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The Role of Corruption in Tertiary Enrolment: Enabler, Neutral, or Disincentive?

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# Contents

# Abstract

This thesis explores whether the presence of corruption plays an important role in deciding whether to enrol in tertiary education. In particular, it observes corruption as a potential factor and tries to understand the different channels through which corruption impacts tertiary enrolment in developing countries. In the first phase, the baseline model compares its effect between developed and developing countries. In the second phase it focuses solely on developing countries and tries to investigate two different ways in which corruption impacts enrolment rates: the brain drain effect and grease the wheel hypothesis. The analysis is conducted through the use of IV regression random effect model.

The main results are as follows. Firstly, corruption seems to exclusively play a significant role in determining enrolment rates in developing countries, where the relationship between corruption and tertiary enrolment rates is positive. In contrast, in developed countries there is no indication that this relationship is significant. On one hand, the presence of a brain drain effect is not supported by the findings of this model specification. On the other hand, this thesis finds some evidence to support the grease the wheel hypothesis applied on the educational sector. It shows that an increase in a proxy for education quality in turn decreases the positive coefficient for corruption on enrolment rates that was found in the baseline model.

# Zussamenfassung

Diese Masterarbeit untersucht, ob das Vorhandensein von Korruption eine wichtige Rolle bei der Entscheidung spielt, ob man sich für ein Hochschulstudium einschreibt. Insbesondere wird Korruption als potenzieller Einflussfaktor betrachtet, und es wird versucht, die verschiedenen Mechanismen zu verstehen, durch die Korruption die Einschreibungsraten im tertiären Bildungsbereich in Entwicklungsländern beeinflusst. In der ersten Phase vergleicht das Basismodell ihre Wirkung zwischen Industrie- und Entwicklungsländern. In der zweiten Phase konzentriert sich die Analyse ausschließlich auf Entwicklungsländer und untersucht zwei unterschiedliche Kanäle, über die Korruption die Einschreibungsraten beeinflusst: den Brain-Drain-Effekt und die Grease-the-Wheel-Hypothese. Die Analyse wird mit Hilfe eines IV-Regression-Panelmodells mit Zufallseffekten durchgeführt.

Die Hauptergebnisse lassen sich wie folgt zusammenfassen: Erstens scheint Korruption ausschließlich in Entwicklungsländern eine signifikante Rolle bei der Bestimmung der Einschreibungsraten zu spielen, wobei die Beziehung zwischen Korruption und tertiärer Einschreibung positiv ist. Im Gegensatz dazu gibt es in Industrieländern keinen Hinweis darauf, dass diese Beziehung signifikant ist. Einerseits wird das Vorhandensein eines Brain-Drain-Effekts durch die Ergebnisse dieses Modells nicht bestätigt. Andererseits findet diese Arbeit Hinweise, die die Grease-the-Wheel-Hypothese im Bildungssektor stützen. Sie zeigt, dass eine Zunahme des Indikators für Bildungsqualität den positiven Koeffizienten der Korruption auf die Einschreibungsraten, der im Basismodell festgestellt wurde, verringert.

# 1 Introduction

The topic of corruption's impact on economic development has been a topic of much research in the economic literature. This does not come as a surprise, as previous studies have shown that corruption affects various economic aspects in multiple ways. This topic warrants investigation, particularly considering that corruption can hinder economic development.

A country's prosperity is highly reliant on various factors, including natural resources, human capital, geographical position, and cultural patterns. Among these, education plays a particularly significant role, as it directly contributes to the accumulation of human capital. It has been widely established that this is a key driver of long-term economic development. Education plays a particularly vital role in economic growth, as it can enable countries to overcome disadvantages such as limited natural resources or less favourable geography. This is especially important for developing countries, as their other resources are often limited, and investment in human capital can compensate for the deficiency of other economic growth determinants. Consequently, the overall educational attainment of a population serves as a crucial determinant of an economy's growth potential. Any barriers to improving education levels may, therefore, impede economic progress and limit a country's developmental prospects.

Corruption can be seen as one of these barriers. As the debate is ongoing as to the extent to which corruption affects an economy's growth potential, investigating the effect of corruption on human capital formation seems pertinent. Therefore, this thesis will explore this relationship further. Specifically, this thesis will help create a better understanding of how corruption influences tertiary enrolment rates, with a particular emphasis placed on those countries that struggle the most with human capital formation, i.e., developing countries. Understanding the effect that corruption has on education may offer insights into how detrimental corruption can be for sustainable long-term human capital formation, and thereby, economic growth. In addition, this thesis aims to disentangle the different mechanisms by which corruption impacts enrolment rates and potentially provide empirical evidence of their different direction and intensities. The former is done by conducting an instrumental variable regression on a large panel dataset that includes a

wide variety of countries, for the years 2012-2022. One of the main findings of this thesis is that corruption seems to have a significant positive impact on tertiary enrolment rates for developing countries. In contrast, the effect for developed countries appears insignificant, as factors such as gender inequality, income inequality, and demographic variables appear to play a more pronounced role in determining tertiary enrolment rates. Two main mechanisms behind the positive effect for developing countries are further investigated. Firstly, adolescents may enrol in university to facilitate moving abroad at a later date, thus increasing tertiary enrolment. Secondly, corruption may make it easier for bribery at entrance exams to occur, thus increasing enrolment at universities. The model is thus expanded to examine these two mechanisms in more depth. The results of these model extensions provide evidence that this positive effect may be caused by an increased ability to engage in bribery and nepotism, whilst the effect of enrolment in order to move abroad appears insignificant.

This thesis is structured as follows. Section 2 provides an overview of the relevant literature to provide the foundation on which this research was conducted. Section 3 explains the theoretical mechanisms behind corruption's impact on tertiary enrolment, providing valuable insights for the modelling process. Section 4 introduces the panel dataset and describes the sources for the variables within it, as well as provides a more general overview through descriptive statistics. Section 5 details the methodological approach and outlines the empirical strategy. Section 6 presents the results of the analysis. Section 7 covers necessary robustness checks to ensure the validity of the results outlined in the previous section. Finally, Section 8 concludes this thesis by summarising its main findings and briefly discussing the limitations of the research.

# 2 Literature Review

There is a broad literature on the effect of corruption on education, including both theoretical and empirical research. Nevertheless, the variable used to measure educational outcomes varies greatly from paper to paper. Any research that seeks to explore the impact that corruption has on educational outcomes, must first define what educational outcomes are.

One branch of the literature investigates the quality of education through the dropout rates. Gupta et al. (2001) explore the impact of corruption on different social services including education. For their measure of educational outcomes, they use dropout rates in primary education and find that corruption has a positive and significant impact on these rates. Abdulla (2021) theoretically investigates the impact of corruption on human capital formation, with dropout rates being used as a measure of educational outcomes within their theoretical model. Dreher and Herzfeld (2005) use enrolment rates in secondary education as an indicator of human capital in their empirical analysis of the effects of corruption on economic growth as a potential channel. They find that secondary school enrolment is not significantly lower in countries that have more corruption. Dridi (2014) utilises regression analyses on a large set of countries in order to examine the impact of corruption on education. To this end, they use secondary enrolment rates as a measure of educational outcomes. The research finds a significant negative effect of corruption on secondary school enrolment rates.

Other measures for educational outcomes are also used in the literature. A wide branch of the literature utilises average schooling years as an educational outcome variable. Duerrenberger and Warning (2018), in their paper on the effects of corruption on educational outcomes in developing countries, use expected years of schooling as their dependent variable. [1] They find that corruption significantly negatively impacts expected years of schooling for developing countries. They stress that, for developing countries, corruption may decrease their human capital formation and therefore lead to lesser economic gains. Furthermore, they emphasise that research into developing countries is limited, and this is a research gap that needs to be addressed. Pellegrini and

[1] The dependent variable denotes the overall duration of formal education that an individual is expected to receive from the age of five onwards (Source: UNESCO Institute for Statistics database).

Gerlagh (2004) use a cross-section of 48 countries and find that there appears to be no significant negative impact of corruption on average schooling years.

In contrast to the literature that uses average years of schooling, Barro and Lee (1996) use educational attainment in primary and secondary school in order to measure educational outcomes. As mentioned by Rajkumar and Swaroop (2008) in their review of the literature, educational attainment as a measure for educational outcomes has a strong inverse relationship with dropout rates. Furthermore, dropout rates are found to be highly affected by educational quality (Harbison & Hanushek, 1992; Lee & Barro, 2001). In essence, then, it appears that enrolment rates are a good indirect measure of educational quality within the literature.

Delaney and Yu (2013) explore the effect of corruption on tertiary education outcomes. Their goal is to understand how the implementation of different policies changes educational outcomes. To achieve this goal, they use an event history analysis with their dependent variable being the tertiary graduation rate.

The measurements for educational outcomes used as the focus of the analysis differ because the aims of the research differ. For example, when the goal was to explore the quality of education, the dropout rates and the enrolment in primary school were used. Adult literacy rates or average years of schooling were mostly used to identify the labour market effects. Additionally, most papers focus on the education period up to secondary school.

The goal of this thesis is to explore and showcase whether corruption affects the willingness of people to further improve their skills and knowledge. In essence, this research aims to investigate the effect that corruption has on the initial willingness to pursue further human capital formation. It thus appears most suitable to use enrolment rates as the dependent variable for this research. Another conclusion that can be drawn from the literature, as it pertains to the dependent variable, is that there appears to be a research gap. As can be seen above, most empirical papers focus on the educational outcomes and quality within the primary or secondary educational level[2], as opposed to the tertiary level. Tertiary education, however, is an essential aspect of human capital

[2] Deleney and Yu (2013) are among the exceptions to this.

formation, and limiting the research to primary and secondary education may thus not capture all of the impacts of corruption on the education system within a country. It therefore appears essential that this research gap is addressed. It remains unclear, however, in which way the effect is hypothesised to go, due to the limited amount of research into tertiary enrolment rates. Lastly, as Dürrenberger and Warning (2018) indicate, developing countries have been mostly neglected in the literature, and they underline the need to differentiate between developing and developed countries when conducting research. It therefore seems appropriate that more research is done into the impact of corruption on the education system in these countries. Particularly, as these countries are the ones where most economic gains could be made from increased human capital formation, further research in this area is needed.

Nevertheless, it is important to note that the relationship between corruption and education does not only go in one direction but goes both ways. Many papers have shown that education has a negative effect on corruption. Cheung and Chan (2008) find that as participation in tertiary education increases, the incidence of corruption in countries decreases. In the same vein, Maria et al. (2021) show that secondary education enrolment has a negative influence on the level of corruption in all categories of countries studied. Asongu and Nwachukwu (2015) investigate the impact of education on corruption and find that increased education may reduce the amount of corruption within a society. Maria et al. (2021) confirm the earlier results from Asongu and Nwachukwu (2015) when investigating the relationship of education on corruption for 13 countries, utilising a 2SLS estimation technique.

This reversibility of the effect of corruption on education indicates a need to control for the simultaneity bias present. As it pertains to this research, then, it is important that a methodology is chosen that accurately controls for this simultaneity bias. Dridi (2014) mentions that endogeneity may be present in their paper on the effect of corruption on education due to the presence of simultaneity bias. To resolve this, they opt for a 2SLS methodology, with the absolute value of latitude and the share of muslims in the population as instruments for the corruption variable. Gründler and Potrafke (2019) opt for a different technique to counter simultaneity bias and apply

a jack-knifed approach, which takes regional averages of corruption as instruments for national corruption levels. Furthermore, they use a two-step system GMM for the dynamic panel data methodology. Dürrenberger and Warning (2018) look to resolve the problem of simultaneity bias by using an instrumental variable approach, with a *Free Country* index, which is a combination of a political rights index and civil liberty index, and GNI per capita in 2000 as instruments for corruption[3]. What all these methods have in common is that they use instruments to correct for the endogeneity that results from simultaneity bias. This research needs to take a similar approach in order to eliminate the simultaneity bias present when investigating the effects of corruption on educational outcomes.

As can be deduced from the previous paragraphs, the empirical literature investigating the impact of corruption on education is vast. However, some time ought to be spent on the theory behind this effect to not just understand the if but also the why.

