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Why is economic growth lagging behind in former Comecon republics?

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Acknowledgements

It became clear early on that we wanted to write a thesis that addresses several aspects of society, both economically, politically, and sociologically. Interest was aroused through various subjects during the bachelor's degree, which addressed these aspects. As civic-minded students, we wanted to shed light on a geopolitical situation that could help us understand why the world is the way it is.

We were therefore thrilled to be supervised by Ola Honningdal Grytten, Professor Dr. Oecon at the Norwegian School of Economics. The many useful and interesting conversations with a very talented professor have had a significant impact on the thesis. We want to express our sincere gratitude for this guidance. At the same time, we have been given full freedom to steer the thesis when new approaches have emerged, which has helped us to maintain independence. Our work the past five months has been rewarding and challenging both on a personal and academic level.

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Acronyms

Comecon	Council for Mutual Economic Assistance
FDI	Foreign Direct Investment
CIS	Commonwealth of Independent States
WB	World Bank
GDP	Gross Domestic Product
IMF	International Monetary Fund
ICRG	International Country Risk Guide
EU	European Union
UNCAC	United Nations Convention against Corruption
OECD	Organisation for Economic Co-operation and Development
EU-15	The first 15 members of the European Union

Abstract

Since 1990, former Comecon countries have been poorer than their neighbors in Western Europe and, over the past 30 years, convergence has been weak. Economic theory and previous research suggest that the region should have approached similar GDP per capita levels more than they have done. This study will therefore seek to explain why the differences still exist. Building on existing research on growth, the thesis asks: Why economic growth is lagging behind in former Comecon republics, and what can explain the internal differences?

Using quantitative data, we attempt to analyze the relationship between more and less traditional explanatory variables for growth and GDP per capita through a linear regression. Our results show that capital and labor in particular are very important factors for growth in the region. It is also clear that corruption has a negative effect on GDP per capita, while a larger proportion of high-educated citizens promote growth. The parameters we use to measure institutional conditions do not have a significant impact on GDP per capita in the regression. However, we believe that this plays an important role, both to explain the lack of convergence, but also to the internal differences in the region.

Keywords – GDP per capita, economic growth, Comecon, Eastern Europe

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1 Introduction

1.1 Motivational purpose

Since the fall of the Berlin Wall 30 years ago, former Soviet republics have experienced a major transformation. From communism, with a centrally planned economy and fixed exchange rate and prices in 1990. To liberalization, increased privatization of businesses, institutional changes, and integration into the global economy today. Building market economies has been a challenging task with varying outcomes and a journey that has affected hundreds of millions of people (Roaf et al., 2014).

Data retrieved from World Bank (2019) show that the average GDP per capita of former Council for Mutual Economic Assistance (Comecon) countries was 37 percent of the first 15 members of the European Union (EU-15) in 2018. Despite the geographical proximity to many of the world's best-performing countries in terms of living standards and well-functioning economies, convergence has been slow. Thus, we believe it is interesting to elucidate which mechanisms have resulted in such economic inequality, and which factors that are key to promote further growth and someday achieve the same economic welfare.

Through this paper, we observe the ripple effects of the decisions made by central bank governors and authorities in the 1990s. We find it particularly interesting to examine how much of today's financial situation is due to decisions and the subsequent reforms carried out 30 years ago. At the same time, it is useful to analyze today's economic policy in an attempt to pinpoint future areas of focus in order for the region to speed up convergence towards Western Europe.

In this paper, we present background material on the economic development of the region from the transitional period, through the golden age of the early and mid-2000s. Then we look at today's situation to provide context to the paper. In Section 3, we present previous literature - both traditional economic growth models, but also specific models for growth in transition economies. A description of data and methodology follows before presenting the analysis and the results. In the end, we look at the results in light of previous literature and discuss the limitations of the task before concluding.

1.2 Research question

Our data set consists of different economic and political measurements for 17 countries, all of which at one time practiced a centralized economic system, but then completed the transition to a market economy. Five of these countries have joined the EU over the past 30 years and achieved fairly solid economic growth. The former Commonwealth of Independent States (CIS) members, on the other hand, have not been able to show similar performance. In this thesis, we look at the region as a whole to identify the primary drivers of growth. At the same time, we use insights and examples from some of the countries where appropriate, to make our analysis more concrete. We have thus compiled data from all of the 17 focus countries under each explanatory variable. Structuring the data this way results in more observations for each of the variables, which increases the credibility of the results we get.

Table 1.1: Focus countries

Armenia	Azerbaijan	Belarus
Estonia	Georgia	Kazakhstan
Kyrgyz Republic	Latvia	Lithuania
Moldova	Poland	Russian Federation
Romania	Tajikistan	Turkmenistan
Ukraine	Uzbekistan	

Much empirical research has attempted to explain the development in the region's economy following the dissolution of the Soviet Union in the 1990s. Fewer researchers have focused on identifying the primary drivers of growth in the region today. At the same time, the main emphasis in the literature has been on the Eastern European countries, while less research is devoted to the former CIS countries. We have chosen to include these countries because it allows us to identify cross-country differences within the region while addressing a gap in the literature.

We use regression analysis to analyze the ratio of GDP per capita to various economic and political measures from 1990 to 2018. The period chosen is because the majority of countries first broke out of the Soviet Union during 1990, which means that the database before this is deficient. By including various political measures, in addition to the traditional ones, we are interested in analyzing the importance of strong institutions. This inclusion is useful to gain more insight into how a legal and structural framework is essential for a well-functioning market economy.

This forms the basis for the following research question:

Why is economic growth lagging behind in former Comecon republics, and what explains cross-country differences within the region?

2 Background

2.1 Transition period

Few, if any, regions have undergone a major transformation over the last 30 years, both from an economic and political perspective such as the Eastern European countries (Pickles and Smith, 1998). This makes the study particularly interesting given the region's proximity to many of the world's great powers in terms of well-functioning democracies and strong economies.

Where some countries implemented shock therapy - a rapid and brutal transition, others practiced gradualism with varying degrees of success (Murrell, 1993). Liberalization of prices, exchange rates, and trade, as well as more extensively privatization was relatively easy decisions that quickly came into force. Changing the institutional structure, on the other hand, turned out to be more difficult. Self-interest from people in positions of power resulted in institutional changes varying across the region. Decisions made in the following years still have implications for economic growth and living standards in the region.

Common was high inflation, increased unemployment, and recession in the early 1990s. The difference, however, was that the countries that were on the front foot with reforms, including the institutional changes, adapted much quicker (Roaf et al., 2014). The consequences were brutal, but short-term macroeconomic instability, before eventually achieving economic growth and income convergence against the rest of Western Europe. For those countries that did not make the transition with adequate reforms, the development was not equally successful. This resulted in more significant differences between the Eastern European countries, many of whom still exist in 2019.

2.2 Golden age and the financial crisis

The early and mid-2000s represented the golden age. The entire region grew by almost 6 percent annually in the period 2002-2007. None of our focus countries grew by less than 3 percent - a consistent growth rate that has not been witnessed before nor after. Hence, if one had managed to achieve similar growth for 12 years, wages would have doubled (Roaf et al., 2014). In such a scenario, Western living standards would be within reach relatively quickly. However, the region was vulnerable after building up financial imbalances while growing fast. When the financial crisis hit in 2008, it ended up stalling the economic convergence to this day.

The financial crisis was a result of uncritical US lenders in the credit markets. The collapse of Lehman Brothers in 2008 triggered the crisis, which led to a halt in growth on a world basis. The same problems had arisen in the Eastern European countries, and with an uncontrolled increase in credit, the economy overheated for several years before it finally ended in crisis (Honningdal Grytten and Koilo, 2019). Capital flows into the countries slowed and placed the region at the epicenter of the crisis among transition economies in the world, with an average output decline of 6 percent. Latvia contracted as much as 25 percent of its GDP during the crisis, with Estonia and Lithuania close behind. All of the Baltic countries had benefited from high capital inflows before 2008, combined with a fixed exchange rate. This resulted in a more challenging post-crisis position. In contrast, Poland had a floating interest rate and less foreign investment, which meant that they escaped recession as the only country in the region (Roaf et al., 2014).

2.3 Post 2014

Most studies on economic growth in Eastern European countries focus on transition factors in the 1990s from an empirical perspective. Fewer studies focus on what drives the economic growth of the region today. Despite this, one can not neglect the post-Soviet period, since the choices made at that time have consequences for what economic level the countries are experiencing today. Because of this, we emphasize initial conditions, but our analysis will focus to a greater extent on more traditional explanatory variables for economic growth than much of previous research.

In the mid-1990s, the average income per capita in the region was 30 percent of the fifteen most wealthy countries in the European Union, compared to 50 percent in 2014 (Roaf et al., 2014). This indicates a strong convergence with Western Europe in the last 30 years, though one must be aware of the differences between the focus countries. The

Baltics and Poland have experienced both income and price levels to rise significantly, while the CIS countries have struggled to do the same.

Since 2014, growth in the region has leveled off, and several countries have experienced a reduction in GDP, including Ukraine and Russia (World Bank, 2019). At the same time, there are poor prospects of growth in the years ahead. Political tensions, especially with the two countries mentioned above, may contribute to further weakening of the economy. At the same time, new lines form the region. The Baltics and Poland are more closely linked to Western Europe in terms of economic systems and have less in common with the former Comecon countries. The traditional east-west line has shifted, which could mean that countries in the east are at risk of falling even further behind. Thus, receiving lover income, facing more unemployment, and living standards generally being lower compared to the rest of Europe.

The lack of post-crisis growth may be a sign that economies are now more closely resembled regular market economies with more stable growth and fewer overwhelming reforms. From this perspective, one could argue that the "window" for economic growth closed in 2008, where some managed to exploit it better than others in the early and mid-2000s (Roaf et al., 2014). Thus, it is more appropriate to conduct a study based on more traditional explanatory variables rather than pure transition variables in order to capture what drives the growth today.

3 Literature Review

The question of what drives economic growth is often asked, and it turns out that the answer is difficult to find. The issue is essential not only for economists but also for policymakers, central bank governors, and ultimately the people of a country. Economists started early in the search for answers to the question, primarily by analyzing economic growth from an empirical and theoretical perspective. In the following section, we will identify key literature and lay the groundwork for the knowledge found on economic growth. We do this because it is essential to evaluate our research in the context of the existing literature in order to argue why it is relevant.

3.1 From Solow to endogenous growth models

Solow (1956) was the leading figure in the development of neoclassic growth models, alongside Koopmans (1963) and Cass (1965). The neoclassical framework seeks to explain long-term growth through capital accumulation, labor, and increased productivity, often referred to as technological growth. The main essence is that there is an inverse relationship between a country's per capita growth and the initial level of per capita income. Consequently, a country's output, which is a function of capital and labor, will grow faster when capital is low. Thus, developing countries will grow faster than rich countries, given that countries' preferences and technology are approximately similar.

The model of Solow (1956) therefore draws in the direction of conditional convergence in per capita income across poor and rich countries, as a result of diminishing returns to reproducible capital. However, not all researchers agree with Solow. The literature has different views on this topic, which is primarily due to different assumptions in the models, which consequently give different interpretations. Romer (1986) argues that this does not hold empirically for a large proportion of economies. It is especially true for developing countries where institutional conditions are often lacking. Thus, it is a clear difference between exogenous and endogenous models, which we will elaborate on further in the theory section.

One additional problem with the Solow model is that growth in per capita output converges towards zero. This is solved by the introduction of an exogenously given technological change factor. However, institutional conditions do not affect steady-state growth - only on long-run output. Besides, Lucas (1988) points out that the basic Solow model predicts that return on capital is many times higher in developing countries compared to wealthy countries. Solow, therefore, implies that there is always new investment in developing countries, an assumption that does not hold empirically.

Although Solow, in many ways, formed the basis for economic growth models with its neoclassical framework, there has gradually been a shift towards endogenous models. Romer (1986) introduced an endogenous model for long-term growth, where knowledge is assumed to be an input into production with increasing marginal productivity. In this competitive equilibrium model, technological change is endogenously given in contrast to models with diminishing returns; hence, growth rates can increase over time, and large countries can achieve stronger growth than small countries.

3.1.1 Weaknesses of the models

There is no doubt that both the neoclassical framework and the endogenous models have weaknesses. Solow's model has a relatively narrow scope, which does not take into account non-economic factors such as political instability and institutional conditions. The model also assumes continuous economic development, an assumption that appears to be wrong historically. The assumption of full employment is also somewhat unrealistic.

The endogenous models of Romer (1986) Lucas (1988) and Rebelo (1991) are subjects to criticism because it is challenging to validate results based on empirics.In other words, the models provide a useful overview of economic growth over time, but Parente (2000) argues that they do not explain why some countries are poor compared to others today. He reasons for this, because the results generated from the models do not hold empirically. Pack (1984) believes empirical research generated by endogenous growth theories does not test the actual endogenous theory, but rather test earlier neoclassical growth models. Hence, he argues that the endogenous models are no more than an expansion of the existing growth models, rather than a framework for explaining actual growth.

3.2 Augmented growth models

The work of Solow (1956) was further developed by Mankiw, Romer, and Weil (1992). The traditional Solow model explained more than half of the cross-country variation in income based on updated data sets from 1992. However, the continued model highlighted how the effects of savings and population growth were overestimated. This is due to the omission of human capital. It showed that physical capital and population growth had a more significant impact on income when taking human capital into account. At the same time, human capital could correlate with saving rate and population growth, thus indicating that omitting accumulation of human capital could give a bias to the estimated coefficients (Mankiw, Romer and Weil, 1992).

In the 90s, the traditional models were augmented with more variables and assumptions with regard to explaining growth. Mankiw, Romer and Weil's model was further developed with a research and development variable by Nonneman and Vanhoudt (1996). Both Saint-Paul (1992) and Aizenman et al. (2007) included public debt as a variable, in order to capture the impact of fiscal policy on economic growth. Fiscal policy to keep price stability is believed to be necessary, and Kormendi and Meguire (1985); Fischer (1993); Barro (1995); Guerrero (2006) have argued that there is a negative relationship between inflation rates and economic growth. Barro (1995) suggested that an increase in average inflation by ten percentage points per year would reduce the per capita growth rate by 0.2-0.3 percentage points per year. Although the effect is not substantial in the short term, a change in monetary policy could reduce GDP by 4-7 percent over a period of 30 years. Hence, Barro (1995) considers that price stability is essential in terms of economic growth.

3.3 Growth models in transition economies

When exploring economic growth and cross-country differences in transition economies, the literature typically focused on empirical studies in an attempt to explain what drove growth in Eastern Europe in the 1990s. Here, the focus was primarily on transition factors such as structural reforms, countries' initial conditions, and macroeconomic stability. In recent years, researchers have often used the traditional framework with neoclassical and endogenous models. Institutional conditions, external debt, the openness of the economy, and corruption are all important explanatory factors in these models. Here we will briefly explain the findings of both approaches.

de Melo et al. (1997) and Fischer and Sahay (2000) finds that initial conditions, regional non-economic challenges, as well as political development, have an impact on economic growth between transitional countries. Initial conditions are important because many countries that already have financial difficulties will be more reluctant to take on the cost of a challenging reform when they are already facing large deficits as a consequence of the disintegration of the old system (de Melo et al., 1997). If reforms are implemented, the initial conditions will not diminish their effectiveness. Liberalization has a negative impact on growth in subsequent months and years, depending on how quickly the country manages to stabilize. In the long run, however, there will be a positive relationship between liberalization and growth.

Fischer and Sahay (2000) summarized the growth of the transition economies after the fall of the Soviet Union and, like de Melo et al. (1997), they found evidence that initial conditions in 1990 were essential for the next decade's performance. Reforms, with increased privatization and stabilization policies, were both active contributors to increased growth. Additionally, the pace of reform - shock therapy and gradualism as the extremes - was essential to how quickly a country managed to reverse its decline and begin to grow. Thus, countries that carried out a rapid transition performed better through the 1990s (Fischer and Sahay, 2000).

