Advances in Business-Related Scientific Research Journal (ABSRJ)
Volume 6 (2015), Number 2

ISSN 1855-931X

EU GROWTH STRATEGY INDICATORS 2020 AND ECONOMIC GROWTH: AN EMPIRICAL INVESTIGATION FOR EU-27 COUNTRIES

Aynur Pala, Ph.D., Assistant Professor
Okan University, Deparment of Foreign Trade
Turkey
aynur.pala@okan.edu.tr

Abstract

The study aims to analyze whether economic growth of EU15 and newly EU12 countries have different sensitivity to "EU Growth Strategy Indicators 2020" for the 2004-2011 periods. Twelve highlight indicators are reduced to four factor indexes, namely; poverty, energy, climate and education using by factor analysis. Variables' stationarity have been checked using by panel unit root tests proved by Breitung (2000), Levin et al. (2002), and Im et al. (2003). For the estimation has been used static panel regression model. Hausman identification test has been used to choose between random effect model vs. fixed effect model. Static panel model estimation results show that EU15 and newly EU12 countries have different sensitivity to the indicators. As a result of the study, growth strategy 2020 is in favour of newly accessed EU-12 countries.

Keywords: growth, education, energy consumption, greenhouse gas emission, poverty, static panel regression.

Topic Groups: Economic growth

JEL Classification: O47, O40, O52

INTRODUCTION

Economic growth is an increase in the production and consumption of goods and services and is generally indicated by increasing real gross domestic product (GDP). A growth model helps to clarify how growth has occured and how it will ocur in the future, namely, determines factors affected on GDP. A growth model is not growth strategy. Growth strategy is a goverment prove to renew the result suggested by the model. There are many factors that impact on economic growth. Exogenous growth model known as the neoclassical growth model or the Solow growth model. Solow (1956), neoclassical growth model, capital accumulation was subject to diminishing returns, and eventually, the economy would come

to rest in a zero-growth steady-state. This growth model shows that if technology makes labor and capital twice as productive, then output doubles. Exogenous growth models explained long run economic growth using population growth, technology, capital savings, and productivity. Exogenous growth theory holds that technology is the main factor of long term economic growth. Economists have began working on endogenous growth models, in the late1980's. Romer (1986) represents that growth arises from increased variety of goods. Endogenous growth theory holds that economic growth determined by endogenous force and examined on population growth and human capital stock. According to Lucas model, the economic growth rate is related to the share of individuals that a society devotes to human capital development.

The second wave of the endogeneous theory tried to model technical change explicitly. It turns out that this requires a whole new modelling addition: imperfect competition, increasing returns to scale at the local level, and other "non-neoclassical" elements. The main three papers in this line were Romer (1990), Grossman and Helpman (1991), and Aghion and Howitt (1992). Romer's approach was that firms could invest in R&D that would expand the sorts of "knowledge" or "blueprints" that they could employ. Grossman and Helpman's approach shows that firms could invest in R&D that allows them to bring new products to the market. New Growth Theory is often called "endogenous" growth theory, because it internalizes technology into a model of how markets function. The essential point of New Growth Theory is that knowledge drives growth. Hulten (2000) says that the new growth theories advocated that the marginal product of capital is constant rather than in diminishing as in the neoclassical theories of growth. Capital often in the new growth models includes investments in knowledge, research and development of products, and human capital.

The aim of the Europe 2020 strategy is that EU to promote the conditions for a more competitive economy, based on a model of growth that is smart, sustainable and inclusive. "Beyond creating financial stability, we can and must go further to put us back on track to growth. Growth is the key, growth is the answer. So the question is how we can promote growth. And in fact I believe it is important to remind people that we have a strategy for growth, it is Europe 2020" (Manuel Barosso, April 2012). There are five major goals to be achieved; employment, innovation, education, social exclusion/poverty reduction and climate/energy. The components of strategy are smart growth which improves EU performances in education, research and innovation and digital society. Sustainable growth which builts a low-carbon economy, protecting the environment, developing new green technologies, harnessing EU-scale network, improving the business environment and helping consumers make well informed choices. Inclusive growth which raises Europe employment rate, investing in skills and training. Inclusive growth targets: 75% of the population aged 20-64, the share of early school leaving below 10%, and at least 40% of 30-34 years old should have completed a tertiary/higher education, and least 20 million fewer people to be at risk of poverty and social exclusion. The quality of education and training is very important to create smart growth, providing a efficient workforce. Targets included in sustainable growth are reducing the greenhouse gas emissions 20% lower than 1990, providing 20% of energy from renewables, increasing in energy efficiency by 20%. Target included in smart growth is 3% of the EU's GDP to be invested in research and development.

The study aims to research that whether economic growth for EU15 and newly EU12 countries has different sensitivity to "EU Growth Strategy Indicators 2020". And another aim of the study is to analyze that whether 2008 sub-prime mortgage crisis have cause to

structural break at the growth model. For this prupose, the study is to produce the effect of economic growth for European Union (27) countries, over the period 2004-2011.

Literature Review

The studies defined by Mansfield (1972), Fagerberg (1994), Grossman and Helpman (1991), Jones (1995), and Stokey (1995) have shown that research and development contributes to economic growth. Mansfield (1972) concluded that R&D expenditures contributed to output growth in a variety of industries in the USA and Japan. Nadiri (1993) and Link and Siegel (2003) provided that investigated the effect of R&D investment on productivity, at the firm and industry levels in advanced countries. Output is treated as a function of conventional labor and capital inputs plus the stock of R&D. Bernstein and Nadiri (1989) concluded that changes in R&D affect demand for labor, energy and physical inputs, with the pattern of substitutions and complementarities differing by industry. R&D investment increases demand for capital but decreases demand for labor and materials. More recently, researchers have begun to examine growth that is endogenously determined by technical change resulting from R&D decisions of profit-maximizing agents. Verspagen (1992) and Ruttan (1997) provide surveys of such innovation and R&D based endogenous growth models. The latest class of models developed in this tradition has arisen from the works of Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1992). Birdsall and Rhee (1993) used cross-country regressions of data from both OECD and developing countries. They found that R&D expenditure and economic growth are positively correlated only for countries in the OECD while there was no significant relationship in the case of developing countries. Even for OECD countries, the study found no evidence that R&D activity causes growth. These findings suggest that R&D activities contribute to productivity only once a country attains a threshold level of economic prosperity. Fraumeni and Okubo (2004) found that the contribution of R&D to economic growth is significant, using US time-series data from 1960 to 2000.

Mendelsohn et al. (2000), Nordhaus and Boyer (2000), and Tol (2002) investigated to produce the total economic effects of climate harnesses. The study of Dell et al. (2008) aims to investigate the fluctuation in temperature on national income. As a result of the study, higher temperatures have negative effects on economic growth, in poor countries. In rich countries, fluctuation in in temperature had no impact on economic growth. Dell et al. (2009) concluded that national income per-capita falls 8.5% on average per degree Celsius rise in temperature.

