CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of International Studies

Master thesis

2023 **Yimeng Zhao**

CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of International Studies

International Masters in Economy, State and Society

Yimeng Zhao

Educational Investment, Human Capital and Economic Growth - Evidence from Transition Economies

Master thesis

Prague 2023

Author: Bc. Yimeng Zhao

Supervisor: prof. Ing. Marek Vokoun, Ph.D.

Academic Year: 2022/2023

ABSTRACT

Human capital theory suggests that education can contribute to economic growth. However, empirical evidence shows mixed positive and negative relationships between educational investment and economic growth. Meanwhile, there is little literature devoted to the impact of educational investment on economic growth in transition economies and most studies ignore the moderating effect of institutional quality, which may lead to biased conclusions and leave an important research gap on this theme.

This thesis develops an extended MRW model based on the endogenous growth theory and uses the System GMM method to estimate the impact of educational investment on economic growth and the moderating effect of institutional quality in 22 transition economies from Europe and the former Soviet Union over the period 2002-2020. The research finds that educational investment can promote economic growth in transition economies and some dimensions of institutional quality have the moderating effect on the impact of educational investment on economic growth. Specifically, government efficiency and control of corruption have a positive moderating effect, while regulatory quality and rule of law have insignificant moderating effects. Finally, based on the empirical results, this thesis makes several recommendations for educational investment policies in transition economies.

Keywords: Educational Investment; Economic Growth; Institutional Quality; Human Capital；GMM

Word count: 20170

ABSTRAKT

Teorie lidského kapitálu předpokládá, že vzdělání může přispět k hospodářskému růstu. Empirické důkazy však ukazují smíšené pozitivní a negativní vztahy mezi investicemi do vzdělání a hospodářským růstem. Zatím existuje jen málo literatury věnované vlivu investic do vzdělání na hospodářský růst v transformujících se ekonomikách a většina studií ignoruje moderující vliv institucionální kvality, což může vést ke zkresleným závěrům a zanechává v tomto tématu významnou mezeru ve výzkumu.

Tato práce rozvíjí rozšířený MRW model založený na teorii endogenního růstu a používá metodu System GMM k odhadu dopadu investic do vzdělání na hospodářský růst a moderujícího účinku institucionální kvality ve 22 transformujících se ekonomikách z Evropy a bývalého Sovětského svazu v období 2002-2020. Výzkum zjistil, že investice do vzdělání mohou podpořit hospodářský růst v transformujících se ekonomikách a některé dimenze institucionální kvality mají moderující účinek na dopad investic do vzdělání na hospodářský růst. Konkrétně efektivita vlády a kontrola korupce mají pozitivní moderující účinek, zatímco kvalita regulace a právní stát mají nevýznamný moderující účinek. Na závěr tato práce na základě empirických výsledků předkládá několik doporučení pro politiku investic do vzdělávání v transformujících se ekonomikách.

Klíčová slova: Investice do vzdělání; hospodářský růst; kvalita institucí; lidský kapitál；GMM

Název práce: Investice do vzdělání, lidský kapitál a hospodářský růst

- Důkazy z tranzitivních ekonomik

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague 01.08.2023 Yimeng Zhao

Contents

1. Introduction

As an important investment in human capital, the positive impact of education on economic growth is widely accepted. Policymakers often consider increasing public educational expenditure as an instrument of fiscal policy that can contribute to economic growth. However, the results of a number of cross-country empirical studies in recent years indicate that the positive relationship between educational investment and economic growth does not always exist. In addition, the relationship between educational investment and economic growth can be affected by the institutional quality of different countries. For example, the growth effect of educational investments is lower in countries with high levels of corruption. Therefore, this research focuses on the relationship between educational investment, institutional quality and economic growth. The introduction section clarifies the objectives of the research, research questions, research scope, significance of the research, and organization of the research, respectively.

1.1 Objectives of the Research

In early studies, economists generally assumed that the impact of educational investment on economic growth was positive and statistically significant. However, many later studies have shown that this early evidence is fragile. The impact of education on economic growth may not be statistically significant and may be influenced by other factors. Meanwhile, there is a growing consciousness of the important impact of the institutional quality of a country on its economic development. Numerous studies have shown that a country's institutional quality can affect the return and efficiency of public investment. A poor institutional environment would reduce the efficiency of public investment, preventing the state from receiving the expected returns, and would also have a negative impact on the productivity of public capital. These controversial findings have triggered extensive discussions of educational investment policies in various countries. On the one hand, education has remained an important instrument for developing countries' human capital accumulation and

economic progress over the past decades. Some scholars pointed out that delays in the reform of educational systems which cannot keep pace with economic structures are most apparent in the transition economies of CEE. The lack of educational investment caused by lags in reform can hinder growth (Ozturk, 2008). On the other hand, some scholars are concerned that increasing the investment in education in a country under poor institutional environment will result in a serious waste of resources, which will in turn hinder economic growth. Despite the intense debate, the systematic evidence on the impact of educational investment and institutional quality on economic growth remains incomplete. In other words, there is no clear empirical analysis of whether educational investment promotes economic growth and how institutional quality influence it.

There are three main objectives in conducting this research. The research firstly reviews the development history and recent trends of research related to the growth effect of education and summarizes the research gap. Secondly, it validates the growth effect of educational investment in the transition economies and explores the moderating effect of institutional quality. Finally, this research attempts to provide policymakers with practical recommendations based on the results of the empirical analysis for targeted interventions in different countries to maximize the impact of educational investments and avoid the waste of resources due to inefficiencies.

1.2 Research Questions

Already in the 1950s, the problem that explaining economic growth in terms of capital and labor, the two traditional factors of production, leaves a large number of 'residuals' unexplained was raised by economists. A variety of growth-related studies finds out that education actually contributed to the unexplained residuals in the economic development of western economies following the pioneering works of Schultz (1961) and Beckerman & Denison (1962). Since the 1980s, the endogenous growth models and the expanded neoclassical growth model of Mankiw, Romer, and Weil (MRW) emphasized the significance of human capital. Therefore, as a kind of investment that

leads to the formation of human capital, the theory that educational investment can contribute to economic growth is widely accepted. However, a selection of recent studies suggests that, have shown that despite the attention paid to the growth effect of education, the empirical evidence indicated that such relationship is weak.

Aghion et. al. (2009) summarized the reasons that led to the unreliability of the existing conclusions. Firstly, the reverse causation. Countries that are richer, growing faster, or have better institutions may be more likely to increase their educational expenditure (Bils and Klenow, 2000). Secondly, endogeneity due to the choice of proxy indicators. For example, some scholars use average years of schooling as a proxy indicator of human capital. However, the number of years of schooling is a decision that people make based on the return on their investment in education in their country. Therefore, applying average years of schooling as a proxy indicator in empirical analysis is prone to endogeneity. Thirdly, omitted variable bias. The factors influencing economic growth are difficult to examine comprehensively. Therefore, further research is still required to verify the specific contribution of educational investment to economic growth.

An important factor that should also be taken into consideration when analyzing the impact of educational investment on economic growth is the institutional quality. Taking corruption as an example, Tanzi and Davoodi (1998) pointed out that the whole decision-making process pertaining to public investment projects can be distorted by corruption. On the one hand, higher levels of corruption can result in a reduction in the average productivity of factor inputs. On the other hand, corruption may reduce some other categories of public expenditure, such as educational expenditure and health expenditure, due to budgetary constraints and other considerations. It makes sense to explore how institutional quality affects the relationship between educational investment and economic growth.

Consequently, the main research questions of this research are presented as follow:

Whether educational investment has enhanced economic growth in the transition economies?

What is the role of the institutional quality in explaining the growth effects of educational investment?

1.3 Research Scope

This research focuses on analyzing the impact of educational investment on economic growth and the moderating effect of institutional quality in transition economies. This study restricts the scope of the research to transition economies in Europe and the former Soviet Union. Considering that heterogeneity among countries can make the findings of this research unrepresentative, we exclude transition economies from Asia from the sample, thus reducing the effect of heterogeneity. The time span of the sample is 2002-2020, which is due to the fact that this time period is characterized by a divergence in the pace of economic growth between the CEE countries, Baltic countries and the CIS countries. In addition, data on educational investments, economic growth and indicators of institutional quality are more readily available for this period.

1.4 Significance of the Research

A series of recent literature shows that the impact of education on economic growth may have been generally overestimated and misestimated in earlier studies for reasons of reverse causality and endogeneity. Meanwhile, earlier studies also neglected the impact of some important institutional quality factors like control of corruption and government efficiency while analyzing the growth effect of education. Guided by inaccurate theories, increasing educational investment blindly may not be effective in promoting economic growth, but may result in a waste of resources instead. For transition economies, positive and stable economic development is essential, and the process of transition is often accompanied by institutional reforms. Thus, from both economic and political perspectives, there is a great need to clarify the relationship between educational investment, institutional quality and economic growth. There is a

vast empirical literature that has contributed to exploring the impact of educational investment on economic growth over the past two decades. However, there is a dearth of cross-country studies on transition economies. As for the moderating effect of institutional factors, recent empirical studies have not been able to provide clear and robust findings. On the one hand, most of the relevant studies focus on the moderating effects of institutional quality on the relationship between public investment and economic growth. These studies have not disaggregate educational investment or human capital investment from public investment. On the other hand, the majority of scholars who have directly examined the effect of educational investment on economic growth have only discussed the influence of institutional quality theoretically and lacked specific empirical analyses.

This study reassesses the relationship between educational investment and economic growth in transition economies empirically by incorporating the moderating effect of institutional quality. This fills the gap in existing research on the growth effects of education. Additionally, by examining the heterogeneity of educational investment on economic growth in various institutional environments, it helps policymakers to target the use of education as a multipurpose policy tool, thereby reducing the waste of resources and promoting economic growth.

1.5 Organization of the Research

This thesis is organized as follows: Chapter 1 introduces the core research questions, research scope and significance of this research. Chapter 2 reviews the development of human capital theory and economic growth theory and summarizes the empirical findings of existing research on the growth effects of education. It also reviews the previous literature on the moderating effects of institutional quality on economic growth and analyzes the relationship between institutional quality, educational investment and economic growth. Chapter 3 establishes the theoretical framework of the relationship between educational investment and economic growth and presents the research hypotheses of this thesis. Chapter 4 describes the estimation methods and

empirical model of this thesis. Chapter 5 describes the data and variables used in this thesis and conducts the descriptive analysis. Chapter 6 presents the findings of the empirical analysis in this research, conducts robustness checks and analyzes the potential limitations of the study. Eventually, Chapter 7 summarizes the entire research and provides some policy recommendations based on the empirical findings.

2. Literature Review

This chapter reviews the literature on the relationship between educational investment, institutional quality and economic growth. It first introduces the development of human capital theory as well as important theoretical models of the impact of education on economic growth. Then, it summarizes the evidence from previous empirical analyses devoted to examining the effect of educational investment on economic growth. Subsequently, we introduced the definition of institutional quality and the commonly used measurement of institutional quality. Next, this research summarizes the previous literature devoted to investigating the correlation between educational investment, economic growth and institutions. Finally, it briefly summarizes and mentions the fact that there are still controversies and research gaps regarding the interactions between educational investment, economic growth and institutional quality of transition economies, which need to be further discussed.

2.1 Educational Investment and Economic Growth

2.1.1 Development of Human Capital Theory

Human capital theory is one of the most important theoretical foundations for investigating the impact of education on economic growth. In empirical analyses, education has always been the most important indicator of human capital investment, despite the fact that elements related to human capital are not limited to education. Sweetland (1996) explains why this phenomenon has developed. For one thing, education is considered to contribute to improvements in other types of human capital investments, such as nutrition and health. Another more important reason is that

education can be measured in terms of costs or years of schooling, which reduces the difficulty of empirical analysis.

The earliest theories of human capital date back to 1776. Adam Smith was the first to explicitly categorize people or their abilities as fixed capital. He argued that people could acquire talents through education, schooling and apprenticeships. The capital spent in this process can form fixed capital in the learner through the creation of other types of value like the upgrading of labor skills. Both for the individual and the public, these abilities constitute a type of property. At the same time, he considered labor to be a source of technological progress and national wealth. Therefore, he suggested that the state should promote, encourage, and even compel the entire population to acquire a basic level of education (Smith et al., 1981).

In the 1840s, Freidrich List introduced the concept of 'spiritual capital', which is derived from intellectual achievements and accumulations. The advancements, innovations, improvements, and efforts of earlier centuries have culminated in the current status of nations, which are the spiritual capital of modern people. He also suggested that education expenditure should be the largest economic expenditure of a country, as increasing investment in the education could enhance the country's future productivity. And he pointed out that teachers should be included in the category of producers, as they can train and educate the next generation of producers (List, 1966).

In the 1890s, Alfred Marshall pointed out that human talent can be regarded as capital and is an important means of production. He categorized human abilities into two types: general and specific abilities. General ability refers to the general knowledge and intelligence possessed by the laborer. Special ability refers to the physical strength and work proficiency of the laborer. Marshall believed that along with the rapid development of industrial technology, traditional manual labor was gradually replaced by machines, and the role of general ability in production would be strengthened. Thus, the most valuable of all capital is investment in people themselves.

Since education improves the ability and employment opportunities of workers, he advocated education as a national investment (Marshall, 1989).

It is clear from the above that early economists included people and their abilities and acquired skills within the scope of capital. They had seen the contribution of human knowledge and skills to a country's economic development, but did not clearly define human capital. Meanwhile, most of the ideas were only at the level of qualitative analysis and did not calculate the effect of human capital quantitatively.

Economists made major strides in the study of human capital in the 20th century. The concept of human capital was initially presented and included in the theoretical framework of economic analysis by Fisher (1906). After him a method for calculating the rate of return on educational investment was put out by Strumilin (1924). Using a simplified calculation of labor, he calculated that one year of primary education for a worker could increase the productivity of labor by a factor of 1.6 compared to the same amount of time spent working in a factory. Walsh (1935) calculates the economic benefits of education by comparing one's educational expenditures to one's future income, using the evaluation of educational return to figure out whether high school and college education are economically beneficial. Galbraith (1961) noted that modern economic activity requires large numbers of trained workers, and that investing in human capital is just of the same importance as investing in physical capital. Promoting productivity by means of physical capital investing itself can only have a very limited effect. Improvements in capital or advances in technology depend almost entirely on investment in education and science.

