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Socio-economic effects of a European Union membership

An empirical study of Hungary and Romania

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Abstract

This study examines the socio-economic impact of European Union membership in Hungary and Romania. EU dictates and shapes institutions in member countries, as well as mandates certain reforms. Therefore it is likely that EU accession should have an impact on various socio-economic outcomes. A Difference-in-Difference (DD) model was employed to estimate these effects, using both Hungary and Romania as treatment groups and Croatia as the control group. The countries were chosen on the basis of being new members of the union, but also sharing similar post-communistic features. This study focus on the time period 1999-2011 and several different social and health related variables have been used to capture a wider perspective of the socio-economic development. Three different models were used to estimate the effects of EU membership. Positive effects were seen in some areas, especially in the case of Romania, but not to the magnitude initially anticipated. From these results, it seems doubtful that the EU accession alone is a catalyst of socio-economic development.

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1. Introduction

The aim of this thesis is to estimate the effect of European Union membership on various socio-economic outcomes in new member countries. Numerous studies have focused on measuring the economic impact of EU accession such as GDP per capita (Mihuț & Luțaș, 2013) and FDI [Böwer & Turrini, 2010, Vilpišauskas, 2002]. These results have shown positive effects of accession. Fewer studies have focused on the social and health related effects of membership, which is the main contribution of this thesis to existing literature.

The European Union, or what came to constitute it, was first formed after the conclusion of World War II by six founding countries; Belgium, France, Italy, Germany, Luxembourg and the Netherlands. The idea behind the union was to link together countries economically as well as politically in the hope that this would create long lasting peace, something many desperately sought after the years of war that had ravaged the continent (El-Agraa, 2011). The EU is currently the largest economy, in terms of GDP, as well as the largest trader in the world while only making up for 7% of the world's population (European Commission, 2014). Over the years, the union has grown substantially. Both economic and political connections between members have intensified with the introduction of the internal market[1], its legislation and other union-wide treaties. Also the borders of the union have expanded with the addition of 22 new member countries, as of 2013 when Croatia joined (Vinyes, et al., 2015). However, there are a number of conditions that have to be met before a country can be considered for membership[2]. When a country receives membership, it can partake in the European internal market, with free internal trade and movement. As indicated by the entrance conditions, these benefits of free trade come with commitments to implement and harmonize institutions to EU standard (Peshkopia, 2014)

[1] The internal market is based on "the four freedoms": free movement of goods, services, people and capital.

[2]

1. Being located in Europe
2. Having stable institutions that promote democracy, rule of law, human rights and the protection of minorities
3. Having a functioning market economy and be able to cope with the competition and market forces of the EU
4. Being able to implement and effectively take on the obligations that follows with a membership, complying with the aims of the union

The EU is based on the idea of promoting free movement of labour, goods, services and capital in order to create a strong economic and political union (European Union, 2005). Besides providing access to a large and diversified internal market, there are potentially large spillover effects of membership on socio-economic outcomes such as welfare and living standards.

The main object of this study is to analyse the socio-economic effects of accession to the European Union. In order to examine these effects, a Difference-in-Difference (DD) approach is used. The DD approach examines the effects of a policy reform, in this case membership of the European Union. It measures the difference over time in the average difference between two groups, where one accesses the EU. Our data consists of observations from three countries; Hungary, Romania and Croatia. They became members of the Union in 2004, 2007 and 2013 respectively. These countries are selected due to the fact that they share many traits that make them suitable for comparison. For example, they are all post-communist countries and they all recently entered the EU. The different variables examined[3] are selected to jointly incorporate the most important socio-economic aspects, namely health, education, corruption and inequality.

The results of this study reveal that EU accession alone may not be a significant source of socio-economic development. Life expectancy, infant mortality rate and enrolment in tertiary education are positively and significantly impacted in the context of Romanian accession to the EU, but not for Hungary. Educational outcomes are ambiguously affected by EU accession. The effect differ between countries and between the two analysed levels of education. Corruption and inequality, measured as the Gini-index, seems unaffected by the Romanian and Hungarian EU memberships.

This paper is divided into five parts, where the first gives a brief background of the history and socio-economic evolution of the observed countries. Previous studies on the subject are presented and explained in the second part. The third part is divided in two chapters where the first presents and discusses the dataset, while the methodological strategy is described and critically reviewed in the second. The results of the regressions are presented in the fourth part and conclusions from these are drawn in the fifth.

[3] Life expectancy, infant mortality rate, net enrolement in primary eduaction, enrolement in tertiary education, corruption perception index and gini-index

1.1 Background

The following section provides a short historical review and socio-economic description of Hungary, Romania and Croatia.

1.1.1 Hungary

After World War II, communism grew in Hungary and the country was successively integrated into the Soviet Union. Under Stalin, collectivization of the private- and agricultural sector began. Average private income as well as welfare fell among the citizens (Bati, 1990). When communism collapsed in 1989, the process of democratization began, but since then the economic situation has been unstable. Budget deficits, unemployment and inflation rates have grown. Prices increased fast while wages lagged behind, leading to growing poverty (Baranty, 1990). The post-communistic politics were focused on European integration. There was a wish to open up the economy for international trade and to unite with the European countries. In the 1990's, Hungary joined CEFTA[4] and came closer to the EU through trade (Dangerfield, 2004). In 1999, the European Commission stated that Hungary might be ready to join the union within a few years. However, the fiscal system and disinflation efforts had to be improved (Csaba, 2000). In 2004, Hungary was accepted as a member of the EU (Murphy, 2006).

The economic and socio-economic development in Hungary, after the EU accession, has not been straightforward. Positive development has been seen in several areas. Income per capita and life expectancy have increased and child mortality has decreased. However, other socio-economic variables such as corruption still seems high and unchanged (own calculations based on World BankData and Transparency international). Hungary is in fact one of the most corrupt countries in the European Economic Community (EEC) (European Bank for Reconstruction and Devlopment , 2011). Hungary also still faces high unemployment.

A particularly vulnerable group in society is the Roma minority, which is largely discriminated against in several contexts. They receive less health care, education and therefore face a higher risk of poverty (Kosa, et al., 2007). Funds are provided by the EU in order to support improvement in these mentioned areas among others (Government of the

[4] Central European Free Trade Agreement

Republic of Hungary, 2011), but the ambiguity in the socio-economic variable trends has led to a discussion whether the EU is the main contributor of development or not (Szemlér, 2009). Szemlér (2009) considers it doubtful that the increase in social and economic standards in Hungary, seen after the EU accession, is all due to the EU. Constant corruption and an initial decrease in GDP per capita seems to point towards the opposite. Instead globalization and domestic policies, independent of EU's influence, need to be considered as possible sources for socioeconomic development.

1.1.2 Romania

Romania became communistic, at the end of World War II, after having received support from the Soviet Union. Fast economic growth was promoted in order to strengthen the power of Romania in South-East Europe (Nilsson, 2002, pp. 158-162). A population growth program was introduced in order to increase the labour force and thus production volumes. As a consequence, the social situation declined since there was a shortage of schools, hospitals, labour opportunities and skilled workers (Nilsson, 2002, pp. 217-218). After the fall of the communistic regime in 1989, agreements about human rights and against discrimination of ethnic minorities were made. This was done in order to improve the situation for the citizens (Nilsson, 2002, pp. 282-294) and in 2007, Romania became member of the EU (Andreev, 2009).

EU accession has implied a change of norms, traditions and has given Romania access to the union's internal market. This seems to have promoted higher and relatively stable economic growth, but there is still a considerable gap in living standards between Romania and the EU-average (Diacon, 2012). Funds of 6.5 billion euros were given to Romania before its accession to the EU, with the purpose of supporting socio-economic reforms to reach the criteria for EU membership. However, Romania has been criticised for not using the funds and even after accession to the EU, the social situation is unsatisfactory. Unemployment is high and about 30% of the population work in the primary and agricultural sector (Katsarova, 2010). The Roma minority is, despite attempts to improve the situation, socially and economically marginalized (Popova & Zeh, 2014).

Furthermore, the free mobility that follows EU accession has potential negative implications for the country. Emigration to other EU countries has increased significantly after the accession, which has limited access to the Romanian social security system. Since emigration

leads to less tax incomes, an imbalance between contributors and receivers of public aid is created. This undermines the whole social security system, which is vital in order to maintain a good socio-economic situation for the remaining population (Panzaru, 2011).

1.1.3 Croatia

With the economic and social misery that followed World War II, communism offered new ideas for development and Croatia became a member of the communistic Republic of Yugoslavia. However, regulatory reforms opened up for generous lending and the public debt rose tremendously. The situation worsened and dissatisfaction among the population grew. In the early 1990s, communism fell and Croatia received independence from the Republic of Yugoslavia, whilst disputes between the former states of Yugoslavia increased (Stallaerts & Laurens, 1995).

Since the independence, the economic and social situation has improved. The relations with surrounding countries have also improved and Croatia has successively strengthened its connections to the EU. Negotiations regarding EU membership led to a number of reform projects in order to meet the membership criteria. Transparency of the juridical system, security in the public administration systems and fight against corruption were pointed out as areas to improve (European Commission, 2012). The Roma Action Plan (AP) (Rodin, 2010) and The Constitutional Act of the Rights of National Minorities were implemented in order to improve the situation for Roma and Serbian minorities. At the closing of the negotiations in 2011, it was decided that Croatia would become member of the EU in 2013 (European Commission, 2012).

The socio-economic situation today is improving, but not without problems. Life expectancy as well as health expenditures as a percentage of GDP are increasing, but are still well below the EU average (Rodin, 2010). Corruption is another problem. The general perception in Croatia is that the corruption level is quite stagnant. Also trust in the government and public administration is low (European Bank for Reconstruction and Devlopment , 2011). Reforms on the labour market have been made, but early retirement and generous social benefits discourages market participation. This is in line with the fact that Croatia has one of the lowest labour market participation rates in the EU (European Commission, 2015). The Roma and Serbian minority groups have amongst the lowest employment rates in Croatia (Government of the Republic of Croatia, 2012). The Roma minority is to a large extent

marginalized in terms of housing, education and labour etc. Despite that inclusion programs like AP have been launched, these people still face a major risk of falling in to poverty and social exclusion (Rodin, 2010).

2. Previous literature

Economic- and socioeconomic development is shown to be highly correlated in several studies [Benzeval & Judge, 2001, Orcutt Duleep, 1986]. For example between GDP per capita and health measures such as life expectancy and mortality rate (Howitt, et al., 2011). These results make the economically oriented literature relevant for our studies, which is important since little is written about the purely socio-economic effects. Nevertheless, it is important to keep in mind that the use of GDP per capita as an indicator for social development is not perfect since it for example does not measure the distribution of income (Stiglitz, et al., 2010). Yet, the effect of an EU membership on welfare is shown to be positive, leading to increased income and also increased longevity. By the process of convergence, initially poor countries can catch up to the average EU standard (Sevinç & Civan, 2013). According to the results of Sevinç & Civan (2013), membership contributes to an average growth of 0.08 percent in life expectancy.

Several researchers have studied the effect of accessing an internal market, with the result of development derived from increasing levels of FDI (Böwer & Turrini, 2010) and that free trade within the internal market enables allocation of human and economic resources to where it is most profitable and efficient. Growth exists even prior to membership since trade agreements with the EU and pre-accessing reforms often are in process before accession (Vilpišauskas, 2002). Along with previous discussion of positive correlation between economic and social variables, these results should indicate an increase in social living standard as well. Nevertheless, the internal market also implies less positive effects as higher competition often leads to closure of domestic industries, rising prices and reduced national sovereignty (Andreev, 2009).

