UNIVERSITY OF KWAZULU-NATAL

THE EFFECTIVENESS OF GOVERNMENT SPENDING ON HIGHER EDUCATION

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Abstract

Governments worldwide spend substantial shares of their budgets on education. This category of expenditure is expected to produce direct benefits for the individuals receiving schooling, as well as indirect benefits to society as whole, since education is known to generate positive externalities. Improvements in education are also associated with economic growth and innovation. Few studies, however, have investigated whether public spending on education is effective at achieving the desired direct outcomes, such as improving enrolment, persistence and completion rates, and ensuring lower repeater and dropout rates. The research conducted in this study looks at the effectiveness of government spending on education. The main objective is to measure the impact that government spending has on all levels of education: primary, secondary and tertiary, for a panel of countries over the period 1990 to 2010. This paper extends previous research since it uses panel data methods and compares how government spending relates to a number of educational outcomes, as defined in previous studies, at the three broad education levels. This study also highlights the differences in the relationships of interest between developed and developing countries.

The study uses panel data methods and controls for population age, health, urbanisation and country fixed effects where necessary. Instrumental variable methods are used in an attempt to address the circular causality between public spending and educational outcomes. The analysis shows that government spending is not highly correlated with educational outcomes, defined as enrolment, persistence and repeater rates, on all levels of education. Government spending on higher education appears to be the most effective.

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Chapter 1

Introduction

1.1) Why is education important?

Education is an important tool that is used throughout history to solve the vast problems that face the world. United States President Barack Obama gives a perfect example in his State of Union Address; “What if the cure for cancer is truly trapped in the mind of someone that cannot afford to be educated so as to unlock this potential?” (2012). Higher education is important because it underpins innovation such that it leads to the development of countries, as well as increases quality of life and decreases high mortality rates through research in the health system such as the cure for cancer.

Aubyn et al describe higher education as one of the driving forces of growth (2009). This study, therefore, puts particular emphasis on higher education. However; education at all levels is valuable. It benefits the person receiving it as well as the society they are part of. The direct benefits from education at all levels to those who receive it span from better employment prospects and reduced likelihood of living in poverty to better health. Reduced crime rates and improved social engagement are among its indirect benefits to society. Hence, government spending on education can be seen as a form of investment.

1.2) Why is government spending on education necessary?

As Obama points out; not everyone can afford to be educated (2012). One of the justifications Milton Friedman gives for government spending on schooling is to create the ideal state for society (1977). Public schooling is to provide a common structure of existence, of both behaviour and thought; whereby the members of each respective society could exist in what he described as a harmonious single free democratic society (Friedman, 1977). Further, since education results in benefits both directly to the individual receiving it and indirectly to society, exclusively private education will result in an under provision from society’s perspective, as individuals only consider the marginal value to themselves in allocating their spending. Thus, governments have an incentive to provide education for those who cannot

afford it to the social optimum point through a public schooling system that is a well-oiled, smooth-running machine hastily producing well-functioning individuals who are net contributors to the economy and society that they are part of. However, how efficient are the public education machines of countries around the world, in terms of their returns to public spending? Specifically, does government spending have an impact on public educational outcomes and to what extent? This study attempts to address these questions.

1.3) How does this study fill the knowledge gap?

There are many microeconomic studies that estimate the private returns to education, but far fewer studies from a macroeconomic or international perspective. Since this is a macroeconomic international study, it fills the current gap in the literature. This is also an updated study using data for more recent time periods unlike older studies. In line with the second Millennium Development Goal (MDG) of universal provision of primary education, a substantial portion of the literature focuses on primary education and looks at the years after efforts to achieve this MDG have been established.

This study, as mentioned before, focuses on higher education; defined as secondary and tertiary education. Thus, this study is also a continuation of existing studies, which mainly cover schooling on lower levels, providing points of comparison of the effectiveness of government spending at different educational levels with regard to a range of outcomes. This study also serves as an extension of other studies, as it shows the differences in the impacts of government spending between developed and developing countries.

1.4) What are the research objectives of this study?

The ultimate aim is to analyse the relationship between government spending and public educational outcomes. The objectives that will allow the aim to be achieved are as follows. The relevant literature will be reviewed to determine the factors impacting educational outcomes. Further, appropriate models that will express the relationship between public educational outcomes and government spending, whilst controlling for other explanatory variables, will be established. Thereafter the appropriate methodology to analyse the data will be determined. The data will also be observed at a basic, descriptive level. And finally; using the appropriate models the available international data at country level over the time period from 1990 to 2010 will be analysed. Tables A1 & A2 in appendix A contain lists of the

countries used in the analysis. Once the above mentioned objectives have been achieved; one will be able to address the question; does government spending have an impact on public educational outcomes?

1.5) Overview of the study

The structure of the study is as follows. The literature relevant to this study will be reviewed in Chapter 2. The appropriate models that will express the relationship between public educational outcomes and government spending, whilst controlling for other explanatory variables, will be presented in Chapter 3. The data that will be used for the purpose of analysis in this study will be covered in the chapter after that. Chapter 4 will cover the econometric methodology used for the data analysis. The descriptive statistics will be presented in chapter 5. The data analysis will be presented in chapter 6; followed by the conclusion in chapter 7.

Chapter 2

Literature Review

2.1) Introduction

This chapter lays the theoretical foundation for studying the effectiveness of government spending on education. It starts with a note on the value of education in section 2.2; and leads into the next section 2.3; which discusses the returns to education on both a microeconomic and macroeconomic scale. The next section 2.4; discussed education as a production function. Then; in section 2.5; the reasons for government spending and involvement in educational markets are reviewed. Since this study is conducted in South Africa; government spending on schooling in South Africa specifically is reviewed in section 2.6. Section 2.7 takes a look at the concept of effectiveness and efficiency, followed by a look at the ineffectiveness of Government Spending in section 2.8. The chapter ends with section 2.9 that discusses the lagged effects.

2.1) The Value of education

The value of education to the nation in which the educated individual lives has long been recognised among economists. In his great work, "The Wealth of Nations", Adam Smith explains that education improves the nation's workforce through division of labour which allows for specialisation, improves efficiency and ultimately it will lead to the wealth of a nation (1776).

Education is important both to the individual receiving it and to the nation in which the educated individual lives. The importance of education is well summarised in the words of South Africa's former President Nelson Mandela: "Education is the great engine to personal development. It is through education that the daughter of a peasant can become a doctor, that the son of a mine worker can become the head of the mine that the child of farm workers can become the president of a great nation. It is what we make of what we have, not what we are given, that separates one person from another" (Gilbert, 2013, 197).

Adam Smith has been quoted saying that; “the difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature, as from habit, custom, and education” (Becker, 1993, 121).

And thus, overall, education is important because it serves, not only as a distinguishing factor to improve the prospects of individuals within a nation, but to further nations as more individuals within that nation become educated.

2.2) Returns to education

When one talks about the ‘value’ of education; it is useful to quantify this value into real terms such as the returns to education. There are two scales on which returns can be measured. Firstly; the returns to education can be measured on a microeconomic scale. This is explained as the returns to the educated individual. And secondly; the returns to education can be measured on a macroeconomic scale. This is explained as the returns to the country in which the educated individual resides. These returns, on both a microeconomic and macroeconomic scales; shall be discussed in the subsections to follow.

2.3.1) On a microeconomic scale

On a microeconomic scale, returns to education are seen in the form of higher earnings for the individual (Mincer, 1974). In other words; the more education an individual receives, the more income they can potentially earn. These potential higher earnings provide incentives for individuals to pursue highest level of education that they are capable of attaining. Thus, even for an individual that does not value education in itself, may potentially value education because they value the greater earnings that might come with obtaining a higher level of education. Regardless of the value of education to an individual; human capital theory describes spending on schooling as an investment in human capital (Becker, 1993).

As Becker explains; the investment in human capital has a rate of return that can be measured (1993). An individuals’ incentive to get an education is based on their measure of the rate of return to receiving an education (Becker, 1993). According to Becker; if an individual sees a greater return to their investment in education than the next person, then they have a higher rate of returns to education and are more likely to place a higher value on education (1993).

The individual who puts greater value on education may or may not be able to afford it his presents a case for the importance of public education. The importance of public education lies in the fact that; if an individual values education but does not pursue it because they cannot afford it, then they ultimately become 'wasted potential'. In any given nation, all over the world, many individuals are intrinsically equally capable of benefiting from education; only poverty prevents most from acquiring one (Becker, 1993). As important as it is for each and every individual in any given nation to reach their full potential by receiving as much education as they have an incentive to do. Further, as explained by Stevens & Weale; since education benefits individuals, one would expect there to be benefits when grouping individuals (2003). This introduces the next subsection discussing macroeconomic returns.

2.3.2) On a Macroeconomic scale

Policy makers are concerned with the effectiveness of public spending, particularly on education, because of the belief that it can increase economic growth and decrease poverty (Gupta et al, 2002). According to Krueger & Lindahl, education reinforces income growth (2000). Primary education skills are related to growth in developing countries whilst tertiary education skills are most important for growth in developed countries (Blundell et al, 1999).Positive externalities, in the form of reduced crime and technological progress, are a result of investments in higher education, and schooling is positively associated with economic growth (Krueger & Lindahl, 2000).

Krueger & Lindahl (2000) present the reasons why the correlation occurs. Countries with an improved education system are more likely to change other policies, not necessarily only those polices directly linked to education, in ways that enhance growth. In other words, education becomes both the start of development process and the means to an end – namely growth. Hence, Krueger & Lindahl describe education as the seed as well as the flower of economic improvement (2000). Friedman acknowledges that education leads to an increase in the productivity of an individual and this, on a macroeconomic scale, will result in a society that is greater in productivity and economic growth (1955). Similarly, Blundell et al argue that education spurs innovation and this ultimately accelerates the rate of economic growth (1999). The concept of education driving self-sustaining growth can be described in new growth literature (Blundell et al, 1999).

New growth literature seeks to define human capital as a primary source of innovation (Blundell et al, 1999). This means that education is directly connected with productivity and growth. In other words; if a country's education level was to increase then the country's economy will grow. And since economic growth is a return to education, it makes sense that effective government spending on education would be seen as a worthwhile investment. Empirically; countries that expanded their education sector (or spending?) during the 1960s, experienced faster growth some thirty years later (Blundell et al, 1999). This type of growth could be seen as having lagged effects. A larger stock of educated workers might be a cause of technological change (Blundell et al, 1999). Many educated workers might enhance productivity which could spur further development of newer technologies and it is highly likely that these new technologies will require individuals that are more highly educated (Blundell et al, 1999). This knock-on effect creates an upward spiral of growth, where more educated individuals in the workplace will create a greater need for education and so on.

Economic growth, measured by living standards, is acknowledged as being one of the most important macroeconomic returns to education (Stevens & Weale, 2003). There are numerous examples of this. For example, the development and growth that were seen in Europe; throughout history, was not as apparent in the illiterate places in the world (Stevens & Weale, 2003). Thus; as a country's population becomes more educated, the standards of living in that country will improve as well. Whilst Stevens & Weale qualify living standards as the most appropriate result of an educated nation, they also quantify the link between education and economic performance (2003). Empirically; a one percentage point increase in the secondary enrolment rate raises gross domestic product (GDP) per capita by 0.35 of a percentage point (Stevens & Weale, 2003). Similarly; Sianesi & Van Reenen show in their work, also a cross country study estimating the effect of school enrolment on growth, that if secondary school enrolment rates were to increase by one percentage point, it would lead to an increase in per capita GDP growth of between one and three percentage points annually (2002).

Theoretically; there are two different approaches that one can take to the subject of education and growth. The first one is an application of the augmented neo-classical approach, where the stock of education affects the long run level of GDP per capita, whilst the second falls under the category of new growth theory, where the stock of education affects the rate of long-run growth (Sianesi & Van Reenen, 2002). If the average education in the population was to increase by one year, then it would raise the level of output per capita by between three and six percent according to the former approach. However if the same scenario were to

be applied to the latter; it would lead to over one percentage point faster growth according which is a large effect theory (Sianesi & Van Reenen, 2002).

This phenomenon is often referred to as Solow's 'residual', explaining that the growth of real income per capita cannot be fully accounted for by increases in the quantities of the capital and labour inputs alone (2002). Empirically, the Solow residual is shown to incorporate the effect of secondary education on economic growth, which amounted to a 3 percentage point increase in growth for every one percentage point increase in secondary school enrolment rates, ceteris paribus (Sianesi & Van Reenen, 2002). Similarly, another component of the Solow residual is the effect of tertiary education on economic growth, where a one percentage point increase in the annual growth of human capital, proxied by total tertiary completion; increases growth by 5.9 percentage points, ceteris paribus (Sianesi & Van Reenen, 2002).

In their study; Bils & Klenow estimate the impact of schooling on the economic growth of human capital and find that an increase in primary and secondary enrolment rates leads to growth in gross domestic product per capita (2000). Bils & Klenow's evidence supports the hypothesis that the higher the stock of human capital, the more economic growth there will be; ceteris paribus. The implication of this is that there is a positive relationship between schooling and the growth in gross domestic product (Bils & Klenow, 2000). Thus the evidence from macroeconomic studies supports the proposition that economic growth is influenced by the quantity of human capital that a country possesses. The link between human capital and growth begs the question why governments have not been able to realise more of the returns available through this process.