In the neoclassical and endogenous models conducted on Eastern European economies in the period after the countries stabilized, several explanatory variables are applied to economic growth. Hlavacek and Bal-Domanska (2016) find a positive relationship between FDI and economic growth in Central and Eastern European countries in the period between 2009-2012. Ciftcioglu and Begovic (2008) suggests that external debt to GDP, however, has a negative relationship with growth in the economy.

Evidently, there has been constructed and developed various theories for economic growth. They range from the exogenous growth model of Solow to endogenous ones, where several variables are included in the model. Additionally, research has stated that different growth models apply for different economies, like transition economies. All of these approaches are relevant, and we will test different combinations of variables to explain what drives economic growth in our focus countries.

4 Theory

In this section, we will explain the theoretical framework that forms the basis for the thesis. Such a foundation is vital as a thorough framework enhances the understanding and analysis of our data. It is also useful for anchoring our approach in credible theory applied in previous similar research.

4.1 Traditional Solow model

Much of our ideas, approach, and hypothesis is based on the neoclassical framework for long-term economic growth initially developed by Robert Solow. The model is built on several assumptions, which are presented in the appendix. The general Solow model conveys that the level of income in a country depends on two input-factors: capital and labor.

$$Y = F(K, L) \tag{4.1}$$

The model can also be portrayed through a Cobb-Douglas function, where the exponents on the respective letters represent how large share the inputs are of the entire economy. Traditionally the exponent for labor has been 2/3 and 1/3 for capital, reflecting that production, in general, has been labor-intensive.

$$Y = K^{\alpha} L^{1-\alpha} \tag{4.2}$$

Based on the model, investments in capital stock and additional labor force will drive economic growth. However, this can not continue eternally. The law of diminishing returns binds both input-factors. Consequently, growth in output will be marginally diminishing until one reaches a steady state where investment equals the depreciation of capital (Samuelson and Nordhaus, 2001). The idea is that output, Y, will partly be consumed, and the rest is saved and invested. The following equation portrays the change in capital. The rate of saving is represented by s, and the depreciation rate by δ .

$$\Delta K = sY - \delta K \tag{4.3}$$

As an example, a country's output, which is a function of capital and labor, will grow faster when capital is low. Thus, poor countries will grow faster than rich countries, given that countries' preferences and technology are approximately similar. This phenomenon is known as the catch-up hypothesis and states that all countries eventually should reach fairly the same economic level (Abramovitz, 1986). However, empirical evidence has proven that this is not always the case. The major difficulty with the basic model is that growth in output per capita converges to zero in steady state, which does not hold empirically. Hence, there must be something outside the model driving constant growth. This has been called the Solow Residual or total factor productivity (TFP). Without increasing TFP, when investment equals capital depreciation in equation 4.3, the economy will be in a steady state. First, when TFP increases, output will increase, and make capital investment higher than depreciation. The economy will be in another steady state, but with a higher level of output than before. New increases in TFP will cause new rounds of Solow-growth and hence increase output.

4.2 Solow-Romer model

While TFP is exogenous in Solow's model, Romer (1986) included TFP and hence created an endogenous growth model. He called this addition technological progress, and it is represented by an A in the model known as the Solow-Romer model.

$$Y = AK^{\alpha}L^{1-\alpha} \tag{4.4}$$

If A were fixed, economic growth would eventually dwindle to zero as $0 < \alpha < 1$. In an attempt to explain what drives technological progress, the creation of new ideas, Romer points to R&D-related labor and the value of A itself.

However, only looking at technological progress as a determinant for cross-country differences in economic growth might be narrow, as TFP is likely to be composed by multiple factors. First of all, a country does not only use technology invented in that country. Thus, when looking at technology, it is better to consider the ability of a country to adapt and use the latest technologies. Hall and Jones (1999) points to differences in social infrastructure as a variable in explaining variations in TFP and hence, output. Social infrastructure refers to institutions and government policies that determine the economic environment where individuals accumulate skills, and firms accumulate capital and produce output (Hall and Jones, 1999). This will, among other things, include the adoption of new technologies. Abramovitz (1986) refers to this as social capability and views this as a decisive factor for the catch-up hypothesis. He proclaims that poorer countries have a potential for rapid advance if they can facilitate the adoption of technologies and create healthy economic and business environments in general.

The expression TFP, A in the Solow-Romer model, thus represent all conditions affecting economic growth beyond capital and labor. In our thesis, we will apply the models above. Our objective is to determine the factors beyond capital and labor decisive for economic growth. In order to study growth rates, we will take the natural logarithm of the Solow-Romer model.

$$\log(Y) = log(AK^{\alpha}L^{1-\alpha}) \tag{4.5}$$

Equation 4.3 represent the geometric growth model when taking the logarithm. The characteristics of logarithms enables us to write the model on another form, portrayed in equation 4.4.

$$\log(Y) = log(A) + (\alpha)log(K) + (1-\alpha)log(L) \tag{4.6}$$

The growth model on a logarithmic and arithmetic form is what we will study in the analysis later in the thesis. This provides the possibility to study growth in GDP per capita combined with the practicality of running regressions on an arithmetic model. Hence, it is a desirable model to progress with,

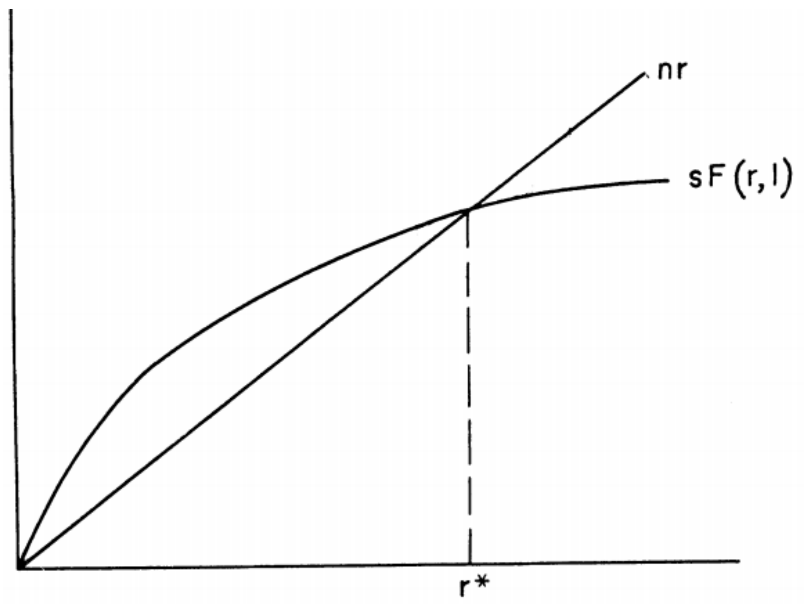
4.3 The ratio of capital and labor

The underlying mechanisms of the model also allow us to study the ratio of capital to labor, which is interesting for our later analysis. The ratio is described by $r = \frac{K}{L}$. Further, the relative change of r, which is how the ratio of capital and labor changes in the economy, can be expressed in the following manner. The full derivation of the term can be found in the appendix.

$$\Delta r = sF(r,1) - nr \tag{4.7}$$

The function, F(r,1), is the total product curve as varying amounts of capital are used with one unit of labor. In other words, it shows output per worker. As s is the share of output saved or invested, the first part of the expression represents the increment of capital. The second part is the increment of labor, where n is the growth in labor. The change in the capital to labor ratio is the difference between the two terms. When $\Delta r = 0$, the ratio is in a stable equilibrium r*, optimal for the economy. As the returns to scale are constant, output and labor will grow proportionally, and hence the ratio between capital and labor will be constant. However, there can be cases where the ratio is not in equilibrium,

Figure 4.1: Capital-Labor ratio, (Solow, 1956)



An example is if $r < r*$, that is the level of capital to labor is lower than in the equilibrium. In such a case, output per worker would be lower than it should be. In a market economy, the level of capital would increase relative to labor, and thus boost the output per worker and bringing the ratio r to the equilibrium of r*. Such a shift would increase both wages and productivity. This is because productivity equals output per worker, and the marginal output per worker determines wages. Both go up due to an increase in output.

In our analysis, we seek to find which variables are most important for economic growth and, consequently explaining what drives differences in TFP between countries. Throughout our thesis, we will ground our analysis and findings in the theoretical framework.

5 Data

This chapter will present and further explain the data used in the empirical analysis. In order to develop the study, data is separated into one dependent variable and several independent variables. Our quantitative data is collected mainly from the World Bank. In the following section, we will explain the different variables and present descriptive statistics. To ensure the validity and reliability of our results, we explain where and how we collected data for the analysis. This is a good opportunity to assess the implications data collection has for the quality of research and how it could have been done differently. We choose to include validity and reliability in this section, as it is primarily assessments of the collection and data robustness that apply to our quantitative approach.

5.1 Quantitative data

In order to investigate differences in economic growth across countries and understand what drives it, we need a comparable measure of a country's national income and relevant explanatory variables. The 17 countries we have analyzed vary greatly in size of the population and the economy, ranging from huge Russia to small Georgia. To account for this, we have chosen GDP per capita as the dependent variable. Nations with larger populations will have a higher GDP, ceteris paribus. Applying GDP per capita in the analysis enables us to compare economic growth across all nations, even Georgia and Russia.

As our explanatory variables, we have included Capital and Labor, as proposed by Solow (1956) in his model for long term economic growth. We have also investigated several other variables likely to be relevant in explaining economic growth, such as corruption, external conflict, and education. In order to decide which variables to include in the quantitative analysis and which to exclude, we performed extensive regression analyses, experimenting with different combinations of variables. The different variables will be explained in detail later in this section. We will discuss the results of the analysis and the effect of both included and excluded variables later in the thesis.

There are several providers of economic and demographic data for countries. Although

Table 5.1: Independent variables

Independent variable	Unit	Exp. sign	Interpretation
Capital formation	2011 USD (PPP)	+	Gross capital formation
Income'90	2011 USD (PPP)	+	Income in 1990 of respective countries
Employment	Percent	+	Employees to total population (millions)
FDI	Percent	?	Foreign direct investment to GDP
External debt	Percent	−	External debt to GNI
Educational level	Percent	?	Different education levels
Year-dummies	Dummy	?	Dummy for the years from 1990-1996
Fast transition	Dummy	+	1 if fast transition to market economy
Corruption	Score	−	Level of corruption (from 1-100)
External conflict	Score	−	Conflict index (from 0-100)
Democratic accountability	Score	+	Government responsiveness (from 0-100)
Government stability	Score	+	Number of years in office (from 0-100)

the World Bank has been our primary source for quantitative data, we have also used the International Country Risk Guide (ICRG), particularly for gathering information regarding the institutional quality of the different countries.

The World Bank is a global partnership comprised of five institutions providing financial products and services to developing countries, as well as knowledge sharing and policy advice (World Bank, 2019). Through its work, the World Bank has built up an extensive database of statistics on developing countries which is free to access, to be used by governments, academics, and others who would need it. It is this database we have used to retrieve much of the statistics used in the analysis.

The IRCG is a guide providing political, economic, and financial risk ratings, which is created by the risk analyzing firm PRS Group. It is the only political risk methodology and data series to be accepted by the courts in commercial disputes involving the valuation of political risk (The PRS Group, 2017).

There is limited data available for our focus countries before the dissolution of the Soviet Union. Hence, our analysis will, in large part, focus on the period from 1990 to 2018. The countries were in significant transition in this period. This allows us to study both traditional economic variables and more unique variables, like how successful a country's transition to capitalism was.

5.1.1 GDP per capita

The dependent variable for economic growth in the analysis is GDP per capita. For the highest possible comparability, we have sourced GDP per capita numbers in constant 2011 US dollar prices adjusted for differences in purchasing power parity (PPP). PPP is an economic theory implying that the same goods will have a different price in two countries. This is due to differences in economic productivity and living standards (Rogoff, 1996). It follows that the value of 1 USD will vary in countries with different living standards. Therefore, when looking at GDP per capita for several countries in USD, adjusting for differences in PPP is crucial for comparability.

The data was retrieved from World Bank, and after that, due to inaccuracies in some of the numbers, adjusted in consultation with Ola Honningdal Grytten, Professor Dr. Oecon at Norwegian School of Economics. Further, the numbers were prepared for analysis by taking the natural logarithm of GDP per capita. The consideration behind the log transformation will be further discussed under the methodology section.

5.1.2 Explanatory Variables

In order to find the main drivers for economic growth and varying levels of living standards between countries, we have included several explanatory variables. When deciding which variables to include or exclude, we have turned to previous literature on the subject. Additionally, we have tested the variables through regressions. In this section, the explanatory variables will be presented and explained.

1. **Labor**: Share of population above 15 years that is employed.
    - Robert Solow's growth model propose labor as one of two main inputs in economic growth. Therefore, we were naturally inclined to include the variable Labor. We are analyzing a percentage instead of the absolute number of people in the labor force. Absolute numbers could confuse a regression because we are comparing very different countries. We retrieved the data from the World Bank.
2. **Capital per capita**: A country's fixed assets plus the inventory of firms in the

country per capita.

- The second main input named to be crucial by Solow is capital. Again, to make the data comparable, we use capital formation per capita in the analysis. Fixed assets include land improvements (fences, ditches, drains, and so on), plant, machinery, and equipment purchases. Further, it includes the construction of roads, railways, schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." (World Bank, 2019). The value of each country's capital formation is in constant 2010 USD prices and was retrieved from the World Bank database.

3. **External debt**: Total external debt stocks to gross national income (GNI)

   - External debt is all debt a country owes to nonresidents. GNI is the GDP plus income of the country's residents abroad. We include this variable as a measure of how much foreign debt a country has compared to their output. The hypothesis behind this variable is that when foreign debt reaches a critical level, the large interest payments flowing out of the country crowd out necessary investments and hence prevent economic growth. We gathered the data from the World Bank database.

4. **Educational level**: Share of population with different levels of education

   - As an additional measure of human capital, we include information on the Educational level of a country's population. Our data informs of the share of the population above 15 years that has achieved different educational levels. The four levels of education are no school, primary school, secondary school, and tertiary school. The data is structured such that a person is only counted once, in the highest level of education achieved by that individual. The hypothesis is that a higher share educated population, particularly larger share with tertiary (higher) education, leads to higher productivity and hence, more economic growth. In our analysis, the variable for tertiary education will be called "higher education". The numbers on education are presented from 1950 to 2010 in

5 years intervals. To prepare the data for analysis, we divided the difference between two five-year intervals by five. We then created a continuous time series by spreading the number equally over those five years. The data was retrieved from Barro-Lee Educational Dataset.

5. **FDI**: Net inflows of foreign direct investment (FDI) versus GDP

   - Net inflows of foreign direct investment are the value of inward direct investment made by non-resident investors in the country of interest. This variable is measured against GDP and is similar in nature to external debt to GNI. External debt is a country borrowing money from abroad and paying interest on loans. Foreign direct investment is the net inflows of investments from non-residents to acquire a management interest, which is a minimum of 10 percent, in a company operating in the country of interest. As with external debt, it is a vital input for growth in developing countries. However, it can also be detrimental to economic growth if the amount passes a critical level, or due to other conditions such as corruption or currency depreciation. Another reason could be that all profits gained on investments are retaken out of the country. Earlier studies have shown that FDI is significant in determining economic growth, but whether it is a positive or negative correlation varies between countries (Bolanlee 2015). We retrieved the data from the database of the World Bank.

6. **Fast transition**: How the countries transitioned from planned economy to a capitalistic system

   - In the years after 1989, several Central Eastern European countries (CEE) turned away from the planned economy of communism, and towards the more liberal capitalistic system of the western world. This happened through several reforms in institutions and systems. However, some countries went through a so-called “shock therapy”, through a Fast transition, while others turned to a more gradual approach. These different approaches have seemingly made countries, to a different extent, able to cope with macroeconomic challenges. Thus, the degree to which countries have gone through a successful transition or not in the early ’90s can prove to be decisive for their future economic and institutional development. In the regression, this is a dummy variable equal to 1 if the country had a fast transition, and 0 if they did not. Which countries that had a fast transition and not was decided based on the IMF paper "25 years of transition – Post-communist Europe and the IMF".

