Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics

Master Thesis

Suada Mammadova

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Suada Mammadova

Economics and Management

Thesis title

The impact of education on economic growth in selected countries

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Objectives of thesis

The main goal of the Diploma Thesis is to define what micro variable influences the economic growth, however, the indicators considered will only be a part of education level such as:
- Average Years of schooling
- Mean years of age
- Total number of institutions
- Total number of qualified teachers
- Undergraduates and postgraduates' specialists
- Dropouts

The above related indicators might be having a hidden effect on the economic development. Thus, all the measures will be analysed. However, the author is interested in knowing, what indicator has the most influential factor on economic growth, as all above factors are correlated with each other, the results help to demonstrate which factor is the most influential. As a study case: two countries were selected, such as the Federal Republic of Germany and United Kingdom.
As the main methodological tool, the author is focused on statistical data, where an annual change in Gross Domestic Product will be taken as the main and dependent indicator and the rest of the variables will be considered as independent with a proposed impact of the development of GDP. The data has a quantitative character of secondary data. The data set is for 15 years, from 2007 up to 2021 (n- 15).

Methodology

As the main methodological tool, the author is focused on statistical data, where an annual change in Gross Domestic Product will be taken as the main and dependent indicator and the rest of the variables will be considered as independent with a proposed impact of the development of GDP. The data has a quantitative character of secondary data. The data set is for 15 years, from 2007 up to 2021 (N – 15).

The author plans to run the data in SPSS IMB program and test the model under the certain assumptions.

- Model Verification
- Autocorrelation

Deals with the residual structure. The Durbin-Watson test will be used to check whether the model has an autocorrelation or not. The null hypothesis is: No autocorrelation, and alternatively HA: no autocorrelation. The Durbin and Watson test is measured from 1-4, whereas the more it is closer to 1, meaning a positive autocorrelation, if it is closer to 4, meaning the negative autocorrelation. Number of Observation – 15 and number of independent variables are – 8.

• Multicollinearity – Occurs when two or more explanatory variables are near perfect linear combinations with the indicator close to 0,9. Which means a strong multicollinearity.

- The way to get-rid of multicollinearity are.

Add Dummy Variable

Add Lagged Variable

• Normality – This is simply an indication of residuals and their distribution, whether they are normally distributed. The normality of residuals is necessary to have, in order to validate the hypothesis testing. Assumption about normality of distribution is a mandatory step for linear regression model. By using Jarque-Bera test, the author plans to check the normality of residuals and their distribution.

• Heteroskedasticity – White's test is mostly used to identify either the model has heteroscedastic or homoscedastic roots, whereas H0: Homoskedasticity, HA: Heteroskedasticity.

• The alfa level is 0,05 %.

The proposed extent of the thesis

60 – 90 stran

Keywords

Education, Economic growth, Human Capital, GDP per capita, Knowledge, School, Years of schooling, impact, variable.

Recommended information sources

Acemoglu, D. (2011): Introduction to Modern Economic Growth. ISBN: 0691132925. Checci, D (2008): Economics of Education. ISBN: 0521066468. Das, S. (2015): Economic Growth and Development. ISBN: 9783319142647. Fuller, W. A. (1976). Introduction to Statistical Time Series. New York: John Wiley and Sons. ISBN: 0-471-28715-6. Kufenko, V (2015): Economic Growth and Inequality. ISBN: 3658080825 McCartney, M. (2015): Economic Growth and Development. ISBN: 9781137290304. Stela L (2022): Humanizing Human Capital: Invest in Your People for Optimal Business Returns. ISBN: 1637741804. Pellegrini, Lorenzo and Gerlagh, Reyer (2004) Corruption's effect on growth and its transmission channels, Kyklos, 57(3), 429-456.

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The Diploma Thesis Supervisor

Bc. Ing. Jiří Čermák, Ph.D.

Supervising department

Department of Economics

Electronic approval: 16. 6. 2022

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 27. 10. 2022

doc. Ing. Tomáš Šubrt, Ph.D.

Dean

Prague on 31. 03. 2023

Declaration

I declare that I have worked on my bachelor thesis titled ***"The impact of education on the economic growth of selected countries"*** by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on _____

_____

Acknowledgement:

I would like to thank my family for supporting me for the past 2 years. I would also take my tame to express the deepest gratitude to my thesis supervisor Ing. Jiří Čermák, Ph.D, who guided me throughout the whole work. Without such a great and helpful teacher, the achievement of such a work wouldn't be possible.

The impact of education on the economic growth of selected countries: United Kingdom and Federal Republic of Germany.

Abstract

The purpose of this diploma thesis is to measure the effect of education on economic growth and development. Economists argue that educational background of the country can dictate the development of economic growth and an overall development of human capital. Education, for the most part is perceived as investment to both, individuals, and societal level. Many analysts argue that the benefits of education on the individual level and micro level, are numerous. Education, in general, helps an individual to be a more productive member of a society, thus, theoretically, should lead to a bigger growth of personal income.

However, within this thesis, the author is focused on identifying the impact of education of economic growth. The development of any state is highly dependent of human capital, hance human capital and its main aspects is the primary goal to analyze. The author applies a Multiple Linear Regression Model to see the direct effect of educational aspects on GDP growth.

Within the theoretical part, the author describes the educational systems which are applied by both states.

The conclusion part demonstrates the results and indicators that have been researched and analyzed. The author summarizes the impacts of particular indicators on the GDP per capita for both states with the help of secondary data.

Keywords: Human Capital Index, Education, Growth, GDP per capita, school, knowledge.

Vliv vzdělání na ekonomický růst vybraných zemí: Spojeného království a Spolkové republiky Německo.

Abstrakt

Cílem této diplomové práce je změřit vliv vzdělání na ekonomický růst a rozvoj. Ekonomové tvrdí, že vzdělání země může diktovat rozvoj ekonomického růstu a celkový rozvoj lidského kapitálu. Vzdělání je z velké části vnímáno jako investice jak pro jednotlivce, tak pro společenskou úroveň. Mnoho analytiků tvrdí, že přínosy vzdělávání na individuální a mikroúrovni jsou četné. Vzdělání obecně pomáhá jedinci být produktivnějším členem společnosti, a tak by teoreticky mělo vést k většímu růstu osobních příjmů.

V rámci této práce se však autor zaměřuje na identifikaci vlivu vzdělávání na ekonomický růst. Rozvoj každého státu je vysoce závislý na lidském kapitálu, na lidském kapitálu a jeho hlavních aspektech je primárním cílem analyzovat. Autor používá model vícenásobné lineární regrese, aby viděl přímý vliv vzdělávacích aspektů na růst HDP.

V teoretické části autor popisuje vzdělávací systémy, které aplikují oba státy.

Závěrečná část demonstruje výsledky a ukazatele, které byly zkoumány a analyzovány. Dopady jednotlivých ukazatelů na HDP na obyvatele za oba státy autor shrnuje pomocí sekundárních dat.

Klíčová slova: Index lidského kapitálu, vzdělání, růst, HDP na obyvatele, škola, znalosti.

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1 Introduction

Today, the education is considered one of the most vital factors of human life. Having an educational background, help people to achieve their missions in life, and therefore, contributes to a development of a state. There was a consistent effect of education on the economic development of a state, specifically: literacy, primary education, secondary education, and tertiary education.

While there are various reasons why education is vital, the main emphasis of this paper is on the role that education plays in the development and results of the economy. A person's education may be described as the store of abilities, competences, and other traits that increase their level of production. In general, education, which is an essential part of a nation's intellectual property, boosts the productivity of each individual worker and enables businesses to advance throughout the supply chain from basic industrial applications or physical labor. Human capital has, for a considerable amount of time, been regarded as a particularly unique aspect of the economic model, and more research has shown the influence that schooling impacts the rise of production in the domestic output.

Nobody disputes that education and external effects matter and have an impact on the economic development; however, many researchers claim that it is not an educational background which eventually contributes to the economic development but rather it contributes to a higher labor quality, thus effecting the economic development of a country. This including of human capital, or set of certain skills and attributes, when performed by an individual, to produce economic value. It is highly important to remember that those qualities are gained through schooling.

Education should give a chance for each individual to gain a certain set of skills that eventually will give a chance to be employed. However, in reality, the education seems to be as an unlimited potential where each individual feels free to spend as much time as he/she prefers.

The thesis is focused on a secondary data and on previously published literature review, where relations and tested causalities were found between two factors, where GDP was the dependent on such variables as: mean years of schooling, mean years of age, numbers of institutions, dropouts level, expenditures on education per capita, number of teachers across country, undergraduate and post graduate students.

The author plans to consider those factors within the theoretical framework and also try to expand those studies with the updated data which are present for today. Eventually, the author will use either LRM of MLRM model to see the correlations between the determinant variables and dependent variables.

2 Objectives and Methodology

2.1 Objectives

The main goal of the Diploma Thesis is to define what micro variable influences the economic growth, however the indicators considered will only be a part of education level such as:

- Mean years of schooling
- Mean years of Age
- Number of institutions
- Total number of teachers
- Educational expenditures per capita
- Number of postgraduate and undergraduate students
- Number of dropouts

Human development index involved all the factors that are related to the development of education. However, the author is interested in knowing, what indicator has the most influential factor on economic growth. It is clear the Human Capital Index is a crucial indicator that has an overall impact of GDP; however, economists and analysts argue that Gross Domestic Product is highly dependent on Human Capita Index. The countries that will be considered are Germany and United Kingdom.

2.2 Methodology

As the main methodological tool, the author is focused on statistical data, where an annual change in Gross Domestic Product will be taken as the main and dependent indicator and the rest of the variables will be considered as independent with a proposed impact of the development of GDP. The data has a quantitative character of secondary data. The data set is for 15 years, from 2007 up to 2021 (N - 15).

The author plans to run the data in SPSS IMB program and test the model under the certain assumptions.

- Model Verification

The most basic idea behind the model verification is that in includes two subsets, whereas:

1. Training – set, we build the model based on the a training set of data, to see, how well the data fits the model and its prediction.
2. A test set – is a validation set, is used to test our model by measuring the prediction error resulting from forecasting new observations. This error is based on how well our model fits the new data.

- Autocorrelation

The correlation of a signal with a delayed duplicate that represents a proportion of latency is defined as autocorrelation. In the scenario of discrete period, autocorrelation is also frequently referred to as serial correlation. Informally speaking, it refers to the degree of overlap between measurements of a random variable as a function of the amount of time that has passed between the two most recent observations. The analysis of autocorrelation is a mathematical tool that can be used to find repetitive patterns, such as the existence of an impulse response that is hidden from view by noise, or the identification of the lacking frequency components in a signal that is suggested by its resonant components. Both of these examples are examples of how autocorrelation can be used. Analysis of functions or sequences of values, such as time domain signals, is a common use of this technique in the field of signal processing. To deal with the autocorrelation, the "Durbin-Watson" test will is used to check whether the model has an autocorrelation or not, thus the Hypothesis are the following:

H0: There is no autocorrelation.
HA: There is an autocorrelation.