2.3) Education as a production function

A branch in the literature attempts to answer this question by suggesting that the education process can be seen as a production function, which may be prone to inefficiencies in converting public spending on educational inputs into educational outcomes and human capital. Like many other processes in the economy, this one may be subject to forces, both political and economic (such as fixed budgets), which may force trade-offs between different educational inputs (Pritchett & Filmer, 1997).

An optimizing model predicts that the educational input use should be chosen so that the marginal product per unit of each input is equalized (Pritchett & Filmer, 1997). In other

words, the allocation of resources should be such that output is maximised. However, the allocation of expenditure on inputs does not conform to the cost effectiveness rule. Specifically, spending on educational inputs is systematically affected by how much weight 'teacher-related' inputs have in determining the allocation of spending across inputs, and is independent of their impact on outputs (Pritchett & Filmer, 1997). Put simply, the allocation of spending is biased towards those educational inputs that directly increase the welfare of teachers for the simple fact that teachers form unions and strike for increased wages whereas books do not. Thus it is difficult to establish an effective education production function.

2.4) Why is government intervention necessary?

2.5.1) Externalities

Since education contributes to both the literacy and knowledge that individuals commonly require to form part of a stable, functioning society; being educated has an effect on the society in which the educated individual lives (Friedman, 1955). This effect is a positive externality arising from education from which a society gains. Friedman refers to it as 'neighbourhood effects' and uses this effect to justify government's involvement in providing schooling (1955). Friedman suggests that each child requires a minimum amount of schooling, which will ensure that society benefits from this positive externality, (1955). This kind of requirement could be enforced as a law (Friedman, 1955).

However, what would be the case if a parent could not afford to educate their child? Friedman gives the example of owning buildings and cars when addressing the issue of what one can do if they cannot afford the upkeep a legal requirement related to ownership (1955). The owners will 'divest' themselves of the item. Now considering - the case if one were to say that parents are rightfully the 'owners' of their children. And if the parent cannot afford the minimum amount of schooling that is enforced by law; would parents be forced to divest themselves of the item, which in this case would be the child, in question?

Friedman argues that in the case of requirements concerning children's schooling, the separation of a child from a parent who cannot afford the minimum requirement of education is against all beliefs and ideas of a free and well-functioning society (1955). Thus, government has to assume the monetary costs of providing schooling in the form of public

education. Since these 'neighbourhood effects' are positive, it would essentially be an investment and not an expense for government to provide public education.

Furthermore, Friedman justifies government spending on higher education because it is beneficial in two ways (1955). Firstly, the compensation of costs is the only viable way to impose a minimum requirement of education; and secondly, the financing of further education can be motivated with the idea that other members of society will benefit from the education of those of 'greater interest and ability' since this is a way of providing better 'political and social leadership' (Friedman, 1955). Hence, government spending on education can be justified on the basis of the broader economic and social gains resulting from it.

2.5.2) Market Failures

Economists recognize that education has distinctive features that imply that market provision may lead to lower levels of educational attainment in a population than would maximize societal welfare (Mitch, 2008). This scenario is more formally known as 'market failure'. Since the benefits do not only accrue to the person who receives education, but to society as a whole, private demand for education will be below the level that is socially optimal (Mitch, 2008). In other words, the market has failed to determine the amount of education that is truly necessary for society, as well as the only the private value of education is considered by individuals. Hence, governments are called to intervene. As Mitch explains; governments solve the problem of market failure due to the positive externalities from education through providing subsidies (2008).

Another failure in education markets can be due to imperfections in capital markets. In other words, parents can find it difficult to borrow so that they can finance their children's education (Mitch, 2008). This is known as the capital goods problem and it arises because, according to Mitch, education is excludable (2008). Excludability is the case when children are prevented from attending school because their parents cannot afford to the price of sending their child to school (Mitch, 2008).

The capital goods problem brings about a whole new set of externalities except this time, the externalities are negative. For example, if a child is not educated, it will render them more prone to be involved in criminal activity, which in turn will not only harm the family of the child and the child herself, but it will be harmful to society (Mitch, 2008). In addition, uneducated children are less civic-minded and thus will be more dysfunctional in society. As

mentioned earlier, individuals do not take all the concerns discussed above into consideration when deciding how much education to obtain (Mitch, 2008). In other words; parents will 'selfishly' decide how much education to give their children based on how much money they earn. This depicts the market failure that calls for government intervention since parents cannot be the only party responsible for deciding how much education their children receive.

The last failure in the education market arises from the limited influence that parents have over the quality of their children's education and the limited extent of supervision that parents can apply regarding the education process without being involved directly (Mitch, 2008). This occurs even if parents are paying in full for their child's education. Thus, a further failure exists in the education market, if parents, paying or not, cannot control the quality of education that their child is receiving. There is a justification for government intervention in setting and enforcing standards for quality and overseeing the process of delivery.

To conclude, since externalities and market failures are present, governments need to provide public education to encourage benefits such as neighbourhood effects, and to avoid negative consequences from the limitations of capital markets, difficulty in enforcing educational standards and lack of supervision.

2.6) Government Spending in South Africa

Bloom et al report that, in South Africa; the number institutions of education have been steadily increasing over the years (2006). An increase in the number of institutions for education has led to more individuals receiving education. The result of this would be an increase in individual gains from higher earnings (Bloom et al, 2006). Importantly, however, higher earning can lead to a virtuous cycle. Since more educated individuals will be able to earn more, consumption will increase which will raise demand, subsequently increasing supply and leading to economic growth, resulting in raised tax revenues for governments, which allow for further spending on education. Education would encourage new technologies, develop new tools and skills, generate entrepreneurship and create jobs (Bloom, et al, 2006).

This favourable cycle has not yet taken full effect. It is important to take into account South Africa's divided historical past in order to truly understand the educational outcomes at present and potentially in the future as well as their impacts on poverty (van der Berg, 2008). In his 2008 work, Servaas van der Berg discusses poverty and educational outcomes in South

Africa. Van der Berg shows in his study that socio-economic differentials in the past still play a role in educational outcomes in South African schooling today (2008).

However; the schooling system is not yet able to overcome the patterns of inherited disadvantages and also suggests that policy interventions are necessary, but are just not as effective as they could be (Van der Berg, 2008). In other words; resources did not necessarily improve school performance. The differential factor with South Africa is that not only do governments have to take effective spending into consideration but they also have to establish that that there is educational inequality between South African schools (van der Berg, 2008). This is an educational challenge that is important to overcome since the lagged after-effects from the past continue to have an unfairly heavy bearing on certain individuals. Due to its divided past; there are certain challenges that the South African education system faces.

The quality of secondary school passes does not prepare students for tertiary education (Jones, 2013). And thus even if one was to complete secondary schooling, they may not be in a position to enrol in tertiary education. Rural schools suffer with backlogs of the delivery of school materials as well as the development of infrastructure that affect educational outcomes for those areas (Jones, 2013). This is something that is specific to South Africa since historical circumstances have placed a large gap between the quality of education in a rural area and the quality of education in an urban area.

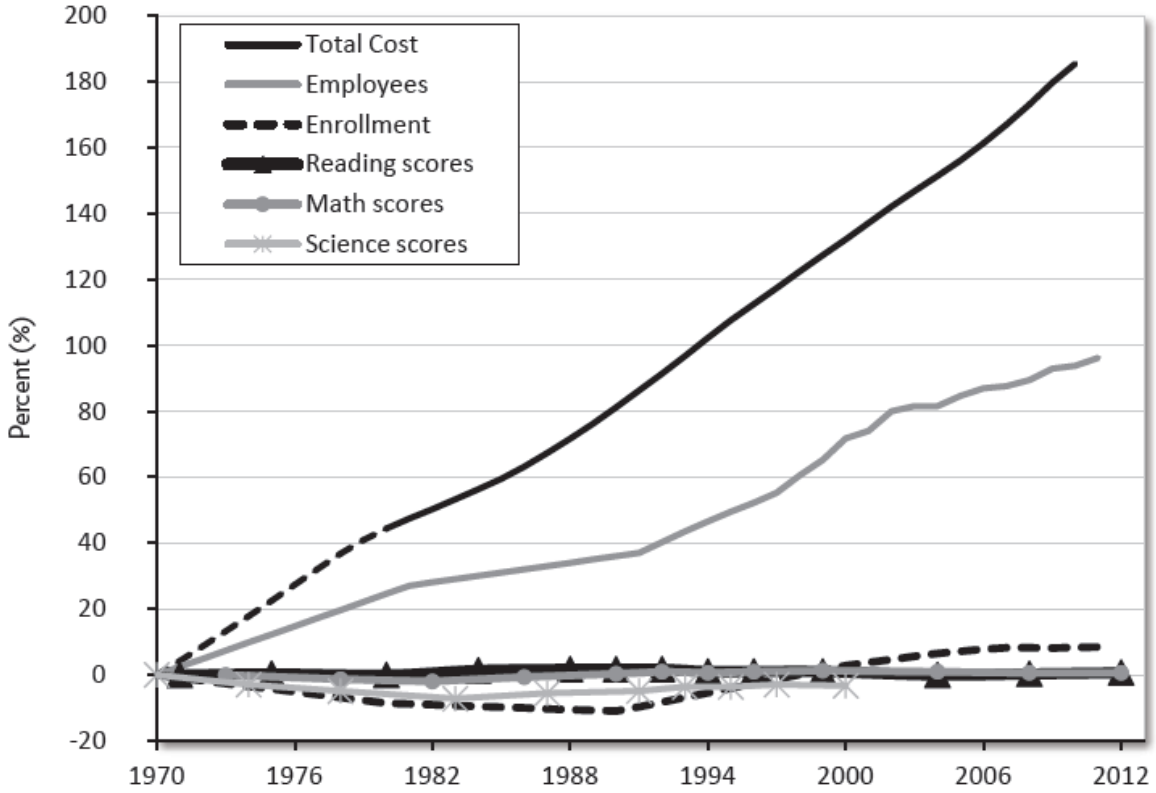
2.7) Effectiveness and Efficiency

Aubyn et al define efficiency as the comparison between inputs and produced outputs (2009). If the certain level of inputs produce less than the maximum output attainable with current technology, then the production of the output is said to be inefficient (Aubyn et al, 2009).

2.8) The ineffectiveness of Government Spending

The figure below is taken from Coulson (2014) and it shows academic performance and spending in America over the past 40 years. As one can clearly see; spending on education has been steadily increasing over the last 4 decades. Unfortunately educational outcomes such as enrolment and math and reading score; have not been increasing.

Figure 2.1: Trends in American Public Schooling since 1970:



Source: Coulson, 2014

Two conclusions were made in Coulson's study. First, spending increases are not necessarily accompanied by improvements in performance (Coulson, 2014). Second, educational outcomes seem entirely disconnected from any fluctuations in spending. Even when spending decreased; there was no decrease in outcomes. Thus, public expenditure is said to not be correlated with schooling outcomes.

2.9) The presence of Lags and Lagged effects

In 2009; Trostel did a study of the state-support elasticity of college enrolment and college degree attainment. He used twenty two years of United States interstate data from 1985 to 2006. And thus one must acknowledge the possibility of the presence of lagged effects.

Gujarati & Porter call such a relationship one that is "not contemporaneous" (2010, 372). These models are also known as dynamic models because they involve changes over time (Gujarati & Porter, 2010). In other words; the effect of a unit change in the explanatory

variable is distributed over a number of periods. Thus it may be difficult to accurately find the effect of government spending on education in one time period.

2.10) Concluding remarks

Government intervention to provide public education is important. However; not all spending done by government will produce efficient results. Once government can spend in such a way that the resources they put into education corresponds the most efficient outcomes, then government spending will be effective. In the next chapter; the variables that influence educational outcomes will be established through empirical review.

Chapter 3

Education Model

3.1) Introduction

The aim of this chapter is to review a few of the empirical studies related to the factors affecting educational outcomes. Since the empirical model used in subsequent chapter is based on these studies, they are discussed in more detail.

3.2) Government spending on education: An Empirical Review

Empirically, substantial public spending on schooling leads to significantly greater educational attainment (Trostel, 2009). Using twenty two years of United States interstate data from 1985 to 2006, the results of Trostel's study indicate a state-support, measured as government expenditure on tertiary education, elasticity of college enrolment and degree attainment of about 0.35. Econometric models that utilise instrumental variable methods are used to ensure that there are only exogenous influences and to account for any biases.

This study aims to develop a cross-country model similar to that employed by Gupta et al (2002) in order to study the effectiveness of government spending in driving educational outcomes,. Further, the aim is also to expand the analysis using a larger number of countries and employing more rigorous methods that panel data allows for. Hence, Gupta et al's results are reviewed here for reference purposes. The models reflect the determinants of three educational outcomes (two positive and one negative): enrolment rates, persistence rates and dropout rates, at primary school level. Government spending is included as two different measures. The first is the percentage of total education spending dedicated to primary and secondary education. The second is total education spending as a percentage of GDP, which caters for differences in the sizes of the economies and different fiscal regimes.