In the above studies, economists initially proposed the concept of human capital and made relatively simple calculations of the yield of human capital investment. However, the research in this period has certain limitations influenced by the neoclassical economic growth theory. Based on the assumption of homogeneity of capital and labor, the existing theories are difficult to explain some emerging

economic problems and appear even contradictory. On the basis of previous research, some scholars keenly felt this change and began to develop human capital theory. Schultz (1961) clearly articulates the ideas of the defination and nature of human capital, the content and methods of investment in human capital, and the significance of human capital to economic growth. He pointed out that researchers should treat population quality as a kind of scarce resource while considering population quantity as one of the important influences on economic growth. In addition, he used the rate-of-return approach to carry out a quantitative analysis of the relationship between educational investment and economic growth and found that educational investment contributed up to 33% of growth of national income during the period 1929-1957 in the United States. This result has been widely cited as the basis for illustrating the economic effects of education. One year later, Denlson (1962) used empirical analysis to demonstrate how human capital influences economic growth. Denlson provided the most convincing explanation for the large unrecognized 'residual values' that are difficult to explain in terms of labor and capital inputs when estimating the contribution of labor and capital in the accumulations of national income using traditional methods of economic analysis. He argues, through fine decomposition calculations, that 23 percent of U.S. economic growth between 1929 and 1957 was attributable to the development of education, that is, to the accumulation of human capital investment. The average quality of the labor force grew by 0.9 percentage points as a result of the rise in educational attainment, adding 0.67 percentage points to the growth rate of the national income in the United States and accounting for 42% of the rise in national income per capita. Denison's research provided strong evidence for Schultz's theory and triggered a decade-long surge in education funding in countries around the world beginning in the 1960s.

2.1.2 Economic Growth Theory

Then following the pioneering works of Schultz (1961) and Denison (1962), a variety of growth-related studies have emerged. By incorporating human capital factors into economic growth models, many scholars have attempted to to use the production

function approach to evaluate how human capital contributes to economic growth in the same way that capital and labor do. As a result, a number of economic growth models centered on human capital factors have been proposed.

Arrow (1962) first endogenized the exogenous variable of technical advancement in the theoretical model of economic growth and proposed his 'learning by doing' paradigm. Arrow argued that capital investment was the source of technical advancement because it could hasten the process of learning new things and gaining experience. Only those who have knowledge and production experience can advance technological advancement. Learning and manufacturing practices are important routes for people to acquire knowledge and experience. Accordingly, Arrow advocated 'learning by doing' as a method of gaining knowledge and experience. Arrow is the first economist who established the endogenous growth model, contributes to the birth of new growth theory by overcoming the constraints of neoclassical growth theory.

Uzawa (1965) developed an extended neoclassical growth model. He extended the Solow model, which included only the production sector, to a two-sector model that included the education sector and the production sector. Uzawa's model assumes that society allocates a certain amount of resources to the non-producing education sector, and the contribution of the education sector to output is indirectly realized through its effect on the technological improvement of the production sector. This model is considered to be the earliest growth model of human capital as well, because it introduced the education sector for the first time.

Based on the and Uzawa's model and the 'learning by doing' theory, Romer (1986) further advanced the development of endogenous growth theory. He developed a classical endogenous growth model by incorporating knowledge as a special factor of production into the economic growth model. He argued that knowledge has the property of increasing marginal benefits in output. The spillover nature of knowledge allows the rate of return on capital to rise with the growth of capital inputs, thus

revising the assumption of diminishing or constant returns in traditional growth. This fully explained the high rate of growth of the world economy at that time, as well as the widening gap between the economic levels of developed and developing countries.

Combining Schultz's theory of human capital with Solow's endogenous growth model, Lucas (1988) proposed an endogenous growth model which is established mainly on the basis of external effects of human capital. He categorizes the effect of human capital into internal and external effects, with internal effects referring to how an individual's human capital affects his or her personal productivity and profits and external effects referring to how an increase in the average level of human capital affects the productivity of all components of production. The improvement of the average level of human capital can benefit society in a variety of ways, such as lowering transaction costs, boosting the population's participation rate in the labor force, improving health, lowering the fertility rate, and lowering the crime rate (Haveman & Wolfe, 1984). However, these positive impacts do not affect individuals' human capital investment decisions and are therefore referred to as human capital externalities. Since the accumulation of human capital is incremental from the existing level of human capital, it is also incremental in the aggregate due to externalities, resulting in the incremental character of the aggregate marginal output of human capital. It solves the constraint of diminishing marginal labor and physical capital output and allows for long-term economic progress. As a result, the accumulation of human capital is the core of long-term economic progress.

2.1.3 Current Empirical Evidence

As can be seen from the previous section, in the process of continuous improvement and development of growth theories and models, human capital has been added to the economic growth model as an independent variable and has been considered as one of the most crucial sources which can promote economic growth. Although there are differences, the existing theories generally agree that education can stimulate the

formation and accumulation of human capital, which in turn promotes economic growth. However, from the existing literature, the results of empirical analysis do not directly provide strong evidence for the above conclusion. The reason is that while the results of most empirical studies show that education does have a positive impact on economic growth, there are some studies that come to a different conclusion.

Firstly, there is a considerable amount of empirical research that shows that education has a positive and significant effect on economic growth. This is consistent with the results predicted by existing theories. Some scholars have used cross-sectional data for a single country to estimate the growth effect of education. Heckman (2003) found through quantitative analysis that educational investment in China has an obvious impact in enhancing economic growth, and the real rate of return on education is up to 30%-40%. However, compared with other countries, China's proportion of GDP invested in education is noticeably lower than the world average. This shows that the current national policy on education investment is seriously insufficient, hindering the long-term development of the economy. Abhijet (2010) investigated the causal relationship between educational expenditure and economic growth in India between 1951 and 2009 using a linear and non-linear Granger causality approach. The findings indicate that, with a certain time lag, investment in education can enhance economic growth, but that economic growth can in turn affect the level of government educational expenditure. This suggests that it is important to focus on reverse causality when examining the growth effects of education. Ganegodage and Rambaldi (2011) assessed the influence of educational investment to the development of economy in Sri Lanka over the period 1959-2008 through an endogenous growth model. Their results indicated a positive return of educational investment, but the return was much lower than in other developing economies.

Time-series analyses of countries around the world generally show a positive and significant relationship between education and economic growth. Jung and Thorbecke (2001) assessed the impact of public expenditure on education on

macroeconomic growth and distribution in Tanzania and Zambia through a multisector CGE model. The results show that educational expenditure can boost economic growth and educational expenditure with specific target can contribute to poverty reducing progress effectively. Fitzgerald (2011) comparatively analyzed the development paths of educational investment in two different models in Ireland and Northern Ireland after the 1960 war, and the results showed that the two models had different impacts on economic growth. The accumulation of human capital resulting from educational investment in Ireland significantly contributed to the promotion of economic development, whereas for Northern Ireland, insufficient educational investment underperformed in terms of the influence of a country's sustained economic growth. Asghar and Awan (2012) examined the relationship between human capital and economic growth in Pakistan for the period 1974-2009 using two human capital indicators, education and health. Their findings show that despite the low percentage of GDP spent on education and health in Pakistan, both of them can significantly promote the economic growth. Gemmell et al. (2014) used a sample of 17 OECD nations from 1972 to 2008 to analyze the long-term effect on GDP of modifications to total government spending and the percentages of different spending categories. They find that spending on infrastructure and education expenditures can positively influence economic growth in the long run.

The research that followed went a step deeper and conducted panel data methodologies. Aschauer (1989) developed an empirical analytical model on cross-country data for 107 market economic countries for the period 1960-1985 to analyze the relationship between aggregate productivity and various public expenditures in each country. They reached the consensus that public educational investment can positively influence the aggregate productivity and that educational investment promotes economic growth. Aghion (1998) was the first to empirically investigate the impact of the level of individual knowledge of the labor force on the growth rate of average output using an endogenous growth model. It was concluded that the higher the level of education of the labor force, the higher the growth rate of

average output. It was also noted that for every 1 percentage point rise in national educational expenditure as a share of GDP, productivity rises by 0.3 percentage points. Herbertsson (2003) used historical data for the five Nordic countries from 1970-1972 to build a discrete Ramsey economy model that takes into account the externalities of human capital to analyze the effects of educational investment, fixed assets, working hours and total factor productivity on economic growth. His findings show that the educational investment have a significantly positive impact on the development of economy in the five Nordic countries. It explains a huge section of the increase in the total factor growth rate in the Nordic countries over the period 1970-1992, contributing 12-33 percent to economic growth. Aghion et al. (2009) analyzed panel data for 48 U.S. states using the 2SLS methodology, and the findings of the research show that educational expenditures can positively affect economic growth, implying that the reason why the educational investment and the economic growth rate vary from country to country is due to the exogenous technological differences between states. Extending the theoretical framework of Lucas (1988), Banerjee (2012) developed a random effects model to investigate the impact of education on economic growth using panel data for 55 developing countries from 1980-2007. His findings show that investment in education has a statistically significant positive effect on economic growth. Ogundaria and Awokuse (2018) developed a dynamic model based on the system generalized method of moments (SYS-GMM) using balanced panel data for 35 Sub-Saharan African countries over the period 1980-2008 to analyze the impact of two human capital factors, education and health, on economic growth. According to the findings of their empirical analysis, health and education both have a sizable beneficial influence on economic growth, although health's contribution is generally greater than education's. These results suggest that the positive impact of education on economic growth does not only hold in a single country, but is equally supported by evidence in cross-country research studies.

However, there are some scholars who have drawn conclusions that are inconsistent with existing theories. They have indicated that the relationship between educational

investment and economic growth may be statistically insignificant or surprisingly negative. Islam (1995) developed a dynamic panel data model to explore the growth convergence problem and estimated the impact of education on economic growth for 115 countries over the period 1960-1986 using different panel data estimators. The results show that most of the estimates for education in the 155 countries are insignificant, which is quite different from the results of a single cross-country regression at that time. Krueger and Lindahl (2001) analyzed the growth effect of education using the OLS method and the IV method for a sample of 34 countries for the period 1960-1985. The results show that when analyzed using the OLS method, the impact of education on economic growth was found to be positive and significant, but when analyzed using the IV method, the impact of education on economic growth was found to be negative and significant. This suggests that there may be unresolved endogeneity issues in the study. In addition they noted that the growth effect of education could be better captured if estimates were made on a ten or twenty year basis. Blankenau and Simpson (2004) empirically analyzed data from 55 countries by constructing an overlapping generations endogenous growth model of human capital-driven economic growth. The research found that there is no evidence that increased public spending on education can necessarily promote economic growth. This is because public expenditure on education has a crowding-out effect on other factors that promote economic growth. The direct impact of public expenditure on education on economic development is positive, but it is diminished or even cancelled completely when general equilibrium adjustments have a negative impact on other factors that determine economic growth. The results of these studies show that the relationship between education and economic growth is not clear at present and there are unresolved issues such as endogeneity, reverse causality, etc. in related areas. This implies that further research is needed on the growth effects of educational investment.

For transition countries, the impact of education on economic growth is not clearly established. On the one hand, there is little literature that directly investigates the

affect of educational investment on economic growth in transition economies, but rather examines investment in education as part of public investment instead. On the other hand, as in other countries, the results of existing studies are controversial and do not clearly support the research hypothesis that investment in education can promote economic growth. Sukiassyan (2007) developed an OLS model to empirically analyze balanced panel data for 26 countries in an attempt to explain why countries in Central and Eastern Europe and the Commonwealth of Independent States have large differences in growth rate. The findings of this study find that unequal distribution of investment in education may negatively influence the economic growth through increased inequality. Chudarkova and Verner (2012) analyze the relationship between education spending and economic growth by developing an error correction model using time series data from the Czech Republic and Austria. Their findings indicate the long-term positive relationship between government expenditure on education and economic progress in Austria for the period 1971-2008, whereas the relationship between government educational expenditure and economic growth in the Czech Republic for the period 1998-2008 is not significant. Acharya and Nuriev (2016) explored the relationship between public investment, growth and poverty by using a least square dummy variable approach to analyze panel data for 30 transition economies for the period 1995-2010. The findings suggest that public investment can promote economic growth. If public investment is mainly used to subsidize education, it can have a pro-poor growth impact, but unbalanced distribution can weaken this effect. Lupu et al. (2018) analyzed the importance of different kinds of public investment on GDP growth in 10 CEE accession countries to the EU over the period 1995 to 2015 using a spatial autoregressive distributed lag (ARDL) model. According to their findings, spending on social welfare, defense, economic affairs, and general public services has a negative influence on economic growth, whereas spending on education and health care has a favorable effect. These inconsistent findings provide implications for continued research on the relationship between education and economic growth in transition economies.

2.1.4 Conclusions

By reviewing the existing research, several questions emerged. Firstly, the relationship between education and economic growth is not clear. Although a considerable number of research provides support for the positive growth effects of education, there are also empirical evidences which show the statistically insignificant effect of education on economic growth. The even more surprising fact is that the negative growth effect of education also occurred in several studies. Several scholars have now attempted to explain these paradoxes. First, in empirical analyses, the proxies for human capital selected by researchers may be mismeasured or weakly measured. This indicates that the available data on human capital proxies are likely to fail to capture all relevant dimensions of human capital (Hanushek & Kimko, 2000). To address this issue, indicators that are directly available and more reliable should be chosen as proxies for human capital as much as possible, for example, compared with the average years of schooling, educational investment is a better proxy for human capital (Aghion et al., 2008). Second, the growth effect of education is not independent; it is influenced by many external factors, such as the efficiency of a country's government, control of corruption, and allocation of public investment, etc. An imperfect institutional environment reduces the productivity and effectiveness of the education sector and reduces the incentives for human capital accumulation (Rogers, 2008) . Therefore, when studying the growth effects of education, proxies for institutional factors should be added to the growth model. Finally, for transition countries, existing research tends to discuss investment in education as included in public investment, and there is little literature, especially cross-country empirical studies, that directly tests the growth effects of education. This suggests that studies on transition countries have certain research gaps in this research area of the growth effect of education. Therefore, this research decides to differentiate educational investment from public investment and analyze it empirically in a sample of transition countries.

2.2 Institutional Quality

2.2.1 The Impact of Institutional Quality on Economic Growth

Institutional quality is an indicator of how well a country's institutions and government are functioning. According to the World Bank's Worldwide Governance Indicators (WGI), institutional quality is usually categorized into for six dimensions of governance, which are voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption.