7. **Income '90**: The income in 1990 of the respective countries

    - All countries we study had different levels of income per capita when the Soviet Union was dissolved in 1990. It is natural to assume that these income inequalities are likely to explain differences in income at a later time. Therefore, we include this variable to control for the effect of initial wealth or poverty. For every period of the analysis, the variable is simply the log of GDP per capita of a country in 1990.

8. **Year-Dummies**: Dummy variable for the first years of the 1990's

    - The first years after the end of the Soviet Union was a period of turmoil for the CEE countries. Economic crises, low-functioning labor markets, and trade and substantial reforms are among the troubles these countries faced. These dummies are hence included to control for the turmoil of these early years and prevent potential bias of regression results. Dummies were created for the years 1991 to 1996.

9. **Corruption**: An index indicating the level of corruption in a country

    - Each country gets a yearly score ranging from 0-100, depending on the level of corruption in the country. A score of 0 indicates the highest level of corruption, while a score of 100 implies no corruption. For most countries, we have scores from 2003 to 2018. This limits the data basis in the analysis, as a regression with corruption as a variable would exclude most data before 2003. To compensate for this, we constructed an alternative corruption variable. With the assumption that the level of corruption remained relatively unchanged from 1990 to 2003, the years with missing data were assigned the corruption score of 2003. During discussions of the analysis in later sections, we will specify what results came from the original data and what came from the constructed variable.

In order to potentially achieve better results, we created dummies for different corruption levels in addition to the index itself. We created two dummies, one for scores below 25 and one dummy for scores from 25 up to, but not including 50. Consequently, the third range is from 50 to 100. These ranges represent a bad state, a medium bad state, and a relatively good state. As a comparison, the average world score was 43 in 2018 (Transparancy, 2019). Thus, if a country in one year has a score that falls within one of these ranges, the associated dummy variable will take a value of 1. As the range 50-100 is not represented by a dummy, it will be the default in a regression analysis, which the coefficients of the other ranges compare against. The dummy for a bad state will be referred to as "high corruption", while the medium bad state will be "medium corruption". The corruption index scores were retrieved from Transparency International. Note that the recent corruption scores of Transparency International are on a scale of 0-100. However, the early publishes contained scores from 0-10. It is indifferent whether the range is to 10 or 100, as it is a matter of multiplying or dividing by 10. We chose to make the whole scale in the range of 0-100.

10. **External Conflict**: The risk of aggressive foreign action towards a country
    - This is a risk measure of external action towards a country ranging from diplomatic pressure and withholding of aid to cross-border conflicts and war. The motivation for including this is that external pressures like these have the potential to impact economic growth substantially. The score was originally from 0-12, but we transformed it into a range of 0-100 by dividing by 12 and multiplying by 100. The data was gathered from ICRG.
11. **Democratic accountability**: How responsive a government is to its people
    - This score is awarded based on the types of government that rule in the country. The government form with the least risk (highest score) is an alternating government – meaning that the government is elected through democracy, does not serve more than two consecutive periods, and has independent judiciaries. The form of government awarding the highest risk is an autarchy, where the state is run by a single group or person holding power through military might or inherited might. The score originally ranges from 0-6, but it is transformed

to reach from 0-100. The data was retrieved from ICRG.

12. **Government Stability**: Governments effectiveness and ability to stay in office

    - This measure assesses the government's ability to carry out declared programs and reforms and stay in office through its entire elected period. The total score is the sum of three sub-components; Government unity, Legislative Strength, and Popular support. The score was originally from 0-12 before it was transformed to 0-100. The data is from ICRG.

5.1.3 Omitted Variable Bias

By including our explanatory variables, we try to control for any event or condition that affects the GDP per capita in our countries of interest. It is, however, possible that the analysis will suffer from an omitted variable bias. Omitted variable bias occurs when a variable outside the model is correlated with both the dependent variable, GDP per capita, and an explanatory variable. In such a case, the effect of the omitted variable will be attributed to the included explanatory variable correlated with the omitted one. The omitted variable biases the coefficient of the explanatory variable, and hence it does not represent its true value.

Although we have tested and included a broad specter of explanatory variables, there are several relevant variables we do not have in the model that potentially leads to omitted variable biases. An example is data on the number of patents registered in a country. More patents are likely to be correlated with higher GDP per capita, as it is indicative of a healthy business ecosystem facilitating research and development. Additionally, it is likely correlated with Higher education, as higher educated people are more likely to have the competence to develop new designs and ideas. If this is the case, the coefficient of Higher education is artificially high. The reason is the attribution of the effect of a healthy business environment with many patents, in addition to the positive effect of Higher education. It is positively biased. This is one example, but there could be other variables that could correlate with both the dependent variable GDP per capita and one or more explanatory variables. These cases would lead to an omitted variable bias.

5.1.4 Descriptive Statistics

The purpose of the descriptive statistics is to provide an overview of the sample and describe what our data shows (Loeb et al., 2017). In other words, we give a summary of how economic developments have been across the focus countries - with a benchmark against the EU-15. Also, we present key figures for the explanatory variables to provide better conditions for interpreting our subsequent analysis.

Table 5.2 shows descriptive statistics on some of our data. Note that this is information on all countries through all years of the analysis. One takeaway is the spread in GDP per capita from high to low. The highest observed GDP per capita is three times as high as the lowest. Further, if one only looks at Income '90, it is apparent that there were significant differences between the countries right after the dissolution of the Soviet Union. From 1990 to 2018, the average growth in GDP per capita was 118 percent. The span, however, is from Lithuania, with 375 percent, to Ukraine with a negative 24 percent.

Table 5.2: Descriptive statistics

	N	Mean	Min	Max
GDP per capita	476	10 687	1 047	31 065
Capital per capita	397	1 424	35	6 255
Labor	470	54 %	35 %	67 %
Income '90	493	8 081	2 981	20 639
Corruption	263	34	16	71
FDI	435	5 %	0 %	55 %
External Debt	350	50 %	0 %	158 %
No School	250	2 %	0 %	10 %
Higher Education	252	8 %	3 %	49 %

It is, however, interesting to look at the economic growth of each country in comparison to a benchmark. Hence, we have extracted data on GDP per capita in fixed 2011 and PPP adjusted prices for the EU-15 countries. These are the countries that were members of the European Union prior to the accession of 10 candidate countries on May 1st, 2004. We have taken the average GDP per capita and a weighted average percentage growth of these countries, creating a benchmark called EU-15.

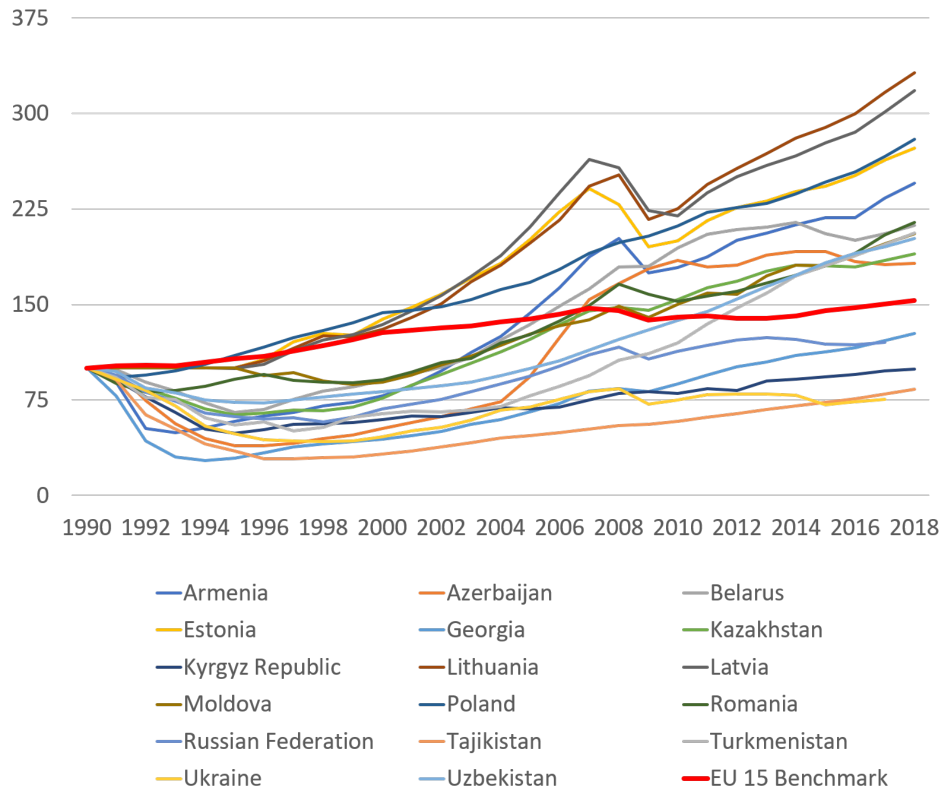
Table 5.3: Members EU-15

Austria	Germany	Netherlands
Belgium	Greece	Portugal
Denmark	Ireland	Spain
Finland	Italy	Sweden
France	Luxembourg	United Kingdom

Looking at the countries included in the benchmark, it is worth noting that it is not purely success stories. Italy and Greece are examples of Western European countries that have experienced turbulence in their economies.

First, we look at the relative growth in GDP per capita in each country, and the benchmark. This is done through indexing all countries, where the base is 100 in 1990. The base is grown each year with a percentage equivalent to the growth of GDP per capita that year for each country. The indexed comparison from 1990 to 2018 is shown in Figure 5.1

Figure 5.1: GDP per capita, Indexed 1990



Almost all focus countries had steep drops in GDP per capita from 1990 to 1995. The EU-15 meanwhile, maintain a modest but stable growth. After 1995 however, the relative growth is higher in all of our focus countries compared to EU-15. This is illustrated when doing the same indexing with 1995 as a base, portrayed in figure A.1.1 in the appendix. The benchmark EU-15 comes out lowest of all. Consequently, without a significant drop after the dissolution of the Soviet Union, the focus countries would have grown relatively more.

It is, however, essential to note that this is the relative growth. Looking at the absolute numbers, the story is quite different, as portrayed in Figure A.1.2 in the appendix.

Even with the difference in percentage growth, the significant difference in absolute numbers restrains the catch up. In fact, when looking at the difference between focus countries and the benchmark in 1990 and 2018, only four countries have reduced the absolute difference. The absolute difference is the GDP per capita of the benchmark, subtracted the GDP per capita of the country of comparison. The four countries that have reduced the absolute difference are Estonia, Lithuania, Latvia, and Poland. All of them EU members since May 1st, 2004.

The relative difference has, however, been reduced for eleven countries, meaning how large percentage a country's GDP per capita is relative to the GDP per capita of the benchmark, reflecting what the indexed comparison shows. However, the GDP per capita of most focus countries is still lagging quite far behind the benchmark. Not counting the EU countries, the Russian Federation and Romania have the highest GDP per capita in 2018, at 56 and 53 percent relative to the EU-15, respectively. The next country on the list is Belarus, at 39 percent. Looking at all focus countries, none of them have a GDP per capita higher than 70 percent of that of EU-15, Lithuania scoring highest at 67 percent.

In the past couple of years, the average growth in GDP per capita in the focus countries has been approximately 4 percent, while it has been about 2 percent for the EU-15. We wanted to get an idea of how the situation will be in the future if these growth rates continue. This is to see if a catch up is likely to happen in the near future. In such a scenario, in 2050, seven countries will have caught up to western living standards. In addition to the Baltic states and Poland, Russia, Kazakhstan, and Romania will also have reached the GDP per capita level of the EU-15. The large part of the countries is, however, still far off Western European standards. This implies that a rapid catch up is unlikely, even if the current growth-situation is to continue.

To summarize, the average growth in GDP per capita has been twice as high in our focus countries compared to EU-15 countries since 1995. At the same time, growth in absolute numbers still appears to be significantly higher among EU-15 countries. The chapter also makes us aware of the significant cross-country differences within the region. This is important insight for interpreting the results of our analysis.

5.1.5 Reliability and Validity assessment

In order to assess sufficient quality of research, we need to ensure validity and reliability. A carefully executed methodology helps us to avoid a subjective approach to the data and research (Raimond, 1993). In the table below, we have evaluated the quality of each variable concerning validity and reliability. The scale ranges from 1-3, where 3 is considered the best.

Table 5.4: Quality of measurements

Variable	Source	Rating
GDP per capita	World Bank	***
Capital per capita	World Bank	***
Labor	World Bank	***
Income '90	World Bank	***
Corruption	Transparency International	**
FDI	World Bank	**
External Debt	World Bank	**
Educational level	Barro and Lee	**
External conflict	ICRG	*
Democratic accountability	ICRG	*
Fast transition	IMF	*
Government stability	ICRG	*

5.1.6 Reliability

Reliability is whether it is possible to replicate the measurement under the same conditions and achieve the same result. Or put in other words; will other researchers be able to repeat our findings? It also addresses the consistency of the research and helps minimize errors and biases in our thesis (Saunders et al., 2019). We evaluate the quality of the source for each variable, as well as how our processing of the data can affect other researchers' ability to replicate the outcome.

We have considered several different sources in our work on data collection that form the basis of our analysis, including Transparency International, OECD, Eurostat, Penn World Table, and World Bank. We obtained data for our dependent variable, GDP per capita, from the latter source. This is an open source and considered trustworthy. However, older GDP data from former Soviet republics often contain errors. Communist countries ignored service production when measuring the size of the economy, resulting in lower GDP. At the same time, the valuation of the market was difficult, as prices were not a product of supply and demand (Svejnar, 2002). It is also uncertain how big the black economy was both before and after the transition. Although the figures have been adjusted somewhat in retrospect, we need to be aware of this in interpreting the data. As a consequence of this, some of the figures were further adjusted in consultation with Ola Honningdal Grytten. Hence, other researchers studying the same topic will not necessarily end up with the same result, even though the data is retrieved from the same source.

However, the adjustments are on such a small scale that we do not consider it a direct threat to reliability. Some differences in GDP data between different providers exist. For instance, OECD and Eurostat, does not provide data for all of our focus countries. Thus, it does not make sense to extract data for the available countries and supplement with the remaining countries from the World Bank database. This can lead to inconsistent data that may have implications for our results.

The same principles apply to our explanatory variables. For example, corruption data can be obtained from Transparency International, Worldwide Governance Indicator, and International Country Risk Guide. All of these sources are trustworthy, but we have chosen Transparency International in terms of authority and reputation. Here we also created dummies for different levels of corruption in each country based on the index. Other researchers may want to choose a different approach and thus have a different outcome.

Capital formation is available in the databases of the World Bank, Eurostat, and Penn World Table. Eurostat only provides data for EU countries, which excludes this source on the same basis as for GDP per capita. World Bank provides data in the country's total Capital formation, not per capita. Since World Bank also offers data on population figures, it was most appropriate to generate per capita data from the same source. The same line of argument in terms of the number of countries applies to both Labor and External debt. The World Bank appears as the database with the widest range of countries, while also being a recognized source. We make no major adjustments for these variables, except that we log Capital formation. Hence, we believe that reliability is relatively well taken care of.

Educational level is retrieved from the Barro-Lee Education Dataset. The source is trustworthy and widely used in scientific articles on the topic. On the other hand, we make adjustments that can jeopardize the reliability, and thus we must be clear on our approach. We compile a continuous time series of the five-year intervals in the dataset. At the same time, the level of education is divided into four categories. It is not certain that other researchers will adopt the same approach, and thus the outcome may be different. Breaking down the five-year intervals will also lower the quality of the data somewhat. Income '90 is retrieved from the same database as for GDP per capita and therefore needs no further analysis.

