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Internationalisation and Bioenergy Effects on Economic Growth

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Declaration

I hereby declare that my dissertation entitled "Internationalisation and Bioenergy: Effects on Economic Growth", submitted in fulfilment of the requirements for the Doctorate of Research degree in Economics and Law of Environment, Region and Landscape, is the result of my own work, except for where it is explicitly attributed to others in the text.

A book chapter, entitled "Second generation biofuels: opportunities and challenges for the development of rural areas" in the Compendium of Energy Science and Technology of Studium Press LLc, USA, is derived partially from Chapter 2 and is currently under peer review.

A poster, entitled "The impact of EU's CAP on the economic development of Italy", was presented in the annual Economics Conference of the Lord Ashcroft International Business Department of Anglia Ruskin University, Cambridge, UK, in December 2013.

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Abstract

Existing literature evidence suggests a strong relationship between internationalisation and economic growth, as well as a link between biofuel production and economic growth for various clusters of countries, including the members of the Eurozone. As Eurozone policy is shaped with a special focus on internationalisation and well defined directives on bioenergy, their actual effect on economic growth needs to be further investigated.

This dissertation aims firstly to evaluate the impact of internationalisation, as represented by foreign direct investments (FDI) and trade openness, and secondly to measure the effects of bioenergy production, as represented by the daily volume of total biofuel production, on the economic growth, as represented by the growth rate of real gross domestic product (GDP), of the Eurozone.

The analysis is conducted by employing the methods of linear regression, under the exogenous growth theory. The research methodology implies a quantitative analysis of economic data collected from the World Bank and OECD, for the period from 1991 to 2013. In addition to this, the model includes several control variables such as labour force, technology, fixed capital formation and the savings rate.

The results of the research reject the hypotheses of the significant effects of internationalisation and biofuel production on economic growth in the Eurozone. The factors that appear to affect economic growth are the growth of gross fixed capital, inflation, human capital and savings.

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1. Introduction

1.1. Background Information

A definition of economic development is not easily constructed, as there are large disparities in natural endowments, structures of financial markets, cultural aspects, as well as political and social institutions that are observed across regions. Therefore, any attempt to determine a single criterion that distinguishes a developed from a developing country may be invalid. Economic development and economic growth can be expressed by numerous variables and concepts, as well as be determined by a range of factors. However, even the approaches that combine various indicators of economic development are often unsatisfactory, because they include excessive number of variables and become descriptive rather than analytical. Economic growth can be represented by per capita income, gross domestic product (GDP) per capita, or GDP growth. The variety of approaches to measuring the level of economic development and the degree of economic growth complicates the process of economic analysis and the estimation of the factors that contribute to economic growth (Nafziger, 2012).

Economic growth is explained by different theories that sometimes contradict each other or complement each other, but no single theory is able to fully explain the concept of economic development (Sardadvar, 2011). At the same time, globalisation trends substantially increase the significance of internationalisation in the context of countries' economic development. Internationalisation can be reflected in the level of Foreign Direct Investment (FDI) that countries send and receive and in the patterns of exports and imports between countries. Trade liberalisation and trade openness can be significant determinants of economic growth, although there is a wide range of other factors that can positively affect development. At the same time,

the patterns of economic growth and the factors that determine it can be different in various countries. Moreover, the differences can be observed not only between the developed and developing economies, but also across the countries with similar degrees of economic development. This assumption is tested in the present study by comparing the outcomes from the developed economies of the Eurozone with the findings of other scholars about the effects of internationalisation on economic growth in other countries.

The role of governments and central banks has always been a controversial question in public debate. Nevertheless, in the aftermath of the global financial crisis the debate has become especially escalated. During the last decades, neoliberal thinking[1] had become more popular, as unregulated markets and deregulation along with opening-up and privatisation were favoured. Many proponents of neoliberalism argued that human nature and the concept of modern political institutions were such that more constrained governments were more efficient for the economy (Boas, 2009; Aminzade, 2003; Wilson, 1994). The push for a minimal state that promoted business increased with globalisation. Numerous neoliberal reforms in developing countries were undertaken under pressure from international agencies, including the International Monetary Fund, the World Bank, and the World Trade Organisation (Chang, 2003). However, less attention has been paid to more developed countries with regard to the liberalisation of their trade regimes, their openness for trade and foreign investments.

Besides the effects of internationalisation on economic growth, this research is focused on the contribution of the bioenergy production in the Eurozone on economic growth. The reason why

[11] While the term was first introduced by Alexander Ruestow in 1938 and the usage of the term was altered in time, David Harvey in his "Brief History of Neoliberalism" gives the following definition: "… in the first instance a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets and free trade" (Harvey, 2005, p.2).

this factor is taken into account because the European Union has been working on the energy security and diversification of the sources of energy that would help the countries to reduce the costs.

Bioenergy produced from renewable sources attracted much attention in the society and academic world. The first generation biofuels face direct competition with food production (Martin, 2010), while problems such as biodiversity conservation and environmental consequences of bioenergy production are often greater than the outcome of fossil fuels (Gasparatos, 2013). These problems need to be addressed by the second generation biofuel technologies that use not only agricultural food products such as oils, starch and sugar, but also compounds used in the generation of fuel and energy. The second generation fuels can ensure higher conversion efficiency. These positive impacts are especially important in the agricultural sector, in which the Eurozone has a common policy among its members. Future economic development of the Eurozone can be determined by the change in the production of the second generation biofuels. The present dissertation analyses the possible effects of biofuels, produced by first generation technologies, on economic growth in addition to the effects of internationalisation. The objectives of the study are to assess economic effects of the total production of biofuels.

Thus, the present study explores a wide array of factors that influence economic growth of the Eurozone. Among these factors, a special attention is paid to the effects of the bioenergy production and internationalisation represented by the FDI inflows and trade openness. This region has been selected as an objective of the research because the countries have a common currency and no barriers to trade among them. Furthermore, some members of the Eurozone such as Greece and Spain suffered considerably during the European Debt Crisis. Thus, the findings

from this research will also have implications for the recovery of the Eurozone economy through internationalisation. It will be shown whether the latter factor can significantly affect economic growth in the region. In turn, the answer to this question will help politicians to make decisions in regards to further internationalisation of the Eurozone by attracting more FDI and removing trade barriers with other countries.

1.2. Aims and Objectives

The aim of the present research is to assess to what extent internationalisation and bioenergy production affected economic growth of the Eurozone. The objectives are:

- To investigate the impact of the openness to trade on economic growth of the Eurozone;
- To evaluate the impact of the FDI inflows on the economic growth of the countries of the Eurozone;
- To measure the effects of biofuel production on economic growth of the countries of the Eurozone.

1.3. Original Contribution

The present study expands the existing literature that has analysed the determinants of economic growth and specifically the effects of internationalisation on economic development. Previous investigations were mainly focused on the effects of internationalisation on the performance of companies (Giovanetti et al., 2013; Mayer and Ottaviano, 2008; Bertolini and Giovanetti, 2006). The current study aims to go beyond the firm level and to assess the impact of internationalisation on the economic growth of the countries that currently comprise the Eurozone. Furthermore, internationalisation is represented by two variables that include FDI and trade openness. While numerous studies explored the effects of these variables on economic

growth for samples of countries (Eller et al., 2006; Hermes and Lensink, 2003), the current investigation undertakes a cross-country analysis that is focused specifically on the Eurozone economies. The contribution of the study to the academic literature would be reflected in the cross-country observations on the effects of internationalisation on economic growth.

Many previous studies explore the determinants of economic growth and particularly the effects of internationalisation for developing countries (Schneider, 2005; Beck, 2002). This research contributes to literature by estimating the effects of internationalisation and bioenergy production on the developed economies. The findings could be valuable both for academic scholars who investigate the same question and to regulators and policy makers who are responsible for economic growth. The findings can be valid not only for the case of the Eurozone, but they can also be extrapolated to other developed countries of the Organisation for Economic Cooperation and Development (OECD)[2]. Furthermore, the discussion of the study includes the comparison of the observations of the present research with the conclusions that were obtained for developed economies. This could provide valuable insights about the peculiarities of the developed and developing countries. The assumptions about the factors that contribute to economic growth at different stages of economic development can be applied by regulators and policy makers from different countries.

[2]The member countries of the OECD are, as of 2014, Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxemburg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, UK and USA.

1.4. Structure

After presenting above a brief introduction and background to the study, including a description of the main aims and objectives of the current research, the dissertation will subsequently be organised according to the following structure:

- Chapter 2 describes the main literature review by focusing on economic growth theories and discusses the empirical findings of numerous studies that explored the respective growth theory question. The review explored various factors affecting economic growth in different countries. Special attention is paid to internationalisation factors, including openness to trade and FDI;
- Chapter 3 illustrates the methodology used in the current thesis. It reflects the design, philosophy, approach and methods of the research;
- Chapter 4 shows the quantitative approach through a case study and presents the main findings of the investigation;
- Chapter 5 discusses the results obtained in the previous chapter and compares and contrasts these ones with current literature in the context of the growth theories;
- Finally, Chapter 5 summarises, concludes and provides policy implications and recommendations for future investigations.

2. Literature Review

2.1. Theories of Economic Growth

Internationalisation can be defined as an expansion of interactions of the country and its businesses with the outside world. This chapter provides a review of the key theories of economic growth and internationalisation. The latter is divided into international trade and foreign investments. The theories reviewed started from the classical growth theory and the theory of absolute advantage and progress to more advanced theories that are currently used by economists (Arestis et al., 2007). Empirical evidence is provided to explore the findings about the relations between internationalisation, FDI, international trade and economic growth.

2.1.1. Exogenous Growth

The models of economic growth are generally divided into exogenous and endogenous. The classical theory is based on the works of Adam Smith who underlined the significance of increasing labour productivity and saving and developed the theory of absolute advantage (Sardadvar, 2011). The theory of absolute advantage assumed that a trade between two nations is based on mutual benefits to the countries. The trade that delivers gains to both parties is based on absolute advantage. The efficiency of one nation in the production of a commodity leads to specialisation in the production and to the absolute advantage that creates trade (Zhang, 2008).

The Neo-Classical school of economics suggests that economic growth is exogenous and determined in the long run by capital accumulation and capital flows, labour market and productivity (Sengupta, 2011). The neo-classical growth model rests on several assumptions. Firstly, the model assumes that the labour force and labour-saving technical progress have a

constant exogenous rate. Then, the model does not take into consideration that there can be an independent investment function and assumes that all saving is invested. Furthermore, the model has an assumption that output is a function of labour and capital. At the same time, the production function demonstrates constant returns to scale, while diminishing returns to individual production function are observed (Thirlwall, 2003).

The Solow-Swan model is the most popular exogenous growth theory that has roots in the Cobb-Douglas production function (Dohtani, 2010). The Solow-Swan model views technological progress as a driver of economic growth whereas other exogenous growth theories such as the Harrod-Domar model view the savings rate in the economy as the main driver of economic growth (Huh and Kim, 2013). Meanwhile, the critics of the Solow-Swan model argue that it is hardly possible to define capital independently of capital goods. Furthermore, reasoning purely in terms of capital value can be not appropriate, as capital may take the form of various commodities (Foley, 1999). The Harrod-Domar model is criticised for the fact that while savings and investment are necessary for economic development, they are not sufficient conditions. Furthermore, the assumption of constant returns to scale can be criticised as well (Mayawala, 2008).

The neoclassical model predicts that under the environment of the steady state, the level of output per capital has positive relations to the ratio of savings to investment. Besides, it has negative relations to the growth of population or labour force. Furthermore, the theory suggests that the growth of output does not depend on the savings-investment ratio. Instead, it is determined by the exogenously driven labour force growth rate that is expressed in efficiency units. This prediction is based on the fact that higher level of savings-investment ratio is offset by a higher ratio of capital to output or a lower level of capital productivity. The predictions are

based on the assumption of diminishing returns to capital. When the savings ratio and production function are the same, an inverse relation across economies between the ratio of capital to labour and capital productivity would be observed. This implies that poorer countries should grow faster than rich nations. This leads to the convergence of incomes per capita across the globe (Westernhagen, 2002). However, the prediction of the convergence in per capita incomes is inherent to the developed economies, while for the developing countries and for the world as a whole this assumption does not hold true. Average incomes in the poor countries do not demonstrate rapid growth that could catch up to the incomes in the rich countries (Neuhaus, 2006).

The neo-classical model can be criticised from different points of view. Firstly, in the real world appropriate government policies, including liberalisation of trade, promotion of domestic savings, and removal of distortions in the domestic market may permanently increase the degree of economic development. However, the neo-classical model assumes that such policies are able to have only a temporal effect. The model does not take into consideration the differences in overall technological efficiency, savings rate and labour force growth rate in different countries. In the long run the level of income per capital depends on these factors. This means that different countries should be expected to converge to different levels of income per capita. Some rich countries grow faster than some poor economies, and this fact contradicts the neo-classical growth model (Boland, 2005). Moreover, the model does not pay attention to the prominent feature of structural change during the process of economic growth. Nevertheless, the model is applicable to advanced economies that are close to the conformity with the assumptions of the theory (Elson, 2013).

2.1.2. Endogenous Growth

An alternative view on economic growth is put forward by the endogenous growth theory (De Liso et al., 2001).This is a rather new approach compared to the exogenous growth theories. The endogenous growth theory is different from the neo-classical approach in that the former views human capital, spillover effects and innovation as the main internal drivers of economic growth in the long run (Romer, 2011). Internationalisation is generally viewed as a factor of economic growth in the context of neo-classical exogenous growth models. Endogenous theory implies that the accumulation of knowledge is important for economic growth, while this factor is not considered in the neo-classical growth models. Knowledge is viewed as a public good in the Solow-Swan model, but under the endogenous growth model, localised knowledge accumulation is possible (Roberts and Setterfield, 2010).

The endogenous growth model was developed as a reaction to several inconsistencies. For example, economic theorists suggested that technological change was important for growth, while income distribution showed that the reliance on the assumptions of free distribution of knowledge and perfect competition were not appropriate for the justification of growth (Capron, 2000). Under the new growth theory technological progress is endogenised as companies operate in the markets under imperfect competition. Meanwhile, there are different approaches to endogenous growth. Some theories include non-convexities or externalities, while some are based on convex models. Nevertheless, endogenous growth theory is aimed at explaining the divergence in income across countries and determines the origin of growth. One of the key outcomes of endogenous growth theory is that policy measures are able to affect the long-term economic growth rate. This is often achieved by higher levels of savings and investment, new technology and human capital. These phenomena lead to the growth in return to scale and

explain divergence in economic performance. This major contrast to exogenous growth models explains the popularity of endogenous growth theory (Stimson et al., 2010).

Despite the factors that are taken into account by the endogenous growth theory and are not considered by the exogenous theory, there are arguments that the neo-classical model is able to explain most of the cross-country differences in output per person (Aghion et al., 1998). There was evidence that countries were converging to similar growth paths in accordance with the Solow-Swan model. At the same time, the growth that is based on technological innovation and research and development can be viewed as less valid, since capital accumulation is a more prominent source of growth (Aghion et al., 1998). Specifically, in the post-war period research and development inputs have increased substantially, while no tendency for the growth of productivity was observed. However, the effects of FDI and exports on growth are limited under the exogenous theory, while endogenous theories provide a framework in which FDI can permanently influence growth rate in the host economy through technology and knowledge transfer (Zheng et al., 2006).

Both exogenous and endogenous growth models are based on the assumptions that are made by individuals with perfect information. However, this significantly contradicts the modern view that is expressed in expectations theory. The theory assumes no perfect information and suggests that people process information to develop expectations. Rational expectations theory suggests that companies that expect diminishing profits or losses would not invest when a positive demand shock is observed. Therefore, the demand shock would be reflected in price changes only. Thus, rational expectations paralyse action and prevent economic growth and business cycles (Brouwer, 2012). Expectations theory implies that negative expectations lead to the absence of natural growth, while the major causes of limited growth are the expectations

themselves. Negative expectations are viewed as self-fulfilling prophecies. However, expectations theory is not able to explain the causes of natural productivity growth (Arnold, 2013). Expectations can be viewed as informed forecasts of future events, and therefore they are considered to be the same as the predictions of the appropriate economic theory. Expectations are formed differently and depend on the economics system and the theory that is applied to describe the economy at a particular period. In view of the global financial crisis and the European sovereign debt crisis the economic expectations theory became more appropriate. However, an alternative theory of bounded rationality places focus on limitations in personal decision making. According to the expectations theory an illusion about a positive or negative economic growth can actually influence real growth, as people can have propensity to spend or save money. In this case savings shall be viewed as a significant determinant of economic growth. Individuals make forecasts about future economic development on the basis of personal expectations and anticipate particular policy implications (Cate, 2013).