The impact of institutions on economic growth has been emphasized by scholars from a very early stage. The neo-institutional school believes that institutional factors are the key factors in economic growth. A country's performance is directly impacted by its institutional foundation, the environment of institution, the structure of institution, and the direction of the system. And institutional change modifies the rate of economic growth by altering the cost-benefit structure in an evolving economic system. North (1989) took institutional factors as endogenous variables in the economic growth model and points out that institutions are the fundamental determinants of economic growth from the perspective of institutional evolution. He believes that it is the existence of a series of effective institutions, such as sound laws, perfect market mechanisms and efficient organizations, and the positive incentives of effective institutions for the economy that triggered the early development of the economies of developed countries, represented by the United Kingdom. Dollar and Kraay (2003) argued that the quality of a country's institutions can affect the input-output ratio of various factors of production in that country. Thus, the ability of a country's institutions to constrain government behavior, promote technological progress and increase the efficiency of factor inputs determines whether a country can achieve its long-term economic growth objectives. These studies show that institutions are one of the important moderators of economic growth. It can affect

economic growth by influencing the performance of some important determinants of production.

In terms of empirical studies, researchers usually start from one or more specific dimensions of institutional quality to examine the relationship between institutional quality and economic growth, such as control of corruption, government effectiveness, regulatory quality, rule of law, and so on. For control of corruption, Heckelman and Powell (2010) conducted OLS regressions and IV regressions to examine the impact of corruption on economic growth taking cross-country data between 1995-2005 as a sample. The findings suggest that corruption favors economic growth when the degree of economic freedom is limited, while the favorable impact of corruption diminishes as economic freedom increases. In particular, when the size of government and the degree of regulation decline, the favorable effects of corruption will disappear rapidly. For government effectiveness, Miniesy and AbdelKarim (2021) developed a multiple linear regression model and analyzed the panel data of 104 countries for the period from 1999 to 2020 using the pooled ordinary least squares (POLS) method. The findings of the study show that when local government functions efficiently, there will be more foreign investment, which will increase development projects and thus lead to economic development. For regulatory quality, Neison and Singh (1998) utilize panel data for 67 developing nations from 1970 to 1989 to examine the impact of quality of institution on economic progress from the perspective of political freedom and economic freedom. Their research indicates that good institutional quality (higher government regulatory quality) leads to a relatively free economic and political environment, which can promote the development of the economy significantly. Henisz (2000) investigates the link between political constraints and cross-country economic growth rate by constructing a spatial model of political interactions. The study finds that low government regulatory quality and increasing political constraints have a significant dampening impact on economic progress. For rule of law, Xu (2011) constructs a growth model using property rights as a feature of institutions affecting

economic growth by reviewing the previous literature, formally showing that institutional improvements promote economic growth.

What's more, there are also several literature that do not delineate the specific dimensions of institutional factors. Jian et al. (1996) analyzed regional economic growth and income disparities in China, applying panel data for 30 Chinese provinces from 1952 to 1993 as a sample. They find that government-led institutional reforms, which promote economic growth, also increase the degree of marketization among regions and thus widen regional income disparities. Linking political institutions and economic outcomes, restrictive policy making and the institutional environment are found to be factors of infrastructure investment by Henisz et al. (2005) in an analysis of panel data for more than 100 nations. Thus, institutional quality can affect economic growth by influencing infrastructure investment decisions. Baryshnikova et al. (2016) use the dynamic panel approach to examine the linkage between institutional quality, inequality and economic development using data from 78 countries. The findings suggest that good institutions can lead to economic prosperity and good long-term development. However, high levels of inequality in economic development can, in turn, negatively affect the quality of institutions. Sharifazadeh and Ziyari (2012) suggest that the institutional environment has a dual effect on economic growth through theoretical analysis and empirical analysis of cross-country data. On the one hand, the institutional environment establishes the ground rules for the interaction between the market and the government, as well as how they function in the economic system. On the other hand, the institutional environment affects economic growth by increasing efficiency and improving capital formation, with the size of the effect varying according to the quality of national institutions.

It is clear from these previous literature that institutional quality can moderate economic growth, whether it is viewed as a holistic indicator or subdivided into multiple dimensions.

2.2.2 The Impact of Institutional Quality on the Growth Effect of Education

There is very limited literature that directly examines the moderating effect of institutional quality on the growth effect of educational investment. Zhu and Li (2016) argued that economic complexity could reflect a country's level of institutions and productive capacity. They measured the economic complexity of 210 nations using the reflection approach and investigated how human capital and economic complexity affected economic growth. Their findings demonstrate that various degrees of human capital and economic complexity have a beneficial influence on both long-term and short-term growth, and that there is a positive interaction effect between human capital and economic complexity on growth. Ali et al. (2018) conducted a regression analysis on panel data from 132 countries over 15 years using a fixed effects model. They discover that human capital only helps GDP per capita rise when there are improved economic opportunities and an effective legal framework. These studies provide preliminary indications of the moderating effects of institutional quality on the growth effects of education.

Most of the relevant research focuses on the impact of institutional quality on the growth effect of public investment, and does not disaggregate educational investment or human capital investment from public investment. The following part therefore reviews the literature relating to the impact of institutional quality on the growth effect of public investment and attempts to speculate the impact of institutional quality on the growth effect of educational investment.

Tanzi. and Davoodi (1998) investigate the moderating effect of institutional quality on the impact of public investment on economic growth by using corruption as a proxy for institutional effects. They found that the whole decision-making process pertaining to public investment projects can be distorted by corruption. Higher levels of corruption would lead to a reduction in the average productivity of public investments. Corruption may reduce some other categories of public expenditure, such as

educational expenditure and health expenditure, due to budgetary constraints and other consideration. In this instance, public capital expenditures' productivity is considerable lower than usually believed, and their contribution to economic growth is therefore significantly smaller. To demonstrate the influence of institutional quality on the link between public investment and economic development, Haque and Kneller (2015) created a theoretical growth model. According to this approach, government employees are in charge of procuring supplies that will be utilized as manufacturing inputs. Public officials may misrepresent high-quality, expensive purchases and provide low-quality, inexpensive items as a result of knowledge asymmetry between the government and public authorities. In this case, corruption can lead to an increase in the amount of public investment, but it can reduce the return on public investment and lead to slower economic growth. Thus, institutional quality can affect economic growth by influencing the efficiency of public investment. In order to investigate the link between public investment and development in various institutional settings, Bon (2019) developed a D-GMM model based on balanced panel data for 52 provinces in Vietnam from 2005 to 2014. According to the findings, institutional quality can have an impact on the link between government spending and economic expansion. In a good institutional environment, there is a positive link between public investment and economic growth, while in a bad institutional environment, there is a negative association.

The results of the above studies suggest that institutional quality has an moderating impact on influence of public investment on economic growth. Although there is no definitive conclusion, as part of public investment, it is reasonable to assume that institutional quality also has an impact on the relationship between educational investment and economic growth.

2.2.3 Conclusion

The findings of the existing literature suggest that institutional quality is one of the crucial elements affecting economic growth.. Whether institutional quality is included

as a single element in the analysis of growth or broken down into a number of dimensions for analysis, the findings of the studies can support the above conclusion. However, there is a paucity of literature on the influence of institutional quality in the relationship between educational investment and economic growth. Most of the relevant literature has examined the relationship between investment in education or institutional quality and economic growth separately, without integrating them. Another part of the literature focuses on the moderating effect of institutional quality on the growth effect of public investment, and discusses investment in education only as a part of public investment together with investment in health and infrastructure construction, without breaking down distinguishing educational investment from public investment and analyzing it empirically. In particular, the existing researches have not estimated the impact of educational investment on economic growth at different levels of institutional quality.

The transition progress of an economy is accompanied by significant changes in the economic and political system that can have a major impact on economic growth. Therefore, considering institutional quality is important for understanding the impact of educational investment on economic growth in transition economies. Therefore, this thesis decides to explore the interaction between educational investment, institutional quality and economic growth, thus filling an important gap on the theme.

3. Theoretical Framework and Research Hypotheses

The chapter begins with discussing the theoretical frameworks used in examining the relationship between human capital and economic growth and deriving the equations used for the empirical analysis. Subsequently, we select appropriate proxy variables for each of the influential factors of economic growth in the equation and determine the measures of institutional quality in this research. Finally, we formulate the research hypotheses of this study.

3.1 Human Capital - Economic Growth Nexus Theoretical Frameworks

3.1.1 Expanded Mankiw-Romer-Weil Model

In the previous part we mentioned that, the neoclassical growth theory was rethought by economists on behalf of Romer (1986) and Lucas (1988) in the 1980s, leading to the proposing of the new growth theory. They built endogenous growth models by incorporating endogenous technological variables such as knowledge and human capital into the classical growth models. These models provide the basis for empirical analysis to examine the growth effect of education. Later, a simple framework for growth regressions was established by Mankiw et al. (1992), which is known as the Mankiw-Romer-Weil (MRW) model. They used a sample of 98 non-oil producing countries, 76 developing countries and 22 OECD countries with populations of more than one hundred thousand over the period 1960-1985, and employed the Cobb-Douglas production function with constant returns to scale as the instrument to explain the differences in per capita incomes across countries. According to their research, an expanded Solow-Swan model that takes both the accumulation of physical capital and the accumulation of human capital into account can effectively account for disparities in per capita income among nations. Additionally, variations in human capital, savings, and population growth seem to account for around 80% of the variation in per capita income among nations. This again demonstrates the contribution of human capital to economic growth. The MRW model provides a good starting point for empirical research based on the inheritance of classical growth theories. Following this variation of the neoclassical model, many subsequent studies have included other control variables to capture the effect of education on growth under various suppositions. For example, Gyimah-Brempong et al. (2006) applied panel data for African countries for the period 1960-2000 to develop an extended MRW model, so as to examine the influence of higher education on economic growth in African countries. In order to make the results more robust, they adjusted the MRW

model and included the incidence of civil war as an independent variable in the growth model. The findings of the research found that the human capital of tertiary education has an estimated growth elasticity of roughly 0.09 and this number is twice as great as the growth effect of physical capital investment. Tsamadias and Prontzas (2012) used the MRW model to analyze the impact of education on economic growth in Greece, applying a sample of time-series data for the period 1960-2000. Their results found that education has a statistically significant contribution to economic growth in Greece, with annual differences in human capital growth contributing up to 0.81% to annual differences in GDP growth.

Referring to previous studies, this research estimates an extended neoclassical growth equation of MRW type so as to examine the influence of educational investment on economic growth in transition economies. Meanwhile, in order to examine the moderating effect of institutional quality, this thesis modifies the MRW model appropriately by including institutional quality as a regression variable in the growth equation. The specific derivation steps are as follows. Firstly, we begin with the basic Cobb-Douglas production function, supposing that the technology, physical capital, and human capital are all determinants of productivity. As a result, the production function can be expressed as follows:

$$y = ak^{\alpha}h^{\beta} \tag{1}$$

where y is productivity a, k is technology, h is human capital.

The growth rate of productivity can be calculated by taking the natural logarithm of the Cobb - Douglas production function $y = ak^{\alpha}h^{\beta}$ and differentiating the resultant equation with regard to time. The eventual equations are as follows:

$$\dot{y} = \dot{a} + \alpha\dot{k} + \beta\dot{h} \tag{2}$$

where $\dot{y}$, $\dot{a}$, $\dot{k}$, and $\dot{h}$ represent the growth rate of productivity, technology, physical capital and human capital respectively.

Human capital has many manifestations, such as knowledge, skill level, health, and so on. Since the focus of this research is on the growth effect of education, it was

decided to use education-related variables as proxies for human capital. Based on the above explanation, we establish the following variant of the MRW growth equation:

$$\dot{y} = \beta_0 + \beta_1 edu + \beta_2 pcap + \beta_3 tech + \sigma_i \quad (3)$$

where $\dot{y}$ represents the growth rate of productivity, edu represents the proxy variable for human capital related to education, *pcap* represents the proxy variable for physical capital, $tech$ represents the proxy variable for technology, and σ_i represents the random perturbation term.

3.1.2 Variable Selection

3.1.2.1 Human Capital Proxy Variable

Commonly used human capital proxies related to education contains highest educational attainment, average years of schooling, rate of enrollment, and educational investment. Unlike highest educational attainment, which can only be used in microeconomics research, the other three indicators have been applied to a wide range of macroeconomics and microeconomics issues.

Some scholars have used the rate of school enrollment as a proxy for human capital. For instance, Barro (1996) argued that enrollment rates can reflect a country's initial level of education. By analyzing panel data for more than 100 countries over the period 1960-1990, his research indicated that the growth rate increases as a result of higher enrollment rates. While Petrakis and Stamatakis (2002) use enrollment rates in primary, secondary and tertiary education to represent the stock of human capital at different levels in each country, and thus examine the contribution of each level of education to economic growth in countries at different levels of development. However, due to the heterogeneity of countries in terms of population size, number of schools, and so on, enrollment rates are not comparable across countries. Therefore, enrollment rates are not a good proxy for cross-country research of the growth effects of education.

Average years of schooling is used by a considerable number of scholars as a proxy for human capital. They argued that average years of schooling can represent the level of a country's human capital stock. For example, Lin (2003) analyzed the influence of education on Taiwan's economic progress over the period 1965-2000 using average years of schooling as a proxy for human capital by means of a structural benefit function and a transcendental production function. In contrast to the findings of Lin (2003), Delgado et al. (2013) use nonparametric local linear regression estimators and nonparametric variable correlation tests to perform a thorough and methodical investigation of the significance of the average years of schooling. The results suggest that average years of schooling is not a statistically relevant variable in economic growth regressions. Actually, it has been controversial whether average years of schooling is a good proxy for human capital. Aghion et. al. (2009) summarized the shortcomings of the average years of schooling as a proxy indicator. On the one hand, average years of schooling is more likely to be endogenous. This is because the years of schooling a person receives is the result of the choice people make based on the local investment in education, which depends on the returns to education in that area. On the other hand, differences in average years of schooling may be because of differences in the years required to obtain a degree as set by local governments, and therefore do not effectively capture the impact of education on economic growth.