The connection between accession to the EU and the macroeconomic phenomenon of growth convergence and "catching up" with the EU average, is investigated in several studies [Böwer & Turrini, 2010, Mihuț & Luțaș, 2013, Wunsch, 2013]. There seem to be evidence of this, sometimes called beta-convergence, existing and being beneficial (Mihuț & Luțaș, 2013) not only for the new EU entrants but also other European countries. However signs of intra-national convergence, called sigma-convergence, or regional processes of catching up are harder to spot (Wunsch, 2013). Differences between regions of a country rather seem to be accentuating (Nordregio, 2007).

EU's enlargement eastwards to the post-communistic countries has evidently been successful in terms of better life quality, health and safety in these countries (Paul, 2012). However, Paul (2012) argues that catching up to Western Europe's standards and fight against corruption will be a long process, which also halted during the recent financial crisis. Nevertheless, the socio-economic improvement that stem from an EU membership is debated and has not met its expectations, according to Andreev (2009) who, in an article, discusses all the socio-economic hopes that did not come to realization in Romania. The political situation has changed after the accession, with the rise of populist parties and wavering support for the regime that brought them towards the EU. According to him, this bears striking resemblance to what happened in the Eastern European countries that became members in 2004, when Hungary among others joined (Andreev, 2009).

3. Data and Methodology

3.1 Data

The data used in the analysis is collected from World Bank database of so-called World Development Indicators, as well as from Transparency International and UNESCO. Definitions and sources of the variable are specified in Appendix I. The analysis is based on a panel data set covering Hungary, Romania and Croatia during the time period 1999 to 2011, a few years before EU accession in Hungary to a few years after accession in Romania. The total number of aggregate data observations are between 37 and 39 in the different regressions. The examined socio-economic indicators are Corruption Perception Index (CPI), infant mortality rate, life expectancy, primary school enrolment, tertiary school enrolment and the Gini-Index. They are chosen in order to incorporate different aspects of living standards.

There are some possible problems with this dataset that needs to be addressed. Data on certain indicators are troublesome to find before 1999, which has thus dictated the time span. Specifically, CPI and net enrolment rate are available first in the late 1990's in all three countries. The limited documentation has also restricted the number of variables that are regressed, which threatens the ability to draw conclusions on general socio-economic outcomes. Furthermore, data of Gini-index has substantial gaps in documentation over time. Therefore, data used in the regressions of this thesis has been both interpolated and extrapolated, shown in Appendix II. This is partially problematic as it estimates missing values based on trends in the observed values. Nevertheless, utilizing these estimation techniques is necessary to be able to use the Gini-index in this study. Another problem concerns the chosen countries. The countries have been chosen on the basis of having similar communistic pasts, corruption problems, marginalized minorities and being new members of the union. Other countries than the chosen three have been considered, however, a lack of available data has restricted the selection. Therefore, it is possible that these countries do not constitute the ideal control groups for each other when it comes to fulfilling the parallel trend assumption, which is discussed in the methodology section.

Summary statistics on all dependent variables are presented in table 1-3 below. From these statistics, it can be mentioned that Croatia on average has a higher life expectancy than Romania and Hungary, who in turn show similar figures. Average infant mortality rate is

significantly higher in Romania than in the other two countries, measuring 2.4 times higher than Hungary and 3.1 times higher than Croatia[5]. Romania has also, on average, the lowest CPI score, indicating the highest level of corruption. Moreover, the score are all relatively low and stable between the countries and over time, which gives justification to the view that corruption is a major problem in these countries, even after accession to the EU. Also the GINI index is relatively stable, indicating comparable levels of inequality between the countries. Primary school enrolment shows no clear trend, but tertiary education seems to be changing a lot over time since all countries have large differences in observed minimum and maximum values. This applies for Romania in particular, that has had a standard deviation twice the size of the other two countries. By examining the data and graph, the extreme values seems to be accurate. The large standard deviations reveals instead a large increase in the variable over time. Concerning the control variables, GDP per capita is considerably lower in Romania than in the other two countries, referring to both mean, minimum and maximum values. FDI is similar in Croatia and Romania while fluctuating considerably in Hungary, from large negative to large positive values. Population growth is on average negative in all three countries. Only Croatia has a positive maximum value within this time frame.

Table 1
Summary statistics
Croatia

Variable	Obs	Mean	Std. Dev.	Min	Max
Life expectancy	13	75.149	1.278	72.642	76.776
CPI	13	3.831	0.556	2.700	5.000
Infant mortality rate	13	5.846	1.021	4.300	7.400
Primary net enrolment	12	88.313	1.634	85.842	90.549
Tertiary enrolment	13	2899.858	479.196	2125.310	3560.739
Gini-index	13	31.406	2.026	27.710	34.332
GDP per capita	13	11132.520	3997.771	4919.628	15889.350
FDI	13	5.102	2.202	1.417	8.249
Population growth	12	-0.156	0.925	-2.851	1.171

[5]Infant mortality rate, calculated from summary statistics in table 1-3:
Romania / Hungary: $17.89231/7.453846 \approx 2.4$
Romania / Croatia: $17.89231/5.846154 \approx 3.1$

Table 2
Summary statistics
Hungary

Variable	Obs	Mean	Std. Dev.	Min	Max
Life expectancy	13	72.849	1.160	70.677	74.859
CPI	13	5.015	0.234	4.600	5.300
Infant mortality rate	13	7.454	1.560	5.500	10.200
Primary net enrolment	13	90.055	2.018	87.160	93.187
Tertiary enrolment	13	3786.673	523.664	2724.998	4353.491
Gini-index	13	29.539	1.799	26.820	31.566
GDP per capita	13	11116.790	3811.563	4613.706	15598.320
FDI	13	11.008	18.583	-16.154	50.968
Population growth	13	-0.224	0.053	-0.286	-0.155

Table 3
Summary statistics
Romania

Variable	Obs	Mean	Std. Dev.	Min	Max
Life expectancy	13	72.097	1.162	70.512	74.563
CPI	13	3.231	0.437	2.600	3.800
Infant mortality rate	13	17.892	4.426	11.500	24.200
Primary net enrolment	13	90.563	3.874	84.332	96.221
Tertiary enrolment	13	3428.396	1061.367	1813.303	5011.511
Gini-index	13	31.460	1.203	29.845	33.797
GDP per capita	13	5178.308	3149.069	1583.850	9949.354
FDI	13	4.465	2.666	1.400	9.333
Population growth	13	-0.852	0.557	-1.831	-0.129

Before employing the model, time trend graphs are made of the socio-economic variables of interests as well as economic control variables. This allows comparison of the socio-economic evolution between the chosen countries and over time. Graphs of all variables are assembled in Appendix III. The two vertical lines in each graph indicates the times of accession. The first line is drawn for year 2004, which is when Hungary accessed the EU. The other line corresponds to year 2007 and EU accession in Romania. The plots reveal a similar, but not always parallel, trend between the countries and over time for all socio-economic variables except for net primary enrolment, where there is no clear trend. Fulfilling the parallel trend assumption is essential when using the Difference in Difference model. The degree to which it holds for the chosen indicators is discussed in greater detail in the methodology section. The

trend over time is mostly positive in the case of tertiary enrolment, life expectancy and infant mortality rate. However, corruption seems quite stable and does not improve much over time. Infant mortality seems to decrease faster in Romania than in the other countries, but the initial mortality rate is also considerably higher in Romania than in both Hungary and Croatia. The economic variable GDP per capita has clearly improved in the last decade for all countries. FDI seem stagnant in Croatia and Romania, but not in Hungary. A recent dip in most variables is consistent with the financial crisis of 2008.

By comparing the economic and socio-economic indicators, there seem to be signs of positive correlation between GDP and certain socio-economic variables. This confirms the existing evidence of economic and socio-economic correlation, discussed above. Since economic factors are shown to improve with EU accession, it thus seem justified to perform a regression to examine the potential effects of EU membership on the socio-economic variables. A discussion of advantages and drawbacks of the chosen indicators follow below. Definitions and sources of the indicators are, as mentioned, put in Appendix I.

3.1.1 Corruption

CPI is one of the most frequently used measures of corruption and has gained international recognition as a relevant proxy for corruption. However, the correctness of using CPI has been criticized since perceived corruption is different from actual corruption. The perceived level is measured instead of actual corruption because actual corruption involves illegal activities that are not present in official statistics and are thus problematic to measure (Olken, 2009). CPI may also be subject to so called "elite bias". Transparency International utilizes surveys from different experts where most of them have a similar background, these surveys are the basis of the CPI score. A lack of diversity within the expert community may thus cause the measurement to become narrow (Cobham, 2013). Moreover, the methodology of composing the index CPI has changed over the years, with the collection of different surveys from year to year, which has implied that making comparisons over time is somewhat problematic (The Economist, 2010).

3.1.2 Health

The indicators for health used in this study are infant mortality rate and life expectancy at birth. Both measures are commonly used as proxies for health in general, making them

suitable to use. Furthermore, the two variables are well-documented, allowing for good comparisons of trends over longer periods of time. A possible problem with these measurements is that they are aggregated on country level. Since the rates can differ within a country, regionally or between ethnical groups, the country level numbers may be misleading.

3.1.3 Education

The possibility to obtain an education not only reflects the life standard of the family and future possibilities for the individual, but also provides positive externalities that benefit the society as a whole. These positive externalities can be seen in terms of longevity of a population (Ricci & Zachariadis, 2013). Therefore it is highly relevant and justified to include this measurement of education. A drawback of the measurement is that it does not include or consider gender distribution. It is therefore hard to see exactly who has got access to the education.

3.1.4 Inequality

Gini index is widely used as an indicator for inequality, more specifically income inequality in this paper, within the field of economics (Weil, 2013, pp. 385-403). This fact motivates its use in this study as well. However, because it is a relative measurement, the interpretation of the index value can be complex – a disadvantage in using the Gini-index. An increasing number, according to the definition, indicate increasing inequality and the country would be worse off. However, it could also reflect increasing incomes for the entire population and people getting out of poverty. The latter case is occasionally seen in developing countries, and is misleading since a rising index is not entirely negative. Secondly, the measurement has its limitations as it only considers inequality in income distribution, not wealth. Wealth and income can differ substantially and since certain groups in the population might be restricted from using financial services, it might be more accurate to measure the distribution of wealth to measure inequality (Burda & Wyplosz, 2013).

3.2 Methodology

3.2.1 Difference-in-Difference

In order to measure the socio-economic effect of accession to the EU, a Difference-in-Difference (DD) model is used. The DD model compares the outcome before and after the reform, for the treatment group and the control group (Angrist & Pischke, 2009, pp. 227-243). In this study, the treatment group and control groups are constructed by using aggregate data

on three countries that have all recently entered the EU. By constructing panel data from this aggregate time series data, it is possible to measure the socio-economic change due to accession to the EU (Wooldridge, 2014, pp. 366-386). Since this study focuses on the effects of accession in not only one country at one time period, but of two countries that enter the EU in 2004 and 2007 respectively, the DD model is modified to allow for two treatments. At the first accession, Hungary is treated and the control group consists of Romania and Croatia. At the second accession, Romania is also treated and only Croatia constitutes the control group. In this way, the effects of treatment in Hungary and Romania can be compared with each other.

3.2.2 Fixed effects model

In order to control for unobserved effects in panel data, a fixed effects model can be utilized. The model is an attempt to divide the error term in to three new terms. The first term represents unobserved effect that differ between individuals, in this case countries, but are constant over time. The second is an unobserved effect that differs over time, but not between countries. Thirdly, there is what is known as the "remainder disturbance", which differs between countries and over time (Brooks, 2014, pp. 526-532). This division is shown in the equation below:

$$u_{tc} = \pi_c + \delta_t + \varepsilon_{tc} \quad (1)$$

Utilizing this technique allows for controlling both unobserved country and time fixed effects without adding numerous control variables. The FE model allows for unobserved time-invariant effects to be correlated with the independent variables and should be used when correlation is expected to exist. Since the FE model is commonly used for policy analysis using aggregate data, it is also considered justified in this study (Wooldridge, 2014, pp. 392-400). The time fixed effects encapsulates all variables that affect socio-economic outcome that are expected to be the same between the countries but vary over time. To the opposite, country fixed effects represent variables that are fixed over time but vary across countries. In this case, possible country fixed effects could be traditions or geographical conditions; access to water sources, fertile soil and temperature. These are typically fixed over several years, but differ between countries. These geographical indicators, for example, can therefore be expected to affect socio-economic outcome differently in different countries and are of interest to include.