In order to measure the age of the population and the share that is of primary school going age, Gupta et al include the percent of the population that is between 0 and 14 years old as an explanatory variable. The authors also control for health factors (proxied by the child mortality rate), family incomes (proxied by income per capita measured by purchasing

power), and ease of access to schools (proxied by urbanisation; defined as a scale of population concentration).

Gupta et al use cross-sectional data for 1993 to 1994. The adjusted R-squared values show that the models have significant explanatory value. The authors find a significantly positive correlation between both variables that represent government spending and the educational outcomes defined by the enrolment rate and persistence through schooling.

Table 2.1 Cross-section regression results for selected developing and transition countries

	Enrolment	Persistence	Dropout
Constant	45.94*** (6.55)	71.72*** (10.78)	34.46* (1.86)
Observations	42	24	38
Primary and secondary education spending (% of total education spending)	0.17** (2.31)	0.17** (2.19)	- 0.43* (1.89)
Education Spending (% of GDP)	1.68* (1.86)	1.59 (1.29)	- 5.19** (2.09)
Population Age 0 – 14 years (% of population)	0.29** (2.25)	-0.07 (- 0.32)	1.16*** (3.93)
Child mortality rate (per 1 000 children aged 0 – 5 years)	- 0.16** (- 2.54)	- 0.10* (-1.73)	0.03 (0.44)
Income per capita (PPP terms)	0.34 (0.69)	0.10 (0.21)	0.98 (0.69)
Urbanization (% of population)	0.27*** (3.01)	0.11 (1.04)	0.07 (0.25)
Adjusted R - squared	0.67	0.50	0.42

**significance at a level of 10 %*

***significance at a level of 5 %*

****significance at a level of 1 %*

Source: Gupta et al, 2002

There is a significantly negative correlation between government spending and education outcomes when they are defined by a negative indicator, such as dropout rates. If child mortality rates increase, then enrolment and persistence rates decrease, thus it is important for schooling to go hand-in-hand with good nutrition for students. This is something that governments can invest in, so as to positively influence educational outcomes.

A similar situation is apparent in the variable called urbanisation. There is a positive correlation between urbanisation and educational outcomes in the form of enrolment and persistence rates. Thus the more urbanised a country is, the better the educational outcomes will be. This is as expected due to the assumption that urbanisation brings better quality education and potentially easier access to schooling.

Gupta et al conclude that their study provides evidence that with an increase in spending on education brings about an increase in educational attainment (2002). Thus, if greater spending on education is to boost economic growth and promote the well-being of the poor, then policy makers should pay more attention to this portion of public expenditure (Gupta et al, 2002). The allocations of the budget to spending on education, the size as well as the efficiency of spending in the correct places, is seen to be an important vehicle to promote reformation and equity (Gupta et al, 2002).

3.3) Determinants of Education

With reference to the study conducted by Gupta et al, the similar model used in this study is presented below (2002).

$$Y_{it} = \bar{a}_1 \pm a_2 x_{2it} \pm a_3 x_{3it} \pm \ldots \pm a_n x_{nit} + \delta_i + \rho_t + \upsilon_{it} \qquad (1)$$

Here, Y is the dependent variable with individual effects i across time period t, $\bar{a}_1$ and υ_{it} are the intercept and error terms respectively; a_2 is the coefficient on the first independent variable x_2 with individual effects i across time period t; a_3 is the coefficient on the second independent variable x_3 with individual effects i across time period t; continued until the coefficient on the nth independent variable x_n with individual effects i across time period t. The dependent and independent variables that will be used in this study are now discussed in more detail.

3.4) Dependent Variables: educational outcomes

The dependent variables in each of the three models are the measures of educational outcomes. In the study done by Gupta et al, the measures of educational attainment are primary school enrolment, persistence through primary school and primary school dropout rates (2002). The same dependent variables will be used in this study, but the analysis will be extended to cover secondary and tertiary education, too. The objective of this study is to test Gupta et al's ideas on all levels of schooling.

Since Gupta et al used primary school enrolment as a dependent variable in one of their models, it is appropriate to use this enrolment variable as the first dependent variable in the primary, secondary and tertiary models (2002). Gupta et al defined another one of their models by persistence through primary school (2002). Thus, it is fitting to define persistence as the next dependent variable in the primary, secondary and tertiary education models in this study. Due to data constraints, the last model of education, with repeater rates as the dependent variable, is only applied to a primary and secondary education. Gupta et al use primary school dropout rates instead of repeater rates. However, due to the nature of and availability of the data, repeater rates will be used instead. .

3.5) Government spending

The main explanatory variable that this study is concerned with is government spending on education. This variable appears in a number of ways in the models. Gupta et al include two measures of government spending (2002). Firstly; it is included as a measure of total government spending on education as a percentage of total public expenditure. In this study, this measure has been included as well.

Secondly; Gupta et al include government expenditure as a measure of the share of spending on primary and secondary education (2002). In this study includes the same measure: namely, government spending per level of education as a share of total public spending on education. Public expenditure on education includes government spending on educational institutions, education administration, and transfers or subsidies.

3.6) Other explanatory Variables

Since government spending is not the only variable that impacts educational outcomes. There are other variables that will be controlled for in each regression namely income, population age, urbanisation and child mortality. These variables, according to Gupta et al, influence educational outcomes (2002).

3.6.1) Income (GNI)

If the income of households should increase, then the expected result would be for the cost of enrolment at both secondary and tertiary levels of education to be relatively less (Gupta et al, 2002). Thus changes in income are expected to have a positive impact on educational outcomes.

3.6.2) Population Age

Since the age of the population influences school enrolment, Gupta et al include a variable that measured the percentage of population in the age group 0 to 14 years old (2002). According to the authors, it is easier to increase enrolment rates in primary but harder to increase enrolment rates in higher levels, if a country has a relatively young population (2002). In this study, the population age will be included as the official (as defined by the World Data Bank for each country) primary aged population and the study will attempt to observe the affects of this on secondary and tertiary education, as well as primary.

3.6.3) Urbanisation

The definition of ‘urbanisation’ is the process by which societies develop, cities grow and rural areas become more urbanised (Farlex, 2012). Lack of infrastructure and higher mortality rates are more common in rural areas than in urban areas (Gupta et al, 2002). Starting from low levels, increased urbanisation is linked to better health for a nation, and if health is a correlate of education, then urbanisation is expected to lead to improved health, which is positively related to education. Here, urbanisation is included as a variable that measures population density at country level. This variable also captures the effects of overpopulation and overcrowding on educational outcomes.

3.6.4) Child Mortality

This variable is measured as the number of children under the age of five that die per 1 000 live births. It reflects child nutrition and health. Gupta et al use child mortality as a proxy for child nutrition (2002, 721). Child nutrition is vitally important to all levels of education because it affects enrolment as well as persistence rates (Gupta et al, 2002, 721). It is expected that increases in child mortality rates will result in decreases in educational outcomes at all levels of education.

3.7) Concluding Remarks

This chapter has provided an overview of the foundation for the models that will be used to measure the impact of government spending on educational outcomes. As in earlier studies about the determinant of educational outcomes, the dependent variables to be used are enrolment rates, persistence rates and repeater rates. The independent variables include different measures of government spending as the main variables of interest, and the control variables per capita income, population age, urbanisation, child mortality. The variables that have been introduced in this chapter will be fully defined descriptively in chapter 5. The next chapter aims to discuss the econometric methodology that the study employs and covers the data, including its deficiencies.

Chapter 4

Methodology

4.1) The Limitations of Ordinary Least Squares

One of the most frequently used methods in data analysis is the method of OLS (Gujarati & Porter, 2010). This study utilises panel data econometric models, but basic Ordinary Least Squares (OLS) estimates are included for comparison purposes. This chapter reviews the problems with OLS estimates and how the use of panel data and instrumental variables can address some of these shortcomings. One of the main limitations of OLS is endogeneity; it shall be discussed in the section 4.2. One of the methods used to combat the effects of endogeneity is the instrumented variables approach (IV); this method shall be discussed in section 4.3. The remainder of the chapter is made up of a discussion of other limitations as well as a brief note on the level of development in countries and how this has been included in the analysis.

4.2) Endogeneity

It is likely that circular causality exists in the relationship between education and government spending. Endogeneity can be defined by circular causality between the variables (Carleton, 2002). A correlation that is known as a 'two-way causality' can be described as an instance where the "predictive variable is dependent on the variable of prediction" (Schmit & Phelps, 1985, 33). The correlation becomes causal and circular. No specific test for endogeneity has been conducted in this study but theoretical reasons for the presence of endogeneity are considered.

An increased funding for education by the government would cause a generation of more educated people that will support the idea of education to the next generation. This in turn will cause a demand for more education, applying pressure on the government to spend more on education and so it will continue in this circular pattern. Circular causality may thus be problematic when studying this relationship and the attempted remedy for the problem here are instrumented variables.

What needs to be specified now, in terms of the literature, is that the instrumented variable is still government spending but it is captured and used in a different way to the variables recognised as affected by circular causality. The way in which this is done is by replacing government spending on the level of education of interest in the model, for example primary education, with government spending on the other levels of education, in this example, secondary and tertiary education).

4.3) Instrumented Variables (IV)

"A solution to endogenous estimates" is what the instrumental variable method is most commonly known as (Baum, 2009, 2). In this study, this method will be used in order to combat endogeneity caused by the circular causality between government expenditure and educational outcomes.

Recall equation (1):

$$Y_{it} = \bar{a}_1 \pm a_2 x_{2it} \pm a_3 x_{3it} \pm \ldots \pm a_n x_{nit} + \delta_i + \rho_t + \upsilon_{it} \qquad (1)$$

When the IV principle is applied to it, the result is as follows;

$$\Sigma Y_{IV}\, x_{IV} = {}_n\hat{a}_1 \pm \hat{a}_2 \Sigma x_2\, x_{IV} \pm \hat{a}_3 \Sigma x_3\, x_{IV} \pm \ldots \pm \hat{a}_n \Sigma x_n\, x_{IV} + \delta_i + \rho_t + \upsilon_{it} \qquad (2)$$

Instrumented variables are proxies for endogenous estimates (Gujarati & Porter, 2009). These proxy variables need to be correlated with the problematic variables and uncorrelated with the dependent variable in order for the IV method to be useful.

Gupta et al use military spending and foreign aid received as instruments for education spending (2002). This makes sense in a study such as theirs, since they include only developing and transitioning economies. It is also logical for the time period that they cover. It is less applicable in this study, since there is a different time frame and this study covers developed as well as developing countries.

A study conducted by Trostel (2009) adopts an instrumentation strategy that is likely be more applicable to this study. Trostel estimates the effects of public support (public spending) on college attainment by using two variables as instruments for the endogenous spending variable of interest: state funding for postsecondary education per potential student (2009).The two instruments are primary education expenditure and secondary education

expenditure (Trostel, 2009). Trostel explains that government spending on higher education could depend on the number of pupils that are enrolled in higher education (2009). He goes on to describe the dependency as a potentially significant difficulty, since government spending on tertiary education might not be exogenous (Trostel, 2009).

This study faces the same problem, thus the same the solution is applied in order to fight the issue of endogeneity. Since Trostel uses primary education expenditure and secondary education expenditure as instruments for government spending on tertiary education, the same concept is applied in the models of tertiary education outcomes in this study. Analogously, in the models related to primary education outcomes, the instruments employed are government expenditure on secondary and tertiary education; and when looking at models pertaining to secondary education outcomes, the instruments used are expenditure on primary and tertiary education.

4.4) Fixed effects

There are two types of effects that a panel data model could have: random or fixed. (Hill et al, 2008). It is important to determine what effects are present in the model because certain assumptions fall in place when either type of model is employed. In the random effects model, the error term is purely unsystematic (Cameron et al, 2010). In contrast, in the fixed-effects model, it is assumed that the error term has a degree of correlation with the independent variables (Cameron et al, 2010). The Hausman test is used to determine which model specification is more appropriate for the underlying data (Cameron et al, 2010). By conducting Hausman tests for each specification (estimation equation), one is able to differentiate between which of the models, fixed or random effects, is better. This test is the similar to a t-test, a decision is made based on the statistic that the test produces.

4.5) Level of development

The study done by Gupta et al looks at a selection of developing and ‘transitioning’ countries (2002). This study considers developing as well as developed countries in an attempt to compare the impact of government spending on education outcomes between countries at different levels of development. Tables A1 & A2 in appendix A contain lists of the countries used in the analysis. Gupta et al do not specify how the countries in their study have been sorted according to levels of development. In this study, countries have been sorted according to the International Monetary Fund definitions of development. Specifically, developed

countries are the countries deemed by the IMF as 'advanced' and the remaining countries are grouped under the 'developing countries' category. Each specification has been tested for all countries, and then estimated separately for advanced economies and for less advanced or developing economies.

4.6) Missing Values

Panel data is affected by missing values and attrition. While the latter problem is less likely to be an issue for country-level data, the problem of missing values is usually serious. It is the repeated nature of recording data that makes panel data useful in addressing problems that are difficult to tackle with cross-sectional data. However, missing values create an unbalanced panel and insufficient observations reduce the accuracy of regression estimates.