In the last decades, studies on the relation between economic growth and energy consumption has increased. Roegen (1971) combined the concept of economic growth with the natural environment. Shahid (2006) represents that an economy recognizes the importance of the energy. Cuevas and Quilis (2011) estimates and forecasts the rate of growth with focus on the Spanish economy. They include energy consumption in the model. That energy consumption affects economic growth can be found at Paul and Bhattacharya (2004). Ciarreta and Zarraga (2008) conducted their causality analysis on panel data for 12 European countries. Their findings suggest that changes in energy consumption induce changes of different intensities in GDP on long-run for each country studied. Erdal et al. (2008) and Bowden and Payne (2009), Payne (2009) focused on US data for 57 years, accepting the growth hypothesis between renewable and non-renewable energy consumption and real GDP. Sharma (2010) in countries from Europe and Central Asia, energy strongly affects economic growth as shown in a study that uses a growth framework.

Recent studies on economic growth have concentrated on labor skills and experience. Human investment has a permanent impact on economic growth. Lucas (1988) contends that human capital has an important role in economic growth. Rosenzweig (1987) and Becker et al. (1990) is among the studies defined human capital as a endogenous variable. The recent studies proved by Topel (1999), Krueger and Lindahl (2001), Temple (2001), and Sianesi and Reenen (2003) found a significant and positive relation between quantitative measures of schooling and economic growth. Sala-i-Martin et al. (2004) found that primary schooling was the most robust impact factor on growth in GDP per capita in 1960-1996, using sixty-seven explanatory variables in growth regressions on a sample of 88 countries. Cohen and Soto (2007) and Barro and Lee (2010) show that is positive growth effects of years of schooling.

Galor and Zeira (1993) and Aghion et al. (1999) found that inequality would reduce growth rate. Becker et al. (1990) advocated that "endogenous fertility approach," income inequality noticeably reduces the future growth rate because of the positive effect of inequality on the overall rate of fertility. Ehrhart (2009) examined that relation between inequality and growth. Amendola and Dell'anno (2013) represent taht negative relationship between level of social exclusion and economic growth.

Data and Methodology

Data

This study obtained EU-27 countries, and the sample period is from 2004 to 2011. Data have been collected from World Bank and EUROSTAT database. Investigated variables are employment rate (age group 20-64), gross domestic expenditure on R&D (GERD) to GDP (%), greenhouse gas emissions, share of renewable energy in gross final energy consumption, primary energy consumption, final energy consumption, early leavers from education and training, tertiary educational attainment (age group 30-34), people at risk of poverty or social exclusion (percentage of total population), people living in households with very low work intensity (percentage of total population), people at risk of poverty after social transfers, severely materially deprived people. GDP growth is proxy for economic growth. We created a dummy variable EU-15, where a value of 1 is identifies for EU-15 countries, and 0 identifies for twelve newly accessed EU countries. Because, each country has specific characteristics and historical experiences that must be reflected in its growth strategy. And, we generate a dummy variable 2008 crisis, where a value of 0 identifies until 2009, and 1 all other years. The STATA software was used to implicate econometric analysis. Most important limitatition of study is sample period, from 2004 to 2011. Because, these variables has been calculated since 2004 by EUROSTAT.

Table 1: Variables Description

Variables	EU-15	EU-12	PIGS
Employment Rate (age group 20-64)	+	-	
Gross Domestic Expenditure on R&D to GDP (%)	+	-	
People at Risk of Poverty or Social Exclusion (percentage of total population)	-	+	
People at Risk of Poverty after Social Transfers	-	+	
Severely Materially Deprived People	-	/	
Primary Energy Consumption (tone)	+	+	

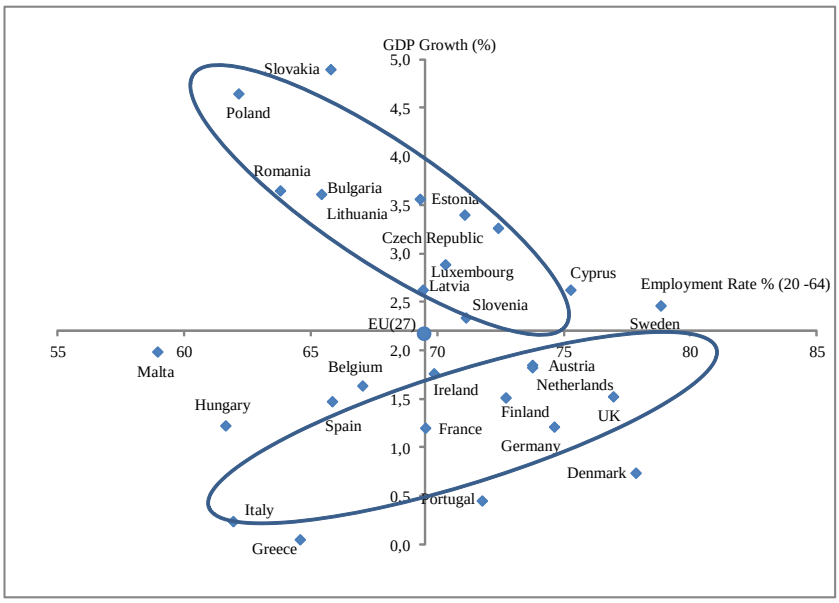
Final Energy Consumption (tone)	+	+	
Greenhouse Gas Emission	+	+	+
Renewable Energy/Gross Final Energy Consumption (%)	-	+	
Early Leavers from Education and Training	/	-	+
Tertiary/Higher Educational Attainment (age group 30-	+	-	
People Living in Households with Very Low Work Intensity (percentage of total population)	/	+	

The hypothesis to be tested in this study are presented below;

H_0: Economic growth of EU15 and newly EU12 countries have different sensitivity to "EU Growth Strategy Indicators 2020
H_A: Economic growth of EU15 and newly EU12 countries have similar sensitivity to "EU Growth Strategy Indicators 2020

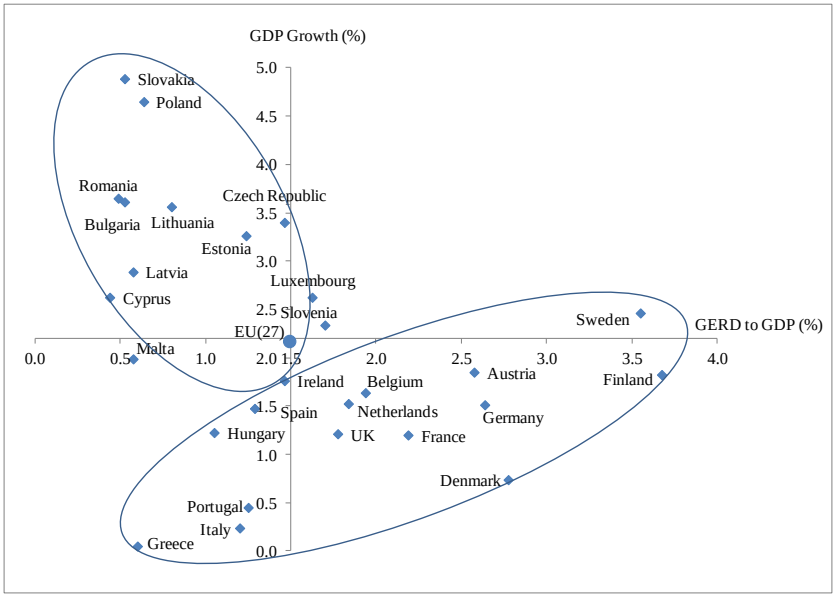
In figure 1, the Employment Rate (age group 20-64) is plotted against the GDP growth rate for EU(27) countries. Average values of the variables calculated from 2004 to 2011. For EU(15) countries, the linear model is often empirically supported on the positive correlation between two variables. However, for other newly accessed twelve EU countries, there is negative correlation between Employment rate and GDP.