Choice of the Difference-in-Difference model

There are several methods available for evaluating the effect of a reform, which in this study is accession to the EU. One possible method is to measure the effect of a reform by comparing the sample average level of chosen variables before and after the reform only for the treatment group: $\beta = \bar{Y}_1^T - \bar{Y}_0^T$. The drawback of this method is that it does not account for other possible factors that can affect changes in the trend over time. The presence of time trends would lead to a biased estimator. Another possible method compares the sample average in the treatment- and control group only in time period 1 which is after the reform is made: $\beta = \bar{Y}_1^T - \bar{Y}_1^C$. Using this estimator, no attention is paid to pre-treatment trends, which will also cause bias in the reform- or treatment parameter. The issues of time trends and pre-treatment behaviour are taken into account by using the DD estimator. The average sample difference between the groups before reform is subtracted from the post-treatment difference: $\beta = (\bar{Y}_1^T - \bar{Y}_1^C) - (\bar{Y}_0^T - \bar{Y}_0^C)$ (Albouy, 2004). This is a preferable method since it examines both treatment group and control group over time. It allows for comparing outcome after treatment and the estimated outcome in absence of treatment, a so called counterfactual analysis (Angrist & Pischke, 2009, pp. 227-243).

3.2.3 Model specification

The Difference-in-Difference estimator can be described as:

$$\gamma = (\bar{Y}_1^T - \bar{Y}_1^C) - (\bar{Y}_0^T - \bar{Y}_0^C) \quad (2)$$

$\bar{Y}_1^T - \bar{Y}_1^C$ measures the difference in socio-economic level between the treatment group and control group after the first group has been treated. $\bar{Y}_0^T - \bar{Y}_0^C$ shows the difference before accession. The term on the left hand side in the equation, γ, is the DD estimator. It measures the difference over time in the average difference of socio-economic outcomes as a result of EU accession (Wooldridge, 2014, pp. 366-386). The equation can be rewritten in regression form:

$$Y_{tc} = \alpha + \gamma RomEU + \mu HunEU + \pi_c + \delta_t + \varepsilon_{tc} \quad (3)$$

Or if control variables are included:

$$Y_{tc} = \alpha + \gamma RomEU + \mu HunEU + \pi_c + \delta_t + X'\beta + \varepsilon_{tc} \quad (4)$$

Y_{tc} is the observed socio-economic variable for a certain time and country. Furthermore, α is a constant. *RomEU* and *HunEU* are interaction terms between the year dummy and the EU membership dummy for each country separately, and thus reflects the treatment effect. These are the variables of interest since their coefficients γ and μ, are the difference-in-difference

estimates that measures the effect of accessing the EU. The fixed effects are π_c and δ_t, representing country fixed and time fixed effects respectively. $X'\beta$ is a vector for time varying control variables: GDP per capita, FDI and population growth. Finally, ε_{tc} is the error term.

A third specification is also made to estimate the average treatment effect of a European Union membership:

$$Y_{tc} = \alpha + \gamma AverageEU + \pi_c + \delta_t + X'\beta + \varepsilon_{tc} \quad (5)$$

Where *AverageEU* is an interaction term between the year dummy and the EU membership dummy for both countries. So if any of the two observed countries access the EU in a time period, this will translate into 1 for the *AverageEU* dummy.

The advantages of using the DD regression are that it is easy to add and withdraw treatment and control groups. The evaluated effect of a policy can also easily be changed by compiling panel data on other variables (Angrist & Pischke, 2009, pp. 227-243).

3.2.4 Validity of DD and Methodological problems

In this section, we discuss potential complications with our chosen identification strategy. In order for the DD model to be valid and reliable, a number of assumptions must be fulfilled.

The Parallel Trend Assumption

"The Parallel Trend Assumption" is critical when using the DD method and implies that in order for the control group to be valid, the two groups would have followed parallel paths of development over time, in absence of the reform (Angrist & Pischke, 2009, pp. 227-243). Because of the importance of the Parallel Trend Assumption, it is relevant to highlight the extent to which it is justified in this study. The three countries measured in this model have, as mentioned, a similar history of communism, minority exclusion, corruption and the same reform process prior to accession to the EU. Furthermore, all three have gained EU membership in the last decade. All these factors are likely to have affected social and health related levels. It thus seems suitable to assume that the three chosen countries develop similarly and therefore constitutes proper treatment and control groups for each other. This is further justified by the graphs of the variables used in the regression, see Appendix III. In spite of this, there are differences between the countries, especially visible in variables like primary education than in others, which make the parallel trend assumption controversial. Even though countries have several similarities, it is unlikely for all features to match and

there will be differences threatening the validity of the analysis and results. The DD model is thus more suitable for regional comparisons, where all observations originate from one country. The socio-economic development could then differ between the countries for reasons other than the accession to the EU. As mentioned, the fixed effect model is estimated in order to control for unobservable factors and to help diminishing risk of a biased model.

Spillover effects

Accessing the EU has many effects, but they may not always originate directly from the anticipated source. It has been shown that that less developed countries close to large and wealthy economies benefit from positive spillovers in FDI, trade and intellectual property rights (Hafner, 2010). Perceived improvements due to EU membership might be a secondary effect of growth in large economies that are already members of the union. Another possibility is that wealth in member countries spill over to non-member countries. As discussed, Hungary among others was connected to the EU in trade agreements long before they became EU members (Dangerfield, 2004). It is likely that growth in the EU stimulated exports from its trading partners outside the EU, like Hungary. This spillover effect could to some extent explain eventual lack of significant socio-economic changes in the context of EU accession. A third possibility is that skilled educated workers migrate to better paying EU countries, when the country accesses the internal market of EU. This "brain drain" undermines socio-economic development in the new member countries (Docquier, et al., 2007). Since countries have different features, these spillover effects are likely to affect socio-economic development in different ways between the EU entrants.

Endogeneity issues - non randomness of accession to the EU

There is a risk that significant determinants of the socio-economic outcome are excluded from the model. This would imply violation of the zero conditional mean assumption: $E(\varepsilon|X_{ct}) = 0$, and causes correlation between the independent variables and the error term, also referred to as omitted variable bias (Wooldridge, 2014, pp. 274-286). The chosen control variables are attempts to minimize the risk of under-specification of the model. Another issue is the non-randomness of accession to the EU, implying that more developed countries are "selected" into the EU. Since membership in the EU is restricted to countries that already have attained a certain degree of development in several areas, accession to the EU itself is not considered as random. Consequently, EU membership can be endogenously correlated with good socio-economic development. This would cause the estimated model to be biased

and inconsistent by once again violating the assumption that the error term should be uncorrelated to the independent variables: $E(\varepsilon|X_{ct}) = 0$. By using the fixed effect model, inconsistency of the variables is controlled for and the risk of omitted variable bias in the model decreases.

Choice of time period

Another important factor to observe is the chosen time period of the regression. This DD regression focuses on the time period a few years before and after treatment, that is accession to the EU. However, as discussed earlier, there is a risk that the significant effect of joining the EU lies in an earlier or later time period and thus will not be displayed in the results. Access to data has to a large extent dictated the choice of time period, which is why this study focuses on the short term effects of a membership of the EU.

Heteroskedasticity

Furthermore, there is a possible problem with heteroskedasticity which implies that the assumption of constants variance of the errors given the explanatory variables is not fulfilled and the standard errors are thus biased (Wooldridge, 2014, pp. 212-240). In this study, robust standard errors are used since they control for heteroskedasticity (Wooldridge, 2014, pp. 366-386).

Serial correlation

Serial correlation implies correlation between the error terms in different time periods and can be especially important to control for when using a DD estimator. Relatively long time series data often suffer from serial correlation. In addition, the most commonly used dependent variables in DD models are often highly serial correlated, which is why this could be a concern in this study. Furthermore, if the treatment variable changes itself very little within a state over time, this could also be a cause of serial correlation (Bertrand, et al., 2004). Serial correlation causes the standard errors to become biased and the results less accurate. It is thus of interest to try to control for serial correlation in this analysis.

There are a number of commonly used methods to control for serial correlation. By clustering the observations on country level, it is possible to control for serial correlation that originates from the fact that these observations are likely to share aspects of background and environment that cause correlation between the observations. However, if the number of clusters are few, less than 42 according to Angrist & Pischke (2008), it is likely that the

standard error are underestimated. Since the data used in this analysis consists of 3 countries, it is not appropriate to cluster in order to control for serial correlation (Angrist & Pischke, 2009, pp. 308-323)**.**

Another possibility is to perform a so called First Differencing (FD) which controls for serial correlation and unobserved time fixed effects. It is thus an alternative to the FE model (Wooldridge, 2014, pp. 366-386). Since the sample in this study has a large T (the 13 years of observation) in relation to N (the three countries), the FE inference is sensitive to heteroskedasticity, non-normality and serial correlation. The FD estimators might then be preferred (Wooldridge, 2014, pp. 392-400). Furthermore, if a time series follow a "random walk", which means that the time series is highly persistent and violates the assumption of weak dependence between the dependent and independent variables, the FD estimators are preferred to the FE estimators since it "differs away" the time correlations and time trends (Wooldridge, 2014, pp. 316-324). However, it can be mentioned that FD is not commonly used in DD models. Previous literature argues that FD is not a better estimator for this kind of model (Bertrand, et al., 2004). A longer elaboration and performance of the FD regression are shown in Appendix IV.

Multicollinearity

Another possible problem concerns multicollinearity between the independent variables. If present, R-squared will become inflated because there is a linear relationship between the independent variables and not because the model is well defined. This might increase the variance in the OLS parameters and thus make the model less precise (Wooldridge, 2014, pp. 81-89). In this model, fixed effects are included, which can be expected to raise the explanatory power of the model. That would justify high R-squared. Nevertheless, it is likely to detect collinearity between the year-dummies since they show a time trend that can be expected to depend on events from earlier years. The year dummies will then be linearly correlated. Usually, to correct for multicollinearity, it is advised to simply collect more data and problems with inflated R-squared and imprecision of the estimates should disappear. However, if there is a large, but not perfect, degree of collinearity between other variables than the variable of interest, it is of minor importance for estimating the model with the OLS-estimates**.** A correlation matrix estimate the correlation between independent variables and can identify if perfect collinearity is present. Such a test is carried out and presented in Appendix V.

4. Results

Three separate models have been used to estimate the following results, based on the equations specified in the methodology section. The first model is referred to as the restricted model, where the independent variables consist of treatment dummies for Romania and Hungary as well as the time and country fixed effects. In the second regression, which is referred to as the unrestricted model, three further control variable were added to control for time-varying effects that might influence the socio-economic development and to improve the accuracy of the model. Note that the indicator for GDP per capita is expressed in logarithmic form. This is done since variables that are positive and measured in dollar usually are taken in its logarithmic form (Wooldridge, 2014, pp. 155-164). After the two initial models were employed, a third one was added to include an average treatment effect of EU accession and to provide more general results.