Values are missing for different reasons. There could be no fixed pattern of missing values and so they are missing at random. Alternatively, there could be a specific reason why values are missing and so there is a systematic pattern. This bias can be addressed by determining the reason why values are missing, either randomly or systematically.

However, the fixed effects method, as discussed in subsection 4.4, cannot address systematic patterns of missing values. What has been noticed in the data is that developing countries had more missing values and this has been addressed somewhat by generating a separate set of estimates for developing countries and advanced countries, as discussed in subsection 4.5. Further investigation into the pattern of missing values is beyond the scope of this study.

4.7) Lagged effects

Trostel (2009) shows the concept of lagged effects in his study, using twenty two years of United States interstate data from 1985 to 2006. This reflects the intuitive idea that the effects of government spending are realised over long periods. Hence, models taking lagged effects into account have also been estimated in the subsequent analysis. This subsection briefly considers the distributed lag effects model. This particular regression model assumes that the relationship between the dependent variable Y and the explanatory variables, the X's, is not contemporaneous, that is, not at the same point in time (Gujarati & Porter, 372, 2010).

The concept is that the Y variable depends not only on the X variable in the current time period but the X variable in the time period before, or even before that. In other words; there may be a lagged relationship between Y and the X's. To illustrate, let Y_{it} be the variable at

time t, X_{it} be the variable at time t, X_{it-1} be the variable at time (t - 1), and X_{it-2} be the variable at time (t - 2). Now consider the model

$$Y_{it} = A + B_0X_{it} + B_1X_{it-1} + B_2X_{it-2} + u_{it} \quad (3)$$

As this model shows, because of the lagged terms X_{it-1} and X_{it-2}, the relationship between Y and X is not contemporaneous. Models like this are called dynamic models and involve changes over time. The effect of a unit change in the value of the explanatory variables is felt over a number of time periods, for example, three time periods in the model of equation 4.1.

4.8) Heteroscedasticity

In each of the models of education, one can assume that the conditional distribution of each dependent variable corresponding to the given value of the independent variable has the same variance. In other words, the individual dependent variables are spread around their mean values with the same variance (Gujarati & Porter, 2010). This is known as homoscedasticity; meaning equal variance.

If this is not the case, however, then there is a case of heteroscedasticity; meaning unequal variance. In some cases in the data analysis; there may be cases of heteroscedasticity present and thus this may be the cause that some coefficient estimates are not as statistically significant as they could be if homoscedasticity was the case. Tests for heteroscedasticity have been included with the data analysis in chapter 6.

4.9) Autocorrelation

The term autocorrelation can be defined as the correlation between members of observations ordered over time and across individual section (Gujarati & Porter, 2010). If there is no autocorrelation, then the expected value of the product of two different error terms is zero. Thus, with autocorrelation, the error term relating to any observation is influenced by the error term relating to any other observation (Gujarati & Porter, 2010). In the presence of autocorrelation, OLS estimates will be unbiased but they will not be efficient. Tests for autocorrelation have been included with the data analysis in chapter 6.

4.10) Multicollinearity

In each of the models of education, one can assume that there is no exact linear relationship between the explanatory variables (Gujarati & Porter, 2010). This is the assumption of no

multicollinearity. If no perfect multicollinearity exists, then this means that any variable cannot be expressed as an exact linear function another variable.

If any variable in the model can be expressed as an exact linear function of another variable in the regression then there would be a case of multicollinearity present within the regression. Similar to the case of heteroscedasticity, as discussed above; there may be some cases in the data analysis where there will be cases of imperfect multicollinearity. This may be the cause that some variables are not as statistically significant as they could be if there was no multicollinearity present in the regression.

4.11) Concluding Remarks

The aim of this chapter was to discuss the econometric methodology used in this study. Other studies were considered to determine what the best way to analyse the data would be. The next chapter presents the variables, as chosen in chapter 3, and the data in a descriptive way. Then chapter 6 contain the analysis of the data using the panel data methods reviewed in this chapter.

Chapter 5

Descriptive Analysis:

5.1) Introduction

This chapter looks at the data descriptively through use of graphs; plotting the variables over time in order to explore general trends in the variables of interest. The variables used in the data analysis will also be defined in this chapter.

5.2) Data

The data used was obtained from the World Bank Development Indicators databank. The World Bank's definition of a country has been used. For example, Reunion and Taiwan appear in the data as countries where in reality they could be considered territories of France and China. The data is an unbalanced panel data because it is both cross sectional and time series but with missing values (Arellano, 2003). For the time series, the years used are from 1990 to 2010 and for the cross section part of the panel; there are 216 countries; for a full listing of countries, see Appendix A.

5.3) Variable Descriptions

This subsection contains definitions of the variables used in the data analysis. The descriptions for all variables are according to World Data Bank definitions. The long definitions of the dependent and main independent variables are defined in Table 5.1 & 5.2. The control variables are defined as follows.

The Gross National Income per capita (GNI) variable is used as proxy for individual income and it is measured as gross national income divided by midyear population. It is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in constant local currency units and measured annually.

The mortality rate variable is used as an indirect measure of child nutrition. It is measured as the probability per 1,000 that a new born baby will die before reaching age five, subject to age-specific mortality rates of the specified year.

The population age variable used in the models related to all the models, at a primary and secondary and tertiary level of education, is the share of population that are the official age, in each country, to be able to attend primary education. And so this is measured as a percentage of the total population. The population size is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country that are generally considered part of the population of the country of origin.

The population density variable is used as an indirect measure of urbanisation. It is the midyear measure of the population divided by land area in square kilometres. Population is measured in the same way as mentioned above for the population age variable. The land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.

Table 5.1: Long Definitions of Dependent variables:

Indicator Name	**Enrolment Rate**	**Persistence Rate**	**Repeater Rate**
Long Definition	Gross intake ratio in first grade of primary education is the number of new entrants in the first grade of primary education regardless of age, expressed as a percentage of the population of the official primary entrance age.	Persistence to last grade of primary is the percentage of children enrolled in the first grade of primary school who eventually reach the last grade of primary education. The estimate is based on the reconstructed cohort method.	Percentage of repeaters in primary/ secondary/ tertiary for all grades. Total is the number of students enrolled in the same grade as in the previous year, as a percentage of all students enrolled in primary/ secondary/ tertiary school.
Periodicity	Annual	Annual	Annual
General Comments	Data may be inaccurate when new entrants and repeaters are not correctly distinguished. Enrolment rates may be greater than 100% since there are those enrolling who are older than the official enrolment age.	Aggregate data are based on World Bank estimates.	Calculated by dividing the sum of all repeaters in all grades of primary/ secondary/tertiary education by the total enrolment in that level of education and multiplying the result by 100.

Source: World Development Indicators databank

Table 5.2: Long Definitions of Independent variables:

Indicator Name	**Spending on education**	**Share of public expenditure per level of education**	**Current expenditure per level of education**
Long Definition	General government expenditure on education (current, capital, and transfers) is expressed as a percentage of total general government expenditure on all sectors (including health, education, social services, etc.). It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments.	Government expenditure per level of education is the average general government expenditure (current, capital, and transfers) per level of education, expressed as a percentage of public expenditure on education. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments	Government expenditure per level of education is the average general government expenditure (current, capital, and transfers) at the given level of education. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments
Measure	As a% of total public expenditure	As a share of public expenditure on education	In Local Currency Units

Source: World Development Indicators databank

5.4.) Descriptive Statistics

This subsection aims to describe the variables used in the data analysis using descriptive statistics. Two main methods of descriptions are going to be used. Firstly, the variables will be presented in correlation matrices. Secondly, the variables will be presented in graphs so that one can observe the trends of these variables over time.

5.4.1) Variable Correlation

This subsection presents the correlations between the variables that are to be used in the education models, as a preliminary analysis of the relationships.

Table 5.3: Primary Schooling: Enrolment Rate:

	Enrol	Gov Spend	Current Prim Spend	GNI	Pop Age	Child Mortality	Urban	Share Prim Spend
Enrol	1							
Gov Spend	0.0183	1						
Current Prim Spend	0.1586	0.0558	1					
GNI	0.0428	-0.1297	-0.0602	1				
Pop Age	-0.023	-0.24	-0.2902	-0.0181	1			
Child Mortality	-0.2334	-0.2535	-0.3046	-0.0601	0.8235	1		
Urban	-0.0218	-0.0668	-0.0824	0.1197	-0.129	-0.1095	1	
Share Prim Spend	0.0732	-0.2761	-0.2768	0.1052	0.7765	0.6048	-0.0473	1

Source: Own calculations using the World Development Indicators databank

Table 5.4: Primary Schooling: Persistence Rate

	Persist	Gov Spend	Current Prim Spend	GNI	Pop Age	Child Mortality	Urban	Share Prim Spend
Persist	1							
Gov Spend	0.2731	1						
Current Prim Spend	0.3084	0.1166	1					
GNI	0.0756	-0.1292	-0.0769	1				
Pop Age	-0.8211	-0.2574	-0.3211	-0.0425	1			
Child Mortality	-0.8127	-0.2393	-0.393	-0.0829	0.8241	1		
Urban	0.0527	-0.0956	-0.0619	0.0805	-0.0849	-0.0801	1	
Share Prim Spend	-0.6747	-0.2498	-0.338	0.11	0.8116	0.6174	-0.0355	1

Source: Own calculations using the World Development Indicators databank

Table 5.5: Primary Schooling: Repeater Rate

	Repeat	Gov Spend	Current Prim Spend	GNI	Pop Age	Child Mortality	Urban	Share Prim Spend
Repeat	1							
Gov Spend	-0.2085	1						
Current Prim Spend	-0.2179	0.1031	1					
GNI	-0.1162	-0.1361	-0.0512	1				
Pop Age	0.7171	-0.2412	-0.2874	-0.0362	1			
Child Mortality	0.7286	-0.2321	-0.353	-0.0811	0.8221	1		
Urban	-0.0771	-0.0921	-0.0605	0.0449	-0.0979	-0.0861	1	
Share Prim Spend	0.4878	-0.2716	-0.3134	0.1071	0.785	0.6026	-0.0667	1

Source: Own calculations using the World Development Indicators databank

Table 5.6: Secondary: Enrolment:

	Enrol	Gov Spend	Current Sec Spend	GNI	Pop Age	Child Mortality	Urban	Share Sec Spend
Enrol	1							
Gov Spend	0.2538	1						
Current Sec Spend	0.2955	0.019	1					
GNI	-0.0073	-0.1447	-0.0235	1				
Pop Age	-0.7977	-0.2148	-0.2762	-0.0023	1			
Child Mortality	-0.8064	-0.2064	-0.2094	-0.0526	0.8112	1		
Urban	0.0511	-0.0702	-0.0156	0.1144	-0.1021	-0.0797	1	
Share Sec Spend	0.384	0.0526	0.0247	-0.0685	-0.5933	-0.4158	0.0831	1

Source: Own calculations using the World Development Indicators databank

Table 5.7: Secondary: Persist:

	Persist	Gov Spend	Current Sec Spend	GNI	Pop Age	Child Mortality	Urban	Share Sec Spend
Persist	1							
Gov Spend	0.3335	1						
Current Sec Spend	0.1005	0.0778	1					
GNI	0.0856	-0.1421	-0.0248	1				
Pop Age	-0.8229	-0.3088	-0.195	-0.0857	1			
Child Mortality	-0.8184	-0.2677	-0.1713	-0.1004	0.8325	1		
Urban	0.0686	-0.0924	-0.0198	0.0556	-0.1421	-0.1046	1	
Share Sec Spend	0.489	0.0738	-0.0689	0.0096	-0.5617	-0.4012	0.0186	1

Source: Own calculations using the World Development Indicators databank

Table 5.8: Secondary: Repeat:

	Repeat	Gov Spend	Current Sec Spend	GNI	Pop Age	Child Mortality	Urban	Share Sec Spend
Repeat	1							
Gov Spend	-0.1654	1						
Current Sec Spend	-0.294	0.0811	1					
GNI	-0.1477	-0.1607	-0.0223	1				
Pop Age	0.6284	-0.2851	-0.2206	0.0188	1			
Child Mortality	0.6681	-0.2247	-0.1998	-0.0467	0.8281	1		
Urban	-0.0962	-0.0826	-0.0229	0.023	-0.0968	-0.0914	1	
Share Sec Spend	-0.2561	0.0685	0.0317	-0.0749	-0.6566	-0.4696	-0.0334	1

Source: Own calculations using the World Development Indicators databank

Table 5.9: Tertiary: Enrolment:

	Enrol	Gov Spend	Current Ter Spend	GNI	Pop Age	Child Mortality	Urban	Share Ter Spend
Enrol	1							
Gov Spend	0.3418	1						
Current Ter Spend	0.1432	0.0992	1					
GNI	0.1162	-0.1585	-0.0793	1				
Pop Age	-0.747	-0.1971	-0.0389	-0.0014	1			
Child Mortality	-0.6869	-0.2426	-0.0264	-0.0555	0.831	1		
Urban	-0.0825	-0.0911	0.0493	0.1486	-0.0677	-0.068	1	
Share Ter Spend	0.3842	0.3234	-0.0693	-0.1763	-0.3146	-0.2591	-0.0821	1

Source: Own calculations using the World Development Indicators databank

The way that these matrices can be understood; the number shows the amount to which the variable at the top of the column is correlated with the variable in that row. So for primary education, in Table 1, it is clear that the correlation between the government expenditure variables and the enrolment rate is weak. The strongest correlate of primary enrolment rates is the child mortality rate.