One channel through which corruption may impact education, as found in the literature, is that increased corruption leads to inefficient fund allocation and overall misuse of funds (Maurissa & Ahmad, 2023; Dridi, 2014; Heyneman, 2004; Mauro & Driscoll, 1997). Funds are allocated to sectors in which it may be easier to skim off the top instead of education. Through the decreased funding of education, the educational outcomes suffer. Another channel that is explored in the literature is the decreased incentives to invest in human capital formation. Dürrenberger and Warning (2018) theorise that corruption reduces the expected gains from human capital formation for students. The main idea they set forth is based on Becker's (1962) theory of investment. It boils down to a standard cost-benefit analysis. As the direct costs for the students increase, as is proposed to be the case in more corrupt countries, for the same benefit, fewer students will enrol. Alternatively, as the benefit decreases through, for example, fewer opportunities to find a job with better pay after completing university in a more corrupt country[4], the same logic applies, and enrolment should decrease. This theory, however, assumes an inability of students to move

[3] Important to note, is that the timeframe of their analysis is 2005-2012. They have therefore selected GNI per capita from 5 years before the starting point of their analysis.

[4] For example, through decreased state-funding, worse transportation possibilities, etc.

abroad. In the case where the cost, be it social or financial, of moving abroad is smaller than the extra costs of studying within the corrupt country as opposed to studying in a corruption-free country, students may instead move abroad. Within the same vein, an increased benefit after studying for those in corrupt countries, i.e., by moving abroad to a corrupt-free country after finishing university, would cause an increase in tertiary enrolment. This process of persons with higher education moving abroad is known in the literature as brain drain, and it muddies the negative effect posited by Dürrenberger and Warning (2018). An additional channel through which corruption may impact tertiary enrolment rates is through the widely discussed *grease the wheel* hypothesis. This hypothesis stipulates that, under certain conditions, corruption can even have positive effects on a variety of variables. Swaleheen (2011), for example, finds that the effect of corruption on economic growth is non-linear. While low levels of corruption hinder economic growth, beyond a certain threshold, corruption may actually stimulate growth. Wang and You (2012) and Ayaydın and Hayaloglu (2014) found some further empirical evidence for this. They researched the effects of corruption on the growth of firms in China and Turkey, respectively. They found that corruption tends to promote firm growth and, hence, economic development.

More details to the effects of brain drain and the 'grease the wheel' hypothesis are provided within Section 3 of this study. Nevertheless, an important take-away is that human capital investment functions very similarly to any other type of investment choice, and that a theoretical framework needs to take into account the cost-benefit analysis associated with deciding to invest in human capital formation by enrolling in education institutions. Additionally, brain drain effects and *grease the wheel* effects may make the hypothesised negative impact of corruption on tertiary enrolment disappear or appear positive.

As it pertains to the empirical methodology, the literature on corruption can broadly be categorised into three distinct methodologies: GMM models, IV fixed-effect models, and IV random effect models.

Gründler and Potrafke (2019) utilise a system GMM model, as well as an IV fixed effect

model, to investigate the impact of corruption on economic growth. They use the lags as instruments in their system GMM equations in order to take into account the endogenous components of their model. Sharma and Mitra (2019) use both system GMM and difference GMM models to investigate the impact of corruption on economic growth. They indicate that the system GMM method works better for finite sample properties. Asongu and Nwachukwu (2015) create an educational index in order to assess the relationship between corruption and education. To this end, they use a system GMM model in order to counter the endogeneity present within the variables. They use the lagged levels and differences of the regressors for the first difference and level equations. Overall, whilst the GMM models appear to be commonly used, it is important to remember under which conditions they can be used, particularly as it pertains to the exclusion restriction.

Swaleheen (2011) examines the effect of corruption on economic growth by means of an IV fixed-effect set-up in order to control for time-invariant country-specific factors. They additionally use a system GMM estimation technique. Boly et al. (2024) use a fixed-effect estimator to investigate the effect of corruption on education quantity. They use two-way fixed effects, controlling for both time and country invariant factors. Nevertheless, the amount of fixed-effect estimation techniques in the literature appears smaller for research that investigates the impact of corruption on enrolment rates. Setodji and Schwartz (2013) state that the fixed effect models should be used if unmeasured time-invariant factors cause bias due to being correlated with both the variable of interest and the dependent variable. According to the authors, the random effect models become appropriate when covariates adequately proxy unmeasured confounders. This allows retention of between-entity variation in the data, yielding two key advantages: 1.) more efficient coefficient estimates through partial pooling, and 2.) the ability to estimate entity-level effects such as policy impacts while still controlling for confounding through observable characteristics. Due to the efficiency with which enrolment rates can be measured using other variables, the literature appears to point away from using fixed-effect methodologies.

Instead, a large body of literature uses random effect models. These models allow for cor-

relation across the error terms for each country. Rajkumar and Swaroop (2008) examine the relationship between corruption and the effectiveness of human capital formation, for example, through primary schooling. They utilise an IV random effect model as an estimation technique. They find that the random effect specification delivers efficient and consistent estimates. As instruments, they use the type of law system, ranging from common law, French civil law, German civil law, Scandinavian civil law or Socialist law to counteract the endogeneity in their public spending variable. Of most importance for this research, however, is the methodology employed by Dürrenberger and Warning (2018). As mentioned previously, they investigate the impact of corruption on expected years of schooling. To this end, they use a random effect specification with clustered standard errors at the country level to correct for potential correlation within countries over time. They use an instrumental variable approach to account for the endogeneity present in the corruption variable. They defend the use of GNI per capita in 2000 and the mean of two indices by Freedom House by first testing for instrument validity. They find that both instruments appear to be highly correlated with the corruption perceptions index. Furthermore, the test for overidentification is not rejected, and the instruments pass the test for weak instruments. They thus conclude that these instruments are suitable for corruption.

Also of interest is the sample selection that studies within the literature use. Many analyses of the impact of corruption on education focus specifically on a certain region or country. For example, Suryadarma's (2012) analyses effects of junior and senior schooling in Indonesian regions. It reveals a positive effect of public spending under low corruption, but no effect under high-corruption regimes. Antwi et al. (2020) focuses exclusively on Ghana, and Orkodashvili (2011) is a study focused specifically on Georgia. There thus appears a need for a large panel dataset analysis, which includes many countries, in order to draw conclusions on a larger scale than what can currently be done with contemporary literature. This allows for a more broad applicability of the results.

Regarding the control variables in the literature, most papers that investigate the effect of corruption on educational outcomes utilise similar ones. The most commonly used variables are

public spending on education and the degree of urbanisation (Gründler & Potrafke, 2019; Rajkumar & Swaroop, 2008; Dridi, 2014). Furthermore, both Rajkumar and Swaroop (2008), and Dridi (2014) have used the following control variables: GDP per capita, education spending and the Gini coefficient. Dürrenberger and Warning (2018) explore the change in the average years of schooling (educational outcome), and control for the enrolment ratio in secondary education and enrolment in tertiary education. Of note is that some papers also use a dummy indicating an East Asian country. This is because they establish that there seems to be a particularly strong culture surrounding higher education in these countries (Dürrenberger & Warning, 2018; Rajkumar & Swaroop, 2008).

The main takeaways from the literature for this research, then, are the following.

First, educational outcomes are measured in a variety of ways in the literature. Nevertheless, as mentioned previously, a large branch of the literature uses enrolment or dropout rates as a measure for educational outcomes. As this research in particular is focused on the choice of people to pursue further human capital formation, it appears appropriate that the dependent variable used in this research is enrolment rates.

Second, the relationship between corruption and enrolment rates, particularly tertiary enrolment rates, remains unclear. Some papers have found significant effects of corruption on primary and secondary enrolment or dropout rates, but to the best of my knowledge, there is limited research into tertiary enrolment rates.

Third, studies investigating the effect of corruption in developing countries are scarce. Developing countries are understudied, even though these are countries where human capital gains remain low and are a potential driver for further growth. A novelty of this research, then, is to explicitly account for this in the modelling technique. Fourth, corruption as a variable is found to be endogenous. Any research into corruption must properly account for this in the methodology.

Fifth, random effect models appear to be widely used when investigating the impact of corruption on educational outcomes. Particularly, the methodology by Dürrenberger and Warning (2018) provides a good baseline on which further research can be conducted. This research will

mostly build on their methodology, as their research is the most similar to what is being conducted in this research.

Sixth, many papers investigate the effects of corruption on education on a country-level, foregoing further panel analyses. This research seeks to contribute to a growing body of literature that uses a panel data approach and explicitly takes developing countries into consideration.

Seventh, this research must take into account the cost-benefit analysis of investing in further human capital formation. It is essential that the mechanism through which some students either pursue or forgo tertiary education is properly investigated, in order to explain the results from the empirical analysis, with special attention paid to the brain drain phenomenon and the grease the wheel hypothesis.

# 3 Theoretical Background

Many papers have shown that corruption can be a determining factor in shaping a country's economy. As it plays a significant part in shaping the world's economy, it is important that corruption is observed and measured. Very often, studies find that corruption is associated with a negative impact on different societal metrics, such as economic development. Moreover, there is a particular strand of the literature that finds empirical evidence for this negative association. Gründler and Potrafke (2019) find a negative effect of corruption on economic growth, analysing 175 countries. Antwi et al. (2020) found a significant negative effect of corruption on per capita growth in Ghana, both in the short term and the long term. Al Qudah et al. (2020) find a negative effect of corruption on per capita GDP in Tunisia. Even though numerous papers find negative impacts of corruption, there is another strand of papers that suggests it might function beneficially in certain contexts. Méon and Weill (2010) showcase that corruption may be positively related to efficiency in countries with severely ineffective institutions. This paper speaks in favour of the "Grease the wheel" hypothesis briefly mentioned in the literature review earlier. This hypothesis believes that in countries where the functioning of institutions is not very effective, corruption can actually have a positive impact on a variety of metrics. The reason behind this is that a culture of bribery and nepotism acts as a replacement for the broken institutional system and "greases" a country's system, thereby making it more efficient. This hypothesis was first advanced by the economist Nathaniel H. Leff (1964) and later promoted by Leys (1965) and Huntington (1968). They propose that corruption can serve as a rescue tool in failing bureaucratic systems. One should thus exercise caution when investigating the effects of corruption, as its effects may be manifold.

Therefore, the key takeaways are that corruption can influence a country's economic performance and that its impact is not always straightforward. The latter conclusion is particularly interesting for this research and is worth exploring in more depth.

Cultural and societal patterns within one country can shape one's way of thinking and play a huge role in the decision-making process. The environment in which choices are made shapes the

actions that are taken. Thus, the impact of the environment should not be neglected or omitted. Moreover, the choice of studying is not only a result of the internal but also the external valuation. As in almost every decision-making process, the decision of whether to study or not includes weighing the pros and cons. If an individual lives in a highly corrupt country and believes that, due to systemic inequality, the returns from university are not certain, he might feel demotivated to study in the first place. In addition, people with good personal connections can find better jobs even without a university degree, which may again negatively impact enrolment rates. To better understand different mechanisms through which corruption can influence enrolment rates and the decision-making process behind it, a simplified model with only two countries is introduced in the following paragraph.