As for FDI, this data is available at the World Bank and the United Nations Conference on Trade and Development (UNCTD). We use the World Bank as the data is expressed as a percentage of GDP, which gives us ratios rather than absolute figures as compared to the UNCTD dataset. This means that we get consistency against the dependent variable, GDP per capita, which is also retrieved from the World Bank. Fast transition is a dummy variable based on an IMF report. Countries received a dummy equal to 1 if they performed "shock therapy" and 0 if not. Here, there may be different assessments for the countries that are not necessarily at the extremes. In this way, it can reduce reliability if other researchers consider one or more countries at different dummy values. This is especially true, given that this is an important explanatory variable in the regression.

Data for External conflict, Government stability, and Democratic accountability are all obtained from the ICRG. This is a commercial source, which reduces quality somewhat. However, we believe that it is sufficient as it is accepted by courts in legal disputes and contributes to the Transparency International Corruption Index. We have transformed all values to reach from 1-100 and explained this earlier in the chapter. Hence, this should not be a significant threat to reliability.

In terms of bias, endogeneity can be a problem. As we will elaborate further in the methodology chapter, there is a risk that we violate the zero conditional mean assumption. This may lead to bias in the results, but this is taken into account in the analysis. The tests of autocorrelation, normality, and heteroskedasticity also contributes to increased verifiability for researchers in the future, thus increasing reliability.

From our perspective, reliability is relatively well taken care of. We have extracted the datasets from open sources, which means that other researchers will have the same opportunities to obtain similar databases. At the same time, we explain how we clean our data through this chapter, which provides better conditions for replicating the results afterward.

5.1.7 Validity

Validity in quantitative research refers to whether our different variables actually measure what we are looking for and if a causal relationship is established (Mohajan, 2017). Whether GDP per capita is appropriate for what we want to measure - that is, economic growth in Eastern Europe - is a frequently asked question. McDowell (2009) argues that GDP does not include any measure of the income distribution, nor the socio-economic cost in the form of environmental damage. Still, we can argue that these are questions about economic well-being and quality of life rather than real economic growth.

GDP per capita is relatively easy to quantify, making it appropriate for this type of analysis. In various databases, GDP per capita is usually stated in US dollars. This allows researchers to perform cross-sectional comparisons and more natural define differences between countries. A common currency can have implications as the exchange rate does not take into account price levels in different countries (Siebert, 1999). However, we avoid this by using GDP per capita in 2011 US dollars, adjusted for differences in purchasing power parity (PPP). Hence, the validity seems to be quite good.

We feel relatively confident that the majority of our explanatory variables measure what we want them to measure. Corruption, as well as the three democracy indexes, are the most uncertain variables. Transparency International measures perceived levels of corruption based on surveys and expert reviews. In other words, it is not a perfect measure of real corruption, but rather an indication. This must be emphasized in the interpretation of our results.

For the Fast transition variable, it is conceivable that the dummy captures more than the actual effect. Empirically, we can see that the countries that conducted "shock therapy" have typically performed better, but too much of the effect may be attributed to the dummy. E.g., if these countries had extensive natural resources, this could be the real reason for growth - not the fact that the transition was rapid.

We also have some doubts as to whether the ratio between Capital and GDP per capita is fully causal or not. There is a very strong correlation between the two, and it is perhaps obvious to assume that the effect goes both ways.

Several democracy indexes combine a variety of measures, which results in one total score, E.g. The Democracy Index by The Economist. To distinguish the effects, we chose to use more narrow measures; in our case, Democratic accountability, Government stability, and External conflict. This increases the validity of each variable compared to an overall democracy index since the three indexes reflect the phenomenon we want to measure and only that. Despite this, we know that quantifying political information into an index score is challenging and represents no perfect science. Hence, we believe that the validity of these explanatory variables is somewhat lower than the traditional macroeconomic variables.

To ensure that the findings are generalizable, we must assess that the entire research process is accounted for in terms of design, findings, and context (Saunders et al., 2019). This is important in order for readers to be able to assess whether the study can be generalized to another setting (Lincoln and Guba, 1985). Most of the variables in our analysis are used in traditional growth models, so the generalizability can thus be considered relatively high.

This is typical of quantitative analyzes, where one looks at a part of a larger population, intending to generalize the findings. However, we must be aware that our regressions contain several explanatory variables that will not necessarily have an impact if applied to Western Europe, E.g., external conflict, corruption index, income in 1990, and democratic accountability.

In summary, the validity of the most significant explanatory variables seems to be good. However, there is some uncertainty attached to the democracy variables - both in terms of generalizability and whether they measure what we want.

Our data consists of publicly available information on variables, both more and less common in explaining economic growth. Despite minor needs of adjusting some data, and that some of our institutional variables are hard to measure, reliability and validity are satisfied.

6 Methodology

In this chapter, we discuss the methodology in our analysis. Such a discussion is to present our analytical approach and facilitate for assessment of the validity of our research.

Our quantitative analysis aims to investigate which factors are crucial for growth in GDP per capita. In order to answer our research question, we have chosen to perform a linear regression analysis. We do this by applying the data set described in chapter 5. This chapter will present and discuss the methodology used.

6.1 Correlation analysis

We conduct a correlation analysis in order to understand better the relationship between the different variables introduced. However, the correlation analysis does not provide information about causality - only how strong the relationship between two variables is. By calculating Pearson's coefficient of correlation, referred to as Pearson's r, one can study these possible connections between two different variables (Keller, 2013). The Pearson's coefficient ranges between -1 and +1, respectively $-1 \geq r \geq +1$. A coefficient of -1 indicates a negative relationship. Hence a positive coefficient indicates the opposite. A coefficient equal to 0 implies no linear relationship.

6.2 Regression analysis

A linear regression model aims to determine the relationship between a dependent and one or more independent variables (Wooldridge, 2012). Our dependent variable will be *GDP per capita* in 15 former Soviet Republics as well as Poland and Romania, from 1990 to 2018. We divide the independent variables into economic, demographic, and institutional variables.

When modeling a linear regression, we create a mathematical equation to explain relationships between variables. GDP per capita is likely to be explained by several different factors. Regression results will vary depending on the combination of explanatory variables. Therefore, the thesis will apply multiple regression models.

6.2.1 Log-transforming variables

Our regression consists of log-transformed variables, percentages, and indexes from 0-100. Taking the natural logarithm of variables provides their estimated growth rate. This enables us to analyze the drivers of GDP per capita. It can also reduce potential skewness in a distribution. A regression with both log-transformed dependent and explanatory variables means that one percentage change in the explanatory variable leads to a percentage change in the dependent variable equal to the coefficient of the respective explanatory variable. The same interpretation is valid for the variables in percentage, or indexed 0-100. One point equals one percentage for the indexed variable.

6.2.2 Regression models

When searching for the most suited variables to explain the growth in GDP per capita, we performed extensive regression analyses. Hence, we tested several combinations of explanatory variables to learn the effect of adding or subtracting different elements. The simplest model includes the explanatory variables Labor and Capital. It provides information of how well the traditional inputs in a model for economic growth explains GDP per capita for our data.

$$GDP_{PerCap} = \beta_0 + \beta_1 Capital_{PerCap} + \beta_2 Labor + \epsilon_i \tag{6.1}$$

In order to gain a broader insight in what drives GDP per capita, we added several variables. One model is expanded with External debt, FDI, No school, Fast transition, Income '90 and dummies for the years 1991 to 1996. This model accounts for the effect of the levels of debt and foreign investment as well as another human capital measure through an education variable. Additionally, it accounts for early conditions like initial wealth and how the country transformed to capitalism. Further, the dummies for the early 1990's control for potential excess turmoil created by the chaotic nature of such a transition period.

$$\begin{aligned} GDP_{PerCap} = \beta_0 + \beta_1 Capital_{PerCap} + \beta_2 Income'90 + \beta_3 Ext.debt + \beta_4 NoSchool \\ +\beta_5 FDI + \beta_6 FastTransition + \beta_7 Labor + \beta_8 1990 + \beta_9 1991 \\ +\beta_{10} 1992 + \beta_{11} 1993 + \beta_{12} 1994 + \beta_{13} 1995 + \beta_{14} 1996 + \epsilon_i \end{aligned} \tag{6.2}$$

Although Capital traditionally is a key element in explaining economic growth, we also made models excluding the variable. This is because some of the results in the analysis raise a question of potential reverse causality and multicollinearity. We will discuss this more deeply in a later section.

In the next model Fast transition and Income '90 is excluded in addition to Capital per capita. The motivation for testing a model where these are excluded derives from their lack of representing a specific condition in the country. Although potentially relevant in explaining economic growth they pose a considerable risk of catching effects beyond those which they are supposed to represent, as discussed in chapter five. The income level in 1990 is likely to have significant explanatory power for a country's level of income today. This could overshadow the effect of other variables like Labor and Educational level. Further, we replace No school with Higher education as a potentially better measure of the educational level in the population. In the following model we also include the dummies for different levels of corruption.

$$\begin{aligned} GDP_{PerCap} = \beta_0 + \beta_1 Labor + \beta_2 Ext.debt + \beta_3 FDI + \beta_4 MediumCorruption \\ +\beta_5 HighCorruption + \beta_6 HighEdu + \beta_7 1990 + \beta_8 1991 \\ +\beta_{10} 1992 + \beta_{11} 1993 + \beta_{12} 1994 + \beta_{13} 1995 + \beta_{14} 1996 + \epsilon_i \end{aligned} \tag{6.3}$$

We have also controlled for the effect of Democratic accountability, Government stability and External conflict. The effect of these variables is fairly well represented when adding them to the first regression. They are present in the following model

$$\begin{aligned} GDP_{PerCap} &= \beta_0 + \beta_1 Capital_{PerCap} + \beta_2 Ext.debt + \beta_3 Labor \\ &+\beta_4 NoSchool + \beta_5 FDI + \beta_6 FastTransition + \beta_7 Income'90 \\ &+\beta_8 ExConflict + \beta_9 Dem.Account + \beta_{10} Gov.Stab + \beta_{12} 1990 \\ +\beta_{13}1991 &+ \beta_{14}1992 + \beta_{15}1993 + \beta_{16}1994 + \beta_{17}1995 + \beta_{18}1996 + \epsilon_i \end{aligned} \tag{6.4}$$

These four models present a solid foundation for discussion in the later sections. We will, however, also take advantage of the insight gained from testing several other combinations of variables in later discussions.

6.2.3 Argumentation for our choice of regression

Our model is a Pooled OLS regression with log-transformed variables. Choosing one model is equivalent to turning down other models. Panel data is another popular way of doing data analysis when studying the same individuals or objects over time. In regressions using panel data, the individual's heterogeneity is accounted for, allowing for different intercepts for all individuals. In our example, panel data would account for differences between the countries. If a country initially were more prosperous than others, it would have a higher intercept than the other countries.

Conversely, if a country has some institutional problem that is detrimental to economic growth, its intercept would be lower compared to the rest. This feature of panel data makes it very suitable for studying the dynamics of change, for example, what effect a particular regulation has when introduced in several towns or states. Since it accounts for the heterogeneity, the model is more likely to catch the real effects of the change. We are, however, not studying the dynamics of change and nor do we wish to take each country's heterogeneity out of our analysis. Our goal is to figure out why countries in Central Eastern Europe are lagging the western world and why there are substantial internal differences within these. In such an analysis, the answer might well be that some countries are richer than others because they were so initially. Instead of removing the heterogeneity, we try to include explanatory variables representing it in our model, with the goal mentioned above in mind. If one uses the wrong regression type or model specification, one runs the risk of biased results

6.2.4 Assumptions for regression analysis

When doing a linear regression analysis, the optimal outcome is for the estimated coefficients for every variable to be the best linear unbiased estimator (BLUE). This implies that an OLS estimator is unbiased and efficient. An estimator of a parameter is unbiased if the expected value is equal to that parameter, its true value (Keller, 2013). $E(\hat{\beta_0}) = \beta_0$ and $E(\hat{\beta_1}) = \beta_1$. Although an estimator is unbiased, it does not imply how close it is to the parameter. Consequently, another desirable trait is consistency. An estimator is consistent if the difference between the estimator and the parameter grows smaller as the sample size grows larger (Keller, 2013).

An estimator is efficient if there are several unbiased estimators, and this estimator has the lowest variance possible to achieve. As it is difficult to know with certainty, one can also use the term relative efficiency. Relative efficiency refers to the unbiased estimator with the lowest variance among the known unbiased estimators.

To achieve this, a set of assumptions must be satisfied. We have primarily performed data analysis in R, including performing several tests to check if the assumptions hold. Firstly, the model needs to be linear in the parameters. Secondly, the distribution of the error variable should be normally distributed. Next, there can be no perfect collinearity. This means that no explanatory variable is a perfect linear combination of other explanatory variables. We test this by performing a variance inflation factor (VIF) analysis. The VIF of an explanatory variable is an index measuring how much the variance of an estimated regression coefficient alters from collinearity. A VIF below 10 is an acceptable level of multicollinearity. Some research, however, argues that 5 is a better maximum limit.

Further, the variance in the error term must be unrelated to the explanatory variables and constant over time. $Var(U|X) = \sigma^2$ This is the assumption of homoscedasticity and is tested with a Breusch-Pagan test.

An OLS regression should ideally also be free of autocorrelation, meaning that the error terms should not be correlated over time. $cov(u_i, u_j) = 0$ We test for autocorrelation with a Durbin-Watson test, where a test-statistic close to 2 will imply little autocorrelation.

However, as our data consists of time series data, it is unlikely that we will have a model free of the phenomenon.

An estimator still can be unbiased and consistent despite the presence of heteroscedasticity and autocorrelation. It will not be efficient, however, meaning that residuals are disturbed. Hence, one should be careful in making inference if these two assumptions are violated.

Further, as we are working with time-series, the data must be stationary. Stationarity is a situation where the unconditional mean, variance, and auto-covariance are constant over time. That is, the movement of the variable does revert to the mean (Wooldridge, 2012). When using non-stationary variables in regressions, the result will be spurious (Wooldridge, 2012). We test for stationarity with an augmented Dickey-Fuller test.

The last important assumption is that of a zero-conditional mean. This states that all explanatory variables in all periods must be uncorrelated with the error term: $E(u_t|X) = 0$. Violation of this assumption will result in endogeneity and, consequently, biased estimators. An example of this is in the earlier discussion regarding omitted variable bias. The above-stated condition is one of strict exogeneity. In practice, the necessary assumption is contemporaneous exogeneity. The latter states that the explanatory variables of period t must be uncorrelated with the error terms in period t:

$E(u_t|x_t) = 0$

Contemporaneous exogeneity will not guarantee unbiasedness, but consistency will hold. Another name for consistency is asymptotic unbiasedness. It will move towards unbiasedness as the number of observations increases.

The two latter conditions of autocorrelation and zero conditional mean can be difficult to satisfy simultaneously when dealing with time series data. Firstly, all variables will be dependent on their value in the previous period. The reason is that a value from earlier periods, for example, t-1 and t-2, naturally will be dependent on each other. Hence, autocorrelation will be present by default:

$Cov(x(t-1), x(t-2)) \neq 0$

To control for this one could include a lagged variable, the value of a variable from an earlier period. These lagged variables will, however, likely be correlated with the error term, and thus violate the zero conditional mean assumption. This trade-off makes it hard to satisfy all assumptions when working with time-series data fully. As endogeneity causes biased estimates, while autocorrelation does not, we have chosen not to include lagged variables. It is, however, still possible that endogeneity is present in the model due to, for example, omitted variable bias.

Given that we only require contemporaneous exogeneity, we can not achieve a BLUE estimator. Hence, we must settle for asymptotic unbiasedness. We present the tests and results in appendix A2. The tests confirm that that residuals are normally distributed, and that multicollinearity is not an issue. Autocorrelation and heteroscedasticity are, however, present to some extent.

We believe the linear regression with log-transformed variables is a suitable approach to analyze our data. Although one must be aware of potential issues of endogeneity, other crucial assumptions are sufficiently satisfied.

7 Analysis

The following chapter presents the results of our quantitative analysis. The aim is to provide readers with an understanding of relationships between the variables. Such insights are valuable when reading the discussion-section coming after.