The adaptive expectations theory suggests that the decisions and expectations are based on the past events, so these events can influence the future. Specifically, the growth of subsequent year is expected to be consistent with the growth in the past years. The changes in the conditions imply that the expectations change as well. Nevertheless, there is a time lag before the change in the expectations as a response to the changes in the conditions. The adaptive expectations theory can be expressed as follows:

$$g^{\varepsilon} = g^{\varepsilon}_{-1} + \lambda(g - g^{\varepsilon}_{-1}) \qquad (1)$$

Where λ takes the value between 0 and 1, g^{ε} is the growth in the next year according to the current expectations, g^{ε}_{-1} is the growth in the present year that was expected in the year before,

and g is the actual growth rate. The equation demonstrates the relationships between the actual growth and expected growth rates. Higher expectations in the current period that were observed in the previous period, imply higher expectations in terms of the next year growth. Higher actual growth is associated with higher expectations for future growth as well.

In contrast to the adaptive expectations theory, the rational expectations hypothesis suggests that the decisions and expectations are based on all available information, including the possible policy changes and their effects on the economy. The rational expectations approach states that instead of assuming that the future will consistently reflect the past, people may take into account the possible effects of policy changes. The expectations may alter in accordance with the understanding of the economic policy. Thereby, the approach assumes that as economic agents obtain more information about the process, they use this information to form expectations of the variable that is determined by this process. Thus, the agents' subjective probability distribution is in line with the objective probability distribution of the events. This implies that the agents' expectations are the same as the conditional mathematical expectations according to the probability model of the economy. The value of variable Y for the period t can be determined by its lagged value and the lagged values of other variables:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} \qquad (2)$$

Where α are the constant coefficients. A rational person who forms the expectations about the value of Y takes into consideration the equation and forms the following expectation:

$$E_{t-1} Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} \qquad (3)$$

Where E_{t-1} is the expectation of Y_t that was formed in accordance with the available information at the end of the period t-1. The rational expectation of Y_t that was formed at period t-1 is the

mathematical expectation of Y_t taking into account the information available. The probability model introduces a random term v_t into the equation:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} + v_t \qquad (4)$$

Meanwhile, the forecaster forms the expectations in regards to *v* as well, so the equation is the following:

$$E_{t-1} Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \alpha_3 Z_{t-1} + E_{t-1} v_t \qquad (5)$$

Where $E_{t-1}v_t$ is the expectation of v_t that was formed according to the information available at the end of the period t-1. The best guess that a rational agent can make with respect to v_t is that it will equal its mean value $E_{t-1}v_t=0$. Therefore, the rational expectation of Y_t according to the available information at the end of period t-1 can be expressed by equation (3).

2.2. Empirical Evidence

2.2.1. Economic Growth and Trade

The relation between openness to trade and economic growth can be not straightforward, as growth can use a large number of openness measures. Specifically, trade intensity ratios can be applied to analyse the effects of trade liberalisation on economic development. However, the application of trade barriers as the proxy for trade openness is possible as well. The observations of Yanikkaya (2003) showed that in contrast to expectations, both trade intensity ratios and trade barriers were positively and significantly associated with economic growth. The findings were especially strong for developing economies. The analysis of a wider range of trade openness and

liberalisation indicators was conducted by Wacziarg and Welch (2008). The authors explored the relation between trade openness and economic growth, including the factor of physical capital investment. The study showed that during the period from 1950 to 1998 countries that liberalised their trade regimes had an average annual growth that was 1,5 percentage points higher than prior to liberalisation. Therefore, the study concluded that liberalisation was able to promote economic growth through its impact on physical capital accumulation. The average trade to GDP ratio was increased by 5 percentage points. Nevertheless, there were large cross-country differences that were masked by average numbers (Wacziarg and Welch, 2008).

The link between trade and growth can be explored with the help of diffusion-based models that suggest that trade with integrated partners ensure greater access to technical knowledge. In contrast, structure-based models suggest that trading with isolated partners can ensure a bargaining advantage (Clark and Mahutga, 2013). Empirical analysis of a sample of over 100 countries analysed the influence of trade centrality on economic development net of control variables. The study found that there were positive relations between trade centrality and growth peaks when countries traded with isolated partners in the periphery. Cross-country differences of the effects of trade openness on economic growth can be attributed to economic conditions when trade liberalisation reforms are undertaken (Falvey, 2012). Trade liberalisation is able to increase economic growth both in crisis and non-crisis periods. However, an internal crisis is associated with lower acceleration of growth, while an external crisis implies a higher acceleration in comparison to the non-crisis regime.

A country's economic growth along with the rate of innovation can be determined by high-technology trade and FDI (Schneider, 2005). A panel data set of over 45 developed and developing countries showed that high-technology imports were able to explain domestic

innovation in both developing and developed economies. Foreign technology was stronger related to GDP per capita than domestic technology. However, the findings about the effects of FDI on economic development were mixed (Schneider, 2005). In contrast, the observations of Eris and Ulasan (2013) showed that there was no direct and robust correlation between trade openness and economic growth in the long run. Different proxies for trade openness, including current openness, real openness, the fraction of open years and the weighted averages of tariff rates, as well as the black market premium were applied. The findings were robust for the inclusion of the proxies as none of them was related to economic growth. Meanwhile, the study concluded that economic institutions and macroeconomic uncertainties, including those created by high inflation and high level of government consumption were the most prominent explanatory factors of economic growth.

The positive relations between trade openness and economic growth were found by Shahbaz (2012). The author confirmed co-integration among the series using different econometric approaches. However, contrasting conclusions were provided by the research of Tekin (2012). The author explored causal relations between trade openness and economic growth and found that there was no significant causality relation among the variables. However, the study was focused only on the least developed countries of Africa, while the conclusions for the developed countries could be different. Developing countries can demonstrate a link between financial development and trade. Financial intermediaries can facilitate large-scale high-return projects, while economies with higher level of financial sector development have a comparative advantage in manufacturing industries (Beck, 2002). Controlling for country-specific effects and possible reverse causality, empirical evidence demonstrated that financial development significantly

affected the level of both exports and the trade balance of manufactured goods. These factors could further affect economic growth (Beck, 2002).

An example of European trade liberalisation and export-led growth was explored by Balaguer and Cantavella-Jorda (2004), who studied the economic growth in Spain. The authors took into account the expansion of export and the shift from conventional exports to other types of exports, such as manufactured and semi-manufactured ones. The study confirmed that the structural transformation in export composition was a prominent factor in the economic growth of Spain along with the relations between total exports and output (Balaguer and Cantavella-Jorda, 2004). However, the effects that trade openness has on economic growth can be determined by corresponding reforms that assist a country in benefiting from international competition. According to the Harris-Todaro model the benefits through openness to trade are determined by the level of labour market flexibility. Evidence on the impact of openness on growth with regard to various structural characteristics was provided by the research of Chang et al. (2009) in a cross-country analysis. A regression model was used and measured that trade openness interacted with the variables of financial depth, infrastructure, the flexibility of labour market, educational investment, ease of entry and exit for companies and inflation stabilisation. The study showed that the impact of trade openness on growth was substantially enhanced under particular complementary reforms (Chang et al., 2009).

Another analysis of a South European country with regard to the relations between the concepts of exports, imports and economic growth was undertaken by Ramos (2001). The study explored the Granger-causality between the factors in Portugal. The role of imports in the causality between exports and output was emphasised, thus enabling different forms of causality between output growth and export growth. The findings did not demonstrate that the variables had any

unidirectional causality. A feedback effect was observed between such variables as exports-related growth and imports-related growth. Furthermore, import-export growths demonstrated no causality. Therefore, the study confirmed that the growth of output in the economy of Portugal had the features of a small dual economy where the intra-industry trade was of limited effect on the growth of the country. In contrast, the evidence from Italy demonstrated that the country's growth was export-led. The tests of the macroeconomic variables, including a GDP index of the countries across the globe, the real exchange rate in Italy, real exports of Italy and the real GDP in Italy were conducted by Federici and Marconi (2002). The authors confirmed the export-led growth hypothesis of the country.

Export growth is often considered to be one of the major factors that assist in economic recovery (Griffith and Czinkota, 2012). However, the analysis of export lenders demonstrated that changes in the structure of the financial sector and economic recession may lead to the policy that mitigated the positive effects of exports on economic recovery. Furthermore, the findings showed that current investment policies often were concentrated on short-term returns instead of favouring a long-period market strategic position of the exporter. Lender preferences along with governmental rules that increased regulation of the financial industry significantly constrained economic recovery. Therefore, key lender and governmental rule amendments could mitigate the constraints in the industry and release the export accelerator that assists in economic recovery (Griffith and Czinkota, 2012). On the other hand, economic growth through internationalisation shall not be viewed purely as an export-led outward phenomenon. Companies contribute to economic development by becoming internationalised through shifting to import-led activities. Furthermore, inward and outward trade activities and investments are often closely related to each other (Fletcher, 2001). Empirical evidence showed that a majority of companies were

involved in inward, linked and outward international activities. The factors that predicted outward internationalisation were also able to predict inward and linked internationalisation (Fletcher, 2001).

2.2.2. Economic Growth and FDI

Trade openness and economic growth link is often explored in combination with FDI effects (Belloumi, 2014). The findings of the study showed that there was no causality from FDI to economic development, from economic growth to FDI, from trade to economic growth and from economic growth to trade in the short term. While the assumption was that FDI could generate positive spill-over effects to the host economy, the findings of a single country study were not consistent with the assumption. Therefore, it was concluded that the positive influence of FDI and trade liberalisation on economic growth was not inherent to all countries and considerable cross-country differences could exist (Belloumi, 2014). The research of Christiaans (2008) provided partial explanation for the possible differences among countries. The author explored the relations between international trade, growth and industrialisation. The study assumed a positive impact of population growth on per capita income growth. However, the assumption was alleviated by allowing for international trade. The author demonstrated that when the rate of population growth was large and the initial capital stock was small, the growth-trade linkage reversed from positive to negative. The time of the shift from autarky to free trade influenced the process of industrialisation. Trade policy affected structural change and long-term growth rates.

FDI can significantly influence economic growth through different channels. For example, the efficiency channel can be one of such ways through which FDI contribute to economic development. An analysis of European countries that was undertaken by Eller et al. (2006) showed that there was a hump-shaped influence of the FDI in the financial industry on economic

development. Medium FDI contributed to growth provided that human capital was sufficient. Above a certain threshold a crowding-out effect of local physical capital through the entry of overseas banks slowed down. The authors combined the FDI-related and the finance-related approaches to growth and demonstrated that the level and quality of FDI affected the contribution of the financial sector to economic development. However, the study was concentrated on emerging European markets (Eller et al., 2006). In contrast, the observations of Hermes and Lensink (2003) found that the level of development of the system of finance in the host economy was a significant predictor of the degree of FDI effects on economic growth. Higher degree of financial system development facilitated technological diffusion that was related to FDI. Empirical investigation of the role of the level of development of the system of finance in improving positive relations between the proxies of FDI and economic growth on a sample of over 65 countries was conducted. The study concluded that in order to ensure that FDI had positive influence on economic growth, the financial system needed to be sufficiently developed (Hermes and Lensink, 2003).

FDI, financial market and economic growth can have various links (Alfaro et al., 2004). Particularly, it was argued that countries with more developed financial systems could make use of FDI with higher efficiency. Cross-country data demonstrated that FDI alone was not able to demonstrate a sufficient impact on economic development. Nevertheless, countries that were characterised by higher degree of financial markets' development could gain substantially from FDI. The findings were robust to different proxies of the level of development in financial markets, the supplementation of the model with other factors that could determine economic growth and consideration of endogeneity (Alfaro et al., 2004). Meanwhile, the analysis of Choe (2003) that was based on a sample of 80 countries showed that FDI Granger-caused economic

development and vice versa. Nevertheless, the effects were stronger from growth to FDI than from FDI to growth. Besides, the study found that gross domestic investment did not demonstrate causal relations with economic growth, while economic development Granger-caused gross domestic investment. Furthermore, the findings demonstrated that strong positive relations between economic development and the inflows of FDI did not imply that high level of inward FDI contributed to rapid economic growth (Choe, 2003).

The influence of FDI on economic growth can be both direct and indirect. The study of Li (2005) showed that FDI not only directly promoted economic development, but also indirectly affected growth through interaction terms. The investigation took into consideration a panel data for over 80 countries and was based both on single equation and simultaneous equation methods. The interaction of FDI with human capital was responsible for the positive impact of FDI on economic growth, while the relations between FDI and the technology gap had a strong negative effect (Li, 2005). However, there can be other determinants of the degree of contribution of FDI to economic development. Wijeweeraet al. (2010) estimated the relations between FDI and GDP growth with the application of a "stochastic frontier model". The authors employed panel data that covered over 45 countries for the period from 1997 to 2004. The study showed that a positive influence of FDI on economic growth was possible only when highly skilled labour was at place. At the same time, corruption negatively affected economic growth, while trade openness contributed to economic growth through efficiency gains.

The effects of FDI can vary significantly across sectors (Alfaro, 2003). Specifically, the effect of FDI on growth in the primary, manufacturing and service sectors can be different. An empirical cross-country analysis demonstrated that total FDI had an ambiguous effect on growth. Nevertheless, FDI in the primary sector negatively affected growth, while FDI in manufacturing

had a positive effect. Evidence from the service sector was mixed. FDI can influence economic growth indirectly and exert positive effects on firms' productivity growth instead. An analysis of the UK manufacturing sector showed that spill-overs led to a positive correlation between total factor productivity of a domestic plant and the foreign-affiliate share of activity in the industry of that plant (Haskel et al., 2007).

The contributions of horizontal and vertical FDI can have different degree of impact on economic growth in developed countries (Beugelsdijk et al., 2008). Horizontal, or market seeking FDI, had a superior growth effect over vertical, or efficiency seeking FDI. The analysis of 44 host countries and the application of traditional total FDI statistics as a benchmark showed that there was no significant effect of horizontal or vertical FDI in developing countries (Beugelsdijk et al., 2008). Meanwhile, the research of Azman-Saini et al. (2010) demonstrated that FDI did not have any direct positive impact on output growth in a panel of 85 countries. Instead, the authors found that the effect was determined by the degree of economic freedom in the host economies. Therefore, countries that ensured higher level of freedom of economic activities were able to gain substantially from the presence of multinational corporations and FDI (Azman-Saini et al., 2010).

2.2.3. Economic Growth and Bioenergy

"Bioenergy contributes to many important elements of a country's or region's development including: economic growth through business expansion and employment; import substitution; and diversification and security of energy supply. Other benefits include support of traditional industries, rural diversification, rural depopulation mitigation and community empowerment".

International Energy Agency (IEA, 2003 p.5)

Biofuels initially presented themselves in the transportation sector as early as with the Henry Ford's famous Model T that was capable of running with both conventional petrol and ethanol. Apart from the energy crisis of the 1970s, when there was an increase in bioenergy production, the low petrol prices until the beginning of the new the 21st century delayed the development of biofuels. With the current environmental and socio-economical aspects governed by the energy supplies, biofuels re-entered the scene when the price of a barrel of crude oil reached 25 USD.

Bioenergy currently constitutes a small percentage of the energy supply around the globe, steadily growing in the past two decades, while it is expected to intensify due to the high fossil fuel prices and the environmental benefits that bioenergy presents. Such environmental benefits can be summarised, but not limited to: renewability, as the fossil fuel availability diminishes; cleaner burn, resulting to fewer and less harmful emissions of acid rain precursors and greenhouse gases that cause climate change; and also biodegradability, as a biofuel associated accident will not produce an environmental danger of lead and sulphur spill. The development of the bioenergy sector offers a significant opportunity to address the challenging targets on renewable energy, emission reductions and waste management, as they will be presented below in the European Commission's directives paragraph.