The Durbin and Watson test is measured from 1-4, whereas the more it is closer to 1, meaning a positive autocorrelation, if it is closer to 4, meaning the negative autocorrelation. Number of Observation – 15 and number of independent variables are – 8.

- Multicollinearity

  Occurs when two or more explanatory variables are near perfect linear combinations with the indicator close to 0,9. Which means a strong multicollinearity.

  - The way to get-rid of multicollinearity are

    Add Dummy Variable

    Add Lagged Variable

- Normality

This is simply an indication of residuals and their distribution, whether they are normally distributed. The normality of residuals is necessary to have, in order to validate the hypothesis testing. Assumption about normality of distribution is a mandatory step for linear regression model. By using "Shapiro – Wilk test" the author plans to check the normality of residuals and their distribution, due to a smaller sample size $n < 40$.

- Heteroskedasticity

  White's test is mostly used to identify either the model has heteroscedastic or homoscedastic roots, whereas H0: Homoskedasticity, HA: Heteroskedasticity.

- The alfa level is 0,05 %.

3 Theoretical Part

It is a common fact that education is a key means of improving the human capital and its development, however, it is based on two main factors, the individual and economy-wide prosperity.

Mincer (1974)[1] has demonstrated on his model and it was also previously confirmed by et. el., Beker (1964)[2] that education improves the earnings and productivity, however, from the micro perspective, the individual returns to education have been enormously large.

Marshall (1890)[3] was one of the first who recognized that social interaction, gives an opportunity to workers to gain new knowledges and enhance their productivity overall. Since then, many economists have confirmed that human capital externalities is also a vital factor of economic growth. Moreover, human capital can generally impact others social factors such as: lowering crime rate and increasing the health outcomes, which are socially desirable and hance, might positively affect the productivity. Indeed, after 60s, governments of different states have shifted the investment patterns to education sector.

In recent years, the studies of (Dearden and Van Reenen, 2006)[4] shown the firm -level productivity regressions, where they found that the returns to human capital appear to be bigger for organizations than for individuals. Additionally, the spillover has also been estimated in individual wages and showed positive trends.

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[1] Mincer, J.A. (1974): The Human Capital Earnings Function. NBER Chapters, National Bureau of Economic Research, Inc.

[2] Becker, G.S. (1964): Human capital: A theoretical and empirical analysis, with special reference to education', University of Illinois.

[3] Marshall, A. (1890): Principles of economics. New-York, Published> Macmillan. ISBN: **1573921408**

[4] Dearden, L., Reed, H. and Van Reenen, J. (2006): The impact of training on productivity and wages. Evidence from British panel data. – Oxford Bulletin of Economics and Statistics, vol. 68 (4). pp.397-421.

Despite the positive trends mentioned above, there are still doubts in overall centrality of human capital contribution to the growth and development. They were a few week results demonstrated in several cross-country studies. Nevertheless, those results stem from specific issues or measurements, some of which will be mentioned in the following chapters.

It is highly important to distinguish between the human capital factors and educational attainments, where human capital is a fact of personal ability and characteristics, such as health, learning experience, building knowledge and help people to be productive. The paper begins with overview of a literature on human capital and growth.

3.1 Human Capital and Growth

The main macro approach for modelling the relationship between human capital and growth are the well-known augmented neoclassical model, together with new theories. In this section, the author covers the basic features of each era which are outlined with a discussion of the key messages that have emerged, and still applied to the data.

3.1.1 Neoclassic model

Solow (1956) considered the outcome of the macroeconomy as a direct function of just its capital, labor, and exogenous technical progress. Mankiw, & Romer, and Weil (199) [5] completed this basic production function by including the human capital stock in the labor force, stressing its role as a factor of production. A Cobb-Douglass production function is often assumed and can be formulated in the following manner by (Jones, 2016)

$$Yt = At * Mt * Kta * Ht1-a$$

5

Whereas, (Y) - to GDP , (H) – to human capital and (K) – to physical capital. Human capital can be expressed as $H=h_L$, where L represents the quantity of labor (workers and hours of workers) and h – human capital per unit of labor. Alfa and (1 – alfa) are the outcome of the elasticities of capital and labor, and At Mt represents Total Factor Productivity (TFP). Within this, At denotes the economy's knowledge stock and Mt is something that influence the TFP, so called (Error term). The formula demonstrates the constant returns to scale, even if, all factors doubling, the production output will double as well. Basically, the formula shows the fact that if production factors are paid their marginal products in which case (1-alfa) also share the profits and wages, which are assumed in monetary funds, respectively. Within this framework of continuous returns to scale and no externalities, growth in the long run it is motivated by technical progress, which is treated as exogenous. In conclusion, the one-off increase in the human capital stock will be associated with a one-off increase of increase in the economy's growth rate during a transition period. However, it is also possible that the productivity of a worker could reach the highest steady-state level. Development in human capital would require driving the economic growth in the long run. Nevermore, within this model, the role of human capital is limited, because there is a natural constraint on the amount of schooling that a society can invest in.

3.1.2 Growth accounting

The model of neoclassicism has been taken further via accounting exercises. In growth accounting theory, the country's growth is divided into two parts, effect of input accumulation and TFP. The equation was expressed by (Hall and Jones, 1999)[6] whereas: the growth accounting equation per worker or per hour, divided by Y_{at}, solving Y_t and dividing by L_t (total number of workers or hours worked), which gives the expression for labor productivity:

$$\frac{Y_t}{L_t} = \left(\frac{K_t}{Y_t}\right)^{\frac{\alpha}{1-\alpha}} \frac{H_t}{L_t} Z_t$$

[6] R.E. and Jones (1999). 'Why do some countries produce so much more output per worker than other? Quarterly Journal of Economics, vol. CXIV, pp. 83–116.

Where $Z_t = (A_t M_t)^{\frac{1}{1-\alpha}}$ is TFP measure.

The variable of interest is the labor productivity, and the fact that indicates it is that all countries tend to have different output per unit, leaving aside differences pin the size of the labor force. However, when the capital output ratio used, the decomposition also has an advantage that make differences in inputs, induced by differences in TFP which are credited to TFP, and it happens only if a country experiences an exogenous increase in TFP by holding its investments rate constant, which eventually increases the capita-labor ratio (Jones, 2016).

3.1.3 The Theory of new growth

New growth theory is explained by endogenous determinants of growth rates via improved innovation drivers. Such model is affected by two main channels, where the first channel explains the production function by explicitly individual choices of educational investment as well as letting human capital to have an external effect, thus deviating from the constant returns of scale. The model easily predicts the output growth by the accumulation of human capital over time rather than its level, the prediction that is equivalent to the augmented neoclassical model.

The second channel, however, relates to technological change and growth to the stock of human capital. One of the most important and vital input within the research sector is the human capital, by coming up with new ideas and technologies (Romer, 1990)[7]. A given and consistent level of education can actually produce a constant stream of technological development and hance, effects the growth in the long run (Aghion and Howitt, 1992)[8]. In particular, the new

[7] Romer, P.M (1990): Endogenous technological change. Journal technological change. Journal of Political Economy, Vol. 98 (5, Part – 2). pp S71-S102.

[8] Aghion, P & Howitt, P. (1992): A model of growrth through creative destruction. Econometrica, 60 (2), 322-351. ISBN:

technologies are implemented based on a transmission of educational facilities and shared knowledge.

3.1.4 Macro Growth regressions

An empirical analysis of new growth theories was mainly based on regression of macro growth, often called as "Barro regressions". Which is completely different from growth of accounting as it estimates but not impose the parameters of elasticity and its outputs of the aggregate production function. Such type of analysis is focused on explaining the variation of TFP among cross-country, rather than leave it as a residual in the model.

Usually, the dependent variable is presented by GDP per capita growth rate, and explanatory variables include stock of human capital, average years of schooling (part of HDI), investment ratio, institutional factors and geographical location as well. Such regressions have been analyzed randomly, where the choice of explanatory variable is "largely driven by previous results in the literature and a prior consideration" (Sianesi and Van Reenen, 2003)[9].

A key aim of macro growth regression is to identify the significance from statistical point of view, its robust relationships between different factors and economic growth with a view to claim that those relationships are casual. At first, studies were based on cross-section of countries, however, later, studies used panel-data (Barro, 2012) where he was able to control the time invariants, at the country level, but the cost of the control was the measurement error. Macro growth indicated positive trends between human capital and growth, however, not than often as it was expected (Barro, 2012). He highlighted that if there is a correlation between the human capital and growth, which is present in the model, the effect is sensitive to the model

[9] Sianesi, B & Van Reenen, J, (2003): Education and economic growth. A review of the literature. Journal of economic survey, vol. 70(1). pp. 65-94.

specifications. However, another study of 60 meta-analysis by Benos, & Zotou (2014)[10], which were tested from 1989 to 2011, and fount-out that over 20 % of estimates were actually negative in relation to human capital. Generally speaking, the problem was the differences in sample, such as: human capital, flow measures of human capita, that's why it was difficult to compare.

Some studies have found that differentiating between stages of education has helped institutions to realize the positive relationship between human capital and growth, instead of using standard average years of schooling measures. (Bils & Knelow, 2000)[11] claimed the so called, reserve relationship (higher growth leading to additional education) could be at least as important as the causal effect of education on growth in these relationships. The importance of having additional things within institutional frameworks have also been highlighted by (Bils and Knelow, 2000).

3.2 The measurement of human capital

The measurement or an indicator which is used to evaluate the human capital level in any country, is the average years of schooling, implicitly assumes that an additional year of schooling, increases the knowledge level and skills, regardless of the stage of education and the type of education being provided. Some studies use enrollment rate, levels of secondary, tertiary education, or proportion of the labor force that has received education on these different levels.

For example, research suggests that investing in education not just enhances economic expansion, but also equips individuals with both the know-how, information, and techniques necessary to enhance the standard of leadership in a nation, which really is, in and of itself, a significant contributor to economic expansion (). This will, in the long run, contribute to the preservation of stable politics and economies, and also have a favorable impact on the gross

[10] Benos, N. and Zotou, S. (2014). 'Education and economic growth: A meta-regression analysis', World Development, vol. 64. pp.669-689.

[11] Bils, M. and Klenow, P.J. (2000): 'Does schooling cause growth?', American Economic Review, vol. 90(5), pp. 1160–1183.

domestic product of such nation (GDP). According to Beal (2012), education and general skill development in a population are the most significant aspects to examine if analyzing a nation's potential for long-term economic sustainability. This is because education is one of the 10 components which build up a nation's economic wellbeing. In furthermore, when likened to investments in the other facets of an economy, such as public finances and economic institutions, education is the most important lever in enhancing a nation's long-term industrial prosperity. This is because education creates a workforce that is better educated and more skilled (Beal, 2012).

