$, POP_HIGH_n, POP_LOW_n, $INFL_n$ and $UNEMPL_n$ as the idependent variables.

5. Results

5.1 "Linear Regression" Results

Type 1 Models (Without Approval Rate): Q1 1981 to Q3 2016, T=143
Dependent Variable: Military Expenditure / Social Expenditure / Federal Budget

	Coefficients[21]		
Constant	1.94093 (<0.0001) ***	13.8915 (<0.0001) ***	75.5697(0.0303) **
$Dq1_n$	−0.0392451 (0.7986)	0.128529 (0.7283)	−14.9205 (0.4496)
$Dq2_n$	−0.0275916 (0.8575)	0.103465 (0.7797)	142.386 (<0.0001) ***
$Dq3_n$	−0.0115406 (0.9401)	0.0912848 (0.8050)	42.5407 (0.0323) **
$UNEMPL_n$	0.387991 (<0.0001) ***	0.316972 (0.0001)***	−37.9043 (<0.0001) ***
$INFL_n$	0.124149 (0.0003) ***	−0.456059 (<0.0001) ***	18.5157 (<0.0001) ***
$DEMOCR_n$	−0.917253 (<0.0001) ***	1.63654 (<0.0001) ***	−18.9925 (0.2396)
$ELECT_n$	−0.00472153 (0.9703)	0.274413 (0.3688)	−29.8022 (0.0683) *
Adjusted R^2	0.653035	0.472492	0.554275

Source: own computations. Software utilized: EViews 10

[21] P-values in parenthesis

Type 2 Models (With Approval Rate): Q1 1981 to Q3 2016, T=143
Dependent Variable: Military Expenditure / Social Expenditure / Federal Budget

	Coefficients[22]		
Constant	1.73480 (<0.0001) ***	17.4067 (<0.0001) ***	−12.4199 (0.8159)
$Dq1_n$	−0.0448860 (0.7713)	0.224722 (0.5123)	−17.3283 (0.3746)
$Dq2_n$	−0.0287494 (0.8520)	0.123210 (0.7187)	141.892 (<0.0001) ***
$Dq3_n$	−0.0104249 (0.9460)	0.0722582 (0.8327)	43.0170 (0.0283) **
$UNEMPL_n$	0.392366 (<0.0001) ***	0.242355 (0.0018) ***	−36.0366 (<0.0001) ***
$INFL_n$	0.123688 (0.0003) ***	−0.448200 (<0.0001) ***	18.3190 (<0.0001) ***
$DEMOCR_n$	−0.912546 (<0.0001) ***	1.55626 (<0.0001) ***	−16.9832 (0.2872)
$ELECT_n$	0.0123620 (0.9241)	−0.0169108 (0.9532)	−22.5100 (0.1711)
$APPR_n$	0.00335991 (0.5258)	−0.0572962 (<0.0001) ***	1.43419 (0.0333) **
Adjusted R^2	0.651498	0.548922	0.565935

Source: own computations. Software utilized: EViews 10

5.2. "Linear Regression" Outline

The results for both specification types present interesting results:

Prediction 1 is confirmed on all three models without the approval variable: the "$ELECT_n$" coefficient is indeed positive in the social expenditure model, negative in the military expenditure model and negative for the federal budget model while also being statistically significant at the 10% level. The results thus

[22] P-values in parenthesis

give some credibility to the expenditure increase in election years. As for type 2 regressions (which include the approval variable) only the federal budget model showed results in accordance with the prediction.

Prediction 2 is also satisfied on all three models without the approval variable: the coefficients for $DEMOCR_n$ assume the expected value sign with the coefficients for the social and military expenditure models being statistically significant at the 1% level, indicating the partisan effect in terms of expenditure type. With regards to the type 2 regressions although all three regressions corroborate with the prediction, the military expenditure regression shows the best results showing the expect coefficient sign as well as being significant at the 1% level.