In Table 2, the correlation coefficient of -0.67 indicates that the share of primary education spending to total government expenditure on education is relatively strongly, but negatively correlated with persistence. This appears to be an odd and unexpected correlation. One way to explain this is due to the millennial developmental goals, government spending has been focused on enrolment rates. The second of the Millennium Development Goals, adopted after the Millennium Summit of the United Nations in 2000, is to achieve universal primary education. The government expenditure data reflects a drive by most countries to meet this goal. However, rising enrolment rates do not automatically translate into improved persistence and reduced repeater rates. In fact, there is some evidence of the opposite pattern form the descriptive trends presented below. This type of focus may produce undesirable side effects, such as overcrowded schools, which will have a negative effect on persistence. Similarly, children who may not have the necessary resources and family support to persist through school will be enrolled in school due to this focus.

It is also interesting to note that the relationship between the three government expenditure variables is weak and may be negative. For example, the correlation between the share of

primary education spending out of the education budget and the proportion of the total budget allocated to education is about -0.28. There is a similar relationship with repeater rates, as seen in Table 3. If a child does not have the resources or support needed to pass, they will repeat. The strongest correlates to persistence and repeater rates are population age and child mortality. These variables are negatively correlated with persistence rates, as expected. This is likely to reflect that overcrowding in schools and lack of nutrition have a negative effect on persistence rates.

Conversely, these variables are positively correlated with repeater rates, as expected. For secondary education, in Table 4, all of the government spending variables do not have much effect on enrolment, as was also seen with primary schooling. The population age and child mortality rates have the strongest correlations with secondary enrolment rates. In Tables 5 & 6, the expected correlation between government spending variables and persistence and repeater rates is observed; the government expenditure variables are positively correlated with persistence and negatively correlated with repeater rates. Once again, the strongest correlates of persistence and repeater rates, as is the case with primary schooling, are population age and child mortality rates, with the expected direction of correlation for both.

In Table 7, the government spending variables have more of an effect on tertiary education outcomes when compared with primary and secondary education. The correlations are also in the expected direction, unlike some of the correlations between government expenditure and primary and secondary educational outcomes. . In a similar way to primary and secondary schooling, however, it is notable that, the variables with the strongest correlations with educational outcomes are population age and child mortality.

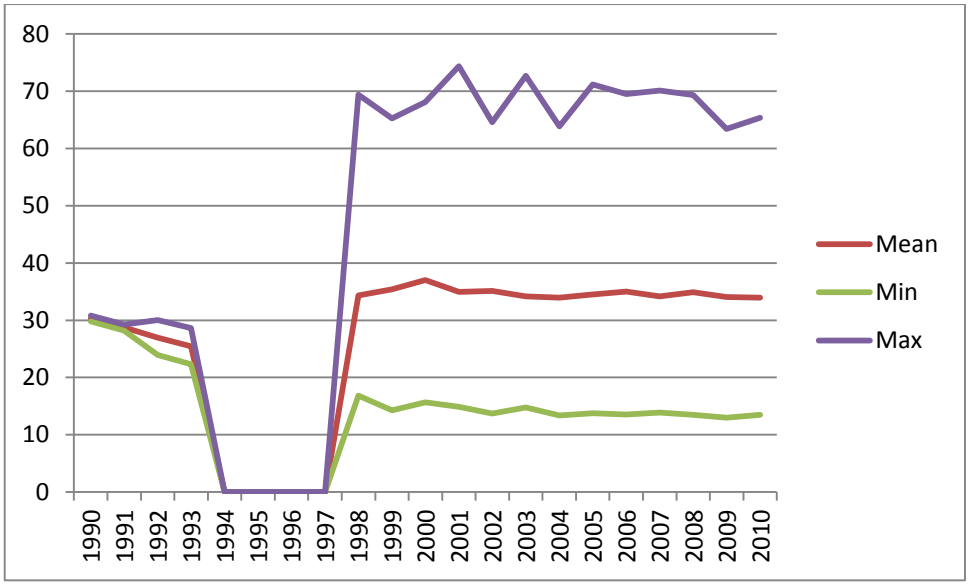
5.4.2) Graphs

This subsection aims to explore the variables used in the data analysis using descriptive methods. The educational outcome variables have been described in terms of average (mean), maximum (Max) and minimum (Min) over all countries for which data is available, for each year. The government expenditure variables have been described in the same way. These descriptive statistics have been presented in graphs so that one can observe the trends of the averages, as well as the largest and smallest values of these variables, over time.

5.4.2.1) Primary schooling

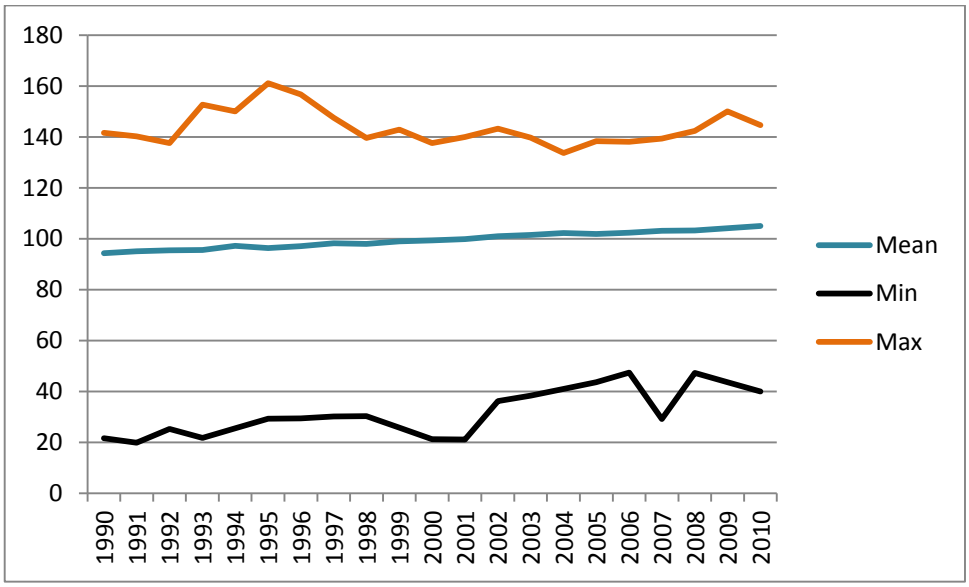
The government expenditure variable used in Figure 5.1 measures the share of expenditure on primary education of total education expenditure. The average appears to remain relatively unchanged over time at just below 40%. The minimum is less than 20% and the maximum fluctuates around 70%. These minimum and maximum values show the importance of primary education according to spending where some countries will spend up to 70% of their total expenditure on education on primary, whereas other countries spend relatively little.

Figure 5.1: Total Government Spending on Primary Education



Source: Own calculations using the World Development Indicators databank

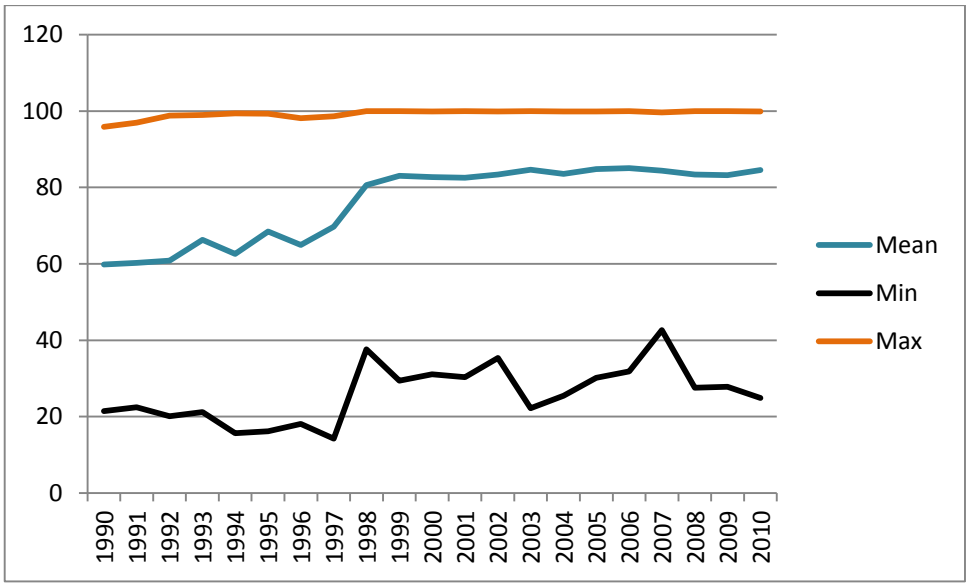
Figure 5.2: Total Primary Enrolment Rate



Source: Own calculations using the World Development Indicators databank

In Figure 5.2; the enrolment rate is the number of children who are enrolled in a given year, divided by the number of individuals who are the official age to attend primary school. The average primary enrolment rate increases steadily over the years to attain an average of over 100%; with maximum values that fluctuate around 140%. These high maximum enrolment rates could be explained by the way the enrolment rate is measured. There are many individuals that are older than the official primary school age who are enrolled in primary education, especially after 2000. The minimum enrolment rates have been steadily increasing as well – from about 20% of the official primary school aged population enrolling to almost half of the primary school aged population. This show some progress towards the developmental objectives of the United Nations, as set out in the Millennium Development Goals, the second one of which is stated as: "achieve universal primary education" (UN, 2014, 16).

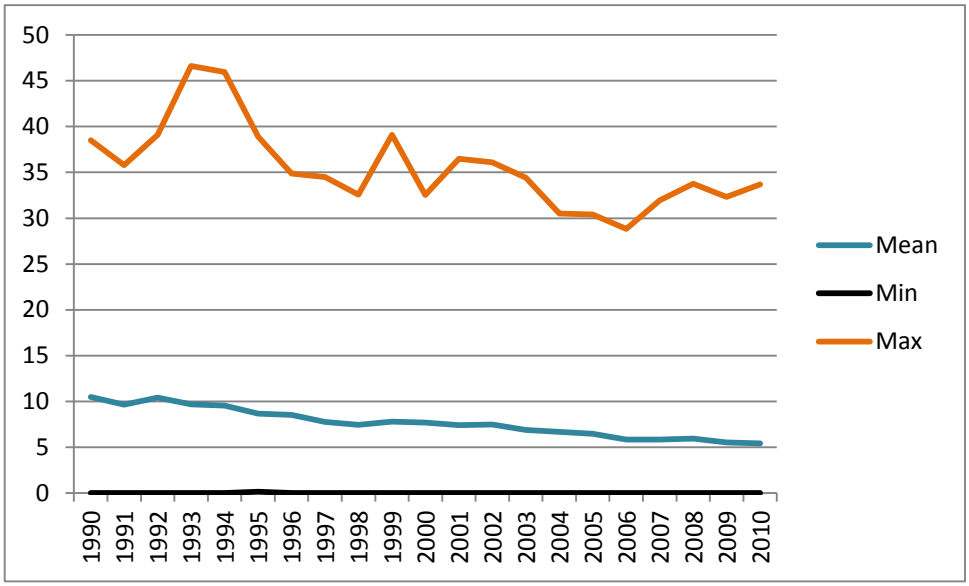
Figure 5.3: Total Primary Persistence Rate



Source: Own calculations using the World Development Indicators databank

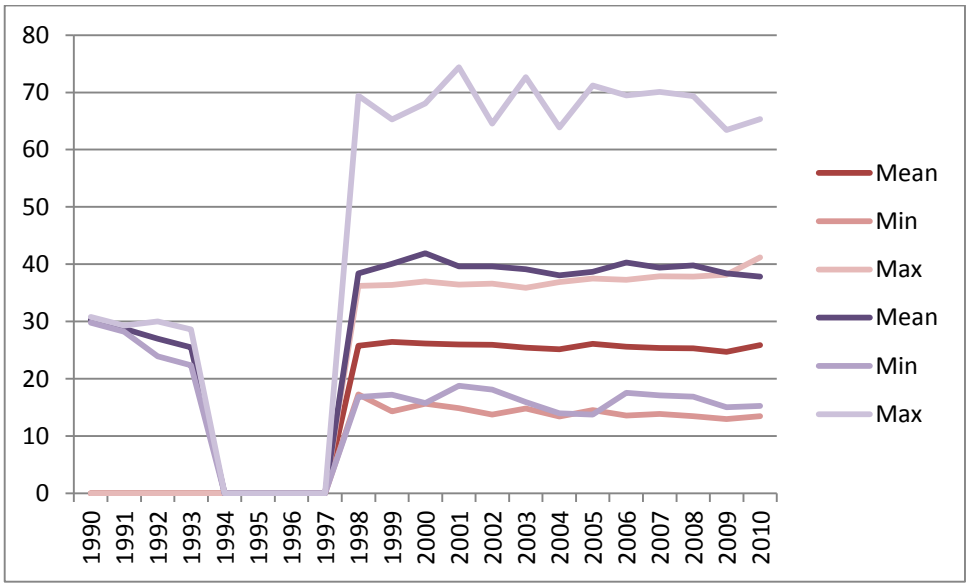
In Figure 5.3 above; average persistence rates have been high, rising from just below 60% to remain over 80% in the first decade of the twenty-first century. As seen in Figure 5.4 below; the average primary repeater rate falls by half to below 5% over the twenty-year period.