3.2.1 Educational stages

Any country, depending on its level of development varies from educational attainments and investments, hance it is expected to have different outcomes from educational point of view.

Montanini (2013)[12] argues that, years of education is the right tool of measuring the human capital but deviate from the assumption in many analyses that are related to linear growth relationship. He found evidence of non-linearities with an inverted U-shaped relationship between the years of education and growth. Based on the data, the peak is 7,5 years of education and given that the mean of OECD countries in 2008, was 8,4 which demonstrates that the average of OECD country is on the downward sloping segment of the education growth profile. However, the results were only positive with the level of education and growth, in case where countries had low level of education.

Many researchers argue that the stages of education are relevant. Especially, tertiary level of education is more vital than any other based on OECD countries growth. Thus, the

[12] Montanini, M. (2013): Supporting tertiary education, enhancing economic development. Strategies for effective higher education funding in Sub-Saharan Africa. ISPS Working Paper No.49.

primary and secondary level of education appear to be very effective in poorest and intermediate developing countries (Gemmell, 1996)[13].

Aghion et. el. (2006) found a correlation between a tertiary education and technological development of a country and concluded that education in such countries is more important and contribute to the growth to the fullest. Theoretically, the author shows the contribution of human capital to growth, and it could be divided into a level effect and composition effect. If the composition of human capital is constant, it is more likely to expect the growth in its aggregate level. However, its constant factor is dependent on both, the composition and on the technological limit.

Preschool education does not seem to have much of an impact on the macro level. There were several experiments of quasi-experimental studies in the micro literature that have measured the impact of pre-school education on individuals labor market and social aspects Cunha and Heckman (2007)[14] pointed out from their research the relevance of skill building from family, school and other agents that are interactive and that those skills developed from early stages boost the development of skills in later stages and increase the productivity later on, forming an individuals with certain set of skills which he/she gained from early ages.

3.2.2 Education quality

Further difficulty with utilizing quantity-based education indicators, such as years of schooling, is the implicit assumption that an extra year of schooling results in the same growth in skill and competencies despite of national curriculum. Even in studies that take into consideration the phases of schooling (for example, through enrolment or spending), as stated

[13] Gemmell, N (1996): Evaluating the impacts of human capital stocks and accumulation on economic growth: Some new evidence', Oxford Bulletin of Economics and Statistics, vol. 58(1), pp. 9–28.

[14] Cunha, F., & Heckman, J. (2007). The technology of skill formation. American Economic Review, 97(2), 31-47.

in the preceding section, issues of varying quality persist. Furthermore, school-based amounts of high measurements disregard variance in non-school elements that affect human capital, such as the influence of familial or societal factors.

Hanushek and Woessmann (2015) compile a set of publications in which they highlight the favorable influence of education quality on development. They claim that prior research that used quantitative indicators of human capital such as years of schooling or even achievement of different levels of education disguised the fundamental link among both education and productivity. Their concern is on the population's cognitive abilities, or "knowledge capital," as evaluated by international study proficiency exams during the periods since 1960 (and adjusted to make them comparable). Researchers discover that this enhances their capacity to justify disparities in productivity growth greatly.

Their data is based on a regression model that predicted 50 nations from 1960 to 2000, with the dependent variable being an average growth rate throughout the time, which is impacted by intellectual skills in mathematics, science scores, and other factors.

The researcher discovered a robust association between brain function[15] and economic growth: a one standard deviation improvement in school achievement is connected with a 1.7% - 2% boost to yearly GDP. Their model with student achievement is only described in three quarters; the fourth quarter data has no bearing on the model. Moreover, the cognitive skill coefficient remains constant across the whole time period. While the year of schooling is present in the model, it has no importance, which indicates that investing in further schooling

[15] The main measure of cognitive skills in Hanushek and Woessman (2015) is based on standardized mathematics and science scores from international student achievement tests in which countries participated. These include the OECD's Programme for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS), and their predecessors.

without ensuring that it genuinely enhances mental abilities will not result in actual growth or a financial return.

Hanushek and Woessmann (2015) investigated alternate requirements, estimate of country subsets, time periods, and the application of other intellectual capacity. They did, however, obtain data on cultural influences, institutional factors, and reverse causality, demonstrating proof and relevance to growth.

Despite the fact that their primary goal was to identify the most relevant components that contribute to GDP development, their model also addressed knowledge capital in the explanation of GDP per capita levels in a development accounting exercise. They found some findings that school performance accounts for 24% of GDP per capita, with the share attributable to total capital rising to roughly 4% when cognitive skills are included in the model. Woessmann et al. (2015) found that the impact of mental abilities on growth is greater in OECD nations, and that this is not just due to the "East Asian Tigers," which accelerate the advancement of cultural investment, he observed the strong development during the tested period of 1960 to 1990.

He additionally investigated how and why the proportion of kids that achieved basic reading compared to others who advanced led to economic development. The basic literacy qualities had little influence in poor countries; moreover, relatively high skills appear to have more influence in comparable countries, which is a controversial opinion of (Nelson and Phelps, 1966) who studied human capital and technological absorption in Portugal using pairing statistics of both employer and employee. According to the research, organizations with more highly educated top-level managers have greater growth performance, which influences technical advancement, which in turn influences economic growth. Nevertheless, the association was just apparent with executives who had advanced majors in science, technology,

as well as business. Yet, they discovered a favorable association between students with non-technological abilities and inventive knowledge, indicating that a country need a workforce that is devoted to the other governmental sector.

Other studies, however, have identified a link between non-cognitive talents and economic development. Balart, P. (2018) evaluated the study of Nahushek and Woessmann (2015) and concluded that non-cognitive talents impact economic growth in addition to cognitive abilities. Furthermore, many sorts of non-cognitive abilities are vital for test results and also affect an individual's social interaction and personal effectiveness. They discovered that non-cognitive talents might be an overlooked component in relation to progress. The author's conclusion is based on the results of multinational examinations, notably PISA scores, which are separated into two portions.

The beginning of those examinations is focused on cognitive abilities, and the drop of results as the test progresses is based on non-cognitive skills such as drive and ambition. Nonetheless, from an experimental standpoint, it is extremely difficult to discriminate between cognitive and non-cognitive talents. Based on the work of Hanushek and Woessman (2015), the author incorporates two distinct components further throughout model, demonstrating a positive link with economic growth. In the theory, the coefficient of cognitive skills is roughly 40% less than the coefficient of non-cognitive abilities. The author also investigates the cultural influence as a component of non-cognitive activities at the federal level, with the goal of determining the causal link between non-cognitive skills and economic growth.

3.2.3 Institutional impact

Several academic publications debate the link between human capital and institutions. For example, Hall & Jones (1999) have suggested the basic reason of disparities in economic growth among nations relate to governments and their programs, which is dubbed as "social

infrastructure". This can affect growth through several sources of input, such as physical and human capital accumulation, which in turn affects TFP. A social infrastructure influences worker production by supporting productive work and encouraging economic growth, skill training, inventiveness, and technology transfer.

According to Acemoglu and Johnson, Ribinson, (2005) universities supply the fundamental notions of education, which influence a nation's economic growth and development. They did, nevertheless, emphasize that human capital is the primary source of growth, as well as being a component of the democratic agenda and better governance. He established the influence of human capital on a cross-section of nations in regards to economic slowdown.

He determined from the data that organizations are the primary source of long-run growth, acting not just through physical capital and TFP, but also through the human capital impact. Essentially, these investigations delve further into the impact of human capital and institutions on economic growth, and the evidence is compelling in the long run. The topic of whether intellectual resources is a basic or necessary source of growth remains unanswered, particularly as part of a production system.

The primary point is that colonists carried both intellectual resources and organizations behind them, and that human capital resulted in stronger economy and political prosperity. Acemoglu et al. (2005) dispute the association between school and governance, arguing that the impacts reported in a cross-section of nations aren't resistant to integrating country fixed effects and utilizing within-country heterogeneity. In terms of the importance of human capital in growth regressions, Acemoglu et al. (2014) contend that regional (or sub - national) assumptions that consider human capital as uncontrollable exaggerate its influence on GDP. fter previous drivers of institutions and human capital are adjusted for, or when both are viewed

as endogenous, estimates of human capital's influence on continuous production fall dramatically. In distinction, when historical factors of schooling are directly accounted for, the impacts of institutional systems which are resistant to the addition of human capital. This data supports the concept that institutions are the primary driver of long-run growth, acting not just via physical capital and TFP but also through human capital.

Hanushek and Woessmann (2015) point out that these research findings have usually tend to use accomplishment-based measures of human capital, and they demonstrate that their measure of cognitive skills maintains a positive and significant coefficient in growth regressions that include two common measures of institutions (openness to trade and the strength of property rights). Nonetheless, the size of the effect is lower than in configurations that do not include institutions (the impact of a one standard deviation rise in cognitive skills being around 1.3 percentage points versus closer to 2 in their core regressions). As the impacts of cognitive skills in bettering organizations will be captured through structural effects, this is viewed as a lower threshold upon that influence of cognitive function. The scientists also demonstrate the existence of beneficial interaction terms between cognitive abilities and institutional contexts.

Human capital and institutions are shown to be essential to economy, to effect long-term progress, and to be connected with one another in the research that has investigated similar questions. Human capital's significance as an input into the production function is undeniable, regardless of whether it serves as a core or proximate engine of prosperity.

3.2.4 Subnational improvement across regions

Examining the connections between human capital and development at a finer scale allows for the absorption of national explanatory variables, which may be useful when dealing with worries about unobserved heterogeneity or challenging aspects at the regional scale (though this comes at the cost of capturing spillovers that might occur between regions). Gennaioli et al. (2013) use a development accounting paradigm to demonstrate that disparities in regional GDP per capita may be partially attributed to differences in regional years of

education. Entrepreneurs' human capital is shown to boost productivity at both the business and regional levels. By doing comparisons within countries, the authors of this article were able to account for differences in institutional frameworks, cultural norms, and language barriers that may exist across countries. Moreover, we account for a range of institutional and cultural factors at the regional level.

The regional multivariate correlation analysis show that the average number of years spent in school is really the strongest indicator of economic achievement, whereas national institutions provide not much in the way of explanation. The authors also compute production functions at the corporate layer, which is relevant since human capital in an area may be unpredictable due to movement (higher-skilled people can abandon less competitive locations for more productive ones). A positive and statistically significant correlation for regional human capital is found, indicating the existence of human capital spillover, and it is shown that the human capital of entrepreneurs and directors is especially crucial in explaining disparities in company growth.

Acemoglu et al. (2014) claim that country serial correlation are insufficient to overcome unobserved heterogeneity prejudices, and that Gennaioli et al (2013) measure of institutions fails to capture substantial subnational variation in institutional quality in their assessment of the regional regressions. Researchers further demonstrate that the variable of human capital decreases in size and significance when disparities in average years of education are viewed as endogenous and instrumented with Protestant missionary activities in the early nineteenth century.