Figure 1: Employment Rate (age group 20-64) and GDP



In figure 2, the R&D intensity measured by GERD to GDP rate is plotted against the GDP growth rate for EU(27) countries. Average values of the variables calculated from 2004 to 2011. For EU(15) countries, the linear model is often empirically supported on the positive correlation between Gross Domestic Expenditure on Research and Development (GERD) and GDP. These countries are Sweden, Finland, Austria, Germany, Denmark, France, Belgium, Netherlands, UK, Ireland, Spain, Hungary, Portugal, Italy and Greece. Although there is a positive relationship between the economic growth and R&D intensity, the low correlation indicates that there are other factors affecting on economic growth. However, for other newly accessed twelve EU countries, there is no relation between GERD and GDP.

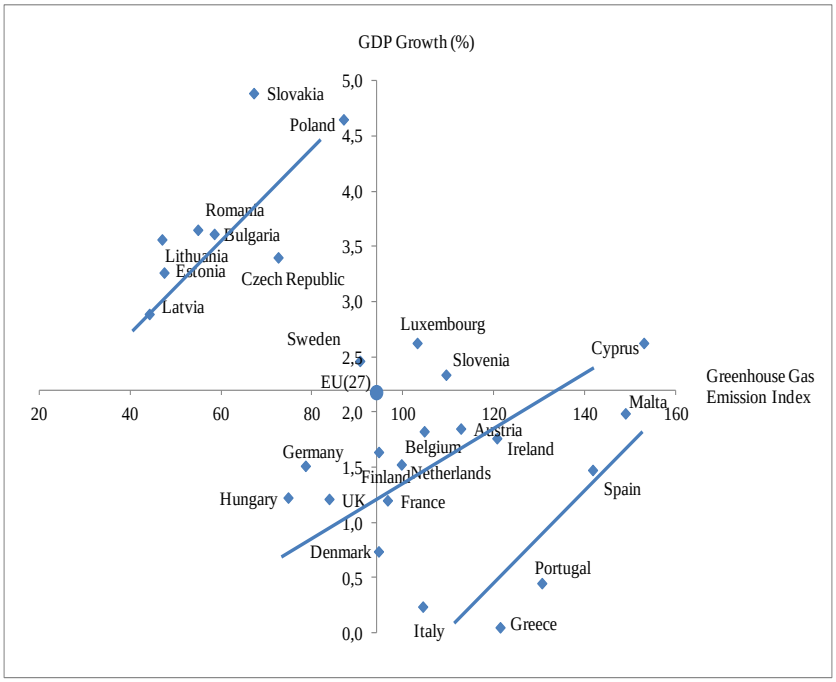
Figure 2: The Relation between Gross Domestic Expenditure on R&D to GDP and GDP Growth Variables



Source: Author's calculation based on EUROSTAT database.

As it is apparent from the Figure 2, among eleven countries that experienced R&D intensity above the EU(27) average, eleven countries show a GDP growth rate higher than the EU(27) average. Finland (Celtic Tiger) and Sweden (Swedish Paradox) reach the highest share of R&D expenditures respectively 3.7% and 3.6%. Other EU-15 countries report higher share as well, such as Denmark (2.8%) and Germany (2.6%).

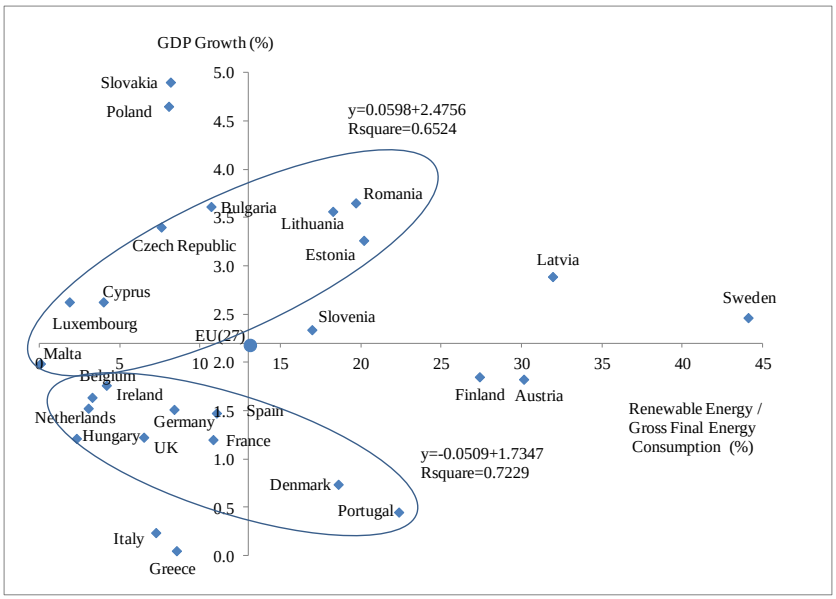
Figure 3: Greenhouse Gas Emission Index and GDP Growth



Source: Author's calculation based on EUROSTAT database.

In the Figure 3, the Greenhouse Gas Emission Index (GHGEI) is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. For EU-27 countries, the linear model is supported on the negative correlation between GHGEI and GDP. These countries are Sweden, Finland, Austria, Germany, Denmark, France, Belgium, Netherlands, UK, Ireland, Spain, Hungary, Portugal, Italy and Greece. Although there is a positive relationship between the economic growth and R&D intensity, the low correlation indicates that there are other factors affecting on economic growth. However, for other newly accessed twelve EU countries, there is no relation between GERD and GDP. The energy consumption is one of the indicators that define the economic devel- opment of a country. Energy is the new driver of the economic growth which was not included in the early growth models; of Solow, AK, and Schumpeter.

