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PARENTAL INVOLVEMENT AND SCHOOL STUDENTS' OUTCOMES

Master's thesis
Programme TAAM, specialisation Economic Analysis

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Tallinn 2022

I hereby declare that I have compiled the thesis independently
and all works, important standpoints and data by other authors
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ABSTRACT

The aim of the study is to determine and assess the effect of parental involvement in education on the academic performance of students. To achieve this goal, previous theoretical and empirical studies are analyzed. In addition, an econometric analysis is performed using RStudio software program for data from the Programme for International Student Assessment 2018 survey. The research methods used in this master's thesis are the following: the hierarchical cluster analysis, the ordinary least squares method, the two-stage least squares, also known as the instrumental variables method, and the non-linear two-stage least squares method.

The following research questions are asked in the master's thesis:

1. What are the positive and negative aspects of parental involvement in student education?
2. Is parental involvement positively or negatively associated with student's outcomes?

The first question of this master's thesis received an answer, according to which involvement can be divided into two types: *(i)* positive parental involvement, which is believed to reduce school absenteeism as well as promote children's social, emotional and academic growth, and *(ii)* negative parental involvement meaning overinvolvement, which implies a negative effect on students' success. Regarding the second question of the study, the econometric analysis confirmed that an increase in the index of parental involvement by 1 unit leads to an increase in the student's academic results by 24.75 points.

Keywords: Parental involvement, education, Programme of International Student Assessment, PISA, two-stage least squares method

INTRODUCTION

Investment in human capital is a central component of economic development policies in most countries and education as the main form of investment in human capital. (Jones 2016) This researcher also discovered that raising labour force educational levels boosted economic growth. High education is a necessity for the production of highly qualified specialists, which, in turn, is associated with the development of organizations and the economy as a whole. Thus, education plays a key role in the economic growth of countries. The level and quality of education can be viewed in terms of school student's performance, and in order to be able to understand this process, it is necessary to know the factors that influence student's achievements, because in the future this will affect the level of education of the workforce and, as a result, economic growth. Further in this thesis, the following synonyms are also used in relation to school children: students, school students/ children, and pupils.

Researchers often look at factors that affect a school student's performance, it can be such factors as parents' education, peers' influence, etc., or even more specific factors such as: whether the child gets enough sleep at night, pre-school, or breakfast before school. (Okano *et al.* 2019; Dye *et al.* 2013; Eshetu 2014) However, one of the most important factors in students' achievements, when at school, is the parental involvement. Parents and the family as a whole have long been an economic category of interest to politicians. The best predictor of student success is how families encourage homeschooling and are involved in their children's education. When parents are involved in their children's school life, students receive the support at home and the knowledge they need to not only complete their assignments, but develop a lifelong love of learning.

Parental involvement, in economic terms, can be defined as a direct parental effort to improve the educational outcomes of their children. This definition clearly refers to the productive function of education and makes parental involvement one of its arguments. The COVID-19 pandemic has highlighted the importance of parenting support because parents have been forced to join the direct teaching and learning process. (Vegas, Winthrop 2020) Parents' ability to support homeschooling can have a critical impact on children's learning outcomes, especially during school closures. (Brossard *et al.* 2020)

Although precise data on the impact of school closings on future student development is not yet known, research by Eric Hanushek and Ludger Wessmann (2020) shows that students in grades 1-12 who have been affected by school closures can expect an estimated 3 percent drop in income over their lifetime. This situation could lead to a decrease in the annual gross domestic product (GDP) by an average of 1.5 percent until the end of the century. Given that these learning disruptions continue, these losses will grow proportionally. Therefore, it is necessary to understand how parental involvement in education can be connected with the academic success of a student, because thanks to this, even at such a time, it would be possible to maintain the level of education and academic success of students at the proper level.

The aim of this master's thesis is to determine and assess the effect of parental involvement in education on the academic performance of students. Previous studies have generally confirmed the relationship between parental involvement and student achievement, but there have been conflicting results. Thus, the author is interested in further researching the topic and contributing to the empirical literature on educational economics.

The following research questions are asked in the master's thesis:

1. What are the positive and negative aspects of parental involvement in student education?
2. Is parental involvement positively or negatively associated with student's outcomes?

The research methods used in this master's thesis are the following: the ordinary least squares (OLS) method, the two-stage least squares (2SLS or TSLS) also known as instrumental variables (IV) method, and the hierarchical cluster analysis (HCA). For the empirical analysis data from the OECD (Organisation for Economic Co-operation and Development) Programme for International Student Assessment (PISA) 2018 survey was used complemented by some descriptive statistics.

Data processing and analysis were performed using the Statistical Package for the Social Sciences (SPSS Statistics), for regression data analysis was used free software RStudio. Graphs and tables were created using Microsoft Excel, SPSS, and RStudio.

The master's thesis is divided into three main parts. The first part summarizes the theoretical literature, including the theoretical background of the problem, influencing factors, and a review of previous research. The second chapter describes the methodology and sampling adopted, the

dataset, the variables used, and the composition of the sample. The last chapter presents and analyses the results, which delves into the content of the results obtained and the rationale for the results along with the conclusions.

1. LITERATURE REVIEW

The section presents a literature review to summarize previous studies and give ground for this thesis according to its aims. It begins with a discussion of the importance of education in the economy and the need to maintain education at an appropriate level and examines the types of parental involvement, and the respective positive and negative aspects of parental involvement in school children's education.

1.1. Education and economic growth

Countries around the world are striving to improve education in order to enhance the skills and employability of young people and to reduce economic inequality. Studying over the past two decades why some countries have achieved economic success while others have not, provides a much clearer picture of the role of human capital in economic development. The impact of human capital on economic growth is best described in terms of the relationship between direct measures of cognitive ability and long-term economic development. (Ozturk 2001) Empirical evidence points to differences in cognitive abilities as the explanation for most differences in the rate of economic growth across OECD countries. The main growth characteristic indicates that higher cognitive skills pave the way for continued economic improvement, so that favourable education policies today will have a big impact on the future of the economy. The core assumption is that countries with higher human capital (as measured by intellectual capacity) innovate at a faster pace than countries with lower human capital, which means that countries with greater human capital would continue to experience higher productivity growth. (OECD 2010)

Investment in human capital is a central component of economic development policy in most countries (Jones 2016). Based on Becker's (1994) human capital theory, a high level of education is a major determinant of social mobility and a country's economic growth and development. In addition, school students are the main assets of schools and then universities. Students' achievements play an important role in producing the best quality graduates, who will become excellent leaders and the workforce for the country, thus responsible for the country's economic and social development. People with higher skills are more productive and better adapted to

technological changes in the economy. Thus, education plays a key role in countries' economic growth. In a linear model, secondary and tertiary education have a positive and significant relationship with economic growth. According to the results by Marquez-Ramos and Mourelle (2018), a 10% increase in secondary education leads to a 1.5 percent increase in economic growth.

In many countries, however, the response to the COVID-19 pandemic has jeopardized the long-term future of current students, and the damage done may affect the global economy in ways that will be felt well into the distant future. The authors of a recent study for several countries around the world found that school closures are likely to reduce global economic growth, equivalent to an annual rate of 0.8 percent. (Psacharopoulos *et al*. 2021) Another study by the same authors reports that school closures reduce students' future incomes, a loss equivalent to 15% of future GDP. (Psacharopoulos *et al*. 2020)

1.2. Definition of parental involvement and its importance

Where does human capital come from? What constitutes a successful investment in human capital on an individual or national level? It is the basis of a good society and economic success. To understand human capital, we must start with the family, because the family is the foundation of a good society and economic success. Families are the ones who take care of their children and try to promote their children's education and values with all the resources they have. Especially considering the current worldwide situation, the importance of parents in children's education has only increased. As school facilities have been and still are forced to close due to the spread of the virus, school activities have been replaced by online learning at home and teachers now share the burden of teaching with parents. Faced with this situation, parents need to be able to play the role of homeschooling their children.

Educational economists are primarily interested in the resources allocated to education and their outputs. Parental involvement, from an economist's perspective, can be defined as the direct effort of parents to improve their children's educational outcomes. This definition explicitly refers to the production function of education and makes parental involvement one of its arguments. (Avvisati *et al.* 2010) Much of the economics of education studies is based on a simple production model. Indicators such as school resources, teacher quality, and family characteristics are considered as input data, and student achievement is considered the result.

The education production function (EPF) in its most basic form is as follows (Bowles 1970):

$$Y_i = f(X_1, X_2, \dots, X_n) \quad (1)$$

where

Y_i – the output (i. e. student's grade)

$X_1, X_2, \dots, X_n$ – inputs (e. g. class size, parental involvement, spending, teacher ability, etc.)

Despite the abundance of input data to this production function of education, the author focuses on the indicator of parental involvement, since parents are one of the most influential factors in their children's lives. According to the results of a study conducted by Sapungan (2014), parental involvement can be defined as any interaction between a parent and a child or a school that contributes to the child's development. Parental involvement activities are also presented as existing on a continuum that extends from homework to school activities and finally to cooperation between home and school. At one end of the continuum are home activities such as reviewing report cards, ensuring school attendance, and monitoring homework. In the middle are traditional school activities such as attending parents' meetings and volunteering. On the other end are more collaborative activities at school, such as planning classroom activities with teachers and participating in policy development. (Reynolds, Shlafer 2009)

Thus, parental involvement is multi-dimensional and is made up of different types of behaviour, attitudes, and parental expectations. (Merin *et al.* 2016) Based on the different interpretations of this terminology, a general conclusion can be reached, that parental involvement or in other words parental participation refers to the parents' use of resources for the benefit of the child and the total number of activities in which parents can participate in order to contribute directly or indirectly to their children's education and development. (Zedan 2012; Bornstein 2002; McWayne *et al.* 2004) It follows that family involvement in the school child's education acts as a social lift. Parents have the ability to shape, support, and develop children to be active, interested, diligent, creative, and tolerant through their positive involvement in learning and educational activities.

Various studies have shown that the fastest way to improve a school student's performance is to increase the degree and quality of parental involvement. (Jaafarawi 2017) According to a meta-analysis of 66 studies of school students' achievements by Henderson (1987), when parents participated in their children's schooling, one or more of the following outcomes were considered: higher grades and better test results, better attendance and regular completion of homework, fewer

students in special or remedial classes, higher graduation rates and more positive attitudes towards student behaviour in school.

Theoretical models link school students' performance and educational trajectories to the level of family resources (including cultural and social capital), to psychological factors (motivation, self-esteem) and educational opportunities (characteristics of schools, teachers and students themselves). The list of determinants is long. (Tovar-García 2012) Researchers consider family resources as the main explanatory variables. They include the different types of capital that parents invest in building their children's human capital. (Bourdieu 1984) In one of the previous studies, the authors noted that educational outcomes are strongly influenced by social capital, i.e. the network of social connections, especially the relationship between parents and children. (Coleman *et al.* 1966) It is important to understand that these approaches are complementary, not mutually exclusive.

1.3. Types of parental involvement

Joyce Epstein is a well-known sociologist who has devoted herself to researching parental involvement in students' academic performance. Epstein (1987) identified six subtypes of parental involvement, ranging from immediate or home influence to furthest or social influence. The first two categories include direct home influence. The first category 'at home' describes specific ways in which parents meet a child's basic needs (e.g. food, shelter and safety). The second category refers to specific activities that parents carry out to create a positive learning environment for the child at home. These include, for example, providing necessary learning materials, offering the child different activities (e.g. visiting a zoo, visiting a museum) where he/she can acquire new knowledge, and participating in these activities together with the child. The next two categories are those of school participation, which emphasise the interaction between family members and the school on issues concerning children. These include both dynamic communication with school staff and active participation in classroom and school activities. The last two categories belong to the most distant ones, i.e. participation in schools and communities. (Epstein *et al.* 2002) To summarise the above, these 6 types can be divided into two main types of parental involvement in their children's education: (1) parental involvement in school and (2) parental involvement in their children's learning activities at home (see Figure 1).

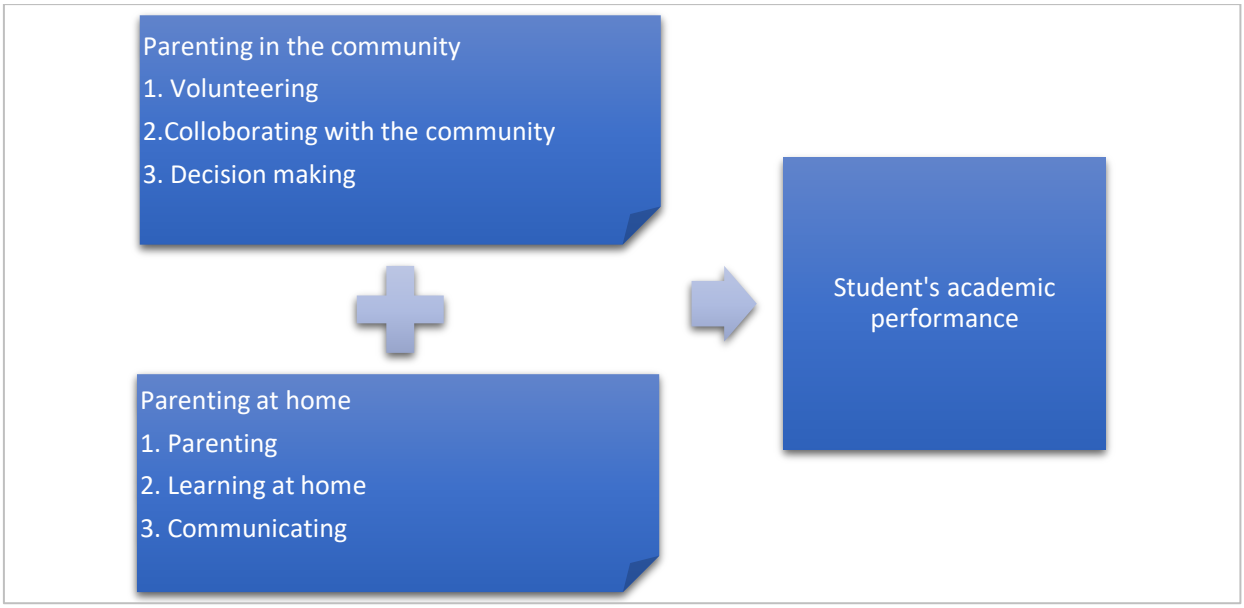

Figure 1. Types of parental involvement
Source: (Smokoska 2020), compiled by the author

These two main types are discussed below under separate headings.