Let us think about a simplified world in which there are only two countries: Effort land (in the following "country E") and Bribery country (in the following "country B"). In both countries, we have two time periods: *T=0* and *T=1*. In *T=0*, people are deciding if they want to study or not. In case they decide not to study, they start looking for employment. We assume that there is a certain amount of effort ($X$) that needs to be exerted in period 0 to graduate in period 1. Everyone who wants to graduate in both countries must fulfil the previously defined requirements. The minimum requirement for enrolling into university can be seen as the following linear function $X = a*I$, where $a$ represents a personal adjustment for the investment that is required to be made for studying. In essence it captures personal inclination towards studying. The higher the $a$, the less investment is necessary to reach the minimum requirement for enrolling into university. Investment in this case denotes all effort that needs to be exerted such as time, money, and opportunity costs. This means that as the $X$ is given, i.e., there is a set minimum requirement that needs to be reached, depending on the personal inclination towards studying, parameter $a$, people may decide whether to enrol in tertiary education or not based on the investment ($I$) they need to make in order to enrol. The aforementioned choice to study is reflected in the inequality below:

$$\text{Gains}_{s_1} \geq \text{Gains}_{NS0} + \text{Gains}_{NS1} + I$$

$Gains_{NS0}$ and $Gains_{NS1}$ are the labour-market gains for those who decide not to enrol. We assume that the labour market gains for those who did not study are some fixed amount ($\rho$) in both countries. In *T=1* there are now two groups of people: the ones who studied (Group *S*) and the ones who decided against studying (Group *NS*). $Gains_{S1}$ reflects the labour market gains in period 1 for the group of people who have decided to study. If we assume that there are no frictions in the system, then the following inequality always holds:

$$\text{Gains}_{s_1} \geq \rho$$

This in turn means that when this inequality holds $Gains_{s_1} - \rho \geq I$, a person decides to enrol in university. In other words, the extra labour-market return to education must be at least as high as the initial effort exerted by the individual. Recalling the equation above, this effort can be expressed as follows:

$$I = \frac{X}{a}$$

As previously explained above, X represents a minimum requirement that needs to be fulfilled for tertiary education and therefore can be seen as the constant. Hence, only the people with a sufficiently large incliniation to studying ($a$) would decide to study.

The model described above assumes that all people have the same access to university and that enrolment in tertiary education depends solely on individuals' level of effort and personal inclination. Nevertheless, in countries where corruption is present, the previous assumption may not hold. As the name of country B introduced previously implies, there is a substantial presence of corruption and bribery culture in this country, which people are well aware of and therefore take into their cost-benefit analysis in their everyday life. In such systems, bribery or personal connections can function as shortcuts that replace the effort normally required to achieve cer-

tain outcomes. Past research has shown that finding a skill-appropriate job is more difficult in countries with more corruption, as it may not depend only on qualifications, but also on personal relations. (Dürrenberger and Warning, 2018; Heyneman, 2004; Stapenhurst and Langseth, 1997). Personal connections or different bribery mechanisms that can influence labour market outcomes can easily be extended to universities. In the context of tertiary education, individuals may draw on personal networks to gain access to resources, assistance, or favourable decisions, which allows them to circumvent the usual path of study and the effort it requires. Thus, to add this friction of the system into our simplified model, the cost for the individual would need to be amended by including the corruption that can be used as a tool. Taking this into account, the function takes the following shape:

$$I = (1 - R)\frac{X}{a}.$$

Where $R$ is a dummy and reflects personal relationships or bribery. Thus, the decision to study is now not only reliant on a parameter value, but also on the existence of corruption in tertiary education. This means that if an individual can bribe the professors and use their personal network ($R=1$), no additional effort needs to be exerted. Hence, there exist some people who would not have enrolled in country E that now do in country B, namely those with an extensive personal network and funds to engage in bribery.

The amendment to the effort function pertains to the fact that in country B, the investment of time and studying can very easily be substituted with bribery ($R$), which would then lead to higher enrolment rates. This is because now access to the universities is broadened to those individuals who would usually decide against studying in country E.

This can be seen in the same vein as the previously mentioned grease the wheel theory, which will be further discussed in the following section.

## 3.1 Grease the wheel

As noted at the beginning of Section 3, the origins of the grease the wheels hypothesis can be traced to Leff (1964). He argued that corruption may facilitate investment by easing the constraints of overly rigid institutional systems. Building on this perspective, Huntington (1968), in his work Political Order in Changing Societies, stated: "Corruption may be one way of surmounting traditional laws or bureaucratic regulations which hamper economic expansion" (p.68). This suggests that, in economies characterised by rigid institutions, corruption might at times be perceived as a mechanism for navigating inefficient governmental regulations and bureaucratic barriers.

During the 1990s and the beginning of the 2000s, this concept was further investigated by a vast number of researchers. Méon and Sekkat (2005) investigate whether corruption is detrimental or beneficial to economic activity through two competing hypotheses, *grease the wheels* and *sand the wheels*. To answer this question, they conducted a macroeconomic-level empirical study using cross-country regression analysis. The econometric model used the per capita GDP growth rate and the investment ratio as dependent variables. Explanatory variables included initial GDP per capita, initial school enrolment, population growth, investment ratio, and economic openness. However, this paper provides empirical evidence for sand the wheels rather than the grease the wheels hypothesis.

On the other hand, Wang and You (2012) found that corruption has little adverse impact on firm growth in contexts where financial markets are underdeveloped, and in such settings, corrupt practices may even exert a greater positive influence. They suggested that corruption can promote firm growth by helping firms circumvent inefficient regulations. Similarly, Gründler and Potrafke (2019), while confirming the generally negative impact of corruption on economic growth, argued that in specific institutional contexts the adverse effects of corruption might be mitigated or, in a weaker sense, appear to play a positive role in navigating highly inefficient systems.

Although the previously mentioned hypothesis has been mostly used for the direct role of

corruption on economic performance, the same idea may also be applied to education. As education represents one of the determinants of economic development, it is not irrational to imply that the same concept could potentially hold for the educational outcomes. Boly et al. (2024) found evidence that corruption may decrease education quality. On the other hand, their regression showcases that corruption increases education quantity by enhancing the aggregate chances of obtaining a degree. The quantity was measured through both the proportion of graduates from tertiary education and the gross enrolment ratio in tertiary education. Overall, corruption can sometimes be perceived as a mechanism to accelerate and simplify administrative procedures in sluggish economies. In the literature, this phenomenon is commonly referred to as the grease the wheels hypothesis. Within the context of this research, such dynamics can also be understood in the field of higher education. For instance, individuals whose academic ability and effort may not be sufficient for admission could still gain access to the university through strong personal connections or bribery (Orkodashvili, 2011). This suggests that personal relationships and informal practices may increase the likelihood of obtaining higher levels of education.

Consequently, corruption can provide access to tertiary education even for individuals who, under merit-based criteria alone, would not be able to acquire a university diploma. It is important to note that the model discussed previously has been limited to a set-up in which cross-country mobility is not possible. However, if the possibility of migration is introduced, the people's choice of studying may change. As already mentioned, country B suffers from corruption. Due to this, the probability of finding employment differs between countries E and B. While in country E there is clear certainty regarding the labour market outcomes, in country B that is not the case. Country E provides classifications of job offers, where the better jobs can only be done with a university degree, and this setup represents publicly available information. On the other hand, in country B, the connection between level of education and employment is not that straightforward, and it can be seen as a discretionary reward system. The latter system brings a high level of uncertainty and consequently may also impact the decision-making process of people in country B.

Thus, when mobility between countries is introduced, there is a possibility that people will move abroad to increase their labour market gains after graduating. This phenomenon is known as brain drain and will be discussed in more detail in the following section.

## 3.2 Brain drain phenomenon

Brain drain finds its roots back in the 1960s in the United Kingdom. This term was used to describe the mass migrations of researchers from the United Kingdom to North America. This term has quickly become popular and relevant for describing all emigrations of highly skilled and educated people to countries with a better standard of living. Arif (2022) in his research argues that migration is often directed to those countries with lower levels of corruption and that in these countries, there are noticeably more people with higher education.

Schaeffer (2005) analyses pre-migration and post-migration human capital investments. This theoretical study argues that individuals may invest more in building up their human capital if they intend to emigrate compared to those who do not. Thus, an individual's decision to invest in education is likely to be influenced by their intention or plan to migrate abroad.

Baruch et al. (2007) investigate the reasons why students from developing countries who study in developed countries decide not to return home after completing their studies. The study was conducted through a questionnaire survey administered in 2003 across five universities in the United Kingdom and the United States. They found that over forty per cent tend to stay after graduation for some time, which may even lead to permanent stay in the end.

Thus, the brain drain effect has negative consequences for the economy of the country from which people are emigrating, regardless of whether the individuals are moving abroad before or after completing their studies. The reason for this is that highly skilled individuals are lost in the country of origin's labour force, and by extension, the country's human capital diminishes, irrelevant to the timing of the emigration. However, in the context of the influence of such emigrations, the timing can determine whether they have a positive or negative effect on tertiary

enrolment rates.

A positive effect of brain drain on tertiary enrolment rates can be observed in situations where an individual plans to move abroad in the future and, to enhance their competitiveness in international labour markets, decides to pursue further studies. In this case, the very prospect of emigration motivates young people to enrol in universities and to obtain additional qualifications. Although this phenomenon initially appears to be a loss for the country of origin, it paradoxically encourages higher education enrolment rates in the short term.

On the other hand, for some individuals, the inefficiencies in their country's system can lead them to a loss of faith in the quality of their local education. When the credibility of universities is undermined by political interference, lack of resources, or nepotistic practices, students begin to perceive the value of a domestic diploma as limited. Consequently, they opt to move abroad to pursue tertiary education, as they believe that abroad they can obtain better education, which can yield greater returns in the global labour market. This represents the negative effect of the brain drain on the enrolment rates in tertiary education.

If we connect the above considerations with the simplified model introduced at the beginning of Section 3, we get a framework in which individuals are assumed to move freely from country B to country E. Within such a setting, there are two possible behavioural scenarios for prospective migrants. In the first scenario, individuals choose to pursue their studies in their home country before emigrating, to later collect labour market advantages available in country E. Here, the very possibility of emigration paradoxically generates a positive effect of domestic corruption on tertiary enrolment rates. In contrast, the second scenario envisions students who decide to relocate even before starting their studies. This has negative implications for the home country's enrolment rates, as it reduces them and accelerates the outflow of human capital.

In conclusion, the already ambiguous relationship between corruption and education becomes even more complex by introducing the possibility of human mobility. In order to gain a deeper understanding of the different effects of corruption on educational outcomes, empirical research is conducted. The following section, therefore, describes the data that was employed to

quantify the relevant variables.

# 4 Data

Data collection can often be one of the most demanding stages of the research process. Problems can arise with both data availability and the selection of trustworthy and reputable sources. Most papers on corruption and education gather their data from the UNESCO Institute for Statistics and Database and the World Bank. This research followed the same approach, and almost all data were gathered from the mentioned databases. In addition, for specific indices published by certain foundations or research institutions, the data were downloaded from their respective databases. For example, the Corruption Perceptions Index (CPI) was found in the database published by Transparency International.

## 4.1 Dependent variable

The goal of this research is to explore and showcase whether corruption affects the willingness of people to further educate themselves. This is hard to measure and observe without global survey data. However, there are some available worldwide data regarding educational outcomes (e.g., enrolment rates, graduation rates, years of schooling, repetition rates, etc.) that are publicly available. As the crucial part of the desired measurement is the willingness to pursue higher education, enrolment rates are a good proxy for expected returns from additional learning and improvement. Therefore, the enrolment rates were used as the dependent variable. Primary school is mandatory in almost every country. Secondary education, although not explicitly mandatory in many parts of the world, can often be considered the minimum level of education required in modern society. Moreover, in some countries, secondary schooling is further divided into lower and upper levels, with at least one of these stages typically being compulsory. Tertiary education, however, is generally a matter of personal choice and is not mandated by the law. That is why the true perception of the people's belief in the public institutions and systems in general can be reflected in educational outcomes within tertiary education. Data for the tertiary enrolment rates was obtained from the World Bank's World Development Indicator database, originally sourced

from the UNESCO Institute for Statistics. The initial research strategy covered the timeframe 2012 to 2023 and included countries from the whole world. However, due to limited data availability of enrolment rates in tertiary education, a shorter time frame was decided on, cutting out 2023. Furthermore, countries that did not have complete data on tertiary enrolment rates were removed from the dataset. Additionally, Cuba was removed from the observation due to the data limitations for the dependent, as well as many of the independent variables. After these amendments, the dataset is down to 81 countries.