4.1 Restricted model

Table 4
Results from the restricted model

VARIABLES	(1) lifeexpect	(2) mortality	(3) cpi	(4) gini	(5) netenrol	(6) tertiaryeduc
RomEU	0.144	-5.561***	0.261	-1.607**	-3.464**	1,213***
	(0.260)	(0.745)	(0.242)	(0.694)	(1.636)	(214.2)
HunEU	-0.105	0.106	-0.528*	1.116	1.198	-61.43
	(0.215)	(0.552)	(0.265)	(0.761)	(1.748)	(140.8)
Constant	73.06***	8.691***	3.464***	29.07***	84.60***	1,892***
	(0.352)	(0.951)	(0.497)	(0.928)	(2.132)	(154.1)
Observations	39	39	39	39	38	39
R-squared	0.976	0.987	0.893	0.841	0.588	0.946
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	NO	NO	NO	NO	NO	NO

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The variables of interest in this study are the interaction terms *RomEU* and *HunEU*. The coefficients of these variables indicate the estimated effect of an EU membership for Romania and Hungary respectively. What firstly can be noted is that Romanian membership seems to

have an impact on the examined socio-economic variables to a greater extent than the Hungarian membership.

The coefficients for life expectancy are small and statistically insignificant for both countries. In other words, life expectancy (denoted *lifeexpect*) does not seem greatly affected by EU accession.

Infant mortality is, on the other hand, significantly affected by Romanian EU membership. It is statistically significant at the 1% level, indicating the highest tested level of significance. The coefficient is negative and quite large in magnitude, which is to be expected since it is reasonable to believe that EU would help its members develop both socially and economically. Accession is estimated to decrease the mortality with about 5.6 infants per 1,000 inhabitants, all else equal, which can be considered as economically significant. However, the same effect does not appear in the case of Hungarian EU membership. The coefficient is positive, which would indicate that a membership increases infant mortality rate, but it is not statistically significant. Since the initial level of infant mortality was notably smaller in Hungary than in Romania, a smaller change in Hungary is only to be expected.

Hungarian membership has a statistically significant impact on CPI at the 10% level, but the sign of the coefficient is not what was expected. A positive coefficient would have been expected as EU can provide legitimacy to the Hungarian state and help with reforms in the fight against corruption. But according to these results, the perceived corruption increases with 0.5, on a scale from zero to ten, after accession to the EU. The magnitude of the coefficient is moderate and does not indicate a major change in corruption level. No significant results, neither statistically nor economically, are found in the case of Romania.

The coefficient for Gini-Index in Romania is negative and statistically significant at the 5% level. EU membership thus seems to have a positive impact on equality in Romania. It indicates that the differences between rich and poor are reduced by the accession to the EU, which can be expected from a membership in a union that is committed to the fight against inequality (European Union, 2005). The magnitude of the coefficient is, however, not particularly large. The impact on the Gini-Index in Hungary is not significant.

The effects of EU membership on education seems to be quite ambiguous, according to the results of this regression. Firstly, the coefficients for Romanian membership are statistically significant for both the observed education variables. However, the signs of the two coefficients differ. Net enrolment in primary education is significant at the 5% level and decreases by 3.46% as a result of EU membership. This is considered as economically significant since primary education is a very basic and important aspect of development, which should be provided to everyone. Enrolment in tertiary education per 100,000 inhabitants is significant at the 1% level and increases by as much as 1213 students. Since the highest measured value for this indicator measures about 5,000 students per 100,000 inhabitants, an increase of 1213 students as a cause of EU membership is highly economically significant. In the case of Hungary, EU membership has no significant impact in any of the two educational measures. All signs of educational coefficients are expected to be positive, referring to the theory that accession to the EU result in a process of convergence to an EU average.

4.2 Unrestricted model

Table 5
Results from the unrestricted model

VARIABLES	(1) lifeexpect	(2) mortality	(3) cpi	(4) gini	(5) netenrol	(6) tertiaryeduc
RomEU	1.018***	-1.397**	0.602	-2.205	-3.333	654.8**
	(0.334)	(0.651)	(0.515)	(1.389)	(2.965)	(252.2)
HunEU	-0.269	-0.414	-0.446	1.170	0.986	116.0
	(0.233)	(0.476)	(0.310)	(0.894)	(2.371)	(122.6)
Constant	88.00***	81.49***	6.135	20.56	95.58	-10,157***
	(7.152)	(9.859)	(10.30)	(20.71)	(59.07)	(2,667)
Observations	38	38	38	38	37	38
R-squared	0.989	0.996	0.930	0.845	0.611	0.976
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In this, the second model, three control variables have been added to control for conjuncture and changes in the population. This has increased the explanatory power of the model, since

R-squared increases in all regressions. It is also notable that the unrestricted model has changed the significance of certain variables, which will be examined further below.

In contrast to the restricted model, Romanian EU membership now seems to have a highly significant impact, at the 1% level, on life expectancy. The sign of the coefficient is positive and implies an increase in expected life length with about one year. Since previous studies have shown that there was an impact on this variable (Sevinç & Civan, 2013), a positive sign was expected. However, EU accession is still insignificant for life expectancy in the case of Hungary.

Moreover, the results of the impact of membership on mortality is to a large extent consistent with the results from the first model. The coefficient for Romania was, in the restricted model, highly significant at the 1% level, but is now significant at the 5% level. The economic significance has also decreased somewhat after introducing the control variables. The infant mortality rate is still unaffected in Hungary. However it is logical to expect a greater effect of the Romanian accession as the country had higher infant mortality rate than Hungary when it joined the EU.

The effect on CPI of EU membership is still insignificant for Romania. At the same time, the variable of Hungarian membership has become statistically insignificant when the control variables are included. This could imply that the previous results were due to conjuncture and the financial crisis. This is in line with previous studies, displaying how the crisis halted the fight against corruption.

The sign of the coefficient for Gini-index is still negative for Romania but has, in the unrestricted model, become insignificant. The same insignificant impact is found in Hungary. This indicates that entering the EU has not decreased income inequality in the population. It can be related to large wage disparities and that EU membership has not succeeded in significantly improve the socially and economically marginalized ethnical minorities like the Roma minorities in Romania or Hungary.

Moreover, the result regarding education are somewhat changed when expanding the restricted model. Previously, Romanian membership seemed to significantly decrease the primary enrolment rate, which was not to be expected. However, the unrestricted model

shows no significant effect. The effect on tertiary education in the case of Romania is still positive, in line with what is expected. However it is now significant at the 5% level, which is a decrease in significance from the restricted model. The coefficient has decreased from 1,213 to about 655 students per 100,000 inhabitants, which implies a smaller effect but still of great importance. Both enrolments in primary and tertiary education still seem unaffected by Hungarian membership.

4.3 Average treatment effect model, unrestricted

After the inconclusive outcomes resulting from the first two models, it was decided to estimate the average treatment effect of EU accession for the two countries. In this third model, the individual treatment dummies for Romania and Hungary have been replaced with an average effect, denoted by *AverageEU*. As indicated, it expresses the average effect of EU membership for both Romania and Hungary.

Table 6
Results from the average treatment effect model

VARIABLES	(1) lifeexpect	(2) mortality	(3) cpi	(4) gini	(5) netenrol	(6) tertiaryeduc
AverageEU	0.0464	-0.655	-0.189	0.344	-0.0835	247.9*
	(0.170)	(0.411)	(0.232)	(0.693)	(1.805)	(124.5)
Constant	73.61***	92.47***	-5.576	58.29***	143.6***	-16,179***
	(3.625)	(6.147)	(4.393)	(10.19)	(33.45)	(2,217)
Observations	38	38	38	38	37	38
R-squared	0.984	0.996	0.918	0.818	0.593	0.972
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Only enrolment in tertiary education seems to be significantly affected at the 10% level, as a result of EU-membership. The coefficient is positive, but small in magnitude. These results are to a large degree consistent with the ambiguity in outcomes seen in the two former estimated models. However, the results are slightly less statistically significant than in previous models. On average, EU accession does not seem to have had a statistically significant effect on socio-economic development.

4.5 Robustness checks

There are a number of methods utilized to examine the robustness of the results, i.e. including adding control variables and observing the changes in the estimated coefficients (Lu & White, 2014). In this thesis the first method is used, which can be seen through the addition of control variables in the second, unrestricted, model. For the results to be considered robust, coefficients should not change dramatically with the introduction of control variables. This holds true for most of the regressions in this thesis, there are some cases where terms become insignificant in the unrestricted after having been significant in the restricted model, and vice versa. However, there are no major changes when it comes to the signs or size of the coefficients. A placebo test is also carried out, in order to estimate how the significance of EU membership changes when the period of treatment is hypothetically and randomly defined different. Romania is treated before 2005 while Hungary is treated before 2003. The results of the placebo test is presented below and show that all variables are insignificant except for Romanian enrolment in primary and tertiary education. In this placebo test, primary enrolment is negatively impacted of EU accession, while tertiary enrolment is positively impacted. This implies that the model in general is robust, with a possible exception for the education indicators which seem to be significant for treatment periods that do not correspond to EU accession. This can be a further proof that the parallel trend assumption is not entirely fulfilled and that the previous results could be inaccurate.

Table 7
Placebo test

VARIABLES	(1) lifeexpect	(2) mortality	(3) cpi	(4) gini	(5) netenrol	(6) tertiaryeduc
RomEUPlac	-0.0240	0.384	-0.0219	0.564	-7.839***	603.1**
	(0.507)	(0.926)	(0.455)	(1.678)	(2.580)	(242.8)
HunEUPlac	0.121	0.271	0.466	-1.186	0.416	-95.31
	(0.247)	(0.514)	(0.296)	(0.840)	(2.127)	(126.4)
Constant	74.18***	92.74***	-1.879	42.69	255.6***	-26,738***
	(7.948)	(13.11)	(8.798)	(26.34)	(47.64)	(4,180)
Observations	38	38	38	38	37	38
R-squared	0.984	0.995	0.928	0.836	0.663	0.973
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

The aim of this study has been to estimate the socio-economic effects of accessing the European Union. From the results, it can be concluded that the effects of accession itself are not as significant as first anticipated. Romanian EU membership seems to have led to positive development in areas such as life expectancy, infant mortality rate and inequality (although the results for the Gini-index should be examined carefully because of the treatment of the data). However, the same effects cannot be seen in Hungary. The result for the average treatment shows the same lack of effect. Therefore it is hard to unambiguously claim the importance of EU accession on socio-economic development. With that said, it is clear that is has been more positive than negative in terms of socio-economic development.

Previous studies have shown evidence of convergence within the EU and that a membership can imply a faster growth of socio-economic variables. The results in this study do not dispute those findings, as we observe the more direct effects of accession. However, it is notable that existing research find a positive connection between EU accession and economic indicators. It can be concluded that those findings are not entirely consistent with the findings in this report. Economic and socio-economic variables are highly correlated, thus the positive effect was expected to be seen in the results of this paper as well. Something that seems evident from looking at earlier studies together with the data from this study, is that development has taken place in the observed countries, however it seems as though the major part of this development takes place at an earlier stage than the year of accession. This conclusion is in line with the fact that a certain attained socio-economic level is necessary in order for a country to be considered for membership. The union has set up a number of entry requirements that lead to a process of reforms and negotiations. So when this negotiation process is finished and accession takes place, most of the development has already transpired. Other studies showed how convergence of economic variables was apparent for most European countries, even those not members of the union. That indicates that other factors, such as globalizations or spillover effects from large economies, are more important for socio-economic growth than a European Union membership. These conclusions are supported by the findings in this paper, as no clear relationship between EU accession and positive socio-economic development was discovered.

There have been some shortcomings with this thesis, mostly due to the limited amount of data available. By using data spanning over a longer period of time, both before and after accession, it would be possible to examine the socio-economic development prior to and after EU accession in more detail. Time lags can also be added to the present model, in order to catch delayed effects or effects of the negotiation process leading up to EU accession. Since there are signs indicating that meaningful socio-economic development occurs before the actual accession, this is clearly of interest and importance to examine in future studies. Another factor that could be improved is to add another suitable control country that never enters the EU. Even though Croatia never enters in our time perspective, it does so in 2013 and it would be interesting to see the difference between the treated countries and a country without this connection to the EU. The more countries added to the analysis, the more general conclusions can be drawn.