Categorising bioenergy

There are various types of bioenergy, or, more specifically, biofuels available today to economies. These include biobutanol, bioethanol, biomethanol, biogas, pyrolysis oils and biohydrogen. Among those biofuels that can potentially substitute traditional gas, it is valid to distinguish bioethanol and biodiesel that can both be transported in liquid form and used instead of gasoline.

As briefly mentioned in the introduction of this dissertation, biofuels are categorised in two generations: the first - also called conventional - being those deriving from food sources, such as sugar, starch, cereals and vegetable oil and the second - also called advanced - produced from sustainable feedstock of lignocellulosic biomass that is no longer useful as food source, such as municipal and industrial waste, animal manure, wine lees, switchgrass, jatropha tree etc. A third generation is the production of biodiesel from algae. The fourth generation refers to engineered crops of higher carbon storage capacity with higher biomass yields and the use of a series of physical and chemical processes for separation of H2/CH4/CO from CO2 to produce ultra clean carbon-negative fuels. A variety of production methods are used for the utilisation of biomass towards the generation of bioenergy, as presented in the figure below.

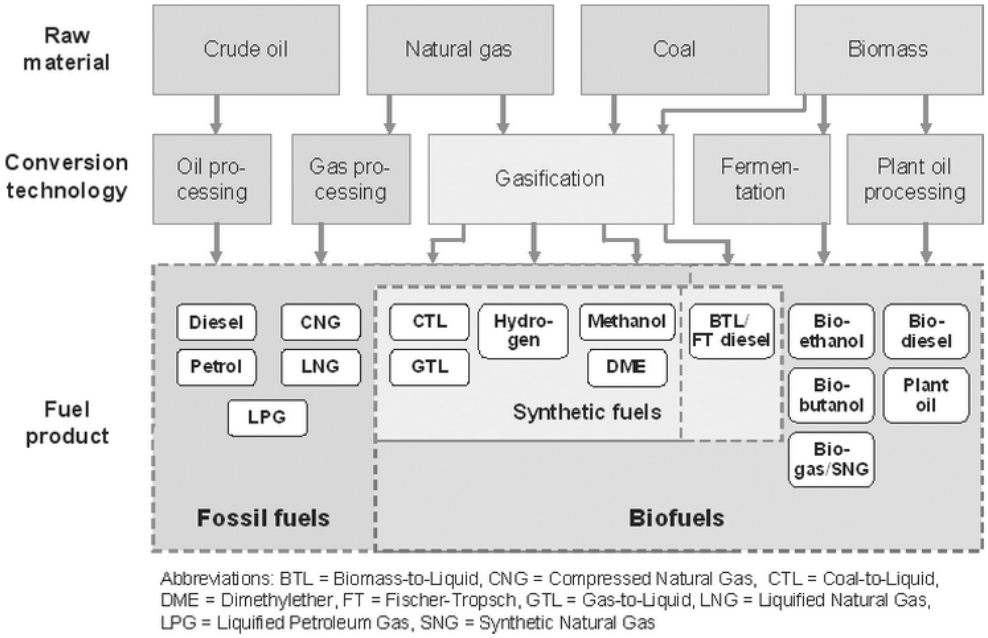

Figure 1: Methods of producing biofuels from biomass. (Festel, 2008)

Biomass has the second largest percentage[3] of renewable electricity generation in the EU-27. Sweden and Finland hold the biggest shares, while recently RES-E[4] generation from biomass increased in Denmark, Italy and the United Kingdom. Further increase of cumulative biomass capacity is expected due to large potentials in the new EU Member States (EmployRES, 2009), as presented in the figure below.

[3] The wind capacity of on-shore facilities holds the highest percentage (Employ RES, 2009).
[4] RES-E refers to the share of Renewable Energy Resource used for Electricity.

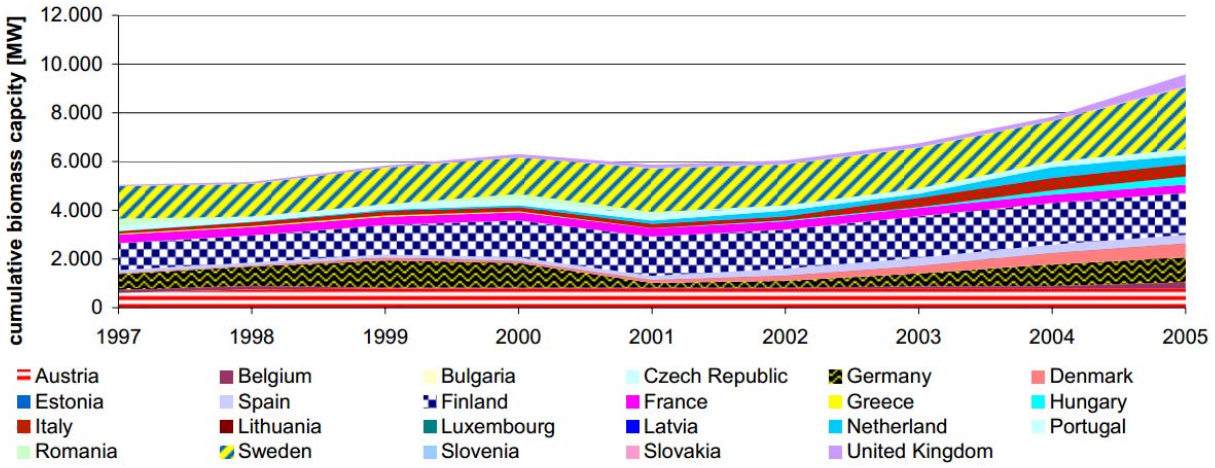

Figure 2: Historical development of cumulative installed biomass capacity in EU27 countries (Eurostat, 2014)

The debate on bioenergy and economics of biofuels

However, the production of the biofuels was also associated with particular challenges and debates in the economies. These included the debate on the environmental impacts of the first generation bioenergy that was produced using food crops. The debate concerned the trade off between food and energy and also covered the possible negative impacts of the first generation bioenergy on the environment. Given these arguments, the previous studies report that there are a limited potential for the future use of the first generation bioenergy and it is unlikely to become a serious alternative to the traditional fuels (Eisentraut, 2010). This critical attitude towards the first generation bioenergy prompted the countries to creatively investigate the production of the second generation biofuels. The latter have some advantages over the first generation bioenergy as the wastes are reduced and there is a lesser negative impact on the environment (Eisentraut, 2010).

Thus, the second generation bioenergy can play a significant role in the future economies and have a strong effect on the economic growth and development. However, in terms of land economy, there is a competition between the production of the second generation biofuels that have positive economic effects in the Eurozone and food production. This competition for the land may cause the second generation bioenergy to become unsustainable and a weak alternative to the traditional fuels (Carriquiry et al., 2011). An alteration of land allocation will lead to a shift of labour allocation as well with mobility between sectors and regions. In order to increase sustainability of bioenergy, Eisentraut (2010) suggests that newer technologies should be researched and the land use should be optimised for the production of bioenergy, with research and development towards the identification of more efficient pathways of bioenergy production from sustainable sources being in the centre of attention of policy makers. Another issue associated with the use of the biofuels and particularly the second generation bioenergy is the cost of production. According to the estimates of Carriquiry et al. (2011), the current costs of the production of bioenergy exceed the cost of diesel fuel by as much as seven times. It is also argued by Carriquiry et al. (2011) that fiscal incentives could help enhance the economic attractiveness of the alternative biofuels. It is generally accepted that if significant reduction of gas emissions is achieved through the use of the second generation biofuel technologies, they could crowd out traditional energy sources and make the Eurozone more independent and secure in terms of energy supplies. This autarky and stability would be expected to have a positive effect on the economic growth. The bioenergy technologies, currently in experimental status, have a strong potential in being environmentally sustainable. As predicted by Raneses et al. (1999), the alternative bioenergy is expected to find the largest room in the sphere of the marine industry, transportation and mining. In regards to significance of the potential effect of the

production of alternative bioenergy on the economic growth, there is no consistent position in the literature and the findings are usually mixed. Kretschmer et al. (2009) argue that the outcome will depend on the changes in technologies and regulations. They assert that both negative and positive effects on the economy could be exercised by the production of the alternative biofuels. The economic impact of one of the most popular biofuels, biodiesel for example, depends on the processes that are employed to make the fuel. The alkali-catalysed process, which uses the vegetable oil, is estimated to be one of the least costly in the production of bioenergy. However, the acid-catalysed process, which employs the waste cooking oil, is believed to be more economical since it incurs even lower production costs which allows for setting a lower price for the final refined product and yield higher returns (Zhang et al., 2003).

The cost of production is not the only factor that countries consider in choosing the alternative bioenergy instead of the traditional fuels. There are other characteristics such as how much energy can be produced by burning biofuels in comparison to the traditional fuels and the respective effects on the environment and ecology. Even with the technologies available in 2006, the production of the bioenergy is not expected to trigger a shortage in the supply of food crops for non-fuel purposes (Hill et al., 2006). It is also underlined that the greenhouse gas emissions are considerably lower when burning biodiesel than traditional fossil fuels (Hill et al., 2006). Another advantage of biodiesel in comparison to other alternative energy sources is that it requires a smaller input of food crops to produce energy. Yet, even in this case, the opportunity cost of production biodiesel associated to the lower supply of agricultural productions for food purposes. Hill et al. (2006) estimated, based on predicted demands, that even if all food crops such as soybeans and corn were employed solely for the production of biofuels rather than used as food, this supply of bioenergy would still be sufficient only to meet approximately 12% of the

total demand for gasoline. However technological upgrades, alternative sources and novel protocols for the production of bioenergy are expected to work in favour of the wider usage of biofuels to cover global fuel demand.

The effect of bioenergy on economic growth

There are significant economic benefits that could be delivered as a result of the promotion and development of bioenergy in the EU. From the perspective of a policy maker, the problem associated with - or addressed by - bioenergy is finding the optimum way of allocating public resources to achieve reduction of oil imports, GHG reduction, restructuring of agriculture policy, creation of rural jobs etc. Considering the Eurozone's performance regarding the bioenergy as an aggregate response on pollution taxes and trade regulations, a clear estimation of the response of the entire sector to a policy is difficult to be calculated, due to the complexity of the relationship of those involved: farmers, process engineers, consumers and policy makers.

Regarding the effect of biofuels on the economic growth, Demirbas (2009) argues that besides the cost of production and energy security, another factor to be considered is the creation of new jobs in the sector, adding to investments and contributing to infrastructure. Energy security as well as the aforementioned environmental factors of the global change of the climate can trigger even further changes in the energy policy of the countries of Eurozone. Furthermore the development of alternative biofuels will depend on the level of the spending on research and development, new technologies and policy regimes. Newer technologies can reduce costs of the alternative bioenergy making this type of fuels even more attractive to countries. Traditional fuels such as gas and oil impose serious risks such as environmental impacts through global climate change, volatility or uncertainty of prices of fuels, scarcity of resources and

concentration. The use of the biofuels can reduce such risks for the countries and this could be reflected in the positive effects on the economic growth in the long run (Gunatilake et al., 2014).

Reddy et al. (2008) argue that the main drivers of the growth of the production of alternative biofuels is the worldwide increases in the oil prices and geo-political issues (Reddy et al., 2008). Both emerging and advanced economies pay much attention to the regulations that encourage the production of the first and second generation biofuels. These regulations create a favourable foundation for public and private investments in the technology related to the bioenergy and the respective research and development. Reddy et al. (2008) also evidenced a significant positive effect of the production of bioenergy on the development and growth of the agricultural sector. Thus, there are also positive economic effects of the implementation of the first and second generation biofuels in additional to the traditional sources of energy (Asif and Muneer, 2007). In conclusion to the section on bioenergy and biofuels, it is valid to note that while these alternative sources of energy have a potential to provide greater energy security and even reduce total costs of production, they also have issues that can trigger negative effects on the economy. For example, an increase in the production of the biofuels can cause a food crisis that would result in the decline of the agricultural industry and negative repercussions for the whole economy (Demirbas, 2008; Rosegrant, 2008). Yet, on the positive side, the production of biofuels reduces the risks associated with the employment of traditional fossil fuels thus helping the countries to enhance economic growth.

An economic investigation of the impacts of biofuels requires an approach of the impact on the local input demand and another on the global energy supply, both approaches complimenting each other. Since the effect of bioenergy in the economic growth of the Eurozone will be discussed in the following chapters, effects on small scale will be masked. A series of economic

questions arise at each of the stages of bioenergy production: biomass feedstock production through cultivation; feedstock conversion to energy; distribution of end product fuels; and respective bioenergy consumption.

Eurozone's timeline on bioenergy

The importance of renewable energy (Figure 4) and more specifically bioenergy in the Eurozone is, for the reasons discussed above, high. Bioenergy use may shape land-use policies, as their production competes with other agricultural activities for land and labour that are both finite, while also their promotion and economical and technological feedback action may affect the supply of conventional fuels, resetting the power balance between fossil fuel producing countries, versus these producing bioenergy.

Since 2001, when in the "Communication on alternative fuels for road transport" the European Commission identified biofuels as potential future transport fuel, bioenergy has been in the focus of the agenda. In 2003 the EU adopted the Biofuels Directive (2003/30 EC), targeting at 2% of bioenergy usage in 2005 and 5,75% in 2010 and also in 2003 the energy taxation directive (2003/96 EC) allowed de-taxation of biofuels. In 2005 the Commission presented the "Biomass Action Plan" and a year later the "EU strategy for biofuels", that served as a revision of the 2003/30 EC directive, while in 2007 the "Road Map for Renewable Energy in Europe" was published the constant increase in bioenergy production (Figure 3) in the EU27 that lead to intensification of the planning. The European Commission's "Common Energy From Renewable Sources Targets" were established in the Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amended and subsequently repealed the previous 2001/77/EC and 2003/30/EC directives. The Horizon 2020 goals were set to at least 20% less GHG emissions, that could reach a 30% if a

global agreement is achieved, as scheduled in the post Kyoto era; an increase of 20% in energy efficiency and a 20% of energy needs coverage by renewable energy resources. Regarding the renewable resources, it refers to 10% of renewable in transportation and at least a 14% of biofuels in the total energy usage of 2020.