1.3.1. School-based involvement

Parental involvement in school represents one of the most visible forms of parental involvement, emphasising the importance of the link between family and school. School-level involvement looks at practices that require contact between the parent and the school such as school assemblies, talking to teachers, attending school events and volunteering at school. In other words, activities that involve parents in school life with their children. (*Ibid*.) Carpenter *et al.* (2016) found that school involvement can vary, with some parents volunteering, others involved in community work and others participating in extra-curricular activities. A study by Murray *et al.* (2014) showed that almost all parents indicated that participation in school was important and that parents should be involved. Parents emphasised the importance of volunteering (e.g. helping teachers in class and accompanying them on trips with the class) as well as attending class and school meetings. Parental involvement has a positive impact on school students' progress, as parents who attend parent-teacher meetings and liaise with the school find it easier to keep track of their child's development and progress. Through participation in activities and constructive communication with the teacher, parents are informed of the teacher's expectations and parents can learn from the teacher how to support their child more at home and what methods to use to make learning more effective. (Dauber, Epstein 1989)

Various studies (Grolnick, Slowiaczek 1994; Jeynes 2014; Pomerantz *et al*. 2007) found a positive correlation between parental involvement in school and children's improved academic achievement, especially in the early years of school. Regular school attendance by parents demonstrates that school and home are interconnected and that school is an integral part of family life. (Sapungan, Sapungan 2014) Setting a positive example is also an important part of parental involvement, so it is the role and responsibility of parents to be model citizens and demonstrate the importance of education through their activities. (Carpenter *et al*. 2016)

1.3.2. Home-based involvement

Home-based involvement includes activities that take place outside the school, usually at the child's home. Parental home involvement can be divided into two forms: participation that is directly related to the child's academic life and participation in life in general. In-home involvement, it is important that the parent takes care of the child's basic needs and creates an ever-developing and positive learning environment for the child at home. (Sanders, Epstein 1998) It is the parent's responsibility to ensure that the child is fed, has a place to live and learn, that learning materials are always available and that the child is able to turn to the parent for help with learning. Non-academic parental involvement at home includes activities such as talking to children about their lives and the world around them, or participating in intellectual activities not directly related to schools, such as attending a play, concert, library or museum. (Pomerantz *et al*. 2007) Parental involvement at home also implies that parents create good patterns of social and educational values, for example through their own behaviour. (Desforges, Abouchaar 2003)

Home-based involvement can either be directly related to school work, such as help with homework or it can have a broader basis, such as guiding or supporting the child's academic choices, and discussing and advising the child on these issues. (Eccles, Harold 1993) Parental involvement in their child's education helps children grow up to be productive and responsible members of society. (Sapungan, Sapungan 2014) At the same time, it can be said that more is not always better and it applies to home participation, because a parent can support and guide their child, but they cannot make all decisions for the child, such as doing their homework (Pomerantz *et al*. 2007).

Pinantoan (2011) noted that the impact of parental involvement on a child's academic success should not be underestimated, as the support system a child receives from home is just as important

as their intellectual ability, work ethic and genetics, all of which work towards a goal. Moreover, children who are supported by both parents enjoy attending school much more and get very good grades compared to their peers whose parents are not involved at home and are unfamiliar with what goes on in school. (Desforges, Abouchaar 2003) It has also been found that parents who follow their child's schoolwork and activities consistently interact more closely with the teacher, thereby contributing to their child's further academic success. (Henderson, Berla 1994) The home learning plays an important role in understanding how children learn at school and in working with the school to help their children to achieve good learning outcomes and goals. (Bu-Hyun, Duk-Byeong 2014) In the case of home participation, parent-child interaction on school and academic topics are also important, and how often parents and children talk about school matters has a significant impact on a child's academic performance. (Jeynes 2005) Parents who are also involved in school involvement can use this knowledge to talk to their children about events they have experienced at school and to explore their child's plans for the future, as these conversations are also part of home involvement. (Carpenter *et al*. 2016) All this promotes communication between child and parent as well as child development and shows that school and home participation complement each other.

1.4. Effect of parental involvement on students' achievements

Depending on the type of parental involvement and behaviour, the effects of parental involvement can have quite contradictory results.

1.4.1. Positive impact

Educational researchers have long been interested in the positive impact of parental involvement on children's learning. (Epstein 1991; Fan, Chen 2001) The notion that parental involvement has a positive impact on student performance has led to a wealth of literature on the subject. (Hill, Tyson 2009; William 2003; Patall *et al*. 2008) The authors of a recent study used the multilevel structural equation modeling (MSEM) method to investigate the Programme for International Student Assessment (PISA) 2018 database and discovered a positive relation between parental involvement and student's success. (Çoban 2020) Sebastian *et al.* (2016) used the confirmatory factor analysis (CFA) method on the PISA 2012 dataset and came to a similar conclusion. Also Giannelli and Rapallini (2018) investigated parental attitudes toward mathematics and its impact on students' academic performance, concluding that children's math performance improves when

parents believe mathematics is worthwhile to study because of its utility in the labor market. Policy-makers and researchers seem to agree that parental involvement is a critical component of children's academic success. (Graves, Wright 2011; Mattingly *et al*. 2002)

It is believed that parents who are actively involved in their children's education contribute to their children's social, emotional and academic growth, as parental engagement motivates children to learn. (Green *et al*. 2007) The level of involvement is crucial in exerting a strong influence on the school students' academic performances. The higher the level of parental engagement, the greater the impact on the child's academic achievement. The research by Lara and Saracostti (2019) includes three types of parental participation: high, medium and low. The results show higher achievement of school students whose parents have high and medium levels of involvement compared to children from families with low levels of involvement. A more recent study by Naite (2021) further supports this concept. The results show that students from actively involved parents have higher test scores in all subjects compared to children from uninvolved parents. Conversely, poorly engaged parents are able to suppress and destroy their children's motivation and abilities through neglect and indifference to their achievement. (Zedan 2012)

Looking at the effect of parental involvement from a different angle, results from a study of secondary school students in a public school show a strong negative correlation between parental involvement and absenteeism, and the study by García and Weiss (2018), in turn, has proved that when students are absent from classes, their academic performance declines. (Grepon, Cepada 2020) This can lead to student expulsion and according to Jason Schoeneberger (2012), students expulsion has long-term consequences on the economy, such as unemployment, low income and more frequent criminal activity. Consequently, it can be concluded that parental involvement encourages children to attend school regularly and increases student performance, which in the long-run has a positive effect on the economy.

1.4.2. Negative impact

Despite the widespread belief that parental involvement increases student achievement, some research contradicts the above, indicating that excessive parental engagement can have detrimental effects and have a negative impact on student success and achievement. (Desforges, Abouchaar 2003; Fan, Chen 2001) Some studies have shown that certain types of parental involvement are negatively related to achievement. Using the data of the 2012 PISA math survey and multilevel regression, Castro *et al.* (2015) found five primary factors that significantly affect student's

performance, including parental participation in the form of homework assistance, which had a negative impact on student's achievement. In addition, Fernandez-Crehuet and Perote (2016) came to a similar conclusion that parental involvement in homework is a good predictor of poor student's performance. This can be seen as further evidence that there is a "reactive" hypothesis that a student with academic or behavioral difficulties in school results in higher levels of parental involvement, although early research has shown that this hypothesis has little empirical support. (McNeal 2012)

Patall *et al*. (2008) found that when parents were directly involved in their children's education, it had a negative impact on their children's achievement. In previous work, Singh *et al*. (1995) investigated the effect of four components of parental involvement on the academic performance of eighth-graders, namely parental commitment to children's education, parent-child communication about the school, the structure at home and parental participation in school activities. They showed that parental involvement in school activities was not related to academic achievement, while home structure had a small negative relationship.

The way parents engage in their children's learning is associated with different effects on academic achievement. Communication style is positively related to academic performance, while control style is negatively correlated with academic performance. (Fernández-Alonso *et al*. 2017) Parents want the best for their children, and sometimes this can lead them to be too involved in different aspects of their child's life. One example of this in relation to academic achievement is support with homework. According to Shumow and Miller (2001), parental involvement in homework has a negative impact on student achievement in the form of lower test scores. Sometimes when parents try to help with homework, they are more of a hindrance to their child's learning than a help. (Patall *et al*. 2008)

Parents who regularly help their children with their homework contribute to a lower level of their autonomy, in turn, such school students have a lower level of academic performance because they do not take responsibility for their learning. This aspect is very important and has an effect in the long term because when school students take responsibility for their education, they lay the foundation to take responsibility for their actions in later life. (Fernández-Alonso *et al.* 2015)

In other words, school children who receive positive reinforcement from their parents are more likely to have higher academic achievement, while school students who have overly involved and

controlling parents are more likely to have lower academic performance. As parents increase control over their child's homework, the child's sense of self-efficacy decreases, leading to lower levels of functioning.

2. DATA AND METHODOLOGY

This chapter describes the database used, as well as the basics and content of the two-stage least squares (2SLS or TSLS) analysis methodology, also called the instrumental variables (IV) technique, and of the hierarchical cluster analysis (HCA) that is used to understand a more complete picture of the data. In addition, the indicators on which the estimates and conclusions are based are specified. Data processing and analysis were performed using the Statistical Package for the Social Sciences (SPSS Statistics), for regression data analysis was used free software RStudio. Graphs and tables were created using Microsoft Excel, SPSS and RStudio.

2.1. Data

In this thesis, the author uses data from the Programme for International Student Assessment, abbreviated as the PISA study. PISA assessments are conducted by the OECD every three years. The PISA survey assesses how well 15-year-olds who complete compulsory education possess the key knowledge and skills needed to fully participate in today's society. The study is conducted in relation to the three main areas of knowledge that are affected by the school curriculum: reading, mathematics and sciences. PISA measures the combined outcomes of education and learning at a stage when most children are still attending formal education (age 15). The 15-year-olds in the PISA sample also had to be enrolled in an educational institution in grade 7 and above. All such students were eligible to take the PISA assessment, regardless of the type of institution they were enrolled in and whether they were enrolled in full-time or part-time education. Detailed information on the sampling strategy can be found in the official report (OECD 2019a).

The original plan was to use the new PISA 2021 dataset for quantitative analysis, but due to the pandemic, the release was delayed until 2022, so it was decided to use the most recent study available, which is the PISA 2018. PISA collects data from both OECD and non-OECD countries and provides an opportunity to study patterns of parental involvement in many countries and economies. Based on the latest PISA 2018, nearly 600,000 15-year-old students from 79 countries and economies were tested. (OECD 2018a) Five additional questionnaires were offered as options

in PISA 2018: questionnaires on computer familiarity, well-being, educational careers, parents and teachers questionnaires. (OECD 2019b)

Given that the study requires the author to examine student and parent questionnaires, this study will only include those countries where PISA collected information on parent surveys in addition to student surveys. In 17 countries (9 of which were OECD countries and economies), questionnaires were distributed to parents to provide information about their home environment, their children's participation in school and their children's career aspirations. (OECD 2019c)

These 17 countries include:

- 9 OECD countries: Belgium (Flemish), Chile, Germany, Ireland, Italy, Korea, Luxembourg, Mexico, Portugal;
- 8 non-OECD countries: Brazil, Croatia, Dominican Republic, Georgia, Hong Kong (China), Macao (China), Malta, Panama.

Although Macao and Hong Kong are China, i.e. one country, they are considered in PISA as two different economies, since Hong Kong and Macau are special administrative regions of China, they have a high degree of autonomy compared to other regions of China, including their own economies, systems of government and education. Therefore, the author decided to follow PISA and also consider them separately from each other. Also, these 17 countries and economies can be divided according to the criterion of belonging to the European Union. Figure 2 provides this information.

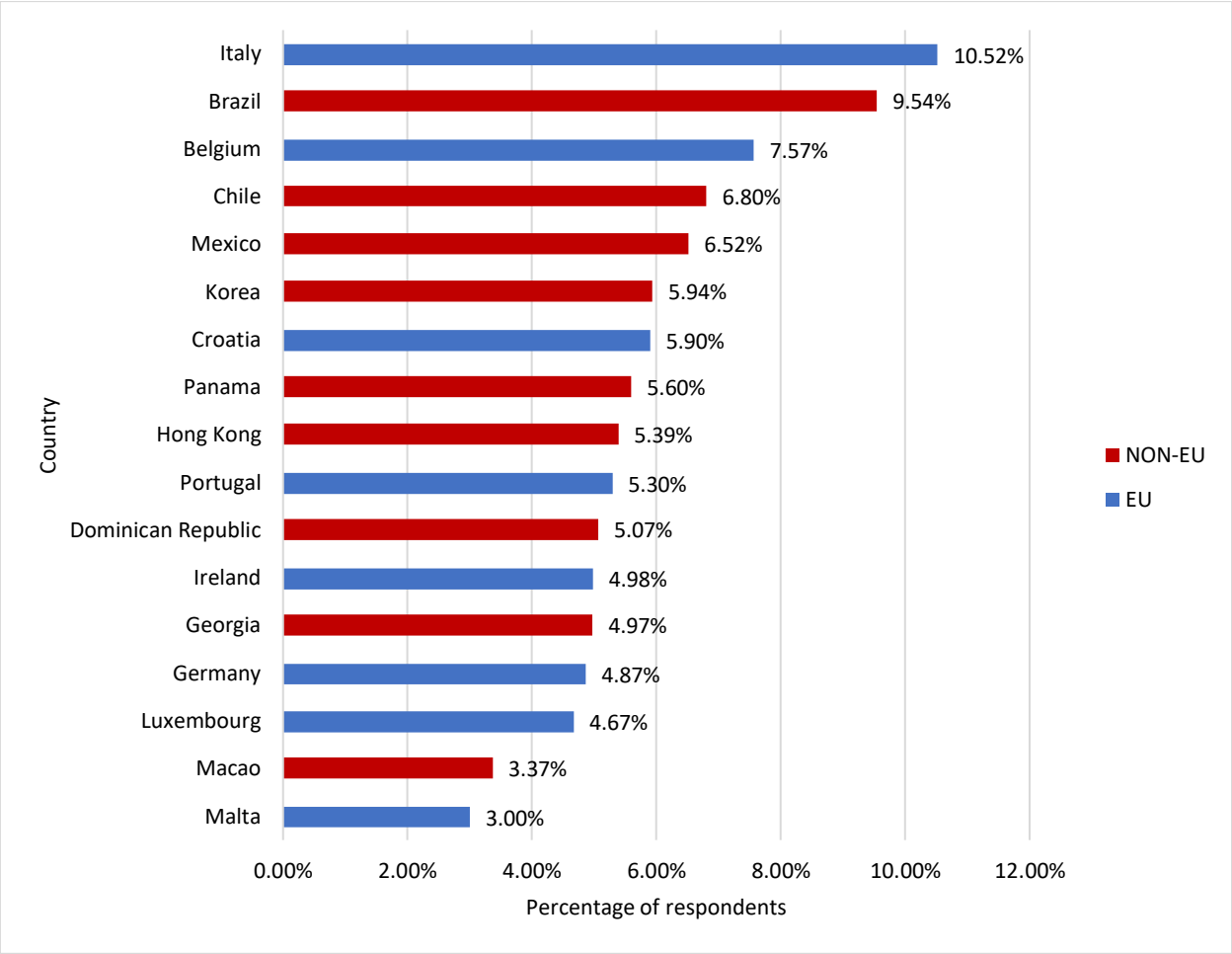

Figure 2. Countries and economies where the parent questionnaire was distributed
Source: Compiled by the author

Based on the data from Figure 2, it follows that the largest participation was taken by children with parents from Italy and the smallest from Malta. This graph also separates the countries according to their membership in the European Union. Accordingly, of the 17 countries and economies in which parent questionnaires were distributed, 8 are European Union members and 9 are non-EU members.