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7. Appendices

7.1 Appendix I – Definitions of variables

Table 8
Definition and source of variables

Variable	Description	Source
Dependent variables		
cpi	Cprruption Perception Index	Trancparency international
gini	GINI-Index	World DataBank, World Development Indicators
lifeexpect	Life expectancy at birth, total (years)	World DataBank, World Development Indicators
mortality	Mortality rate, infant (per 1000 live births)	World DataBank, World Development Indicators
netenrol	Net enrolment rate in primary education: ratio of enrolled children to population of corresponding school age	UNESCO institute for statistics
tertiaryeduc	Enrolment in tertiary education, number of students per 100,000 inhabitants	UNESCO institute for statistics
Control variables		
fdi	Foreign Direct Investment, net inflows as a percentage of GDP	World DataBank, World Development Indicators
gdpcapita	GDP per capita (current, US$)	World DataBank, World Development Indicators
popgrowth	Population growth rate	World DataBank, World Development Indicators
Dummy variables		
RomEU	Dummy = 1 if Romania has entered the EU, year > 2007	Own calculation
HunEU	Dummy = 1 if Hungary has entered the EU, year > 2004	Own calculation
AverageEU	Dummy = 1 if Hungary has entered the EU, year > 2004 and/or Romania has entered the EU, year > 2007	Own calculation
Fixed effect variables		
π	Country fixed effects	Estimated in STATA
δ	Time fixed effects	Estimated in STATA

7.2 Appendix II – Treatment of Gini-index

In order to fill in gaps in documentation of the Gini-index, Data of existing Gini-Index is treated. The data is *interpolated*, when documentation is missing for a year between known observations, and *extrapolated*, when future figures are estimated. Interpolation is done with simple linear interpolation for unknown values, which is assuming that the unknown value is the average difference between two known values. Extrapolation is done by estimating a linear trend line, based on the observed and interpolated data of the index, which allows estimation of future values.

The graphs with trend lines as well as table of the observed and treated data follow below:

Figure 1
Gini-index for Croatia

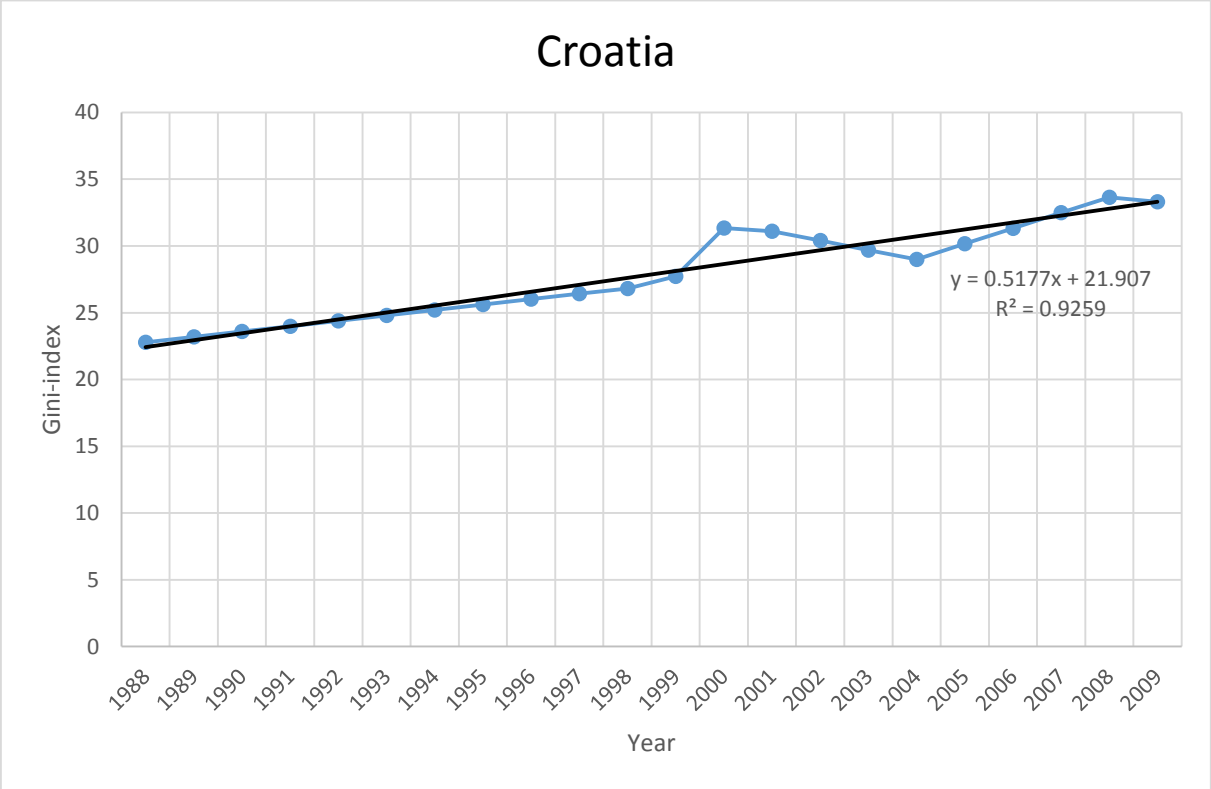


Figure 2
Gini-index for Romania

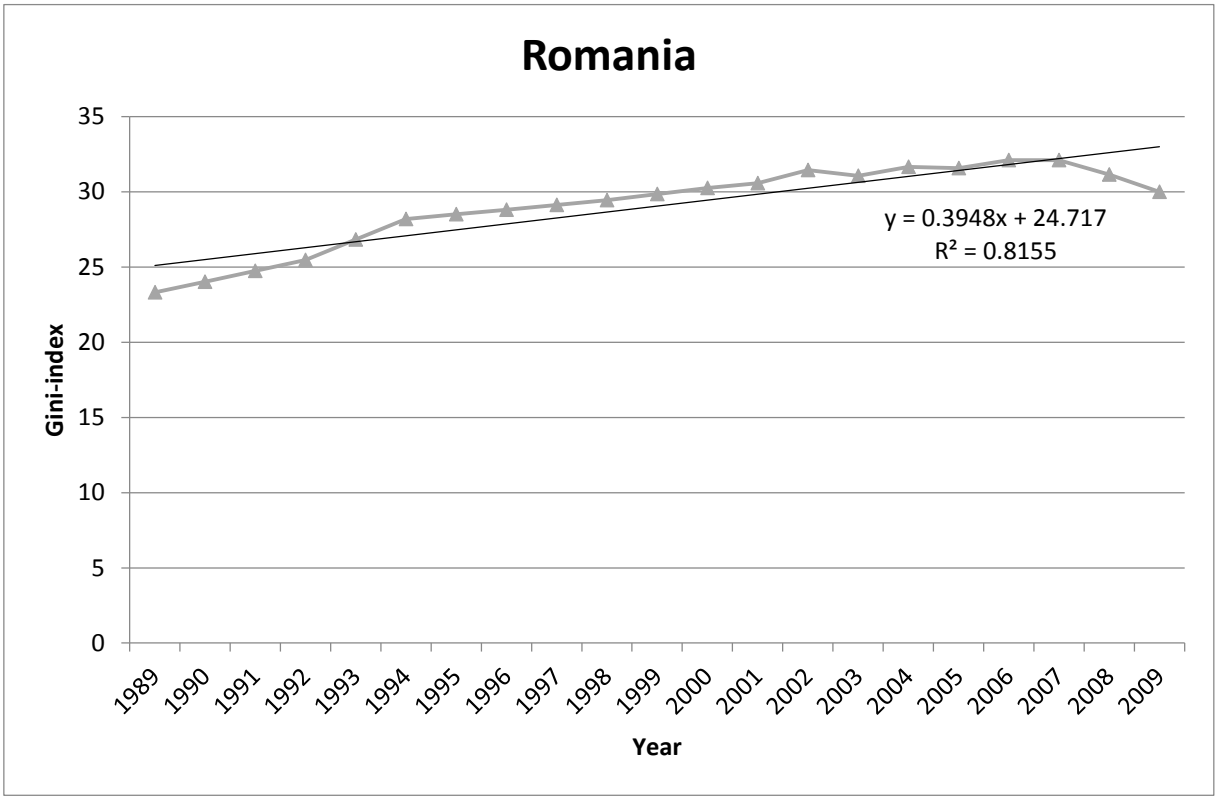


Figure 3
Gini-index for Hungary

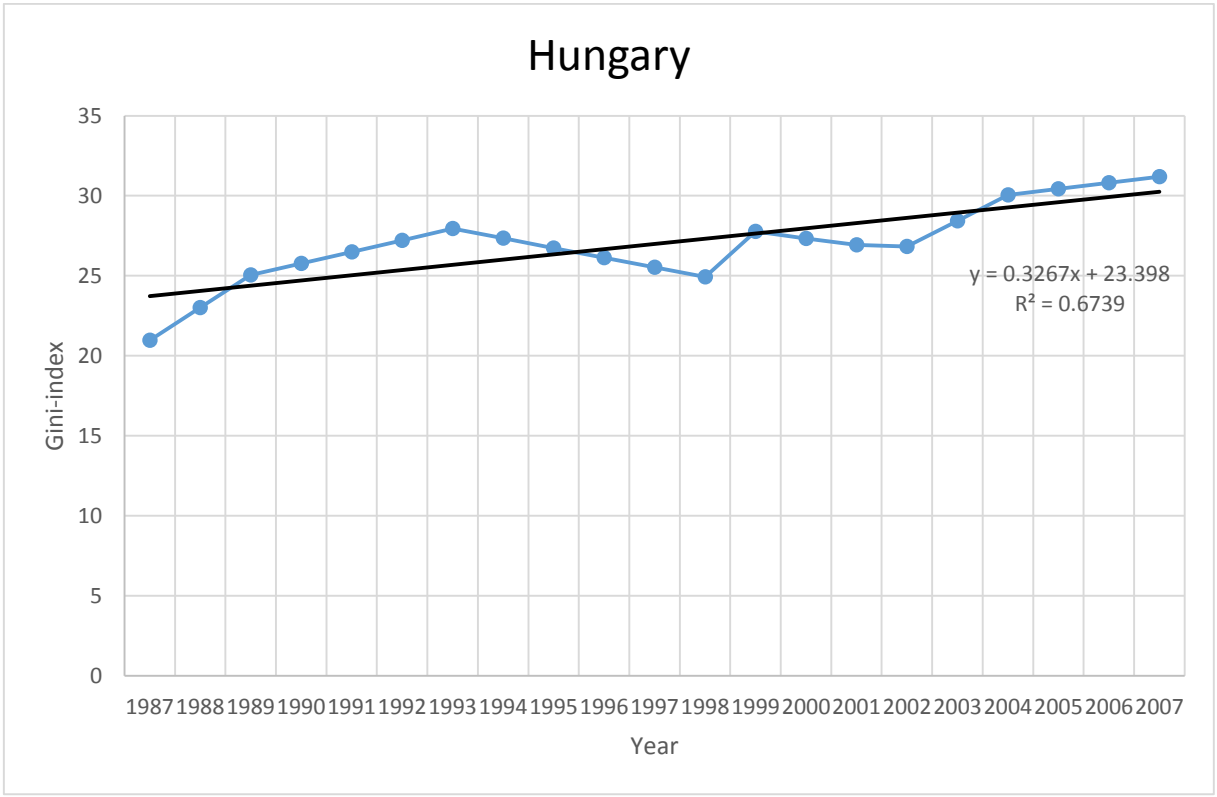


Table 9
Gini-index panel data

	Hungary	Romania	Croatia
1987	20.96		
1988	23.05*		22.78
1989	25.05	23.31	23.184*
1990	25.7725*	24.026667*	23.588*
1991	26.495*	24.743333*	23.992*
1992	27.2175*	25.46	24.396*
1993	27.94	26.83*	24.8*
1994	27.338*	28.2	25.204*
1995	26.736*	28.51*	25.608*
1996	26.134*	28.82*	26.012*
1997	25.532*	29.13*	26.416*
1998	24.93	29.44	26.82
1999	27.77	29.845*	27.71
2000	27.32	30.25	31.33
2001	26.92	30.57	31.1
2002	26.82	31.46	30.39667*
2003	28.43*	31.06	29.69333*
2004	30.04	31.66	28.99
2005	30.42*	31.57	30.155*
2006	30.8*	32.11	31.32*
2007	31.18	32.1	32.485*
2008	30.5854**	31.15	33.65
2009	30.9121**	30	33.2964**
2010	31.2388**	33.4026**	33.8141**
2011	31.5655**	33.7974**	34.3318**
Equations	= 0.5177x + 21.907	= 0.3267x + 23.398	=0.3948x + 24.717