Prediction 3 is confirmed for the federal budget model without the approval variable: with both $INFL_n$ and $UNEMPL_n$ coefficients according to intuition and statistically significant at the 1% level. As for the type 1 social expenditure model the prediction is confirmed only for the inflation level varible while the military expenditure model the prediction is valid for the unemployment variable. The results for type 2 regressions are very good for the federal budget regression with both variables containing the expected sign as well as being significant at the 1% level

Prediction 4 did not perform well with regards to the military spending regression however it showed very good results for both the social expenditure and federal budget regressions, with both of them containing statistically significant results at the 1% and 5% levels, respectively.

The fact that prediction 4 was not significant for the military spending regression is in accordance with intuition and the fact that social expenditure is more appealing to voters. Therefore it is possible to infer that fiscal manipulation happens only when the president is faced with low approval rates, otherwise there is no attempt of inducing manipulation. Presidents can work in a "popularity maintenance" framework as suggested by Frey and Schneider (1978), establishing a threshold level of popularity which indicates when to attempt to use fiscal manipulation.

Although interesting these results do not take into consideration the time effects that the variables analyzed might have in the occurrence of the cycle, therefore lagging certain variables should give better results as theoretically the government does not react immediately to economic changes.

4.3. "ARDL Modeling" Results

Q1 1981 to Q3 2016, T=143
Dependent Variable: Federal Budget

	Coefficients	P-Values
FED_BUDG(-1)	0.093650	0.2929
FED_BUDG(-2)	0.221922	0.0076
FED_BUDG(-3)	0.423177	0.0000
FED_BUDG(-4)	0.558475	0.0000
FED_BUDG(-5)	-0.164862	0.0669
FED_BUDG(-6)	-0.288495	0.0005
FED_BUDG(-7)	-0.483114	0.0000
FED_BUDG(-8)	0.372810	0.0000
APPR n	1.535505	0.0575
INFL n	24.89379	0.0001
$INFL_{n-1}$	-21.47452	0.0191
$INFL_{n-2}$	-17.48004	0.0652
$INFL_{n-3}$	5.417999	0.5661
$INFL_{n-4}$	16.94849	0.0102
UNEMPL n	-62.19900	0.0037
$UNEMPL_{n-1}$	51.67338	0.0077
POP_HIGH	-16.32686	0.2736
POP_LOW	-0.886907	0.9507
Constant	-60.42815	0.1816
Adjusted R^2	0.879854	

Source: own computations. Software utilized: EViews 10

"ARDL Modeling" Long Run (Levels Equation) Results
Q1 1981 to Q3 2016, T=143
Dependent Variable: Federal Budget

	Coefficients	P-Values
$APPR_n$	5.763107	0.0638
$INFL_n$	31.17330	0.0230
$UNEMPL_n$	-39.50512	0.0008

Source: own computations. Software utilized: EViews 10

4.4. "ARDL Modeling" Outline

The results suggest that the FED_BUDG variable is autoregressive, thus its value is dependent on itself up to 2 years back.

In accordance with the intuition the POP_LOW variable presents a negative coefficient indicating that even given the low popularity threshold of 30% FED_BUDG is still pushed towards a deficit thus suggesting the use of said instrument for political means (i.e. increase approval rates).

The variable POP_HIGH shows a surprising positive coefficient suggesting that the hypothesis of "political insurance" may be correct. In this sense, even possessing a high approval rate the government still induces expenditures (thus worsening FED_BUDG) as to prevent

The variables INFLATION, INFLATION(-3) and INFLATION(-4) perform very well in accordance with the expectation of a positive coefficient, meaning a higher inflation level would lead to the mitigation of expansionary policy. INFLATION(-4) in particular presents great performance considering its P-Value.

The unemployment variables show dubious results as the UNEMP_R(-1) variable presents a positive coefficient while UNEMP_R shows a negative coefficient. The assumption would be that the unemployment rate of the previous period would affect the federal budget in terms of expansionary policy. In any case both variables perform very well in terms of P-Values.

The levels equation performs precisely as the theoretical assumptions indicate: positive coefficient for $APPR_n$ as well as $INFL_n$ and negative coefficient for $UNEMPL_n$, thus suggesting that the long run relationship of the variables analyzed perform as the intuition suggests, meaning that high inflation and approval rates minimize the need for expansionary policy (thus not inducing a federal budget deficit) while high unemployment rates have the precise opposite effect, leading to a budget deficit tendency.