Figure 5.4: Total Primary Repeater Rate



Source: Own calculations using the World Development Indicators databank

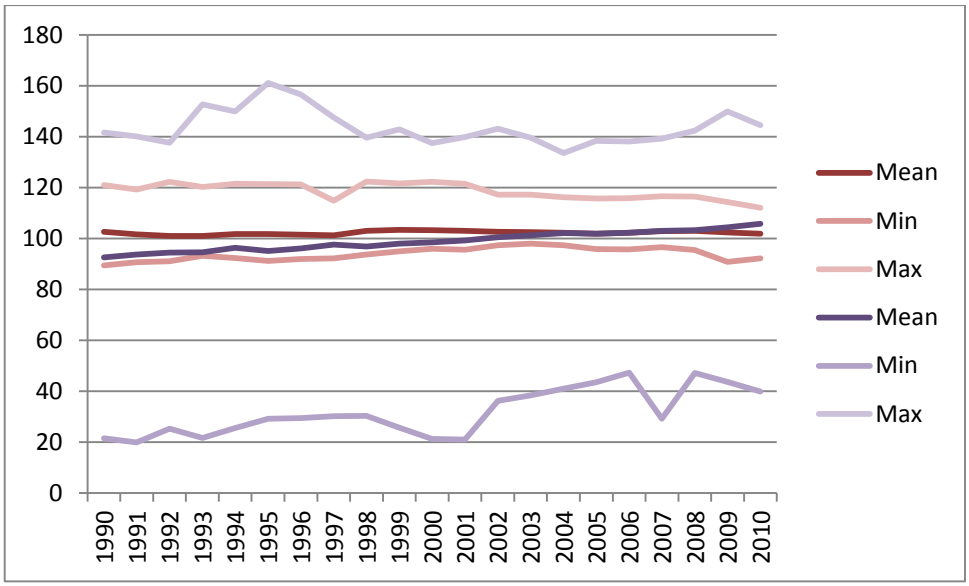
Figure 5.5: Government Spending on Primary for Advanced & Developing Countries



Source: Own calculations using the World Development Indicators databank

In Figure 5.5, above the shades of red represent advanced countries the shades of purple represent developing countries. The average expenditure on primary education, measured as the share of total public expenditure on education that is allocated to primary education, is higher in developing countries than it is in advanced countries, showing developing countries' shift in focus from other objectives. Similarly, both the minimum and maximum expenditure on primary education is higher in developing countries than it is in advanced.

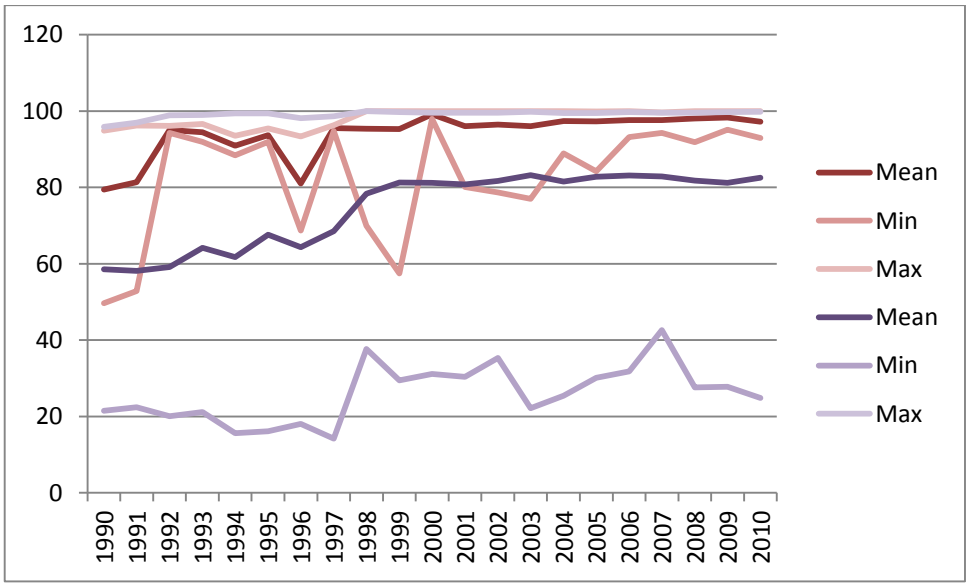
Figure 5.6: Primary Enrolment Rate: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

In Figure 5.6, above; the average enrolment rates in developed countries are high at around 100%. The maximum values are also very high. The fluctuations in the maximum and minimum values could be explained by conditions in the economy as well as lagged effects from policy and changes in government spending. While there are no large differences in the average enrolment rates between the two, developing countries have a much wider within-group variation, with the range of enrolment rates decreasing only slightly over time.

Figure 5.7: Primary Persistence Rate: Advanced and Developing Countries

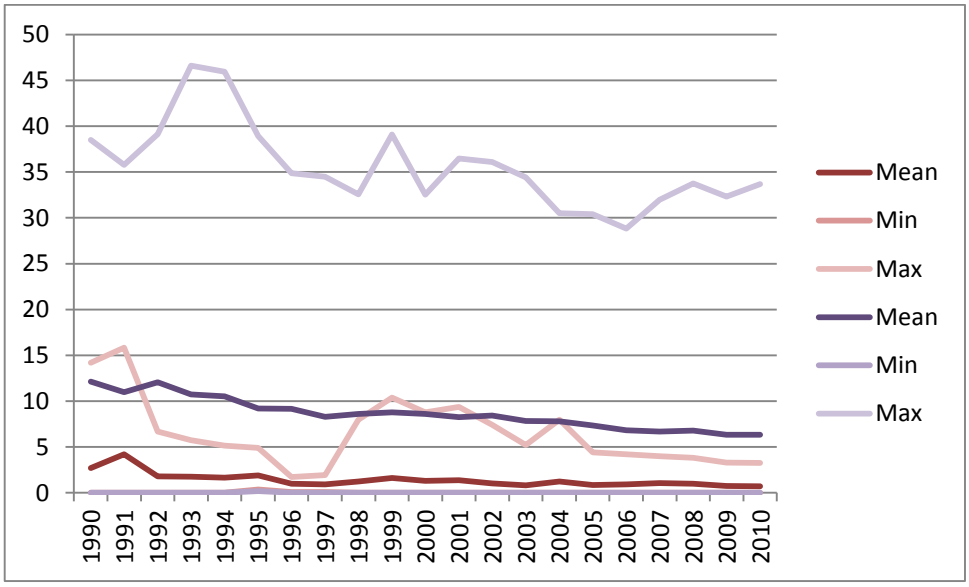


Source: Own calculations using the World Development Indicators databank

The average rates of persistence for developed countries in Figure 5.7 above are high, but settle marginally below 100%, after rising from 78% in the beginning of the period to a high of 91%. The average rates of persistence for developing countries are remain consistently below those for advanced countries, however the minimum rates much lower than in advanced countries. Here too, developing countries' performance is varies substantially from country to country and narrows only slightly over the period.

In Figure 5.8, seen below, the average primary repeater rate for advanced countries is consistently below that for the developing group. . Even for less advanced nations, the average rates of repeaters are relatively low, falling to below than 10% over the years. The maximums values for developing countries remain disturbingly high, but show some decline to settle below 35% in recent years.

Figure 5.8: Primary Repeater Rates: Advanced and Developing Countries

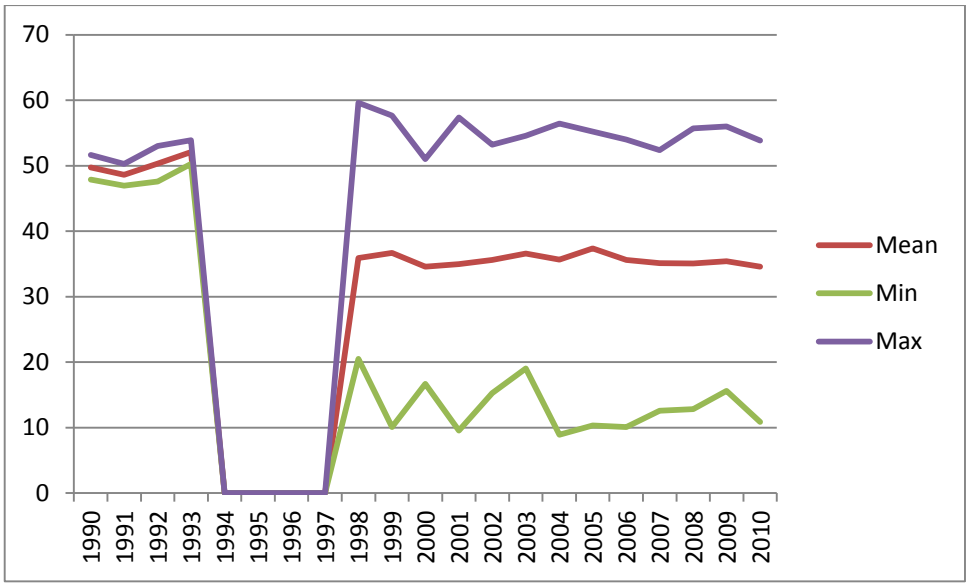


Source: Own calculations using the World Development Indicators databank

5.4.2.2) Secondary

In Figure 5.9, below, as seen with primary education expenditure, the average appears to remain constant at just below 40%. The minimum share falls steeply to below 20% in the early 1990s and the maximum remains under 60%, which is lower than for primary.

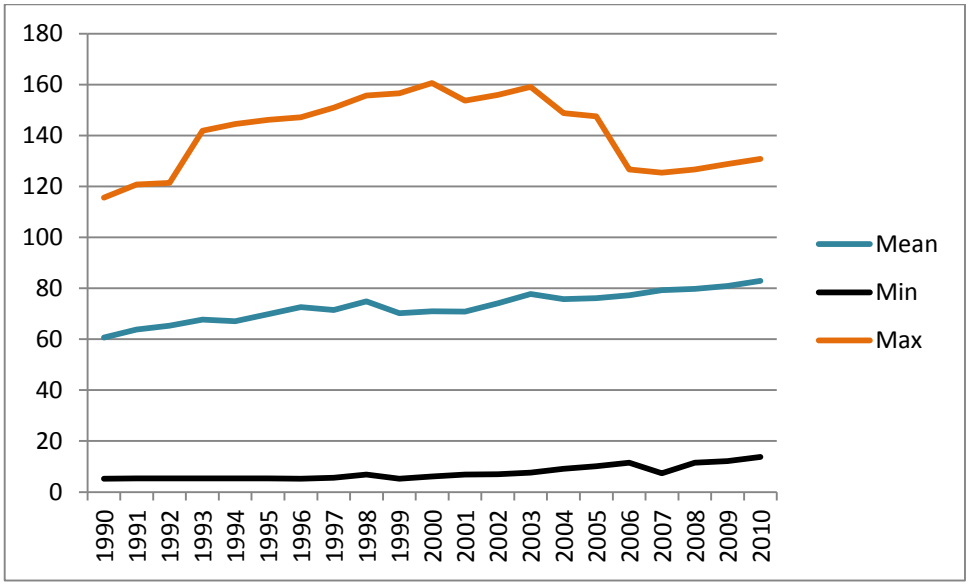
Figure 5.9: Government Spending on Secondary Education as a Share of Education Spending



Source: Own calculations using the World Development Indicators databank

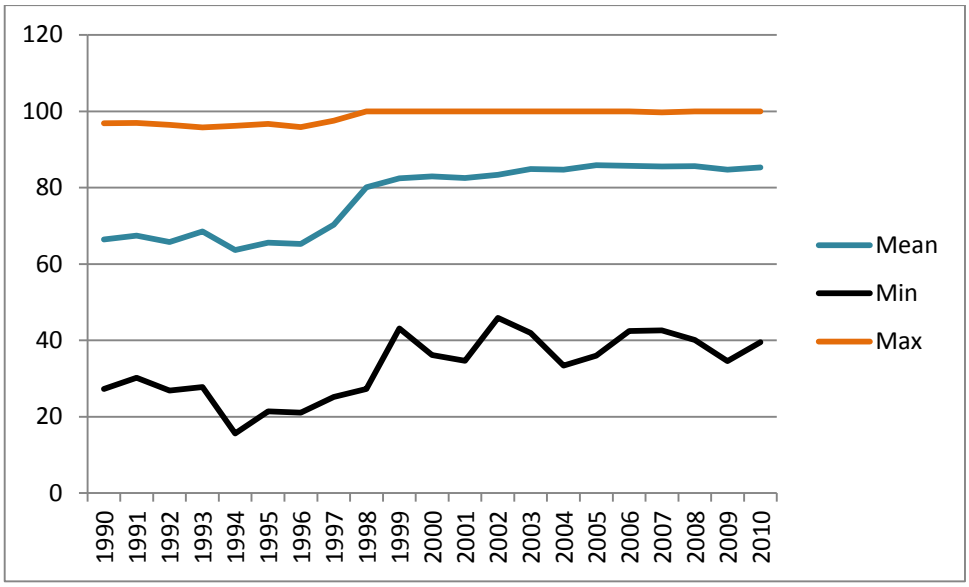
The average enrolment rates, shown in Figure 5.10 below, are low when compared with primary. The minimums are relatively small; remaining at below 20% over the entire period. This is substantially lower small compared with primary enrolment rates.