*interpolated, **extrapolated

7.3 Appendix III – Time trend graphs

Figure 4
Life expectancy

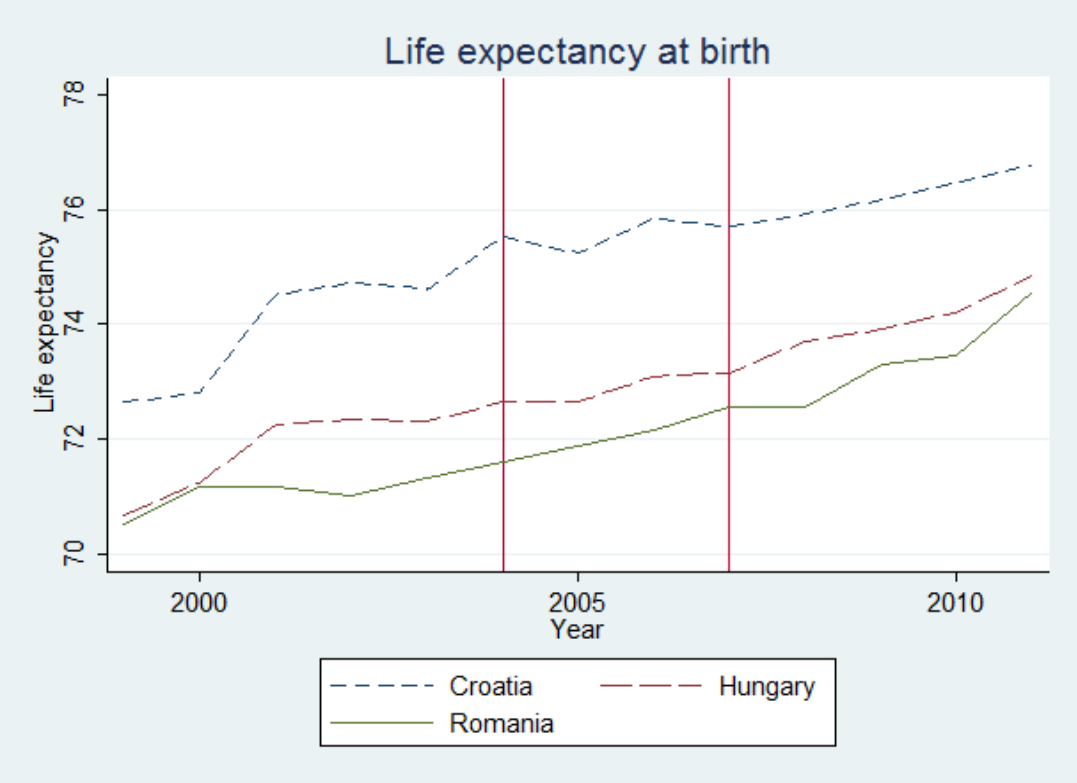


Figure 5
Infant mortality rate

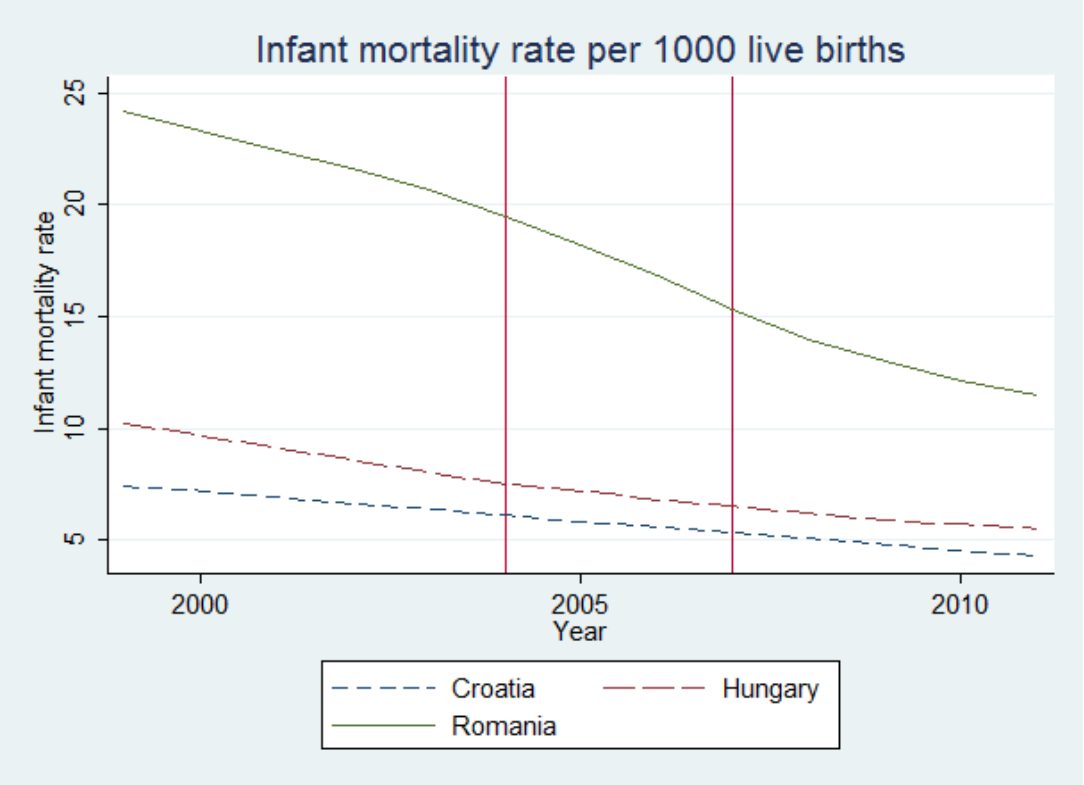


Figure 6
CPI

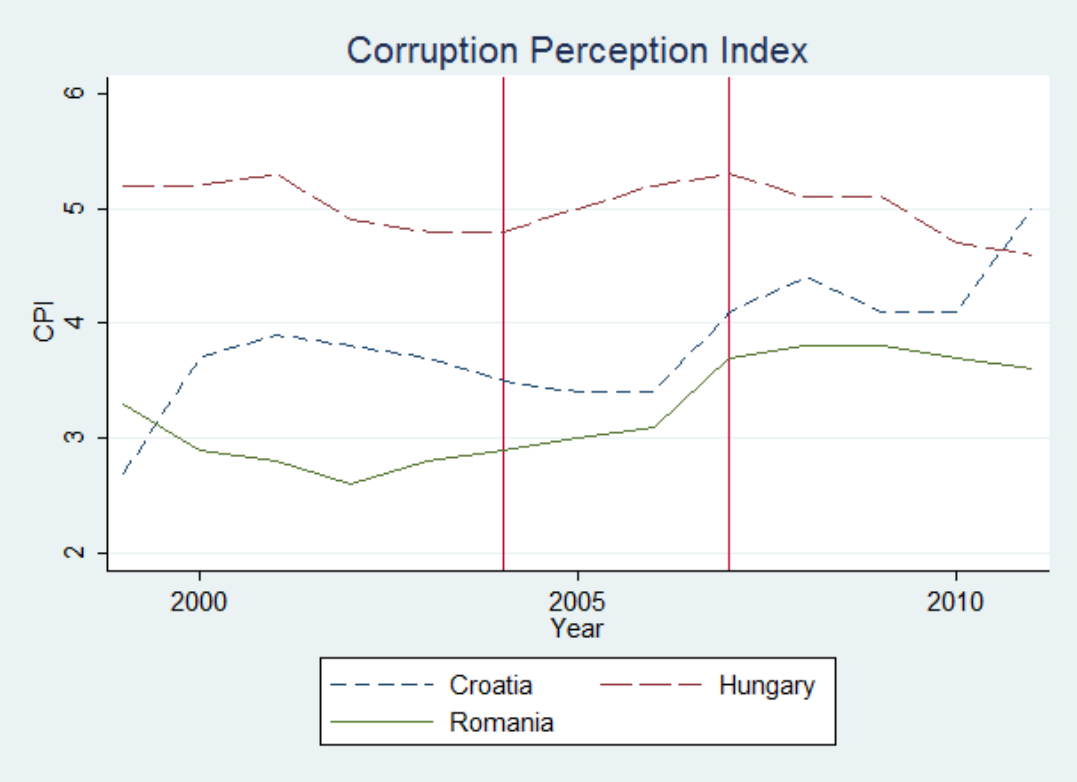


Figure 7
Gini-index

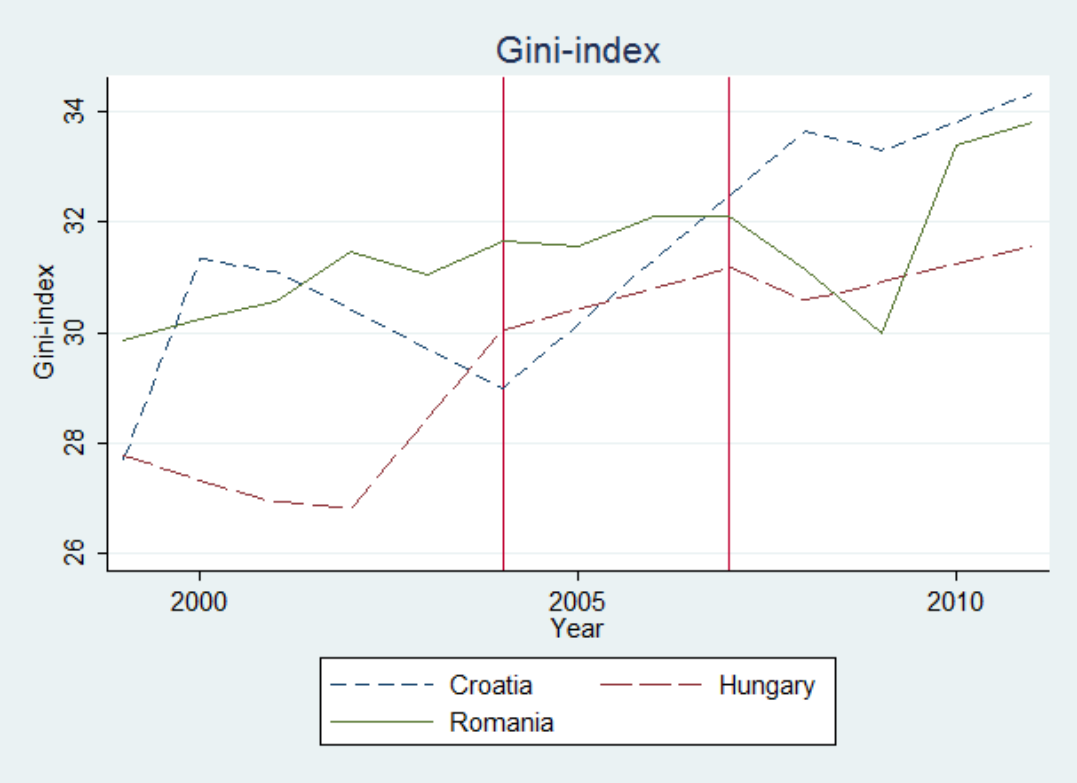