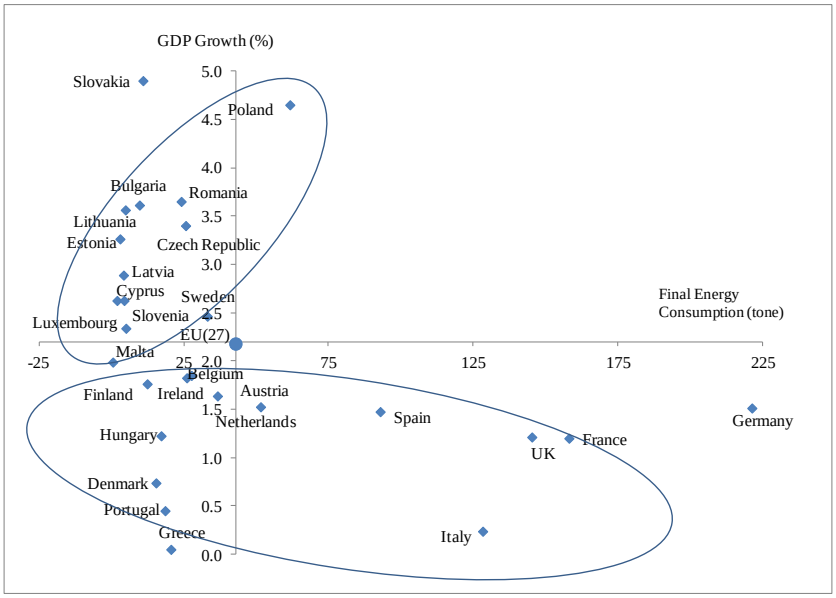
Figure 4: Share of Renewable Energy in Gross Final Energy Consumption and GDP Growth



Source: Author's calculation based on EUROSTAT database.

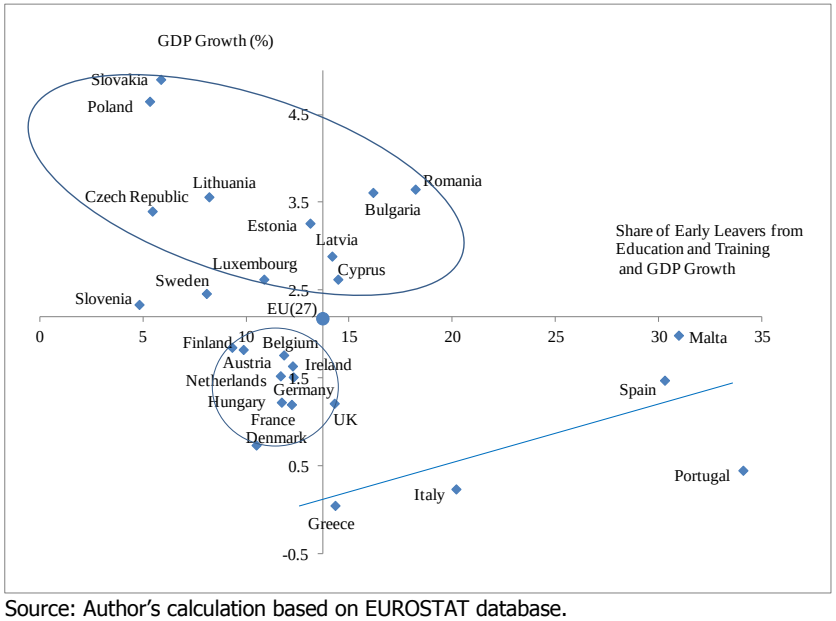
In the Figure 4, the share of renewable energy in gross final energy consumption is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. For EU-27 countries, the linear model is supported that there is no correlation between share of renewable energy in gross final energy consumption and GDP growth. For EU-15 exluded Italy, Greece, Finland, Austria, Sweden, there is positive relationship between share of renewable energy in gross final energy consumption and GDP growth. For newly accessed EU-12 countries excluded Slovakia, Poland, Slovenia, Latvia, there is negative relationship between share of renewable energy in gross final energy consumption and GDP growth.

Figure 5: Final Energy Consumption (tone) and GDP Growth



In the Figure 5, the Final Energy Consumption (tone) is plotted against the GDP growth for EU-27 countries. For EU-15 countries, there is negative relationship between this two variables. For newly accessed EU-12 countries, there is positive relationship between that variables

Figure 6: Share of Early Leavers from Education and Training and GDP Growth

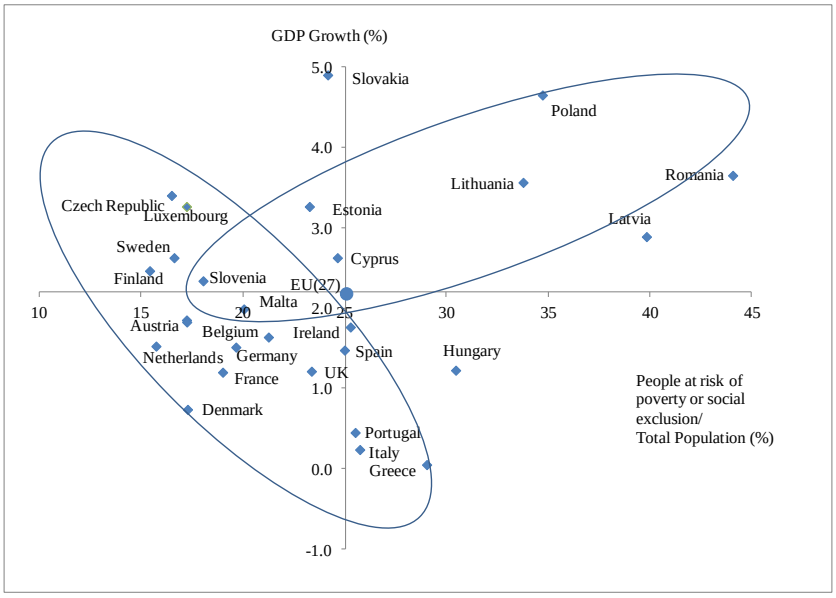


Source: Author's calculation based on EUROSTAT database.

There are six countries where the share of early leavers from education and training was above 13.7%, (average of European-27 countries): Bulgaria (16%), Romania (18%), Italy (20%), Spain (30%), Malta (31%), and Portugal (34%). Europe's growth strategy, Europe 2020, has set an EU-27 target for the proportion of early leavers from education and training to be below 10% by 2020; there are individual targets for each of the Member States that

range from 5% to 29%. There were six countries where the share of early leavers from education and training was equal or belove 10%, EU-27 target, they were: Austria (9%), Czech Republic (5%), Denmark (10%), Finland (10%), Lithuania (8%), Poland (5%), Slovakia (6%), Slovenia (5%), and Sweden (8%). In the Figure 4, the share of early leavers from education and training is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. For EU-27 countries, excluded six higher rate countries, the linear model is supported that there is negative correlation between share of early leavers from education and training and GDP growth.