7.1 Quantitative analysis

7.1.1 Correlation Analysis

Our correlation analysis provides insightful information about the relationships between our variables. The degree to which the explanatory variables are related to the independent variable, GDP per capita, varies. Although causality is not certain, it reveals which explanatory variables that are closely related to the independent variable, GDP per capita, and those that are not. Additionally, we see that the relationship between explanatory variables varies widely. Some variables are barely correlated with others, not posing a risk of multicollinearity. Some variables, however, correlate highly with others, and it is important to be aware of when they are used in the same regression.

7.1.1.1 Relationship with dependent variable

Several variables have a substantial correlation with the GDP per capita, as evident in column (1) in table 7.3. Capital per capita has the closest relationship with the independent variable, with a correlation coefficient of 0.92. Although it implies a solid positive relationship, it is highly unlikely that the entire relationship is causal. We discuss this further under the regression analysis. Further, the variables Income '90, Fast transition, and Corruption all have a positive correlation coefficient of minimum 0.5, implying a strong positive relationship. The corruption variable in this analysis is the entire index from 0-100. A higher score implies less corruption, and thus it seems that less corruption correlates with economic growth. When taking the correlation of the dummy variable for High corruption with GDP per capita, the result is negative 0.37, supporting this finding. Next, Labor is positively correlated with a coefficient of 0.30, in line with

Table 7.1: Correlation of numerical variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) GDP	1.00												
(2) Labor	0.30	1.00											
(3) Income'90	0.55	0.45	1.00										
(4) Capital	0.92	0.18	0.51	1.00									
(5) Corruption	0.55	-0,10	0.01	0.62	1.00								
(6) FDI	0.04	0.09	0.08	0.05	-0.11	1.00							
(7) Ex.Debt	-0.37	-0.15	-0.06	-0.37	-0.36	0.10	1.00						
(8) No.School	-0.07	-0.04	0.03	0.01	0.04	-0.23	-0.22	1.00					
(9) High.Edu	0.19	-0.01	0.24	0.21	0.09	0.07	-0.14	0.43	1.00				
(10) Fast.Trans	0.50	-0.13	-0.13	0.52	0.78	-0.05	-0.53	0.05	0.22	1.00			
(11) Ex.Conf	0.27	0.04	0.05	0.29	0.44	-0.23	-0.20	0.28	-0.10	0.36	1.00		
(12) Dem.Acc	0.15	-0.54	-0.32	0.21	0.63	-0.20	-0.34	0.05	-0.11	0.60	0.44	1.00	
(13) Gov.Stab	-0.06	0.24	0.20	-0.11	-0.35	0.23	0.10	-0.08	0.30	-0.15	-0.12	-0.26	1.00

Note : The variables are: GDP = Logged GDP per capita, Labor = Employment in percent, Inome'90 = GDP per capita in 1990, Capital = Logged capital formation per capita, Corruption = Corruption score (1-100), FDI = Foreign Direct Investment to GDP, Ex.Debt = External debt to GDP, No.School = Rate of working stock without school, High.Edu = Rate of working stock with tertiary school, Fast.Trans = Dummy, 1 if shock therapy, Ex.Conf = Level of external conflict, Dem.Acc = Democratic Accountability, Gov.Stab = Government stability. *Datasource* : World Bank, Transparency International, Lee and Barro.

standard economic theory. Other variables with a high positive correlation coefficient are Higher education, External conflict, and Democratic accountability. The index External conflict is structured such that a higher score means less external conflict. The only variable with a negative relationship below 0.1 is External debt. With a correlation coefficient of negative 0.37, it implies that an increasing amount of debt is related to lower economic growth.

7.1.1.2 Relationship between explanatory factors

There is no immediate concern of a broad multicollinearity problem based on the correlation analysis of the explanatory variables. The only coefficients above 0.6 are between the three variables Corruption, Fast transition, and Democratic accountability. The numbers confirm the elusion of a multicollinearity problem shown in the VIF-analysis. It does, however, uncover other interesting relations. Capital is, for example, positively correlated with Income '90 with a correlation coefficient of 0.51. This could infer that a high level of income in 1990 leads to a higher level of capital in later years. We cannot draw firm conclusions based on the correlation coefficient. However, if one takes this information one step further, it might suggest that more capital follows higher income. If this is the case, or at least partially, one should be careful in the interpretation of Capital in the following regressions, as there is a risk of reverse causality.

Another result worth noting is that Fast transition is strongly positively correlated with Capital, Corruption, Democratic accountability, and weaker but still substantially with Higher education. It is also highly negatively correlated with External debt. Hence, it correlates the "right direction" with several variables also highly correlated with GDP per capita. An inferential from this could be that a fast, successful transition from a planned economy to capitalism facilitated the rise of several conditions that helps drive economic growth.

Lastly, Democratic accountability also correlates strongly with External conflict, with a correlation coefficient of 0.6. Both of these are indices from ICRG. It might be that a good score on democratic accountability will bring a lower possibility of external conflicts, and hence the two variables cover each other in some sense.

7.1.2 Regression Analysis

We study several variables in this analysis. The effect of an explanatory variable on GDP per capita will vary as the combination of variables in the model changes. To maximize our insight, we have tested several combinations of explanatory variables, giving us a broader understanding of the effect of each variable. These regressions resulted in three different models presented in tables 7.2, 7.3, and 7.4. In these tables, we show the development of each model, starting with a few variables and studying changes as we add more variables. In each table several regressions is portrayed, with a total of 19 regressions.

7.1.2.1 Regression 1-6

In table 7.2, we initially regress GDP per capita on Capital and Labor. This equals the basic growth model where TFP lies in the residual. Both variables are highly significant with a positive effect on GDP per capita, with Labor showing the highest effect. The findings are in line with the theory. The explanatory power of the model is quite high, at 0,88. However, Capital per capita accounts for nearly all of it. Regressed alone, Capital and Labor have an explanatory power of 0.85 and 0.09, respectively. Considering the correlation coefficient between Capital and GDP per capita of 0.92, this is not too surprising. It does, however, support the suspicion that the results do not provide the true causal effect of Capital on GDP. Next, we start including variables beyond Capital and Labor. This is equivalent to including the A in the growth model. We are trying to explain what comprises TFP. In model 2 the variables External debt and FDI is added. Both variables are negative, indicating that higher levels of external debt and FDI are negative for economic growth. All four variables are still highly significant at a one percent level. The explanatory power increases to 0.89.

Next, the variables Fast transition and Income '90 is added to model 3. Both are positive and highly significant, indicating that countries that went through "shock therapy" has had better economic growth than those who did not. Additionally, countries that were rich in 1990 are more likely to have a higher level of GDP per capita later. This makes sense, and the variable Income '90 alone has 0.3 explanatory power. After the introduction of these two variables, the significance of External debt falls from one percent level to a ten percent level. Model 3 has an explanatory power of 0.90.

In model 4, the variable for Higher education is introduced. First, the variable is significant at a one percent level. The sign of the coefficient is, however, negative. The hypothesis is that higher education should lead to more economic growth. Thus, the expectation is for the coefficient to be positive. Additionally, adding Higher education to the model deprives all significance from both external debt and FDI. Consequently, there is reason to assume that Higher education is not the best fit for the current model. As an alternative, Higher education is replaced by the variable No school in model 5 as a measure of the educational level in the adult population.

The results show that the latter variable is negative and highly significant. This is in line with expectations, as fewer people without an education should contribute to more productivity, and hence economic growth. FDI is still negative and insignificant when No school is added, but External debt is now significant at a five percent level. The coefficient of No school is, however, at negative 6,2, which is three times as big as Labor, which formerly had the largest coefficient. This cast some doubt to whether No school represents

Table 7.2: Regressions 1-6

	Dependent variable: GDP per Capita					
	(1)	(2)	(3)	(4)	(5)	(6)
Capital	0.708***	0.682***	0.571***	0.579***	0.572***	0.565***
	(0.014)	(0.015)	(0.021)	(0.024)	(0.023)	(0.022)
Labor	1.921***	1.934***	1.698***	1.461***	1.453***	1.720***
	(0.226)	(0.218)	(0.227)	(0.223)	(0.210)	(0.208)
External debt		−0.210***	−0.087*	−0.063	−0.118**	−0.226***
		(0.044)	(0.050)	(0.054)	(0.052)	(0.054)
FDI		−0.820***	−0.831***	−0.132	−0.615	−1.191***
		(0.259)	(0.243)	(0.457)	(0.419)	(0.416)
Fast Transition			0.300***	0.361***	0.307***	0.235***
			(0.054)	(0.057)	(0.054)	(0.054)
Income ’90			0.235***	0.280***	0.271***	0.263***
			(0.034)	(0.037)	(0.034)	(0.033)
Higher Education				−0.849***		
				(0.190)		
No School					−6.260***	−3.600***
					(0.841)	(0.943)
1991						−0.384***
						(0.117)
1992						−0.376***
						(0.115)
1993						−0.337***
						(0.098)
1994						−0.348***
						(0.096)
1995						−0.181**
						(0.075)
1996						−0.174**
						(0.071)
Constant	3.217***	3.504***	2.190***	1.852***	2.059***	2.122***
	(0.143)	(0.150)	(0.231)	(0.232)	(0.212)	(0.204)

Note: *p<0.1; **p<0.05; ***p<0.01

the true effect on GDP per capita following more people having attended school. When adding dummies for each year from 1991 to 1996 in model 6, this improves slightly. All dummies are significant, and the coefficient No school drops from to negative 3.6. This is still high, but more plausible. Additionally, FDI is now significant at a 1 percent level again. The explanatory power of this table's final model is 0.94, with 311 degrees of freedom. The constants in all models are significant at a one percent level.

Several other variables were also tested in this model but were not significant. This was the case for the corruption variables. It seemed that the presence of Capital in the model led to Corruption being insignificant. As Capital has such a high correlation with GDP per capita, without it necessarily being a causal relationship, it could potentially bias and disturb the significance of other variables. Although Capital likely has an effect on GDP per capita, it is interesting to see how other variables behave without its presence. Table 7.3 shows these regressions.

7.1.2.2 Regressions 7-13

We begin in model 7 by running a regression with the explanatory variables Labor and External debt. Both are highly significant, and the sign of the coefficients is in line with expectations. The explanatory power is 0.24. Further, in model 8, FDI is added but is not significant. This changes in model 9 when Higher education is included. FDI turns positive, with a relatively high coefficient and significant at a one percent level. Higher education is also significant at one percent level. With this combination of variables, the coefficient for Higher education has a positive sign, more in line with expectation. The explanatory power of model 9 is 0,3. Corruption was insignificant in the previous table, but here it is highly significant. The dummies for Medium and High corruption is both significant, Medium corruption on a five percent level and High corruption on a 1 percent level. Additionally, the dummy for High corruption has a larger negative value than Medium corruption. It seems plausible, as it is natural to assume that more corruption has a higher impact on economic growth than less corruption. Corruption was also significant when the index score was included instead of the dummies. When Corruption is added, FDI turns negative again, this time at a ten percent significance level.

Table 7.3: Regressions 7-13

	Dependent variable: GDP per Capita						
	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Labor	2.983***	2.948***	2.766***	4.914***	3.415***	3.770***	0.670***
	(0.503)	(0.505)	(0.524)	(0.532)	(0.433)	(0.425)	(0.223)
External debt	−0.895***	−0.899***	−1.031***	−0.864***	−0.690***	−0.845***	0.032
	(0.098)	(0.098)	(0.103)	(0.118)	(0.089)	(0.090)	(0.052)
FDI		0.440	3.299***	−1.624*	1.731**	0.132	−2.584***
		(0.620)	(1.026)	(0.972)	(0.840)	(0.859)	(0.421)
Higher Education			1.567***	0.989**	0.860**	0.913**	−0.143
			(0.463)	(0.440)	(0.378)	(0.364)	(0.168)
Medium Corruption				−0.297**	−0.377***	−0.301***	−0.014
				(0.114)	(0.101)	(0.099)	(0.042)
High Corruption				−1.075***	−1.193***	−1.044***	0.068
				(0.117)	(0.103)	(0.103)	(0.055)
1991						−0.434**	
						(0.202)	
1992						−0.588***	
						(0.201)	
1993						−0.510***	
						(0.189)	
1994						−0.566***	
						(0.186)	
1995						−0.496***	
						(0.157)	
1996						−0.526***	
						(0.156)	
Capital							0.797***
							(0.020)
Constant	7.689***	7.689***	7.609***	7.414***	7.939***	7.864***	3.38***
	(0.282)	(0.282)	(0.294)	(0.300)	(0.253)	(0.246)	(0.155)

Note: *p<0.1; **p<0.05; ***p<0.01

An important note is that the original corruption data only has a range from 2003. The regressions mentioned above use the original data. Hence, only observations from 2003 are included in the analysis. In order to test with all observations, we did a similar regression with the assumed corruption levels used on the early observations in model 11. The results are mainly the same, except that FDI now turns positive on a 10 percent significance level. With the same data, we also included dummies for the years 1991 to 1996 in regression 12. Again, the only notable difference is that FDI changes, this time turning insignificant. The last model has an explanatory power of 0.57, with 365 degrees of freedom. This table implies that variables like Higher education and Corruption also affect GDP per capita in a significant way.

As a final check for these variables, we also included the variable Capital. It made a substantial impact on the model. When it is introduced to the model, coefficients change significance levels, size, and sign. An example given, Higher education, External debt, and the dummies for Corruption turn insignificant. Although insignificant, the coefficients for External debt, Higher education, and High corruption also change sign. The coefficients of the above-mentioned variables, as well as Labor, is reduced substantially. In the opposite direction, FDI turns highly significant, negative, and the absolute value of the coefficient is increased. This final regression shows the immense impact of Capital on other variables. Another takeaway from the regressions in this table is that FDI is a somewhat volatile variable. Through these regressions, it has shown four different states, both significant and insignificant, as both positive and negative. This result finds support in earlier research as different studies have found FDI to be both positive and negative for economic growth. We elaborate this further in the discussion section. Some variables that have not proven significant in the other combinations of regressions. These new variables are in the regressions in table 7.4.

7.1.2.3 Regressions 14-19

Democratic accountability is the first variable in model 14. It is significant at a five percent level, and the coefficient is positive, as expected. Based on the coefficient size, the effect of Democratic accountability on economic growth seems limited. When External conflict is added in model 15, the coefficient is reduced and turns insignificant. External conflict is, however, significant at a one percent level, and the coefficient is positive but small. Government stability does not have any significant effect. This supports the correlation analysis, which showed a correlation coefficient close to zero. The explanatory power of model 16 is 0,073.

Table 7.4: Regressions 14-19

	Dependent variable: GDP per Capita					
	(14)	(15)	(16)	(17)	(18)	(19)
Democratic Accountability	0.003**	0.001	0.001	0.002**	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
External Conflict		0.012***	0.012***	−0.001	−0.003	−0.001
		(0.003)	(0.003)	(0.001)	(0.002)	(0.002)
Government Stability			−0.001	−0.00003	−0.003*	−0.004**
			(0.003)	(0.001)	(0.002)	(0.002)
Capital				0.666***	0.644***	0.556***
				(0.021)	(0.032)	(0.044)
Labor				1.865***	2.534***	2.138***
				(0.324)	(0.468)	(0.521)
High Corruption					0.032	−0.009
					(0.046)	(0.045)
External debt						−0.191***
						(0.071)
Income '90						0.148***
						(0.039)
Constant	9.232***	8.368***	8.439***	3.558***	3.602***	3.211***
	(0.092)	(0.258)	(0.324)	(0.181)	(0.200)	(0.270)
Note:						*p<0.1; **p<0.05; ***p<0.01

The effect of adding Capital and Labor is, however, that External conflict turns insignificant, and Democratic accountability regains its significance. As expected, both the variables for Labor and Capital are still highly significant. Adding the variable for High corruption in model 18 does not change the other coefficients other than Democratic ability increasing its significance from ten to a one percent level. Thus, we confirm again that Capital removes the significance of the corruption variable. Finally, External debt and Income

'90 is added to model 19. They are both significant, and the sign of the coefficient is as expected. After the introduction of these variables, the significance of Democratic accountability is again reduced to a five percent level, and Government stability turns significant on a five percent level. Note that the latter has the opposite sign of what we would expect, and the coefficient is minimal.