Figure 8
Net primary enrolment

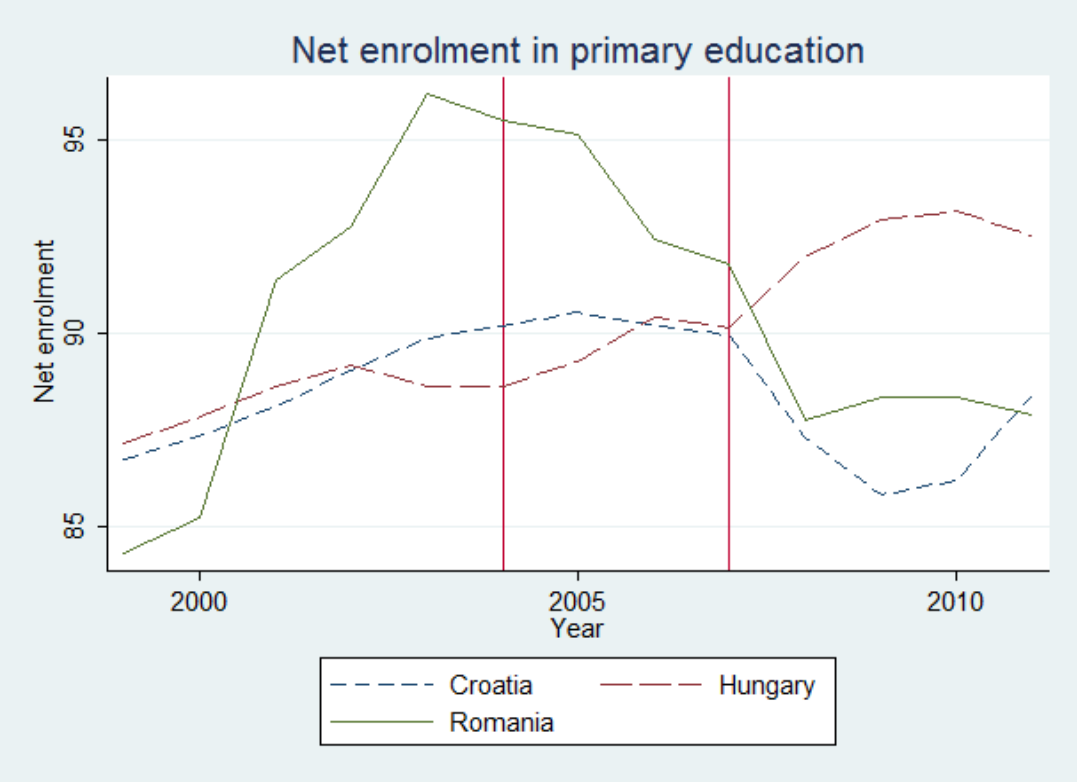


Figure 9
Tertiary enrolment

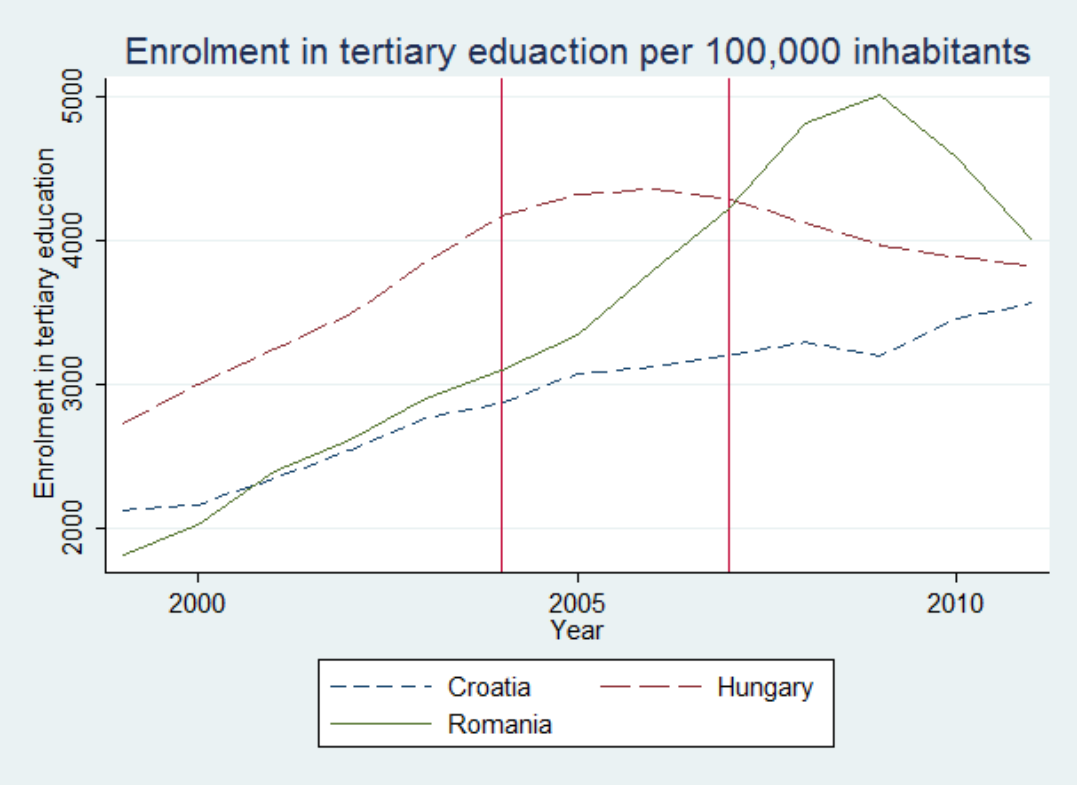


Figure 10
GDP/ capita

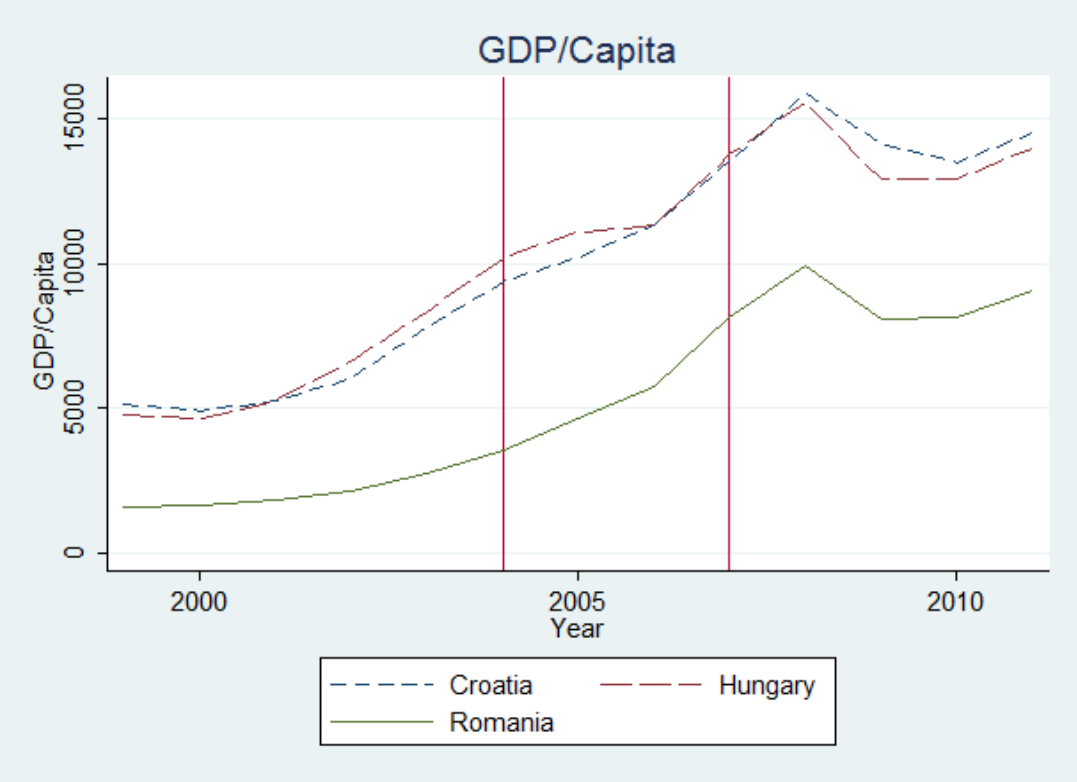


Figure 11
FDI

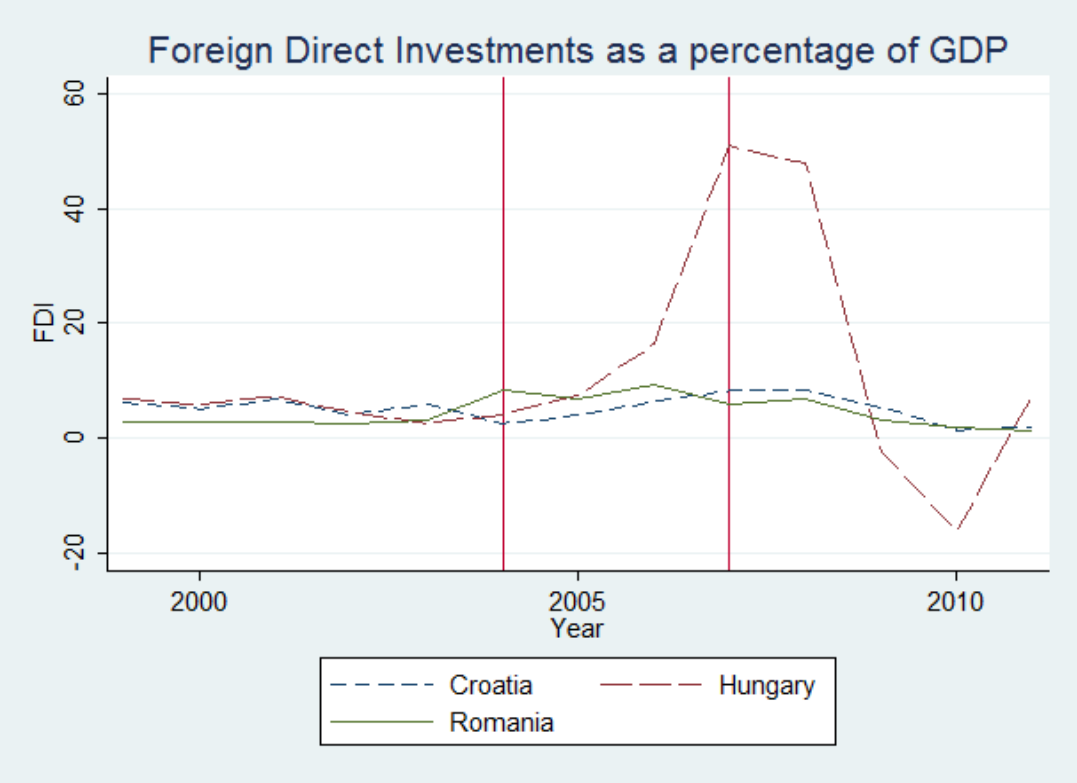
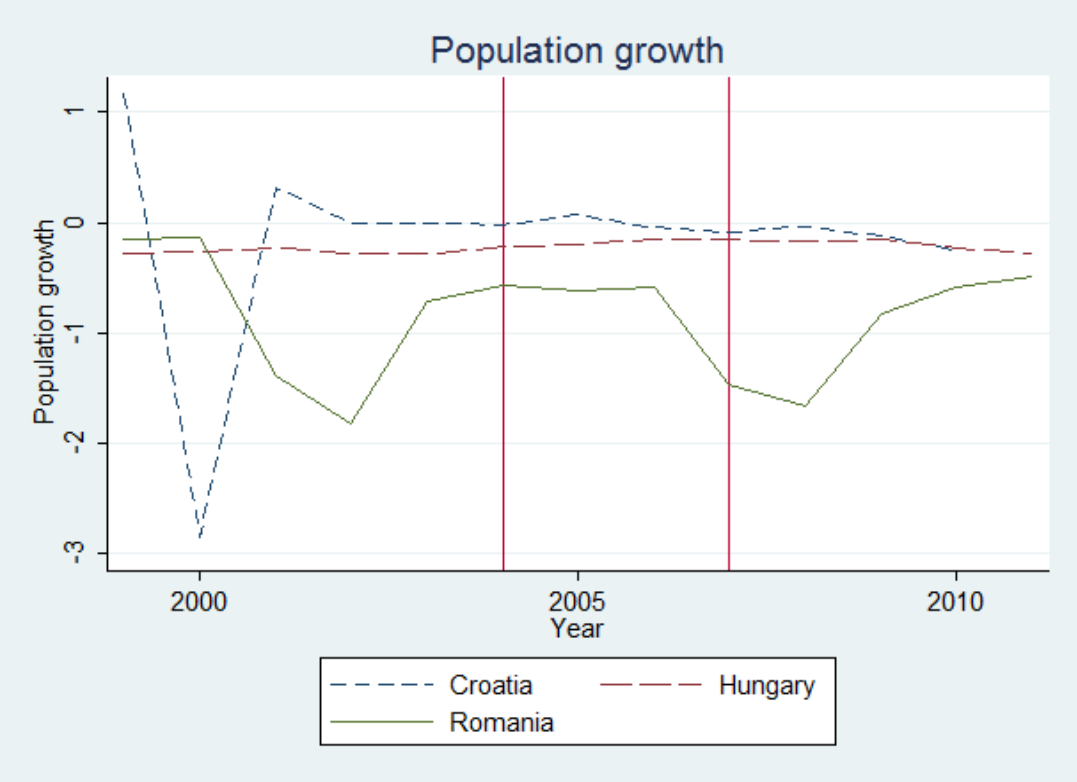