A limitation of this sample is that the parent survey was optional, and some parents did not participate in the PISA parent survey, so their blank questionnaire and thus their children's results would have to be excluded from the sample. There were also incorrect or missing values in the responses, so the author had to exclude these observations. After excluding missing values, the final sample of this study includes 14 countries and economies: Italy, Chile, Croatia, Portugal, Hong Kong (China), Georgia, Ireland, Dominican Republic, Panama, Belgium (Flemish), Macao (China), Malta, Luxembourg, Germany.

As only 14 countries and economies provided correct information on parental participation in the survey questions, the results of this working paper cannot be generalized to other countries or even to the countries and economies that were included in the survey sample, as the sample is not representative. Care should be taken when using the results for this limited set of countries and economies to make decisions about parent participation.

Further, the author will consider separately each of the variables used, their method of processing and provide descriptive statistics.

2.2. Methodology

Based on the previously studied literature, the main econometrical approach the author plans to use is the two-stage least squares model (2SLS or TSLS), also known as the instrumental variables (IV) method since from a methodological point of view, the study of the relationship between parental involvement and school performance of pupils may suffer from the problem of endogeneity. Moreover, also the ambiguity of whether parental involvement leads to improved academic performance, or whether poor academic performance causes parents to interact more actively with their child. Associated with endogeneity is the possibility of unexplained effects due to omitted variables (omitted variable bias). For this reason, the instrumental variable method should be used to study potential endogeneity. (Blank 2016)

The two-stage least squares (2SLS or TSLS) method was proposed by Heckman and it is a standard econometric approach used to solve the problem of data endogeneity, which can arise from missing explanatory variables in a regression, leading to correlations of the error term with the explanatory variables, thereby violating the basic assumption underlying conventional ordinary least squares (OLS) regression analysis. (Heckman 1979) When evaluating systems of simultaneous equations, the instruments are usually the exogenous variables of the system. The availability of information about such an instrumental variable allows to isolate the exogeneity of the model, and thus obtaining objective estimates. (Schlotter *et al.* 2011)

The instrumental variable is the third variable introduced into the regression analysis that correlates with the predictor variable but does not correlate with the response variable. By using

this variable, which helps to control for biases and measurement errors, it becomes possible to estimate the true causal effect that some predictor variable has on the response variable. In particular, the instrumental variable Z is an additional variable used to evaluate the effect of variable X on Y. According to the standard definition, a variable Z is instrumental (in relation to the pair (X, Y)) if it is independent of all variables (including errors) impacting Y that are not mediated by X, and it is also independent of X. (Pearl 2009) Therefore, the instrumental variable Z affects Y only through its influence on X and variable Z is not related to the outcome (Y). In this sense, the key issue in the implementation of the IV approach is the choice of an instrument that would meet certain conditions (Figure 3), which have been described in detail above. (Wooldridge 2000)

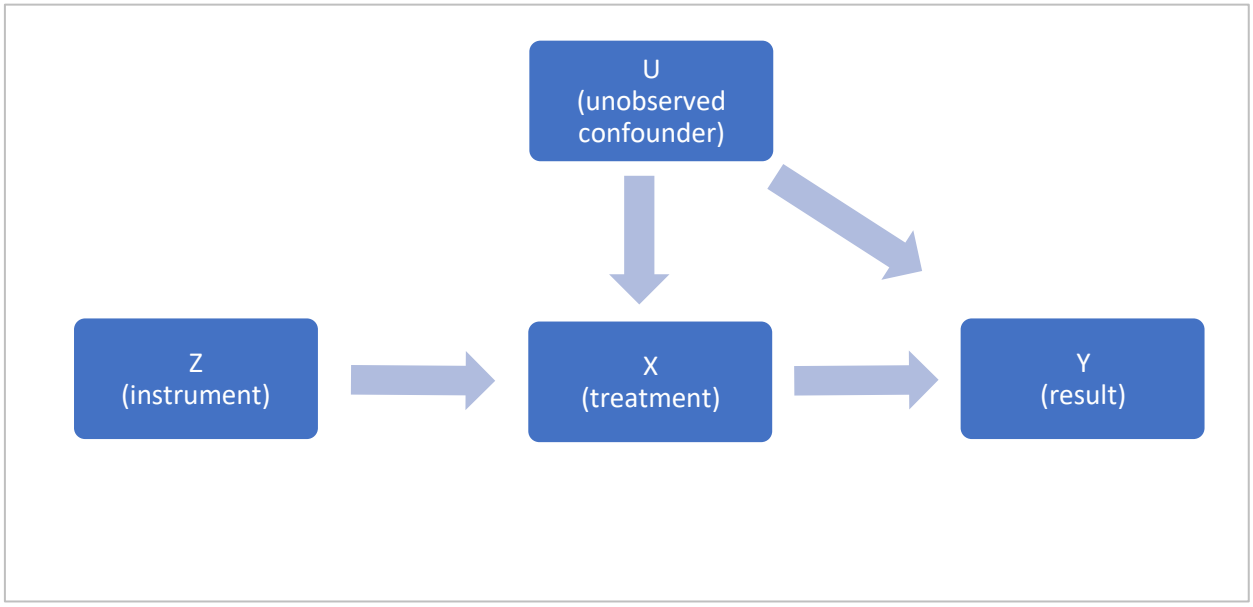

Figure 3. Instrumental variable (IV) assumptions
Source: Compiled by the author

Summarizing the above, there are two main criteria for determining instrumental variable:

1. it must cause a variation in the treatment variable;
2. it has only an indirect effect on the outcome variable through the treatment variable.

These two conditions must be met for a reliable IV implementation, as well as a sufficient sample size to allow for a realistic evaluation of the treatment effect. If the first assumption is not met, meaning that the IV is linked to the result, the IV effect estimation may be biased. If the second

condition is not met, i.e., the IV has no effect on the treatment variable, the random error will have a similar effect on the treatment variable. (Lousdal 2018)

Taking into account all the above considerations, the model can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 W_i + u_i \quad (2)$$

where
Y_i – dependent variable (students' mean score)
X_i – endogenous independent variable (parental involvement)
W_i – exogenous variables (control variables)
Z_i – instrumental variable
u_i – error term

Since the method is called the two-stage least squares model, so this will involve running OLS twice. The first step is used to regress endogenous variable on all instruments and all exogenous variables:

$$\hat{X} = \hat{\pi}_0 + \hat{\pi}_1 Z_i + \hat{\pi}_2 W_i + v \quad (3)$$

The second stage is used to implement the model-estimated values from the first stage in place of actual values to compute an ordinary least squares model for the response of interest:

$$Y_i = \beta_0 + \beta_1 \hat{X}_i + \beta_2 W_i + u_i \quad (4)$$

In the presented linear model (2), the dependent variable is defined as the students' average score in three subjects: mathematics, reading and science. The predictors are the following variables: parental involvement index calculated based on types of activities and control variables. Also, the model includes instrumental variable (IV) and error term. A description of the choice of instrumental variable and a more detailed characterization of each variable included in the model is presented in the following chapters. Also, the use of the 2SLS method has been slightly extended to use it in a non-linear form. (Essen 2015) To do this, the instrumentation was applied using Z and Z^2, where Z is a valid instrument in form of parental expectations. (Wooldridge 2000)

For a more in-depth descriptive analysis and a better understanding of the overall picture of the data, the author also used hierarchical cluster analysis (HCA). Hierarchical clustering (also called HCA) is a cluster analysis method that builds a hierarchy of clusters, it is designed to split the source data into combinable groups, so that elements are included in the group of the most "similar" and elements from different groups were maximally "different group" from each other. Typically, HCA results are presented as a dendrogram. The algorithm's dendrogram output can be used to understand the big picture as well as the groups in your data. (IBM 2021) Ward's method was chosen as the cluster agglomeration method, since it analyzes the dispersion of clusters, instead of direct distance measurement. The Ward's method is considered to be the most suitable method for quantitative variables. (Yuxuan Hu, Meng 2018)

Ward's method is aimed at minimizing the total intracluster variance. At each step, a pair of clusters merge with a minimum intercluster distance. In other words, it forms clusters in such a way as to minimize the loss associated with each cluster. At each step, we consider the union of each possible pair of clusters that give the smallest increase in the total sum of distances. (Murat 2020)

2.2.1. Choosing an instrumental variable (IV)

Parental involvement is related to characteristics of parenting background, in particular parental income and family structure. In terms of income, low-income parents have been found to be less likely to participate in their children's education. (Lanot, Chevalier 2002; Jenkins, Schluter 2002) This may be due to a lack of knowledge, motivation, longer working hours, transportation problems, some other difficulty or a combination of these. (Card 1999; West 2007) It is also possible that parents with lower incomes may also have lower parenting abilities. (Mayer 1997) This may explain why, when low income/educated people choose to participate, their participation benefits their child less than the corresponding participation contributions of parents with higher income/education. (Canova, Vaglio 2010; Maynard *et al.*1981)

In terms of family structure, there is evidence to suggest that single-parent households are a predictor of parental involvement, but single-parent families often have lower levels of participation, such as volunteering. (Cooper 2010; Jeynes 2005; Kalenkoski *et al.* 2006) The research by Magwa and Mugari (2017) also identified a number of factors associated with parental involvement, one of which is the socioeconomic status of the parents, which includes the level of education of the parents, employment status, and income. This study argues that due to low levels

of literacy, parents lack the knowledge and skills needed to help their children learn. It has been found that educated parents are more likely to be involved in their children's work than illiterate parents.

These results are consistent with the literature, which states that the level of education that parents have achieved determines whether parents will actively participate in their children's learning. (O'Donoghue 2014) Lee and Bowen (2006) found in their study that parents with higher education are more likely to attend meetings organized at school, and talk more about educational topics. Such parents are more involved in their children's work because they know the learning requirements and can place high expectations on their children. Shumow, Lyutykh and Schmidt (2011), as well as Glick and Hohmann-Marriott (2007) show, among others, that student achievement is related to parent participation, and parental education levels can influence parent participation.

Research on parenting has also shown that parental education is associated with a warm social climate in the home, which in turn affects children's success. Klebanov *et al.* (1994) found that both mothers' education and family income are important predictors of the physical environment and learning experience in the home. In the same way, Duncan and Brooks-Gunn (2000) found that the relationship between family income and parental education and children's academic performance was mediated by the home environment. The mediation effect was stronger for the mother's education than for family income. Thus, these authors argued that education may be associated with certain behaviors in the family. Corwyn and Bradley (2004) in their research concluded that, with some indirect effects through an intellectually stimulating home environment, the mother's education has the most consistent direct effect on children's behavioural and cognitive results.

Other authors (Lee, Bowen 2006) argued that parents with high socioeconomic status are more involved in their children's school work than parents with low socioeconomic status. The fact that parents' socioeconomic status affects parental involvement was also noted by Hornby (2011). Hornby argues that poor parents are less involved, less informed, and more likely to have problems with language, transportation, communication and childcare. The foregoing leads to the conclusion that probably parental education or income, and, accordingly, socioeconomic status, are not good enough instrumental variables, since they can directly correlate with the achievements of children, which does not satisfy the conditions of the instrumental variable.

Vincent and Neis (2011) come to the conclusion that the work schedules of parents in the modern world have changed, reaching a configuration in which both parents work full-time and even irregular working hours. In addition, they found that parents' work schedules can affect the emotional state of parents, influencing their relationships and interactions with their children, which ultimately indirectly affects student achievement.