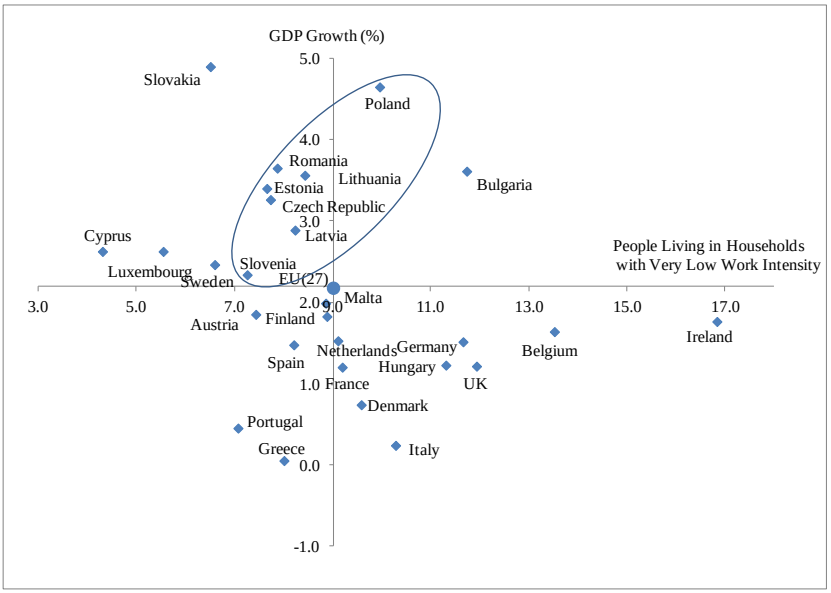
Figure 7: People at Risk of Poverty or Social Exclusion and GDP Growth



Source: Author's calculation based on EUROSTAT database.

Poverty and social exclusion are the challenges in achieving the Europe 2020 targets for inclusive growth. In the Figure 7, people at risk of poverty or social exclusion is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. While there is negative correlation between that variables at EU-15 countries, there is positive relation between EU-12 countries' variables.

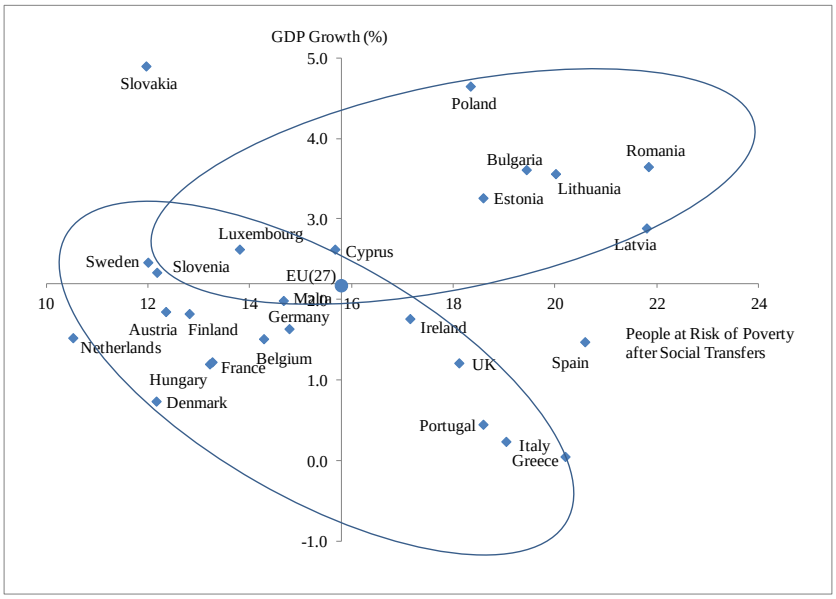
Figure 8: People Living in Households with Very Low Work Intensity and GDP Growth



Source: Author's calculation based on EUROSTAT database.

In the Figure 8, people living in households with very low work intensity is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. The linear model is shown that there is no correlation between people living in households with very low work intensity and GDP growth.

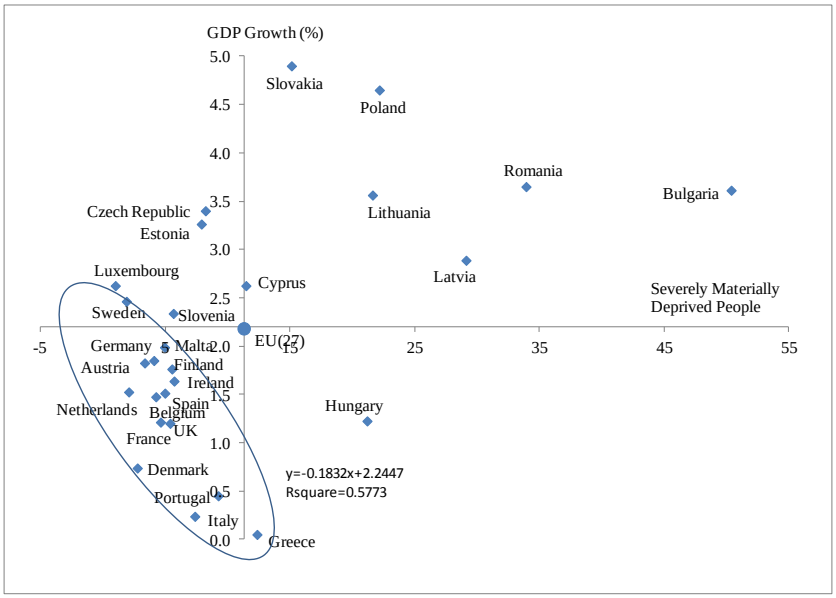
Figure 9: People at risk of poverty after social transfers



Source: Author's calculation based on EUROSTAT database.

In the Figure 9, people at risk of poverty after social transfers is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. While there is negative correlation between that variables at EU-15 countries, there is positive relation between EU-12 countries' variables.

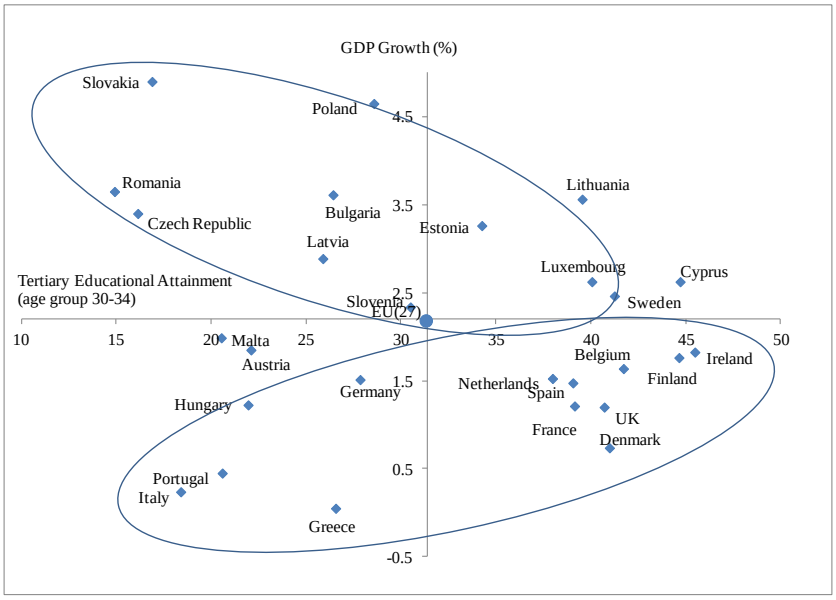
Figure 10: Severely materially deprived people and GDP Growth



Source: Author's calculation based on EUROSTAT database.