Gennaioli et al. (2013) construct their sectoral dataset into a time series and forecasted with a Barro style growth regression in a subsequent paper that focuses on trying to understand convergence in GDP per capita between subnational regions in the same country. This article

was written with the intention of understanding integration in GDP per capita. They discover a substantial and positive correlation between the number of years spend in university, however this result is conditional on the qualification and rather limited within sectors. In particular, the coefficient is significant in regressions that adjust for geographic characteristics or area fixed effect model; however, this is not the case when other factors are added, such as average lifespan, investment-to-GDP ratio, and demography.

By using datasets at the industry level across countries, Ciccone and Papaioannou (2009) were able to contribute to shedding light on the process via which human capital influences economic growth. To be more specific, they integrate data on value-added and employment at the sector level for a total of 28 industrial and services sectors spread over 66 nations with measurements of the industry-level human capital investment (based on the United States as a benchmark). Their multivariate correlation analysis, as a result, investigate the connection between baseline education attainment in a nation and the development of various sectors, as well as the ways in which these connections are distinct for higher-skilled and lower-skilled industries. The inclusion of adjustments and fixed effects at the industrial and nation level in the multiple regression helps to resolve a variety of endogeneity problems, and this is made possible by the inclusion of these controls. The most important finding is that value-added and occupation growth in human capital-intensive industries was way quicker in nations with higher interim educational levels, so these outcomes are robust even after including a large number of restraints and employing different methods of education. These findings are compatible with endogenous growth theories, according to which an increase in human capital speeds up innovation as well as the introduction of new technologies and industrial methods. In this paper, the authors use the mean length of time people spend in college as their primary standard of human investment at the national stage. However, in parameter estimation, they also use proxies of human capital depending on things like the percentage of the population that has graduated high school and a predictor developed by Hanushek and Kimko (2000) that uses exam scores.

Based on the United States, Aghion et al. (2009) study the link between government education expenditure and development utilizing governmental tools for various forms of education spending. The researchers show proof for their theory that educational expenditures boost growth in certain cases. Exogenous shocks to investments in four-year higher education are shown to have positive growth benefits across all states, but external shocks to investments in two-year higher education are not. Only nations somewhat close to the technology frontier get favorable growth impacts from exogenous shocks to research-type training. In part, this is because research-type investment shocks push the beneficiaries of such schooling to relocate to narrow border states from much further states. They demonstrate that innovation is a fairly feasible pathway for the developmental advantages of research and four-year college type education: exogenous inputs in both forms of education boost patenting of discoveries.

A number of research findings in the micro literature had already attempted to generate causal assumptions of human capital external costs directly. These assumptions are typically obtained by assessing the scope to which average education and salary in the relevant subnational geographic area (often a city) are related to individual's earnings, as well as their education (some studies have also done this). While studies at the macro country or region level can seek to capture both the personal and slightly larger sociocultural returns from education, studies in the micro literature had already attempted to obtain correlational assumptions of skilled labor spillovers explicitly. The first study of this kind was conducted by Rauch (1993), who looked at variations in the overall number of years spent in school between different cities within the United States. The findings suggested that human capital spillover could be somewhere in the range of 3–5%. Yet, there are problems with unobserved heterogeneity in this research. Cities with greater levels of education may have better wages for a number of reasons, and higher salaries may induce higher educational levels in those places.

Acemoglu and Angrist (2000) use a method known as instrumental variables technique in order to evaluate the impact of the typical degree of education found in an individual's home state. This tactic takes use of the fact that different states in the United States had different mandatory attendance and child labor rules between the years 1920 and 1960. The results of their IV regressions show that the effects of externalities are on the order of 1–2%, which is a considerable reduction from what is predicted by the OLS assumptions.

Moretti (2004) has indeed produced causal proof of (municipality) human capital spillovers in wages, applying multiple directions to account on the quantity of university graduates at the local level. Moretti's research may be found here. 7 According to the author's research, spillover effects are observed by people of all academic achievement, although their magnitude is much greater among populations with low education levels. In addition, Glaeser and Lu (2018) use an IV technique for education at the city level in order to assess the human capital externalities in China. The research conducted by Ghignoni (2019) on the effects of STEM and non-STEM graduates on the earnings of other employees in the same geographic region only within United States found that although both categories yield favorable pay effects, the effects of University graduates were much bigger.

3.3 Human capital differences and growth rate

This chapter is dedicated to explaining how educational inequalities might impact the growth rate. Even though, the literature review doesn’t concern Germany or United Kingdom in Particular, it is still relevant to consider such knowledge when analyzing the model in the empirical part.

3.3.1 Inequality of education and county’s growth

According to the findings of empirical research with the macroeconomic data, income disparity and inequality of wages are often being detrimental in relation to a growth rate, especially when it comes down to a long – term success of a country. For example, Persson and

Tabellini (1994); Berg et. al (2018) have concluded in their analysis that inequality of education and school curriculum might eventually cause problems in the further growth of education and macroeconomic background. Short – term causes are barely noticed. Because of the influence that multigenerational remittances have on the continuation of disparity, it's possible that, in the long term, this will also have a negative impact on economic growth. For this reason, basic education could be vital for development even in nations that are farther down the path to industrialization.

Yet, there is a distinct body of research that specifically examines the effect of education disparity on economic development (Blanden and McNally, 2015). Using data from 70 different countries from 1960 to 2000, Castelló and Doménech (2002) address academic disparity head-on and find that the Gini coefficient for years of schooling indicates an inverse connection among academic inequality and socioeconomic development. They find that while wealth and educational inequality are linked, the former may be more detrimental to economic development.

Financial system flaws are a major contributor to inequalities in human capital because they cause those with financial limitations to make worse investments in their education. Credit limits have a greater impact on the investment choices of persons with lower income, according to research by Deininger and Squire (1998), who also found that beginning inequality of assets has a major negative influence on education and economic progress. Such concerns persist even when schools are funded publicly. Because of inequalities in household wealth and access to higher education, some families may be unable to provide their children with the finest possible educational possibilities.

Several investigations, especially those focusing on developing nations, have also highlighted demography as an additional conduit. Human capital disparities is the focus of

research by Castelló-Climent and Doménech (2008), who point that it might slow economic growth by lowering life expectancy and education spending. A subsequent study by Castelló-Climent (2010) demonstrates that escalating capital disparities lowered GDP per capita growth rates in developing nations from 1965 to 2005, with evidence suggesting that life expectancy and reproduction streams played a significant role.

3.4 Stages of education and impact on income level

Even though, this chapter is short, it emphasizes different literature reviews on how different stages of education impact the economic growth, such as: Primary education, secondary education and tertiary education. It is assumed that the higher education there is, the better off the economy is going to be, however, what happens with the migration rate when an individual is majored with his tertiary education. Thus, the chapter discovers such problems based on scientific researchers.

3.4.1 Primary Education

Throughout the last 40 years, a large number of studies has indeed been amassed demonstrating the macroeconomic advantages of completing one's elementary education, particularly for individuals in the agricultural sector (UNESCO, 2010). Each extra year of education has been shown to raise yearly wages by 10% and average GDP by 0.37%, according to research who estimated the effect of attendance in 50 nations during 1960 and 2000 (Hanushek et al., 2008). Another international survey found a 10% gain in earnings for every year of schooling after high school (Psacharopoulos and Patrinos, 2004). Financial rate of return on individual and societal investments in basic school have been found to be greater in lower socioeconomic nations than in countries with high incomes and to be higher for basic education than for secondary and tertiary school (UNESCO, 2010). As a result of the larger contributions intelligent people provide to society, the Commission on Growth and Development (2008) determined significant social returns probably outweigh economic returns.

Five years of schooling is connected with a mean yearly boost in productivity of 8.7 percent, according to seminal research that analyzed the impact of basic education on agriculture productivity in 13 nations (Lockheed, Jamison and Lau, 1980). Latest evidence by de Muro and Burchi (2007) looked at the correlation involving low levels of elementary school enrollment and food shortages in 48 different nations. The findings indicated that a 20%-24% reduction in insecurity might be achieved by increasing primary school participation rates among rural people. Studies that looked at how much higher education levels affected earnings found that the effects were larger than was previously believed (Hanushek and Wossman, 2007).

Education level is a strong predictor of whether or not a family is poor (UNESCO, 2010). One study found that in Papua New Guinea, over than half of the poor live in homes where the family home leader did not complete proper qualifications, and in the State of Serbia, the income inequality among homes where the head of family did not complete formal education was three times exceeds the national mean (UNDP, 2010).

Hunger and poverty may be alleviated via basic education. Many early childhood programs help reduce malnutrition by keeping track of a child's food intake and weight, and studies using data from the International Adult Literacy Survey demonstrate that adult literacy programs increase a person's income possibility just as much as gaining an extra year of schooling (UNESCO, 2010). For example, in the last twenty years, China has proved that a vigorous effort to eliminate illiteracy is viable and may give governments with the motivation to relocate their population to relatively high parts of the economy (UNESCO, 2010).

The extension of high-quality educational possibilities to everybody is crucial towards the development of society as well as overall future of the economy. A more balanced redistribution of wealth and less social disparities in general may be achieved via increased parity in the rates

of school enrollment and the education level received by every segment of society (UNESCO 2010).

If every student in low-income nations graduated with even rudimentary reading abilities, 171 million people would be lifted out of poverty. This represents a 13% reduction in the number of people who live on less than $1.25 per day (UNESCO, 2011).

When people have access to more fundamental knowledge, they tend to do better in all aspects of life. This is especially true for underprivileged communities, which stand to benefit the most from a solid foundation in education (UNESCO, 2010).

3.4.2 Secondary Education

The macroeconomic benefits of investing in secondary level are undeniable and far outweigh those of focusing just in ensuring that all children attend kindergarten through grade five. Hence, the United Nations' Millennium Development Goals' emphasis on elementary education for everyone was necessary but inadequate. In addition to ensuring that all children can finish elementary school, it is essential that large sections of the population have access to and graduate a degree of secondary schooling (IIASA 2008). Earlier studies has shown that shifts in educational attainment are unconnected to economic development, but this IIASA paper argues that this is because of a lack sufficient data. Scientists from the International Institute for Applied Systems Analysis (IIASA) have reconstructed the age and gender distributions of educational achievement over 100 nations between 1970 and 2000. This dataset has a number of benefits above rest of the group because of the level of specifics it provides (four educational categories for five-year age groups for men and women), the fact that it takes into account relative death rate, as well as the fact that this also maintains a consistent definition of educational categories over time. Analysts may now do more in-depth quantitative evaluations of the correlation among educational attainment and economic growth than ever before because to such precision (Lutz et al 2007).