5. Conclusions

In summary the goal of this paper was indeed achieved: the results obtained do suggest the occurrence of PBCs during the course of the period analyzed through the use of fiscal instruments and presidential popularity proved to be an important component of the process. Additionally the means through which the cycle is induced also corresponds to the expected intuition: fiscal expenditure is partisan in the sense that the Democratic Party has a preference for Social Expenditure ("butter") while the Republican Party's preference is Military Expenditure ("guns"). In this regard the Obama administration is the best example of such mechanism, with the expected high social expenditure levels associated with low approval rates indicating the occurrence of a PBC. However, unlike traditional theory proposes the cycle occurred despite the fact that a second reelection is impossible, therefore giving room for a possible "long run" PBC in which a party attempts to maintain power within itself rather than only within a single candidate.

The hypotheses were partly correct: fiscal instruments are indeed utilized in the period as a means to induce PBC, furthermore incumbents manage to manipulate the electorate (which proved to be "irrational" and easily fooled in this sense). The intuitive hypothesis that the cycle would be majoritarily opportunistic given the nature of the elections and democracy proved to be incorrect considering the partisan tendencies discussed previously. Finally, the role that presidential popularity plays in the occurrence of the cycle is very interesting although not as decisive as imagined: the results suggest that a president with low approval rates (i.e. less than 30%) *still* tries to induce a cycle through expansionary measures, therefore implying that a low popularity rating does not stop manipulative behaviour. Interestingly, the results imply that a president with high approval (i.e. more than 60%) rates also induces a PBC cycle. This can be interpreted as "political insurance" against unpredictable circumstances. In this sense the behavior of incumbents is *opportunistic in nature* and *partisan in its policy implementation*.

The results in both models thus suggest that the partisan pattern in expenditure is potentially true for Federal Budget and Social Expenditure, thus implying that abnormal Military Expenditure levels may be due to actual conflict rather than PBC inducement.

The regressions assume that popularity and therefore reelections are necessarily related to economic factors which is not always the case (Paldam 2008). The U.S. had presidents in the past that were popular for non economic reasons (Dwight D. Eisenhower, for example). Not only the determinants of popularity

are abundant but also the non rational behavior of voters limits the scope of this analysis at the present state of the research agenda. An example would be the election of George H. W. Bush following the presidency of Ronald Reagan. The important aspect to note is the notion that although Reagan finished his mandate with low popularity (considering the Iran Contra affair) the Republican party still remained in power, therefore the "political torch" was passed on successfully. President George H. W. Bush did not manage to get a reelection most probably due to the fast increasing unemployment rate towards the end of his mandate.

Following the lineage President Bill Clinton stabilized the unemployment rate issue and managed to guarantee his reelection at the expense of increasing social expenditure, a probable PBC inducing measure. Political instability and aggressive foreign policy dominated George W. Bush's presidency leading to very high military expenditure levels and while his patriotism represented in the response to the terrorist attacks guaranteed his reelection such measures did not hold well against the test of time leaving Bush with a historical low approval rate towards the end of his mandate. Barack Obama experienced a spike in popularity given the political circumstances in which his predecessor left the presidency, and while his popularity had multiple instances of declining throughout the mandate social expenditure levels escalated during his administration, again suggesting PBC induction.

The conclusion is that although there are suggestive elements in the results that indicate a higher possibility of partisan rather than opportunistic PBC occurrence[23] given the expenditure levels in accordance with the expected intuition through the use of the analyzed fiscal instruments as well as the fact that it is possible to manipulate the "rational"[24] electorate through the use of PBC instruments, solely a high or low popularity level is not enough to guarantee or dismiss an incumbent's reelection given the uncertainty of the future political scenario, the role played by the media and the general unpredictability of the electorate.

Finally, PBC theory is an instrumental tool which constitutes an element that should be taken into consideration when analyzing a particular period, it should not be taken as a standalone explanation for fluctuations: it should be integrated into historical narratives of business cycles.

[23] In accordance with Drazen (2001).

[24] À la Rogoff and Sibert (1988), for example.

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