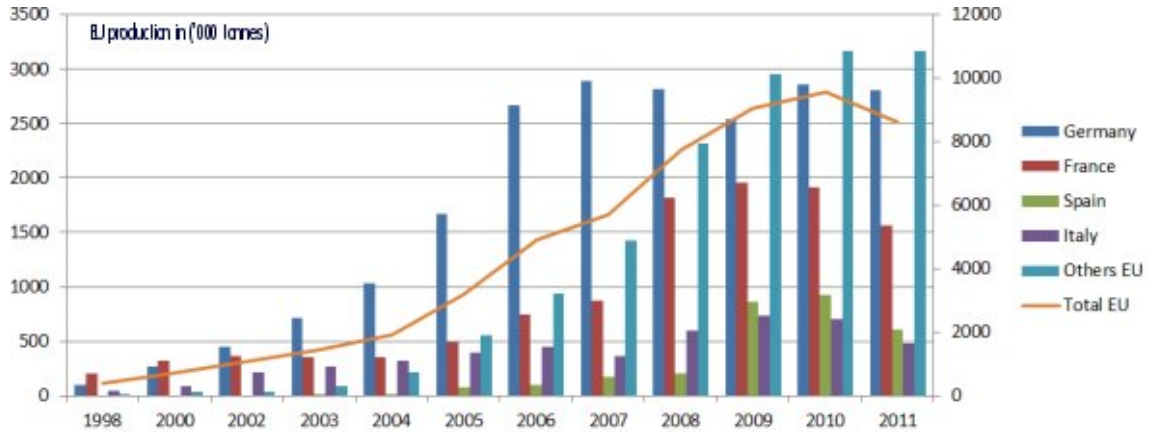

Figure 3: Total EU27 biodiesel production for 2010 was over 9.5 million metric tons, an increase of 5.5% from the 2009 figures. (EBB, 2014)

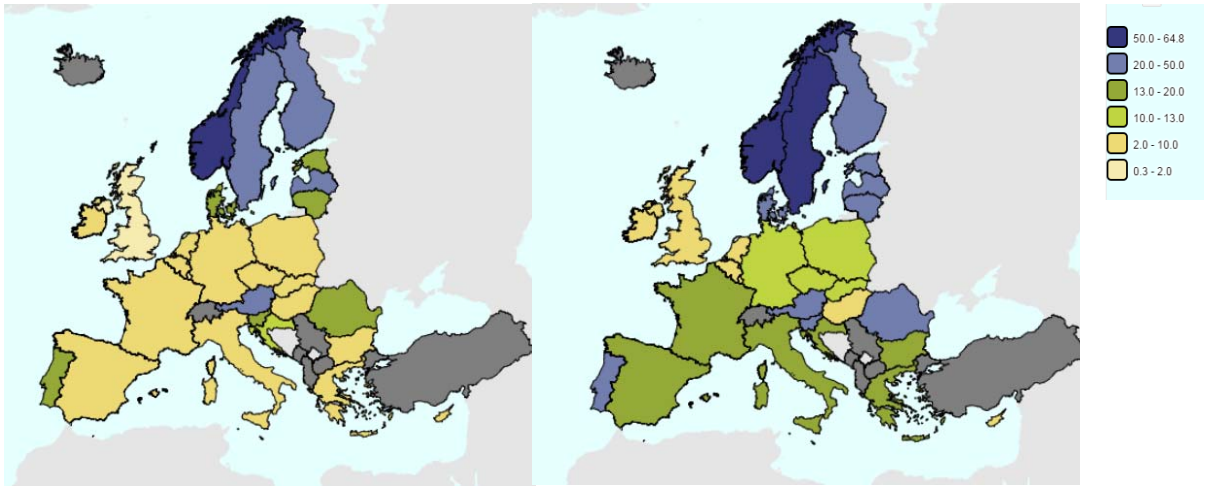

Figure 4: Share of renewable energy in gross final energy consumption of 2005 (left) and 2012 (right) presented as a percentage on the heat map. *(Ragwitz, 2006)*

Policy Implications

For the targets set in the Horizon 2020 to be met, biofuel production should be promoted from policy makers, as will have long term positive effects on environmental factors as well as the economic growth, as discussed in this thesis. Along with the intervention designed in the European Biofuels Technology Platform of "Horizon 2020", a policy harmonisation needs to be considered. Climate change is strongly highlighted in the political agenda in an international framework and since biofuels offer a large potential of replacing petroleum fuels, while in parallel decreasing GHG emissions and providing local and regional benefits, such as energy security and rural development, their promotion should be considered.

Regarding the future of bioenergy in Europe, in the sectors of electricity, the realisable midterm potentials up to 2020 are not expected to increase for the 2030 goals, as a saturation of the bioenergy growth will become apparent due to limitations of domestic resources and the presumed limitation of alternative imports from abroad, as presented in the figure below.

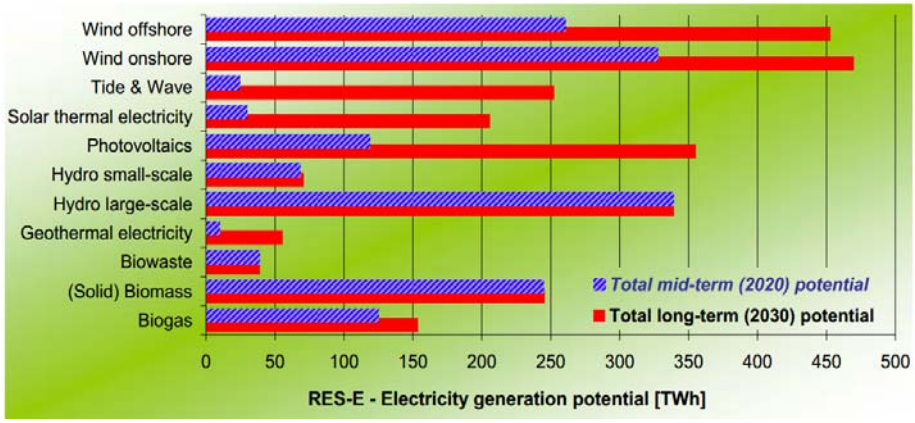

Figure 5: Total realizable potentials (2030) and achieved potential for renewable energy sources for electricity generation (RES-E) in EU-27 countries on technology level. (Ragwitz, 2006)

At the current R&D state, there is a dependence of bioenergy on government support to compete with fossil fuels at the marketplace. An overview of the complex web of international energy policies is given in the Policy Research Working Paper 4341 (Rajagopal et al., 2007), in excising tax credit for biofuels, renewable fuel standards and mandatory blending, carbon footprint tax, ethanol vehicles, as well as farm and trade policies and governmental funding for R&D.

Related to agriculture is the relationship between biofuels and international trade. A major motivation for biofuel is that they will raise farm income, which will have attendant political and economic benefits. But such gains may not be realized when domestic production competes with imports that are cheaper. This is the reason biofuel crops like other agricultural goods are also subject to barriers in the form of duties, quotas, and bans on imports. The rationale for such protection could be environmental regulations, as well as the need to support domestic farmers; enabling the development of a domestic infant industry and keeping food prices low. An obvious effect of trade barriers is to prevent the best biofuel from entering the market. In this case, tariffs should be imposed on the economically and environmentally superior biofuel, in a way that by reducing the volume of trade, welfare could actually be enhanced. One instance where this can be true is when biofuel production has environmental externalities that are not taken into account. Biofuels will also affect trade by reducing food surpluses in developed countries, which will reduce both food exports and food aid. This will allow farmers in poor importing countries to receive higher prices, which can be an opportunity to increase productivity, especially in those countries.

2.2.4. Other Determinants of Economic Growth

Internationalisation can have indirect effects on economic growth not only through FDI, export and import, but also through other channels, including knowledge output, structural change and competition (Mayer and Ottaviano, 2008). Regarding the European manufacturing firms for instance, a large fraction of 77% is engaged in at least one mode of internationalisation: exporter, importer, outsourcer, outsourcee or FDI maker (Altomonte, 2014). In another example, an analysis of the performance of Italian companies was undertaken by Giovanetti et al. (2013). The authors measured performance by the firms' propensity to export and showed that performance was determined both by geographical and institutional features along with firm individual characteristics. The analysis of internationalised companies demonstrated that both firms and province heterogeneity shaped the estimated results. The structural changes can be a response to internationalisation. Specifically, the institutional structure of production can determine firms' performance (Bertolini and Giovanetti, 2006).

The effects of internationalisation on knowledge output were analysed by Pittiglio et al. (2009). The authors collected qualitative information about Italian manufacturing companies and applied a probit model in the econometric analysis. The findings showed that companies that were active in international market were able to generate more knowledge than their counterparts that sold solely in the national market. The authors concluded that internationalisation led to the employment of more knowledge inputs, for example led to higher innovation expenditures. Besides, internationalisation could contribute to innovation due to better access to a larger number of ideas from outside sources (Pittiglio et al., 2009). Different factors can influence economic and innovative performance of companies. The analysis of Italian manufacturing firms showed that exporters had moderate innovative performance between non-internationalised and

internationalised companies (Castellani and Zanfei, 2007). Multinational corporations with a weaker focus on foreign markets had a higher degree of productivity than exporters, but they did not innovate more than highly internationalised firms. Heterogeneity in productivity was robust to controlling for such factors as innovation outputs and inputs. This implied that the differences in economic performance were not determined by different innovative activities. The degree of internationalisation could be a strong channel of accumulation of knowledge (Castellani and Zanfei, 2007). More recent data by Altomonte et al. (2013) on European manufacturing firms, showed a positive and strong correlation between the extent of involvement of firms on both international and innovation activities. In particular, firms that export their goods and/or have set up factories abroad are, on average, also more likely to have invested into in-house research, introduced new IT solutions, or adopted new management practices. The linkage between internationalisation and innovation is bidirectional, as almost all innovating firms import and more innovative firms source more foreign products (Boler et al., 2012). Altomonte et al. (2014) constructed a measure of internationalisation intensity, defined as the number of internationalisation modes in which a firm is simultaneously involved and innovation intensity, defined as the number of innovation modes in which a firm is simultaneously involved. As the pyramidal structure of the figure below shows, innovation and internationalisation intensities are positively correlated, while the number of highly international and highly innovative firms is low. A similar pyramidal structure appears in the employment to innovation correlation, offering evidence that higher intensities are also associated with better firm performance, as measured by the employment status, that is the size of the firm.

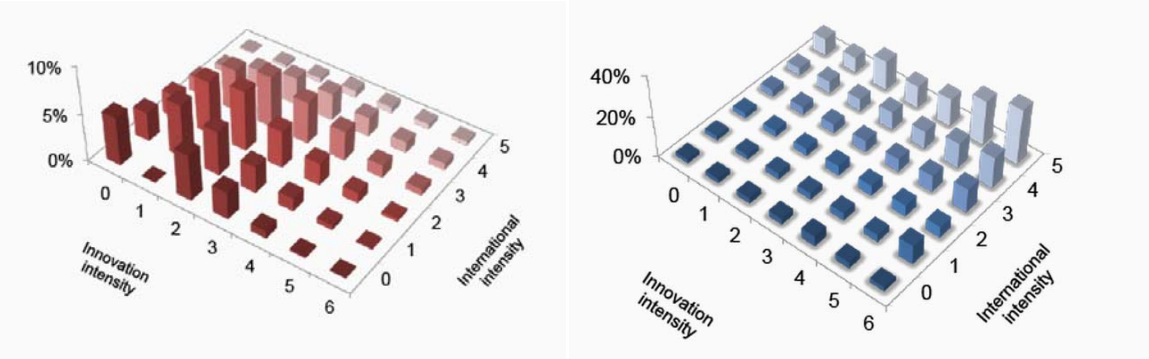

Figure 6: Innovation and internationalisation share of firms (left) as compared to the share of employment by intensities (right). (Altomonte, 2014)

Other factors, including gross fixed capital formation, labour or savings can affect economic development of a country along with trade openness and FDI. For example, technology that can be measured through information and communication technology capital accumulation can affect output growth, as suggested by the study of Colecchia and Schreyer (2002). An analysis of OECD countries showed that communication technology contributed to economic growth, while the contribution increased in the 1990s. The positive association between telecommunication infrastructure and economic development in the long run across OECD countries was also confirmed by the study of Datta and Agarwal (2004). Similar observations were obtained by Roller and Waverman (2001), but the authors also found that a critical mass of telecommunications infrastructure significantly enhanced the positive causal link between telecommunications and economic growth. In that direction, technology centres supporting knowledge-intensive services, demonstrate a positive association between the use of such services and exportation, especially in a R&D intensive firm operating manner (Martinez-Gomez et al. 2009). Czenich et al. (2011) demonstrated the effect of broadband infrastructure on economic growth in a panel of OECD countries, when an increase of 10 percentage points in broadband penetration raised annual per capita growth by 0.9-1.5 percentage points.

The relations between savings and growth are positively correlated, although it is suggested that the correlation is based on the fact that high growth determines high savings (Carroll et al, 2000). Barro and Sala-i-Martin (2004) agreed that the growth of output depends not only on productivity growth, but also in capital accumulation. They showed that growth in physical capital accounted for a large share of the growth in output, even in developed countries. However, according to traditional growth models consumers with forward-looking aspirations with standard utility tend to save less since they know they will be able to become richer in the future. The research of Aghion et al. (2006) explored the ability of saving to contribute to economic growth. The authors constructed a model where growth was determined by innovations that allowed local sectors to be in line with the frontier technology. In order not to lag behind the frontier industries, firms could require an overseas investor who had higher experience with the technology. Besides, a local bank could play a role by monitoring local projects on the technology adaptation. Under these circumstances local savings contribute to innovation and, consequently, growth, as the domestic bank co-financed projects and attracted foreign investment. However, in the industries close to the frontier companies had competence with the technology and had no necessity to attract local investment and therefore, local savings did not matter for growth (Aghion et al., 2006). Gourichas (2013) discussed that in a closed economy, a successful mobilization of national savings would lead to growth, although his model left the question between savings and growth open.

Labour force and human capital is another factor that may contribute to economic growth. The empirical study of Wang and Yao (2003) showed that economic growth could be based on human capital stock. The findings demonstrated that human capital considerably contributed to growth and welfare. After the inclusion of human capital variable, the growth of total factor

productivity positively affected GDP growth. Therefore, human capital accumulation and productivity growth should be taken into consideration by regulators (Wang and Yaom 2003). The observations about the effects of labour force on economic growth are mostly based on the example of Asia that demonstrated rapid growth in the past decades (Bloom and Finlay, 2009). Such human-capital based growth is also demonstrated in the models of Perla and Tonetti (2014), as well as of Perla et al. (2014). Stokey (2014), however demonstrated a higher effect of technology in earning in the case of R&D investments, compared to the case of human capital investments. His observations are in agreement with the technology-driven growth literature of Atkeson and Burstein (2007). Along with trade openness, high savings rates, macroeconomic policy, and human capital accumulation, demographic change contributed to the growth of the region. Demographic transition could be related to economic growth through the changes in labour force (Bloom and Finlay, 2009).

2.3. Summary of Literature Review

Regarding the research methods used, the main finding from the literature review chapter are summarised in the following table that provides a database for research methods employed, previous results and future prospects that could enhance the research.

Table 1: Summary of Literature Review

Author	Year	Methods	Results	Prospects/Implications
Belloumi	2014	Time series regression, Granger causality	No impact of FDI and trade on growth	Cross-country analysis
Clark et al.	2013	Difference-of-logs models	Trade centrality contributes to GDP	Effects of trading partners
Falvey	2012	GMW regression	Trade liberalisation promotes GDP	More data for the analysis of crisis periods
Shahbaz	2012	Generalized forecast error variance decomposition	Trade openness promotes growth	Cross-country analysis
Tekin	2012	Granger causality	No relationship between trade openness and growth	Larger sample
Wijeweerae t al.	2010	Panel data model for SFM	FDI promotes growth only through skilled labour; Trade openness promotes growth through efficiency gains	Developing countries need to improve education level and encourage FDI

Author	Year	Methods	Results	Prospects/Implications
Azman-Saini et al.	2010	GMM system estimator	FDI does not have direct impact on growth	Effects of the degree of economic freedom on the impact of FDI on growth
Haskel et al.	2007	Weighted regression	FDI produces positive spillovers to growth	Differences between the channels of productivity spillovers; differences between the modes of FDI activity
Eller et al.	2006	Panel regression	Financial sector FDI promotes growth	Broader efficiency channels beyond financial sector FDI
Aghion et al.	2006	Panel regression	Domestic savings promote growth	Analysis of other variables; cross-country analysis
Schneider	2005	Panel and OLS regressions	Stock of physical capital promotes GDP	Collecting more data on R&D for developing countries
Balaguer et al.	2004	Granger causality	Exports promotes growth	Cross-country analysis
Alfaro et al.	2004	Cross-section regression	FDI contributes to economic growth	Costs of policies to attract FDI vs promote local conditions
Yanikkaya	2003	OLS, SUR, 3SLS	Restrictions on trade promote GDP	Country-level differences
Choe	2003	Panel VAR model, Granger causality	FDI causes economic growth	Associations between FDI and GDI

The analysis of the literature demonstrates that the majority of scholars applied regression models in their investigations. This underlines the reliability of the method and implies that the regression models are most appropriate for the investigation of the determinants of economic growth. The literature provided mixed results in terms of the effects of trade openness, FDI or other factors on the pace of economic development. The differences could be explained by the analysis of different samples and the selection of different proxies for growth and trade by the researchers. The investigation of the limitations and recommendations for future studies that were found in the literature indicate that the majority of studies could be expanded by enlarging the sample. Data availability is one of the limitations that are inherent to most of the investigations. The limitations include insufficient sample sizes or the focus on a single country. Nevertheless, a cross-country comparison could ensure a deeper understanding of the determinants of economic growth and specifically the effects of trade liberalisation, trade openness and FDI on GDP.

3. Methodology

The current chapter is focused on the methodology of the research, as it explains the philosophy, approach, design, data, variables, methods, and limitations of the study. The chapter discusses the relevant methodology and compares it to the alternative approaches to the study in order to justify the selected methods.