Pavlova (2016) mentioned in her research the indirect evidence suggests a link between a country's primary and secondary enrollment rates and its place in the International Competitiveness Index, but actual statistics remain unavailable (WEF, 2016). Enrollment rates in high school are particularly low in countries like Laos (ranked 93rd), Cambodia (ranked 95th), and Myanmar (ranked 125th) (WEF, 2016). (ASEAN Secretariat, 2015). Figure below compares five nations and illustrates how economic progress is related to secondary enrollment (UNESCO 2012).

3.4.3 Tertiary education

HEART has compiled a Higher Education Subject Guide that investigates the role that increased levels of education have in driving economic growth (Power et al 2015). According to what is stated in the article, traditionally, the contribution of education to economic development was analyzed in terms of the relationship between the level of education and profits, and additionally in the shape of return on investment, which is an estimator that summarizes the relationship between annual earnings and also the educational expenditures. The existing data suggests that the rate of return on investment in elementary education is the greatest, followed by the rate of return on investment in secondary education. The return on investment (ROI) for education seem to be the lowest. Throughout the 1980s and 1990s, this research was implemented to a large extent in order to discourage public investment in higher education as well as to focus nearly completely on basic education (Power et al 2015.)

Picture 1: Effect of private and social education on economy across the globe

Region	Social (%)	Private (%)
Asia	11.	18.5
Europe/Middle East/North Africa	9.9	18.8
Latin America	12.4	20.5
OECD countries	8.6	11.8
Sub – Saharan Africa	11.3	27.8
World Average	10.3	21.1

Source: (Psacharopoulos, G. and Patrinos, H., 2004)

Yet, recent data shows that HE may offer societal as well as private advantages for its participants. The table that can be seen below, which was taken from the HEART subject guide, provides some estimates for the regional norms of both the social and private rates of return. In spite of the fact that the returns on investments in various nations differ, the majority of the time, they demonstrate that an investment in higher education results in positive rates of return for both the person (19%) and the society (10%). (Psacharopoulos & Patrinos, 2002).

A paper written by Tilak (2003) is discussed in the HEART Topic Guide. According to the findings of this study, the influence of higher education (HE) to growth in the economy could also be quantified using a simple regression equation. Tilak (2003) examined data from 49 nations in the Asia Pacific area and discovered that the degree of socioeconomic and social progress is significantly impacted by higher education (both the gross enrollment proportion and the degree of higher academic achievement) (as measured by GDP per capita). Tilak (2003) disproved the claim that there's simply a link among the two by assuming the existence of a significant delay involved in the process of higher education that results in prosperity (GDP per capita from 1999 was regressed on the enrolment ratio around 1990). That means that steps to enhance higher education should be made right now in order to provide enough time for such improvements to have an influence on economic growth. Additionally, there are relatively few economically underdeveloped nations that have increasing amounts of HE, whereas all of the economically succeeded nations have not definitely improved in the creation and dissemination of HE.

Psacharapoulos (2004) argues that the advantages of the private market for people include improved work opportunities, increased earnings, more flexibility in the labor market, and a stronger capacity to save and invest. While they have received less research attention, there are also public advantages, which include increased productivity and production per worker, as well as increased net tax income and reduced dependency on government financial assistance (Psacharapoulos 2004). Rates of return that are solely focused on the private and

public financial rewards fail to encompass the broader benefits of higher education, which are manifested through entrepreneurship, job creation, and good economic and political governance, in addition to the positive impacts that research has on economies Pillay (2011).

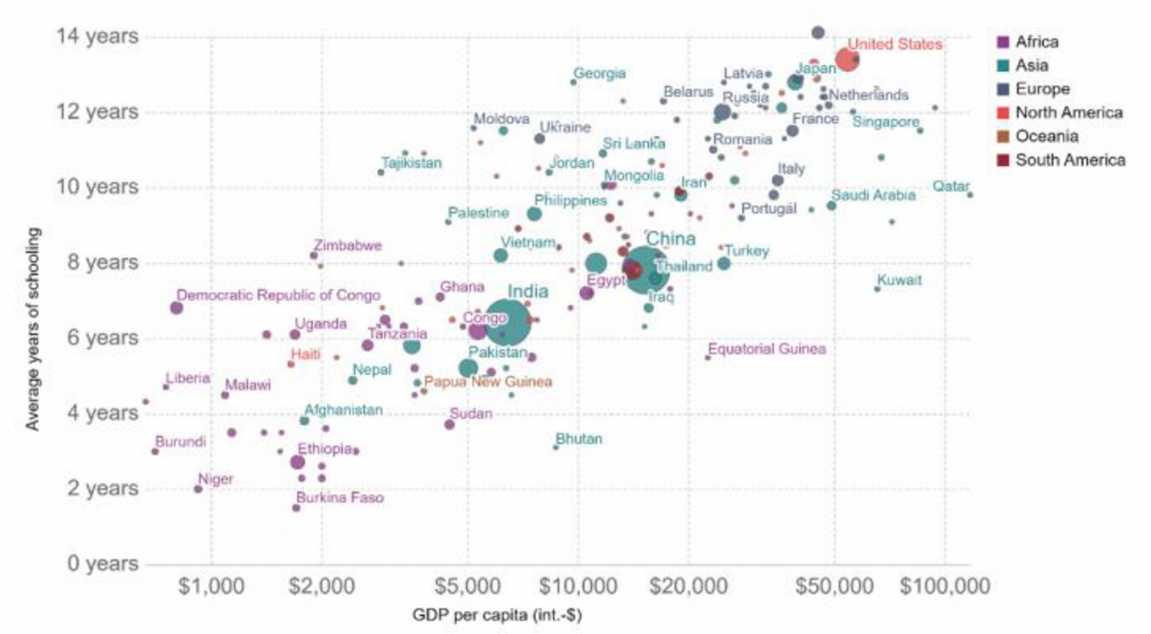
Current research has been conducted to investigate the intricate interactions in economic growth, with a particular emphasis on the context in which academic institutions perform (social and social economic), the structure and trends of universities themselves, and the interaction between national and institutional contexts. Pillay (2011) started out by doing a literature assessment of the research that has been done all around the world on the connection between higher education and economic growth. After this, an analysis of three prosperous countries, namely Finland, South Korea, and the state of North Carolina in the United States, who have included higher education into their economic expansion efforts in order to derive consequences for African nations was carried out (Pillay, 2010). The factors that support the achievement of the above structures include, but are not limited to, the link between economic and educational planning; quality public schooling; high tertiary participation rates with institutional differentiation; demand from the labor market; cooperation and networks; and widespread agreement regarding the significance of higher education for both learning and growth.

Pillay (2010) pays more attention towards a tertiary education and claims that standard of one's fundamental skills is of the highest concern, and increasing one's level of education without improving one's fundamental abilities is not profitable. According to what is said in his research, receiving a higher education has been shown to provide large benefits to people in the form of increased individual incomes. The extension of higher education has been prioritized by governments in part because of this factor, but maybe more importantly due to the possible influence it may have on worker efficiency and general income development.

There have been a lot of research that point to a beneficial correlation between education and economic development. According to Cooray (2009) indicates that enrolment in elementary, secondary, and tertiary levels is helpful and extremely relevant for economic development. This is true for all three levels of education. According to Roser (2013), there is

a positive relationship between the mean number of years spent in school and the GDP per capita, as well as the predicted number of years spent in school and the GDP per capita (**Figure 1**). According to Chien (2015), there is a significant correlation among increases in labour productivity and general Economic development on average.

Figure 1: Average years of schooling vs GDP per capita



Source: Roser (2013).

3.5 Governmental expenditures on education

The analysis of the impact of public expenditures on education on economic growth has been accorded a special significance in the different literatures. The outcomes of such previous research have generated a variety of different findings, based on the nations, duration, or political framework that was taken into consideration in the models that were approached. Thus, this part is devoted to explaining the impact of education on economic growth.

The first piece of advice comes from the findings of a large number of studies that demonstrate the importance of education to the development of a nation's economy. This result

is analysed and demonstrated starting from the theory of endogenous growth, that also deems the number of individuals as such main producing element; the rise in the learning level among individuals results in a boost in productive output, which would yield an increase in gross domestic product (GDP). The hypothesis of growth theory takes into account the population as that of the major component of production. According to these scholars (Barro, 2001) Blankenau (2004); Benos and Zotou (2014); the link of impact involving educational achievement and socioeconomic development is straight and favourable. Barro's research (2001) examines over 100 nations during the timeframe 1960-1995 and demonstrates that such level of education achieved has a favourable impact on the development of GDP. According to research conducted by Abington and Blankenau (2013), which examines over 70 nations, there is a connection between higher investment in education and increased GDP. Moreover, Benos and Zotou. (2014) perform a cross-sectional analysis of 989 samples that investigate the topic of the impacts of education on GDP and find that the majority of the publications suggest that schooling has a beneficial influence. Using panel regression data, Teixeira, Aurora AC, and Queirós. (2016) investigate OECD nations and come to a number of subtle findings concerning the influence of schooling on GDP: Essentially, the impact is beneficial for economically advanced economies over the lengthy periods of time exceeding more than 50 years; however, the impact is adverse for much less advanced nations in the relatively short term (20 years), and this is mostly influenced by the absence of technical growth. Hence, technological development is essential. However, the transition period would demonstrate the lagging trends in technological improvements.

Nevertheless, there are research that indicate the negative effect of the Governmental expenditures on the Economic growth.

According to the alternative interpretation of the findings, there is either a negative relationship between education spending and economic development or there isn't a connection among the two whatsoever. According to the findings of Devarajan et al. (1996), who analyzed

43 nations during the years 1970-1990, there is a slight inverse correlation among the amount of money spent on schooling and the country's GDP. After looking at education's role in economic development in 52 different nations between 1960 and 1990, the researchers concluded that it had a relatively little role. Pritchett (2001) demonstrates there isn't a connection between human capital and Economic growth by analyzing 70 countries more than a timeframe of 25 years. The author's interpretations begin from a variety of variables including institutional framework, reducing concentration prices in the education sector, and the standard of education. The authors Annabi et al. (2011) examine the impacts of education on GDP in Canada and demonstrate that all these impacts are inconsistent and may not even present at all according to the age of the population and the fiscal and monetary policy currently in power. Churchill and Yew (2017) demonstrate how expenditure by wealthy nations' administrations on schooling has a beneficial impact, but expenditure by less developed nations' government has an effect that is essentially inconsequential.

4 Empirical part

The part is devoted to study the relationship between the GDP per capita (economic growth) and its explanatory variables that somehow contribute to the dependent variable, based on the theoretical part of the thesis.

4.1 Model specifications

This chapter is dedicated to explaining each variable individually. For better understanding.

GDP/ GDP per capita:

The Gross Domestic Product (GDP) is an essential indicator since it provides data on the size of the economy as well as the performance of the economy. The pace of expansion of the real gross domestic product is often used as a measure of the state of the economy as a whole. An rise in real GDP is often seen as evidence that the economy is performing well and should be regarded in these terms.