## 4.2 Independent variables

The variable of interest in this thesis is corruption. Many papers (Paldam, 2002; Paldam, 2019; Aidt, 2009; Goel & Nelson, 2010; Lessmann & Markwardt, 2010; Bjørnskov, 2012; Debski et al., 2018) have used the Corruption Perception Index as a measurement for corruption. Important to note, however, is that Gründler & Potrafke (2019) emphasise that this measurement is not comparable between periods before 2012 and after. This is due to the inclusion of differing index components making it not comparable across countries and over time. Thus, the starting point of this research is precisely 2012. As for the control variables, this paper will follow those variables that have been identified in the literature review. Some of these variables, such as secondary school enrolment rates, are highly correlated with the dependent variable and are thus added to the regression to capture more of the variation. Other control variables identified, such as government expenditure on education, may be correlated with both the dependent and independent variables. It is therefore important to include them in the regression analysis to eliminate any potential omitted variable bias. As was noted in the literature review, a dummy for East Asian countries was added, as papers have found that these countries may exhibit different cultural characteristics that may be important to capture variation in enrolment rates. The following paragraphs provide a complete list of the independent variables, together with their corresponding descriptions.

*Corruption Index (CPI)*: The Corruption Perceptions Index (CPI) was employed as a measurement of corruption. CPI is a global metric that ranks countries based on perceived levels of public sector corruption. The standard CPI assigns values on a scale of 0 to 100, where 0 denotes highly corrupt and 100 represents the least corrupt nations. To make the interpretability of the empirical analysis more intuitive, a reversed CPI index was constructed using the following transformation: $100 - CPI$. This adjustment reverses the scale such that 0 now corresponds to minimal corruption, while 100 signifies maximal corruption. Additionally, the regression model's lagged values of CPI were used to reflect the real-time lag effects of the decision-making. Data was collected from Transparency International, which collects its data on a yearly basis.

*The Gross Domestic Product per capita* is a direct indicator of a country's economic performance and can consequently have a significant impact on education. The data were obtained from the World Bank and subsequently transformed into logarithmic values.

*Education Expenditure as a percentage of GDP* is another variable that should be controlled for, as it can impact educational outcomes, and is correlated with corruption. To ensure comparability across different countries, the relative measure of this expenditure, expressed as a percentage of GDP, was used. These data were collected through the database of the UNESCO Institute for Statistics.

*Gender Inequality Index* reflects gender-based disadvantage in the following three dimensions: reproductive health, empowerment, and the labour market. It shows the loss in potential human development due to inequality between female and male achievements in these dimensions. It ranges from 0, where women and men fare equally, to 1, where one gender fares as poorly as possible in all measured dimensions. It is assumed to be correlated with tertiary enrolment rates, as an unequal society may not provide women with the opportunities to attend university. The Gender Inequality Index data was collected from the United Nations Human Development Reports.

*Age Dependency Ratio* is expressed as the proportion of people younger than 15 or older than 64 per 100 working population. It was collected from the World Bank. The measure is based

on the World Bank's staff estimates based on age distributions of United Nations Population Division's World Population Prospects.

*Fertility Rate* is a measurement that shows the number of children that women would give birth to if they lived to the end of their childbearing years and bore children in accordance with the specified year's age-specific fertility rates. It was collected from the World Bank.

*Gini coefficient* measures income or consumption distribution inequality by quantifying the area between the Lorenz curve and the line of absolute equality. This measurement takes a value from 0 (total equality) to 100 (total inequality). The index was collected from the World Bank Poverty and Inequality Platform. It is based on primary household survey data obtained from government statistical agencies and World Bank country departments.

*Urban Population percentage* expresses the number of people residing in urban areas per 100 people. In essence, it measures the amount of urbanization in a country. This measure comes from the World Bank database.

*Secondary enrolment rate* measures the gross enrolment rates in secondary education. The gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. It was collected from the UNESCO Institute for Statistics. It is calculated by dividing the number of students enrolled in secondary education regardless of age by the population of the age group that officially corresponds to secondary education and multiplying by 100 to get a percentage.

*East Asia Dummy* is a dummy variable that takes value 1 for countries located in East Asia. The following countries are classified as belonging to East Asia: China, Japan, South Korea (Republic of Korea), North Korea (Democratic People's Republic of Korea), Mongolia, Taiwan, Hong Kong (Special Administrative Region of China), and Macau. [5]

*Researchers*: The number of researchers engaged in R&D, expressed as per million of people. Researchers are professionals who conduct research and improve or develop concepts, theories, models, techniques, instrumentation, software, or operational methods. R&D covers basic re-

[5] Note that not all these countries are included in the dataset. All were mentioned to indicate what was classified as east Asian, not as an indication that all these countries are used in the analysis.

search, applied research, and experimental development.

*Outbound mobility rate* represents the number of students abroad, expressed as a percentage of total tertiary enrolment in that country. The data is taken from the UNESCO Institute for Statistics database.

*The E3: Human Flight and Brain Drain indicator ("BD indicator")* is part of the Fragile States Index, which is published annually by the Fund for Peace. The BD indicator specifically evaluates the economic impact of human displacement, including both voluntary emigration and forced displacement due to political reasons, and its consequences on a country's development.

## 4.3 Descriptive statistics

The aim of this research is determining whether the impact of corruption differs between developed and developing countries. To do that, the dataset was divided into these two groups of countries. For this purpose, a dummy for developing countries was used.

The classification of countries into developed and developing categories is not completely straightforward and continues to be open to debate. In determining which group a country belongs to, both economic and social factors are taken into account. Nevertheless, a general approximation exists, where developed countries are typically characterised by higher income levels. The World Bank classifies all countries into four groups based on their Gross National Income (GNI) per capita: low-income, lower-middle-income, upper-middle-income, and high-income. Therefore, the World Bank's official thresholds for GNI[6] per capita were applied to categorise countries into these four groups. In this classification, the dataset representing developed countries consists of high-income countries, while the dataset representing developing countries includes countries from the low-income, lower-middle-income, and upper-middle-income groups. The following table showcases descriptive statistics for these two separate datasets.

[6] In 2022, the World Bank classified economies according to gross national income (GNI) per capita using the Atlas method. Under this classification, low-income economies had a GNI per capita of $1,085 or less, lower-middle-income economies ranged from $ 1,086 to $4,255, and upper-middle-income economies fell between $4,256 and $13,205.

Table 4.1: Descriptive statistics for Developed countries

| Variable | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Tertiary Enrolment rate | 429.00 | 67.97 | 18.80 | 1.56 | 104.94 |
| Corruption | 424.00 | 36.95 | 15.04 | 8.00 | 73.00 |
| log GDP | 429.00 | 10.06 | 0.42 | 9.33 | 12.08 |
| Education Expenditure | 393.00 | 4.98 | 1.30 | 1.99 | 8.59 |
| Gender Inequality Index | 403.00 | 0.15 | 0.10 | 0.01 | 0.74 |
| Age Dependency Ratio | 429.00 | 48.69 | 9.06 | 17.36 | 67.06 |
| Fertility Rate | 429.00 | 1.66 | 0.38 | 0.70 | 3.11 |
| Gini coefficient | 326.00 | 32.64 | 4.97 | 23.20 | 47.00 |
| Urban Population | 429.00 | 76.48 | 13.80 | 51.76 | 100.00 |
| Secondary Enrolment Rate | 413.00 | 108.74 | 15.07 | 76.88 | 164.08 |
| Democracy | 396.00 | 7.31 | 2.02 | 1.71 | 9.93 |
| GNI.2007 | 429.00 | 28 704.36 | 19 600.36 | 2510.00 | 78 750.00 |
| Infant Mortality | 418.00 | 0.44 | 0.24 | 0.17 | 1.36 |

Table 4.2: Descriptive statistics for Developing countries

| Variable | N | Mean | SD | Min | Max |
|---|---|---|---|---|---|
| Tertiary Enrolment rate | 462.00 | 39.70 | 23.92 | 4.37 | 127.58 |
| Corruption | 461.00 | 62.76 | 8.71 | 38.00 | 83.00 |
| log GDP | 462.00 | 9.24 | 0.70 | 7.28 | 10.55 |
| Education Expenditure | 419.00 | 4.07 | 1.41 | 0.86 | 7.92 |
| Gender Inequality Index | 451.00 | 0.38 | 0.14 | 0.10 | 0.67 |
| Age Dependency Ratio | 462.00 | 55.53 | 12.55 | 38.40 | 93.53 |
| Fertility Rate | 462.00 | 2.53 | 1.01 | 1.27 | 5.79 |
| Gini coefficient | 299.00 | 38.46 | 7.18 | 24.40 | 63.00 |
| Urban Population | 462.00 | 57.81 | 18.28 | 16.94 | 92.35 |
| Secondary Enrolment Rate | 393.00 | 83.08 | 21.97 | 25.35 | 129.44 |
| Democracy | 440.00 | 5.30 | 1.65 | 1.72 | 8.28 |
| GNI.2007 | 462.00 | 3295.47 | 2400.73 | 400.00 | 9720.00 |
| Infant Mortality | 462.00 | 2.06 | 1.49 | 0.20 | 6.98 |

The data set containing developed countries has 429 observations, while the data set with developing countries has 462 observations. It can be observed that the tertiary and secondary

enrolment rates exceeded 100 percent. According to the database source, this may happen due to the inclusion of students who are either younger or older than the official age range for secondary and tertiary education. [7] The graph below captures the difference between the average rate of enrolment rates between these two datasets. As can be seen from the graph, the difference between the two groups of countries is rather substantial, and the trend of increased enrolment rates over time is visible in both developed and developing countries. Nevertheless, we see that although enrolment rates are increasing in both sets of countries, enrolment rates increased more for developed countries. This underlines the necessity of further research into why developing countries are struggling to increase these enrolment rates, further justifying the need to differentiate between these two groups within our analysis.

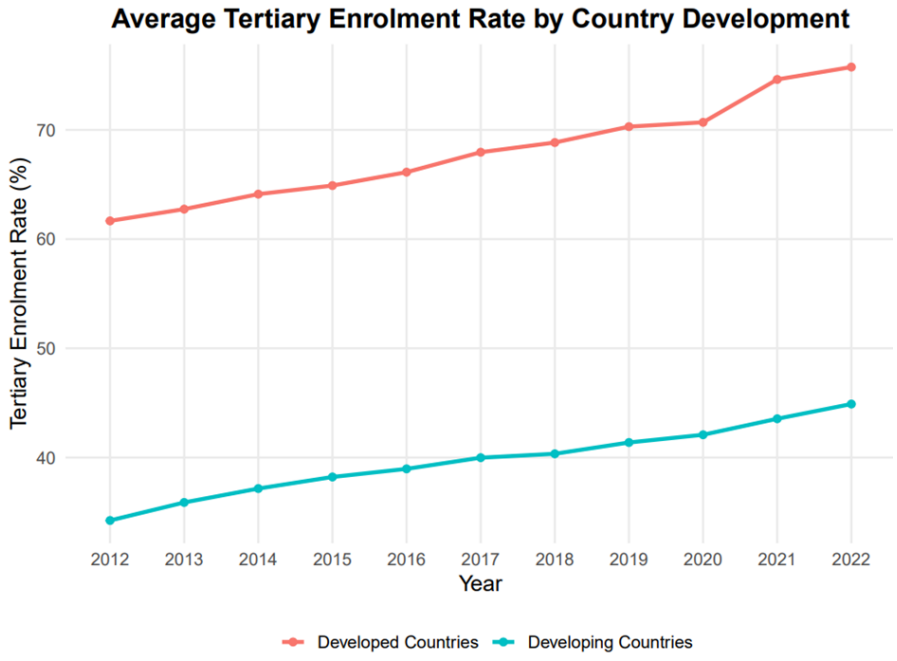


Figure 4.1: Average Tertiary Enrolment Rate Developed vs. Developing countries

[7] This can happen due to factors like early or late enrolment as well as grade repetition.

# 5 Methodology

The goal of this research is to identify how corruption impacts the behaviour of a country's population within an educational context. For this purpose, a panel dataset containing 81 countries over the period 2012 – 2022 is utilised.

Countries inherently have many differences that are hard to quantify. These include, but are not limited to, historical trajectories, cultural norms, economic structures, and governance legacies. Measuring these differences remains a challenge. Moreover, they profoundly shape both baseline educational outcomes and the impact of corruption on them.

A random effect model allows for the modelling of country-specific baseline educational levels (random intercepts) and country-specific deviations in the effect of corruption (random slopes) as random variations around the overall population averages. By accounting for this inherent national heterogeneity as random variance, the model significantly reduces background noise, leading to more precise and reliable estimates of the average causal effect of corruption on educational outcomes across the sampled population.