In the Figure 10, severely materially deprived people is plotted against the GDP growth for EU-27 countries. Average values of the variables calculated from 2004 to 2011. For EU-27 countries, the linear model is supported that there is no correlation between this series. For EU-15 excluded Hungary, there is negative relationship between severely materially deprived people and GDP growth. For newly accessed EU-12 countries, there is no relation between the series.

Figure 11: Tertiary Educational Attainment and GDP Growth



Source: Author's calculation based on EUROSTAT database.

In the Figure 10, Tertiary Educational Attainment is plotted against the GDP growth for EU-27 countries. For EU-27 countries, the linear model is supported that there is no correlation

between this series. For EU-15, there is positive relationship between Tertiary Educational Attainment and GDP growth. For EU-12, there is negative relationship between Tertiary Educational Attainment and GDP growth.

Factor Analysis

Europe 2020 strategy based on a model of growth that is smart, sustainable and inclusive. There are five major goals to be achieved: employment, innovation, education, social exclusion/poverty reduction and climate/energy.

Table 2: Three priorities and related five targets of EU Growth Strategy

Smart	Sustainable	Inclusive
Knowledge and Innovation	Greener and More Competitive Economy	High-Employment
R&D	Climate/Energy	Employment, Poverty, Education
Gross Domestic Expenditure on R&D to GDP (%)	Primary Energy Consumption (tone)	Employment Rate (age group 20-64)
	Final Energy Consumption (tone)	People at Risk of Poverty or Social Exclusion (percentage of total population)
	Greenhouse Gas Emission	People at Risk of Poverty after Social Transfers
	Share of Renewable Energy in Gross Final Energy Consumption	Severely Materially Deprived People
		Early Leavers from Education and Training
		Tertiary (higher) Educational Attainment (age group 30-34)
		People Living in Households with Very Low Work Intensity (percentage of total population)

Total twelve indicators have been classified using factor analysis method. Table 3 presents the factor results.

Table 3: Factor Analysis Results

Variables that Significantly Load on the Factor	Factor Loading	Factors Loaded Variables	Eigen Value	Prop.	Cum.
Employment Rate (age group 20-64)	0.601	Factor 1			
Gross Domestic Expenditure on R&D to GDP (%)	0.816	Factor 1	3.748	0.397	0.397
People at Risk of Poverty or Social Exclusion (percentage of total	-0.927	Factor 1			

People at Risk of Poverty after Social Transfers	-0.651	Factor 1			
Severely Materially Deprived People	-0.889	Factor 1			
Primary Energy Consumption (tone)	0.8872	Factor 2	2.201	0.231	0.629
Final Energy Consumption (tone)	0.8899	Factor 2			
Greenhouse Gas Emission	-0.691	Factor 3	1.545	0.163	0.793
Share of Renewable Energy in Gross Final Energy Consumption	0.500	Factor 3			
-	-	Factor 4	0.937	0.099	0.892
Early Leavers from Education and Training	-0.483	Factor 5	0.741	0.078	0.970
Tertiary (higher) Educational Attainment (age group 30-34)	0.559	Factor 5			
People Living in Households with Very Low Work Intensity (percentage of total population)	0.499	Factor 5			

Twelve growth strategy indicators have been reduced to five factor using factor analysis method. Only ten indicators have significant factor loading bigger than 0.5. Factor 1 has five variables with significant loadings. These variables are employment rate (age group 20-64), gross domestic expenditure on R&D (GERD) to GDP (%), and people at risk of poverty or social exclusion (percentage of total population), people at risk of poverty after social transfers, severely materially deprived people. Factor 1 is labelled "Poverty". Factor 2 has two variables with significant loadings. These variables are primary energy consumption (tone), final energy consumption (tone). Factor 2 is labeled "Energy". Factor 3 has two variables with significant loadings. These variables are greenhouse gas emissions and share of renewable energy in gross final energy consumption. Factor 3 is labeled "Climate". Factor 5 has one variables with significant loadings higher more than 0,5. This variable is tertiary (higher) educational attainment (age group 30-34). Factor 5 is labeled "Education". The factor analysis reveals that "Poverty" accounts for 39% of the total change, whereas "Energy" accounts for 23%, "Climate" accounts for 16%, "Education" accounts for 7.8%, Factor 4 accounts for %9.9, adding up to a total of 97%. Factor 4 has any variables.

Table 4: Proxy Variables for Five EU Targets.

Smart and Inclusive	Sustainable_1	Sustainable_2	Inclusive
R&D, Employment, and **Poverty**	Competitive Economy **Energy**	Greener Economy **Climate**	**Education**
Factor 1	Factor 2	Factor 3	Factor 5
Gross Domestic Expenditure on R&D to GDP (%)	Primary Energy Consumption (tone)	Greenhouse Gas Emission	Tertiary (higher) Educational Attainment (age

			group 30-34)
Employment Rate (age group 20-64)	Final Energy Consumption (tone)	Share of Renewable Energy in Gross Final Energy Consumption	
People at Risk of Poverty or Social Exclusion (percentage of total population)			
People at Risk of Poverty after Social Transfers			
Severely Materially Deprived People			

While twelve variables reduced to four factors. We have predicted four factor indexes which have utilized as explanatory variables. We use this separation proxy for five EU targets. Because, factor analysis result has not approved five EU target.

Methodology

Panel data refers to multi-dimensional data. Panel data contains time series observations of a number of individuals. (Hsiao, 2007) Observations in panel data has two dimensions; cross-sectional dimension and and a time series dimension. Cross-section and time series dimensions have been indicated by subscript *i* and *t* respectively. Panel data have several advantages over cross-sectional and time-series data. Panel data generally contain higher degrees of freedom and higher sample variability than cross-sectional data. The standard cross-section methods set forward to biased results depending on heterogeneity. Panel regression model has been larger capacity to deal with the complexity of human behavior than a single cross-section or time series data. Panel data simplifies computation and inference. I have used static panel regression model for the analysis.

First question is that whether EU15 and newly EU12 have different sensitivity to highlight indicators. Second question is that whether 2008 sub-prime mortgage crisis cause to structurak break on growth model. The econometric model takes the following form:

$$GDP_{it} = \alpha_{it} + \beta_{0i}F1_{it} + \beta_{1i}F2_{it} + \beta_{2i}F3_{it} + \beta_{3i}F5_{it}$$
$$+ \beta_{4i}EU15DUMMY * F1_{it} + \beta_{5i}EU15DUMMY * F2_{it} + \beta_{6i}EU15DUMMY_{sit} * F3_{it}$$
$$+ \beta_{7i}EU15DUMMY * F5_{it}$$

$$+ \beta_{8i}2008CRISIS_{it} + \beta_{9i}2008DUMMY * F1_{it} + \beta_{10i}2008DUMMY * F2_{it} +$$
$$\beta_{11i}EU15DUMMY * F3_{it} + \beta_{12i}2008DUMMY * F5_{it} + e_{it}$$

i, represent cross-section dimension, t represent time dimension, GDP_{it} represent Gross Domestic Product Growth (%) of ith country at the tth period. $F1_{it}$ represent Factor 1 (Poverty) index of i^{th} country at the t^{th} period, $F2_{it}$ represent Factor 2 (Energy) index of i^{th} country at the t^{th} period, $F3_{it}$ represent Factor 3 (Climate) index ith country at the t^{th} period, $F5_{it}$ represent Factor 5 (Education) index of i^{th} country at the t^{th} period, EU15DUMMY represent which value of 1 for EU-15, 0 value for others, 2008DUMMY represent which value

of 1 post-2008, value of 0 for other time periods. B represents slope, and eit represents error term.