Figure 5.10: Total Secondary Enrolment Rates



Source: Own calculations using the World Development Indicators databank

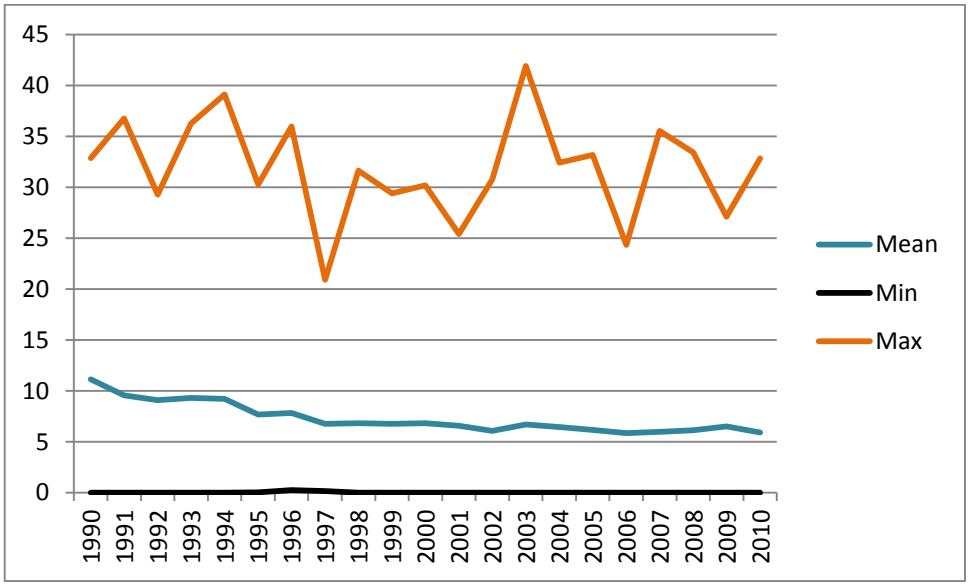
Figure 5.11: Total Secondary Persistence Rates



Source: Own calculations using the World Development Indicators databank

In Figure 5.11, above, persistence rates are, on average, similar in the 80s and towards the end of the period. On average are higher in primary than they are in secondary education. Total persistence rates in secondary school raise about twenty percentage points. In Figure 5.12, below, the average repeater rates have been steadily decreasing since 1990, approaching 5% by 2010. The maximum repeater rates are similar to those in primary education. The minimum repeater rate, similarly to primary education, is a low of zero.

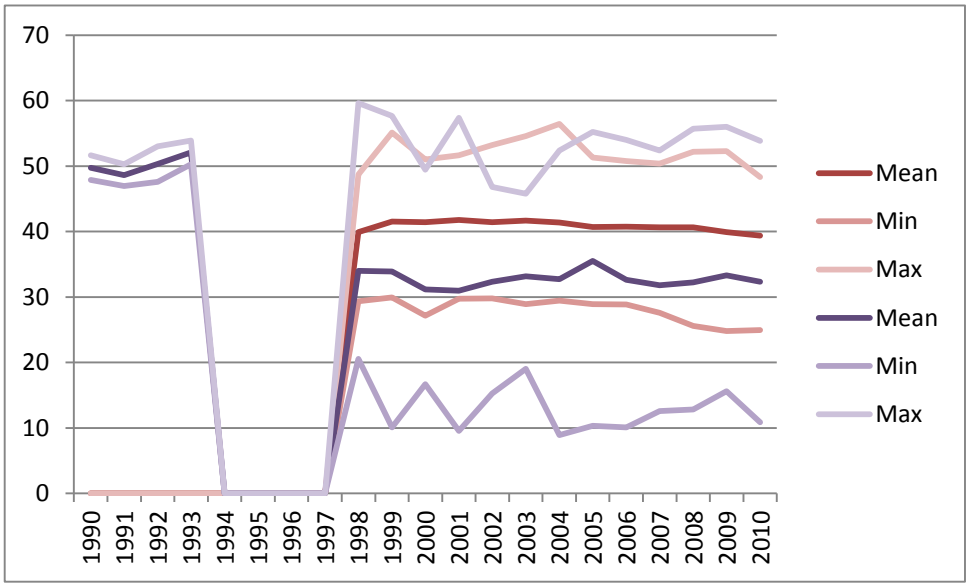
Figure 5.12: Total Secondary Repeater



Source: Own calculations using the World Development Indicators databank

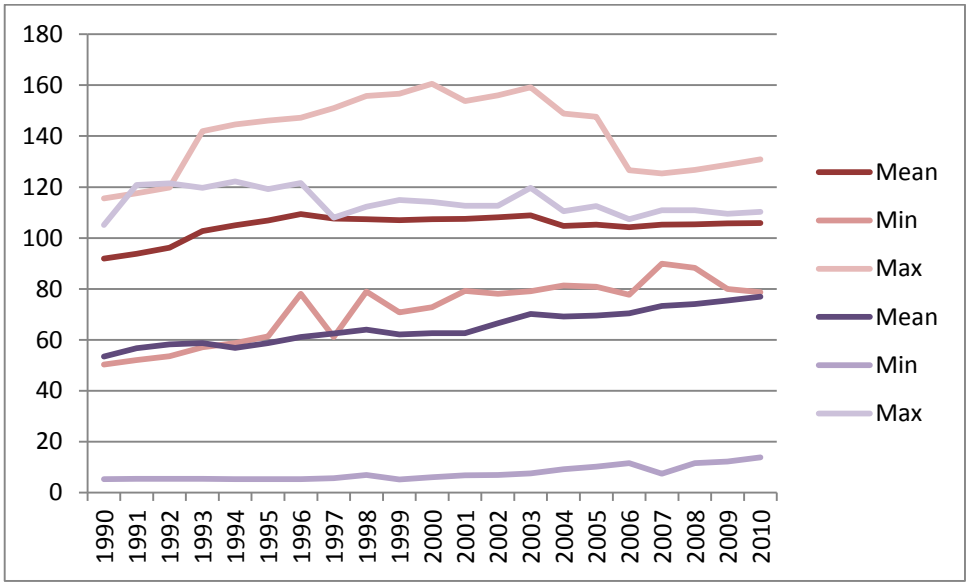
In Figure 5.13, below, the average expenditure on secondary is higher in advanced countries than it is in developing countries, which is opposite to the pattern observed with primary education expenditure. Maximum and minimum expenditure shares are relatively the same in developing counties, with large fluctuations due to changes in policy and spending.

Figure 5.13: Government Spending on Secondary Education as a Share of Total Education Spending: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

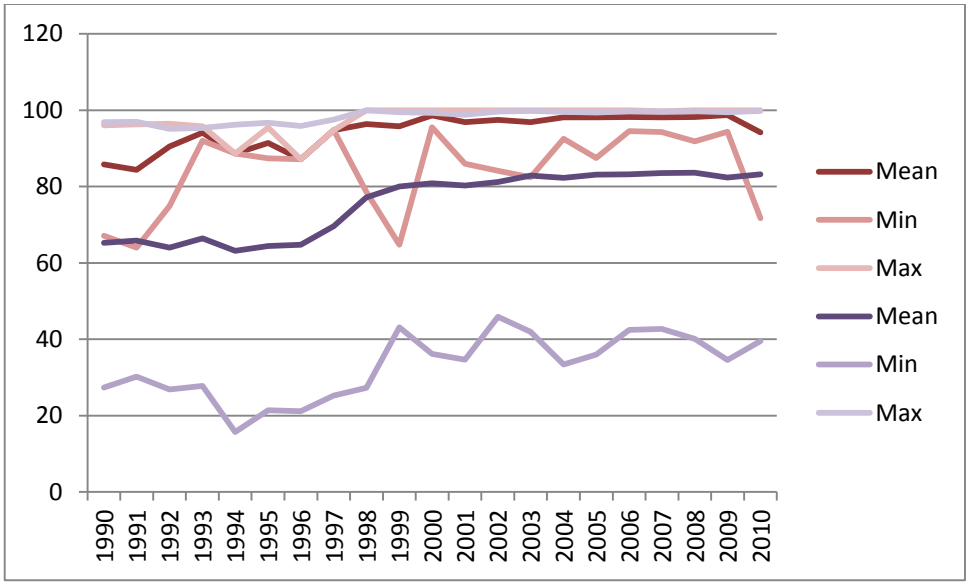
Figure 5.14: Secondary Enrolment Rate: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

In Figure 5.14, above, the average enrolment rates in developed countries rise to above 100% in the early part of the period and remain relatively steady afterwards. . The average enrolment rate for developing countries is never higher than 80%, which is lower than primary education; even the maximum is much lower than for primary education.

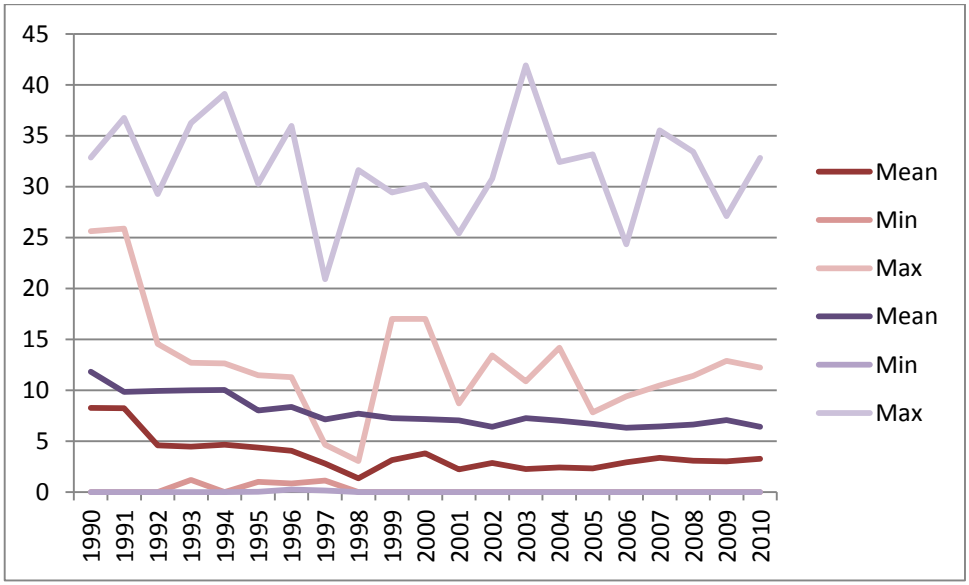
Figure 5.15: Secondary Persistence Rate: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

In Figure 5.15, above; the mean persistence rate in advanced countries stays below 100%. The average persistence rate in secondary is similar to that of primary education. The persistence rate in developing countries is consistently lower than that for the advanced group, remaining below 90%, but the gap narrows gradually over time.

Figure 5.16: Secondary Repeater Rates: Advanced and Developing Countries



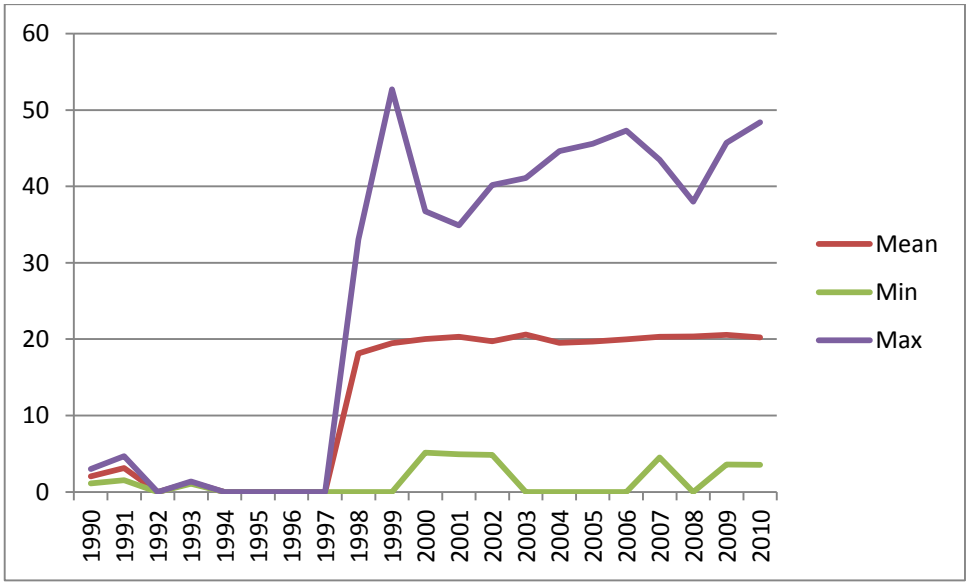
Source: Own calculations using the World Development Indicators databank

In Figure 5.16 above, the average repeater rate in developed countries stays below 5% for most of the period, which is low even when compared with primary schooling. The maximums are similar to those for primary education. The average repeater rate for developing countries decreases gradually over time. However, the maximum values for developing countries remain stubbornly high and substantially above what is seen in developed countries.