The work by Cabus and Ariës (2016) explores the hypothesis that if family size increases, younger children receive less parental involvement than older children. The authors also face the challenges of endogeneity and reverse causation, to overcome this they use birth order as an instrument for parental involvement. The birth order is assigned randomly, and in addition, the child cannot influence his/her rank in the family. Birth order as such, is exogenous to the child. Damian and Roberts (2015) show that birth order is not an important determinant of personality and intelligence, and therefore this study supports the hypothesis that the main influence of birth order on student achievement is due to differences in parental participation. The authors of another study in the same area pointed out that although the family size and birth order are closely related to each other, they are still conceptually distinct. Family size is a constant for each child in a household and captures unobservable information at the household level. On the other hand, birth order is an individual (children's) level instrument that differs between siblings. Thus, the authors evaluate the impact of birth order on academic performance through its (negative) relationship with parental participation and as a function of family size. The authors confirmed that older children, on average, receive more parental involvement than the youngest family members. (Cabus, Ariës 2016)

Another variable that deserves attention is the academic expectations of parents, which are defined as the beliefs and requirements of parents regarding the future academic achievements of their children. A study by Davis-Kean (2005) found that children learn better and get higher grades whose parents are aware of their academic achievement compared to those whose parents show no interest in children’s studies. Goldenberg *et al*. (2001) stated that high achievers were more likely to come from families with higher educational expectations. Such children are more successful in their studies because their parents cooperate with them in every possible way and control their activities through their involvement so that they can get more success. When parents think about the importance of education and expect high academic performance for their children, they become more occupied with activities and tasks related to learning. Consequently, parents

help and support children, then tasks become easy and interesting for them, which leads to maximum achievements in educational activities. (Sy *et al.* 2007) In addition, parental involvement has been found to influence students' achievement-related beliefs, including their perceived competence and aspirations for academic achievement. (Grolnick, Slowiaczek 1994) Of particular relevance to this review are data showing that parents who value education more and have higher expectations for their child's educational achievement tend to be more involved in achievement-related activities, including reading to their children, sending them for extra-curricular lessons and training, as well as monitoring their progress. (Halle *et al.* 1997) It is also worth noting that parents with high expectations for their children's educational success may invest not only time and effort, but also money. Some studies note that investment in children and their education is also part of parental involvement. In a meta-analysis, Stephen and Charol (1986) came to the conclusion that the costs directly related to education have the most positive impact on student achievement. For example, private tutoring or the purchase of a computer to help with studies can be seen as parental participation in education in the form of financial activity. Grolnick and Slowiaczek (1994) even describe parental involvement as the allocation of resources by the parent to the child, as well as LaRocque *et al*. (2011) explain parental involvement as the investment of parents or guardians in the education of their children.

In most of the studies examining the association of parental expectations with student achievement, researchers have tested and found strong and consistent evidence of a positive relationship between parental expectations and the achievement of European students. (Alexander *et al.* 1994; Neuenschwander *et al.* 2007; Phillipson, Phillipson 2007) None of the studies that have examined the relationship between parental expectations of families of European ancestry and children's achievement has failed to find an association.

The results, however, were not consistent for students of other races, such as Asian Americans or African Americans. (Okagaki, Frensch 1998; Sy *et al.* 2007) A study by Vartanian *et al.* (2007) with 9,494 participants showed that parental expectations were an important predictor of graduation for non-Asians, but not for Asian Americans. Davis-Kean (2005) studied children aged 8-12 and found similar patterns in African Americans: parental expectations had a direct significant impact on the academic performance of European Americans, but not African Americans. Similar to the results of studies of Hispanic students, none of the studies reviewed found a significant relationship between parental expectations and student achievement. An analysis (Goldenberg *et al.* 2001), conducted on a small sample of 57 people, found no significant

relationship between parental expectations and school performance (measured by teacher grades) or test scores in reading and math. Similar results were found in a large study of 1,050 Hispanic immigrant students and families, which found that parental expectations measured in 10th grade were not related to children's math achievement in 12th grade. (Dick 2008)

These conflicting results raise questions about the mechanisms by which parental expectations influence student learning outcomes. Probably, as the authors Yamamoto and Holloway (2010) of the article suggested, that parental expectations affect students' academic results not directly, but, for example, through the intensive and effective participation of parents.

Taking into account all of the above, the author comes to the conclusion that such variables as income, education, and hence the socio-economic status of the family can be correlated with the achievements of students, which makes it impossible to use these variables as instrumental variables for the model (Figure 4). Also, based on the previously studied literature, the author suggests that parental expectations are not directly related to the achievements of school children, but through parental behaviour and their involvement.

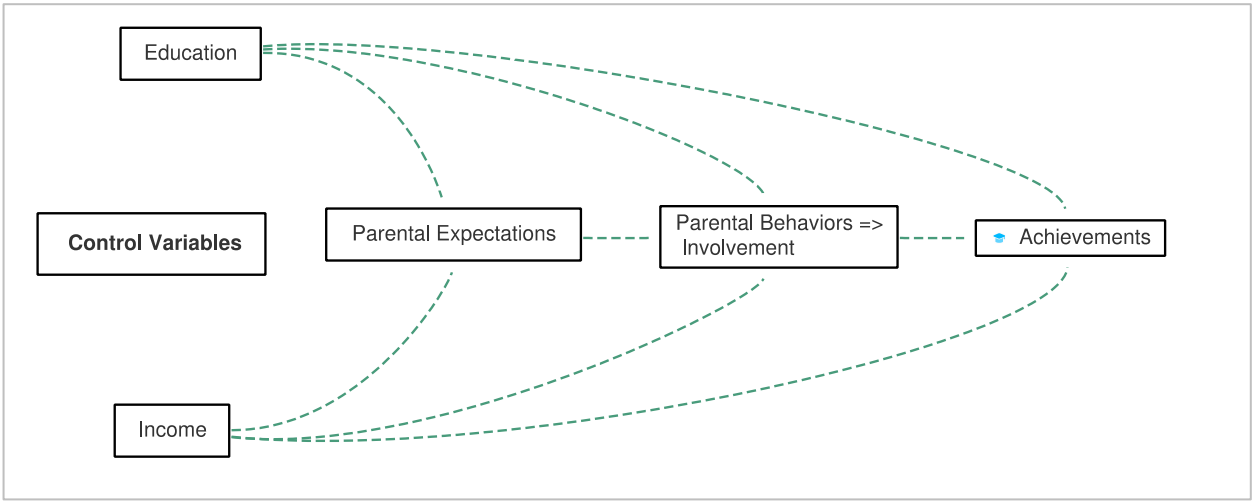

Figure 4. Conceptual model. Indirect and direct relations with students' achievements
Source: (Davis-Kean 2005), compiled by the author

Summing up all of the above in this chapter, it can be concluded that probably suitable instrumental variables would be:

- birth order;
- family structure;

- parents' work schedule;
- parents' expectations.

In the next chapter, the author will explore the database for econometric analysis and match potential instrumental variables with the available data in the database.

2.2.2. Variables explanation and processing

- Dependent variable

In the two-stage least squares (2SLS) model chosen by the author, the dependent variable is the students' overall average grade in three subjects: mathematics, science and reading. For each scale and subscale, ten plausible values (PV) per student are included in the PISA international database, meaning each of these variables is measured by 10 plausible values that PISA uses to report student performance. The plausible values are a set of likely skills for the students who scored each score. Plausible values are generated by multiple imputations based on students' responses to a subset of test questions they were asked at random and their responses to the original questionnaires. (OECD 2014)

In some empirical research on plausible values, usually, two different ways of doing secondary analysis with econometric methods can be found. Firstly, analysts often choose to use only one of the five or ten plausible values. In this case, the standard errors of the statistics of interest are usually underestimated because the uncertainty associated with measuring skill distributions is ignored. However, PISA analysts pointed out that the use of one or five plausible values in a large sample does not really matter. (OECD 2009) In fact, during the data exploration phase, statistical analysis can be based on a single plausible value, although it is highly recommended to use all available values to improve the accuracy of estimates even for large samples.

The second method used is to calculate the average from the existing plausible values (five or ten) and use it as if it were the only available assessment of student achievement. (Reimer *et al.* 2018) The main problem with calculating this average as a performance measure is that standard errors are grossly underestimated (especially if only one plausible value is used), which can lead to misleading results. Therefore, the mean of the available plausible values should never be used in empirical analysis with econometric methods. (Davier *et al.* 2009)

Based on all of the above, it is not so easy to calculate the average, because according to the OECD guidelines for preparing PISA data for analysis, it also states that the plausible values should not be averaged at the student level, i.e. by calculating the average of five or ten likelihood values in the data set student-level values, and then computing the statistic using that average plausible value. (OECD 2022)

Secondary analysis should be performed independently of each of the available plausible values so that they can provide appropriate estimates of population statistics such as means and variances. (Goldstein 2004) In particular, the correct procedure for processing likely values can be divided into five steps based on the OECD guidelines for preparing PISA data (*Ibid*.):

1. calculate estimates for each plausible value (PV);
2. calculate the final estimate by averaging all the estimates obtained from the first step (1);
3. calculate the sample variance (an unbiased estimate is provided using only one PV);
4. calculate imputation variance (variance of measurement error estimated for each plausible variable (PV) and then averaged over a set of PVs);
5. calculate the final standard error by combining the third (3) and fourth (4) steps.

To make it easier to perform these actions, the "univar" macro was developed in the SPSS program to work with plausible values. (OECD 2009) Based on the previously mentioned PISA technical guidelines and using the "univar" SPSS macro, the author adapted it to the PISA 2018 database, because unlike earlier studies where 5 plausible values were used, PISA 2018 uses 10 plausible values.

In order to be able to compare the results obtained by the author and the official PISA reports, thus, to test the methodology, the author used the entire database without exceptions, then conducted an assessment and received the results (Figure 5). Thus, the author repeated the PISA methodology and received the results of average scores in mathematics, reading and science, which absolutely coincide with the official published results of the OECD PISA, which confirms the correctness of the methodology, which means it can be used for further estimated sampling of the author. (OECD 2019d) However, for further econometric analysis, the author intends to use the total average score for all three subjects as a dependent variable, which is calculated by the usual calculation of the average from the obtained values from the plausible variables, which is also displayed in Figure 5.

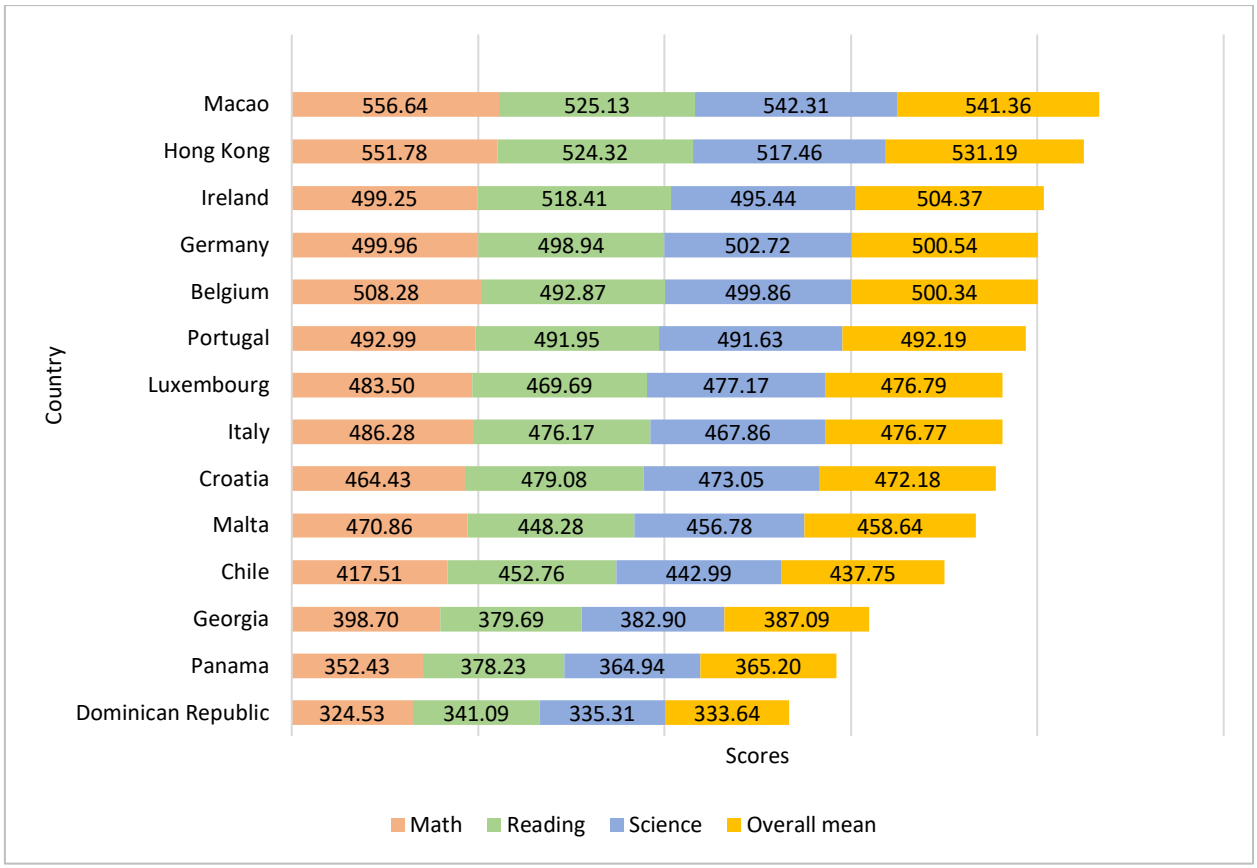

Figure 5. Mean test scores by country and subject based on plausible values (PV)
Source: Author's calculations

The graph shows that China, in particular Macau, has the highest averages in math, reading, science, and therefore the highest overall average in all three subjects. The Dominican Republic has the lowest results. If focus only on the countries that are members of the European Union (EU), then of them the highest score in reading and the overall average score is in Ireland, which is also a member of the OECD countries, and the lowest in Malta, which is not a member of the OECD. Among the EU countries, in mathematics leads Belgium (OECD country) with 508.28, and Croatia occupies the last place in this ranking with 464.43 points (non-OECD). In the field of science, Germany is in the lead - 502.72 (OECD), and again, Malta lags behind the most - 456.78 (non-OECD). What is noteworthy, when studying the EU countries and their belonging to the OECD, it is noted that the countries that are members of the OECD have the highest scores, and the lowest scores that do not belong to the OECD. This is because the economic infrastructure of OECD countries is fundamentally more extensive than that of countries that do not participate directly in the OECD. (Campbell, Donev 2019)

As mentioned above, the author tried this technique with the full amount of data in order to be able to compare obtained results with the official PISA reports. Nevertheless, the technique has confirmed its correctness and for further analysis the author uses an estimated sample, which includes 60,147 observations (Table 1).