7.1.3 Summary

According to the preliminary hypothesis, both Capital and Labor shows a significant and positive relationship with GDP per capita. Of these, Labor is the larger coefficient by a clear margin in all but one model. Further, educational level, Income in 1990, and Fast transition are significant and positively related to GDP per capita. Income in 1990 and the dummy Fast transition have each almost 0.3 explanatory power. This implies that important factors for income level in a country are how rich it was in 1990, and well-organized reforms to capitalism. On the other side, both External debt and Corruption are significantly negatively related to GDP. This is in line with the expected relations. FDI is often significant but varies between a positive and negative coefficient. As mentioned, this is somewhat in line with earlier research. Variables such as Democratic accountability, Government stability, and External conflict is not very significant in explaining economic growth according to our analysis.

The findings are mostly in line with expectations. Although the analysis help explain which variables are important for economic growth, one must keep the possible endogeneity in mind. We include these results in the discussion of the next section.

8 Discussion

In the discussion chapter, we interpret the results. We discuss the findings in light of our theory and literature review to answer the research question.

Our research question was, "Why is economic growth lagging behind in former Comecon republics, and what explains cross-country differences within the region?". To answer this question, we will present and discuss each of the explanatory variables. To be able to assess the validity and context to a greater extent, the discussion will take into account previous literature and research on the topic. The regression analysis clearly shows that Labor and Capital are, without a doubt, the two most important explanatory variables for economic growth in the region.

Especially Capital seems to be essential, but here we must note that it is hardly a fully causal relationship. The importance of these two variables is in line with previous research and the neoclassical framework developed by Solow (1956), where the model with capital, labor, and technology seeks to explain economic growth. In this chapter, we will divide the discussion into the different explanatory variables, show the effect of each, explain what causes the effect, and finally explain the probability that such a result is plausible, given empirical data and previous research.

8.1 Labor

As shown in the correlation and regression analysis, Labor is an important explanatory variable for growth in our focus countries. The correlation coefficient is positive by 0.30 while being significant and positive in all regressions. This is in line with our theory and also what we would intuitively expect. Naturally, more people employed result in higher GDP per capita because a bigger workforce contributes to a higher total GDP despite the somewhat diminishing marginal utility in the long term. Fewer people being unemployed, and thus fewer people representing a cost to society will also contribute to growth.

Admittedly, just after the 1990 reform, there were high social costs, including unemployment. In fifteen of the focus countries, both GDP per capita and the proportion of employees were reduced. This shows the inverse relationship between unemployment and GDP per capita growth. In retrospect, this could be a necessary correction, as many jobs were superfluous in the years leading up to the transition. The main goal of transitioning from communism to capitalism was to increase productivity and income level to western standards. Productivity is expressed as output per worker, Y/L. Together with the ratio of capital to labor, K/L, productivity also determines wages. The overstaffing following communist policies hence led to both productivity and wages being low since the level of capital was below the equilibrium, showed as r* in theory. Increasing capital was not a feasible alternative in the short run, and hence productivity gains, higher Y/L, necessarily had to come from decreasing L, the labor force. This brought the ratio between capital and labor, R, towards equilibrium by increasing the relative share of capital. As explained in theory this leads to higher productivity per worker and higher wages.

In Poland, unemployment increased to 16 percent, resulting in approximately 1 million people becoming unemployed (Roaf et al., 2014). However, the forward-thinking reforms of Minister of Finance Leszek Balcerowicz worked. Consequently, in 1992 the economy stabilized and growth could begin as the number of people in work increased. If the outcome of the regression is to make sense, the increase in the labor force must be a result of market mechanisms rather than state involvement causing over-employment. After the initial pain of the reforms, productivity increased, and both wages and economic growth were on the rise. On the other hand, some countries have issues with workers migrating to other countries. Uzbekistan is one of the countries that chose gradualism when imposing reforms. Today, they still lack well-functioning systems, which weakens the effect of privatization (Auyezov, 2018). This causes a severe lack of available jobs in the country, and millions of the 15 million-strong labor force leaves the country in search of jobs (Auyezov, 2018). Naturally, this loss of labor force is damaging to the country's economic growth.

Labor is a critical factor in the framework of Solow (1956), which is the base for the neoclassical frameworks. Hence it is no surprise that it shows up significantly in our model as well.

8.2 Capital

The most important explanatory variable in the regression is Capital. It is positively correlated with GDP per capita 0.92 and highly significant in all regressions, as with the Labor variable. With an explanatory power of 0.85, we can imagine that it is hardly a fully causal relationship. However, there is little doubt that Capital is essential to understanding what drives economic growth. Further analysis revealed that the Capital variable with one and two lags has an even higher correlation with GDP per capita than the non-lagged variable. It could imply that the effect of capital on GDP is largest in the periods after the investments are made. It would make sense as it is normal for an investment to yield returns in later periods.

Although it is unlikely that these results show a fully causal relationship, a large part of it could be explained by the initial low levels of capital in the region. It suggests that the region has been following a process of convergence towards the EU-15, characterized by a more capital intense economy, as explained in the theory section. After the reforms opened for more privatization, Western European companies were seeking to move to manufacture to the Eastern European countries (Marcin Grela, 2017). This led to more capital in the region, and consequently, a rise in GDP, as production increased.

The positive relationship between Capital and GDP per capita can be found in both the exogenous models of Solow (1956), but also in the endogenous growth models by Romer (1986). It was thus to be expected that Capital would play an important role, and we find good support for our results in the existing literature.

Labor and Capital are traditionally essential variables in explaining economic growth. Therefore we performed individual regressions for each country with Labor and Capital as the explanatory variables. Additionally, we included year-dummies for 1991 to 1996 but excluded these numbers in the table due to formatting considerations. Because we have less than thirty observations or years, for each country, we did not expect as significant and unambiguous results as in the past regressions. They did, however, prove to be mostly in line with previous results and our theory.

Table 8.1: Capital and Labor for each country

	Dependent variable: GDP per Capita					
	Armenia	Azerbadjan	Belarus	Estonia	Georgia	Kazakhstan
Capital	0.642***	0.353***	0.192***	0.637***	0.319	0.415***
	(0.123)	(0.108)	(0.021)	(0.079)	(0.209)	(0.036)
Labor	−5.082	19.190***	6.588***	0.318	1.390	4.802***
	(4.887)	(3.748)	(0.359)	(0.948)	(2.847)	(1.108)
	Kyrgyzstan	Lithuania	Latvia	Moldova	Russia	Tajikistan
Capital	0.335***	0.782***	0.591***	0.601***	0.180**	−0.115
	(0.034)	(0.074)	(0.103)	(0.087)	(0.070)	(0.097)
Labor	−2.703	−0.266	1.332	−2.700***	7.196***	25.836***
	(1.629)	(1.180)	(1.521)	(0.916)	(1.171)	(2.299)
	Turkmenistan	Ukraine	Uzbekistan	Poland	Romania	
Capital		0.381**	0.302***	0.910***	0.673***	
		(0.169)	(0.020)	(0.084)	(0.071)	
Labor	16.063***	−5.513	4.902***	−1.371*	0.754	
	(0.982)	(5.559)	(0.532)	(0.790)	(0.751)	

Note: *p<0.1; **p<0.05; ***p<0.01

Capital is still highly significant and positive. This applies to all countries, except Turkmenistan, where data on capital was unavailable. Labor is less significant when considering each country individually. However, for the countries where labor is significant, it is mostly positive.

Another interesting aspect when looking at Labor and Capital in this region is the interaction between the two. As mentioned, the communist governance caused an inefficient distribution of labor, but the structure of the economy was also inefficient (Marcin Grela, 2017). Compared to Western Europe, the agriculture-sector was substantially larger, both in terms of the number of workers and as a share of the total economy. In Romania, the share of workers in agriculture amounted to 45 percent as late as in 2000, while in 2015, it had shrunken to 30 percent (Marcin Grela, 2017). These shifts were, in large part, driven by the transition towards more manufacturing, as mentioned above. Hence, in the years following the transition to capitalism, one had two significant effects involving capital and labor. First, the share of capital increased relative to labor, which itself is a driver for productivity and economic growth, in line with our theory. Additionally, it caused a shift in the employment structure. Large numbers of the labor force now moved from agriculture to a more value-creating sector in manufacturing. The interaction of increased capital, and the shift in employment structure towards more productive sectors, has been a key for economic growth in our focus countries.

8.3 Educational level

To distinguish the effect of different levels of education, we divide the population of each country into No school, Primary school, Secondary school, and Higher education. The correlation coefficient is positive for the proportion of highly educated people with 0.19 and negative for the proportion who have no education with -0.07. It makes intuitive sense, as one would imagine, that the value creation of a highly educated person would be greater. This is supported by Hanushek and Wößmann (2007), which points out that better education increases human capital in the workforce. Thus, it will increase productivity and, consequently, output. Given this train of thought, the human capital variable introduced in the growth model of Mankiw et al. (1992) will increase. Thus it makes sense to assume that Higher education is affecting economic growth. Similarly, education can increase innovation and thus also lead to better technology, as explained in the endogenous growth models of Lucas (1988) and Romer (1989).

In the analysis, however, we find no significance for Higher education if Capital is part of the regression. The lack of significance can partly be explained by the substantial share of the explanatory power of Capital. It can also be explained by the fact that Higher education itself does not necessarily lead to economic growth, as we elaborate further below. No school, on the other hand, gives significant coefficients, both with and without Capital in the regression. However, we believe that the negative coefficient is too high and does not represent the real effect on GDP per capita. One possible explanation could be that the relative change in the proportion without schooling is minimal compared to the increase in economic growth. Thus it might be given more weight than it should.

We use the number of years studying as a measure of education. Thus we do not take into account cross-country differences in the quality of education. According to Hanushek and Wößmann (2007), this is a weakness of such a quantitative approach. The number of people with higher education has been increasing in all our focus countries, except for Tajikistan (Alexandre Ardichvili, 2013). However, according to OECD's PISA study Eastern European countries score an average of 440 across all subjects, while the average is 496 in advanced economies (EBRD, 2018). The PISA study tests the analytical abilities of 15 years old people in a country. Additionally, merely taking higher education does not automatically make a productive worker. Looking at, for example, ICT-skills, firms in our focus countries report a higher mismatch of skills than the United States and Western Europe (Alexandre Ardichvili, 2013). The chance of the mean-job in our focus countries is more likely to be automated compared with those of advanced economies (EBRD, 2018). Hence, in addition to increasing the share of workers with higher education, education must be of high quality. It must also provide skills matching the demand from firms. In our theory, this would show through an increase in total factor productivity, A, and contribute to an increase in economic growth.

8.4 External debt

We calculate External debt as a percentage of GNI and find a negative correlation with GDP per capita with a coefficient of -0.37. It is significant in almost all regressions, which implies that External debt harms GDP growth per capita. Earlier literature disagrees to a greater extent on the effect of External debt based on three approaches.

The first approach can be recognized in the neoclassical models. Here it is suggested that there is a positive relationship between External debt and GDP per capita. This is due to it being a result of a lack of internal funding and can thus help stimulate growth through the financing of capital formation (Cline, 1985). Generalized across the world's economies, such an approach may be correct. However, in our population, where countries have been transition economies and presumptively poor, debt overhang can occur. That is, the accumulated debt exceeds the present value of expected income (Krugman, 1988). In such cases, the loans are used in the short term to cover deficits rather than being invested in projects that drive future growth.

The second approach has a view of external debt as negative for economic growth. Macroeconomic instability and inflation can create problems with servicing external debt. Examples of this were observed after the output from following the dissolution of the Soviet Union, and after the Asian financial crisis in 1997. The monetary overhang from a drop in production combined with money printing to cover deficits caused hyperinflation in most countries in the early 90's. Prices jumped seven times in Poland, 26 times in Russia, and 100 times in Ukraine (Roaf et al., 2014). The spillovers from the Asian financial crisis forced Russia to default on its debt and caused a recession for many countries in the region. In both cases, currencies devalued drastically. This made it challenging to service external debt and is an example of situations where external debt can be harmful to a nation's economy.

A note worth making is that the Baltic countries, Estonia, Latvia, and Lithuania, refused to accept responsibility for both the assets and liabilities of the former Soviet Union. Hence, they did not inherit any external debt, along with their independence. Since then, their reserves accumulated at a faster pace than debt. The financial position of these countries was favorable until 1995 when Lithuania's turned negative. These countries are among the few former Soviet states that have managed to join the EU and are among the those that are best off economically. Their favorable financial position is likely to have contributed to financial stability and hence, economic growth in the following years.

A third approach suggests that there may exist a non-linear relationship between External debt and GDP per capita (Sachs, 1986). The approach implies that the relationship is positive up to the critical point where the expected present value is lower than the debt that is accumulated. In 2018, Georgia and Kazakhstan had an External debt share of 110 and 106 percent of GNI, respectively (World Bank, 2019). According to our theory, the sign of External debt will depend on whether it increases investments in capital and ideas, or not. Although external funds used for investments could be positive for economic growth, we are looking at a particular case. Most of our focus countries suffered from macroeconomic instability, and consequently, external debt was often combined with hyperinflation. In such cases, rather than contribute to consumption smoothing, external debt service will grow higher and crowd out investments that spur economic growth. Hence, we believe that the high level of External debt among our focus countries reduces

GDP per capita to a greater extent than it stimulates new growth.

8.5 Corruption

The Corruption variable is an index, where low scores indicate high corruption in the country. This index score is positively correlated with a coefficient of 0.55 with GDP per capita, which makes sense given the index's design. We have also created dummies for Medium and High corruption, both of which are negatively correlated. It supports our assumption that more corruption results in lower economic growth. Just as with the Educational level variable, Corruption variables lack significance when Capital is in the model. In the regressions without Capital, however, the dummies are significant, and the coefficient for High corruption is larger than that of Medium corruption. In other words, the size and the signs make sense.

Quantifying the effect of corruption is no easy task. Previous research by OECD (2013), finds a strong correlation between corruption and output but has greater difficulty showing the effect on GDP growth, as do we. OECD (2013) points out that the link between the variables is hourly variant, non-linear, and indirect. Besides, the actual measurement and various forms of indexes of corruption are different, making it challenging to capture the true ratio across countries. There is no standard definition of corruption or industry-standard across anti-corruption organizations such as UNCAC or the OECD Anti-Bribery Corruption. This can result in different measures being used in previous research.

Although Corruption does not become significant in the regression with Capital, we still believe it negatively affects GDP per capita. We use the "Corruption perception" index from Transparency International as a measurement. For the majority of our focus countries, the public confidence in the state is weak. This could result in the private sector being less willing to invest long-term as a result of increased uncertainty and lower expected returns and thus making it more difficult to achieve growth over time. An ideal environment for economic growth is one where competition is fair. The most competitive offers win a tender, contracts are upheld, and patents and ideas are protected. In a corrupt system, this will not necessarily be the case. As a consequence, less productive companies might stay operating while others do not. Entrepreneurs might also seek to other countries with their ideas and startups. This can affect GDP per capita negatively.

Corruption is more likely to arise in structures where power is centralized like it was in the communist system (Svendsen, 2003). Countries like Russia and Ukraine have yet to replace the centralized power structures fully and are also two of our countries with the highest level of corruption. Additionally, they are two of the worst-performing countries when looking at percentage growth since 1990. Corruption and trust usually have an inverse relationship. Comparing Western and Eastern Europe, the Western countries, on average, have higher trust and lower corruption (Svendsen, 2003). Lower trust in the government will also make it harder to successfully impose reforms in a country (Svendsen, 2003). As high corruption usually leads to lower trust, a possible side effect of it could be that reforms have been less successful. Hence, corruption can be detrimental to economic growth both from directly ruining the business environment and through less chance of imposing reforms crucial for prosperity. Such an environment will likely decrease a country's TFP, and hence lower economic growth according to our theory.