Figure 12
Population growth



7.4 Appendix IV – First Differencing

In order to control for serial correlation, a First Difference (FD) model is utilized. When constructing the FD model, two single cross sectional models for two years are differenced with each other for each variable. This cancels out the unobserved fixed effects, and lets the intercept be the change in intercept from one year to another (Wooldridge, 2014, pp. 366-386). A rewritten version of the DD model is presented in equation 6. The variables *Post1* and *Post2* are time dummies, corresponding to the time period after Hungarian accession and after Romanian accession respectively. The variable *EU* is the treatment variable and the variable of interest. τ is thus the socio-economic effect of entering the EU. For simplicity, the model presented below shows the First Differencing between the time periods before and after Hungarian accession. The outcome of the FD is displayed in equation 7. Estimating the FD model for between time periods before and after Romanian EU accession is done in a similar way.

$$Y_{tc} = \eta Post1 + \gamma Post2 + \tau EU_t + X'\beta + \varepsilon_{tc} \quad (6)$$

$$\Delta Y_{tc} = \eta + \tau \Delta EU_t + \Delta X'\beta + \Delta \varepsilon_{tc} \quad (7)$$

If the time series is highly persistent and violates the assumption of weak dependence between the dependent and independent variables, the model follows a so called "random walk". It is an example of the "unit root process" and means that the outcome of one year,y_t, depends on the outcome of previous year,y_{t-1} , and an uncorrelated, zero mean, random variable, e_t (Wooldridge, 2014, pp. 316-324).

$$y_t = y_{t-1} + e_t, \qquad t = 1, 2 \ldots \quad (8)$$

If the time series follows a random walk and e_t is not a highly persistent variable, the FD estimators are preferred to the FE estimators since the FD regression cancels out the time correlations and time trends (Wooldridge, 2014, pp. 316-324). By comparing the outcomes in the FE regression with the first differenced, it is possible to analyse to which extent serial correlation exists and for what reason. If serial correlation exist, FD might produce more precise estimators than FE, as serial correlation causes the standard errors to become biased (Wooldridge, 2014, pp. 392-400).The results of the FD model are presented below.

Table 10
Results from the First Difference model

VARIABLES	(1) Diff_lifeexpect	(2) Diff_mortality	(3) Diff_cpi	(4) Diff_gini	(5) Diff_netenrol	(6) Diff_tertiaryeduc
RomEU	0.134	-0.648***	0.0897	0.0241	0.248	39.49
	(0.181)	(0.147)	(0.0984)	(0.898)	(0.785)	(226.1)
HunEU	0.00724	-0.0437	-0.141	-0.267	1.065	-36.13
	(0.143)	(0.124)	(0.122)	(0.597)	(0.620)	(119.7)
Constant	-3.746	8.858***	-4.577**	-10.76	-24.71**	75.91
	(2.522)	(2.169)	(2.159)	(6.374)	(9.711)	(1,442)
Observations	36	36	36	36	34	36
R-squared	0.942	0.996	0.720	0.475	0.742	0.850
Country FE	NO	NO	NO	NO	NO	NO
Year FE	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The standard errors are in general smaller in the FD model than in the FE model. However, the differences are not particularly large. The variables life expectancy and tertiary enrolment, which were significantly impacted by Romanian EU membership in the unrestricted FE regression, are no longer significant. However, infant mortality rate has become even more significant, at the 1% level. The difference in magnitude of the variables of interest, between the FD and FE model, could imply that they are affected by serial correlation in the FE model. However, FD is rarely used in a DD setting (Bertrand, et al., 2004), which is why this thesis relies on the estimations of the FE model to control unobserved effects. Furthermore, the time trend do not seem to follow a random walk, as the values do not fluctuate enough to indicate such a phenomenon, which is shown in the time trend graphs in Appendix III.

7.5 Appendix V – Test of correlation between independent variables

A test of the magnitude of potential correlation between independent variables is performed and presented in the table below:

Table 11

Test of correlation between independent variables

```
. corr RomEU HunEU year Countryfix loggdpcapita fdi popgrowth
(obs=38)
```

	RomEU	HunEU	year	Countr~x	loggdp~a	fdi	popgro~h
RomEU	1.0000						
HunEU	-0.2010	1.0000					
year	0.4422	0.3750	1.0000				
Countryfix	0.4675	-0.0168	0.0546	1.0000			
loggdpcapita	0.1266	0.4740	0.7388	-0.4895	1.0000		
fdi	-0.1117	0.3530	0.0677	-0.0391	0.2411	1.0000	
popgrowth	-0.3471	0.1710	-0.0065	-0.4276	0.2684	0.0940	1.0000

A value of one represents perfect collinearity. This is not displayed between any of our independent variables and thus do not breach the assumption of no perfect collinearity. Nor is the correlation between the variables of interest, *RomEU* and *HunEU*, and other variables high enough for it to cause severe problems when running the regressions. However, relatively high correlation can be seen between the year trend and the logarithm of GDP per capita. But since these are not the variables that are of interest in this study, it is of lesser importance. Note that the individual year dummies are not tested in this matrix, only the year trend.

7.5 Appendix VI – Panel data

Table 12
Panel data

Country	Year	EU	Life expect	Mortality	Net enrol	GDP/Capita	FDI	CPI	Tertiary educ	GINI	Popgrowth
Romania	1999	0	70.512	24.200	84.332	1583.850	2.925	3.300	1813.303	29.845	-0.157
Romania	2000	0	71.163	23.300	85.260	1662.218	2.780	2.900	2021.681	30.250	-0.129
Romania	2001	0	71.161	22.400	91.377	1833.813	2.851	2.800	2389.735	30.570	-1.395
Romania	2002	0	71.010	21.600	92.779	2116.312	2.488	2.600	2616.775	31.460	-1.831
Romania	2003	0	71.310	20.700	96.221	2756.333	3.101	2.800	2900.292	31.060	-0.721
Romania	2004	0	71.594	19.500	95.540	3533.266	8.501	2.900	3094.652	31.660	-0.570
Romania	2005	0	71.879	18.200	95.162	4651.692	6.924	3.000	3341.008	31.570	-0.618
Romania	2006	0	72.163	16.800	92.441	5789.244	9.333	3.100	3784.063	32.110	-0.592
Romania	2007	1	72.566	15.300	91.806	8170.143	6.031	3.700	4215.923	32.100	-1.477
Romania	2008	1	72.566	14.000	87.790	9949.355	6.777	3.800	4810.489	31.150	-1.666
Romania	2009	1	73.310	13.000	88.354	8068.957	2.997	3.800	5011.511	30.000	-0.833
Romania	2010	1	73.459	12.100	88.353	8139.147	1.944	3.700	4572.075	33.403	-0.594
Romania	2011	1	74.563	11.500	87.902	9063.676	1.400	3.600	3997.637	33.797	-0.492
Hungary	1999	0	70.677	10.200	87.160	4782.977	6.755	5.200	2724.998	27.770	-0.283
Hungary	2000	0	71.246	9.700	87.845	4613.706	5.881	5.200	3003.400	27.320	-0.260
Hungary	2001	0	72.249	9.100	88.639	5254.772	7.367	5.300	3241.906	26.920	-0.229
Hungary	2002	0	72.349	8.600	89.177	6631.448	4.472	4.900	3485.104	26.820	-0.285
Hungary	2003	0	72.300	8.000	88.640	8365.465	2.569	4.800	3849.770	28.430	-0.286
Hungary	2004	1	72.649	7.500	88.663	10206.325	4.151	4.800	4172.587	30.040	-0.221
Hungary	2005	1	72.649	7.200	89.299	11092.431	7.602	5.000	4318.676	30.420	-0.199
Hungary	2006	1	73.098	6.800	90.451	11342.891	16.351	5.200	4353.491	30.800	-0.156
Hungary	2007	1	73.151	6.500	90.170	13781.141	50.968	5.300	4289.645	31.180	-0.155
Hungary	2008	1	73.702	6.200	92.005	15598.323	47.907	5.100	4118.182	30.585	-0.175
Hungary	2009	1	73.905	5.900	92.952	12906.750	-2.294	5.100	3964.462	30.912	-0.155
Hungary	2010	1	74.207	5.700	93.187	12958.530	-16.154	4.700	3883.817	31.239	-0.226
Hungary	2011	1	74.859	5.500	92.531	13983.498	7.535	4.600	3820.712	31.566	-0.283
Croatia	1999	0	72.642	7.400	86.737	5135.473	6.210	2.700	2125.310	27.710	1.171
Croatia	2000	0	72.808	7.200	87.378	4919.628	5.097	3.700	2162.987	31.330	-2.851
Croatia	2001	0	74.513	6.900	88.121	5245.421	6.794	3.900	2342.544	31.100	0.316
Croatia	2002	0	74.717	6.600	89.060	6053.716	4.092	3.800	2542.578	30.397	0.000
Croatia	2003	0	74.614	6.400	89.894	7805.881	5.911	3.700	2759.279	29.693	0.000
Croatia	2004	0	75.520	6.100		9365.742	2.594	3.500	2871.146	28.990	-0.023
Croatia	2005	0	75.245	5.800	90.549	10224.304	3.913	3.400	3068.179	30.155	0.068
Croatia	2006	0	75.837	5.600	90.242	11359.526	6.383	3.400	3120.768	31.320	-0.045
Croatia	2007	0	75.706	5.300	89.957	13540.403	8.236	4.100	3204.056	32.485	-0.090
Croatia	2008	0	75.912	5.100	87.322	15889.351	8.249	4.400	3289.125	33.650	-0.034
Croatia	2009	0	76.168	4.800	85.842	14142.151	5.430	4.100	3197.040	33.296	-0.123
Croatia	2010	0	76.476	4.500	86.219	13500.854	1.417	4.100	3454.405	33.814	-0.255
Croatia	2011	0	76.776	4.300	88.434	14540.274	1.996	5.000	3560.739	34.332	