Table 1. Sample statistic

Country	N	Percent (%)	Mean	Minimum	Maximum
Macao	3,352	5.57	543.05	269.57	731.25
Hong Kong	4,660	7.75	538.67	253.91	749.13
Germany	2,191	3.64	533.79	252.47	773.06
Belgium	3,378	5.62	531.75	263.10	735.70
Ireland	4,472	7.44	510.94	244.24	709.52
Luxembourg	2,207	3.67	500.60	227.06	740.90
Portugal	4,759	7.91	498.62	197.11	735.85
Italy	8,771	14.58	494.02	236.06	721.37
Malta	2,351	3.91	476.71	186.41	753.12
Croatia	5,222	8.68	476.51	199.60	698.29
Chile	5,937	9.87	460.02	185.98	698.85
Georgia	4,562	7.58	392.36	182.45	656.73
Panama	3,883	5.62	371.40	163.36	627.01
Dominican Republic	4,402	7.32	340.99	187.18	606.66
Total	60,147	100.00	473.26	163.36	773.06

Source: Author's calculations

- Endogenous variable

As an endogenous variable, the author uses the value of parental involvement. As discussed in the qualitative part of the paper, there are many definitions of parental involvement in the literature, but in order to make parental involvement measurable for quantitative research, a clear and unambiguous definition of what constitutes parental involvement is needed. For econometric analysis, three different types of parental involvement are identified, namely: involvement at the household level, involvement at the school level and educational spending. The wide variety of data on parental participation presented in PISA 2018 makes it possible to consider these forms of participation and motivational support. After examining the questions from the parent questionnaire, the author identified three questions that reflect these three types of participation (OECD 2018b):

1. The home-based parental involvement: "How often do you or someone else in your home do the following things with your child?".

This question lists 7 activities of a parent with a child and each of them is rated on a five-point scale, in which "1" is never or almost never and "5" is every day or almost every day.

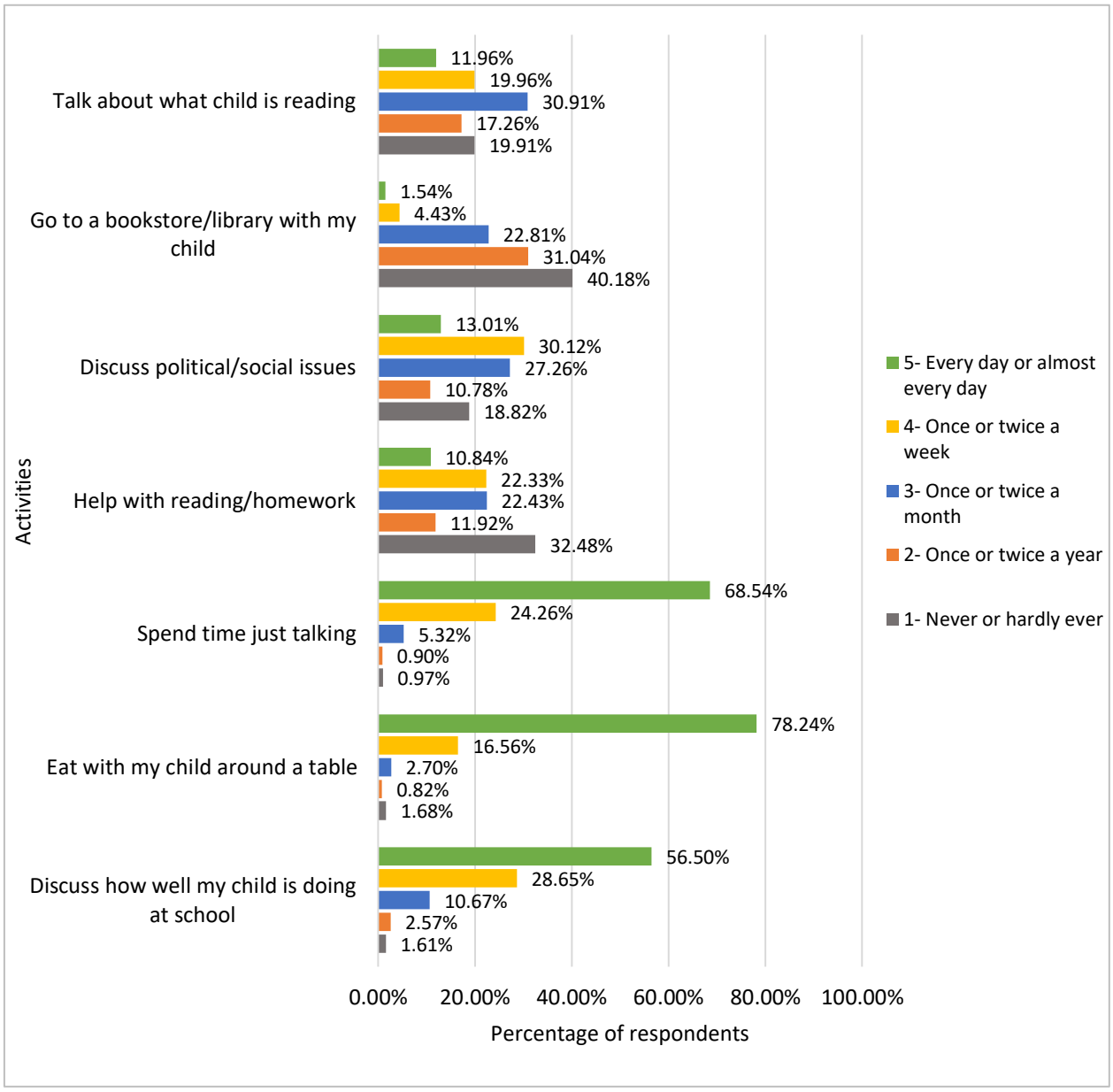

Figure 6. The home-based activities
Source: Author's calculations

The Figure 6 above shows that the largest number of responding parents every day or almost every day spend time talking with their children, eating together at the dinner table and discussing how their child is doing at school. Of all the types of activities listed in this question, these three are the most basic, that is, they create a trusting relationship between children and their parents and create

emotional support. Based on the same results of Figure 6, the least number of parents go to the library or the bookstore with their children.

2. The school-based parental involvement: „During <the last academic year>, have you participated in any of the following school-related activities?“.

This question includes 10 activities that are scored as “yes”, “no” and “not supported by the school”. Scoring is done as follows: for each positive statement is set "1", for negative statements, scoring is done in the reverse order, i.e. "-1", and if this type of activity is not supported by the school then it is "0".

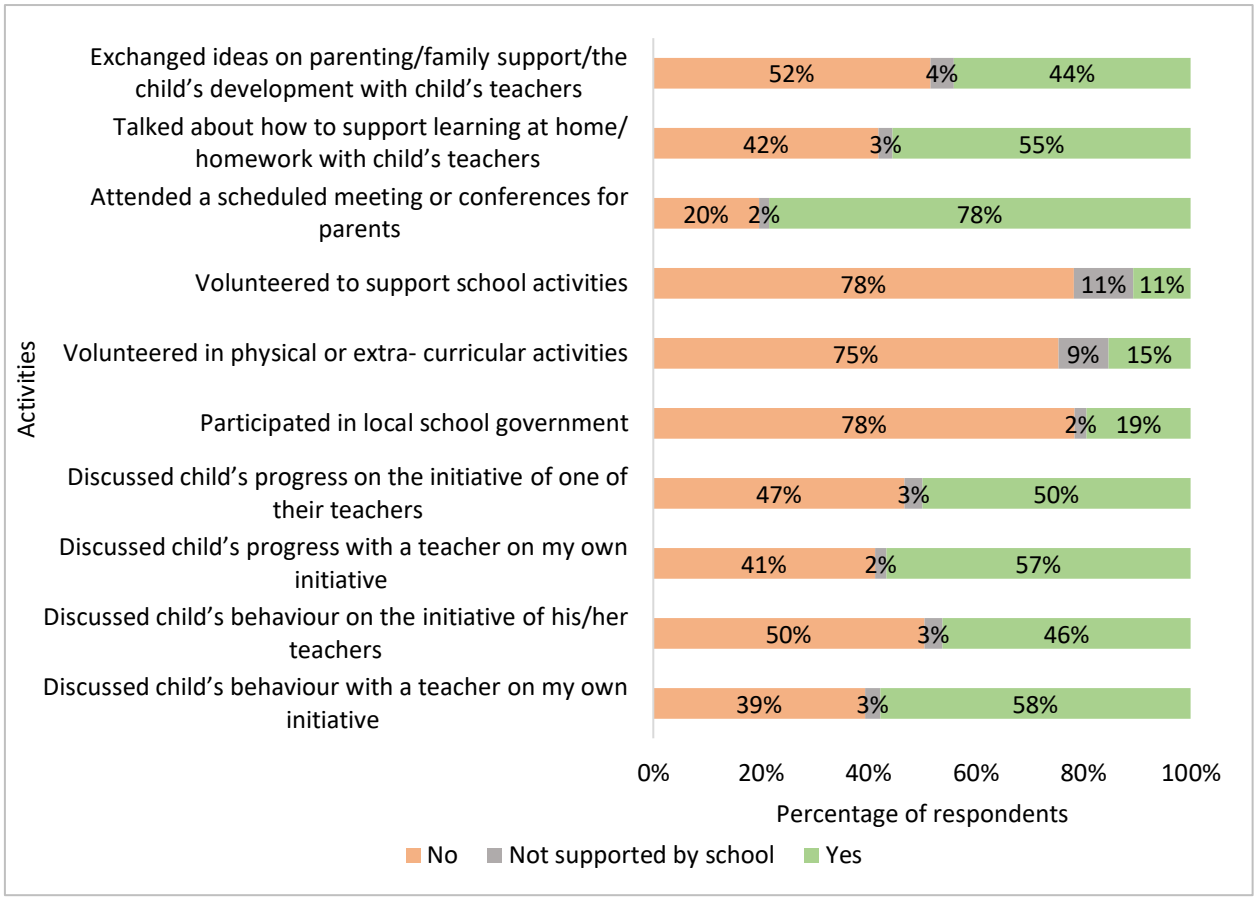

Figure 7. The school-based activities
Source: Author's calculations

The results in Figure 7 show activities related to the parental school-based involvement. The largest number of parents participate in scheduled meetings or conferences and the least number of parents participate in the local school government.

3. The educational spending: “In the last twelve months, about how much would you have paid to educational providers for services?”.

This determination includes any tuition fees the parent pays to the child's school or tutors, but does not include costs for items such as sports equipment, school uniforms, computers, or textbooks, unless they are included in the total fee. In this question, it is assumed that under the notation of the intervals, for different countries and economies are indicated specific values, depending on the level of economy and the possible cost of services. To analyze these answers, the author uses a rank scale from “0” to “5”, that is, if the parent has not spent anything over the past 12 months, then this is “ 0”, and if he spent $Z or more, then this is “ 5”, respectively. This way author could order the cost from smallest to largest, where the average is 3”- “$X or more but less than $Y”.

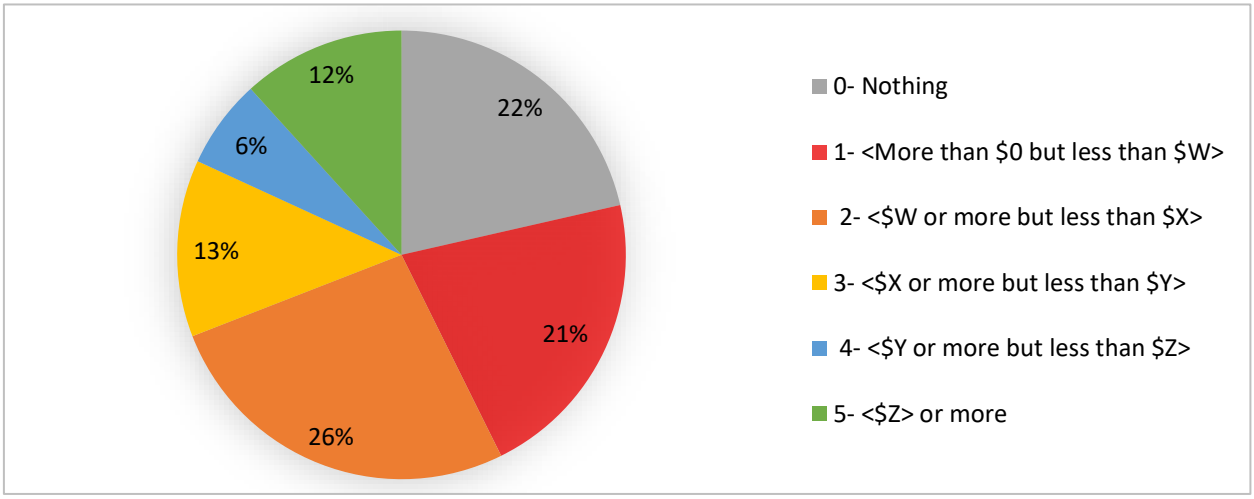

Figure 8. The educational spending
Source: Author’s calculations

The pie chart shows that a fairly large number of parents did not pay anything to representatives of education over the past 12 months - 22%, 21% and 26% paid less than the average, 13% of parents invested the average amount in education and 18% paid above average (6% and 12%).

The involvement of parents is assessed according to the scales proposed by (Hoover-Dempsey, Sandler 2005). Thus, the score obtained on the items related to each component gives a measure of the component of parental involvement.

- Instrumental variable

Further, approaching the choice of an instrumental variable and the method of its measurement, it is worth listing the previously indicated options based on the previous chapter, which discussed the choice of instrumental variables:

1. birth order;
2. family structure;
3. parents' schedule;
4. parents' expectations.

Given the availability of data in the sample, it is not possible to consider the variables of birth order, family structure, and parental work schedules. Thus, the last but not least variable remains parental expectations. Parental expectations are mental states that cannot directly affect student achievement.

Eccles' expectancy-value model suggests a cascade process: parental beliefs and values trigger parental behaviour and interactions with the child aimed at encouraging children, which ultimately influence the child's behaviour and achievements (Simpkins*et al.* 2012). Therefore, this variable "parents' expectations of children's success" is likely to be highly correlated with how strongly parents are involved in the child's learning and development, because the more parents believe in their child and his success, the more resources they invest, including time, effort and money to promote the development of the child. However, the variable "parents' expectations of children's success" is not expected to have any correlation with student grades (Figure 9).