RESULTS

In our study, it has been investigated stationarity using panel unit-root tests proved by Breitung (2000), LLC test by Levin et al. (2002) and IPS test by Im et al. (2003). The results of test have been demonstrated in Table 4. The results indicate that the null hypothesis of a unit root is rejected, namely all variables are stationary, in level. It has no necessary to apply panel cointegration approach.

Table 5: Panel Unit Root Tests

	Breitung (2000)	LLC (2002)	IPS (2003)
GDP Growth (%)	-5.292*(0.000)	-9.694* (0.000)[b]	-2.046* (0.020)
Poverty	-1.9179* (0.000)[a]	-15.969* (0.000)[b]	-3.1293* (0.001)[b]
Energy	-3.403* (0.000)[a]	-10.423* (0.000)[b]	-2.586* (0.005)[b]
Climate	-2.241* (0.000)[a,c]	-11.897* (0.000)[b]	-3.174* (0.000)[b,d]
Education	-1.402 (0.080)[a]	-6.6413* (0.000)[b]	-2.101* (0.000)[c]

Note: Probability values are in brackets. *denotes statistical significance at the 1% level, [a], represents 2 lags, [b], represents ADF regressions 1 lag, [c], represent included time trend, [d], represent included panel mean.

In the estimation of model was used the linear static panel regression. Hausman (1978) test was used to select from among fixed effect model and random effect model. Table 3 represents that the estimation result of random and fixed effect model. Table 3 contains that parameters coefficient, standard error. F test and Hausman Chi-Square test statistics. The result of Hausman test null of "random and fixed effect model coefficient is equal and random effect model is valid" is rejected. Namely, fixed effect model is valid.

As a result of fixed effect model estimation, while the coefficient of the Poverty, Energy and Climate indexes are positive and statistical significant, Poverty, Energy and Climate indexes multipled by EU15 dummy variables are negative and statistical significant. It means that the effect of these factors on economic growth differs among EU-15 and twelve newly accessed EU countries. At the EU-15 countries, the impact level of these factors on economic growth less than newly accessed EU countries. Education index coefficient is negative and statistically significant. The Education index multiplied by EU15 dummy variable is statistical insignificant. Education index has explained economic growth for only twelve newly accessed EU countries. Constant is positive and statisticaly significant. Coefficient of 2008 crisis dummy variable is negative and statistically significant. It shows that average growth rate reduced after the 2008 crisis. Moreover, Poverty and Energy indexes multipled by 2008 crisis dummy variable are positive and statistically significant. It represents that the effect level of these factors on economic growth have increased after the 2008 crisis for all of EU-27 countries. The impact of EU growth strategy indicators on economic growth has different effects for EU-15 countries and newly accessed EU-12 countries. Growth strategy 2020 is in favour of newly accessed EU-12 countries. Results supported H_0 hypothesis namely economic growth of EU15 and newly EU12 countries have different sensitivity to "EU Growth Strategy Indicators 2020.

Table 4: Static Panel Regression Model (Dep. Var: Gross Domestic Product Growth (%))

Explanatory Variables	Fixed Effect	Random Effect
Social Exclusion	10.452*(0.000)	-1.450*(0.000)
Energy Consumption	19.325*(0.000)	-0.950 (0.202)
Gas Emission	13.245*(0.000)	0.481 (0.298)
Education	-4.525*(0.000)	-0.925*(0.000)
Social Exclusion *EU15 Dummy Variable	-13.069*(0.004)	0.077 (0.934)
Energy Consumption*EU15 Dummy Variable	-11.780*(0.046)	0.400 (0.626)
Gas Emission*EU15 Dummy Variable	-6.764*(0.017)	0.484 (0.489)
Education*EU15 Dummy Variable	2.164 (0.198)	0.954 (0.083)
2008 Crisis Dummy Variables	-6.051*(0.000)	-4.769*(0.000)
Social Exclusion *2008 Crisis Dummy Variable	2.545*(0.000)	2.249*(0.000)
Energy Consumption*2008 Crisis Dummy Variable	2.050*(0.000)	0.927 (0.066)
Gas Emission*2008 Crisis Dummy Variable	0.226 (0.681)	-0.390 (0.473)
Education *2008 Crisis Dummy variable	0.017 (0.974)	0.037 (0.940)
Constant	9.717*(0.000)	3.687*(0.000)
R2 (within)	0.508	0.3748
R2 (between)	0.092	0.5389
R2 (overall)	0.003	0.3886
F (13, 176)	14.010* (0.000)	-
Wald(6)	-	128.410* (0.000)
Hausman – Ki-Kare (6)	49.040* (0.000)	

Note: *, represent statistical significancy at 1% level.

CONCLUSION

European Commission supports the EU to become a smart, sustainable and inclusive economy. These three priorities include in employment, innovation, education, social inclusion and climate/energy targets to be reached by 2020.This paper presents a framework that identifies the determination of the impact of the Eupropean growth strategy indicators 2020 on economic growth, from an econometric analysis of EU-27 for 2004-2011 periods. It has been used static panel regression model to analyse. The impact of Poverty, Energy and Climate factor indexes on economic growth differs among EU-15 and twelve newly accessed EU countries. These factor indexes make a higher positive effect on economic growth for twelve newly accessed EU countries than EU-15 countries. The estimation result shows that Education index has explained to economic growth for only newly accessed EU countries.

As a result of the study, the average growth rate of EU-27 countries reduced to 3,7% from 9.7% before the 2008 crisis level. Additionally, the effect of poverty and energy on economic growth increased after the 2008 crisis. As a result of the study, growth strategy 2020 is in favour of newly accessed EU-12 countries. The impact of growth strategy indicators 2020 on economic growth for the EU-27 can bring economic benefits. But, the question is "Which

method leads all EU-27 countries to real growth path together? Because, each country has specific characteristics and historical experiences that must be reflected in its growth strategy. The effects of growth strategy indicators 2020 on EU27 countries' economy can be investigated country by country. Because each country has specific characteristics and historical experiences that must be reflected in its growth strategy. In practice, the model should be developed a new strategy to cover all EU countries. In future studies, EU 2020 growth strategy of the effects on the economy can be studied separately for each country.

REFERENCES

Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. *Econometrica*, *60* (2), 323-351.

Aghion, P., Caroli, E., & García-Peñalosa, C. (1999). Inequality and Economic Growth: The Perspective of the New Growth Theories. *Journal of Economic Literature, 37*, 1615-1660.