More scholars have applied educational investment as a proxy indicator for human capital, such as Thorbecke (2001), Heckman (2003) and Fitzgerald (2011) previously mentioned in the literature review section. While an important issue with using educational investment as a proxy indicator is the problem of reverse causality. This is manifested by the fact that educational investment in a country is non-random. Countries that are richer and growing faster may be more likely to increase their education expenditure. Using the ratio of a country's education expenditure to GDP partially solves the reverse causation problem and is comparable across countries compared to education expenditure. Therefore, this thesis decides to use the

government expenditure on education as a percentage of GDP to represent educational investment as a proxy variable for human capital.

3.1.2.2 Institutional Quality Proxy Variables

In early studies, institutional quality was considered difficult to measure. Although there are no systematic proxies, some scholars have made attempts to empirically analyze the relationship between institutional quality and economic growth. Scully (1988) attempted to use measures of political, civil, legal and economic freedom as proxies for political institutions and conducted an empirical analysis with data from 115 market economies over the period 1960-1980.The effectiveness and growth rate of an economy were discovered to be significantly and substantially impacted by the institutional structure. Knack (1996) found that economic growth is faster in countries that have institutions that favor savings, investment and production. Barro (1996) analyzed panel data for about 100 countries over the period 1960-1990 using variables such as the rule of law, free market, and subjective index of political freedom as proxies for institutional quality. His findings suggested that enhancements in institutional quality would be favorable to economic growth.

Over the past two decades, many systematic measures of institutional quality have been developed and widely used in empirical research, such as economic freedom of the world (EFW), corruption perceptions index (CPI), and worldwide governance indicators (WGI).

The EFW is a comprehensive measure constructed by Gwartney and Lawson (2003) to measure to what extent a nation's institutions and policies favor voluntary trade, the preservation of property rights, free markets, and minimum regulation of economic activity. According to the definitions raised by Gwartney and Lawson (2003), the EFW consists of ratings in five major areas consisting of 38 components, namely, size of government, legal structure and security of property rights, access to sound money, exchange with foreigners and regulation of economic activity. The ratings for these areas are aggregated into a composite index for EFW. Based on the aspects covered

by the indicators, it can be observed that EFW focuses mostly on indicators of institutional quality related to the market economy. While a country's investment in education is part of public investment with few market economy attributes. Therefore, EFW is not the most appropriate indicator when exploring the moderating effect of institutional quality on the impact of educational investment on economic growth.

The CPI is an annual assessment published by Transparency International since 1995. It evaluates and ranks the opinions of scholars about regional corruption. According to the CPI, corruption is the misuse of official authority for personal benefit. Higher CPI scores indicate lower levels of corruption. A portion of scholars applied this indicator to corruption-related economic growth studies. Podobnik et al. (2008) examined the relationship between changes in CPI and GDP. The findings of the study found that for every unit rise in the CPI, the annual growth rate of GDP per capita rose by 1.7% for all countries in the world over the period 1999-2004. In particular, when the regression only contains sample for transition economies of Europe, the annual growth rate of GDP per capita rises by 2.4% for every unit rise in the CPI. Christos et al. (2018) analyzed the relationship between corruption and economic growth across Europe using the CPI as a proxy of corruption. It demonstrated that practically all European nations' GDP per capita and the degree of corruption are strongly inversely related, and that lower corruption promotes economic growth. These findings indicated that CPI is a good proxy variable for exploring the effect of corruption on economic growth. Unfortunately, the CPI includes corruption as only one dimension of institutional quality, and more dimensions of institutional quality that would influence the growth effect of investment in education are not included.

Compared to the CPI, the WGI is a more comprehensive measure of the institutional quality.The WGI is a composite indicator created in 1966 to measure a government's capacity to govern. It includes six dimensions which are voice and accountability, political stability and lack of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. Unfortunately, there is no research that clearly

identifies which dimensions of institutional quality moderate the impact of education on economic growth. However, as we have mentioned in section 2.2.1, it can be found that the economic growth is mainly moderated by four main dimensions, and they are government effectiveness, regulatory quality, rule of law, and control of corruption. Therefore, this research decides to select the four dimensions of government effectiveness, regulatory quality, rule of law, and control of corruption in the WGI as proxies for institutional quality.

3.1.2.3 Control Variables

Besides educational investment and institutional factors, there are many other factors that are not the focus of this study but also can influence economic growth. If these factors are not included in the regression model, it may lead to the problem of omitted variables, which may have an impact on the results of model fitting. Therefore, this research mainly refers to Benhabib and Spiegel (1994), Temple (2003), and Gyimah-Brempong et al. (2006), using the annual population growth rate and gross fixed capital formation as control variables. However, this research could not confirm that this is the most appropriate regression model. Actually, when examining the correlation between economic growth and the dependent variable of interest, no quantitative framework can specify which factors should be included in the model (Levine & Renelt,1992).

3.1.3 Conclusions

After reviewing human capital - economic growth nexus theoretical frameworks, this research builds an extended MRW model to estimate the growth effect of educational investment based on the research of Mankiw et al. (1992). In addition, after analyzing the advantages and disadvantages of various existing human capital proxies and institutional quality proxies, it was chosen to include the government expenditure on education as a percentage of GDP and the four dimensional indicators in the WGI as proxies for human capital and institutional quality, respectively, in the extended MRW model. In addition, in order to avoid the problem of omitted variables, this research

selected appropriate proxy variables for technology and physical capital respectively as control variables to be added to the regression model.

3.2 Research Hypotheses

This section presents research hypotheses based on previous literature on the relationship between educational investment, institutional quality and economic growth. This enables the research to provide plausible conclusions on the relationship between educational investment, institutional quality and economic growth.

Firstly, the research examines the relationship between educational investment and economic growth in transition economies. Based on the human capital theory and endogenous growth model, the first research hypothesis of this research is proposed as follow:

Hypothesis 1: Educational investment can independently exert a positive impact on economic growth in transition economies.

The next stage of this research will analyze the institutional quality's moderating effect on the relationship between educational investment and economic growth. Based on the previous literature, the second research hypothesis of this research is proposed as follows:

Hypothesis 2: Institutional quality can positively moderate the growth effect of educational investment in transition economies.

Specifically, since institutional quality in this research is categorized into four dimensions: control of corruption, regulatory quality, government efficiency, and rule of law, Hypothesis 2 can be split into four specific research hypotheses

Hypothesis 2a: In transition economies, government efficiency can positively moderate the growth effect of educational investment. That is, the more efficient the government is, the better the growth effect of educational investment.

Hypothesis 2b: In transition economies, control of corruption can have a positive moderating effect on the growth effect of educational investment. That is, a higher degree of control of corruption is associated with a better growth effect of educational investment.

Hypothesis 2c: In transition economies, the regulatory quality can have a positive moderating effect on the growth effect of educational investment. That is, the higher the quality of regulation, the better the growth effect of educational investment.

Hypothesis 2d: In transition economies, the rule of law can positively moderate the growth effect of educational investment. That is, the stronger the rule of law, the better the growth effect of educational investment.

4. Methodology

This chapter describes the estimation method, the econometric model, and makes preliminary speculations about the regression coefficients.

4.1 Estimation Method

The core explanatory variable in this research is educational investment, which is a proxy variable for human capital. Regardless of how this variable is measured, educational human capital increases with income levels across countries and continues to increase over time (Barro and Lee, 2000).Thus, even if the proxy variables for human capital have been chosen as appropriate as possible, educational investment remains an endogenous regressor with a time trend. This means that the parameters estimated with the simple fixed effect or random effect model would have no consistency and thus losing their reference value. Therefore, this study decided to use the generalized method of moments (GMM) estimation used to analyze dynamic panel data for estimation.

Hansen and Singleton (1982) first introduced the basic idea of GMM estimation and applied it to the estimation of the Euler equation, and the testing of the rational expectations hypothesis. The advantage of this estimation method over the traditional Ordinary Least Squares (OLS) regression method is that rather than requiring the observable variables in the economic model obey some specific joint distribution function, GMM only requires that the orthogonality condition of the sample moments

corresponding to the aggregate moments implied in the economic model be zero. This makes GMM estimation widely applicable.

As the availability of data improves, panel data have received more and more focus in empirical research. Meanwhile, the research perspective has gradually tilted from static panel data models to dynamic panel data models. Especially in topics related to economic growth, the dynamic terms of the explanatory variables need to be incorporated in the model to measure the potential dynamic effects. For GMM estimation of dynamic panel data models, Arellano and Bond (1991) proposed a Difference GMM approach, whose core idea is to construct moment conditions through difference equations. The Difference GMM method removes individual effects through first-order difference and endogenous variables are identified, which in turn allows the regressors to be considered as exogenous variables. This approach solves the endogeneity problem and substantially improves estimation efficiency, however, it also leads to the problem of weak instruments and over-identification. Based on the Difference GMM estimation method, some scholars introduced the level equation and in turn created the System GMM estimation method (Arellano & Bover, 1995; Blundell & Bond, 1998). The assumption implicit in the level equations is that the correlation between individual effects and explanatory variables is fixed. The instrumental variables obtained from the difference equation and the instrumental variables obtained from the level equation are combined to obtain the matrix of instrumental variables for the estimation of the System GMM, which in turn obtains the estimation of the System GMM.

The estimation methods of Difference GMM and System GMM have been very mature so far. There are many scholars applying them to the study of problems related to economic growth.For instance, Fukase (2010)examined the relationship between openness, education and economic growth using the GMM estimation method with a sample of data from 106 countries over the period 1969-2004. Siddiqui and Ahmed (2013) explored how institutional quality affects economic growth using panel based

OLS and GMM estimation methods following the theoretical framework proposed by North (1981). Therefore, this research decided to use the System GMM method for estimation so as to address the potential endogeneity problem.

4.2 Econometric Model

In section 3.1.1, a variant of the MRW growth equation is constructed as the base regression model for this study based on the endogenous growth model. The specific model is as follows:

$$\dot{y} = \beta_0 + \beta_1 edu + \beta_2 pcap + \beta_3 tech + \sigma_i \quad (3)$$

where ẏ represents the growth rate of productivity, *edu* represents the proxy variable for human capital related to education, *pcap* represents the proxy variable for physical capital, *tech* represents the proxy variable for technology, and σ_i represents the random perturbation term.

While using the System GMM estimation method for regression analysis of dynamic panel data samples, this research incorporates the one period lag variable of the explanatory variable into the regression model. Therefore, we adapt the initial equation and the final form of the equation used to examine the impact of educational investment on economic growth (Hypothesis 1) is as follows:

$$Growth_{i,t} = \beta_0 + \beta_1 Growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 pcap_{i,t} + \beta_4 pop_{i,t} + \varepsilon_{i,t} \quad (4)$$

where $Growth_{i,t}$ represents the growth rate of productivity of country i in year t, $Growth_{i,t-1}$ represents the growth rate of productivity of country i in year t-1, $edu_{i,t}$ represents the government expenditure on education as a percentage of GDP of country i in year t , $pcap_{i,t}$ represents the gross fixed capital formation of country i in year t, $pop_{i,t}$ represents the annual population growth rate of country i in year t, and $\varepsilon_{i,t}$ represents the random perturbation term.

The second objective of this study is to explore the moderating effect of institutional quality on the impact of educational investment on economic growth. In order to achieve this objective, institutional quality and the interaction variable between

educational investment and institutional quality are added to the equation. Thus, the equation used to examine the moderating effect of institutional quality on the relationship between educational investment and economic growth (Hypothesis 2) is as follows:

$$Growth_{i,t} = \beta_0 + \beta_1 Growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 inst_{i,t} + \beta_4 edu_{i,t} * inst_{i,t} + \beta_5 pcap_{i,t} + \beta_6 pop_{i,t} + \varepsilon_{i,t} \quad (5)$$

Further, since institutional quality is categorized into four dimensions: control of corruption, regulatory quality, government efficiency, and rule of law, the following four equations are used to examine the moderating effects of government efficiency (Hypothesis 2a), control of corruption (Hypothesis 2b), regulatory quality (Hypothesis 2c), and rule of law (Hypothesis 2d) on the impact of educational investment on economic growth, respectively. The specific models are as follows:

$$Growth_{i,t} = \beta_0 + \beta_1 growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 GE_{i,t} + \beta_4 edu_{i,t} * inst_{i,t} + \beta_5 pcap_{i,t} + \beta_6 pop_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$Growth_{i,t} = \beta_0 + \beta_1 growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 CC_{i,t} + \beta_4 edu_{i,t} * inst_{i,t} + \beta_5 pcap_{i,t} + \beta_6 pop_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$Growth_{i,t} = \beta_0 + \beta_1 growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 RQ_{i,t} + \beta_4 edu_{i,t} * inst_{i,t} + \beta_5 pcap_{i,t} + \beta_6 pop_{i,t} + \varepsilon_{i,t} \quad (8)$$

$$Growth_{i,t} = \beta_0 + \beta_1 growth_{i,t-1} + \beta_2 edu_{i,t} + \beta_3 RL_{i,t} + \beta_4 edu_{i,t} * inst_{i,t} + \beta_5 pcap_{i,t} + \beta_6 pop_{i,t} + \varepsilon_{i,t} \quad (9)$$

where $Growth_{i,t}$ represents the growth rate of productivity of country *i* in year *t*, $Growth_{i,t-1}$ represents the growth rate of productivity of country *i* in year *t-1*, $edu_{i,t}$ represents the government expenditure on education as a percentage of GDP of country *i* in year *t*, $CC_{i,t}$ represents the evaluation of control of corruption of country *i* in year *t*, $RQ_{i,t}$ represents the evaluation of regulatory quality of country *i* in year *t*, $GE_{i,t}$ represents the evaluation of government efficiency of country *i* in year *t*, $RL_{i,t}$

represents the evaluation of rule of law of country i in year t, $pcap_{i,t}$ represents the gross fixed capital formation of country i in year t, $pop_{i,t}$ represents the annual population growth rate of country i in year t, and $\varepsilon_{i,t}$ represents the random perturbation term.

4.3 Expected Signs of Coefficients

This section discusses the expected signs of the coefficients of the core explanatory variables of this research. Firstly, after reviewing previous works related to the growth effect of educational investment and identifying the theoretical framework adopted in this research, we find that although the results of the empirical analysis indicate that the relationship between educational investment and economic growth has not reached a unified result, the promotion of economic growth by educational investment still holds from the perspective of human capital theory. Therefore, we speculate that the coefficient of education investment is expected to be positive in equation (4). This implies that educational investment can contribute to economic growth in transition economies.