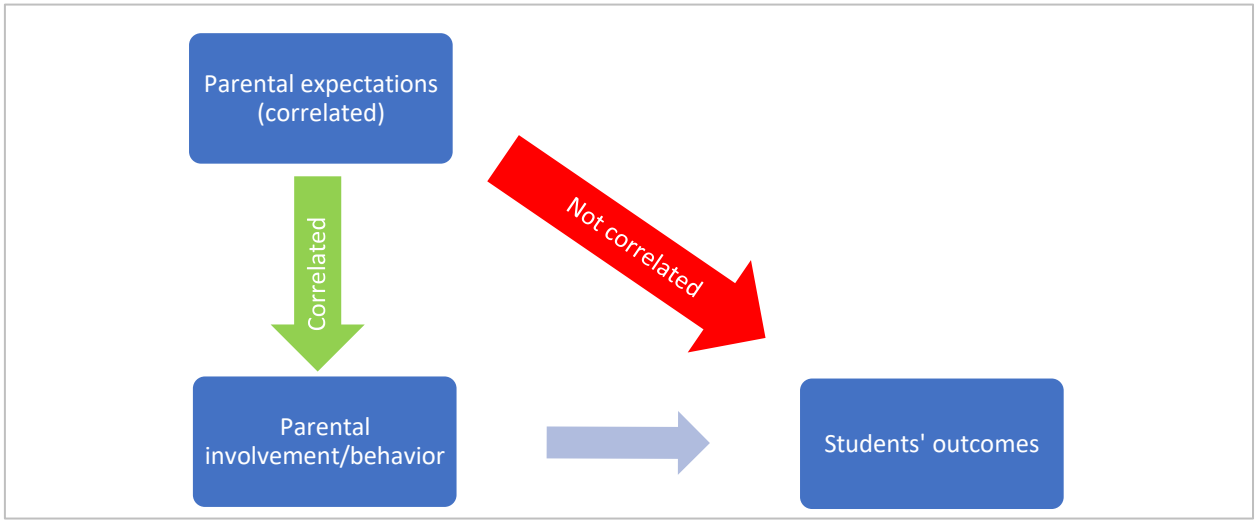

Figure 9. Variables relations
Source: Compiled by the author

Although there are different approaches to how researchers measure parental expectations, there is evidence that parental expectations are usually analyzed by assessing ability expectations, short-term expectations for grades, and long-term expectations for educational attainment. (Sukhdeep, Reynolds 1999) As an option to measure it, the parent questionnaire contains the following question: “Which of the following do you expect your child to complete?”. (OECD 2018b)

The options for answering this question contain various levels of the International Standard Classification of Education (ISCED). (UNESCO 2011) The measurements ranged from “1”- “ISCED level 2” to “ 6”- “ISCED level 5A or 6”, meaning from lower secondary education to bachelor or equivalent level. When reviewing the overall statistics of answers to this question, the author noticed that many respondents chose several answers, although it is assumed what the highest degree of education a parent or guardian expects from a child. Therefore, to obtain a correct sample, the author took into account only one marked option, that is, the highest level of education expected by the parent. General statistics are shown on the Figure 10.

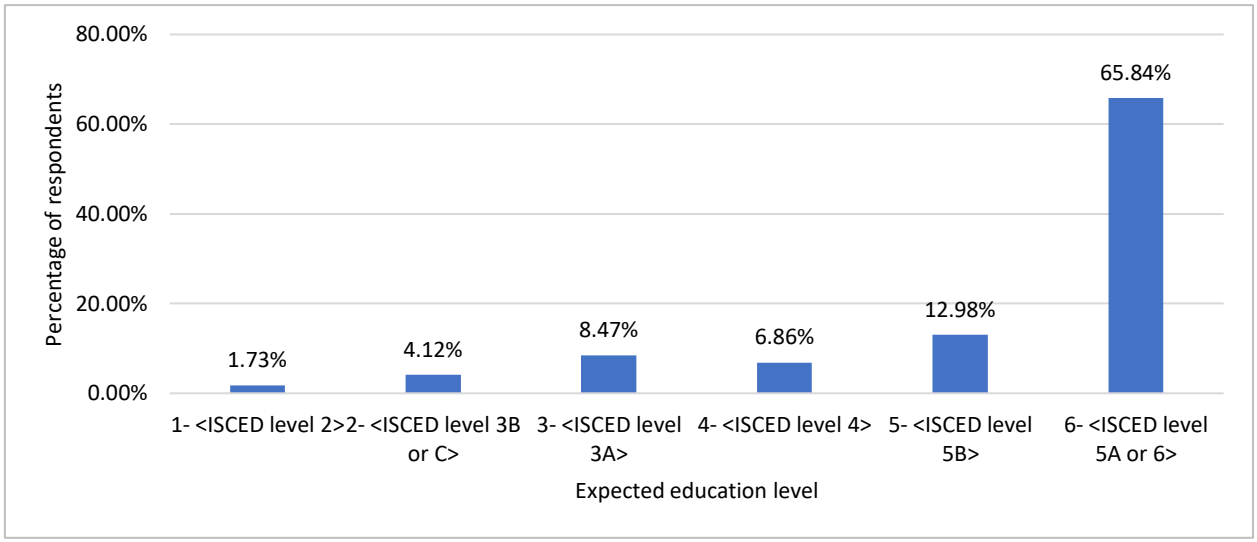

Figure 10. Parental expectations
Source: Author’s calculations

This graph clearly shows that more than half of the parents have the highest level of expectation provided in this questionnaire, which corresponds to a bachelor's degree.

- Control variables

The theoretical analysis shows that many factors contribute to the academic performance of students. Econometric analysis uses control variables to explore the relationship between parental

involvement and student academic achievement. The control variables are: student's age (*AGE*), educational resources at home (*HEDRES*), such as a desk, computer, study room, textbooks or educational software, socioeconomic and family cultural status (*ESCS*), variable which describes how much effort student put into that test (*EFFORT1*) and variable which describes how much effort student would have invested (*EFFORT2*), also father's and mother's education by ISCED scale (*FISCED*) and (*MISCED*), index of immigration status (*IMMIG*) and household income (INCOME). Thus, all variables included in the model were identified, prepared, evaluated and ready for empirical analysis. The author reports descriptive statistics of variables in Table 2.

Table 2. Variables descriptive statistic

Variable	N	Mean	Median	Min.	Max.	Std.Dev.
Dependent variable:						
MeanScore	60,147	473.26	479.57	163.36	773.06	100.15
Independent variables:						
Involvement	60,147	25.28	25.00	-3.00	50.00	7.54
AGE	60,147	15.78	15.75	15.25	16.33	0.29
HEDRES	58,443	-0.12	-0.14	-4.53	1.21	1.05
ESCS	58,875	-0.28	-0.27	-7.01	4.21	1.06
EFFORT1	52,407	7.84	8.00	1.00	10.00	1.78
EFFORT2	51,976	9.14	10.00	1.00	10.00	1.48
MISCED	58,183	4.15	4.00	0.00	6.00	1.67
FISCED	57,166	4.03	4.00	0.00	6.00	1.72
IMMIG	57,798	1.20	1.00	1.00	3.00	0.53
INCOME	41,412	3.47	3.00	1.00	6.00	1.89
Instrumental variable:						
Expectations	60,147	5.23	6.00	1.00	6.00	1.29

Source: Author's calculations

Descriptive statistics for variables include a number of observations, mean, median, standard deviation, minimum and maximum values. There are 60,147 observations in the prepared dataset, but there are missing observations for some control variables that will be excluded during the analysis itself, so the final sample for model estimation is smaller.

In the next chapter, the author estimates the model and describes the results.

3. EMPIRICAL ANALYSIS AND RESULTS

3.1. Descriptive statistics

Hierarchical cluster analysis (HCA) was used to identify country groups based on three previously studied types of parental involvement (home-based, school-based and educational spending) and average students' scores, using the Ward's method. (Yuxuan Hu, Meng 2018) The results of the hierarchical cluster analysis show that the optimal solution was to group the countries into three groups (Figure 11).

Figure 11. Hierarchical cluster analysis dendrogram
Source: Author's calculations

Countries form three large clusters. The first includes the Dominican Republic, Panama and Georgia. The second cluster is formed by such countries as: China (Hong Kong and Macao), Belgium and Germany. The third cluster, the largest, contains such countries as Italy, Luxembourg, Ireland, Croatia, Chile, Malta and Portugal. This distribution can partly be explained by the geographic location, since, for example, in European countries, parental involvement and students'

success may have similar dynamics due to similar cultural values, educational levels and parenting methods.

Looking at the clusters in Figure 11 in order from left to right, the first cluster has the highest index of parental involvement and the lowest students' scores. The second cluster consists of countries that, relative to other clusters, have a low level of parental involvement, but the highest scores among students. The third cluster includes those countries that have average involvement and average results.

For a more visual demonstration of the results, the author has compiled a graph that shows the ratio of the level of parental involvement and the overall results of students by country (Figure 12).

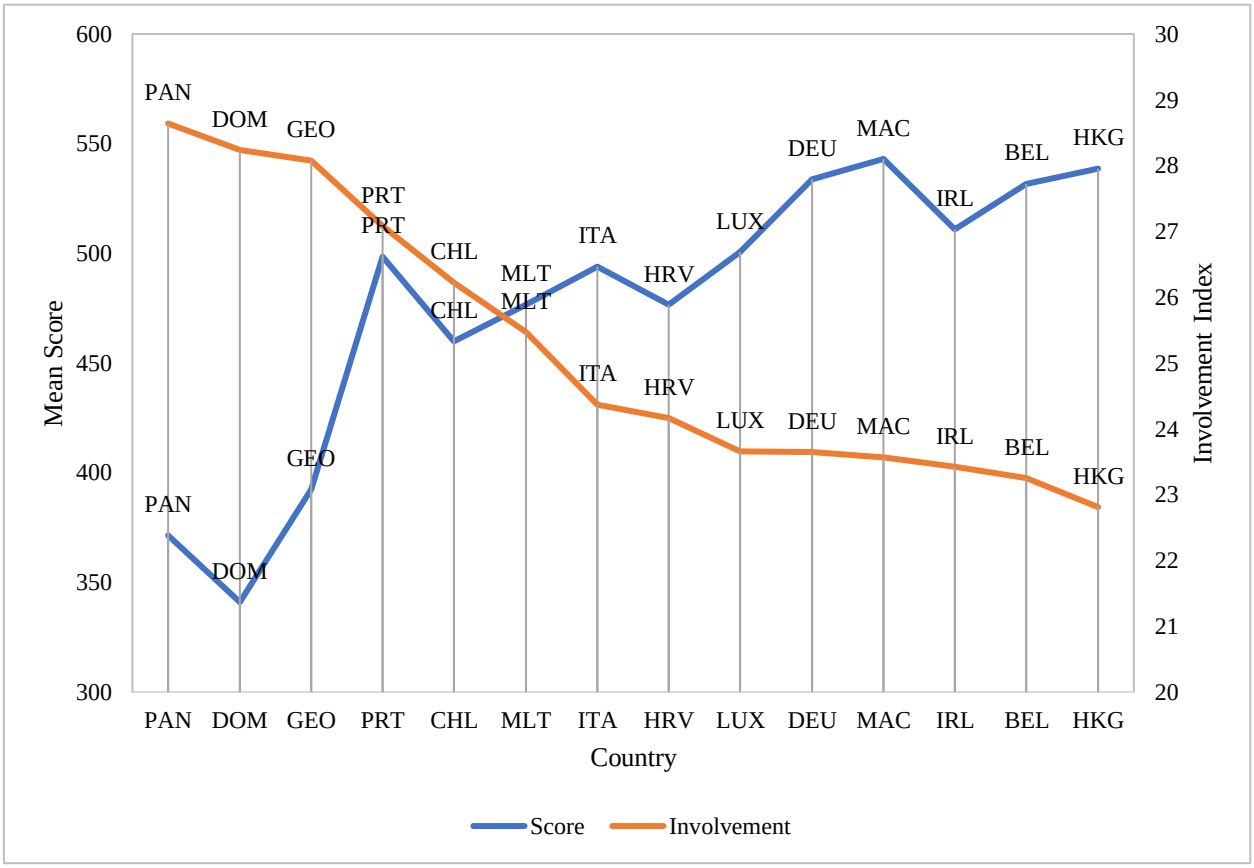

Figure 12. The ratio of two variables by countries
Source: Author's calculations

The graph shows the previously described results of the HCA, where the countries were divided into 3 groups. Visually, these three clusters of countries are almost also clearly visible, of which

some have a high index of involvement from parents, but low results of students, others seem to practically find an equilibrium between these two indicators, and the third ones, relative to the previous two clusters, have a low indicator of parental involvement, but the highest scores of students.

Based on these findings, it can be assumed that parental involvement and students' scores have a non-linear relationship, an assumption indirectly discussed in the theoretical part of the thesis. That is, too high a level of parental involvement that develops into parental overinvolvement does not guarantee good students' scores, but rather predicts poor students' grades, while relatively low involvement guarantees better scores. This is due to the same factor mentioned earlier: overinvolvement can lead to parents intervening too often in solving problems that the child must cope with, this can interfere with the development of the child's sense of autonomy.

The author also compiled another graph to visualize the relationship between parental involvement and the students' average scores (Figure 13).