As mentioned briefly in the literature review, theoretical reasoning speaks in favour of using a random effects set-up as compared to a fixed-effects set-up. Nevertheless, the Hausman test was performed to confirm this. The Hausman test essentially tests whether the entity-specific effects are correlated with the regressors. If there is a correlation between the unobserved country-specific effects, the random effects set-up is biased, and, therefore, a fixed effects set-up ought to be used. If the correlation is deemed sufficiently small, a random effects set-up is deemed more appropriate. This is because when the unobserved entity-specific effects are uncorrelated with the independent variables, the random effects set up is more efficient. The null hypothesis of the test, then, is that the entity-specific effects are not correlated with the regressors and, thus, that a random effects set-up is preferred. Having split the data into developing and developed countries, the test is run two times to ensure that the random effects set-up is valid for both groups of countries. The results of the Hausman test indicate sufficiently large p-values. For the model that uses the dataset with developing countries, the p-value of the test is 0.7754. This means

that the null hypothesis cannot be rejected, and that a random effects model is preferable to one with fixed effects. Running the same test on the model with developed countries shows the same conclusion. The p-value for developed countries amounts to 0.3011. This p-value is sufficiently large such that the null hypothesis cannot be rejected. Therefore, we find that the random effects model is more efficient for both developing and developed countries' datasets than the fixed effects model.

## 5.1 Developed vs Developing countries

As mentioned previously in the literature review, there is a need to control for country-specific cultural and institutional factors. Specifically, one ought to control for those country-specific factors which may systematically influence the relationship between education and corruption. In other words, when a country-specific factor, such as the presence of particular religious or ethical values, is correlated with both the dependent and the independent variable, this may lead to bias. This thus needs to be controlled for. This is why the random effects set-up is chosen, as it controls for these country-specific unobservables that are correlated with both tertiary enrolment rates and the level of corruption within a country. Nevertheless, some variables may be correlated with both the variable of interest and the dependent variable and be non-country specific. These variables are included in the regression as control variables.

Furthermore, this thesis argues that a distinction ought to be made as to whether a country is developing or developed[8]. Essentially, the idea behind this research is that there are fundamental differences in how corruption impacts tertiary enrolment rates between developing and developed countries. The arguments as to why there are structural differences between the impact of corruption for developing and developed countries are presented in the following:

- The impact of corruption on government services in developing and developed countries is fundamentally different. Montes and Paschoal (2016) provide evidence for this. They

[8] Notwithstanding that the distinction between developing and developed may be somewhat crude, the distinction is generally useful as a classification mechanism for the purpose of this research.

find that corruption impacts government effectiveness, and as a result educational outcomes, more so in developed countries than in developing countries. They basically argue for the grease the wheels hypothesis. Thus, this thesis argues in the same vein, that due to the inherently lower government effectiveness in developing countries as opposed to developed countries, corruption may not influence educational outcomes as much in developing countries. If this is the case, then developing countries must be separated from developed countries within the regression.

- Within developing countries, there is a higher likelihood of someone enrolling in university to afterwards move abroad. Furthermore, as was shown in the theoretical framework, this may increase as corruption increases for those that lack an extensive personal network. This correlation is less likely to be present in developed countries, as the differences between wages at home and abroad are smaller. As this means that there are cross-country unobservable variables associated with developing countries that are correlated with both corruption and tertiary enrolment, this must be accounted for in the model.

Additionally, separating countries by their development level provides useful insights that a simpler model would miss. As Dürrenberger and Warning (2018) state, research into developing countries is limited. By delineating the effects of corruption on human capital formation clearly, more attention can be paid to those countries for which human capital formation is currently low. This sheds light on a pathway to economic growth for those countries for which economic growth is lagging. Furthermore, as was seen in the descriptive statistics, the enrolment gap between developing and developed countries appears to be increasing over time, further indicating a necessity for research aimed specifically at developing countries.

Having established that a distinction between developing and developed countries within the model makes sense, it remains vital to assess how to introduce this into the model. One way to do this is by introducing a dummy variable to distinguish between developed and developing countries. While this approach allows for a larger sample and enables a direct comparison between country groups within the same regression framework, the interpretability of the coefficients suf-

fers, particularly when adding many control variables. A different approach, then, is to split the sample into two and simultaneously run those two models. This approach lends itself to an easy way to interpret the results. Furthermore, as discussed previously, there are certain effects[9] that affect only developing countries. In order to be able to explore these effects more thoroughly without hurting the interpretability of the results, splitting the data seems an appropriate solution.[10] Additionally, as the main focus of this thesis is to explore the behavioural changes as it pertains to tertiary enrolment due to corruption for students in developing countries, splitting the sample seems like the most appropriate course of action. Therefore, the sample was split into developing and developed countries, based on the classification mentioned previously.

## 5.2 Empirical strategy

This study examines the relationship between education and corruption using a panel data framework. Given potential heterogeneity in the relationship between education and corruption across different institutional contexts, we estimate the model separately for two distinct country groups: developed countries and developing countries. This allows for differential effects of education on corruption depending on political and economic structures. The baseline econometric specification is given by the following equation:

$$\mathrm{EDU}_{i,t} = \beta_0 + \beta_1 \,\mathrm{CPI}_{i,t-1} + \beta_2 \,\mathrm{GDP}_{i,t-1} + \gamma \, C_{i,t} + \varepsilon_{i,t}. \tag{5.1}$$

Where EDU represents the tertiary enrolment rate in country i at time t. CPI is the variable of interest in this analysis and denotes a reversed corruption perception index from the previous period in the country i. GDP denotes the economic metric GDP per capita at country i at period t-1, which is likely to influence tertiary enrolment rates. C denotes the set of additional controlling variables used in the regression.[11]

[9] Such as the brain drain effect mentioned in the theoretical background section of this thesis.
[10] Particularly as the two approaches are econometrically the same.
[11] The additional set of controls is as follows: education expenditure as the percentage of GDP, gender inequality index, age dependency ratio, fertility rates, GINI coefficient, urban population percentage, secondary enrolment

As established in earlier sections, both GDP per capita and the corruption measure are endogenous in this model due to potential reverse causality. To address this, a Two-Stage Least Squares (2SLS) instrumental variables approach is employed.

Previous sections elaborate that the effect of corruption is ambiguous. The baseline model defined above does not take into account the presence of corruption at the university level, nor the potential brain drain effects. Thus, there are two null hypotheses within the baseline model:

**(1) Ho: Corruption has no significant impact on education in developing countries.**

**H1: Corruption has a significant impact on education in developing countries.**

**(2) Ho: The impact of corruption on tertiary enrolment rates is the same in developed and developing countries.**

**H1: The Impact of corruption on tertiary enrolment rates in developed and developing countries differs.**

In order to account for the differential effects of corruption on education previously discussed in the theoretical background, additional control variables were introduced.

Although it is mostly understood that corruption has a negative effect on the country's economy and, consequently, on education, there is also a positive effect that should not be neglected. In this research, the positive effect or the *greasing of the wheel* is reflected through the increase in tertiary enrolment rates due to the easier access to higher education provided to students with a sufficient level of personal relationships within more corrupt countries. This suggests that corruption can enable individuals who would otherwise be ineligible for higher education to gain admission through bribes or other illicit means. This behaviour naturally undermines educational quality. To test for this effect, controlling for educational quality is essential. However, finding a universal and reliable measure of educational quality across countries is challenging.

rate and East Asia dummy.

For this reason, the number of researchers per million of people in a country is used as a proxy for educational quality.

$$\mathrm{EDU}_{i,t} = \beta_0 + \beta_1 \,\mathrm{CPI}_{i,t-1} + \beta_2 \,\mathrm{GDP}_{i,t-1} + \beta_3 \,R_{i,t} + \beta_4 (R_{i,t} \times \mathrm{CPI}_{i,t-1}) + \gamma \,C_{i,t-1} + \varepsilon_{i,t}. \tag{5.2}$$

It should be remembered that people these days can move abroad more easily and that the foreign educational market is becoming more and more approachable. With this, the effect of brain drain or the move of highly skilled people cannot be neglected within the analysis. To ensure that brain drain is captured, simply using the emigration share of the country of the origin is not enough as it can contain people of all different age groups and levels of education. As brain drain is limited only to highly educated groups of people, the migration data of the country of origin should be segregated by their level of education. However, since reporting on people leaving the country in the origin country is less rigorous than for immigrants or inhabitants, the data of emigration by country of origin and educational level is hard to gather. Consequently, tracking the brain drain phenomenon is challenging. Docquier and Marfouk (2006) constructed a new dataset on international migration by combining census and population register data from OECD countries. They calculated emigration rates by education level and gender for developing countries, making it possible to measure the extent of "brain drain" (the emigration of highly skilled individuals) for the years 1990 and 2000. Up to this day, the dataset was not updated and recent data are not available. The Fragile States Index publishes the index E3 Human Flight and Brain Drain, which measures the economic impact on a country due to the loss of productive and skilled professional labour. It should be noted that this variable also comes with some limitations, and in particular, these limitations come from two different reasons. One is that rather than showing the brain drain quantity in a country, it measures the economic consequences that such a phenomenon leaves in a country. However, it is reasonable to assume that the number of highly educated people leaving the country and the impact on the economy are highly correlated.

The other aspect that should be taken into account comes from the fact that this index may also include flight of professionals due to political reasons (due to actual or feared persecution or repression). Notwithstanding that these effects are important, its effects are rather limited due to a relatively small number of countries within the analysis that would suffer from a substantial involuntary movement of highly skilled workers as compared with people migrating voluntarily. For the rest of this thesis, the effect that stems from involuntary movements of people will thus be neglected. The other consequence of the brain drain phenomenon can be reflected through the massive migrations of "potential" highly skilled people, i.e., prospective students. As these people migrate before their educational path is complete, the outbound mobility rate was employed as a variable for the negative implication of brain drain on enrolment rates. Hence, to control for the brain effect, controls for the positive (BD) and negative effects (OM) of the brain drain were incorporated in the following way:

$$\begin{aligned} \mathrm{EDU}_{i,t} = \beta_0 + \beta_1 \,\mathrm{CPI}_{i,t-1} + \beta_2 \,\mathrm{GDP}_{i,t-1} + \beta_3 \,\mathrm{BD}_{i,t+3} + \beta_4 \,\mathrm{OM}_{i,t} \\ + \beta_5 (\mathrm{BD}_{i,t+3} \cdot \mathrm{CPI}_{i,t-1}) + \beta_6 (\mathrm{BD}_{i,t} \cdot \mathrm{CPI}_{i,t-1}) + \gamma \, C_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{5.3}$$

As discussed above, the BD indicator is used to capture the phenomenon of skilled emigration, i.e., the outflow of professionals who have already completed their degrees. When examining the relationship between this variable and enrolment rates, it is necessary to consider the temporal gap between these two events. This gap exists due to individuals who are enrolling in tertiary education at time t moving in the future (t+n). Thus, enrolment takes place contemporaneously within the observed years, whereas migration of highly skilled people typically occurs only after the completion of a tertiary degree, which, on average, requires three years of study. To address this lag, forward-shifted values of the BD indicator (n=3) were incorporated into the regression analysis, which allows the alignment of timing between emigration and corresponding enrolment cohorts.

## 5.3 Endogeneity

One of the key takeaways from the literature review was that there is ample evidence within the literature of the presence of simultaneity bias with regards to corruption and educational outcomes. Whilst briefly touched upon in Section 2 of this thesis, it is worth exploring the presence of simultaneity bias further.

Simultaneity bias occurs when there is no clear-cut X causes Y within causal research, but instead a two-way relationship. To illustrate, let us revisit the findings of Cheung and Chan (2008) that were mentioned in the literature review. Their research finds that when participation in tertiary education increases, the incidence of corruption in a given country decreases. The authors argue that "higher education provides opportunities for students to learn about their social responsibilities and thus should equip people to uphold their morality ideals" (Cheung and Chan, 2008). For this research, then, this would mean that increased enrolment in tertiary education decreases corruption levels. Nevertheless, as mentioned previously, the level of corruption also appears to be influencing educational outcomes. This is an example of simultaneity bias, where it is not the case that X simply causes Y, but that there is a feedback loop of sorts between the two variables. They both influence one another, leading to endogeneity.