Furthermore, this research also focuses on the moderating effect of institutional quality on the impact of educational investment on economic growth. Therefore, we also pay attention to the coefficients of the interaction term between institutional quality and educational investment. As previous studies have shown that higher institutional quality can provide a favorable external environment, which in turn increases the efficiency of public investment and promotes economic growth. Therefore, we speculate that the sign of the coefficients of the interaction term between educational investment and institutional quality is the same as the sign of the coefficients of educational investment, which means that institutional quality has a positive moderating effect on the growth effect of education. Specifically, in equations (6) (7) (8) (9), the coefficients of educational investment itself and the interaction terms between educational investment and control of corruption,

regulatory quality, government efficiency, and rule of law are expected have the same sign.

5. Data, Variables, and Descriptive Analysis

5.1 Data Source and Selected Countries

The data used in this research are panel data from 22 transition economies from 2002 to 2020. All data used for empirical analysis in this study are obtained from the World Bank Development Indicators (WDI) database and Worldwide Governance Indicators (WGI) database. All data are measured on year and country level.

The time range selected for this study is 2002-2020, a period of 19 years. Since the time range of the WGI database is 1996, 1998, 2000, 2002-2020, the beginning of the time range is chosen as 2002 in this research in order to obtain panel data for continuous years. And since most of the countries' data are updated only up to 2020, the end of the time range is chosen as 2020 in this research in order to avoid the existence of missing values.

The research object of this article is 22 transition economies in Europe and the former Soviet Union. The 22 transition economies are Albania, Armenia, Azerbaijan, Bulgaria, Belarus, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Lithuania, Latvia, Moldova, Poland, Romania, Russia, Slovak Republic, Slovenia, Tajikistan, and Ukraine.

Transition economies are economies that have switched from a centrally planned economy to a market economy. China, the countries of the former Soviet Union, the countries of Central and Eastern Europe and a series of Third World countries have experienced this process. According to the classification proposed by the International Monetary Fund (IMF) in 2000, transition economies include 25 transition economies in Europe and the former Soviet Union and 4 transition economies in Asia. The specific countries can be seen in Table 1.

Table 1. *Classification of transition economies*

Transition economies in Europe and the former Soviet Union				
	Albania	Bulgaria	Croatia	Czech Republic
CEE	North Macedonia	Hungary	Poland	Romania
	Slovak Republic	Slovenia		
Baltics	Estonia	Latvia	Lithuania	
	Armenia	Azerbaijan	Belarus	Georgia
CIS	Kazakhstan	Kyrgyz Republic	Moldova	Russia
	Tajikistan	Turkmenistan	Ukraine	Uzbekistan
Transition economies in Asia				
	Cambodia	China	Laos	Vietnam

Since transition economies from Asia and Europe have large differences in socio-economic characteristics, and since this research focuses on transition economies from Europe and the former Soviet Union, four transition economies from Asia are excluded from the sample. In addition, because of the large number of missing values in the data for North Macedonia, Turkmenistan, and Uzbekistan, these three countries its removed from the sample in this study to achieve a highly balanced panel database and to improve data availability. It is worth noting that while the World Bank considers Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, and Slovenia to have completed their transition process (Asad et al., 2008), this study still considers the above countries as transition economies and includes them in the sample as the time range of this study covers the transition process of these countries.

5.2 Variable Definition

5.2.1 Dependent Variable

The dependent variable in this research is economic growth. The measure of economic growth used in this research is the annual percentage growth rate of GDP based on constant local currency.

5.2.2 Core Independent Variable

The core independent variable in this research is educational investment. The measure of educational investment used in this research is the general government expenditure on education expressed as a percentage of GDP.

5.2.3 Moderating Variables

The moderating variable in this research is institutional quality. The measures of institutional quality used in this research are control of corruption, regulatory quality, government efficiency and rule of law, respectively. Kaufmann et al. (2010) review the development of the World Governance Indicators project and provide specific definitions of these institutional quality dimensions: control of corruption reflects opinions of to what extent public authority is utilized for private benefit in the country, and both petty and grand corruption, as well as the capture of the state by elites and commercial interests, are all considered to be forms of corruption; regulatory quality reflects a government's ability to create and enforce effective rules and regulations that promote and facilitate the growth of the private sector; government efficiency reflects assessments of the quality of public services, civil servants' independence from political constraints, policy establishment and implementation quality, and the credibility of government adherence to those policies; rule of law reflects the degree of trust in, and adherence to, the rules of society, particularly with regard to the enforcement of contracts, the protection of property rights, the quality of the police and courts, and the likelihood of crime and violence. These four indicators of institutional quality all range from -2.5 to +2.5, with positive values representing higher institutional quality and negative values indicating lower institutional quality.

5.2.4 Control Variables

This research includes two control variables, physical capital and population growth. The measure of physical capital used in the research is the gross fixed capital formation expressed as a percentage of GDP. The measure of population growth used in this research is the annual population growth rate.

5.3 Descriptive Analysis

Table 2 reports the summary statistics of all the variables of this research. Detailed definitions of all variables are given in Appendix 1.

Firstly, we analyze the dependent variable and the core explanatory variable. The average annual GDP growth rate is 3.706%, and the standard deviation of annual GDP growth rate is 4.642%, which indicates that the annual GDP growth rate is highly spread out. The lowest annual GDP growth rate is -14.1%, which occurred in Ukraine in 2009 and the highest annual GDP growth rate is 13.9%, which occurred in Azerbaijan in 2007. This suggests that there is a wide variation in the annual GDP growth rates of different countries over time. The government expenditure on education as a percentage of GDP for each countries during this period ranged between 2.145% and 7.499%, with a mean value of 4.383%.

Table 2. *Summary statistics of variables*

Variable	Obs	Mean	Std. Dev.	Min	Max
Growth	418	3.706	4.642	-14.1	13.9
edu	418	4.383	1.177	2.145	7.499
pcap	418	24.364	5.658	13.366	42.884
pop	418	-0.032	0.873	-1.831	2.262
GE	418	0.072	0.691	-1.192	1.166
RQ	418	0.278	0.738	-1.346	1.590
CC	418	-0.062	0.764	-1.317	1.274
RL	418	-0.204	0.703	-1.328	1.291

Figure 1 gives the average GDP growth rate of transition economies over the period 2002-2020. It can be seen that the average GDP growth rate of the transition economies fluctuated during the period 2002-2020 and showed a trend of slowing down. This suggests that the economies in transition have entered a phase of relatively slow economic growth and that there is insufficient momentum for economic growth.

Figure 1. *The trend of average GDP Growth rate over the Period 2002-2020*

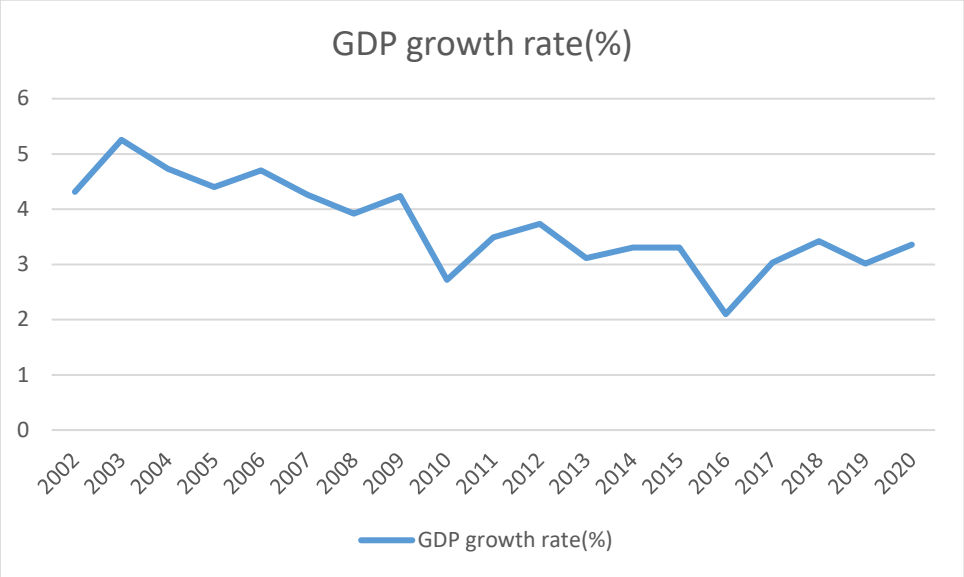
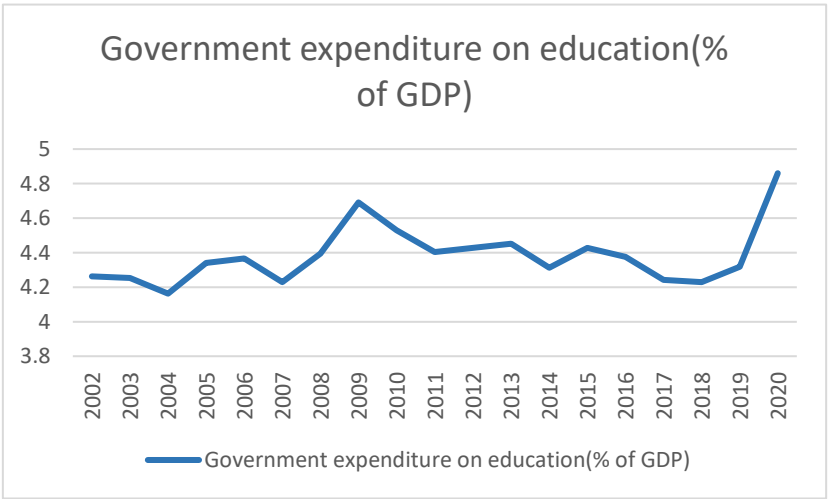


Figure 2 illustrates average government expenditure on education as a percentage of GDP of transition economies over the period 2002-2020. It can be seen that during the period 2002-2020, the average government expenditure on education as a percentage of GDP in transition economies fluctuates around its mean value, with no significant increasing or decreasing trend, which suggests that investment policies in education in transition economies have been relatively stable during this period.

Figure 2. *The trend of government expenditure on education (% of GDP) over the Period 2002-2020*



Secondly, we analyze the moderating variables. Since institutional quality is divided into four specific dimensions in this research paper: control of corruption, government efficiency, regulatory quality, and rule of law, we conducted a correlation analysis of these four variables. Table 3 shows the correlation between the four indicators of institutional quality. It is clear that control of corruption, government efficiency, regulatory quality, and rule of law are highly correlated with each other. Therefore, to avoid the problem of multicollinearity, it is necessary to analyze the moderating effect of these indicators of institutional quality on the impact of educational investment on economic growth separately in the regression analysis.

Table 3. *Correlation coefficients between institutional quality measures*

Correlation	GE	RQ	RL	CC
GE	1.000			
RQ	0.859	1.000		
RL	0.936	0.869	1.000	
CC	0.731	0.692	0.743	1.000

We can also see the summary statistics for institutional quality variables from table 2. It can be seen that the mean values of government efficiency and regulatory quality are positive, which are 0.072 and 0.078, respectively, indicating that transition economies from Europe and the former Soviet Union have higher levels of government efficiency and regulatory quality during the period 2002-2020. However, the mean values for control of corruption and rule of law are negative, which are -0.062 and -0.204, respectively, indicating that transition economies from Europe and the former Soviet Union have lower levels of control of corruption and rule of law during the period 2002-2020. In addition, the standard deviations of government efficiency, regulatory quality, control of corruption, and rule of law are 0.691, 0.738, 0.764, and 0.703, respectively, which suggests that all dimensions of institutional quality in transition economies are highly volatile.

Table 4 presents the details of corruption control, regulatory quality, government efficiency and legal rules in the 22 transition economies from Europe and the former Soviet Union studied in this article for the period 2002-2020. Overall, the institutional quality of the transition economies is varied. Among the 22 countries in our selected sample, Estonia and Slovenia have relatively high institutional quality, while the Kyrgyz Republic, Azerbaijan, and Ukraine are characterized by poor institutional quality. The extreme deviations of the countries with the best and worst institutional quality in each dimension in the transition economies in terms of corruption control, regulatory quality government efficiency and legal rules are 2.241, 2.552, 1.773 and 2.180, respectively, which again illustrates the high degree of dispersion in the institutional quality of the 22 transition economies used in this research. In addition, the level of institutional quality has not remained stable across countries between 2002 and 2020. Although institutional quality varies across countries, the level of institutional quality has improved in most of the transition economies. This suggests that there has been a gradual realization of the importance of institutional quality in the transition economies and efforts have been made to address its improvement.