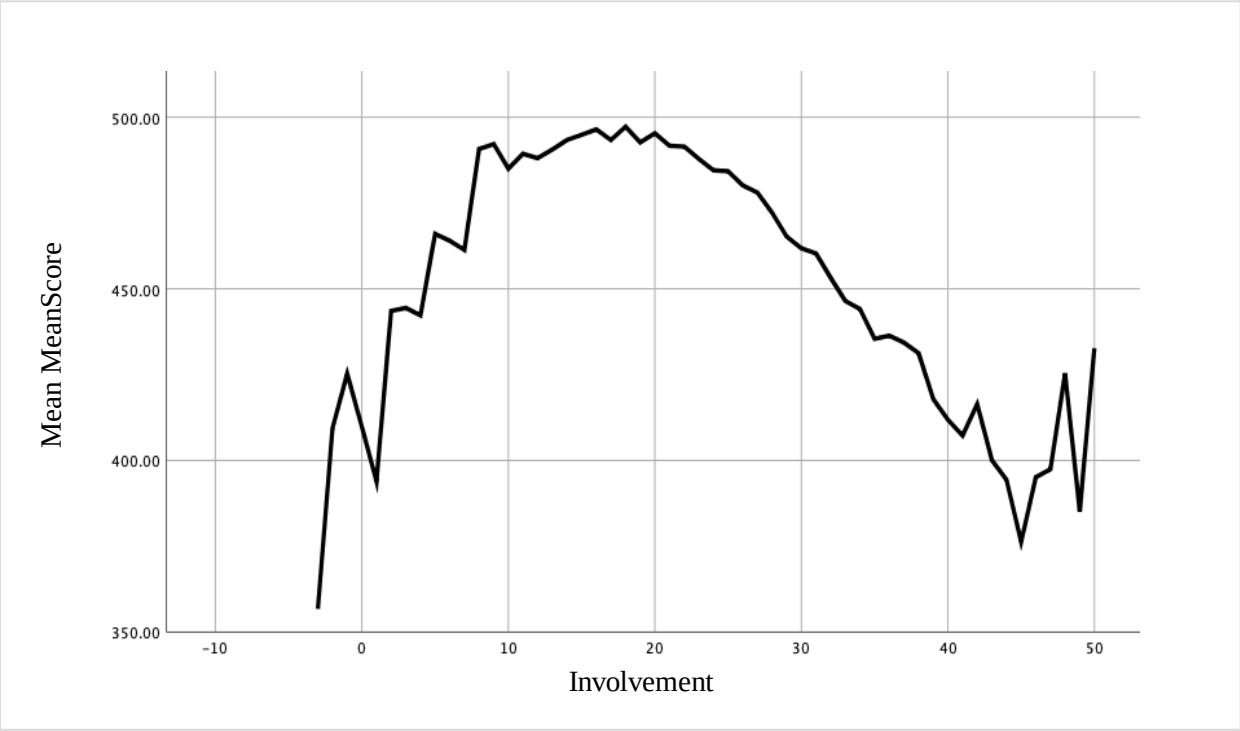

Figure 13. Parental involvement and students' mean scores relation
Source: Author's calculations

The result obtained is quite interesting because the relationship between parental involvement and students' academic success in form of average scores in three subjects is non-linear, as the author assumed earlier. As the parental involvement in the child's learning increases, so does the child's average score but, at some point, if the parental involvement in the child's learning exceeds a certain threshold, it negatively affects the child's academic success. This result supports the notion of parental overinvolvement, which the discussion mentioned in section 1.4.2. on involvement negative aspects, which may cause students' underachievement, as students whose parents are overly involved and controlling are more likely to underperform. As parents increase control over the child, the child's sense of independence decreases, and the child ceases to feel his own responsibility for learning and relies on parents for everything and waits for their approval, which leads to lower results.

There is another assumption of this type of results, and it lies in the fact that may be in the countries where noticed high parental involvement and low score results of children, it is not parental involvement that has such an effect, but the initially low scores of children provoked parents to become more involved in their children's education, and therefore at the time of data collection it was not possible to track what further effect this increased involvement would have on students' success.

3.2. Model estimation

The main goal of this master's thesis is to determine the relationship between students' achievements and parental involvement in their education. The positive structural relationship between students' academic performance and parental involvement has been confirmed by a number of early studies, which are described in the theoretical part of the thesis. Taking into account these theoretical and experimental data, the author hypothesized that there will be a positive relationship between parental involvement and students' academic success. As the main econometrics approach, the author chose the 2SLS method, also known as the IV method.

This section presents estimates of the effect of parental involvement using the ordinary least squares (OLS) method (Table 3). Later in this section, the author will compare these results with the results obtained when evaluating the instrumental variable IV (2SLS) model (Table 4). In the selected model, the dependent variable was defined as the average score calculated based on the plausible values methodology in three subjects: mathematics, reading and science. The predictors

are the following variables: parental involvement index (*Involvement*) calculated based on three types of activities (home involvement, school involvement and educational spending), age of student (*AGE*), educational resources at home (*HEDRES*), the index of the economic, social and cultural status of the family (*ESCS*), a variable that describes how much effort student put into that test (*EFFORT1*) and variable that describes how much effort student would have invested (*EFFORT2*), also father's and mother's education by ISCED scale (*FISCED*) and (*MISCED*), index of immigration status (*IMMIG*) and household income (INCOME). As instrumental variable, parental expectations regarding the success of children in the form of the expected level of education (*Expectations*) was chosen. Since in the previous chapter, using the hierarchical clustering method, three groups of countries were identified, the author was interested in compiling different models also for these three clusters separately. Thus, these results are also provided for both the OLS and 2SLS models.

Table 3. The results of the ordinary least squares (OLS) models.

Variable	Overall dataset Coefficient	First cluster Coefficient	Second cluster Coefficient	Third cluster Coefficient
Intercept	332.98 ***	76.34 *	222.59 ***	342.21 ***
Involvement	-2.35 ***	-0.82 ***	-1.04 ***	-1.60 ***
AGE	9.75 ***	17.31 ***	14.73 ***	7.74 ***
HEDRES	8.46 ***	2.98 ***	3.47 ***	-1.25 *
ESCS	41.87 ***	18.27 ***	21.13 ***	40.15 ***
EFFORT1	-0.15	-3.37 ***	5.87 ***	2.68 ***
EFFORT2	6.74 ***	7.32 ***	6.05 ***	7.18 ***
MISCED	-10.06 ***	-2.40 ***	-3.44 ***	-3.55 ***
FISCED	-7.82 ***	-0.95 *	-1.72 ***	-5.29 ***
IMMIG	25.39 ***	6.20 **	5.61 ***	1.03
INCOME	13.08 ***	13.56 ***	6.63 ***	4.65 ***
p-value	< 2.2e-16	< 2.2e-16	< 2.2e-16	< 2.2e-16
R-squared (adj.)	0.34	0.31	0.13	0.23
N	32,518	7,318	10,109	15,091

Source: Author's calculations

Note: Significance level values *, **, *** indicate significance at 10%, 5% and 1% level

The ordinary least squares (OLS) model reports that parental involvement and students' outcomes have a negative relationship, that is, as the involvement increases, then students' grade decreases. Also, a mother's and father's education have a negative impact on children's success. The following variables consistently have a positive relationship with student achievement: age,

socioeconomic status, effort that the student could make, immigration status, and household income. The effect of the remaining variables varies for these four models.

However, the author cannot rely on the ordinary least squares (OLS) estimates. First, a child's poor academic performance may encourage a parent to become more involved in education to help the child succeed in school. Second, a high level of parental involvement can motivate a child to learn better. That is, just as parental involvement can influence a child's success, so a child's success can influence parental involvement.

Therefore, the OLS model is not able to assess the structural relationship between the variables under consideration. This is mainly due to the fact that standard linear regression models assume that errors in the dependent variable are not correlated with the independent variables, which allows the parameter coefficient to be represented as a function of the correlation coefficients between the variables. Because of this, the OLS method is asymptotically biased in terms of structural parameter estimation, which leads to inconclusive empirical results.

Instead, the author investigates the structural equation in (2), directly estimating the structural parameter using the so-called two-stage least squares (2SLS or TSLS) or instrumental variables (IV) method. This method is a two-stage evaluation that uses an instrumental variable that is correlated with the cause variable but not correlated with the error term. To assess the chosen model, the author uses one instrumental variable: parental expectations regarding the success of children in the form of the expected level of education (*Expectations*). This variable is expected to be associated with a predictor because the more parents expect their child to be academically successful, the more likely they are to be involved in their child's development and education, and as a result, the child's performance will be higher. Also in this study, the author suggests that there is no direct relationship between parental expectations and student’s success in this analysis.

To begin with, the two-stage least squares (2SLS or TSLS) or instrumental variables (IV) regress the cause variable on the selected instrumental variable and non-cause explanatory variables to obtain a fit cause variable, and then regresses the dependent variable on the fitted cause variable and the other explanatory variables in models by evaluating an unknown parameter in a structural model. Since the calculated values are based on variables that do not correlate with errors, the results of the model are optimal. Table 4 presents the results of the two-stage least squares (2SLS or TSLS) or instrumental variables (IV) model, instrument: parental expectations (*Expectations*).

Table 4. 2SLS (TSLS, IV) models estimation and testing

Variable	Overall dataset Coefficient	First cluster Coefficient	Second cluster Coefficient	Third cluster Coefficient
Intercept	-672.83 ***	-580.77 ***	-4941.67	49448.44
Involvement	24.75 ***	13.26 ***	167.23 *	-1157.15
AGE	33.98 ***	33.50 ***	139.39 *	-1169.26
HEDRES	6.63 ***	-3.07	-84.63	243.76
ESCS	38.29 ***	13.65 ***	-99.58	1205.45
EFFORT1	-8.21 ***	-6.22 ***	-13.97	214.24
EFFORT2	7.09 ***	7.72 ***	1.82	-50.94
MISCED	-24.36 ***	-5.64 ***	-64.48 *	78.35
FISCED	-11.52 ***	0.76	-14.03	-157.70
IMMIG	48.58 ***	15.02 **	-139.94	-978.65
INCOME	22.99 ***	17.53 ***	-7.68	-152.58
p-value	< 2.2e-16	< 2.2e-16	0.64	1.00
R-squared (adj.)	-9.56	-1.96	-253.41	-9284
N	32,518	7,318	10,109	15,091
Diagnostic tests:				
Weak instruments	111.52 ***	25.59 ***	3.03 *	0.09
Wu-Hausman	793.81 ***	127.56 ***	838.75 ***	1399.17 ***
Sargan	NA	NA	NA	NA

Source: Author's calculations

Note: Significance level values *, **, *** indicate significance at 10%, 5% and 1% level

The results of the 2SLS estimate change the sign of the effect, which, in turn, changes the interpretation of the results. Based on the assessments of the main model, an increase in the index of parental involvement 1 unit leads to an increase in the student's academic results by 24.75 points. Also, the success of school children is positively affected by age, which is logical, since the older the student, the more knowledge she/he has and the greater her/his mental abilities. With an increase in the indicator of home educational resources by 1 unit, the total average score in three subjects of the student increases by 6.63, which is also consistent with the literature. The social and cultural status index is significant and has a large positive impact on academic performance, meaning that by increasing it by 1 unit, the results increase by 38.29 points. The efforts that the student has invested in passing the test have a negative impact on academic performance, probably the students have not used their full potential by taking this testing lightly, however, the effort that the student could invest in passing have a positive effect on the overall grade in three subjects.

The education estimates of mother and father are statistically significant, but the mother's education has a larger negative impact on student's scores, than the father's education. This result

conflicts with the theory that the higher the education of the parent, the better the success of the student. It can be assumed, however, that usually mothers are more involved in the education of children, therefore the effect is greater than the father, and it is negative since the more the higher the education of the parent, the more she/he strains the child to achieve the same success or even more, thereby interfering excessively in the child's studies or even exerting excessive pressure, causing the child to reject studying, thus, the child has lower results. With an increase in the index of immigration status by 1 unit, the total score in three subjects increases by 48.58 points, that is, immigrants receive higher scores than non-immigrants. This result may be due to the fact that being not in their country of birth, these people are likely to have more motivation to achieve success. Last but not least, the income variable shows a positive relationship with students' grades.

As for the remaining three models divided by clusters, which were identified as a result of applying the hierarchical clustering method, the models for the second and third clusters are not statistically significant, and the statistically significant indicators of the first cluster model are more or less consistent with the results of the main model. If compare the estimates of the first and second clusters and observe the dynamics, can be seen that the description of the clusters from the previous chapter is consistent with the empirical results. Thus, starting from the index of parental involvement equal to 29 or more, the straight line of the second cluster is almost vertical, which means that with the slightest change in the index of parental involvement, the success of the child increases with great dynamics, while for the second cluster its growth is smoother and the index of parental involvement should be significantly higher than for the first cluster in order to obtain the same level of average student's score.

Additionally, the author carried out testing and diagnostics with a special function, the results of which are displayed in the same table 4 in the "Diagnostic test" section. Weak instruments: this is an F-test for instruments in the first stage. If the endogenous regressor is weakly related to instrumental variables, then its coefficient will be estimated inaccurately. The null hypothesis, in fact, is that there is a weak instrument. In the main model, the test statistic is 111.5 and the p-value is smaller than 1 percent, and this means that the selected instrument is not weak, which is good.

The Wu-Hausman test is a test for endogeneity. If all regressors are exogenous, then the OLS and 2SLS estimates are consistent and the OLS estimate is more efficient, but if one or more regressors are endogenous, then the OLS estimate is inconsistent. In this case, the test statistic is large (793.8)

and the p-value is less than 1 percent, hence the null hypothesis is rejected and this means that the OLS estimate is inconsistent and therefore the 2SLS estimation is preferable.

Sargan: this is a test of the exogeneity of an instrument using over-identifying constraints called J-statistics. In the above results, the test statistic of the Sargan test is "NA". This is to be expected because the author uses one instrument for one endogenous regressor, and the mathematical properties of the test require that there be at least one more instrument than the endogenous regressor.

Also in the previous chapter, it was suggested that the relationship between parent involvement and student achievement is non-linear, so as an experiment, the author was interested in using a nonlinear two-stage least-squares model to determine such a relationship. (Essen 2015) To do this, the instrumentation was applied using Z and Z^2, where Z is a valid instrument in form of parental expectations. (Wooldridge 2000) The following result was obtained:

Table 5. Non-linear 2SLS model estimation and testing

Variable	Coefficient
Intercept	-5213.07 ***
Involvement	462.78 ***
Involvement^2	-8.64 ***
p-value	1.02e-12
R-squared (adj.)	-47.44
N	60,144
Diagnostic tests:	
Weak instruments (Involvement)	230.02 ***
Weak instruments (Involvement^2)	230.51 ***
Wu-Hausman	2123.83 ***
Sargan	NA

Source: Author's calculations

Note: Significance level values *, **, *** indicate significance at 10%, 5% and 1% level

The obtained coefficients of the 2SLS quadratic equation are as follows:

$$Y = -8.64Involvement^2 + 426.78Involvement\ - 5213.07 \quad (5)$$

Based on the result obtained, it can be said that the negative quadratic coefficient makes the ends of the parabola look down, respectively, the curve is concave down. The roots of this equation are 16.11 and 37.46, therefore, if the index of parental involvement is too low (less than 16.11), then this negatively affects the grade of the student, as well as too high an index of parental involvement (above 37.46). At the top of the parabola is the index of parental involvement of 26.8, and after that, with an increase in this index, the average score of the student begins to decrease. Nevertheless, the index of parental involvement in the limits of these two indicators in one way or another has a positive impact on the students' mean score, since parents take part, but do not overinvolved and do not exert excessive pressure, thus this is a positive parental involvement.