However, simultaneity bias is not the only way through which a variable can be endogenous. Endogeneity occurs when an explanatory variable is correlated with the error term in the regression model. Having already touched on simultaneity bias, another common source of endogeneity is omitted variable bias. In other words, when a regressor in the model is correlated with some variable Z that is not present in the model, but correlated with the dependent variable, the coefficient of the regressor becomes biased. Having outlined the variables previously, the most obvious candidate for omitted variable bias is log GDP. Wealth is correlated with countless other variables that may influence educational outcomes[12], and attempting to add all of them to the model is futile. Therefore, this variable is additionally treated as an endogenous variable. The other variables in the regression are treated as exogenous.

[12] Some of which are likely to be unmeasurable and therefore, unable to be added to the model.

To properly account for endogeneity, the previous literature investigating corruption and educational outcomes has resorted to using instruments for the endogenous variables, utilising an instrumental variable set-up. This research follows a similar approach. However, this begs the question as to which instruments are to be used for the endogenous variables previously identified. Vital when identifying instruments is that any instrument that is used must satisfy, on the one hand, the relevance condition, and on the other hand, the exogeneity condition.

The relevance condition refers to the strength of the instrument to explain the variation in the endogenous regressor. In essence, it means that the instrument must be highly correlated with the endogenous regressor. This is because an instrument basically functions as a predictor for the value of the endogenous regressor. The better explanatory power the instrument has over the endogenous variable, the better the value of the endogenous regressor can be predicted. This ensures that enough explanatory power is preserved whilst instrumenting.

The exogeneity condition states that the instrument must be uncorrelated with the error term in the regression. In other words, the instrument chosen must only influence the dependent variable through its correlation with the endogenous regressor. This condition makes sure that no bias can creep into the coefficient for the endogenous regressor. Keeping in mind the conditions outlined above for instruments, let us first examine the possible instruments for the Corruptions Perceptions Index. Dürrenberger and Warning (2018) identify the Free Country Index, and GNI in 2000 as their instruments for corruption in their research on corruption and educational outcomes.

As it pertains to relevance, the authors find that both instruments appear relevant. The F-statistic of the first stage random effects model they employ indicates that both instruments appear to be highly correlated with corruption. Regarding the exogeneity condition, they test for this using a Sargan-Hansen test for over-identification of instruments. The results of this test indicate that the instruments appear to be uncorrelated with the error term of their regression. Additionally, their instruments pass the test for weak instruments. They therefore conclude that the instruments are suitable to capture corruption.

This research follows the same line of instruments for corruption. On one hand, it uses the Economist Democracy Index, and on the other hand GNI in 2007 as instruments for the Corruption Perceptions Index. The same tests were conducted as specified in Dürrenberger and Warning (2018) to ensure the relevance and validity of the instruments. Furthermore, the instruments were also seen to reject the null hypothesis in the test of weak instruments.

As mentioned previously, GDP per capita is another endogenous variable. A common way to instrument for GDP per capita in the literature is to use its lagged values to explain GDP at present. However, it can be deduced that lagged values of GDP are correlated with enrolment rates. As tertiary education is rarely free, specifically in developing nations, these study costs may need to be saved up for. A historic measure of wealth, as GDP per capita is, can thus safely be assumed to be correlated with enrolment rates today. This research therefore proposes infant mortality rates to be a good instrument for GDP per capita. It is found to be highly correlated with GDP per capita, due to GDP's impact on tax revenues and therefore maternal healthcare. Furthermore, infant mortality rates do not impact tertiary enrolment rates directly. Notwithstanding that infant mortality rates may impact the amount of children that reach the age at which they are eligible for tertiary education, due to the fact that the dependent variable is enrolment rates[13], this argument does not hold. To the best of my knowledge, the literature does not offer any evidence to the contrary. Specifically, as this research is focused on tertiary enrolment rates, as opposed to primary enrolment rates, the instrument thus appears to satisfy the exogeneity condition.

As discussed previously, the baseline empirical model is being expanded through two different channels. One of them is the brain drain expansion, where the BD indicator and outbound mobility rate are added to the model. In such an expanded model, additional instruments are needed, as the brain drain variables can be seen as endogenous variables due to omitted variable bias. The reason for this is that some variables are not included in our model, but impact both enrolment rates and the brain drain variables. Factors such as culture and university quality, as well as university supply[14], could be just some of those examples. These variables can shape

[13] Meaning the percent of students out of all people in an age cohort that is eligible for tertiary education.
[14] Notwithstanding the impact of these variables, e.g., university supply, on both variables, due to data limitations, it is

brain drain flows and, at the same time, have a direct influence on enrolment rates.

To solve for endogeneity in this case, this thesis builds on the correlation found in Kritz (2016) by using population size and a Portuguese/Spanish language dummy[15] as instruments for these two variables. The idea behind this is that for both of these variables, they found evidence of high correlation with studying abroad. To check the strength of the instruments, a first stage regression was run, which confirmed the high correlation between the instruments and both brain drain variables.

Notwithstanding the relevance condition, the instruments must additionally satisfy the exogeneity condition outlined previously. Population size may be viewed as having a direct influence on enrolment. However, following the same line of thinking as for the infant mortality instrument presented previously, it is important to remember that the dependent variable is enrolment rates. The rates do not increase necessarily with population, as it is the percent of students out of the eligible people for tertiary education. Whilst population size may increase the supply of tertiary education and can thus influence enrolment rates, the presence of relatively low tertiary enrolment rates within countries with larger population sizes[16] presents arguments that this may not be the case. The exogeneity condition as it pertains to the Portuguese/Spanish language dummy appears less problematic, as there is no inherent reason to assume a correlation with enrolment rates outside of the correlation that goes through the brain drain variables.

In the next section, the results of the empirical analyses of the different regression models explained above are presented.

difficult to properly account for them. This thesis, therefore, uses an instrumental variable approach to counteract potential bias that may arise from omitting these variables from the model.

[15] Spanish-speaking countries: Argentina, Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Equatorial Guinea, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Spain, Uruguay, Venezuela; Portuguese-speaking countries: Angola, Brazil, Cape Verde, Guinea-Bissau, Mozambique, Timor-Leste, São Tomé and Príncipe, and Portugal.

[16] An example of this being Nigeria.

# 6 Results

## 6.1 Results: Baseline model

The empirical analysis begins by estimating the random effects model on two panel datasets: one for developed countries and the other for developing countries. As outlined in Sections 4 and 5, the full dataset was divided into these two subsets to allow for separate regression analyses and clearer comparisons and distinctions. Furthermore, the random effects model was selected over the fixed effects model, as both theoretical considerations and the results of specification tests indicate that the random effects approach is more appropriate in this context (Section 5). The table below shows the results from both described models.[17]

Table 6.1: IV Regression Results: Baseline model

| | **Developing countries** | **Developed countries** |
|---|---|---|
| Corruption (t–1) | 1.740*** | 0.226 |
| | (0.573) | (0.170) |
| logGDP | 35.240 | -0.172 |
| | (26.254) | (8.750) |
| Education Expenditure (t–1) | -1.104 | 2.726** |
| | (0.872) | (1.343) |
| Gender Inequality Index | -67.553 | -74.220*** |
| | (51.166) | (24.663) |
| Age Dependency Ratio | 0.835** | -0.093 |
| | (0.355) | (0.215) |
| Fertility Rate | 2.549 | -8.150*** |
| | (6.711) | (2.713) |
| Gini coefficient | 0.486 | 1.352**** |
| | (0.480) | (0.260) |
| Urban Population | -0.230 | -0.219** |
| | (0.593) | (0.086) |
| Secondary Enrolment Rate | 0.299* | 0.403**** |
| | (0.177) | (0.074) |
| East Asia Dummy | 3.895 | 17.233**** |
| | (30.645) | (3.658) |
| Observations | 462 | 429 |
| R-squared | 0.327 | 0.420 |
| Adjusted R-squared | 0.297 | 0.398 |

Notes: Standard errors in parentheses.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.

[17] The results of first-stage Chi-squared statistics are provided in the Appendix.

As can be seen from the table, the regression analysis reveals that the coefficients, their signs, and significance are substantially different between developing and developed economies for most regressors.

In developing countries, corruption in a country seems to have a significant and positive effect on enrolment rates. A one point increase in corruption in developing countries leads to a 1.74 per cent increase in tertiary enrolment rates. An additional significant impact on educational aspirations in developing countries seems to be demographic structure, measured through the age dependency ratio. This indicates that the higher the number of children and the elderly, the more likely people are to enrol in tertiary education. Although this result can seem counterintuitive at first, it should not be forgotten that the measurement in question is the enrolment rate and not the graduation rate. Even though people get enrolled does not mean that they will finish their degree. It may happen that due to financial limitations, some of them decide to drop out and find a job. Additionally, it should also be noted that the educational costs are usually lower in developing countries in comparison to developed countries. Thus, the financial burden on the household is not as high as it would be in developed countries and therefore enables more people to pursue higher education. The positive marginal effect of secondary education is expected, as completion of secondary education serves as a necessary prerequisite for accessing higher education.

Surprisingly, economic factors like GDP and educational expenditure appear not to have an impact on the percent of people enrolling in higher education. As it pertains to log GDP, the most likely culprit for this result is the lack of variation due to the introduction of the instruments. Although the instruments are relatively strong, some of the variation of the variable is still lost when instrumenting. This may lead to coefficients that are not inherently biased, but may be less significant than the actual impact of GDP on tertiary enrolment. The effects of GDP on tertiary enrolment rates are interesting, though a further analysis as to the cause of this coefficient falls outside of the scope of this thesis. As the main variable of interest within the analysis is not GDP, but instead corruption, no further analysis is done to uncover the driver of this insignificance. Regarding education expenditure, the results seem to indicate that educational expenditure is

significant at the 10 per cent level for developed countries, whereas the coefficient for developing countries is insignificant. This could be due in part to decreased effectiveness of government spending in developing countries, as was found in Montes and Paschoal (2016).

On the other hand, in developed economies, corruption has almost no impact on enrolment rates. Gender inequality index seems to be an educational driver in developed countries, where the less inequality there is between men and women, the more people are enrolling into tertiary education. This is intuitive as the lower the index is the more equal rights women have, including the opportunity to study.

Fertility rates showcase a negative relationship with education. This can happen due to two reasons. The first one is that in advanced economies, lower fertility enables greater per-child educational investment. In other words, the more children people have, the less amount of money can be spent on the education of each of them. The second argument can come from a different perspective. The higher number of children per family is believed to be less common for parents with higher educational degrees, who are more likely to have kids who pursue higher education. Income inequality has a strong negative influence on education, demonstrating how educational investments create educational barriers, especially in wealthy nations.

The previous results indicate that, within this specific model, corruption has a strong and positive effect on enrolment rates in developing countries. In contrast, this relationship is not statistically significant in developed countries. Therefore, the analysis will now focus exclusively on developing countries to better understand the dynamics behind this positive and significant effect of corruption on tertiary enrolment rates. To further explore and understand the reason for the previously shown positive and significant impact that corruption seems to have in developing countries, the inclusion of additional controls is needed. Keeping in mind that corruption may influence education in different ways, an attempt to capture these different effects is conducted in the following sections. The model is extended to account for two different effects that were mentioned in the theoretical framework part of this thesis: the grease the wheels hypothesis and the brain drain effect.

## 6.2 Results: Grease the wheel hypothesis

The theoretical idea behind the grease the wheel hypothesis, as well as the empirical strategy for accounting for such an effect, was already explained in Section 3 and Section 4, respectively. The table below shows the regression results of the baseline model in the case of developing countries, which includes the additional variable *Researchers*, as a proxy for education quality.[18] As bribery is not public information, nor is it easy to detect it through surveys, a direct variable for the existence of corruption in higher education cannot be utilised. Nevertheless, the presence of this kind of behaviour in the long term shapes the country's education system, as with every new generation, the quality of education will continue to decrease. Thus, in order to test whether bribery influences tertiary enrolment rates, the baseline model is extended for a control for the quality of education. Researchers are used as a proxy for educational quality, as R&D is stipulated to be a good indicator for the extent to which tertiary education enhances the ability of graduates to compete in an innovative global field. The grease the wheels hypothesis in this context means that people may enrol as they are able to get a degree through bribery and nepotism, pushing enrolment rates up alongside corruption. The hypothesised effect of including this variable, then, is that the interaction term between researchers and corruption should be significant and negative. This is because real educational quality is assumed to be inversely related to the ease of bribing professors.