Table 4. *Institutional quality in the transition economies in Europe and the former Soviet Union, 2002-2020*

Institutional Quality	**Control of Corruption (CC)**				**Regulatory Quality (RQ)**				**Government Efficiency (GE)**				**Rule of Law (RL)**			
Country	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Albania	-0.579	0.442	-1.297	0.344	-0.014	0.568	-1.128	1.038	-0.297	0.476	-1.162	0.810	-0.494	0.519	-1.296	0.900
Armenia	-0.478	0.395	-0.954	0.755	0.206	0.364	-0.489	1.222	-0.120	0.430	-0.930	1.166	-0.395	0.320	-0.987	0.488
Azerbaijan	-0.813	0.560	-1.245	0.746	-0.113	0.568	-0.732	1.154	-0.259	0.649	-0.985	0.900	-0.340	0.708	-1.100	1.022
Belarus	-0.430	0.232	-0.759	0.032	-1.134	0.212	-1.346	-0.663	-0.748	0.547	-1.192	0.922	-0.902	0.514	-1.304	1.115
Bulgaria	-0.059	0.485	-1.043	0.600	0.430	0.707	-1.077	1.109	0.102	0.619	-1.123	0.865	-0.031	0.684	-1.263	0.988
Croatia	-0.317	0.541	-1.141	0.694	0.405	0.214	0.214	1.127	0.296	0.448	-0.257	1.037	0.089	0.456	-0.497	1.023
Czechia	0.024	0.658	-1.280	0.587	0.899	0.401	-0.052	1.309	0.479	0.461	-0.286	1.057	0.413	0.558	-0.591	1.132
Estonia	1.097	0.166	0.739	1.291	1.419	0.141	1.174	1.590	1.025	0.129	0.668	1.166	1.118	0.160	0.771	1.274
Georgia	-0.152	0.529	-1.264	0.829	0.096	0.528	-0.736	0.766	0.014	0.519	-0.713	1.012	-0.383	0.455	-1.084	0.583
Hungary	0.344	0.222	0.056	0.665	0.926	0.253	0.482	1.259	0.757	0.187	0.487	1.099	0.711	0.188	0.404	0.977
Kazakhstan	-0.715	0.476	-1.222	0.077	-0.142	0.527	-1.012	0.680	-0.381	0.540	-1.075	0.961	-0.735	0.440	-1.213	-0.016
Kyrgyz Republic	-1.144	0.118	-1.328	-0.934	-0.403	0.181	-1.008	-0.141	-0.569	0.555	-0.974	0.978	-1.062	0.189	-1.317	-0.760
Latvia	0.333	0.159	0.011	0.719	1.018	0.108	0.874	1.191	0.746	0.196	0.426	1.086	0.762	0.182	0.310	1.024
Lithuania	0.120	0.482	-1.052	0.614	0.942	0.250	0.252	1.273	0.565	0.367	-0.188	1.090	0.493	0.396	-0.389	0.937
Moldova	-0.753	0.145	-1.040	-0.550	-0.178	0.160	-0.461	0.015	-0.614	0.143	-0.843	-0.401	-0.420	0.091	-0.626	-0.244
Poland	0.516	0.195	0.106	0.792	0.882	0.129	0.650	1.063	0.570	0.174	0.338	1.051	0.595	0.174	0.383	0.872
Romania	-0.148	0.349	-0.997	0.708	0.332	0.511	-0.391	1.133	0.089	0.542	-0.563	1.066	-0.016	0.645	-0.939	1.048
Russia	-0.503	0.510	-1.099	0.805	0.205	0.522	-0.548	1.297	-0.150	0.296	-0.601	0.591	-0.399	0.390	-0.875	0.496

Table 4. *(continued)*

Institutional Quality	**Control of Corruption (CC)**				**Regulatory Quality (RQ)**				**Government Efficiency (GE)**				**Rule of Law (RL)**			
Country	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Slovak Republic	-0.099	0.593	-1.143	0.793	0.637	0.484	-0.357	1.231	0.279	0.495	-0.496	1.065	0.170	0.592	-0.832	1.017
Slovenia	0.881	0.102	0.722	1.052	0.768	0.129	0.576	1.007	1.013	0.109	0.790	1.166	0.989	0.075	0.849	1.112
Tajikistan	-0.690	0.750	-1.328	0.746	-0.599	0.856	-1.346	1.156	-0.605	0.696	-1.192	0.929	-0.732	0.767	-1.317	1.274
Ukraine	-0.943	0.135	-1.176	-0.741	-0.459	0.136	-0.624	-0.203	-0.615	0.164	-0.871	-0.309	-0.792	0.053	-0.855	-0.690

6. Empirical Findings

This chapter presents the empirical findings corresponding to the hypotheses presented in Section 3.2. In Section 6.1, this research will analyze the direct impact of educational investment on economic growth using the System GMM estimation method. Section 6.2 will investigate the moderating effect of institutional quality on the impact of educational investment on economic growth. This is done by constructing the interaction term between educational investment and each of the indicators of institutional quality and applying them to the GMM regression model. Section 6.3 will conduct the robustness test. This research examines the robustness of the estimation results by replacing the proxies for economic growth. Section 6.4 will analyze the various shortcomings in the empirical analysis of this research.

6.1 The Direct Impact of Educational Investment on Economic Growth

This research analyzes the direct impact of educational investment on economic growth using GMM estimation method. Since the data used in this research is panel data, the presence of unit roots can have serious consequences such as spurious regression. Therefore, it is necessary to carry out the unit root test for each variable, which will ensure the stationarity of each variable and the validity of the results of empirical analysis. Table 5 reports the results of the Levine-Lin-Chu (LLC) unit root test. It can be seen that the p-values of Growth, edu, pcap, and pop are less than 0.05, which means that the null hypothesis is rejected at the 5% significance level and the panels are stationary. Therefore, the sample used in this research satisfies the basic conditions for conducting dynamic panel analysis.

Table 5. *The result of Levin–Lin–Chu (LLC) unit-root test*

Variables	Adjusted t* Statistic	P-value
Growth	-5.089	0.000
edu	-3.586	0.000
pcap	-5.340	0.000
pop	-2.855	0.002

Since the educational investment, fixed capital formation and economic growth are not strictly exogenous, this article subjects them to endogenous corrections in the regressions. Table 6 gives the results of the estimation of the stepwise regression method at this stage, controlling for gross fixed capital formation and the annual population growth rate.The model calculated in Table 6 has passed the joint test of significance. We can find through column (3) that the p-value of the AR (1) test is 0.0303, which is less than 0.1 and rejects the null hypothesis, suggesting that there is a first-order autocorrelation in the error term in the estimation. The AR (2) test has a p-value of 0.323, which is larger than 0.1 and does not reject the null hypothesis, indicating that there is no second-order autocorrelation of the error term in the estimation and that the instrumental variables are reasonable. The p-value of Sargan's J-test is 0.130, which is larger than 0.1 and does not reject the null hypothesis, indicating that the estimates at this stage are not affected by over-identification in the GMM model.

After establishing the validity of the regression model, we further analyzed the coefficients of the variables. It can be observed from Table 6 that the core explanatory variable of this research, educational investment, has a positive impact on economic growth. The coefficients of educational investment range from 1.043 to 1.630 and are all significant at the 5% level, which suggests that for transition economies from Europe and the former Soviet Union, increased investment in education can promote economic growth. Thus, Hypothesis 1 is confirmed, which is consistent with our derivation from existing theories and in line with our expectations. In addition, the lagged values of GDP growth rates all have positive coefficients and are significant at

the 1% level. This suggests that the rate of economic growth in the previous year has a boosting effect on the rate of economic growth in the current year, and those countries with relatively high economic growth rates in the past are also more likely to maintain a higher rate of economic growth in the coming years. This is consistent with the reality of the world today. Unfortunately, although the signs of the coefficients on fixed capital formation and annual population growth rate are both positive, their coefficients are not significant, which may be due to potential colinearity in the model. However, in order to avoid the problem of model misspecification caused by omitted variables, this study did not exclude non-significant variables from the regression model.

Table 6. *The results of estimation of the direct effect of educational investment on economic growth*

VARIABLES	(1) Growth	(2) Growth	(3) Growth
L.Growth	0.507***	0.496***	0.493***
	(0.082)	(0.125)	(0.151)
edu	1.043**	1.630**	1.565**
	(0.426)	(0.595)	(0.554)
pcap		0.084	0.096
		(0.049)	(0.073)
pop			0.150
			(0.610)
Constant	-2.837	-7.557**	-7.514**
	(1.933)	(2.876)	(2.907)
Number of Country	22	22	22
AR (1) (p-value)	0.0244	0.0338	0.0303
AR (2) (p-value)	0.350	0.346	0.323
Sargan (p-vaplue)	0.000360	0.119	0.130
N	396	396	396

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

6.2 The Moderating Effect of Institutional Quality

In the literature review, we discussed the moderating effect of institutional quality on the impact of investment in education on economic growth. Therefore, in this section, the moderating effect of institutional quality on the relationship between investment in education and economic growth is estimated by adding the institutional factor variables and the interaction terms between the institutional factor variables and educational investment to the regression model. In section 5.3 we mentioned that since the four specific dimensions of institutional quality are highly correlated with each other, it is necessary to estimate the moderating effects of corruption control, regulatory quality, government efficiency and rule of law on the relationship between education and economic growth separately.

Similarly, to ensure the smoothness of the institutional quality variables and the validity of the results of the empirical analysis, it is necessary to conduct the unit root test for each institutional quality variable. Table 7 reports the results of the Levine-Lin-Chu (LLC) unit root test for our institutional quality variables. It can be seen that the p-values of CC, RQ, GE, and RL are all less than 0.01, which means that the null hypothesis is rejected at the 1% significance level and the panels are stationary. Therefore, the sample used in this research still meets the basic conditions for conducting a dynamic panel analysis with the inclusion of the four institutional quality indicators.

Table 7. *The results of Levin–Lin–Chu (LLC) unit-root test for institutional quality variables*

Variables	Adjusted t* Statistic	P-value
CC	-4.075	0.000
RQ	-4.443	0.000
GE	-6.772	0.000
RL	-4.725	0.000

Table 8 illustrates the results of the estimation of the moderating effect of institutional quality on the relationship between educational investment and economic growth. Column (1) shows the results of the regression with government efficiency as a moderating variable. The p-value of the AR (1) test is 0.0257, which is less than 0.1 and rejects the null hypothesis, suggesting that there is a first-order autocorrelation in the error term in the estimation. The AR (2) test has a p-value of 0.216, which is larger than 0.1 and does not reject the null hypothesis, indicating that there is no second-order autocorrelation of the error term in the estimation and that the instrumental variables are reasonable. The p-value of Sargan's J-test is 0.149, which is larger than 0.1 and does not reject the null hypothesis, indicating that the estimates at this stage are not affected by over-identification in the GMM model. After establishing the validity of the regression model, we further analyzed the coefficients of the variables. It can be seen that the coefficient of our core explanatory variable, educational investment, is 1.527 and significant at the 5% level when government efficiency is introduced as a moderating variable in the model. This suggests that educational investment can contribute to economic growth in transition economies, which is consistent with our expectations. The coefficient of the lagged value of GDP growth rate is 0.483 and is significant at the 1% level, which indicates that the economic growth rate of the previous year has a positive impact on the economic growth rate of the current year, which is in line with the previous conclusion. The regression coefficient for gross fixed capital formation is 0.104 and significant at 10% level. This suggests that physical capital accumulation has a positive impact on economic growth, which corresponds to the conclusion reached in previous literature (Gyimah-Brempong et al., 2006; Banerjee 2012). Moreover, since the central issue of interest in this section is the moderating role of institutional quality, we are most concerned with the coefficients and their signs of the interaction term between educational investment and government efficiency. The coefficient of the interaction term of educational investment and government efficiency can be found to be 0.513 and significant at the 1% level. The sign of the coefficient of educational investment is the same as the sign of the interaction term of educational investment

and government efficiency, which indicates that government efficiency has a positive moderating effect on the impact of educational investment on economic growth. The hypothesis 2a is proved. According to the definition given by WGI, government efficiency reflects an assessment of the quality of public services, the independence of civil servants from political constraints, the quality of policy formulation and implementation, and the credibility of government compliance with those policies. A well-functioning government is more likely to ensure the quality of the formulation and implementation of its educational investment policies and to adhere strictly to the corresponding policies, which contributes to the quality of education as a public service. Improvement in the quality of public services helps to increase the efficiency of educational investment, which in turn contributes to economic growth. This result is consistent with Hanushek's (1989) findings that an efficient government enables educational investment to maximize its contribution to economic growth.

Column (2) shows the results of the regression with control of corruption as a moderating variable. The p-value of the AR (1) test is 0.0372, which is less than 0.1, suggesting that there is a first-order autocorrelation in the error term in the estimation. The AR (2) test has a p-value of 0.717, which is larger than 0.1, indicating that there is no second-order autocorrelation of the error term in the estimation and that the instrumental variables are reasonable. The p-value of Sargan' J-test is 0.164, which is larger than 0.1, indicating that the estimates at this stage are not affected by over-identification in the GMM model. Similarly, after confirming the validity of the regression model, we further analyzed the coefficients of the variables. The coefficient of educational investment is 2.377 and significant at the 5% level, which is the same as the results of the two previous models. It means that after adding the control of corruption as a moderating variable to the model, the regression results still show that educational investment has a significant positive effect on economic growth. The coefficient of the lagged value of GDP growth rate is 0.477, which is significant at the 1% level, indicating that the rate of economic growth in the previous year still has a significant positive effect on the rate of economic growth in the current year.

More importantly, the interaction term between educational investment and control of corruption is also positive and statistically significant. The estimated coefficient of the interaction term between educational investment and corruption control is 0.554 and is significant at the 10% level. The sign of the coefficient of educational investment is the same as the sign of the interaction term of educational investment and control of corruption, which indicates that control of corruption has a positive moderating effect on the impact of educational investment on economic growth. The hypothesis 2b is proved. According to the WGI, the control of corruption reflects opinions of to what extent public authority is utilized for private benefit in the country. Tanzi et al. (1998) pointed out that corruption can distort the entire decision-making process related to public investment projects. The higher the level of corruption, the lower the average productivity of the investment. Moreover, corruption may lead to a reduction in actual investment in education due to budgetary constraints. Therefore, countries with better control of corruption can reduce the extent to which public investment is used for private gain, thus ensuring that educational investment is actually invested in the appropriate projects, thereby increasing the efficiency of educational investment and reducing the waste of resources. Strengthened control of corruption can enable educational investment to realize its role as a catalyst for economic growth.

Columns (3) and (4) show the regression results when regulatory quality and rule of law are used as moderating variables respectively. It can be seen that although the results of the AR (1) test, AR (2) test and Sargen's J-test indicate that the regression results of the model are valid, the coefficients of the interaction term between educational investment and regulatory quality, as well as the interaction term between educational investment and rule of law, are not significant. This indicates that there is no evidence that regulatory quality and rule of law have any moderating effect on the impact of educational investment on economic growth. Hypothesis 2c and Hypothesis 2d are rejected, contrary to our expectations. Therefore, this research attempts to explain the reasons for this phenomenon. Firstly, according to the interpretation of WGI, the regulatory quality reflects public opinions of a government's capacity to

establish and enforce effective rules and regulations that enable and support private sector development. Thus, good regulatory quality promotes private investor confidence in the market, which in turn promotes private sector development. At the same time, regulatory quality can promote FDI by implementing market-friendly policies (Hayat, 2017). This suggests that the moderating effect of regulatory quality on economic growth is mainly reflected in the attraction of private investment and FDI, which is also confirmed by previous studies (Dellis K. et al. 2017). In contrast, as a form of public investment, educational investment will not be affected by investors' attitudes towards the market. Therefore, the regulatory quality does not have a significant moderating effect on the impact of educational investment on economic growth. Similarly, according to WGI's definition, the rule of law reflects The degree of faith in and adherence to social norms, particularly in terms of contract enforcement, property rights, the effectiveness of the police and courts, and the risk of crime and violence. Countries with well-developed legal systems provide better guarantees of contractual compliance and clarity of property rights, which help to safeguard the interests of private investors and thus increase their incentives to invest. At the same time, nations with a more robust legal system may get greater advantages from FDI through the use of contracts, safeguarding future profits and lowering economic risks (Hoff and Stiglitz, 2005). Thus, the impact of rule of law on economic growth is also evident in the attraction of private investment and FDI. Educational investment, however, is mainly invested directly by the government and is mainly influenced by government policies and budgetary constraints, and will not be subject to changes in the attitudes of the private sector. Therefore, the rule of law does not have a significant moderating effect on the impact of educational investment on economic growth.