The Gross Domestic Product (GDP) per capita is a measure of a country's economic output relative to the population. The gross domestic product (GDP) may be broken down further by factoring in the population of a nation via a metric known as the GDP per capita. The computation is straightforward; just take the GDP and then divide it by the population of the nation. Regarding this theory, it will be crucial to note that the geographical distance does not necessarily have an influence on the GDP per capita. But, the high latitude may have an effect on the weather as well as the various working conditions. This statistic is considered to be more accurate since it involves dividing a country's total **gross domestic product** (GDP) by its population after **inflation** has been taken into account.

Median years of age:

Age that divides the population in two parts of equal size, that is, there are as many persons with ages above the median as there are with ages below the median.

Undergraduate students' number:

a student at a college or university who has not yet received a degree.

Postgraduate students' number:

Number of students who already graduated.

Expenditures on education in USD per capita

The ratio of the total initial funding including transfers paid but excluding transfers received from government (central, regional, and local), private (households and other private) or international sources for a specific level of education (pre-primary, primary, lower secondary, upper secondary, post-secondary non-tertiary, and tertiary education) relative to the total number of students enrolled in that specific level of education in a specific year. This ratio can be expressed as a percentage The final number is then split in two ways: I by the GDP per capita, and (ii) by the PPP$ conversion factor.

Figure 2: Assumption of the model

Dependent	Independent	Potential outcome
GDP per capita	Median years of age	In increased, negatively impacts the economic growth as there is a shortage of qualified workers.
	Undergraduate students' number	Positive impact, if increased, the output of economy will also be increased, however, in the long – run.
	Postgraduate student's number	Positive impact, see above.
	Expenditures on education in USD per capita	Positive impact, more money invested, the qualified personal will be.
	Total number of teachers and total number of institutions	Positive feedback, has a strong correlation with post and undergraduate students.
	Students' dropouts	Negative impact, increases criminality rate

Source: Own creation.

4.2 Data for Germany

The **Table – 1**, represents the descriptive statistics of the variables that will be considered within a model.

Table 1: Descriptive statistics of variables

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
y - GDP per capita in USD. (numeric)	15	41107	56735	46036.47	4073.20	16590961.2
Median age of years	15	42.2	45.1	43.527	.9603	.922
Mean years of schooling	15	13.6	14.2	13.953	.1959	.038
Undergraduate students' number	15	469896.70	672486.858	600135.72	62928.62	3960011232.7
Postgraduate students' number	15	249742.2	466965.66	329812.906	72385.24	5239623419.046
Expenditures on education in USD per capita	15	10667.1	22281.49	15290.96	4009.43	16075554.6
Total number of teachers	15	742892	795214	767911.80	15880.002	252174468.8
Number of institutions	15	340	353	347.53	4.373	19.124
Student dropouts	15	31824.0	102757.79	63004.26	21234.76	450915285.188
Valid N (listwise)	15					

Source: Own processing, SPSS IBM.

First of all, the author wanted to see, whether the residual of the dependent variable is normally distributed. Based on the results that are shown in the **Table – 2**.

Table 2: Normality distribution of residuals

Descriptives

			Statistic	Std. Error
Standardized Residual	Mean		.0000000	.16903085
	95% Confidence Interval for Mean	Lower Bound	-.3625351	
		Upper Bound	.3625351	
	5% Trimmed Mean		-.0166443	
	Median		-.3074207	
	Variance		.429	
	Std. Deviation		.65465367	
	Minimum		-.70264	
	Maximum		1.00223	
	Range		1.70487	
	Interquartile Range		1.49612	
	Skewness		.192	.480
	Kurtosis		.828	.921

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.214	15	.463	.843	15	.314

a. Lilliefors Significance Correction

Source: Own process, SPSS IBM.

As stated by Thode (2022) the model residuals of the dependent variables should be normally distributed in order to proceed with the rest of the testing. Since, in this research, the residuals are normally distributed, the author might carry – on with the testing. The result of the **"Shapiro – Wilk"** due to a small sampling size which is 15. We look at the significance level of .314, which is higher than 0.05 significance level, hence, the residuals are normally distributed. The following step is to see the how the rest of the variables are contributing the dependent variables. Since all the variables have a numeric measurement, the author expects that not all of the variables will be contributing to the model, see **Table – 3.**

Table 3: Coefficients of the model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-37006.8	422488.1		-.088	.034	-1123047.2	1049033.4
	Median age of years	656.747	1442.846	.155	.455	.048	-3052.2	4365.7
	Mean years of schooling	-15930.9	39927.7	-.766	-.399	.106	-118568.4	86706.6
	Undergraduate students total	.058	.049	.893	1.188	.228	-.067	.183
	Postgraduate students total	.342	.172	6.081	1.984	.024	-.101	.785
	Expenditures on education in USD per capita	-2.179	2.89	-2.145	-.753	.015	-9.61	5.256
	Total number of teachers	-.244	.378	-.951	-.645	.147	-1.216	.728
	Number of total institutions	1085.12	1581.6	1.165	.686	.023	-2980.7	5150.9
	Student dropouts	-.082	.107	-.429	-.766	.178	-.358	.194
	Time Series	-2767.85	2935.99	-3.039	-.943	.039	-10315.0	4779.3

a. Dependent Variable: y - GDP per capita in USD. (numeric)

Source: SPSS, IBM.

From the **Table – 3**, it is clear that three variables out of all 8 are insignificant and hence might undermine the model the model and the roots of the other variables. Hence, the author has to get-rid of those variables and run the model again to see whether the new variables would be significant. In the following model, the author excludes variables**: undergraduate students total**, **total number of teachers** and **total number of institutions.**

Table 4: Coefficients of the model - 2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	19402.991	158002.303		.123	.005
	Median age of years	882.734	897.885	.208	.983	.041
	Mean years of schooling	2332.330	11216.182	.112	.208	.040
	Postgraduate students' number	.187	.098	3.330	1.918	.037
	Expenditures on education in USD per capita	2.549	2.036	-2.509	-1.252	.022
	Student dropouts	-.033	.064	-.172	-.517	.047

a. Dependent Variable: y - GDP per capita in USD. (numeric)

Source: SPSS, IBM.

Based on the results of the 2nd model, it indicates that all coefficients are significant and contribute to the model. From the above table, we could see that each independent variable contributes to the model with a certain sign, whether negative or positive. The median year of age impacts the economic growth or GDP per capita with its value of 882.734, meaning that if the "media year of age increases by 1 %, it will increase the GDP per capita by 882.734 USD, the positive sign indicates a positive relationship between those two variables. The next is the mean years of schooling that also has a positive impact on a GDP per capita, meaning that if the "Mean years of schooling" increases by 1 %, the GDP per capita will increase by 2332.330 USD.

The postgraduate students also impacts the GDP per capita in a positive way, meaning that, if "Postgraduate number of students" will increase by 1 %, the GDP per capita will be increased by 0.187, even though the contribution is small, still makes total sense to consider. In the research of Anthonia (2012), she also found a positive relationship between "Postgraduates"

and economic growth, concluding that the skilled labor force has a long – term impact on economic growth. The following variable is the "Expenditures" on education in USD per capita and economic growth. Those two also correlate in a positive way, meaning that if "Expenditures on education will increase, the GDP per capita will increase". This hypothesis was confirmed by so many researchers such as: (Baldacci, E., Benedict, C.,Sanjeev, G., and Qiang,. C., 2004). In case of this research if a "Expenditures on education per capita" increases by 1 %, it will eventually increase the GDP per capita by 2.549 USD.

The last variable to consider is "Student dropouts". (Olneck, Michael R. and Ki-Seok Kim, 1989) did analyze the effect of dropouts on the economic growth. They identified that the higher dropout's rate eventually lead to a higher unemployment rate, where country experiences big recessions and downturns. In the author's research, the "Dropouts" variables negatively impact the GDP per capita, meaning that an increase by 1 % of "Dropouts" will decrease the "GDP per capita" by 0.033 USD.

Even though, the variables seem to be statistically significant; the author still needs to check the model of further assumptions which are stated in the Chapter – 2.2.

Table 5: Correlation analysis

Correlations

		y - GDP per capita in USD. (numeric)	Median age of years	Mean years of schooling	Postgraduate students' number	Expenditures on education in USD per capita	Student dropouts
y - GDP per capita in USD. (numeric)	Pearson Correlation	1	.437	.437	.700**	.643**	.410
	Sig. (2-tailed)		.103	.103	.004	.010	.129
	N	15	15	15	15	15	15
Median age of years	Pearson Correlation	.437	1	.364	.407	.402	.457
	Sig. (2-tailed)	.103		.182	.132	.137	.087
	N	15	15	15	15	15	15
Mean years of schooling	Pearson Correlation	.437	.364	1	.560**	.098**	.004**
	Sig. (2-tailed)	.103	.182		.000	.000	.000
	N	15	15	15	15	15	15
Postgraduate students' number	Pearson Correlation	.700**	.407	.860**	1	.592**	.659**
	Sig. (2-tailed)	.004	.132	.000		.000	.001
	N	15	15	15	15	15	15
Expenditures on education in USD per capita	Pearson Correlation	.443**	.402	.398**	.492**	1	.678**
	Sig. (2-tailed)	.010	.137	.000	.000		.001
	N	15	15	15	15	15	15
Student dropouts	Pearson Correlation	.410	.457	.004**	.559**	.778**	1
	Sig. (2-tailed)	.129	.087	.000	.001	.001	
	N	15	15	15	15	15	15

**. Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS IBM.

Based on the correlation analysis, there is no identification of multicollinearity between independent variables, meaning that contribution across variables are recognized and thus, there is no need to add dummy variable, lagged variables or exclude any other variables.