3.1. Philosophy

During a research it is important to construct a philosophical position and orientation towards the process. A paradigm and philosophy that is defined in the current research is positivism, as opposed to interpretivism. This implies high degree of rationality during the investigation. The philosophy of positivism is often associated with scientific research (Saunders et al., 2009). Observable reality is the basis of the investigation and law-like generalisation are the result of the study. One of the peculiarities of the philosophy of positivism is the fact that the research is conducted in a value-free way. This means that the researcher is external to the process of data collection. The analysis of data on economic growth dictates the inability of the researcher to influence the substance of the data from statistical databases. However, it can be argued that the researcher affects the process of investigation by selecting variables and applying particular models during the analysis. Nevertheless, in contrast to the philosophy of interpretivism, the researcher is value free. Furthermore, interpretivism would have required a particular degree of empathy on behalf of the researcher, while the present analysis does not allow for researcher's deep involvement into the substance of the subject. Instead, the focus on facts, causality and fundamental laws is required in the investigation of the relations between internationalisation and economic growth. Phenomena are reduced to their simplest elements, while hypotheses are

formulated and tested. The researcher is an objective analyst who undertakes the study that is based on quantifiable observations and consequent statistical analysis (Armstrong, 2010).

3.2. Approach

The study follows the deductive approach that is most often associated with scientific research (Saunders et al., 2009). Deduction means that a theory is tested using the selected research methods. Scientific research implies that laws are the basis of explanation of the phenomena that are explored. Appropriate theories of economic growth allow for anticipation of phenomena, prediction of their occurrence and according control. Thus, the approach suggests that hypotheses are deduced from the theories of economic growth. The hypotheses are the predictions about the relations between particular variables. The equations of the model express the hypotheses in operational terms and illustrate how the variables are to be measured. Then the analysis is conducted and the operational hypotheses are tested. The outcomes may either confirm or reject the theory and, consequently, may lead to the necessity to modify the theory (Saunders et al., 2009; Guajarati, 2003). In contrast, induction would have implied that the theory should be developed after data assessment. Nevertheless, induction is more appropriate for the sample qualitative data. Besides, it is associated with the risk to arrive at no useful theory. Deduction is considered to be the appropriate approach to the investigation of the relations between internationalisation and economic growth as it allows for explanation of the causal relations between variables. The controls allow for testing of the hypotheses as the research is based on a highly structured methodology. Quantitative measure of the concepts means that the phenomena are operationalised and allow for reductionism and generalisation (Bryman and Bell, 2011).

3.3. Design

One of the advantages of quantitative research is the ability of the analysis to provide a logical explanation of the observations. Furthermore, the explanation is delivered in the form that can be effectively communicated to others. This strengthens the confidence of the researcher in the outcomes. The present analysis is to provide a quantified correlation between the according variables of internationalisation and economic growth. Quantitative research allows for testing and validating existing theories about the relations between different phenomena. The hypotheses can be constructed before data collection, while the findings can be generalised on the basis of random samples. Besides, quantitative research implies that the researcher is able to construct a situation that eliminates the impact of some variables. This allows for testing the outcomes and establishing robust cause and effect relations. The application of precise numerical data means replicability, as other academic scholars are able to obtain the same results provided that they apply the same statistical method. Secondary research is undertaken, as the data is collected from external sources, including World Bank (2014) and OECD (2014). Secondary research normally includes several steps, such as identification of relevant sources of information, gaining access to the sources, estimating the suitability of the sources and data for the purposes of the study, as well as estimating the quality of the data. No original data is collected in the secondary research, and the reliability of the data that is analysed is ensured by the quality of the sources of data. Secondary data allows for the analysis of the information of a higher quality and ensures comparative and contextual data. The major advantages of secondary research include resource efficiency, capacity for estimation, and potential for comparative time-series analysis. The disadvantages can be related to the misalignment of purpose, concerning the different purposes for data selection and data evaluation. However, the collection of appropriate

data and the selection of relevant variables for the analysis under investigation allow for mitigating this limitation. Quality concerns are addressed by the selection of reliable sources (Collins, 2010). Longitudinal analysis that is undertaken herein implies the comparison of findings across time to reveal possible trends and patterns. External secondary data is used in the study, as the statistics from the Eurozone are explored. Finally, secondary research addresses the limitation of data access (Saunders et al., 2009).

3.4. Data and Methods

The investigation is based on the data from World Bank (2014) and OECD (2014) database. The study covers the period from 1991 to 2013 for the countries that belong to the Eurozone and the relations between internationalisation and economic growth of the eighteen countries of the Eurozone are explored. Data availability was subject of course to the entry date of each country to the Eurozone, as adopted on January 1st of each year presented in the following table. Lithuania that currently belongs to the Eurozone entered in January 2015, so it is not included at all in the model.

Table 2: States adopted in the Eurozone as of January 1st of the respective year until 2014

State	Date adopted	State	Date adopted
Austria	1999	Italy	1999
Belgium	1999	Latvia	2014
Cyprus	2008	Luxemburg	1999
Estonia	2011	Malta	2008
Finland	1999	Netherlands	1999
France	1999	Portugal	1999
Germany	1999	Slovak Republic	2009
Greece	2001	Slovenia	2007
Ireland	1999	Spain	1999

The list of variables used in the research is provided in the following table.

Table 3: List of Variables as sourced from the World Bank (2014) and the OECD (2014)

Variable (Abbreviation)	Definition	Expected Effect	Source
GDP Growth (GDP)	Annual growth rate of real output		OECD
Openness (OPENNESS)	(Imports+Exports)/GDP	+	World Bank
FDI (FDI)	FDI/GDP	+	World Bank
Capital (CAPITAL)	Annual growth rate of gross fixed capital formation	+	World Bank
Labour (LABOUR)	Unemployment rate	-	OECD
Technology (TECH1)	Internet Users per 100 people	+	World Bank
Technology (TECH2)	R&D Expense as % of GDP	+	World Bank
Savings (SAVINGS)	Household Savings as percent of GDP	-	World Bank
Credit (CREDIT)	Credit Provided to Private Sector	+	World Bank
Human Capital (HC)	Tertiary School Enrollment Ratio	+	World Bank
Inflation (INF)	Growth rate of consumer price index	+	World Bank
Industrial Production (IND)	Industry value added growth rate	+	World Bank

The panel regression analysis is applied to test the relations between the listed variables. The dependent variable is economic growth; the independent variables include trade openness and FDI; while the control variables are gross fixed capital formation, labour force, technology, credit, inflation, industrial production, human capital and savings rate. The control variables are added to the model to take into consideration the exogenous factors in accordance with the neo-classical economic growth theory (Gujarati, 2003).

Two hypotheses (H1 and H2 below) have been deducted from the growth theories and are tested in the research (Farvey, 2012; Aghion, 2006; Alfaro, 2004; Yanikkaya, 2003; Choe, 2003).

H1: Openness to trade positively affects the country's economic growth[5].

H2: Foreign direct investments positively affect the country' economic growth.

The study is conducted using the method of econometric modelling. Neo-classical growth model reviewed in Chapter 2 are quantitative and allow for establishing the relationships between the economic variables using linear regressions. The factor of internationalisation is represented by two variables, namely the openness of trade and FDI. The former is calculated as follows:

$$Openness = \frac{(Imports+Exports)}{GDP} \qquad (6)$$

FDI are represented as a percentage growth rate. In addition to these variables related to internationalisation, the econometric growth model should control for other exogenous factors based on the Solow-Swan growth model and the Harrod-Domar model. These control variables include technological development, unemployment rate, human capital, credit, inflation,

[5] Eurozone is a compact cluster of countries, so for a linear regression model, openness is a good representation of trade.

industrial production, savings rate and gross fixed capital formation growth rate. These variables are collected from several databases that include World Bank (2014) and OECD (2014).

The econometric model is represented by the following equation:

$$Y_{ij} = \alpha + \beta_1 Openness_{ij} + \beta_2 FDI_{ij} + \beta_3 Capital_{ij} + \beta_4 Labour_{ij} + \beta_5 Tech_{ij} + \beta_6 Savings_{ij} + \beta_7 Credit_{ij} + \beta_8 HC_{ij} + \beta_9 Inf_{ij} + \beta_{10} Ind_{ij} + \varepsilon_{ij}, \quad (7)$$

where Y is the growth rate of real GDP; i defines the country and j the year from the panel data.

The ordinary least squares linear regression is one of the most popular prediction techniques that are applied in statistics and economics. However, when running the method in the context of the panel data, there could be limitations such as the inability to capture correlations between the country term and the independent variables. For this reason, the Hausman test that differentiates between a fixed effects model and a random effects model in panel data, is run to choose between random and fixed effects panel regression models to achieve the highest efficiency. The model is then improved by introducing instrumental variables- to free the model from biased[6] or inconsistent estimates- and by running a structural equation model estimated with the generalised method of moments (GMM)[7].

In the second part of the analysis the effects of bioenergy production on economic growth of the countries are explored. The data on bioenergy production is collected from the Energy Information Administration (EIA, 2014). However, the data for biofuels production is available

[6] An estimator is unbiased if the expected value is equal to the true value.

[7] The three methods of parameter estimation, are the least squares, the maximum likelihood, and the generalized method of moments. In the method of moments, there is an analogy principle, in which the sample moments try to duplicate the properties of their population counterparts. The advantage lies in the fact that the GMM estimators are known to be consistent, asymptotically normal and efficient (Hansen, 1996).

only for 15 countries of the Eurozone over the period 2000-2011. This limits the number of observations of the model.

$$Y_{ij} = \alpha + \beta_1 FDI_{ij} + \beta_2 Capital_{ij} + \beta_3 Savings_{ij} + \beta_4 HC_{ij} + 5Inf_{ij} + \beta_6 Bio_{ij} + \varepsilon_{ij}, \quad (8)$$

where Bio is total biofuels production in thousand barrels per day.

The biofuels model tests the following hypothesis:

H3: Biofuels production positively affects the country's economic growth (EmployRES, 2009).

3.5. Limitations

One of the limitations of the study is the variables that are selected for the investigation. The time period runs from 1991 to 2013, but some data is not available for that time frame. In particular, data about biofuels' production is available starting from the year 2000 and for 15 countries of the Eurozone. Additionally, for countries that entered the Eurozone after 2000, there are missing values until their entry date. For some other variable, technology for example, data is represented by two proxies and there is also the case of a few missing observations. The problem of missing values can be dealt with in several ways. Imputation approach replaces missing values with predicted values (Schafer, 2002). The information from the existing and complete variable is used to fill in the variables that are missing. The imputation is based on the information from the observed data. A missing observation that lies in between two available observations was estimated as the arithmetic average of the latter. This allowed for smoothing the data with missing values, and this did not break the overall trend in the data observed. If several missing observations are present in a row, it could be reasonable to replace them with zeros to retain the balanced structure of panel data (Baltagi, 2006; Arellano, 1990).

Such limitations imply that future studies can improve the findings of the present research by undertaking an alternative investigation with different variables.

4. Analysis and Discussion

The economic analysis of the Eurozone is conducted in Eviews (2014) and Microsoft Excel. Graphical instruments as well as econometric modelling are used to present the results and findings and provide their interpretation. These results are then discussed in the context of the growth theories reviewed in Chapter 2. Descriptive statistics of the data is presented. Furthermore, diagnostic tests are performed to test the estimated results and address adequate measures to correct the estimates when necessary.

4.1. Presentation of Variables

The balanced panel data constructed for this research contains 414 observations for each variable. The descriptive statistics for the economic indicators in the Eurozone are reported in the following table.

Table 4: Internationalisation Descriptive Statistics

	OPENNESS	CREDIT	FDI	GDP	SAVINGS	CAPITAL
Mean	1,059	90,287	46,378	2,176	4,262	1,984
Median	0,990	88,665	0,000	2,375	4,905	1,915
Maximum	3,340	305,090	2.841,630	12,230	79,450	61,410
Minimum	0,000	0,000	-1.084,090	-32,120	-100,000	-63,940
Std. Dev.	0,600	57,013	297,574	4,094	19,359	10,414
Skewness	1,083	0,749	5,404	-2,155	-1,935	-0,484
Kurtosis	4,918	3,936	43,695	16,869	14,160	9,989
Jarque-Bera	144,409	53,801	30.582,710	3.638,631	2.406,788	858,791
Probability	0,000	0,000	0,000	0,000	0,000	0,000
Sum	438,560	37.379,010	19.200,560	900,690	1.764,310	821,320
Sum Sq. Dev.	148,592	1.342.462,000	36.571.158,000	6.923,356	154.787,500	44.790,650
Observations	414	414	414	414	414	414

	IND	INF	TECH1	TECH2	HC	LABOUR
Mean	1,226	4,624	34,730	0,933	43,682	8,296
Median	1,440	2,515	31,715	0,630	46,945	7,700
Maximum	19,990	243,270	93,960	3,940	113,980	25,200
Minimum	-49,560	-4,480	0,000	0,000	0,000	0,000
Std. Dev.	6,444	14,275	30,118	0,972	25,342	4,585
Skewness	-2,009	12,925	0,296	0,822	-0,174	0,812
Kurtosis	15,396	199,879	1,645	2,805	2,346	4,115
Jarque-Bera	2.929,258	680.156,900	37,729	47,296	9,477	66,963
Probability	0,000	0,000	0,000	0,000	0,009	0,000
Sum	507,590	1.914,200	14.378,380	386,410	18.084,170	3.434,500
Sum Sq. Dev.	17.149,760	84.161,590	374.637,600	390,410	265.238,400	8.683,543
Observations	414	414	414	414	414	414

The mean and median values for each variable are both the measures of central tendency of data. The mean of the sample shows the average value of every variable. The median of the variable is

the central value observed after rearranging the variable from the lowest to the highest. The greatest differences between the mean and the median values are observed for FDI and inflation. The average economic growth in the Eurozone during the period from 1991 to 2013 was 2,18%. The average annual growth rate of FDI constituted as much as 46% but this indicator was much more volatile than economic growth. It is also interesting to observe that the economic growth in the Eurozone countries was higher than the average annual growth rate of industrial production. The countries of the Eurozone are found to be actively involved in international trade, which is evidenced by the trade openness. The average openness is higher than 1. This means that the sum of imports and exports on average is equal to the GDP of the Eurozone. The region also had a relatively high unemployment rate of 8,3% on average during the period from 1991 to 2013. The region is also characterised by moderate inflation of 4,6% on average and low savings rates that were on average 4,26% of GDP.

The descriptive statistics also include the maximum and minimum values for each of the variables to show extreme points. Standard deviation estimates the spread of the values around the mean. Skewness and kurtosis measure the characteristics of the probability distribution of the variables. A symmetric distribution implies that there is no skewness. Extreme observations in tails of the distributions lead to non-normal distribution, while 'fatness' in the tails of the distribution is referred to as excess kurtosis. Jarque-Bera statistics measures the normality of the distribution of the series by estimating the difference of the kurtosis and skewness of the series from the normal distribution. The null hypothesis of the Jarque-Bera is that the data has normal distribution. The sample of economic data provides evidence that all variables are non-normal. The problem of high asymmetry, measured with skewness, is observed in inflation rate and FDI growth rate. In regards to technological development, it can be observed that the number of

internet users (TECH1) increased to almost 94% with the historical average indicator of 35% or 35 internet users for 100 people. The countries of the Eurozone spend on average less than 1% of GDP on research and development whereas the average annual growth rate of total credit to the private sector reaches 90%.

4.2. Fixed and Random Effects Regressions

The initial panel regression was originally estimated using the pooled method and after this the fixed and random effects were tested. The summary statistics of the pooled regression is presented in Table 5.

Table 5: Internationalisation Pooled Regression Summary Statistics

R-squared	0,783	Prob(F-statistic)	0,000
Adjusted R-squared	0,777	Mean dependent var	2,176
S.E. of regression	1,933	S.D. dependent var	4,094
Sum squared resid	1501,320	Hannan-Quinn criter.	4.,230
Log likelihood	-854,105	Durbin-Watson stat	1.,574
F-statistic	131,984		

R-squared of the model is 0,78. The R-squared value indicates the fit of the regression line to the actual data and hence the ability of the model to forecast the values of the dependent variable in the sample. Under standard settings, R-squared indicates the fraction of the variance of the economic growth that is explained by the explanatory variables. The value of 1 implies 100 per cent and shows that the regression is perfectly fit, while zero indicates that the fit is no better than the simple mean of the dependent variable. In the current model, the R-squared indicator can be interpreted as a sign that the independent variables are able to explain 78 per cent of the variation in the economic growth of the Eurozone.