Table 8. *The results of estimation of the moderating effect of institutional quality*

VARIABLES	(1) Growth	(2) Growth	(3) Growth	(4) Growth
L.Growth	0.483***	0.477***	0.494**	0.487***
	(0.130)	(0.140)	(0.195)	(0.114)
edu	1.527**	2.377**	1.834**	1.555***
	(0.573)	(0.882)	(0.703)	(0.530)
pcap	0.104*	0.073	0.099	0.092
	(0.058)	(0.062)	(0.080)	(0.062)
pop	-1.922	0.213	-0.005	0.102
	(1.278)	(1.395)	(0.572)	(0.855)
GE	1.549*			
	(0.869)			
edu*GE	0.513***			
	(0.162)			
CC		-1.394		
		(1.585)		
edu*CC		0.554*		
		(0.318)		
RQ			-0.189	
			(0.559)	
edu*RQ			0.399	
			(0.347)	
RL				-0.123
				(0.602)
edu*RL				0.234
				(0.173)
Constant	-8.075**	-10.543**	-9.427**	-7.453**
	(2.878)	(4.481)	(4.065)	(2.876)
Number of Country	22	22	22	22
AR (1) (P-value)	0.0257	0.0372	0.0339	0.0353
AR (2) (P-value)	0.216	0.717	0.314	0.314
Sargan (P-vaplue)	0.149	0.164	0.144	0.103
N	396	396	396	396

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6.3 Robustness Checks

In order to improve the reliability of the findings, this research uses the natural logarithm of real GDP (LnGDP) as a proxy variable for economic growth for robustness testing. Since the data used in this research are cross-country panel data, we use GDP expressed in current dollars after conversion in terms of purchasing power parity (PPP), thus achieving comparability between the values of different countries. Table 9 demonstrates the results of the robustness test for the direct impact of educational investment on economic growth. From column (3), it can be seen that the p-values of AR (1) and AR (2) pass the autocorrelation test and the Sargan's J-test corresponds to a p-value of 0.362, which is larger than 0.1, so the estimation results are reliable. The regression results in Table 9 show that the range of regression coefficients for educational investment is 0.336-0.379 and is significant at the 10% level, which suggests that educational investment has a significant and positive impact on economic growth. This result is consistent with the results of the previous section and indicates that the findings we have drawn are reliable.

Table 9. *The results of estimation of the direct effect of educational investment on economic growth（Robustness checks）*

	(1)	(2)	(3)
VARIABLES	**lnGDP**	**lnGDP**	**lnGDP**
L.lnGDP	0.444***	0.501**	0.550***
	(0.126)	(0.187)	(0.113)
edu	0.336***	0.379*	0.379*
	(0.114)	(0.211)	(0.213)
pcap		0.025	0.018*
		(0.020)	(0.010)
pop			0.105
			(0.313)
Constant	12.569***	10.319**	9.203***
	(2.985)	(3.981)	(2.967)
Number of Country	22	22	22
AR (1) (p-value)	0.0450	0.0425	0.0389
AR (2) (p-value)	0.223	0.201	0.189
Sargan (p-vaplue)	0.00381	0.570	0.362
N	396	396	396

Standard errors in parentheses，*** p<0.01, ** p<0.05, * p<0.1

Table 10 demonstrates the results of the robustness checks on the moderating effect of institutional quality. As can be seen in column (1), the p-values of AR (1) and AR (2) pass the autocorrelation test and the Sargan's J-test corresponds to a p-value of 0.298, which is greater than 0.1, so the estimation results are reliable. The regression coefficient of the core explanatory variable educational investment is 0.499 and is significant at the 5% level. This indicates that educational investment can contribute to economic growth. The coefficient of gross fixed capital formation is 0.025 and significant at the 10% level, which indicates that physical capital accumulation has a significant positive effect on economic growth. The coefficient on the lagged value of the natural logarithm of real GDP is 0.579 and is significant at the 1% level, which indicates that the level of the economy in the previous period affects the rate of economic growth in the next period. When we focus on the moderating effect of institutional quality, we can find that the sign of the coefficient of the interaction term between government efficiency and educational investment is the same as the sign of the coefficient of educational investment and is significant at the 10% level, which suggests that government efficiency has a positive moderating effect on the impact of educational investment on economic growth.

As can be seen from column (2), the p-values of AR (1) and AR (2) pass the autocorrelation test and the Sargan's J-test corresponds to a p-value of 0.272, which is greater than 0.1, so the estimation results are reliable. The coefficient of educational investment is 0.526 and is significant at 1% level, indicating that the impact of educational investment on economic growth is positive and significant. The coefficient of the interaction term between control of corruption and educational investment is 0.183 and is significant at the 5% level. This indicates that the sign of the coefficient of the interaction term of control of corruption and educational investment is the same as the sign of the coefficient of educational investment, and that control of corruption has a positive moderating effect on the impact of educational investment on economic growth.

As can be seen in columns (3) and (4), the coefficients of the interaction term of regulatory quality and educational investment and the interaction term of rule of law and educational investment are insignificant, indicating that regulatory quality and rule of law do not have any significant moderating effect on the impact of educational investment on economic growth. These results are all consistent with the findings in the previous section, indicating that the findings drawn in this research have passed the robustness checks.

Table 10. *The results of estimation of the moderating effect of institutional quality (robustness checks)*

VARIABLES	(1) lnGDP	(2) lnGDP	(3) lnGDP	(4) lnGDP
L.lnGDP	0.579***	0.512***	0.526***	0.431**
	(0.098)	(0.116)	(0.101)	(0.167)
edu	0.499**	0.526***	0.388	0.334
	(0.194)	(0.165)	(0.243)	(0.264)
pcap	0.025*	0.036*	0.028***	0.034
	(0.013)	(0.021)	(0.010)	(0.029)
pop	-0.420	-0.659	-0.357	-0.067
	(0.535)	(0.620)	(0.314)	(0.588)
GE	0.009			
	(0.422)			
edu*GE	0.164*			
	(0.090)			
CC		0.127		
		(0.481)		
edu*CC		0.183**		
		(0.087)		
RQ			-0.319	
			(0.281)	
edu*RQ			0.114	
			(0.074)	
RL				-0.301
				(0.252)
edu*RL				0.088
				(0.085)
Constant	7.649***	9.247***	9.496***	12.044**
	(2.398)	(2.711)	(3.154)	(4.256)
Number of Country	22	22	22	22
AR (1) (p-value)	0.0351	0.0620	0.0481	0.0514
AR (2) (p-value)	0.263	0.348	0.284	0.285
Sargan (p-vaplue)	0.298	0.272	0.300	0.288
N	396	396	396	396

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

6.4 Summary of the empirical results and potential limitations

This chapter empirically tests the relationship between educational investment and economic growth in transition economies and how institutional quality moderates the growth effect of educational investment. Based on the resuls of the empirical analysis we find that educational investment can promote economic growth. This provides empirical support for countries' policies to increase investment in education. In addition, the results of the research suggest that institutional quality has a positive moderating effect on the impact of educational investment on economic growth, but this is not true for every dimension of the institutional quality. In addition, the results of the research suggest that institutional quality has a positive moderating effect on the impact of educational investment on economic growth, but this is not true for every dimension of the institution. Higher government efficiency and better control of corruption can help to increase the returns to educational investment, which can in turn provide a guarantee of the contribution of educational investment to economic growth. However, the findings of the research also suggest that the role of regulatory quality and rule of law on the impact of investment in education on economic growth is not significant. This may be due to the fact that the moderating effect of regulatory quality and rule of law on economic growth is mainly realized through the improvement of the private sector and the attraction of foreign investment. Considering the public investment attributes of educational investment, regulatory quality and the rule of law do not play a significant role in the relationship between educational investment and economic growth. Overall, in order to promote economic growth, transition economies should not only emphasize investment in human capital, but also consider the need for more efficient government and stricter controls on corruption.

Although this thesis attempts to conduct empirical analysis by using relatively comprehensive indicators and reasonable estimation methods, there are still some limitations that may reduce the reliability of the empirical results. There are three

main limitations in this thesis, which are reflected in the sample selection, model setting and the solution to endogeneity.

One of the limitations of this thesis is the reliability of the data caused by the sample selection. First, since the time range of the WGI's database is 1996, 1998, 2000, and 2002 to the present, in order to ensure the temporal continuity of the panel data, we chose 2002 as the starting point of the time period for the data used in this thesis. This leaves the data for the entire 1990s out of the scope of this study. However, the 1990s contain an important stage in the dissolution of the Soviet Union and the political and economic transitions that took place in the CEE and CIS countries, so many factors that could have had an impact on the results of the study have been omitted. In addition, taking into account the effect of missing values, the temporal endpoint of the data used in this study was chosen to be 2020, which somewhat reduces the timeliness of the data we use. Similarly, North Macedonia, Turkmenistan, and Uzbekistan are excluded from the sample in this study due to the large number of missing values. As a result, the original list of 25 transition economies from Europe and the former Soviet Union is reduced to 22. These reasons may contribute to the fact that the findings of this thesis are not universally representative.

The second limitation of the thesis is the problem of modeling. Starting from human capital theory, we derived a variant of the MRW equation for estimating the impact of educational investment on economic growth. However, in the empirical analysis we found that the coefficients of the control variables are not always significant. This may be due to hidden colinearities in the variables. Therefore, there are some biases in the modeling of this study.

The third limitation of the thesis is the solution of endogeneity. This research addresses endogeneity by employing the System GMM estimation method. However, addressing the endogeneity inherent in this topic purely from the perspective of an econometric estimation method is never fully convincing. Perhaps finding more

exogenous shock scenarios or more skillful instrumental variables can better control the endogeneity problem in order to obtain a more credible causal identification.

Overall, despite some limitations, this thesis provides empirical findings on the relationship between educational investment and economic growth in transition economies and explores the moderating effect of institutional quality in several dimensions. This bridges the research gap in this area to a certain extent and provides a new perspective for growth-related research.

7. Conclusions and Policy Recommendations

Using panel data for 22 transition economies from Europe and the former Soviet Union over the period 2002 to 2020, this research examines the relationship between educational investment and economic growth, as well as the moderating effect of institutional quality on the impact of educational investment on economic growth. Considering the potential endogeneity problem in dynamic panel data, this thesis uses the estimation method of System GMM to conduct the regression analysis.

According to the descriptive analysis in section 5.3, the economic growth rates of the transition economies from Europe and the former Soviet Union vary considerably and have shown a trend of slow development in recent years. While the mean value of government expenditure as a percentage of GDP is 4.38%, which is higher than the world' mean value. This implies that transition economies need to improve the efficiency of their production factors in order to fully utilize their role as drivers of economic growth. In addition, the institutional quality of the transition economies is uneven across dimensions, with higher levels of government efficiency and regulatory quality and lower levels of corruption control and rule of law.

Although previous literature has not reached a clear conclusion on the relationship between investment in education and economic growth and has virtually ignored transition economies as an important object of research, this research explores the

relationship between educational investment and economic growth in transition economies through empirical analysis. The empirical framework of the relationship between educational investment and economic growth in transition economies responds to the human capital theory that educational investment, as an important investment in human capital, can contribute to economic growth by promoting human capital accumulation.

The second objective of this research is to investigate the role that institutional quality plays in the relationship between educational investment and economic growth. To answer this question, we categorize institutional quality into four dimensions: government efficiency, regulatory quality, control of corruption, and rule of law, and add the interaction terms between them and educational investment to the regression model separately. The results show that not all indicators of institutional quality moderate the impact of educational investment on economic growth. Specifically, government efficiency and control of corruption have a positive moderating effect on the impact of educational investment on economic growth. In contrast, regulatory quality and rule of law have no significant moderating effect. This is because the moderating effect of regulatory quality and the rule of law on economic growth is mainly in the improvement of the private sector and the absorption of foreign investment, with little effect on the public sector. Although there has been some theoretical and empirical analysis of the impact of institutional quality on the relationship between public investment and economic growth in the existing literature, none has distinguished educational investment from public investment and focused on the moderating effect of institutional quality on the growth effect of educational investment. Therefore, this research fills an important research gap in this theme.

Based on the results of the empirical research, this section tries to provide some policy recommendations on how to implement effective educational investment policies to promote economic growth in transition economies. From the results of the empirical analysis, it can be seen that educational investment can promote economic

growth in transition economies. Therefore, increasing education expenditure and appropriately raising the government expenditure on education as a percentage of GDP can help promote economic growth. However, data show that the government expenditure on education as a percentage of GDP in transition economies from Europe and the former Soviet Union is already higher than the world's average level. And since the total amount of public expenditure in each country is limited, the increase in education expenditure is also limited. In addition, because of budget constraints, higher investment in education may have a crowding-out effect on other types of public investment, such as transportation and health care, which in turn constrains economic growth. Therefore, increasing investment in education may not be the best way to promote economic growth. The analysis of the moderating effect of institutional quality indicates that government efficiency and control of corruption have a positive moderating effect on the impact of education on economic growth, and therefore a good institutional environment for educational investment can be provided by improving government efficiency and strengthening control of corruption. It can be seen from the data that there is more potential to improve both government efficiency and control of corruption in transition economies, so improving institutional quality may be a better way to promote economic growth with limited budget constraints.

Bibliography

Abhijeet, C., (2010). 'Does Government Expenditure on Education Promote Economic Growth? An Econometric Analysis,' *MPRA research 25480*, University Library of Munich, Germany.

Acharya, S. and Nuriev, S. (2016) 'Role of public investment in growth and poverty reduction in transition economies', *Journal of Reviews on Global Economics*, 5, pp. 310–326.

Aghion, P., Boustan, L., Hoxby, C. and Vandenbussche, J. (2009) The Causal Impact of Education on Economic Growth: Evidence from U.S. Harvard University, Mimeo.