8.6 Fast transition

To measure the effect of Fast transition, we created a dummy; 1 for the countries applying shock therapy and 0 for countries with a gradualist approach. The variable correlates positively with GDP per capita with a coefficient of 0.5. This indicates that a rapid and brutal transition from a centrally planned economy to a market economy is positive. It is in line with our hypothesis, and empirical data shows that countries that apply shock therapy more quickly achieved the stability that provided good growing conditions in the 1990s. The variable had a value of 0.3, which was highly significant, thus making it important for explaining growth. However, we are aware that it is a dummy variable, which consequently carries a risk of being attributed to the effects of several conditions.

Giannaros (2008) finds that the countries that were willing to take the social cost of shock therapy in the short term, perform better than those who did not in the longer term. These costs involved stagflation with high inflation and rising unemployment. Consequently, the negative effect becomes greater but ranges over a shorter period. Poland, the pioneering country for shock therapy, thus had the best conditions for growth in the 2000 period when "all" countries in the region experienced the golden period. Roaf et al. (2014) suggests that the window for when a transitional country can make a rapid and radical change may no longer exist. Uzbekistan and Ukraine are two examples of countries that still struggle with the effects of delayed reforms. As mentioned earlier, Uzbekistan suffers from a non-privatized economy, which causes a severe lack of available jobs. Ukraine has, among other things, not managed to decentralize power sufficiently and suffers from corruption. Both are examples of how a gradualist approach failed to produce successful reforms. This has led to problems with economic and social stability in different ways. Thus, it has been a hinder for economic growth.

It is important to remember that a transition from a centrally planned economy to a market economy is not just about privatization. As discussed earlier in the thesis, functioning institutional conditions, and a legal framework adapted to a market economy is essential (Svejnar, 2002). Poland is considered a country that made a fast transition, but the privatization of businesses was slower than, for example, Russia and Ukraine. In these two countries, however, there is a negative relationship between mass privatization and performance. This is a consequence of the institutional conditions not being in place when privatizing. Sachs (1986) explain the same phenomenon and find that it is the combination of privatization and institutional reforms that has a positive effect on GDP growth, not privatization by itself. The reason why some countries succeeded in a fast transition can be explained by the following; liberalization of prices and currency, as well as privatization of companies, is relatively simple and can happen quickly. However, changing the institutional structure is more complicated. In large part, because people with power act from self-interest and thus are more reluctant to make such a change (Roaf et al., 2014).

Economic growth has been slowed down after the financial crisis. It is conceivable that the countries that dared to implement the toughest reforms thus took advantage of the above mentioned window to a greater extent than others. Today, the region's economies behave in much the same way as traditional market economies, which means that this opportunity may never arise again. Looking at our theory, a fast transition, or shock therapy, seems to have facilitated both higher labor, capital, and total factor productivity in general. As the variable contributes to all parts of the theoretic model, it makes sense that it is essential in determining economic growth for the different countries.

8.7 Foreign direct investment

Foreign direct investment (FDI) is very volatile in our analysis. The correlation coefficient indicates a positive ratio between FDI and GDP per capita but is very low at 0.04. In the regression analysis, both significance and sign vary with different combinations of variables, which makes it challenging to draw a clear conclusion on the effect. Earlier research on FDI also varies between positive and negative impact on economic growth. Hence it might make sense that the coefficient is so volatile from a literature perspective.

Melnyk et al. (2014) has studied the effect of FDI in earlier Comecon economies and find a positive relationship. Admittedly, it is pointed out that financial and institutional sectors must be well-developed in order to achieve the desired effect and at the same time, attract foreign investment. Again, we observe that institutional stability is crucial for traditional drivers of growth to impact GDP per capita. Increased inflow of FDI could give companies in the region new knowledge, technology, and capital. Hence, it is argued that FDI is an important channel for technology transfer that is crucial for transition economies to converge. On the contrary, one often sees that the return from foreign investments is the subject of repatriation. Thus it is profiting the foreign investors rather than countries or firms receiving the initial investment (Schoors, 2002). From such a perspective, FDI could harm the capital stock and hence on economic growth.

More FDI can spur economic growth when looking at the golden period from 2000-2007. Capital inflows to the region skyrocketed, mostly through investments from Western European countries. This caused a substantial increase in capital in Eastern European countries. As discussed under Capital, it led to higher economic growth, with a peak in the period leading up to the financial crisis. However, we see the doubled-edged blade of foreign investment. When the financial crisis hit, flows of capital to the region dried up. When foreign investment no longer fuelled domestic demand, most countries went into a deep recession. Hence, FDI drove growth in the early 2000's, albeit artificial to some extent. However, it also contributed to magnify the negative effects of the financial crisis. These effects are still evident today, through high unemployment and fragile economic systems (Roaf et al., 2014).

8.8 Income per capita '90

We include Income per capita '90 concerning adjusting for the base different countries had before the transition. The variable is not surprisingly positively correlated with GDP per capita at 0.55. In all regressions, it is highly significant with value typically around 0.20, while having high explanatory power at around 0.30.

By taking the initial conditions into account, we can more easily distinguish cross country differences. The high explanatory power indicates that those countries that were rich in 1990 will have better conditions for being rich today. It will not necessarily translate into percentage growth, considering the catch-up effect where poor countries converge towards rich, but in absolute numbers. For example, Russia had GDP per capita of over 20,000 US dollars and, together with the Baltic countries, was the country with the best base in absolute figures before the transition in the 1990s (World Bank, 2019). Looking at GDP per capita figures in 2018, the same countries dominate, while Kyrgyz Republic and Tajikistan, which had the lowest per capita GDP, have not converged remarkably over the last 30 years. Growth rates vary between countries, but there seems to be little doubt that the starting point is vital for the position they are in today.

This is in line with the research of de Melo et al. (1997) and Fischer and Sahay (2000), which found that the initial conditions had an impact. The reason was that countries struggling financially in 1990 were more reluctant to implement large-scale reforms as they were already facing large deficits. Hence, those countries with a low GDP per capita in 1990, had poorer conditions, or will, to implement the reforms that today contribute to inequalities between the focus countries.

8.9 Less significant variables

External conflict, Democratic accountability, and Government stability, with the two latter as measures on institutional quality, shows little or no significance in our regressions. Especially Government stability is intuitively challenging to interpret, as its negatively correlated with GDP per capita and only has significance in a few regressions.

The data was obtained from the ICRG and measures a total score based on government unity, legislative strength, and popular support. We do not rule out the opportunity that other indexes are more fit for this measuring this effect. When studying the data, we find that only Poland, Russia, and Romania have increased their score since 1990. Considering that GDP per capita has increased in the region over the period, it, therefore, makes sense that we do not get the significant positive effect we expected.

For External conflict, high scores indicate low conflict levels and vice versa. Ukraine and Russia, which are in conflict with each other, are the only countries with substantially lower scores than the rest of the region. The latter's annexation of Crimea has reduced their score from 84 in 2002 to 54 in 2016 - similarly, Ukraine's score has been reduced from 92 to 58. Apart from these two countries, most are at a relatively low level of conflict associated with high scores, which may explain relatively small values and significance for the variable.

Democratic accountability is prepared so that high scores reflect the form of government with the least risk. These are typically governments with democratic elections and a high degree of independent judiciaries. In this category are the member countries of the EU, in addition to Romania. At the opposite end of the scale are, among others, Azerbaijan and Kazakhstan, both with a score of 25, as well as Belarus, which has a score of 17 out of 100 (The PRS Group, 2017). In context with the growth achieved in the respective countries over the last 30 years, there is a reason to believe that Democratic accountability plays an important role without being able to achieve significant results.

All variables in this section profoundly affect the quality institutions in a country. As discussed previously, institutions are crucial for economic growth in several ways. It affects a country's ability to attract capital, the effectiveness of reforms, and it facilitates a sound business environment in general. Overall the countries would be better suited for a market economy. Thus, the three variables discussed above are likely to affect economic growth, although it does not show in the regressions.

9 Conclusion

This study aimed to identify the most important drivers of growth in 17 former Comecon countries. Based on a quantitative analysis of GDP per capita in relation to economic and political measurements, we find that Capital and Labor are the most important variables for economic growth. Both are positively related, hence more capital reflects in a higher GDP per capita. This can be viewed as relatively standard economic results and was expected, given the knowledge we acquired through previous literature and theory. Our other findings are much as expected, like corruption being bad and high-quality education being good. The above mentioned variables are relatively easy to quantify and measure. However, measuring institutional quality based on a variety of estimated political parameters does not necessarily return representative results. Thus, based on previous literature, it is natural to believe that institutions play a more important role than what our regression shows.

The respective explanatory variables have a weak effect in countries where institutions are not in place. Given the catch up hypothesis, the region should have experienced a greater convergence towards the more advanced Western economies. However, their lacking capability to acquire and apply new technologies, partly explained by poor institutional quality, has impaired the process of convergence. Each of the countries' decisions on whether to conduct a fast transition has dramatically influenced the internal differences we observe in the region today. It seems clear that those who dared to make a rapid transition have managed to converge with Western Europe to a greater extent than those who did not. The initial conditions in 1990 affected whether countries did or did not opt for a fast transition, as already poor countries were more reluctant due to the risk that followed with the short term social costs. Thus, initial wealth seems to have been important. This is reflected by observing how countries that were rich relative to the rest of the region in 1990 have maintained their advantage. Despite this, even the best-performing Comecon countries are far from the GDP per capita level of their neighbors in the west.

9.1 Weaknesses

When interpreting the results, there are a few things to keep in mind. Our regression results might be endogenous, particularly from omitted variable bias and reverse causality. Hence, one should be cautious in interpreting the relationships as causal. The fact that we, to a greater extent, presents relationships between variables rather than assured causal effects on growth is a drawback to the thesis. Further, having more than 30 observations per country for each variable would allow us to infer more from analyses on the specific countries. It would provide more accurate results.

9.2 Future research

Institutions seem to play a central role, which is difficult to measure and apply quantitatively. Thus, it could be interesting to do a deeper analysis of the political system in each country, with the aim of capturing the impact institutions have on economic growth. Such research will be particularly relevant for the former CIS countries, which are experiencing both poor institutions and low per capita GDP. It could also be interesting to do comparative research with the Asian transition economies, which have achieved a much better growth rate over the last 30 years. This can, to a greater extent, help to distinguish the real reasons why the former Comecon countries are unable to converge more towards Western Europe.

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Appendix

1 Theory

Equation for capital level.

$$\Delta K = sY - \delta K \tag{.1}$$

The initial model is based on some assumptions. It is based on continuous time and that it is a single good produced with constant technology. There is no government or international trade, and all factors of production are fully employed. The labor force grows at a constant rate of n, and the initial values for capital and labor are given.

Additionally, production has constant returns to scale, and productivity is positive but diminishing.

The constant growth of labor lets us express labor as a function of the initial level of labor and the constant growth through several periods t.

$$L(t) = L_0 e^{nt} \tag{.2}$$

The relative change of the ratio between capital and labor, r, is the difference between the development in relative rates in capital and labor.

$$\frac{\Delta r}{r} = \frac{\Delta K}{K} - \frac{\Delta L}{L} \tag{.3}$$

As described, the growth in L is equal to N, and the additional capital is equal to sF(K,L). Applying this and rearranging gives us the following equation.

$$\Delta r = r\frac{sF(K,L)}{K} - nr \tag{.4}$$

Using the fact that $\frac{L}{K} = \frac{1}{r}$ leaves us with the final expression for the relative change in capital.

$$\Delta r = sF(1,r) - nr \tag{.5}$$

2 Descriptive Statistics

Figure 2.1: GDP per capita, Indexed 1995

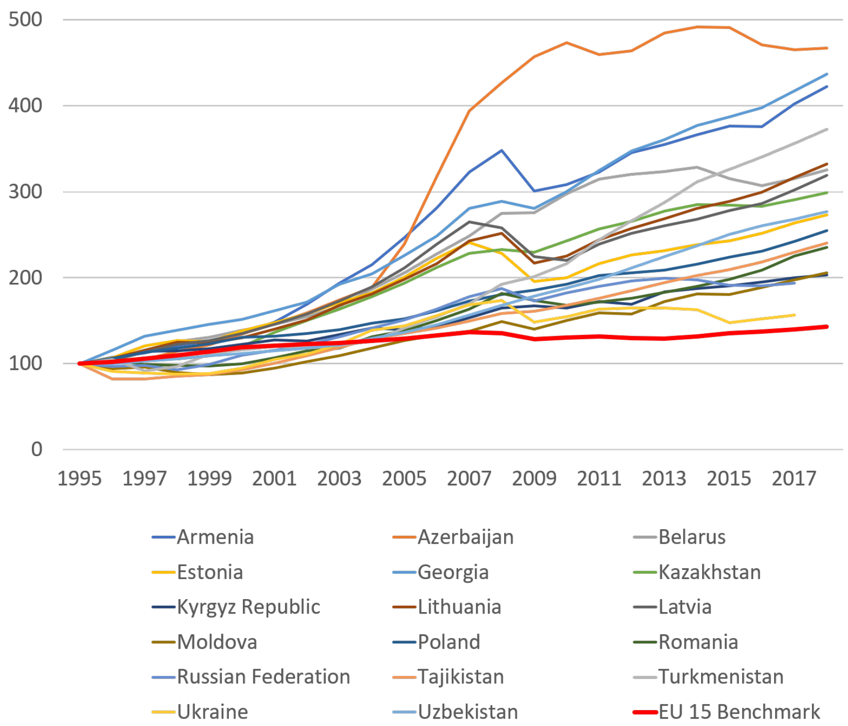
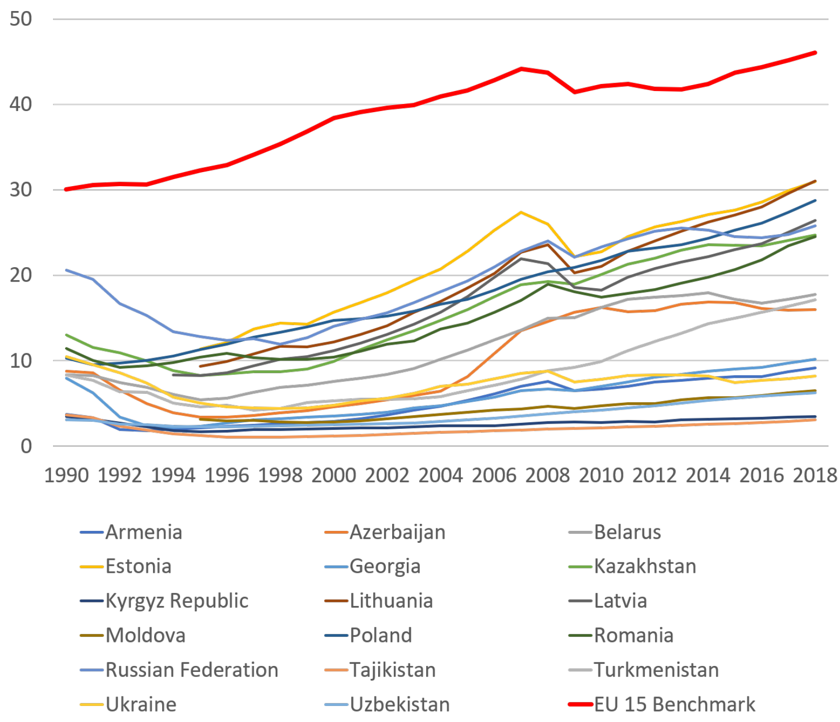


Figure 2.2: GDP per capita, Absolute numbers



3 Regression Analysis

As discussed in the methodology section, several conditions should be met for the regression analysis to be reliable. Here we perform tests to verify whether the conditions are met or not. Our primary focus will be the most complete model in each table with regressions in the analysis section. Hence, we show tests performed on models 6, 12, and 19. Hence, they represent the regressions in tables 1, 2, and 3, respectively. We start by plotting histograms and Q-Q plots for the residuals to check the normality assumption. A bell curved histogram and a straight line imply normally distributed residuals. From the figures, we conclude that the normality assumption is satisfied in these regressions.