Table 6: F – Test for the whole model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.830[a]	.688	.515	2836.970	.688	3.972	5	9	.035	2.131

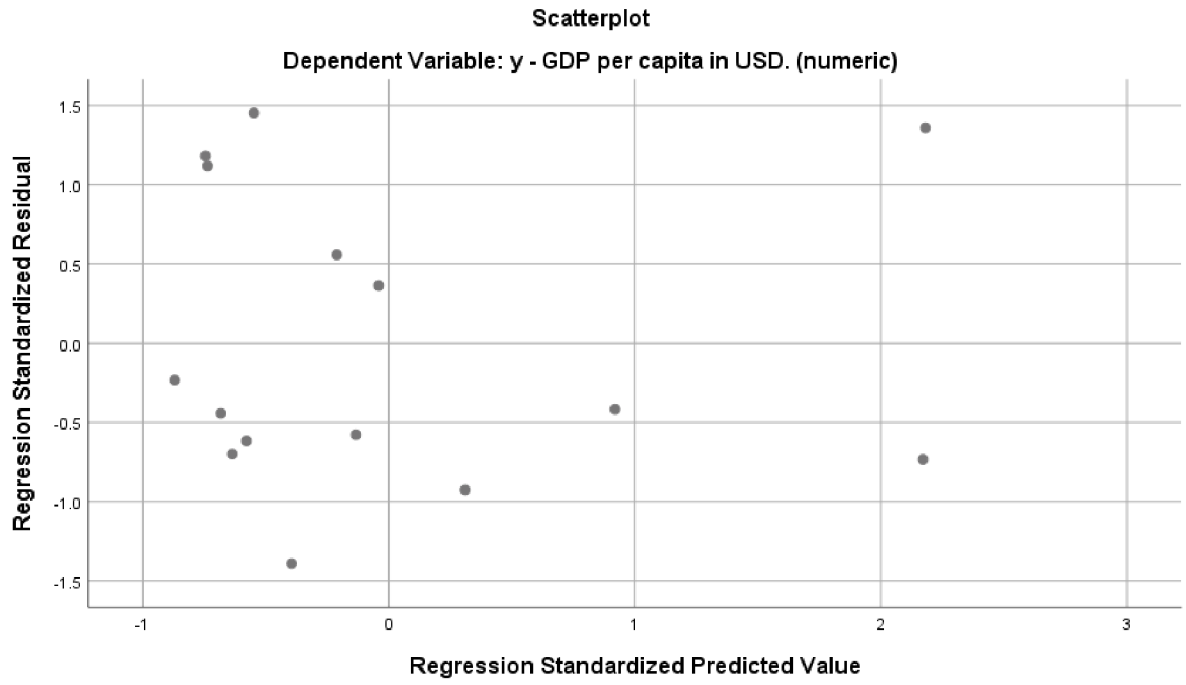
a. Predictors: (Constant), Student dropouts, Median age of years, Postgraduate students' number, Mean years of schooling, Expenditures on education in USD per capita

b. Dependent Variable: y - GDP per capita in USD. (numeric)

Source: SPSS IBM.

The **F – test** and its significance demonstrate that data is a good fit for the model. Since its significance is .035 which is lower than .05 alpha level. The **R – Square** is 68 %, which explains that the dependent variable is explained by independent variables by 68 %, which is a good result. The Durbin – Watson test identified zero autocorrelation as its value equals to 2.131.

Picture 2: Heteroskedasticity for Federal Republic of Germany



Source: SPSS, IBM.

Based on the sampling size, 15, which is not a big sample size, we could see that residuals are close to each other, however, still the deviation is big. By looking at the **Picture – 2**, that indicates that the model has a heteroskedasticity roots.

Criteria for the model:

GDP per Capita – USD

Median Years of Age – Years.

Mean Years of Schooling - Years

Postgraduate students – total number.

Expenditures on education per capita – in USD

Dropouts – total number.

B_0 – *Intercept term.*

$B_1, B_2, B_3, B_4, B_5, B_6$ – *Partial Regression Coefficients.*

t – Time period (2007 – 2021).

E – Error Term.

Based on the results of the coefficients, the assumptions almost were met, and the model look like the following:

$$GDP_t = 19402{,}991 + 882{,}734*MYA_t + 2332.330*MYSCH + 0.187*PGS_t + 2.549*ExOe_t - 0.033*DO_t + E_t.$$

4.3 Data for United Kingdom

This chapter is devoted to an empirical part and statistical analysis of the data for United Kingdom. The author considers the same variables as for the Federal Republic of Germany. Thus, the procedures will be performed the same.

Table 7: Descriptive statistics of all variables.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
y - GDP per capita in USD. (numeric)	15	41103	50802	45005.07	2933.784
Median age of years	15	41.0	51.0	44.613	2.6546
Mean years of schooling	15	12.60	13.30	13.0300	.20857
Undergraduate students total	15	399501	541224	465330.40	51044.300
Postgraduate students total	15	194905	351102	261597.73	50858.729
Expenditures on education in USD per capita	15	8260.5	16753.0	12119.267	2878.007
Total number of teachers	15	620994	636327	624835.87	3795.471
Number of institutions	15	159	166	162.20	2.007
Student dropouts	15	26424.904	81590.819	49184.731	16702.894
Valid N (listwise)	15				

Source: Own processing. SPSS IBM.

The **Table – 7**, depicts the descriptive statistics for all variables. However, first of all, the author should make sure that all of the mentioned variables are statistically significant.

The same procedure as for the data for Federal Republic of Germany, the author checks the Normality test for the dependent variable, See **Table – 8**.

Table 8: Test of Normality.

Descriptives

			Statistic	Std. Error
Standardized Residual	Mean		.0000000	.17888976
	95% Confidence Interval for Mean	Lower Bound	-.6697568	
		Upper Bound	.4427987	
	5% Trimmed Mean		-.548764	
	Median		-.123876	
	Variance		.659	
	Std. Deviation		.1567877	
	Minimum		-.7524	
	Maximum		1.00223	
	Range		1.7986	
	Interquartile Range		1.4442	
	Skewness		.185	.242
	Kurtosis		.734	.841

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.214	15	.657	.843	15	.515

a. Lilliefors Significance Correction

The author considered the **Shapiro – Wilk** test to identify the distribution of residuals and whether they are normally distributed or not. Based on the results, the data demonstrates the significance of .515 which is higher than .05 alpha level, meaning that the residuals are normally distributed. Hence, the author may carry – on with the testing.

Further, the author analyses the coefficients for the statistical significance. The **Table – 9**, represents the outcome.

Table 9: Coefficients of the model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	88152.533	250305.696		.352	.037	-524323.440	700628.506
	Median age of years	1087.304	934.916	.984	1.163	.089	-1200.353	3374.960
	Mean years of schooling	-9426.337	9501.641	-.670	-.992	.059	-32676.015	13823.342
	Undergraduate students' number	-.086	.072	-1.494	-1.199	.276	-.261	.089
	Postgraduate students' number	-.045	.204	-.777	-.219	.004	-.545	.455
	Expenditures on education in USD per capita	1.106	3.000	1.085	.369	.025	-6.235	8.447
	Total number of teachers	-.081	.400	-.105	-.202	.847	-1.060	.898
	Number of institutions	671.854	1141.451	.460	.589	.578	-2121.177	3464.885
	Student dropouts	.223	.194	1.269	1.148	.155	-.252	.698

a. Dependent Variable: y - GDP per capita in USD. (numeric)

Source: Own processing, SPSS IBM.

Based on the results, the author could see that that there are three variables that do not contribute the dependent variable and thus have to be excluded and the model needs to be run again. There are 4 variables to exclude out of 8. In comparison to the Federal Republic of Germany, the "Student dropouts" doesn't fully contributed to the GDP per capita. However,

there is no literature review confirming such a statement. As covered earlier, the higher rate of student dropouts might eventually lead to a higher unemployment rate. Thus, effecting GDP growth overall.

Table 10: Coefficients of the model – 2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	19545.633	46988.707		.416	.006
	Median age of years	114.202	385.968	.103	.296	.007
	Mean years of schooling	808.874	3926.795	.058	.206	.041
	Postgraduate students' number	.073	.115	1.261	.630	.003
	Expenditures on education in USD per capita	.759	1.956	-.745	-.388	.016

a. Dependent Variable: y - GDP per capita in USD. (numeric)

Based on the results of the rerun model, we could see that all variables that stated in the model from the previous test, are statistically significant as their significance level is less than .05 alpha level. Thus, we could carry – on with testing.

As in the first case, we could see the coefficients with a certain signs that indicate a direction of relationship. Based on the results, it is seen that the "median age of years" effects the dependent variable in a positive direction, meaning that if 1 % change in "media age of year" would change the GDP per capita by 114.202 USD. The following variable "Mean years of schooling" has the same effect on the dependent variable, 1 % change in "Mean years of schooling" will change the GDP per capita by 808.874 USD. Postgraduate student's effect has also a positive effect on the GDP per capita, indicating, if 1 % changes in "Postgraduate student's number, the dependent variable will change by .073 USD, the effect is however, minor. The variable of "Expenditures on education in USD per capita" if changed by 1 %, will eventually affect the GDP per capita by .759 USD.

Even though, the variables seem to be statistically significant; the author still needs to check the model of further assumptions which are stated in the Chapter – 2.2.

Table 11: Correlation analysis

Coefficient Correlations[a]

Model			Expenditures on education in USD per capita	Mean years of schooling	Median age of years	Postgraduate students' number
1	Correlations	Expenditures on education in USD per capita	1.000	.130	.288	-.988
		Mean years of schooling	.130	1.000	-.285	-.140
		Median age of years	.288	-.285	1.000	-.370
		Postgraduate students' number	-.988	-.140	-.370	1.000
	Covariances	Expenditures on education in USD per capita	3.827	999.589	217.677	-.223
		Mean years of schooling	999.589	15419716.179	-431847.269	-63.285
		Median age of years	217.677	-431847.269	148971.052	-16.479
		Postgraduate students' number	-.223	-63.285	-16.479	.013

a. Dependent Variable: y - GDP per capita in USD. (numeric)

Based on the correlation analysis, the author didn't identify a high multicollinearity between independent variables. The highest is "Postgraduate students' number" and "Median age of years" is state for -.370. However, a number higher than .8, would mean a high multicollinearity. Thus, the model is free of multicollinearity issue. Thus, there is no need to add dummy variable, lagged variables or exclude any other variables.

Table 12: F - Test for the whole model.

Model Summary[b]

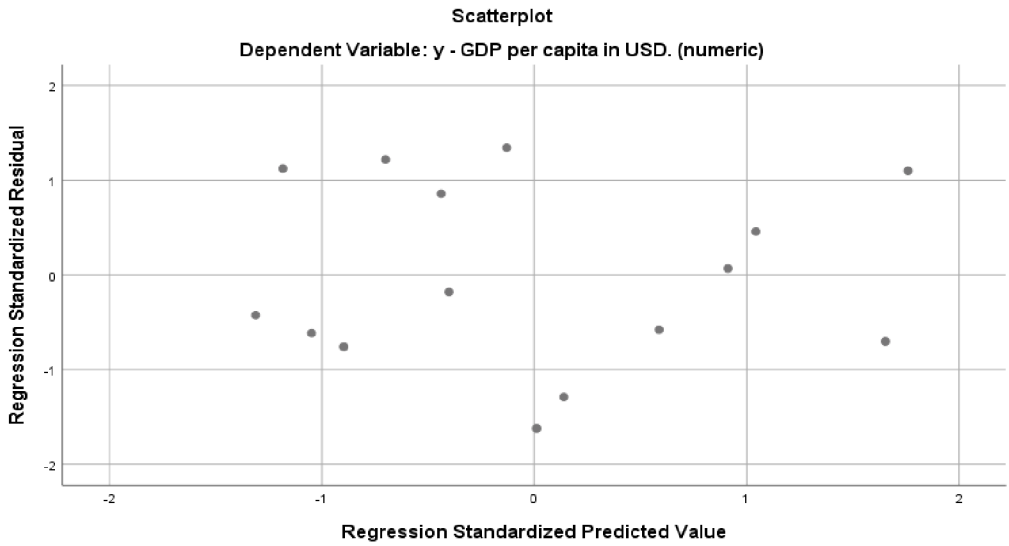
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.632[a]	.786	.760	2689.293	.820	1.665	4	10	.018	2.158

a. Predictors: (Constant), Expenditures on education in USD per capita, Mean years of schooling, Median age of years, Postgraduate students' number

b. Dependent Variable: y - GDP per capita in USD. (numeric)

The **F – test**, is shown in the **Table – 12.** In indicates the overall contribution of all independent variables on the dependent variable. The significance of F – test equals to .018 which is lower than the .05 alpha level, meaning that the data indicates a good fit to the model. Moreover, the author considers the Durbin – Watson and its value equals to 2.158, which indicates a zero autocorrelation. The model also demonstrates the **R – Square** on a relatively good level, meaning that dependent variable is explained by independent variables by **76 %.**

Picture 3: Heteroskedasticity for United Kingdom



Source: SPSS, IBM.