Amendola, A., & Dell'anno, R. (2013). Social Exclusion and Economic Growth: An Empirical Investigation in European Economies, *Università degli Studi di Salerno-CELPE*, Discussion Paper 126.

Barro, R., & Lee, J-W. (2010). A New Data Set of Educational Attainment in the World, 1950-2010, *NBER Working Paper No. 15902.*

Barro, R. J. (1997). *Determinant of Economic Growth*. MIT press. Cambridge, MA.

Becker, G. S., Murphy, K. M., & Tamura, R. (1990). Human Capital, Fertility, and Economic Growth. *Journal of Political Economy*, *98* (5), 12-37.

Benhabib, J., & Spiegel, M. M. (1994). The Role of Human Capital in Economic Development. *Journal of Monetary Economics*, *34*, 143-173.

Bernstein, J. I., & Nadiri, M. I. (1989). Research and Development and Intraindustry Spillovers: An Empirical Application of Dynamic Duality. NBER Working Papers 2002, National Bureau of Economic Research, Inc.

Birdsall, N., & Rhee, C. (1993). Does results and development (R&D) contribute to economic growth in developing countries? Policy Research Working Paper Series 1221, The World Bank.

Bowden, N., & Payne, J. E. (2009). The causal relationship between U.S. energy consumption and real output: A disaggregated analysis. *Journal of Policy Modeling*, *31* (2), 180-188.

Ciarreta, A. A., & Zárraga, A. A. (2008). Economic Growth and Electricity Consumption in 12 European Countries: A Causality Analysis Using Panel Data. *BILTOKI 2008-04, Universidad del País Vasco - Departamento de Economía Aplicada III* (Econometría y Estadística).

Cohen, D., & Soto, M. (2007). Growth and human capital: good data, good results. *Journal of Economic Growth*, *12* (1), 51-76.

Cuevas, A., & Quilis, E. M. (2011). A factor analysis for the Spanish economy. *Series*, *3*, 311-338.

Dell, M., Jones, B. F., & Olken, B. A. (2008). Climate Shocks and Economic Growth: Evidence from the Last Half Century, *NBER Working Paper 14132*.

Dell, M., Jones, B. F., & Olken, B. A. (2009), Temperature and Income: Reconciling New Cross-Sectional and Panel Estimates. *American Economic Review Papers and Proceedings*.

Ehrhart, H., (2009). The effects of inequality on growth: a survey of the theoretical and empirical literature. *ECINEQ Working Paper 107.*

Erdal, G., Erdal, H., & Esengun, K. (2008). The causality between energy consumption and economic growth in Turkey. Energy Policy, *36* (10), 3838-3842.

Fagerberg, J. (1994). Technology and International Differences in Growth Rates, *Journal of Economic Literature*, *32* (3), 1147-1175.

Fraumeni, B. M., & Okubo, S. (2004). R&D in the National Income and Product Accounts, A First Look at its Effect on GDP. Presented at the NBER Conference on Research in Income and Wealth, April 26-27, 2002.

Galor, O., & Zeira, J. (1993). Income Distribution and Macroeconomics. Review of Economic Studies, *60*, 35-52.

Georgescu-Roegen, Nicholas. (1971). *The Entropy Law and the Economic Problem.* Distinguished Lecture Series no. 1, Department of Economics, University of Alabama.

Grossman, G., & Helpman, E. (1991). *Innovation and Growth in the Global Economy*, Cambridge: MIT Press.

Hausman, J. A. (1978). Specification Tests in Econometrics, *Econometrica*, *46* (6), 1251-1271.

Jones, C. I. (1995). R&D-Based Models of Economic Growth. *Journal of Political Economy*, *103*, 759-784.

Krueger, A. B., & M. Lindahl (2001). Education for Growth: Why and For Whom? Journal of Economic Literature, *39*, 1101-1136.

Link, A. N., & Siegel, D. S. (2003). Technological Change and Economic Performance, London and New York: Routledge.

Lucas, R. E. (1988). On the Mechanism of Economic Development. *Journal of Monetary Economics*, *22*, 3-42.

Mansfield, E. (1972). Contribution of R&D to economic growth in the United States. Science *175* (4021), 477-486.

Mendelsohn, R., Morrison, W., Schlesinger, M. E., & Andronova, N. G. (2000b). Country specific market impacts from climate change, Climatic Change, *45*, 553-69.

Nadiri, M. I. (1993). Innovations and Technological Spillovers, NBER Working Paper, 4423.

Nordhaus, W. D., & Boyer, J. (2000). *Warming the World: Economic Models of Global Warming*. Cambridge, MA: The MIT Press.

Paul, S., & Bhattacharya, R. N. (2004). Causality between Energy Consumption and Economic Growth in India: A Note on Conflicting Results, Energy Economics *26*, 977–983.

Pesaran, H. (2003). A Simple Panel Unit Root Test in the Presence of Cross Section Dependence. *Cambridge Working Papers in Economics 0346*, Faculty of Economics (DAE), University of Cambridge.

Romer, Paul M. (1990). Endogenous Technological Change. *Journal of Political Economy*, *98*, 71-102.

Rosenzweig, M. R. (1987). Human Capital, Population Growth and Economic Development: Beyond Correlations. *Bulletins 7520*, University of Minnesota, Economic Development Center.

Ruttan, V. W. (1997). Induced innovation, evolutionary theory and path dependence: Sources of changes. *The Economic Journal*, *107* (444), 1520-1529.

Sala-i-Martin, X., Doppelhofer, G., & Miller, R. I. (2004). Determinants of long-term growth: A Bayesian averaging of classical estimates (BACE) approach. *American Economic Review, 94*, 813-835.

Shahid, A. M. (2006). Economic Growth with Energy, *MPRA Working Paper 1260*.

Sharma, S. S. (2010). The relationship between energy and economic growth: Empirical evidence from 66 countries. Applied Energy, *87* (11), 3565-3574.

Sianesi, B., & Reenen, J. V. (2003). The Returns to Education: Macroeconomics. *Journal of Economic Surveys*, *17* (2), 157-200.

Simon, C., & Nardinell, C. (1996). The Talk of the Town: Human Capital, Information, and the Growth of English Cities, 1861 to 1961. *Explorations in Economic History*, *33* (3), 384-413.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics, 70*, 65-94.

Stokey, N. L. (1995). R&D and Economic Growth, *Review of Economic Studies*, *62*, 469-489.

Temple, J. (2001). Growth effects of education and social capital in the OECD countries. *OECD Economic Studies*, OECD Publishing, *2001* (2), 57-101.

Tol, R .S. J. (2002). Welfare specifications and optimals control of climate change: an application of fund. *Energy Economics*, *24* (4), 367-376.

Topel, R. (1999). Labor markets and economic growth. *Handbook of Labor Economics*, in: Ashenfelter, O., & Card, D. (ed.), Handbook of Labor Economics, *3* (44), 2943-2984.

Verspagen, B. (1992). Endogenous Innovation in Neo-Classical Growth Models: A Survey. *Maastricht University.*