Standard error (S.E.) of the regression shows a summary estimation that is based on the measured variance of the residuals. F-statistics is derived from a test of the hypothesis that the

slope coefficients in the model are equal to zero altogether. The test does not take into account the constant or intercept coefficients. Probability F-statistics indicates the significance of the F-test. The p-value of the test in the current model is close to zero. Therefore, the null hypothesis of the F test is rejected. This means that it is impossible to conclude that all factors of the economic growth are insignificant in this model.

The Durbin-Watson statistics estimates the serial correlation in the residuals. A large deviation of the value from 2 would indicate the existence of serial correlation. A positive serial correlation is generally found for values less than 2. The current value of Durbin-Watson statistics is 1,57, so it can be suggested that the problem of serial correlation is of minor concern. This is not surprising because the research employs panel data in which there are 18 cross-sections. In such cases, the instance of serial correlation would be rare (Wooldridge, 2010).

The estimated parameters of the pooled regression are shown in Table 6.

Table 6: Internationalisation Pooled Regression Parameters

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0,961	0,357	2,695	0,007
CAPITAL	0,125	0,013	9,714	0,000
CREDIT	0,002	0,002	1,178	0,240
FDI	0,000	0,000	0,675	0,500
HC	0,012	0,005	2,661	0,008
IND	0,335	0,023	14,563	0,000
INF	-0,032	0,008	-4,119	0,000
LABOUR	-0,027	0,023	-1,176	0,240
OPENNESS	0,810	0,182	4,459	0,000
SAVINGS	0,013	0,006	2,316	0,021
TECH1	-0,017	0,004	-4,361	0,000
TECH2	-0,117	0,116	-1,006	0,315

The results indicate that gross fixed capita formation, human capital, industrial production, inflation, trade openness, savings and technology represented by internet users have a statistically significant impact on the economic growth of the Eurozone. The estimated coefficients show the sensitivity of the dependent variable in regards to the changes in the respective independent variable. The standard errors show the deviations of the estimated parameters. Thus, the standard error determines the statistical reliability of the estimates of the coefficients. Larger values of the standard error imply that there is more statistical noise in the coefficient estimates and therefore less reliability. The standard errors of the measured coefficients are the square roots of the diagonal units of the coefficient covariance matrix. The t-

statistics shows the ratio of an estimated coefficient to its standard error. The t-statistics applied are to test the null hypothesis that an individual coefficient equals zero. The probability value is applied to interpret the t-statistics. The probability draws a t-value as extreme as the actually observed value. Furthermore, this is conducted under the assumption of normal distribution of the errors, or of the asymptotical normal distribution of the estimated coefficients. The p-value allows for testing the hypothesis that the actual coefficient is zero. Using the 5 per cent significance level, it has been detected that gross fixed capita formation, human capital, industrial production, inflation, trade openness, savings and technology represented by internet users had the parameters that differed from zero significantly. The p-value that is lower than 0,05 shows that the null hypothesis is rejected and the estimated coefficients are not zero for these variables.

Whereas these seven variables were found to be statistically significant, the signs of the coefficients were different than those predicted. This means that these variables had different effects on economic growth. For instance, an increase in the gross fixed capital formation, human capital, industrial production, trade openness and savings had a positive effect on economic growth whereas inflation and technology had a negative effect. The latter findings are inconsistent with the initial expectations. The problems could be found in the model specification. The estimated pooled regression did not consider specific country or period effects. In order to test whether these effects are actually present, the fixed and random effects panel regressions are run and the Hausman test is employed to select which of these models should be treated as optimal.

The next table provides the output of the fixed and random effects models.

Table 7: *Internationalisation Fixed and Random Effects Regressions*

Variable	Fixed Effects	Random Effects	Pooled Regression
C	2,117** (0,866)	1,112*** (0,407)	0,961*** (0,357)
CAPITAL	0,109*** (0,014)	0,121*** (0,013)	0,125*** (0,013)
CREDIT	-0,010*** (0,004)	0,000 (0,002)	0,002 (0,002)
FDI	0,000 (0,000)	0,000 (0,000)	0,000 (0,000)
HC	0,015** (0,007)	0,014*** (0,005)	0,012*** (0,005)
IND	0,300*** (0,027)	0,332*** (0,024)	0,335*** (0,023)
INF	-0,042*** (0,009)	-0,035*** (0,008)	-0,032*** (0,008)
LABOUR	-0,070* (0,039)	-0,039 (0,026)	-0,027 (0,023)
OPENNESS	0,456 (0,420)	0,835*** (0,221)	0,810*** (0,182)
SAVINGS	0,016** (0,007)	0,013** (0,006)	0,013** (0,006)
TECH1	0,003 (0,016)	-0,017*** (0,004)	-0,017*** (0,004)
TECH2	-0,206 (0,228)	-0,062 (0,130)	-0,117 (0,116)
R-squared	0,822	0,767	0,783
Adjusted R-squared	0,798	0,761	0,777
Durbin-Watson stat	1,646	1,602	1,574
F-statistic	33,612	120,398	131,984

* significant at 10% ** significant at 5% *** significant at 1%

The results of the random effects model and the pooled regression are very close and provided similar evidence on significance of the variables. This is explained by the fact that both the pooled regression and the random effects regressions do not assume that there is a correlation

between the period or country terms and the independent variables. The results of the fixed effects regression are different. It is evidenced that the internationalisation variables such as FDI and trade openness are not statistically significant. Among the control variables, significant positive effects on economic growth were exhibited by industrial production, gross fixed capital formation, human capital and savings. The unemployment rate, inflation and growth of credit provided to the private sector are found to produce a significant negative effect on the economic growth of the countries in the Eurozone according to the fixed effects model. The same evidence is provided by the R-squared that shows a better fit for the fixed effects regression. However, in order to make a more informed decision, the Hausman test is run. The results are presented in the next section.

4.3. Diagnostic Tests

In order to run the Hausman test, the model had to be estimated with the cross-sectional and period random effects[8]. The null hypothesis of the test is that these random effects are significant and the fixed effects model is not optimal. The test statistic follows the chi-square distribution.

Table 8: Internationalisation Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	20,308	11	0,041
Period random	18,927	11	0,062

The results of the Hausman test reject the null hypothesis for both the cross-sectional and period random effects. Thus, the fixed effects model is considered optimal for our case study. However, among eleven predictors there could be strong correlations that would distort the results. This problem is known as multicollinearity that is investigated.

The next table provides the results of the multicollinearity testing conducted by estimating the correlation coefficients among explanatory variables.

[8] A true null hypothesis, specifies the random effects estimator as consistent and efficient, while the fixed effects estimator as consistent and inefficient. For a rejected null hypothesis, the random effects estimator is inconsistent, as compared to the consistent fixed effects estimator.

Table 9: Internationalisation Multicollinearity Test

	CAPITAL	CREDIT	FDI	HC	IND	INF	LABOUR	OPENNESS	SAVINGS	TECH1	TECH2
CAPITAL	1,00	-0,16	0,08	0,01	0,66	-0,10	-0,08	0,12	0,32	-0,17	0,03
CREDIT	-0,16	1,00	0,06	0,17	-0,07	-0,19	-0,07	0,11	-0,06	0,33	0,22
FDI	0,08	0,06	1,00	0,01	0,08	0,00	-0,05	-0,06	0,02	-0,02	0,03
HC	0,01	0,17	0,01	1,00	0,07	-0,08	0,27	-0,22	0,01	0,23	0,37
IND	0,66	-0,07	0,08	0,07	1,00	-0,40	-0,04	0,11	0,40	-0,06	0,11
INF	-0,10	-0,19	0,00	-0,08	-0,40	1,00	0,08	0,05	-0,10	-0,17	-0,15
LABOUR	-0,08	-0,07	-0,05	0,27	-0,04	0,08	1,00	-0,22	-0,03	-0,20	-0,05
OPENNESS	0,12	0,11	-0,06	-0,22	0,11	0,05	-0,22	1,00	0,24	0,20	0,02
SAVINGS	0,32	-0,06	0,02	0,01	0,40	-0,10	-0,03	0,24	1,00	-0,07	0,07
TECH1	-0,17	0,33	-0,02	0,23	-0,06	-0,17	-0,20	0,20	-0,07	1,00	0,44
TECH2	0,03	0,22	0,03	0,37	0,11	-0,15	-0,05	0,02	0,07	0,44	1,00

Multicollinearity can exist in a model when independent variables in the regression are related to each other. This leads to the inappropriateness of the estimated results, as the significance of the independent variables cannot be tested due to the invalid test statistics (Guajarati, 2003). Independent variables may provide identical or redundant information in explaining the independent variable. The issue of multicollinearity is associated with the data of the regression

and not with the predictive model. This means that the independent variables can cause multicollinearity (Belsley, 2005). The perfect fit of the data is often a preliminary indicator that there could be an issue of multicollinearity. Multicollinearity does not imply any violation of assumptions. Therefore, all statistics that are obtained in the model are valid. However, the problem with the data could mean that the appropriate estimation of the partial coefficients is not possible. A partial coefficient can be defined as the effect of amending one variable while other variables are held constant. An existence of linear relationship between some variables would mean that it is impossible to change one variable holding the other variable constant (Freund et al., 2010).

The highest correlation is observed between industrial production and gross fixed capital formation that represents investments. Both of these correlated variables are found to be statistically significant. Thus, the final fixed effects regression model will be improved by removing industrial production to avoid the problem of multicollinearity.

The estimated coefficients are best linear unbiased estimators and this assumption does not depend on the normality of distribution of the residuals. However, the t-tests of the coefficients and the total model goodness of fit are related to the normality of the residuals. This means that if the residuals are not distributed normally, the results of t-statistics and F-statistic can be inaccurate. The histogram of the residuals can reveal the issue of non-normal distribution of the residuals. The plotted distribution may have fatter tails or may be tightly concentrated around zero in comparison to the prediction of the normal distribution (Kao, 1999; Jarque et al. 1980). Besides, the distribution can be skewed to either of the directions. The results of the normality test are presented in Figure 1.

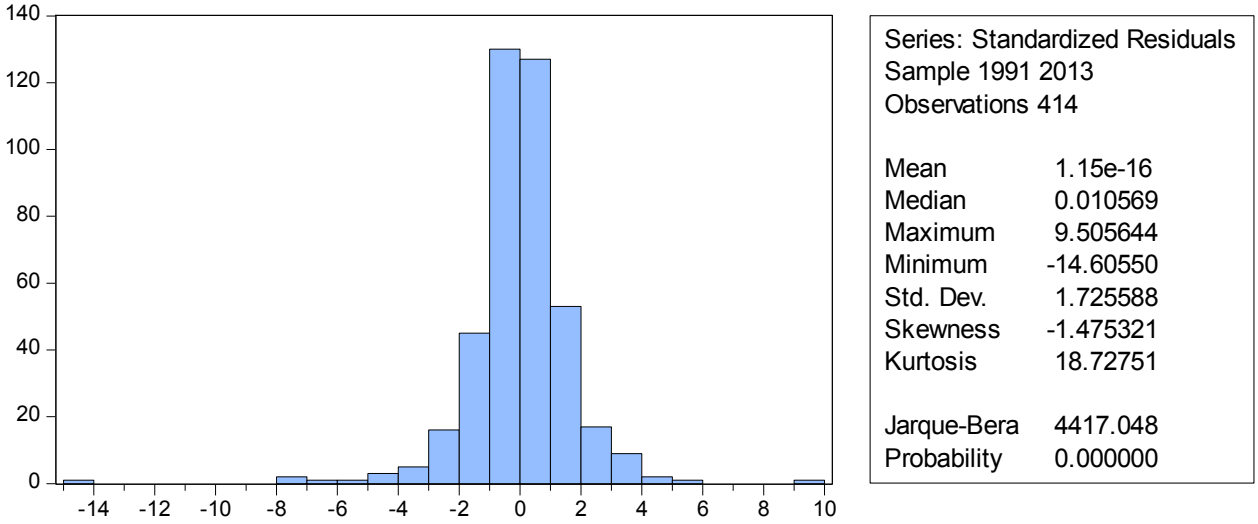

Figure 7: Normality of Residuals' Distribution

The normal distribution of the residuals normally results in a bell-shaped histogram. Furthermore, the Jarque-Bera statistics shall be insignificant to confirm the hypothesis of normal distribution. The histogram of the present model shows some non-normal distribution of the residuals. Often the issue of non-normality can be caused by some extreme residuals. Such observations are present in the tails of the distribution and lead to large value of kurtosis. The outliers that are detected in the model can be removed to enhance the normality of the residuals' distribution. However, the present model is based on a limited number of observations. The removal of outliers from the model would decrease the number of observations. This is considered to be undesirable for the regression, as the overall strength of the model can be reduced. Therefore, the issue of non-normal distribution of the residuals of the model is ignored (Kennedy, 2003).

4.4. Dynamic Panel Regression with Instruments

After the use of the backward elimination procedure to remove the least significant variables and after removing the correlated industrial production, the final model was estimated with fixed effects.

The summary statistics of the final model is presented in the next table.

Table 10: Internationalisation Final Fixed Effects Model Summary Statistics

R-squared	0,754	Prob(F-statistic)	0,000
Adjusted R-squared	0,724	Mean dependent var	2,176
S.E. of regression	2,150	S.D. dependent var	4,094
Sum squared resid	1706,064	Hannan-Quinn criter.	4,644
Log likelihood	-880,569	Durbin-Watson stat	1,574
F-statistic	25,646		

The final regression statistics shows a strong fit of the model, as R-squared and adjusted R-squared values are over 75 per cent. This means that over 75 per cent of the variation in the GDP growth rate in the Eurozone can be explained by the selected independent variables. The F-test is found to produce a statistically significant value indicating that the null hypothesis that all predictors are zero is rejected.

The estimated coefficients of the adjusted fixed effects model are shown in the following table.

Table 11: Internationalisation Final Fixed Effects Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1,183	0,461	2,568	0,011
CAPITAL	0,198	0,020	9,749	0,000
FDI	0,001	0,000	1,863	0,063
HC	0,019	0,010	1,943	0,053
INF	-0,086	0,018	-4,668	0,000
SAVINGS	0,033	0,007	4,658	0,000

The results are somehow consistent with the findings of the initial regression. Capital is found to be a significant variable that determines the GDP growth in the Eurozone. The growth of the fixed capital formation is found to have a positive effect. The coefficient indicates that an increase in Capital by 1 percentage point (pp) leads to a change in GDP growth by 0,2 pp. Meanwhile, the trade openness that was used along with FDI as a proxy for internationalisation was found to be insignificant at the 5 per cent significance level and was removed from the model during the backward elimination procedure. Even though FDI remain in the final model, it is not possible to consider this variable as a statistically significant determinant of economic growth in the Eurozone at the 5% significance level.

Therefore, the primary conclusion of this research is that the GDP growth in the Eurozone is not determined by FDI and trade openness.

However, the economic growth is found to be positively affected by the savings of households. This is explained by the fact that the more people save, the more they can invest. Inflation is found to have a detrimental effect on the economic growth of the Eurozone. This may be

explained by the argument that higher inflation discourages investments due to the rise in the opportunity cost of capital. Human capital had a statistically significant positive effect on the economic growth in the initial pooled regression and it can still be considered significant in the final model. This finding is consistent with the endogenous growth theory.

The fixed effects regression failed to account for an assumption that the past economic growth can determine future output. This limitation is addressed by running the dynamic panel regression using the Arellano-Bond technique. The parameters are estimated with the generalised method of moments (GMM). The results are shown in the following table.