[18] The results of first-stage Chi-squared statistics are provided in the Appendix.

Table 6.2: IV Regression Results: Grease the wheel vs. Baseline model

| | **Grease the wheel** | **Baseline** |
|---|---|---|
| Corruption (t–1) | 0.035 | 1.740*** |
| | (0.281) | (0.573) |
| logGDP | -4.697 | 35.240 |
| | (21.579) | (26.254) |
| Education Expenditure (t–1) | -1.633 | -1.104 |
| | (3.153) | (0.872) |
| Gender Inequality Index | -97.512* | -67.553 |
| | (53.982) | (51.166) |
| Age Dependency Ratio | 0.759* | 0.835** |
| | (0.397) | (0.355) |
| Fertility rate | -7.162 | 2.549 |
| | (7.618) | (6.711) |
| Urban Population | 0.897* | -0.230 |
| | (0.456) | (0.593) |
| Gini coefficient | -0.504 | 0.486 |
| | (1.389) | (0.480) |
| Secondary Enrolment Rate | 0.216 | 0.299* |
| | (0.165) | (0.177) |
| East Asia Dummy | 2.996 | 3.895 |
| | (11.530) | (30.645) |
| Researchers | 0.037*** | |
| | (0.012) | |
| Corruption × Researchers | -0.0006** | |
| | (0.0002) | |
| Observations | 462 | 462 |
| R-squared | 0.673 | 0.327 |
| Adjusted R-squared | 0.631 | 0.297 |

Notes: The results pertain to the developing countries. Standard errors in parentheses.
The significance levels are indicated with the following signs: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.

The inclusion of additional variables changes the coefficients. First, the coefficient on corruption is no longer statistically significant in developing countries. However, both the *Gender Inequality Index* and *Urban Population* are highly significant at the 0.1 per cent level ($p < 0.001$). Both these results seem intuitive. First, regarding the gender inequality index, higher gender inequality effectively reduces tertiary enrolment rates for the female population of the country, which would bring overall tertiary enrolment rates down. Second, a higher degree of urbanisation increases access to universities, often located within urban centres, thus allowing for more students to enrol.

The main results in this expanded model show that the quality of education positively and

significantly leads to higher enrolment rates, as expected, indicating that improvements in education quality directly incentivise people to study. Although corruption alone is not statistically significant, the negative and significant interaction term suggests that the positive effect of corruption on enrolment rates is weaker as the ease of bribery and nepotism diminishes alongside an increase in quality. Moreover, as the political interference in educational institutions diminishes, people without a certain amount of knowledge may become unable to attend higher education using bribes and personal connections.

In conclusion, the positive significant coefficient of corruption in the baseline model may have been driven by increased enrolment rates due to an increased incidence of bribery and nepotism within the education system.

## 6.3 Brain drain effect

After examining whether the *grease the wheel* is valid in our example, the baseline model has again been extended, in this instance to account for the brain drain effect. The theoretical idea behind the brain drain phenomenon was already explained in Section 3. People, due to their dissatisfaction regarding the current institutional setup in the country of their origin, want to pursue a better life in a different country. Moving to another country is a challenge, and that is why they try to make their prospects as good as possible. One of the things that they can do to facilitate their move is to gain a higher education and gain access to foreign labour markets. Precisely, this is one of the ways corruption can influence educational outcomes. In other words, when the corruption effect is being explained through the brain drain effect, the positive relationship between corruption and enrolment rates is expected. The brain drain effect may thus increase enrolment in more corrupt countries. As mentioned previously, corruption may be an incentive for people to want to move abroad. Whether they do it before or after higher education determines the sign of the impact on the enrolment rate. Therefore, the BD indicator and outbound mobility rate are expected to have positive and negative effects on tertiary enrolment, respectively. The

table below contains the regression results when it is controlled for the brain drain effect. [19]

Table 6.3: IV Regression Results: Brain Drain vs. Baseline model

| | **Brain Drain** | **Baseline** |
|---|---|---|
| Corruption (t–1) | 0.430 | 1.740*** |
| | (0.312) | (0.573) |
| logGDP | 8.098** | 35.240 |
| | (4.005) | (26.254) |
| Education Expenditure (t–1) | -0.439 | -1.104 |
| | (0.573) | (0.872) |
| Gender Inequality Index | -112.310**** | -67.553 |
| | (18.711) | (51.166) |
| Age Dependency Ratio | -0.119 | 0.835** |
| | (0.227) | (0.355) |
| Fertility rate | 10.786*** | 2.549 |
| | (3.266) | (6.711) |
| Urban Population | 0.216 | -0.230 |
| | (0.163) | (0.593) |
| Gini coefficient | -0.081 | 0.486 |
| | (0.243) | (0.480) |
| Secondary Enrolment Rate | 0.390**** | 0.299* |
| | (0.088) | (0.177) |
| East Asia Dummy | 8.547 | 3.895 |
| | (15.055) | (30.645) |
| BD Indicator (t+3) | 0.581 | |
| | (3.264) | |
| Outbound mobility ratio | -0.556 | |
| | (1.554) | |
| Corruption × BD (t+3) | -0.009 | |
| | (0.051) | |
| Corruption × Outbound mobility | -0.006 | |
| | (0.024) | |
| Observations | 462 | 462 |
| R-squared | 0.475 | 0.327 |
| Adjusted R-squared | 0.434 | 0.297 |

Notes: The results pertain to the developing countries. Standard errors in parentheses.
The significance levels are indicated with the following signs: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.

After including additional control variables in the model, we can observe the change in esti-

[19] The results of first-stage Chi-squared statistics are provided in the Appendix.

mators. Specifically, the previously significant influence of corruption and the age dependency ratio on tertiary enrolment rates is no longer statistically significant. This suggests that their effects may have been confounded by other factors. In contrast, the coefficient for secondary school enrolment rate becomes statistically significant and positively associated with educational outcomes, indicating that higher secondary enrolment is linked to higher tertiary enrolment rate across countries.

The results indicate that countries with higher outbound mobility rates tend to experience a loss in tertiary enrolment rates, but the positive BD indicator seems to increase the enrolment rates. Although the hypothesised signs of effects of brain drain variables on enrolment rates are true, these coefficients are not significant. Therefore, this model does not provide evidence for the existence of the brain drain phenomenon. Nevertheless, the positive and significant coefficient of corruption in the baseline model disappears, instead turning into an insignificant coefficient. Some of the variation in enrolment rates that was captured in the corruption coefficient has thus disappeared, which lends some credence to brain drain being a confounding factor pushing the positive coefficient for corruption in the baseline model. Nevertheless, interpreting the coefficients is tricky due to the limitations within the variable measuring brain drain, and caution is thus advised when interpreting these results.

The main findings can be summarized as follows. There appears to be a positive impact of corruption on tertiary enrolment rates in developing countries. Nevertheless, this positive impact of corruption on tertiary enrolment rates disappears when taking into account two of the channels through which it may come about. The first model extension looks at the grease the wheel hypothesis, which states that bribery might make it easier for students to enrol, thus pushing enrolment rates up. It was found that, when controlling for educational quality which is inversely related to ease of bribery within universities, the positive effect of corruption on enrolment rates disappears from the model. This provides evidence for the theory that bribery may increase tertiary enrolment rates in developing countries. The second model extension tackles people enrolling in university in order to move abroad. No evidence is found that this increases tertiary

enrolment rates. Nevertheless, the positive effect of corruption on tertiary enrolment disappears within this model set-up. This does indicate that brain drain may be moving the coefficient up in the baseline model, though this could not be definitively proven with these variables within this model set-up.

It remains essential, however, that these results hold up when performing robustness checks. This is to make sure that slight variations in the model set-up do not cause wildly different results, which could indicate a degree of randomness which should be avoided in causal research. This thesis will therefore perform three robustness checks to ensure the validity of the results.

# 7 Robustness check

It remains essential to check whether the results found in the previous section of the thesis hold up under slightly altered model specifications. The first robustness check that was performed to ensure model validity was to use a different measure of corruption.

The usage of alternative measures of the variable of interest as a robustness check represents a common practice within the literature (Boly et al., 2024; Arif, 2022; Gründler & Potrafke, 2019; Sahnoun & Abdennadher, 2020). The variable of interest in this thesis is corruption, which is measured by Corruption Perception Index. In order to ensure that the obtained results are not highly dependent on a specific measurement choice, an alternative measurement for corruption is utilised. Hence, the specifications are re-estimated using the variable control of corruption, which was obtained from the World bank database and represents the perceptions of the extent to which public power is exercised for private gain. The measurement was constructed using various corruption indexes, as well as the different measurements for political risks, transparency levels and evidence of bribery in the Worldwide Governance Indicators. In essence, this index should measure the same thing as the Corruption Perceptions Index, and it is thus expected that the main findings of the paper hold up with this new measure. The results of this re-estimation are represented in the Table 7.1.

As can be deduced from the table, the main results do not change. The measure of corruption remains positive and significant for developing countries. Furthermore, the coefficients only differ slightly from one another. This indicates that the results found in the baseline model within this thesis were not caused specifically by the measurement of corruption.

Table 7.1: Robustness vs. Baseline: Control of Corruption

| | **Robustness** | | **Baseline: CPI** | |
|---|---|---|---|---|
| | **Developing** | **Developed** | **Developing** | **Developed** |
| Control of Corruption (t–1) | 1.635*** | 0.165 | | |
| | (0.600) | (0.133) | | |
| CPI (t–1) | | | 1.740*** | 0.226 |
| | | | (0.573) | (0.170) |
| logGDP | 57.125 | -2.062 | 35.240 | -0.172 |
| | (37.346) | (7.979) | (26.254) | (8.750) |
| Education Expenditure (t–1) | -1.035 | 3.362*** | -1.104 | 2.726* |
| | (0.965) | (1.281) | (0.872) | (1.343) |
| Gender Inequality Index | -16.742 | -64.831*** | -67.553 | -74.220*** |
| | (73.012) | (23.413) | (51.166) | (24.663) |
| Age Dependency Ratio | -0.011 | -0.156 | 0.835** | -0.093 |
| | (0.383) | (0.185) | (0.355) | (0.215) |
| Fertility Rate | 16.512 | -7.027*** | 2.549 | -8.150*** |
| | (10.685) | (2.378) | (6.711) | (2.713) |
| Gini coefficient | 0.451 | 1.475**** | 0.486 | 1.352**** |
| | (0.544) | (0.231) | (0.480) | (0.260) |
| Urban Population | -0.623 | -0.332**** | -0.230 | -0.219* |
| | (0.820) | (0.082) | (0.593) | (0.086) |
| Secondary Enrolment Rate | 0.137 | 0.429**** | 0.299* | 0.403*** |
| | (0.225) | (0.060) | (0.177) | (0.074) |
| East Asia Dummy | 4.838 | 19.087**** | 3.895 | 17.233**** |
| | (28.136) | (3.223) | (30.645) | (3.658) |
| R-squared | 0.238 | 0.446 | 0.327 | 0.420 |
| Adjusted R-squared | 0.204 | 0.424 | 0.297 | 0.398 |

Notes: Standard errors in parentheses.
The significance levels are indicated with the following signs: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.

The second robustness check pertains to the examination of the validity of the GDP per capita variable. As can be seen from the previous chapters, the lagged values of corruption and education expenditure data have been utilised. The need to exploit the values in t-1 for education expenditure is that there is a time gap between education expenditure and policy implementation. In addition, the lag values of corruption were used to determine whether the perception of corruption among people can impact their decision to study. However, when it comes to GDP

per capita, the primary role in this context is to examine how household wealth influences the enrolment process. Thus, the idea behind this is that the contemporary level of wealth is crucial, as tuition is being paid at the time of enrolment. However, there is also a part of GDP per capita in the previous period that can influence this decision-making process, as people may be demotivated to study in the next period due to being financially constrained. Thus, the contemporaneous values of GDP were replaced by their lagged values to ensure that the results are robust.