Based on the sampling size, 15, which is not a big sample size, we could see that residuals are close to each other, however, still the deviation is big. By looking at the **Picture – 1**, that indicates that the model has a heteroskedasticity roots.

Specification of the model:

GDP per Capita – USD

Median Years of Age – Years.

Mean Years of Schooling - Years

Postgraduate students – total number.

Expenditures on education per capita – in USD

B_0 *– Intercept term.*

$B_1, B_2, B_3, B_4, B_5, B_6$ *– Partial Regression Coefficients.*

t – Time period (2007 – 2021).

E – Error Term.

Based on the results of the coefficients, the assumptions almost were met, and the model is the following:

$$GDP_t = 19545{,}633 + 114{,}202*MYA_t + 808.874*MYSCH + .073*PGS_t + .759*ExOe_t + E_t.$$

4.4 Main finding

Within the practical part, the author has compared the identical data for two different states to see how independent variables effect the economic growth of developed states, such as: Federal Republic of Germany and United Kingdom. Based on the Linear Regression Analysis, the author identified different results for two different states. First of all, results differ from the statistical point of view, some of the variables in "Federal Republic of Germany" have demonstrated significant impact on the GDP per capita, whereas, the same variables in United Kingdom were not even statistically significant. The author applied a "Time vector" as a few variables have been consistent with its numeric values.

4.4.1 Summary for "Federal Republic of Germany"

After running a Linear Regression model, the author has excluded the variables**: undergraduate students total**, **total number of teachers** and **total number of institutions,** as they were not statistically significant after all. Acemoglu (2014) in his research has highlighted the importance of the "Undergraduate students" and what curriculum they receive, as those two in combination impact a long – term growth of the economy. He run a cross-sectional analysis for CIS countries and Turkey, where the data was presented in percentages as concerns the relationship between GDP growth and % of undergraduate students.

However, in the author's research, there is not such impact of undergraduate student on the GDP growth. The reason could be that the data was not computed in a percentage, but mostly numeric data was present. Still, the author lacked the data on the curriculum provided for both countries. It will be highlighted in the further chapter. The relationship between "Teaching staff" and "GDP growth" wasn't studied so far. The variable of "Total teachers" was added in the model to see whether it influences GDP growth. The variable was not significant; hence it was excluded from the model.

The last variable of "number of institutions". The variable was studied by Kanani and Larizza (2021) and concluded that "Institutions" have a power to change the direction of any state towards long – term prosperity. As a for variables, they captured various dimensions of institutional quality to identify rather a qualitative effect. The impact of their "dimensions" had

a low correlation rate .035. The correlation analysis was performed with the help of bivariate correlation. However, their sampling was mainly focused on such countries that undergone institutional changes overall. Germany and United Kingdom were the ones; however time frame was long – termed, between 1870 – 2008. They also included a lagged variable.

Nevertheless, in the author's research, the variable turned out to be insignificant.

4.4.2 Summary for "United Kingdom"

After running a Linear Regression model, the author has excluded the variables**: undergraduate students total**, **total number of teachers** and **total number of institutions** and student dropouts were identified as insignificant for the model, hence didn't have any impact on the GDP per capita.

In comparison with the "Federal Republic of Germany" this indicator demonstrated a statistical significance, even though it was small, still that indicates the importance of "students' dropouts" in Germany economy.

The model for "United Kingdom" demonstrates that the highest impact of the "GDP per capita" comes from "Students dropouts", whereas: in the "Federal Republic of Germany" The highest impact comes from "Expenditures on education per capita". This completely contradicts the study of Abington and Blankenau (2013) in concern of "United Kingdom". However, they did research a success rate on final exams and overall institutional impact on GDP per capita, concluding a positive correlation.

Comparison of both models

Overall, the models and its structure differ from each other. In both models' explanatory variables demonstrated the impact which is logical, and it was precisely described in the theoretical part. However, some variables were not statistically significant and in both cases, three variables of the same quality, demonstrated insignificance. None the less, the author excluded those variables and carried on the procedures. Both models met the Normality test and its distribution of residuals. Both models also have "Heteroscedasticity roots" which isn't an issue overall, however, the author would recommend do the further research that will be focused on explaining those roots more in – depth.

Both models also lacked the "Multicollinearity issue" and autocorrelation problem, based on "**Durbin and Watson**" test. Which indicated that data fits the model. The **R – Square** of both models demonstrated relatively good results, however, the data for "United Kingdom" was better explained by independent variables than for "Federal Republic of Germany".

5 Discussions

5.1 Limitations of the research

Unfortunately, the research perspective, there are not enough literature that studied the effect of the following indicators on the GDP per capita development, such as:

- Student dropout's ratio
- Number of post graduate students
- Number of teachers
- Number of institutions

Thus, this fact, has limited the research and its potential outcomes, whether those indicators have an impact only from the theoretical perspective or could actually impact the GPD of the selected countries in reality.

Another limitation of the study is the limited time that has been taken as a sample size. Number of years considered were only **15 years**. Even though, the results in theory demonstrated relatively good outcome. Still, the studies of Christel et el., (2007) discovered how low skilled labor force decreases the income level and how the increasing level of dropouts creates burden on social assistance programs which are financed by government, hence, considered as an additional cost. However, the level of dropouts might be slightly "underestimated" and the official statistic could not be a reliable source of information. Eventually, in the further research, it is better to consider that additional factors as "Low level of income".

Muhammed et al. (2008) demonstrate in his research the impact of graduates on economic growth across 120 countries for the period of 1976 – 1999. His research was limited due to "data availability" and undefined particular "spill over" effect. He substituted missing values with the "Lagged variable".

5.2 Implications of the research

Even though the study was performed with its certain limitations. It is still supporting an idea of having educational impact of the economic expansion. The models for both countries have demonstrated the positive effect of “selected variables” on the GDP per capita in both states. The author’s result demonstrates the same effect, where correlation is positive for both states. Hence, the dataset could be applied to further research from the theoretical point of view.

5.3 Similar researchers

Christle et el. (2007) discovered how low skilled labor force decreases the income level and how the increasing level of dropouts creates burden on social assistance programs which are financed by government, hence, considered as an additional cost. Moreover, the dropouts are associated with the several negative phenomena, mainly concerned with the reduction of well-being in the country.

Baldacci Emanuele and Gupta (2004) discovered that an increase in the amount of money that the government spends on education is strongly correlated with an improvement in students' academic performance. Yet, the beneficial effects of education investment are less pronounced in nations run by governments that are considered to be "poor." They have used a recursive set of equations in order to determine the direct and indirect link that exists between public spending on education, human resources, and overall economic development. In a sample of 120 developing nations for the period 1975–2000 (Baldacci et al. 2004), the findings suggest that public spending on education have a positive influence on education accumulation and consequently on economic development.

6 Conclusion

In this research, the author has described the essence of "Education" on the "Economic growth" across two developed countries, the Federal Republic of Germany and the United Kingdom.

Within the theoretical part, the author has focused on different research theories that contributed to explanation of the educational impact on economic growth. Such theories as "Neoclassical model", "Model growth theory", "Accounting growth" and etc were explained in – depth to see how educational factors contribute to such theories in the long – run.

In the Empirical part, the author has analyzed the data for 15 years and considered educational factors that were studied previously by (Barro, R.J., 1996) (Benos, N & Zotou, S., 2014) (Aghion, P & Howitt, P. , 1992) (Abington, C., & Blankenau, W., 2013) (Lorna P, Kerry A. and Stephanie, B., 2015) and many more.

Eventually, the author runs the Linear Regression Analysis where the "GDP per capita" was a dependent variable, and the rest (Student dropouts total, number of institutions, educational expenditures per capita, mean years of age, mean age of schooling, total number of teachers undergraduate total, postgraduates total) were as explanatory variables. The detailed summary is written in Chapters – 4.4.

Findings demonstrate that the economic growth of both countries is heavily dependent on educational factors.

In conclusion, a substantial body of evidence lends legitimacy to the notion that improvements in educational quality and access both contribute positively to GDP development and economic expansion in nations still in the process of industrialization. Education has the potential to improve a nation's social, economic, and political climates, and it also plays an essential part in the success of both individuals and communities. Investing in education yields even greater returns in underdeveloped countries than it does in more developed nations. An increase in both the quality and quantity of education may trigger a positive feedback loop, which can assist a developing nation in its transition toward a knowledge-intensive, creative, and service-based economy by enhancing the skills of its labor force. The data tends to point to a connection

between education and economic expansion, and studies have indicated that education aspects will have an influential impact on economic growth if public expenditures are allocated.

Despite other things, the author has concluded that public expenditures in the Federal Republic of Germany, with its significance level of **.022**, has the highest impact on the economic growth, however. Considering the fact of positive correlation, the more money spend by government on a public education, will potentially lead the country to a better – off conditions.

The same variable for United Kingdom didn't demonstrate such an impact but other opposite, it has a minor effect on the GDP growth. Nevertheless, the mean years of schooling, with its significance level of **.041**, has bigger impact on GDP growth. However, interestingly enough, the same variable for the "Federal Republic of Germany" impacted the dependent variable with quite a high coefficient 2332, and its significance is **.040**.

For both countries, it could be a sign of prolonging the average years of schooling in order to achieve the highest output per capita, hence increase its GDP in the long – run.

The findings of this research might provide a foundation for additional clarifications in this area, therefore assisting in the development of a comprehensive framework in connection between **public spending** on education and economic growth as well as "average years of schooling" as shown by a number of different indicators. It is notably advised that academics and policy makers utilize these data for the purpose of establishing better programs and policies with the goal of transforming education into a factor that boosts economic development.

7 References

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