Ali, M., Egbetokun, A. and Memon, M. (2018) 'Human capital, social capabilities and economic growth', *Economies*, 6 (1), p. 2.

Arellano, M. and Bond, S. (1991) 'Some tests of specification for panel data: Monte Carlo Evidence and an application to employment equations', *The Review of Economic Studies*, 58 (2), p. 277.

Arellano, M. and Bover, O. (1995) 'Another look at the instrumental variable estimation of error-components models', *Journal of Econometrics*, 68 (1), pp. 29–51.

Arrow, K.J. (1962) 'The economic implications of learning by doing', *The Review of Economic Studies*, 29 (3), p. 155.

Asad, A. et al. (2008). "Unleashing Prosperity : Productivity Growth in Eastern Europe and the Former Soviet Union," *World Bank Publications - Books*, The World Bank Group, number 6588, December.

Aschauer, D.A. (1989) 'Is public expenditure productive?', *Journal of Monetary Economics*, 23 (2), pp. 177–200. doi:10.1016/0304-3932 (89)90047-0.

Asghar, N., Awan, A. and Rehman, H. ur (2012) 'Human Capital and Economic Growth in Pakistan: A cointegration and causality analysis', *International Journal of Economics and Finance*, 4 (4).

Banerjee, S. (2012) 'Economic growth and the quality composition of Human Capital', *SSRN Electronic Journal [Preprint]*.

Barro, R. (1996) Determinants of economic growth: A cross-country empirical study [Preprint].

Barro, R.J. (1996) 'Democracy and growth', *Journal of Economic Growth*, 1 (1), pp. 1–27.

Baryshnikova, N.V., Pham, N.T.A. and Wihardja, M.M. (2016) 'Does political and economic inequality affect institutional quality?', *Economic Record*, 92 (297), pp. 190–208.

Beckerman, W. and Denison, E.F. (1962) "The sources of economic growth in the United States and the alternatives before us.," *The Economic Journal*, 72 (288), p. 935.

Benhabib, J. and Spiegel, M.M. (1994) 'The role of human capital in economic development evidence from aggregate cross-country data', *Journal of Monetary Economics*, 34 (2), pp. 143–173.

Bils, M. and Klenow, P. (2000) 'Does schooling cause growth?', *American Economic Review*, 90 (5), pp. 1160–1183.

Blankenau, W.F. and Simpson, N.B. (2004) 'Public education expenditures and growth', *Journal of Development Economics*, 73 (2), pp. 583–605.

Blundell, R. and Bond, S. (1998) 'Initial conditions and moment restrictions in dynamic panel data models', *Journal of Econometrics*, 87 (1), pp. 115–143.

Bon, N.V. (2019) ‘Institutional Quality and the public investment-growth relationship in Vietnam’, *Theoretical Economics Letters*, 09 (04), pp. 691–708.

Christos, P. et al. (2018) ‘Corruption perception index (CPI), as an index of economic growth for European countries’, *Theoretical Economics Letters*, 08 (03), pp. 524–537.

Chudárková, S., and Verner, T. (2012). Relationship between human capital and economic growth : The case of Austria. Proceeding of 30th International Conference on Mathematical Methods in Economics

Delgado, M.S., Henderson, D.J. and Parmeter, C.F. (2013) ‘Does education matter for economic growth?’, *Oxford Bulletin of Economics and Statistics*, 76 (3), pp. 334–359.

Dellis, K. et al. (2017). "Determinants of FDI inflows in advanced economies: Does the quality of economic structures matter?," *Working Paper Series 2066*, European Central Bank.

Denison, E.F. (1962) ‘Education, economic growth, and gaps in information’, *Journal of Political Economy*, 70 (5, Part 2), pp. 124–128.

Dollar, D., and Kraay, A. (2004). Trade, Growth, and Poverty. *The Economic Journal*, 114 (493), pp. 22–49.

Fisher, I. (1906) The nature of capital and income. Melsungen, germany: Wirtschaft u. Finanzen.

Fitzgerald,J. (2011)."Investment in Education and Economic Growth on the Island of Ireland," *Trinity Economics researchstep0719*, Trinity College Dublin, Department of Economics.

Fukase, E. (2010) ‘Revisiting linkages between openness, education and economic growth: System GMM approach’, *Journal of Economic Integration*, 25 (1), pp. 194–223.

Galbraith, J.K. (1961) The Affluent Society. London, United Kingdom: Hamish Hamilton.

Ganegodage, K.R. and Rambaldi, A.N. (2011) "The impact of education investment on Sri Lankan Economic Growth," *Economics of Education Review*, 30 (6), pp. 1491–1502.

Gemmell, N., Kneller, R. and Sanz, I. (2014) 'Does the composition of government expenditure matter for long-run GDP levels?', *SSRN Electronic Journal* [Preprint].

Gwartney, James and Robert Lawson (2003). Economic Freedom of the World: Annual Report 2003.Vancouver, B.C.: Fraser Institute.

Gyimah-Brempong, K., Paddison, O. and Mitiku, W. (2006) 'Higher education and economic growth in Africa', *The Journal of Development Studies*, 42 (3), pp. 509–529.

Hansen, L.P. and Singleton, K.J. (1982) 'Generalized instrumental variables estimation of nonlinear rational expectations models', *Econometrica*, 50 (5), p. 1269.

Hanushek, E. A. (1989). Expenditures, Efficiency, and Equity in Education: The Federal Government's Role. *The American Economic Review*, 79 (2), pp. 46–51.

Hanushek, E.A. and Kimko, D.D. (2000) 'Schooling, labor-force quality, and the growth of Nations', *American Economic Review*, 90 (5), pp. 1184–1208.

Haque, M.E. and Kneller, R. (2015) 'Why does public investment fail to raise economic growth? the role of corruption', *The Manchester School*, 83 (6), pp. 623–651.

Haveman, R.H. and Wolfe, B.L. (1984) 'Schooling and economic well-being: The role of nonmarket effects', *The Journal of Human Resources*, 19 (3), p. 377.

Hayat, A. and Cahlik, T. (2017). FDI and Economic Growth: A Changing Relationship Across Country and Over Time.

Heckelman, J.C. and Powell, B. (2010) 'Corruption and the institutional environment for growth', *Comparative Economic Studies*, 52 (3), pp. 351–378.

Heckman, J.J. (2003) 'China's investment in human capital', *Economic Development and Cultural Change*, 51 (4), pp. 795–804.

Henisz, W.J. (2000) 'The Institutional Environment for Economic Growth', *Economics and Politics*, 12 (1), pp. 1–31.

Henisz, W.J., Zelner, B.A. and Guillén, M.F. (2005) 'The worldwide diffusion of market-oriented infrastructure reform, 1977–1999', *American Sociological Review*, 70 (6), pp. 871–897.

Herbertsson, T.T. (2003) 'Accounting for human capital externalities with an application to the Nordic countries', *European Economic Review*, 47 (3), pp. 553–567.

Hoff, K. and Stiglitz, J.E. (2005) 'The creation of the rule of law and the legitimacy of property rights : The Political and Economic Consequences of a corrupt privatization', *Policy Research Working Papers [Preprint]*.

IMF. (2000) Transition Economies: An IMF Perspective on Progress and Prospects. International Monetary Fund.

Islam, N. (1995) 'Growth empirics: A panel data approach', *The Quarterly Journal of Economic*s, 110 (4), pp. 1127–1170.

Jian, T., Sachs, J.D. and Warner, A.M. (1996) 'Trends in regional inequality in China', *China Economic Review*, 7 (1), pp. 1–21.

Jung, H.-S. and Thorbecke, E. (2001) 'The impact of public education expenditure on human capital, growth, and poverty in Tanzania and Zambia: a general equilibrium approach', *SSRN Electronic Journal [Preprint]*.

Kaufmann, D. et al. (2010) The Worldwide Governance Indicators: Methodology and Analytical Issues. *World Bank Policy Research Working Paper No. 5430*

Knack, S. (1996) 'Institutions and the convergence hypothesis: The cross-national evidence', *Public Choice*, 87 (3–4), pp. 207–228.

Krueger, A.B. and Lindahl, M. (2001) 'Education for growth: Why and for whom?', *Journal of Economic Literature*, 39 (4), pp. 1101–1136.

Levine, R. and Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. *The American Economic Review*, 82 (4), 942–963.

Lin, T.-C. (2003) 'Education, technical progress, and economic growth: The case of taiwan', *Economics of Education Review*, 22 (2), pp. 213–220.

List, F. (1966) The National System of Political Economy (1841). New York, America: Kelley.

Lucas, R.E. (1988) 'On the mechanics of Economic Development', *Journal of Monetary Economics*, 22 (1), pp. 3–42.

Lupu, D. et al. (2018) 'The impact of public expenditures on economic growth: A case study of central and Eastern European countries', *Emerging Markets Finance and Trade*, 54 (3), pp. 552–570.

Mankiw, N.G., Romer, D. and Weil, D.N. (1992) 'A contribution to the empirics of economic growth', *The Quarterly Journal of Economics*, 107 (2), pp. 407–437.

Marshall, A. (1989) Principles of Economics (1890). Düsseldorf, Germany: Verlag Wirtschaft und Finanzen.

Miniesy, R.S. and AbdelKarim, M. (2021) 'Generalized Trust and Economic Growth: The Nexus in MENA countries', *Economies*, 9 (1), p. 39.

Nelson, M.A. and Singh, R.D. (1998) 'Democracy, economic freedom, fiscal policy, and growth in ldcs: A fresh look', *Economic Development and Cultural Change,* 46 (4), pp. 677–696.

North, D.C. (1981) Structure and change in economic history. New York, United States: Norton.

North, D.C. (1989) 'Institutions and economic growth: An historical introduction', *World Development*, 17 (9), pp. 1319–1332.

Ogundari, K. and Awokuse, T. (2018) 'Human capital contribution to economic growth in Sub-Saharan Africa: Does health status matter more than education?', *Economic Analysis and Policy*, 58, pp. 131–140.

Ozturk, I. (2008) "The role of education in economic development: A theoretical perspective," *SSRN Electronic Journal [Preprint]*.

Petrakis, P.E. and Stamatakis, D. (2002) 'Growth and educational levels: A comparative analysis', *Economics of Education Review*, 21 (5), pp. 513–521.

Podobnik, B. et al. (2008) 'Influence of corruption on economic growth rate and foreign investment', *The European Physical Journal B*, 63 (4), pp. 547–550.

Rogers, M.L. (2008) 'Directly unproductive schooling: How country characteristics affect the impact of schooling on growth', *European Economic Review*, 52 (2), pp. 356–385.

Romer, P.M. (1986) 'Increasing returns and long-run growth', *Journal of Political Economy*, 94 (5), pp. 1002–1037.

Schultz, T.W. (1961). Investment in Human Capital. *The American Economic Review*, 51 (1), pp.1–17.

Scully, G.W. (1988) 'The Institutional Framework and Economic Development', *Journal of Political Economy*, 96 (3), pp. 652–662.

Sharifazadeh, M., and Ziyari, R. (2012). 'The study of the dual effects of institutional environment on economic growth.' *Iranian Journal Of Applied Economics*, 3 (9), pp. 1-37.

Siddiqui, D.A. and Ahmed, Q.M. (2013) 'The effect of institutions on economic growth: A global analysis based on GMM Dynamic Panel estimation', *Structural Change and Economic Dynamics*, 24, pp. 18–33.

Smith, A., Campbell, R.H. and Skiner, A.S. (1981) An inquiry into the nature and causes of the wealth of nations. Indianapolis, America: Liberty Classics.

Strumilin, S.G. (1924) 'The economic significance of National Education', *The Economics of Education*, pp. 276–323.

Sukiassyan, G. (2007) 'Inequality and growth: What does the Transition Economy Data Say?', *Journal of Comparative Economics*, 35 (1), pp. 35–56.

Sweetland, S.R. (1996) 'Human capital theory: Foundations of a field of inquiry', *Review of Educational Research*, 66 (3), pp. 341–359.

Tanzi, V. and Davoodi, H. (1998) "Corruption, public investment, and growth," *The Welfare State, Public Investment, and Growth*, pp. 41–60.

Tsamadias, C. and Prontzas, P. (2012) 'The effect of education on economic growth in Greece over the 1960–2000 period', *Education Economics,* 20 (5), pp. 522–537.

Uzawa, H. (1965) 'Optimum technical change in an aggregative model of economic growth', *International Economic Review*, 6 (1), p. 18.

Walsh, J.R. (1935) 'Capital concept applied to man', *The Quarterly Journal of Economics*, 49 (2), p. 255.

Xu, G. (2011) 'The role of law in economic growth: A literature review', *Journal of Economic Surveys*, 25 (5), pp. 833–871.

Zhu, S. and Li, R. (2016) 'Economic complexity, human capital and economic growth: Empirical Research based on cross-country panel data', *Applied Economics*, 49 (38), pp. 3815–3828.

List of Appendices

Appendices

Appendix 1: Variables List

Variables		Description	Defination	Unit
Dependent Variable	Growth	Economic Growth	Annual percentage growth rate of GDP based on constant local currency.	%
Core Explanatory Variable	edu	Educational Investment	General government expenditure on education expressed as a percentage of GDP	%
Moderator Variables	GE	Proxies of institutional quality	Indicator to measure the capacity of Governments to formulate and implement policies	
	CC		Indicator to measure control of corruption in the public sector	
	RQ		Indicator to measure the ability of Governments to promote private sector development through policy instruments	
	RL		Indicator for measuring the authority and influence of law in society	
Control Variables	pcap	Proxy for physical capital	Gross fixed capital formation as a percentage of GDP	%
	pop	Population Growth	Annual population growth rate	%

Appendix 2: Abbreviations and Acronyms

AR (2)	Second-order Autocorrelation
AR(1)	First-order Autocorrelation

ARDL	Autoregressive Distributed Lag
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
CPI	Corruption Perceptions Index
D-GMM	Difference Generalized Method of Moments
EFW	Economic Freedom of the World
EU	European Union
GDP	Gross domestic product
GMM	Generalized Method of Moments
IMF	International Monetary Fund
IV	Instrumental Variable
LLC	Levine-Lin-Chu
MRW	Mankiw, Romer, and Weil
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
POLS	Pooled Ordinary Least Squares
PPP	Purchasing Power Parity
SYS-GMM	System Generalized Method of Moments
WDI	World Bank Development Indicators
WGI	Worldwide Governance Indicators