Table 7.2: Table 7.2: Robustness vs. Baseline: GDP time specification

| | **Robustness** | | **Baseline: GDP (t)** | |
|---|---|---|---|---|
| **Variable** | **Developing** | **Developed** | **Developing** | **Developed** |
| CPI (t–1) | 1.631*** | 0.217 | 1.740*** | 0.226 |
| | (0.546) | (0.162) | (0.573) | (0.170) |
| logGDP (t–1) | 26.028 | -1.440 | | |
| | (19.860) | (8.162) | | |
| logGDP (t) | | | 35.240 | -0.172 |
| | | | (26.254) | (8.750) |
| Education Expenditure (t–1) | -0.502 | 2.900** | -1.104 | 2.726* |
| | (0.641) | (1.320) | (0.872) | (1.343) |
| Gender Inequality Index | -78.261** | -77.196*** | -67.553 | -74.220*** |
| | (34.687) | (23.707) | (51.166) | (24.663) |
| Age Dependency Ratio | 1.027*** | -0.127 | 0.835** | -0.093 |
| | (0.377) | (0.200) | (0.355) | (0.215) |
| Fertility Rate | -1.690 | -7.978*** | 2.549 | -8.150*** |
| | (0.408) | (2.587) | (6.711) | (2.713) |
| Gini coefficient | 0.281 | 1.378**** | 0.486 | 1.352*** |
| | (0.453) | (0.246) | (0.480) | (0.260) |
| Urban Population | -0.001 | -0.231*** | -0.230 | -0.219* |
| | (0.407) | (0.085) | (0.593) | (0.086) |
| Secondary Enrolment Rate | 0.341** | 0.409**** | 0.299* | 0.403*** |
| | (0.169) | (0.073) | (0.177) | (0.074) |
| East Asia Dummy | 3.322 | 17.156**** | 3.895 | 17.233*** |
| | (22.512) | (3.485) | (30.645) | (3.658) |
| R-squared | 0.369 | 0.430 | 0.327 | 0.420 |
| Adjusted R-squared | 0.340 | 0.408 | 0.297 | 0.398 |

*Notes:* Standard errors in parentheses.
Significance levels are indicated as follows: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.

The results above do not report substantial differences between regressions with different

time specifications of the GDP variable. Although the explanatory power of the model with lag value of GDP appears to be slightly stronger, the impact of corruption on tertiary enrolment rates remains almost the same. The main differences can be observed in the case of developing countries, where the *Gender Inequality Index*, become a significant variable in contrast to the baseline model.

The results pertaining to the brain drain effect are also further scrutinized using a robustness check. The amount of leads, that is periods in the future, at which the BD indicator was included in the model was changed from three years to four years. As it is assumed that the timing of migration is realised immediately after completion of studies, three years were used. Nevertheless, the first-cycle tertiary degree length differs from country to country, as it does between different fields of study. Students may additionally take longer to complete the degree. Therefore, the difference in estimates for the three to four period forwarded values of the BD indicator should be minimal. The model was thus re-estimated using four period-forwarded values of the BD indicator to ensure that the results found in Section 6 of this thesis remain. The results of this re-estimation can be found in the Table 7.3.

As can be seen from the table, the results differ slightly. The corruption variable in the four-period set-up stays positive and significant, even when accounting for the brain drain effect. Nevertheless, the significance of this variable is only at the 10 per cent level, which, compared to the baseline model, is less significant. Furthermore, the main result of the brain drain set up with three leads remains in the set up with four leads. Namely, that the brain drain effect appears of little significance to the positive coefficient of corruption on tertiary enrolment rates in developing countries. The *grease the wheels* explanation of the positive significant coefficient, then, remains as the most robust explanation for why corruption is associated with higher tertiary enrolment in developing countries.

Table 7.3: IV Regression Results: Brain Drain (t+4) vs. Brain Drain (t+3)

| | **BD (t+4)** | **BD (t+3)** |
|---|---|---|
| Corruption (t–1) | 0.612* | 0.430 |
| | (0.314) | (0.312) |
| logGDP | 6.632 | 8.098** |
| | (4.085) | (4.005) |
| Education Expenditure (t–1) | -0.353 | -0.439 |
| | (0.539) | (0.573) |
| Gender Inequality Index | -110.853**** | -112.310**** |
| | (19.029) | (18.711) |
| Age Dependency Ratio | 0.025 | -0.119 |
| | (0.253) | (0.227) |
| Fertility rate | 9.247** | 10.786*** |
| | (3.824) | (3.266) |
| Urban Population | 0.246 | 0.216 |
| | (0.161) | (0.163) |
| Gini coefficient | -0.128 | -0.081 |
| | (0.216) | (0.243) |
| Secondary Enrolment Rate | 0.416**** | 0.390**** |
| | (0.089) | (0.088) |
| East Asia Dummy | 8.012 | 8.547 |
| | (14.774) | (15.055) |
| BD Indicator (t+4) | 1.544 | |
| | (3.512) | |
| BD Indicator (t+3) | | 0.581 |
| | | (3.264) |
| Corruption × BD (t+4) | -0.03 | |
| | (0.052) | |
| Corruption × BD (t+3) | | -0.009 |
| | | (0.051) |
| Corruption × Outbound mob. | -0.013 | -0.006 |
| | (0.023) | (0.024) |
| Outbound mobility ratio | -0.113 | -0.556 |
| | (1.527) | (1.554) |
| Observations | 462 | 462 |
| R-squared | 0.520 | 0.475 |
| Adjusted R-squared | 0.477 | 0.434 |

Notes: Standard errors in parentheses.
Significance levels: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$, $^{****}p < 0.001$.
Blank cells indicate that the corresponding term is not included in that specification.

# 8 Conclusion and Limitations

In conclusion, this research has shed light on the impact of corruption on tertiary enrolment rates, with a specific focus on the dynamics of this effect for developing countries. It has done this using a two way approach.

First, it created a theoretical framework which follows a rather simple cost-benefit analysis inspired by the relevant literature on educational choices. This cost-benefit analysis showcased the complexity of the impact of corruption on tertiary enrolment rates, and indicated that this effect may be either positive or negative. The insights gathered from the theoretical framework were used to construct an empirical model to investigate the effects of corruption on enrolment rates for both developing and developed countries. It did this by creating a baseline random effects model within an instrumental variable framework. This model takes into account the potential endogeneity that is present due to simultaneity bias and omitted variable bias in the variable of interest, namely the Corruption Perception Index.

Secondly, the theoretical model showcases that the effect of corruption on enrolment rate cannot be precisely defined. This unclear relationship stems from the variety of channels through which corruption may impact tertiary enrolment rates. Vital for this research were the grease the wheels hypothesis on one hand, and the brain drain effect on the other. The former involves an increased ability of nepotism and bribery, which may influence some students to enrol who in a corrupt-free society may not have enrolled. The cost-benefit analysis showcased how this may influence the decision to pursue further education. The brain drain effect was disentangled into having two possible effects on enrolment, depending on the timing of emigration. If potential-students decide to move abroad to study, this would decrease tertiary enrolment. If they decide to emigrate after studying, this may lead to an increase in tertiary enrolment. The results of the baseline empirical approach show a divergent impact of corruption on educational outcomes between developed and developing countries. Moreover, this effect is not only significant but also positive for the set covering 42 developing countries. Meanwhile in more advanced economies corruption appears not to influence tertiary enrolment rates. In those countries, social and eco-

nomic factors seem to play more of a role in determining tertiary education. Thus, it finds further evidence for the necessity of differentiating policies regarding within educational context among different levels of country development.

This thesis examines two channels to explain the positive association between corruption and tertiary enrolment in developing countries. Under the grease the wheels mechanism, controlling for education quality and including its interaction term with corruption makes the standalone corruption coefficient insignificant. Moreover, the negative interaction term between them indicates that the positive corruption impact declines with higher educational quality. This could suggest that the baseline relationship partly reflected omitted differences in quality of education and that corruption, if relevant, positively influences enrolment rates where quality is weak. On the other hand, the second expanded model, which controls for the brain drain channel, indicates that there is limited evidence that the brain drain channel drives the positive significant coefficient for corruption on tertiary enrolment in the baseline model. The latter can happen due to the limitation in the data set which ought to be mentioned. Some of the most common limitations that can typically occur refer to data availability. The overcomplexity of reality, even with the best attempts, can remain hard to measure and quantify. In this thesis, the biggest obstacles were precise data collection. Particularly, the measurements for brain drain and quality of education. The BD Indicator used for the measurement of the positive impact of corruption on tertiary enrolment has two major limitations. The first one refers to the fact that not only does it include the voluntary migration of highly skilled people, it also includes involuntary migration. Even though there was no evidence found to believe that these involuntary migrations make up a substantial part of the variable, the effect of those should still be noted. In addition, this variable showcases the economic impact of such migrations on a country's economy. In Section 5 we are equalising this with the quantity of migrations of the skilled people, reasoning that the more people are emigrating the higher the economic impact will be. Still, these effects can also be highly dependent on the country's stability itself, meaning that some countries may experience higher rates of migration that affect the economy less and vice versa. In addition, the quality

of education variable may not measure educational quality as precisely as was assumed in this research. This is because the amount of researchers that are produced by a country's education system were equated with the quality of said education system, which may be a somewhat strong assumption to make. Nevertheless, due to the nature of the R&D market, this assumption does seem plausible within this framework as a valid proxy for tertiary educational quality, due to the inherent global competitiveness in the field of research and development.

The second limitation with this research pertains to the data selection. This limitation, too, is twofold. First, the time dimension for the panel dataset used for the regression is limited, making the regression analysis lose some of its strength. Notwithstanding the importance of maximising the time dimension, due to data limitations, there was no possibility to extend it. The timeframe before 2012 was incomparable to the timeframe after for the variable of interest, thus making the starting point of the analysis self-evident. Data limitations for the control variables meant that the end point of the analysis was also constrained to 2022. Second, the threshold at which countries were subdivided into either developing or developed countries was based on values of the countries' respective GNI per capita in 2022. This could be an arbitrary border, as some countries could be on the border of developing and developed, thus making a clear-cut distinction in how corruption influences enrolment rates seem subjective. Nevertheless, it must be mentioned that the framework of developing and developed countries overall is a rough approximation, and clear thresholds are hard to define. Furthermore, the vast majority of the countries used within the dataset fell clearly into either of the two categories, with *border* countries being the exception, not the rule. For the purpose of researching differences between these two distinct groups of countries, then, the threshold as defined in this thesis appears appropriate.

# 9 Appendix

The table below presents the Chi-squared statistics for the relevant endogenous variables in the corresponding regression models.

Table 9.1: First-stage (Chi-squared Statistics)

| | | **Developing countries** | | | **Developed countries** | | |
|---|---|---|---|---|---|---|---|
| **Model** | **Endogenous variable** | $\chi^2$ | DF | p-value | $\chi^2$ | DF | p-value |
| **Baseline model** | Corruption (t-1) | 88.65 | 11 | 0.0000 | 134.80 | 11 | 0.0000 |
| | LogGDP | 543.52 | 11 | 0.0000 | 802.90 | 11 | 0.0000 |
| **Grease the Wheel model** | Corruption (t-1) | 59.07 | 12 | 0.0000 | — | — | — |
| | LogGDP | 209.42 | 12 | 0.0000 | — | — | — |
| **Brain Drain model** | Corruption (t-1) | 84.66 | 13 | 0.0000 | — | — | — |
| | LogGDP | 593.25 | 13 | 0.0000 | — | — | — |
| | BD Indicator (t+3) | 75.15 | 13 | 0.0000 | — | — | — |
| | Outbound Mobility | 64.95 | 13 | 0.0000 | — | — | — |

*Notes:* Chi-squared statistics correspond to the joint significance of the excluded instruments in the first-stage regressions of the Random Effects 2SLS models.
All reported tests are highly significant ($p < 0.01$), confirming the strong joint relevance of the instruments in predicting the endogenous variables.

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