3.3. Results

A discussion of the results is presented in the following section. Before this, it is necessary to give some comments on a number of exceptions and consequences. Since only 14 countries and economies provided correct information on parental participation in the survey questions, the results of this master's thesis cannot be generalized to other countries or even to countries and economies that participated in the parent survey, as the sample is not representative of except for missing or incorrect data. Care should be taken when using the results for this limited set of countries and economies to make decisions about parent involvement.

Furthermore, prevailing discourses regarding the learning and achievements of children in different countries do not always take into account the unique political and social contexts in which schools, teachers and parents operate. In a culturally diverse world, the validity of data on parental involvement and the form in which it occurs can be compromised by data on cross-cultural comparability. What parental support for learning entails, and how it manifests itself, likely differs across cultures. In addition, there is a possibility of inconsistency between parents' self-reports and their actual behaviour, and therefore care must be taken when interpreting results regarding parents' subjective views on supporting learning at home and school.

The study conducted by the author confirmed the existence of a relationship between the two indicators studied: the level of parental involvement and the average score of students in three subjects. Although econometric analysis using the 2SLS method confirmed a positive relationship between parental involvement and students' academic performance, however, with a more detailed analysis of the data using hierarchical clustering analysis, descriptive statistics and non-linear

2SLS method, it was possible to establish that the relationship between parental involvement and students' results is still not so unambiguous, that is, they can have both positive and negative relationship, which is in line with the literature. There is a certain threshold beyond which too much participation of parents in the education of children begins to have a negative impact on the academic success of the latter. Also, in turn, it is observed that relatively low involvement corresponds to the success of children, presumably because children feel more independent and responsible for their learning and are able to cope with it on their own. However, it cannot be argued that this conclusion is always valid - the lower the involvement, the better the academic performance, since based on the data used in the study, it is impossible to determine the threshold when low involvement would cause low results for children, since, relative to the available results, low involvement, in fact, is not low, but only within the framework of this study.

Another possibility for these types of results is that in countries where high parental involvement and low child score results have been observed, it is not parental involvement that has such an effect, but rather the initially low child score results that prompted parents to become more involved in their children's education, and thus it was not possible to track what further effect this increased involvement would have on student success in the future. Therefore, another limitation is the type of data: cross-sectional studies cannot provide definitive information about causal relationships due to the causality dilemma (i.e., they do not clearly identify the temporal relationship between putative exposures and outcomes). This is because such studies offer a snapshot of a single point in time, they do not take into account what happens before or after the snapshot is taken. Through such a study, it is possible to test the relationship of parental involvement with student academic performance, but it is not possible to know whether the effect preceded the effect. Although cross-sectional studies cannot be used to determine causation, it helps generate causal hypotheses and can be a useful springboard for further research.

CONCLUSION

The aim of this master's thesis was to determine and assess the impact of parental involvement in a child's education on the academic performance of students.

The following research questions are asked in the master's thesis:

1. What are the positive and negative aspects of parental involvement in student education?
2. Is parental involvement positively or negatively associated with student's outcomes?

Taking into account the cross nature of the data and the possibility of the problem of endogeneity, therefore, as a method of econometric analysis, the author chose the two-stage least squares (2SLS or TSLS) model, also known as the instrumental variables (IV) method, using an instrumental variable in the form of parental expectations. For a more detailed study of the data, descriptive statistics and hierarchical clustering were also carried out. The data used is from the 2018 Program for International Student Assessment (PISA), which measures the cognitive skills of 15-year-olds.

The study is divided into three main parts. The first part deals with the theoretical side of the topic, including the theoretical background of the problem, influencing factors and a review of previous research. The second part of the master's thesis includes a description of the methodology and data. The third section contains empirical analysis such as model estimation, results and conclusions.

The first question of this master's thesis received an answer in the theoretical part of the study, where both positive and negative aspects of parental involvement in children's education were described in detail. Based on this, involvement can be divided into two types - positive parental involvement and overinvolvement, which implies a negative effect on students' success. Positive involvement is believed to reduce school absenteeism as well as promote children's social, emotional and academic growth, as parental involvement motivates children to learn, which has a positive impact on the economy in the long run. Parents who are too involved in school and other aspects of their child's life contribute to a lower level of independence in their children, in turn,

such students have a lower level of academic achievement because they do not take responsibility for their learning. This aspect is very important and has an impact in the long term, because when students take responsibility for their education, they lay the foundation for taking responsibility for their actions later in life.

In the third part of this research, the answer was also received to the second question of the master's thesis, thus the relationship between parental involvement in learning and the academic success of students was determined and evaluated. Econometric analysis using the 2SLS method confirmed a positive relationship between parental involvement and students' academic performance, an increase in the index of parental involvement by 1 unit leads to an increase in the student's academic results by 24.75 points. Also, the success of school children is positively affected by their age, home educational resources, social and cultural status, immigration status index and household income. The efforts that the student has invested in passing the test have a negative impact on academic performance, however, the efforts that the student could invest in passing that test have a positive effect on the overall grade in three subjects. The education estimates of mother and father are statistically significant, but both have a negative impact on student's scores. However, with a more detailed analysis of the data using hierarchical clustering, descriptive statistics and non-linear 2SLS, it was possible to establish that the relationship between the involvement of parents and the success of students is still not so unambiguous, that is, they can have both a positive and a negative relationship, which motivates the further and in-depth study of this topic.

The first assumption underlying the ambiguity of the relationship between parental involvement and student success is that there is a point beyond which too much parental involvement in their children's education begins to have a negative impact on their success, and that relatively low involvement corresponds to good child success, presumably because children feel more independent and responsible for their learning and are better able to cope with it on their own. However, in the context of this study, it cannot be argued that this conclusion is always true, that the lower the involvement – the better the academic performance, because it is impossible to determine the threshold when low involvement causes low results for children, because based on the data used in the study, low engagement is not actually low, but only within the scope of this study.

The second presumption is that it may be that in countries where high involvement and poor performance of children is observed, it is not involvement at all that has such an impact, but the initially low success of children provoked parents to become more involved in children's education and therefore at the time of data collection, and also taking into account type of data, it was not possible to track what effect this increased involvement would have on student success in the future.

Despite a number of limitations mentioned in the last chapter, the results of the study indicate several directions for future research on this topic. First, in order to better understand how these relationships exist, further research is needed on the relationship between parent involvement and students' achievements, using different methods and studying each type of interaction specifically. Second, longitudinal studies are needed to understand how these variables interact over time and to explore the possibility of bidirectional relationships between variables, in other words, to be able to analyze the dynamics of indicators over time and identify causal relationships. In addition, better results with the use of other instrumental variables or additional research methods are not excluded.

KOKKUVÕTE

VANEMATE OSALUS JA KOOLIÕPILASTE TULEMUSED

Jekaterina Maslennikova

Investeerimine inimkapitali on enamikus riikides majandusarengu poliitika keskne komponent. (Jones 2016) Kõrgemate oskustega inimesed on produktiivsemad ja kohanevad paremini majanduse tehnoloogiliste muutustega. Seetõttu on haridusel riikide majanduskasvus võtmeroll. COVID-19 pandeemia tõttu olid aga koolid ajutiselt suletud ning Eric Hanushek ja Ludger Wessmann (2020) uuring näitab, et koolide sulgemisest mõjutatud 1.–12. klasside õpilased võivad oodata oma elu jooksul hinnanguliselt 3 protsenti sissetulekute langust. Selline olukord võib kaasa tuua aastase sisemajanduse koguprodukti (SKP) vähenemise kuni sajandi lõpuni keskmiselt 1.5 protsenti. Seetõttu on COVID-19 pandeemia rõhutanud vanemate toetuse ja osaluse tähtsust, kuna vanemad on olnud sunnitud osalema otseses õpetamise ja õppimise protsessis. (Vegas, Winthrop 2020) Vanemate võime toetada koduõpet võib kriitiliselt mõjutada laste õpitulemusi, eriti koolide sulgemise ajal. (Brossard et al. 2020)

Vanemad ja perekond tervikuna on pikka aega olnud poliitikute jaoks huvipakkuv majanduslik teema. Vanemate kaasamist võib majanduse mõistes määratleda kui vanemate otsest pingutust oma laste haridustulemuste parandamiseks. Kui vanemad on kaasatud oma laste kooliellu, saavad õpilased kodust tuge ja teadmisi, mida nad vajavad mitte ainult ülesannete täitmiseks, vaid ka elukestva õppimise armastuse arendamiseks. Seetõttu on vaja mõista, kuidas saab vanemate kaasamist haridusse seostada õpilase õppeedukusega, sest tänu sellele oleks ka sellisel ajal võimalik säilitada õpilaste haridustaset ja õppeedukust õigel tasemel.

Käesoleva magistritöö eesmärk oli välja selgitada ja hinnata vanemate kaasamise mõju õpilaste õppeedukusele. Selle eesmärgi saavutamiseks analüüsitakse varasemaid teoreetilisi ja empiirilisi uuringuid. Lisaks tehakse RStudio tarkvaraprogrammis ökonomeetriline analüüs. Empiirilise analüüsi jaoks kasutati 2018. aasta rahvusvahelise 15-aastaste õpilaste hindamise programmi

(PISA) andmeid. Käesolevas magistritöös kasutatud uurimismeetodid on järgmised: tavaline vähimruutude meetod, kaheastmeline vähimruutude meetod, tuntud ka kui instrumentaalsete muutujate meetod ja hierarhiline klasteranalüüs. Andmetöötlus ja analüüs viidi läbi sotsiaalteaduste statistilise paketi (SPSS Statistics) abil, regressiooniandmete analüüsiks kasutati tasuta tarkvara RStudio. Graafikud ja tabelid loodi Microsoft Exceli, SPSS-i ja RStudio abil.

Magistritöös esitatakse järgmised uurimisküsimused:

1. Millised on vanemate kaasamise positiivsed ja negatiivsed küljed?
2. Kas vanemate kaasamine on õpilase tulemustega positiivselt või negatiivselt seotud?

Selle magistritöö esimene küsimus sai vastuse töö teoreetilises osas, kus kirjeldati üksikasjalikult nii positiivseid kui ka negatiivseid aspekte vanemate kaasamisel laste haridusse. Sellest lähtuvalt võib kaasamise jagada kahte tüüpi - vanemate positiivne kaasamine ja hüperosalus, mis tähendab negatiivset mõju õpilaste edukusele. Arvatakse, et positiivne kaasamine vähendab koolist puudumist ning soodustab laste sotsiaalset, emotsionaalset ja akadeemilist kasvu, kuna vanemate kaasamine motiveerib lapsi õppima, millel on pikas perspektiivis positiivne mõju majandusele. Vanemad, kes on liiga kaasatud oma lapse haridusse ja muudesse eluvaldkondadesse, aitavad kaasa oma laste iseseisvuse vähenemisele, nendel õpilastel on omakorda madalam õppeedukus, kuna nad ei võta vastutust oma õppimise ja otsuste eest. See aspekt on väga oluline ja sellel on pikaajaline mõju, sest kui õpilased võtavad oma õppimise eest vastutuse, loovad nad aluse oma tegude eest vastutuse võtmiseks täiskasvanueas.

Käesoleva töö kolmandas osas saadi vastus ka magistritöö teisele küsimusele, seega selgitati välja ja hinnati seost vanemate õppimisse kaasatuse ja üliõpilaste õppeedukuse vahel. Ökonomeetriline analüüs 2SLS-meetodi abil kinnitas positiivset seost vanemate kaasatuse ja õpilaste õppeedukuse vahel, vanemate osaluse indeksi suurenemine 1 ühiku võrra toob kaasa õpilase õppetulemuste tõusu 24,75 punkti võrra. Samuti mõjutavad kooliõpilaste edu positiivselt nende vanus, kodused haridusressursid, sotsiaalne ja kultuuriline staatus, immigratsioonistaatuse indeks ning leibkonna sissetulek. Jõupingutused, mida õpilane on testi sooritamiseks panustanud, mõjutab hindeid negatiivselt, kuid pingutus, mida õpilane saab selle testi sooritamiseks teha, mõjutab positiivselt kolme aine üldhinnet. Ema ja isa hariduse hinnangud on statistiliselt olulised, kuid mõlemal on negatiivne mõju õpilaste tulemustele. Andmete detailsem analüüs hierarhilise klasterdamise, kirjeldava statistika ja mittelineaarse 2SLS-meetodi abil aitas tuvastada, et seos vanemate

kaasamise ja õpilaste edukuse vahel ei ole siiski nii üheselt mõistetav, neil võib olla nii positiivne kui negatiivne suhe, ning need uuringu tulemused näitavad mitmeid suundi selle teema edasiseks uurimiseks.

Esiteks, selleks, et paremini mõista, kuidas need suhted eksisteerivad, on vaja täiendavaid uuringuid vanemate kaasamise ja õpilaste saavutuste vahelise seose kohta, kasutades erinevaid meetodeid ja uurides iga interaktsiooni tüüpi konkreetselt. Teiseks on vaja pikisuunalisi uuringuid, et mõista, kuidas need muutujad aja jooksul interakteeruvad, ja uurida muutujatevahelise kahesuunalise seose võimalust, teisisõnu, et oleks võimalik analüüsida indikaatorite dünaamikat ajas ja tuvastada põhjuslikke seoseid. Lisaks pole välistatud paremad tulemused teiste instrumentaalmuutujate või täiendavate uurimismeetodite kasutamisel.

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