Table 12: Internationalisation Arellano-Bond Dynamic Panel Regression with Instrumental Variables

Instrument specification: C CREDIT INF SAVINGS LABOUR CAPITAL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	1,741	0,190	9,150	0,000
C	-0,826	2,159	-0,383	0,702
FDI	-0,012	0,017	-0,682	0,496
OPENNESS	-0,238	2,673	-0,089	0,929
R-squared	-2,060	Mean dependent var		2,272
Adjusted R-squared	-2,084	S.D. dependent var		3,945
S.E. of regression	6,928	Sum squared resid		18814,620
Durbin-Watson stat	1,979	J-statistic		5,295
Instrument rank	6,000	Prob(J-statistic)		0,071

The list of the instrumental variables is comprised of the credit, inflation, savings, unemployment rate and growth of fixed capital, that although may be highly correlated to the independent variables, they are uncorrelated contemporaneously (at the same point in time), or are independent of the equation and the measurement of the error terms[9]. The independent variables are represented by only FDI and trade openness, the two measures of internationalisation. The evidence from the dynamic GMM regression supports the final conclusion from the fixed effects regression that internationalisation does not have a statistically significant effect on the economic growth of the Eurozone. Yet, the dynamic panel regression also revealed that the previous economic growth affected future output.

4.5. Bioenergy and GDP Growth Model

The bioenergy and GDP growth model explores the effects of biofuels production on economic growth in the selected Eurozone countries. The most appropriate model across the pooled, fixed effects and random effects regressions is selected and several diagnostic tests are performed in order to determine the possible limitations of the models.

In the current section the analysis is focused on the investigation of the effects of biofuels production on economic growth in the countries of the Eurozone. The following table presents the descriptive statistics of the sample that shows the daily production of all biofuels measures in thousand barrels.

[9]In the case of the strong assumption of the independent variables and the errors to be independent, the estimators are unbiased and consistent. In the case of the less strong assumption of contemporaneously uncorrelation, the estimators are consistent but may be biased, so if the sample size would increase infinitely they would converge to their true values. If they are contemporaneously correlated, the estimators are biased, as well as inconsistent and instrumental variables are used to obtain consistent estimators (Guajarati, 2003).

Table 13: Production of Bioenergy (in thousand barrels per day). Descriptive Statistics

	AUSTRIA	BELGIUM	CYPRUS	FINLAND	GERMANY	GREECE	IRELAND	ITALY
Mean	3,64	4,07	0,06	1,59	38,52	0,82	0,41	9,27
Median	2,00	0,26	0,02	0,31	46,90	0,48	0,03	9,00
Maximum	8,70	15,20	0,20	5,90	65,30	2,40	1,40	16,60
Minimum	0,40	0,00	0,00	0,00	4,30	0,00	0,00	1,60
Std. Dev.	3,45	5,81	0,08	2,14	26,13	0,92	0,56	5,34
Skewness	0,48	0,99	1,11	0,95	-0,21	0,43	0,88	0,03
Kurtosis	1,53	2,34	2,69	2,35	1,25	1,62	2,09	1,57
Jarque-Bera	1,54	2,19	2,53	2,03	1,62	1,33	1,97	1,02
Probability	0,46	0,33	0,28	0,36	0,44	0,51	0,37	0,60
Sum	43,7	48,8	0,7	19,1	462,2	9,9	4,9	111,2
Sum Sq. Dev.	131	371	0	51	7512	9	3	314
Observations	12	12	12	12	12	12	12	12

	LUXEM-BOURG	MALTA	NETHERLANDS	PORTUGAL	SLOVAKIA	SLOVENIA	SPAIN
Mean	0,00	0,01	2,80	2,07	1,71	0,11	10,09
Median	0,00	0,00	0,43	0,81	1,45	0,10	8,20
Maximum	0,00	0,04	13,60	6,00	4,00	0,40	24,00
Minimum	0,00	0,00	0,00	0,00	0,00	0,00	1,60
Std. Dev.	0,00	0,02	4,47	2,42	1,59	0,13	7,80
Skewness	NA	0,86	1,54	0,51	0,39	1,12	0,73
Kurtosis	NA	2,25	4,00	1,60	1,57	3,28	2,15
Jarque-Bera	NA	1,76	5,24	1,49	1,32	2,56	1,42
Probability	NA	0,41	0,07	0,48	0,52	0,28	0,49
Sum	0,0	0,1	33,6	24,8	20,5	1,3	121,1
Sum Sq. Dev.	0	0	219	65	28	0	670
Observations	12	12	12	12	12	12	12

The analysis is limited to 15 countries, as the data on biofuels production is not available for other countries. Furthermore, the research covers the period over 2000-2011 due to the limitation of data availability. No data on biofuels production prior to 2000 is available. Therefore, the research includes 12 observations for each of the 15 countries. Table 13 includes the most prominent descriptive statistics for the sample. Particularly, the table demonstrates that the

largest daily biofuel production belongs to Germany with the maximum value of 65,3 thousand barrels per day, followed by Spain (24,0 thousand barrels) and Italy (16,6 thousand barrels). Jarque-Bera values are relatively low for every country, suggesting that the values are normally distributed. Skewness and Kurtosis values are also within the normal limit.

Table 14 presents the results of the pooled, fixed and random effects models of the regression with the variable of biofuel production. The final regression of the economic growth based on the independent variables including Capital, FDI, HC, INF, and Savings is supplemented with the BIO variable that represents daily biofuel production for the sample of 15 countries over the period 2000-2011.

Table 14: Bioenergy Pooled, Fixed, and Random Effects Models

Variable	Pooled Regression	Fixed Effects	Random Effects
C	2,511 ** (0,013)	1,368 (0,173)	2,153** (0,033)
CAPITAL	10,046*** (0,000)	9,655*** (0,000)	9,944*** (0,000)
FDI	0,508 (0,612)	0,744 (0,458)	0,612 (0,541)
HC	-0,917 (0,361)	-0,109 (0,913)	-0,652 (0,515)
INF	3,927*** (0,000)	3,003*** (0,003)	3,572*** (0,001)
SAVINGS	4,071*** (0,000)	3,887*** (0,000)	4,013*** (0,000)
BIO	-1,611 (0,109)	-0,933 (0,352)	-1,361 (0,175)
R-squared	0,596	0,634	0,595
Adjusted R-squared	0,582	0,587	0,581
Durbin-Watson stat	1,881	2,016	1,943
F-statistic	42,622	13,744	42,429

* significant at 10% ** significant at 5% *** significant at 1%

The above table indicates that the significance of the variables did not change compared to the final model of internationalisation and economic growth. Specifically, the significant variables are Capital, INF, and Savings in all three models. In the meanwhile, BIO is not significant in either of the models. The R-squared and adjusted R-squared values of all the models are higher than 0,58, demonstrating that the models are able to explain over 58 per cent of the variation of the dependent GDP variable. The Durbin-Watson statistics of all three models is close to 2, implying that the issue of serial correlation is not observed in the pooled, fixed effects and random effects models.

In order to test the validity of the three models and to determine the most appropriate model among the fixed effects and random effects models the Hausman Test is performed. The results of the test are presented in Table 15.

Table 15: Bioenergy Model Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1,156	6	0,979

The p-value of the Hausman Test is 0.979, implying that the null hypothesis for the cross-cross-sectional random effects is confirmed. Thereby, the research finds that the random effects model is considered to be the most optimal[10].

[10]As economic growth stems from the institutional qualities of each country, a different disturbance error term is respective to each data point, representing the combined influence on economic growth of the errors for each country and for each year.

The issue of multicollinearity can exist between the independent variables. Strong correlation between the variables would imply a bias in the outcome of the model. The following table presents the results of the multicollinearity test for the predictors of the biofuel model.

Table 16: *Bioenergy Model Multicollinearity Test*

	CAPITAL	FDI	HC	INF	SAVINGS	BIO
CAPITAL	1	0,073	0,012	0,217	0,457	-0,038
FDI	0,073	1	0,027	0,069	-0,047	-0,102
HC	0,012	0,027	1	-0,034	-0,030	-0,231
INF	0,217	0,069	-0,034	1	0,167	-0,188
SAVINGS	0,457	-0,047	-0,030	0,167	1	-0,042
BIO	-0,038	-0,102	-0,231	-0,188	-0,042	1

The above table indicates that the issue of multicollinearity does not exist in the regression. The correlation values between the variables are low and never exceed 0,46 (correlation between Savings and Capital). Therefore, the research concludes that the bioenergy model does not suffer from the problem of multicollinearity.

The figure below presents the test of the normality of the distribution of the residuals of the model. The normal distribution of the residuals leads to a bell-shaped histogram, while the insignificance of the Jarque-Bera statistics would indicate the normal distribution.

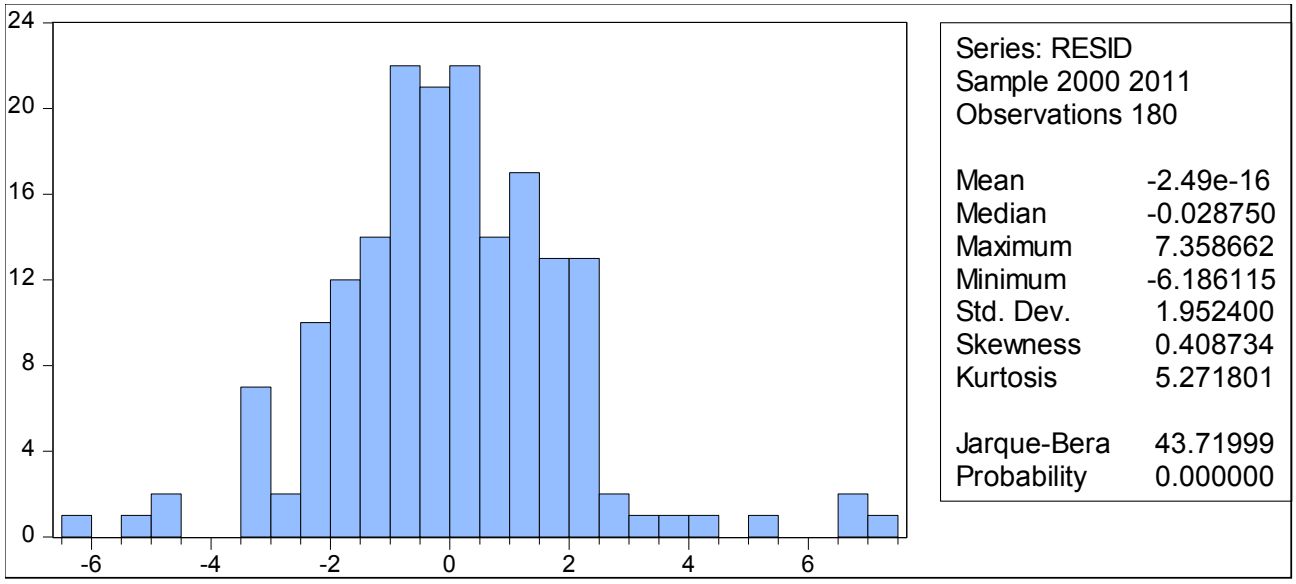

Figure 8: Bioenergy Model Normality of Residuals' Distribution

The above figure suggests that the distribution of the residuals is not normal, since the p-value of the Jarque-Bera statistic is significant. Nevertheless, the biofuel sample is limited to 12 years of observations and to 15 countries only. This implies that the model is based on a limited number of observations. In the meanwhile, the problem of the non-normality of residuals' distribution can be caused by the presence of the outliers in the data. The limited number of observations suggests that it would be inappropriate to remove the outliers. Thereby, the research suggests that it would be relevant to ignore the problem of non-normal distribution of the residuals.

The results of the final biofuels regression model are included in Table 17. The table presents the coefficients, standard error, t-statistics and p-values of the variables.

Table 17: Bioenergy Final Random Effects Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1,113	0,517	2,153	0,033
CAPITAL	0,199	0,020	9,944	0,000
FDI	0,000	0,000	0,612	0,541
HC	-0,005	0,007	-0,652	0,515
INF	0,330	0,092	3,572	0,001
SAVINGS	0,040	0,010	4,013	0,000
BIO	-0,020	0,015	-1,361	0,175

The table indicates that three predictor variables are significant in determining the changes in GDP. Specifically, the significant variables are Capital, INF and Savings. All three significant variables are positively related to GDP. The growth of Capital by 1 pp implies the growth of GDP by 0,199 pp, the growth of INF by 1 pp leads to the GDP increase by 0,33 pp and the growth of Savings by 1 pp leads to the increase in GDP by 0,04 pp. In the meanwhile, the model rejects the hypothesis that BIO is positively correlated with GDP, implying that the production of biofuels does not contribute to economic growth in the selected Eurozone countries.

Table 18 includes the statistics of the final biofuels regression model.

Table 18: *Bioenergy Final Random Effects Model Summary Statistics*

R-squared	0,595	Mean dependent var	1,592
Adjusted R-squared	0,581	S.D. dependent var	3,008
F-statistic	42,429	Sum squared resid	655,091
Prob(F-statistic)	0,000	Durbin-Watson stat	1,943

The R-squared and adjusted R-squared values indicate that the selected predictor variables are able to explain over 58 per cent of the variation of the dependent variable. Meanwhile, p-value of F-statistic is 0, implying the good fit of the model. The Durbin-Watson statistics indicates the absence of the problem of serial correlation, as the value of the statistics is close to 2.

The results of the bioenergy model indicate that daily production of biofuels does not contribute to economic growth of the selected countries. The significant variables correspond to the findings of the initial model of internationalisation and economic growth, as the positive significant effect is found to the variables that represent annual percentage growth of Gross Fixed Capital Formation, annual percentage growth of consumer prices inflation, and gross domestic savings in current US dollars.

5. Conclusions and Recommendations

Conclusions are made on the basis of the discussion. The original aims and objectives of the research are addressed and final recommendations for future studies are provided.

5.1. Discussion

The major findings of the study indicate that gross fixed capital formation is significant in explaining the GDP growth in the Eurozone. Meanwhile, the openness to trade is not statistically significant and does not explain much of the economic growth. The observations reject both hypotheses of the study. The hypothesis that openness to trade positively affects the economic growth of the Eurozone is not confirmed, as the p-value of the t-statistic associated with the parameter for trade openness was too high and the coefficient was not considered different from zero. The second hypothesis stated that FDI positively affected the Eurozone economic growth. This hypothesis was also rejected, as the variable that represented inward FDI was not statistically significant at the 5% level and hence it could not explain the changes in the GDP growth rates in the Eurozone.

The findings of the present study are in line with the classical economic theory that assumed that labour productivity and saving were important factors that contributed to economic growth (Sardadvar, 2011). However, technological progress was not found to be a significant determinant of the economic growth, and this observation contradicts the Solow-Swan model (Foley, 1999). The Harrod-Domar model stated that the savings rate was a significant factor that explained economic growth, and this assumption was confirmed by the current investigation. Besides, the neo-classical exogenous growth models assume internationalisation to be an important determinant of economic development, while the variables that represented

internationalisation in the current study were not found to be significant for GDP growth. FDI did not influence the growth of output as suggested by the endogenous growth theories (Zheng et al., 2006).

The observations on the inability of trade openness to influence economic growth contradict the findings of Yanikkaya (2003). However, it can be assumed that the effects of openness to trade on growth may not be straightforward. The outcomes of empirical tests often depend on the proxies that are applied to measure the openness to trade. Furthermore, the study of Yanikkaya (2003) was focused on developing economies, while the current research was devoted to the developed countries of the Eurozone.

The research of Wacziarg and Welch (2008) found strong cross-country differences with regard to the effects of trade openness on growth. The authors applied liberalisation as a proxy for trade openness and their general findings showed that liberalisation was positively associated with economic development. Possibly due to the different proxies and to the country samples, the conclusions of the current study contradict the findings of Wacziarg and Welch (2008).

Trade openness and growth was also recently explored by Clark and Mahutga (2013) and the authors found positive relations between the variables. However, the study applied the trade centrality concept to measure openness to trade and distinguished between trading with isolated partners in the periphery and integrated partners. The observations of the present research found no positive association between trade openness and growth. Meanwhile, Falvey (2012), showed that economic conditions in the country of interest can significantly influence the outcomes of empirical studies. Although the author applied trade liberalisation as the proxy for openness to trade, it was found that the increase during crisis and non-crisis periods and the types of the

crises could distort the effects of trade liberalisation and lead to insignificant effects of the variable on economic growth (Falvey, 2012).

The effects of technology and FDI on economic growth were confirmed by the study of Schneider (2005), as the author explored developing countries. Nevertheless, foreign technology was strongly related to GDP, while FDI effects showed mixed results. These observations contradict to the current study, as neither technology nor FDI were found to be significant drivers of economic growth in the case of the Eurozone. The difference can be explained by the focus on different regions. This dissertation employed the sample of developed economies rather than a set of developing countries. At the same time, the current research confirmed the findings of Eris and Ulasan (2013) that demonstrated the absence of relations between trade openness and economic growth. The study included different proxies for trade openness, and the present research findings were in line with the conclusions.