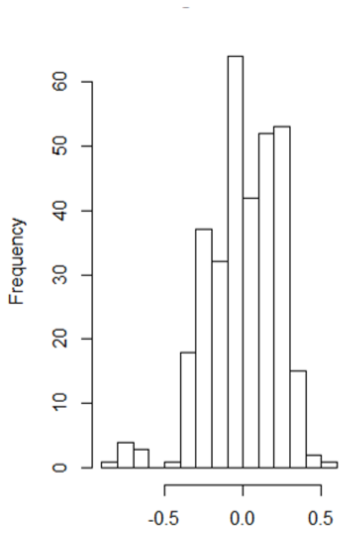


Figure 3.1: Hist, model 6

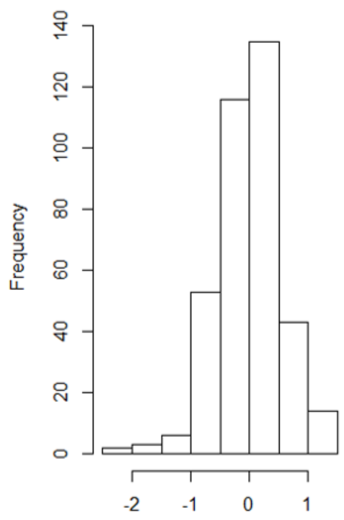


Figure 3.2: Hist, model 12

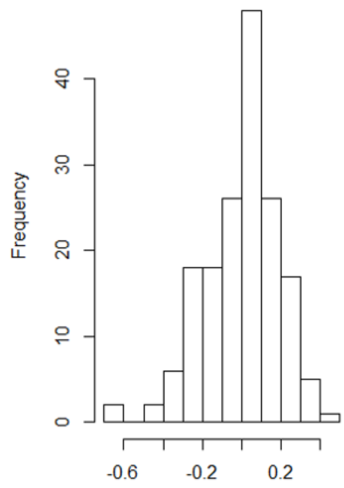


Figure 3.3: Hist, model 19

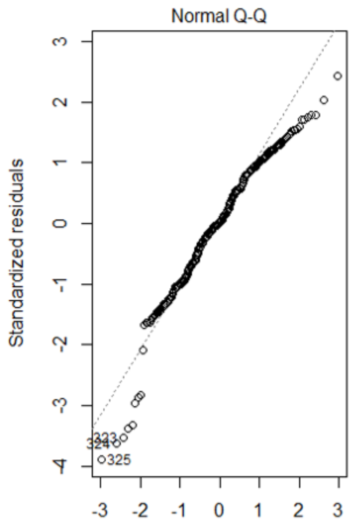


Figure 3.4: Q-Q, model 6

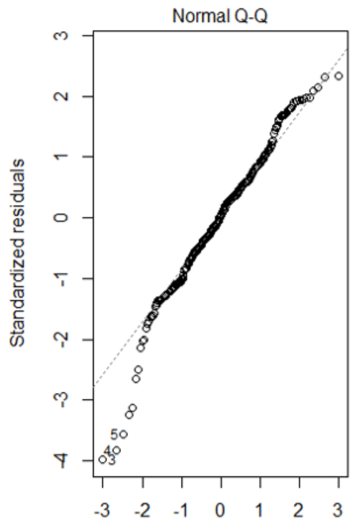


Figure 3.5: Q-Q, model 12

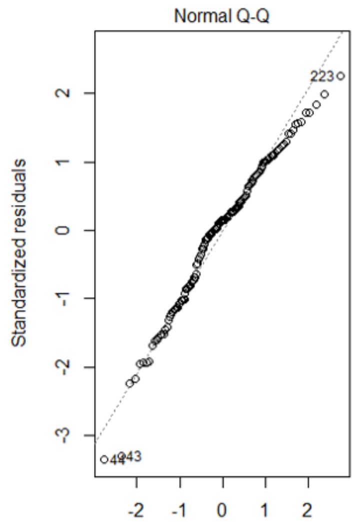


Figure 3.6: Q-Q, model 19

Next, we check whether the assumption of homoscedasticity holds. First, we look at scale-location plots for each regression. If the spread of residuals, the dots, is equal along with the plot, the assumption holds. If the spread grows more substantial or smaller when moving along the x-axis; however, the assumption could be violated. In the plots, this will be highlighted by a red line. A relatively horizontal line implies homoscedasticity. The y-axis shows the square root of standardized residuals, while fitted values are along the x-axis.

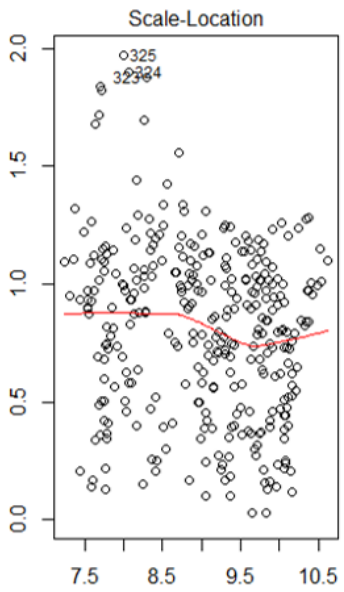


Figure 3.7: Scale, model 6

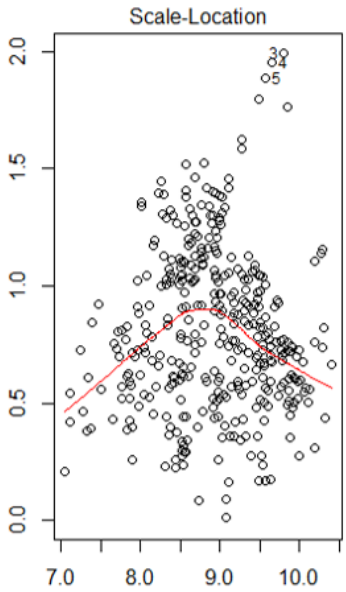


Figure 3.8: Scale, model 12

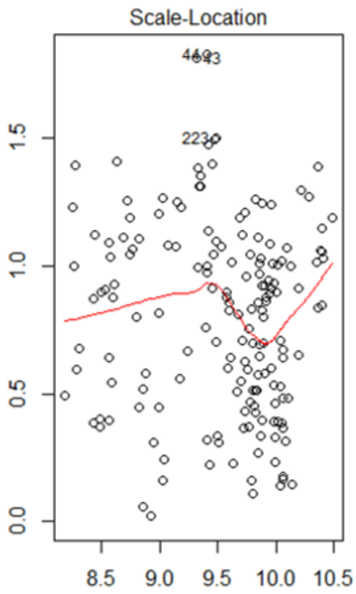


Figure 3.9: Scale, model 19

From the plots, model 6 satisfy the homoscedasticity assumption. Model 12 does not, however, as the spread in residuals is increasing. Model 19 is on the edge of being satisfied. These plots are, however, not bulletproof. Therefore we also perform the Breush-Pagan test for heteroscedasticity in R. The null hypothesis is rejected at a one percent level in all three tests. The null hypothesis is that the homoscedasticity assumption is satisfied. Hence, the test results say that heteroscedasticity is present in the models. Heteroscedasticity is not a problem when only interpreting the coefficients, but one should be careful when doing inference. If required, one can create standard errors robust to heteroscedasticity.

Next, we test for autocorrelation. This can also be viewed in a plot, although another type than the above. Here, we plot the residuals to see if they follow each other in any specific pattern. If they are, the residuals are likely correlated with each other, and that autocorrelation is present.

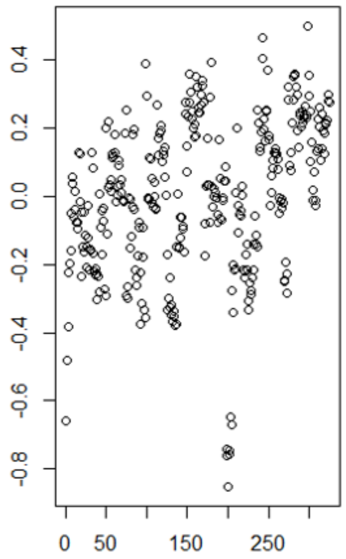


Figure 3.10: Auto, mod 6

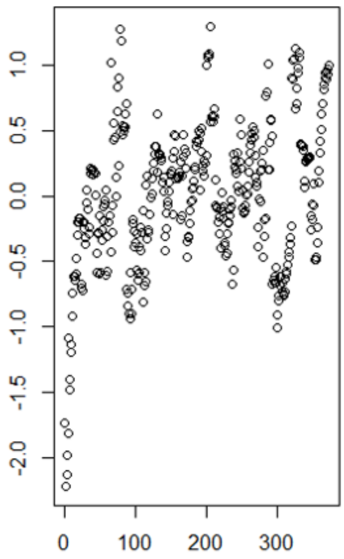


Figure 3.11: Auto, mod 12

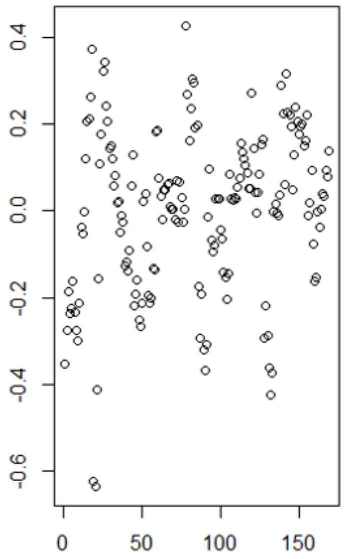


Figure 3.12: Auto, mod 19

In models 6 and 12 we can see clear patterns. In the first, the residuals have an upward trend, and in the latter, they form a convex shape. It is harder to tell from the residuals in model 19. The presence of autocorrelation seems at least to be weaker than in the former two models. To gain a higher degree of certainty, we conduct a test also here. The Durbin-Watson test is often used to reveal the presence of autocorrelation. The test provides a Durbin-Watson statistic, which is close to 2 if there is no autocorrelation. When performing the test in R, the range of statistics was 0,25 to 0,53. A statistic between 0 and 2 implies positive autocorrelation. The fact that 0,53 is quite far from 2, combined with the residual plots, it is highly likely that autocorrelation is present. As discussed in methodology, however, this was expected since we are working with time series.

To check for multicollinearity, we performed a VIF analysis. As previously discussed, a VIF below 10 is usually acceptable, although some argue that the limit should be 5. The VIF analysis provided the following results, and as no variable has a VIF above five multicollinearities is not a problem in our regressions.

Figure 3.13: VIF, model 6

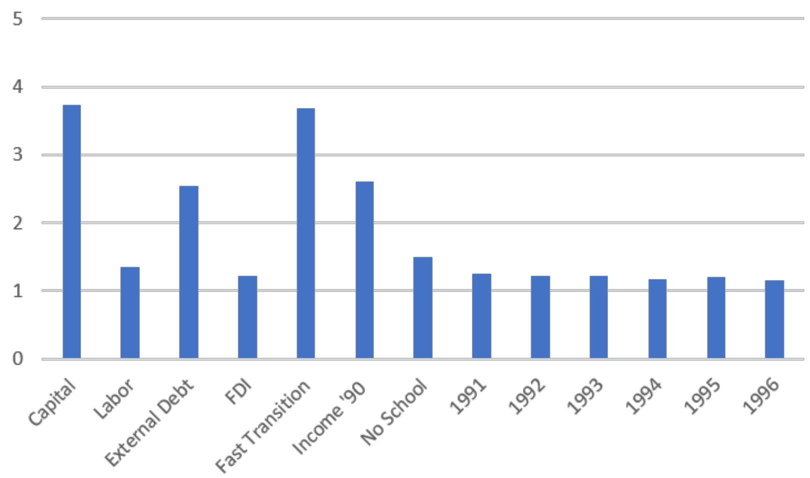


Figure 3.14: VIF, model 12

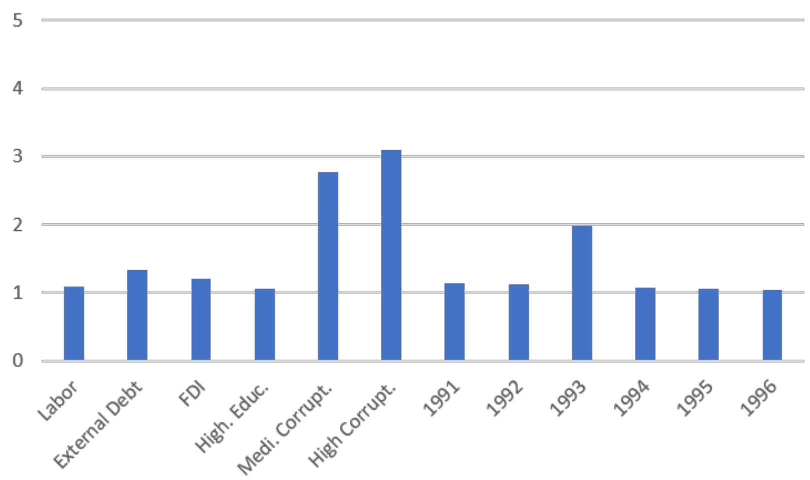
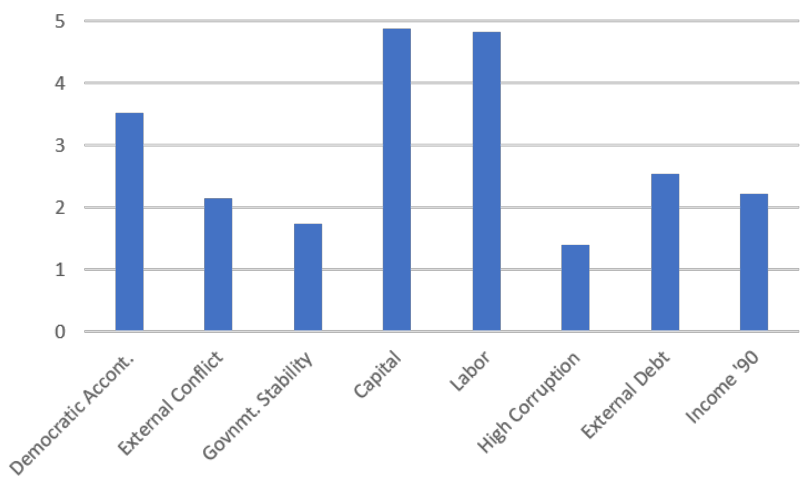


Figure 3.15: VIF, model 19



Below are the results from the augmented Dickey-Fuller test for stationarity. In the Dickey-Fuller test, the null-hypothesis is that the time series has a unit root, which is non-stationarity. Consequently, a low p-value is desirable. The two tables presented show results of the Dickey-fuller test on GDP per capita with two different assumptions for the time series. Table A2.1 shows results with an assumption of upward drift in the time-series, while table A2.2 assumes both drift and a trend. As it is not always clear which of the two one should apply, we ran tests for both. The results show low p-values for all lags in both tables. Only the variable with zero lag in the model with drift and trend is not rejected at a five percent level. It has a p-value of 0.125, and looking at both tests as a whole. We conclude that the assumption of stationarity is satisfied.

Table 3.1: Augmented Dickey Fuller test. Left: Drift. Right: Drift and trend

Lag	ADF	p.value	Lag	ADF	p.value
T	-3.069	0.031	T	-3.071	0.125
T-1	-3.436	0.010	T-1	-3.435	0.049
T-2	-4.058	0.010	T-2	-4.052	0.010
T-3	-4.421	0.010	T-3	-4.415	0.010
T-4	-4.599	0.010	T-4	-4.594	0.010
T-5	-4.633	0.010	T-5	-4.628	0.010