In contrast to the observations of Shahbaz (2012), the research did not provide strong evidence of the effects of trade openness on economic growth. Various econometric approaches were applied by the author. Nevertheless, the conclusions of Tekin (2012) were confirmed, as the authors also found no significant causality relation among the variables of trade openness and economic growth. Although the findings were related to a sample of African countries, the evidence from the Eurozone corresponds to the observations. Meanwhile, these conclusions contradicted the findings of Beck (2002), who showed that trade and economic growth were correlated. The author's study was devoted to developing countries and it was concluded that economies with higher level of financial sector development benefited from higher degree of exports and trade balance. The observations from the Eurozone that can be considered to be a region with a developed financial sector were not in line with these conclusions.

The present observations were in contrast to the findings of Balaguer and Cantavella-Jorda (2004), who showed that in Spain exports promoted economic growth. Although the current research did not focus on the structural transformation in export composition, it showed that the variable of trade openness that was constructed on exports was not a significant determinant of GDP growth. The differences can be explained with the help of the findings of Chang et al. (2009). The authors demonstrated that the relations between economic growth and trade openness depended on structural characteristics and appropriate reforms. Furthermore, the authors showed the effects of additional moderator variables, such as labour market flexibility, financial depth and infrastructure.

The conclusions of the present research confirmed the findings of Ramos (2001). The author showed that there were no unidirectional causality between the variables of imports, exports and growth. However, the author studied the role of imports in the causality between exports and output, whereas the present research studied the mutual effects of exports and imports on economic growth. In contrast to the results of the present research, Federici and Marconi (2002) showed that the economic growth of Italy was export-led. At the same time, the study included a range of alternative variables, including the real exchange rate, real exports, real GDP and global GDP index. A more recent study that covered the relationship between exports and GDP in Italy from 1863 to 2004 from Pistoresi and Rinald (2012) demonstrated that exports were an important driver of economic growth that created a chain reaction effect on improving employment rates, capital formation and the expansion of internal demand.

The importance of exports for economic growth was explored by Griffith and Czinkota (2012). The findings of the study provided some possible explanation to the discrepancies between the present study and the conclusions of other authors about the positive effects of trade on growth.

The research illustrated that changes in the structure of the financial section and economic conditions can mitigate the effects of exports on economic growth. At the same time, Fletcher (2001) argued that the relations between internationalisation and economic growth shall not be viewed purely as an export-led phenomenon. In line with these statements, the present research included the proxy of trade openness that included both imports and exports values. Moreover, inward and outward activities can often be closely associated.

The conclusions of the present study confirm the findings of Belloumi (2014) who showed that there were no relations between FDI, economic growth and trade. Belloumi's research was based on single country data and the assumption that FDI could affect economic growth through spill-over effects was not confirmed. The observation of the absence of the positive effect of FDI and trade liberalisation on economic growth was confirmed by the present dissertation, while the author also assumed that cross-country differences could exist in this regard as there were significant fixed effects. However, the study was focused on the cross-country differences within the Eurozone and not with developing countries. This limitation was addressed by Christiaans (2008) who showed that the relations between international trade and growth were moderated by the rate of population growth. The current research did not include the population variable to test the observations. Furthermore, Christiaans showed that initial capital stock and trade policy influenced growth rate in the long-term. Partially in line with the argument, the current research found that gross fixed capital formation was a significant determinant of economic growth.

The effects of FDI on economic growth through different channels were studied by Eller et al. (2006) and the authors showed that FDI could affect economic development. The study was concentrated on European countries and the associated channels included human capital and quality of FDI. While the current study found no impact of FDI on economic growth, Eller et al.

showed that the effects could depend on the level and quality of FDI. This could explain the differences in the conclusions of the current research and other studies.

Furthermore, the study of Hermes and Lensink (2003) showed that the degree of financial development of the recipient economy significantly affected the level of FDI impact on economic growth. In contrast to the conclusion about a greater impact of FDI on growth in a highly developed financial system, the present study showed no influence of FDI on GDP growth in the Eurozone at the 5% significance level. The argument that in order to capture the positive effects of FDI on economic growth, the financial system needed to be sufficiently developed was not supported by the present investigation as all analysed countries were developed.

The conclusions about the relations between the level of financial system development, FDI and economic growth were also provided by Alfaro et al. (2004). In line with the present views, the study showed that FDI alone was not able to ensure economic growth. However, in contradiction to the current findings, the authors illustrated that higher degrees of the development of financial markets could facilitate the positive influence of FDI on growth.

The conclusions of Choe (2003) about the effects of FDI on economic growth were also rejected by the present research. However, the authors also demonstrated that the effects from growth to FDI were stronger than those from FDI to growth. A cross-country analysis could provide different results than the findings of a single country investigation. Besides, the research of Choe (2003) showed that strong positive relations between the level of economic development and inward FDI did not contribute to the positive effects of FDI on economic growth.

In contrast to the current investigation, Li (2005) demonstrated that FDI could directly promote economic growth. Furthermore, the author found indirect positive effects of FDI on economic development through interaction terms. A cross-country analysis was undertaken and this could explain the discrepancies with the current research conclusions. The author showed that human capital and technology gap could determine the degree of FDI effects. Furthermore, Wijeweera et al. (2010) showed that only highly skilled labour could lead to the positive effects of FDI on growth. The current research included a variable of labour, but it was found to be insignificant in terms of the impact on economic development. Besides, Wijeweera et al. (2010) showed that trade openness contributed to economic development through efficiency gains, while the present research found no significant influence of openness to trade on GDP growth in the Eurozone.

The discrepancies between the findings about the effects of FDI on economic growth could be further explained by the variation across sectors, as was suggested by Alfaro (2003). The author showed that FDI had an ambiguous effect on economic development. The ambiguity was explained by the differences in the effects across the primary, manufacturing and service sectors. The evidence from the service sector was mixed, while in the primary sector FDI negatively affected growth and in the manufacturing sector a positive effect was observed. Furthermore, Haskel et al. (2007) demonstrated that in the UK FDI could indirectly affect economic growth through total factor productivity and spill-over effects. Nevertheless, the present analysis of the Eurozone economy showed no relations between FDI and economic growth.

The observations of the effects of FDI on growth could be different depending on the types of FDI (Beugelsdijk et al., 2008). Horizontal market seeking FDI affected growth to a greater extent than vertical efficiency seeking FDI. However, a cross-country analysis showed that the effects of FDI were no significant impact of FDI in developing countries. The present research also

demonstrated that FDI did not significantly affect GDP growth in the Eurozone. The observations were in line with the conclusions of Azman-Saini et al. (2010) who illustrated the absence of positive FDI effects on the output growth in a panel data comprised of 85 countries. However, the authors found that the influence depended on the level of economic freedom in the recipient economy. The current research found no effect of FDI on economic growth, but the research did not take into consideration the degree of economic freedom and did not undertake a comparison of the effects between developed and developing countries.

The effects of technology were explored by Colecchia and Schreyer (2002) and the authors found that in the OECD countries communication technology significantly contributed to economic growth. The observations of the present study were not in line with the findings. Furthermore, the authors showed that the contribution of technology to growth increased in the 1990s, while the present research did not split the observations into time periods. Besides, the present study did not confirm the conclusions of Datta and Agarwal (2004) who also found the positive effects of technology on economic growth in OECD countries. The investigation of Roller and Waverman (2001) showed that a critical mass of telecommunications infrastructure ensured stronger positive effects of technology on economic development. The current research included the technology variable as a control variable and it was found to be insignificant in determining economic development. Yet, this insignificance can be explained by the weakness of the proxies for technology and the presence of missing values that were replaced with zeros.

Another control variable of the present research was savings and in line with the findings of Carroll et al. (2000) the variable was found to be a significant determinant of economic growth. However Carroll et al. postulated that the correlation between savings and growth was based on the ability of high growth to determine savings and not vice versa. The ability of savings to

promote growth was studied by Aghion et al. (2006) and the authors showed that local savings couldn't promote innovation and through this link the positive effects on economic growth could be achieved. However, the authors also found industry-level differences in the effects on innovation and technology, so the study concluded that local savings were not associated with economic growth. The conclusion is not in line with the observations of the present research.

Another factor that was explored in the study was labour force. Since the variable of labour force was not available, the research used unemployment rate as a proxy for labour. In contrast to the observations of Wang and Yao (2003) the current investigation found no significant relations between the state of the labour market and economic growth. Wang and Yao (2003) showed that human capital could contribute to GDP growth. This was also supported in this dissertation when the tertiary school enrolment ratio was used as a proxy for human capital. Besides, the observations of Bloom and Finlay (2009) showed that trade openness, savings, policy and human capital could positively affect economic growth in Asia. In contrast to the observations, the present research found no correlation between all these variables. The differences could be explained by the samples that were studied in the papers.

The present study finds that the effects of biofuels production on economic growth are insignificant. This observation contradicts to the findings of Eisentraut (2010) who suggested that this new type of fuels could contribute to the economic development of many regions. However, the author paid attention to the development of rural areas, while the present research was devoted mostly to the industrialised countries of the Eurozone. The inability of the biofuels to contribute to economic growth could be explained in view of the observations of Carriquiry et al. (2011). The author showed that fiscal incentives and consumption mandates should be

different for different fuel types in order to improve the economic potentials of second generation biofuels.

The findings about the insignificance of biofuels production for economic growth also can be explained through the conclusions of Zhang et al. (2003). Their study demonstrated that the economic effects of biofuels depended on the types of the processes that were applied for fuel production. Some processes were found to be more economically feasible than others due to the differences in manufacturing costs, after-tax rates of returns, and the level of biofuel break-even price. Such factors, as plant capacity and feedstock oils prices, were the significant determinants of the economic feasibility of biofuels production. This implies that the effects of biofuels can be different depending on the input characteristics, such as equipment and processes. The present research did not differentiate between the types of processes and the types of fuels that were produced by the selected countries.

The results of the present research contradict the assumptions of Gallagher (2011) who argued that the economic viability of the production of biofuels could be high. However, the study noted that insufficient productivities, high operating costs, market prices volatility, and low level of government support could mitigate the positive effects of biofuels production on economic development. Furthermore, the research by Campbell et al. (2011) demonstrated that in order for biofuels to positively contribute to economic development, the costs of biofuels should be favourably comparable to the costs of other fuels. The inability to offer favourably comparable costs in the markets could have mitigated the contribution of biofuels to economic growth, as the fuels were not economically attractive.

The study of Demirbas (2009) demonstrated that the economic performance of biofuels was determined by process technology, raw materials costs, chemicals costs, and plant capacity. The findings of the current study show that biofuels production did not contribute to economic growth. Therefore, the study suggests that the aforementioned factors were not favourable in the selected countries, so biofuels production was not a significant determinant of economic development. However, Charles et al. (2007) argued that biofuels production could have most significant economic effects on farmers and agricultural rural areas. The effects should be supported by the appropriate policies in terms of biofuels. The present research did not take into consideration the differences between agricultural and non-agricultural areas. Furthermore, the study did not investigate the policies and regulations that were related to biofuels. This could explain the fact that the present research model did not capture the positive effects of biofuels production on GDP growth.

The investigation of Hoffmann and Weih (2005) also provided a possible explanation of the inability of biofuels to contribute to economic growth. The study showed that such factors as the lack of a market for biofuels, low awareness level and inappropriate infrastructure for the management of biofuels could mitigate the positive effects of bioenergy. The findings of the present research did not demonstrated a significant effect of biofuels on economic growth, thus indicating that the aforementioned constraining factors could take place across the selected sample of countries of the Eurozone.

5.2. Recommendations and Policy Implications

The recommendations for future studies can include the expansion of the number of observations of the research. The focus on the Eurozone countries only did not allow for a more comprehensive analysis of the determinants of economic growth and particularly of the effects of

foreign direct investment and trade openness on GDP growth in general or in emerging economies. Internationalisation can influence economic growth differently at different periods and different countries, so the analysis that includes a larger number of observations could provide alternative and more consistent results. Besides, the inclusion of other variables as proxies of internationalisation could lead to different results as well. The current study was based on openness to trade and inward FDI as the proxies for internationalisation. Meanwhile, trade openness can be measured differently, as variables, such as trade liberalisation and economic reforms could also represent internationalisation. Furthermore, the research focused on inward FDI only, while future investigations could pay attention to aggregate FDI values.

Future studies could analyse cross-country differences in the determinants of economic growth and in the effects of internationalisation on GDP growth. The discussion demonstrated that there can be substantial differences not only between the developed and developing economies, but also across the countries with close levels of economic development. Furthermore, future investigations can pay attention to possible cross-industry differences in FDI patterns, as there is evidence in literature that demonstrates the differences in the effects of FDI inflows on economic growth across industry sectors.

The findings and discussion demonstrated that the effects of internationalisation on economic growth could depend on various factors, such as economic freedom and the degree of financial market development. Therefore, it is recommended that regulators should focus on these factors in order to stimulate the positive effects of internationalisation on economic growth. This recommendation to policy makers can be taken into consideration not only by the regulators from Italy, but by the policy setters from other developed countries. The analysis of any of the developing countries was not undertaken herein, but it can be assumed that the results could be

inherent to developing economies as well. Such data can be extrapolated, as the analysis combines the statuses of developed and developing countries as absolute values, as well as their relative development.

With regard to the economic effects of biofuels, the study concludes that the processes of production, plant capacities, manufacturing costs, after-tax rates of return, operating costs, market prices volatility, and low government support could be the constraints of the positive effects of biofuels on economic development. Thereby, the research suggests that government policies should be directed at the elimination of these constraints in order to yield the economic benefits from the production of biofuels.

The recommendations for future studies are related to the sample selection. The present research of biofuels effects is based on a limited sample due to the issue of data availability. Future investigations could obtain a more extensive sample both in terms of countries and take into account a longer period of biofuels production. This could substantially contribute to the evidence on the effects of biofuels. Furthermore, future studies could differentiate between agricultural and non-agricultural areas, as the assumptions and findings of other studies suggest that biofuels production have the strongest economic effects on the economic growth in rural and agricultural areas.

5.3. Conclusion

The first objective of the research was to investigate the impact of the openness to trade on economic growth of the countries that currently comprise the Eurozone during the period from 1991 to 2013. The study analysed the hypothesis of the positive effects of trade openness on economic growth and rejected it. It was concluded that trade openness did not influence economic growth of the Eurozone countries in the mentioned period.

The second objective of the research was to estimate the impact of the FDI inflows on the economic growth of the Eurozone countries during the period. The hypothesis of the positive effects of FDI on economic growth was rejected as well. Therefore, the research concluded that neither openness to trade nor FDI had any significant impact on the economic growth in the countries that current comprise the Eurozone during the time frame from 1991 to 2013. Thus, the aim of the research was achieved and the study concluded that internationalisation did not significantly affect economic growth during the period that was explored. Yet, it is valid to note that the chosen countries adopted the Euro as a common currency in different years and this took place after 1999. For this reason, the period fixed effects were considered along with the country specific fixed effects.

The third objective of the research was to measure the economic effects of biofuels production. The study achieved the objective and concluded that the production of biofuels was not significantly related to the economic growth of the Eurozone countries.

The analysis showed that the overall current EU biofuel profile is not coherent between countries, so for the targets mandated in the Horizon 2020 to be met, a stronger and more unified framework should be developed. That should include the adoption of common definitions and

fuel specifications in the legislative documents to improve communication between policymakers and stakeholders. Additionally food crops production shouldn't be compromised by the indirect land use change for the production of bioenergy. As currently bioenergy is highly dependent on governmental funds for the establishment and operation of biofuel production unit, a business-led investment should be secured. A shift from "policy-driven biofuels" to "market-driven biofuels" would have a greater effect as driver of economic growth. Such change could ensure the large-scale production for commercial products that shouldn't of course affect the balance of the ecosystem, or put the biodiversity in danger. Cooperative programs involving the governments and industry, along with the transport authorities and other stakeholders should ensure a harmonized way of strategically meeting the goals of the Horizon 2020.

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