5.4.2.3) Tertiary education

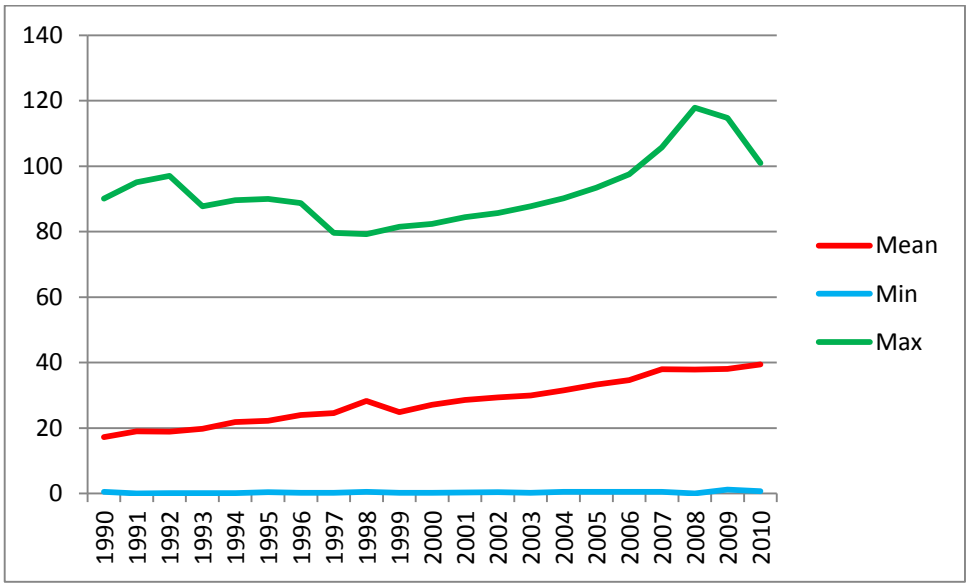
There is only one educational outcome on this level of education namely enrolment rates. This is due to limited data. There is neither a persistence rate nor a repeater rate available to tertiary education. In Figure 5.17 below, unlike primary and secondary expenditure, the average is rather low at about 20%, with high maximums, fluctuating around 40% and low minimums, lower than 10%. There was a large increase in spending after 1992. The tertiary enrolment rate, shown in Figure 5.18 below, is measured by dividing total enrolment in tertiary education by the proportion of the population that is the official tertiary enrolment age, 15 to 65 years old. The average enrolment rate rises gradually from about 20% to just below 40% by 2010, reflecting a strong global trend of increasing demand for tertiary education, as the youth unemployment in many countries has been rising. The minimums are very low, and the maximums are high steadily increasing to a peak above 100% and then decreasing slightly.

Figure 5.17: Government Spending on Tertiary as a Share of Total Education Spending



Source: Own calculations using the World Development Indicators databank

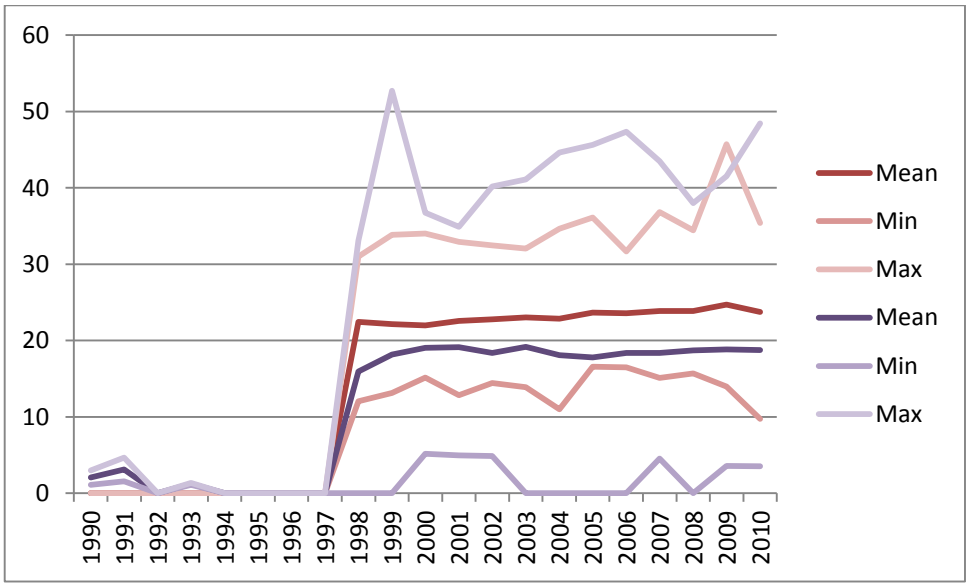
Figure 5.18: Total Tertiary Enrolment Rate



Source: Own calculations using the World Development Indicators databank

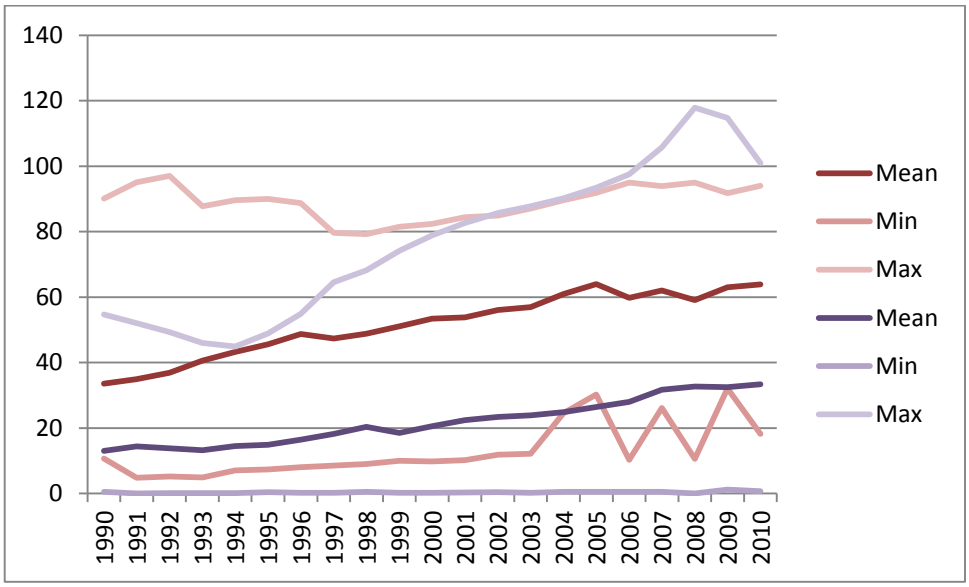
Similarly to secondary education, Figure 5.19, below shows that the average expenditure on tertiary education is higher in advanced countries than it is in developing, but not by much. There are similar maximums, with large fluctuations. Here again, the range for developing countries is much larger, reflecting a diverse group of countries with varying educational priorities.

Figure 5.19: Government Spending on Tertiary Education as a Share of Total Education Spending: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

Figure 5.20: Tertiary Enrolment Rates: Advanced and Developing Countries



Source: Own calculations using the World Development Indicators databank

In Figure 5.20, above, the average enrolment rate in advanced countries increases through the two decades from below 40% to above 60%. In developing countries, a similar trend occurs, with the average rate rising from below 20% to less than 40%. The gap between the enrolment rates between developing and advanced countries has not shrunk over the period.

5.5) Concluding Remarks

This chapter has defined the variables to be used in the data analysis. The descriptive analysis and trends shown for the dependent variables and one of the government expenditure variables for every level of education serve as the background for the regression analysis presented in the next chapter.

Table 6.1: Primary: Total:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	-0.031	0.450***	-0.165	1.876**	-0.652	-0.13	1.744***	-0.604*	-0.096
	-0.252	-0.166	-0.117	-0.758	-0.511	-0.222	-0.331	-0.359	-0.105
Gov Spend on Prim (amnt)	0.169*	-0.039	0.019	-0.005	-0.03	-0.004	0.029	-0.021	0.008
	-0.094	-0.084	-0.041	-0.064	-0.056	-0.017	-0.04	-0.048	-0.014
GNI	0	0.000***	-0.000***	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	0.386***	-0.530***	0.303***	0.683	-0.215	0.23	0.448**	-0.197	0.199***
	-0.138	-0.112	-0.047	-0.515	-0.312	-0.143	-0.226	-0.243	-0.07
Child Mortality	-0.183***	-0.181***	0.072***	-0.477**	0.028	0.031	-0.485***	0.045	0.035**
	-0.03	-0.029	-0.014	-0.204	-0.07	-0.059	-0.051	-0.059	-0.016
Urban	-0.001	-0.001	0	0.148	-0.02	0.02	0.130***	-0.017	0.019***
	-0.002	-0.001	0	-0.109	-0.038	-0.017	-0.027	-0.031	-0.006
Gov Spend on Prim (share)	0.176*	-0.129**	-0.074**	0.192	-0.154	0.032	0.506***	-0.137	0.116**
	-0.094	-0.064	-0.03	-0.122	-0.11	-0.049	-0.143	-0.171	-0.047
Constant	77.740***	112.167***	-3.231	61.193**	106.934***	-5.279	57.163***	104.033***	-8.510***
	-9.007	-7.903	-3.878	-30.657	-12.42	-5.367	-9.861	-11.079	-3.155
Observations	613	416	520	613	416	520	602	409	511
Model Fit	0.1713886	0.7391495	0.5871829	0.3894671	0.0321271	0.0917928	0.0188	0.0165	0.0663

Table 6.2: Primary: Advanced:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	-0.475**	-0.379**	-0.147***	2.101***	-0.627***	-0.144	2.115***	-0.668**	-0.141***
	-0.195	-0.149	-0.043	-0.67	-0.215	-0.1	-0.346	-0.27	-0.047
Gov Spend on Prim (amnt)	0.325***	-0.008	-0.003	0.205	0.014	-0.02	0.212***	0.005	-0.017**
	-0.082	-0.032	-0.019	-0.143	-0.031	-0.013	-0.059	-0.044	-0.009
GNI	-0.000***	0	-0.000***	0	-0.000**	0	0	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	-0.299***	0.096*	-0.01	-0.175	-0.364	0.004	-0.206	-0.262	-0.013
	-0.102	-0.051	-0.024	-0.454	-0.241	-0.074	-0.273	-0.237	-0.04
Child Mortality	-0.274***	-0.199***	0.141***	0.14	0.345*	0.014	0.178	0.218	0.04
	-0.101	-0.044	-0.022	-0.444	-0.188	-0.07	-0.254	-0.229	-0.044
Urban	-0.001	-0.000*	0	-0.049***	-0.014	-0.001	-0.050***	-0.011	-0.001
	-0.002	0	0	-0.016	-0.009	-0.002	-0.019	-0.013	-0.002
Gov Spend on Prim (share)	0.313***	0.004	-0.002	0.661***	-0.136*	0.029**	0.702***	-0.222**	0.047**
	-0.057	-0.03	-0.012	-0.153	-0.072	-0.013	-0.145	-0.101	-0.021
Constant	75.298***	100.467***	1.529	65.944***	111.293***	2.954*	64.669***	112.908***	2.421*
	-8.296	-3.105	-1.832	-21.949	-5.728	-1.638	-8.646	-6.105	-1.242
Observations	291	160	221	291	160	221	291	160	221
Model fit	0.2637214	0.1710456	0.2865495	0.2564606	0.1281573	0.1307131	0.0116	0.0075	0.0008

Table 6.3: Primary: Developing:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	0.342	0.311	-0.067	1.942**	-0.697	-0.158	1.688***	-0.652	-0.128
	-0.311	-0.198	-0.151	-0.795	-0.606	-0.238	-0.463	-0.515	-0.15
Gov Spend on Prim (amnt)	0.137	-0.049	0.011	0.035	-0.04	0.008	0.058	-0.033	0.012
	-0.109	-0.098	-0.046	-0.067	-0.061	-0.016	-0.052	-0.066	-0.02
GNI	0	0.000***	-0.000***	-0.000**	0	0	-0.000*	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	0.471***	-0.604***	0.308***	0.628	-0.335	0.375*	0.209	-0.292	0.363***
	-0.179	-0.14	-0.055	-0.707	-0.494	-0.216	-0.381	-0.442	-0.124
Child Mortality	-0.204***	-0.161***	0.066***	-0.188	0.012	0.093*	-0.190**	0.029	0.094***
	-0.031	-0.031	-0.015	-0.176	-0.099	-0.049	-0.078	-0.095	-0.026
Urban	-0.001	-0.010***	0.002	0.461**	-0.044	0.110**	0.439***	-0.036	0.108***
	-0.004	-0.003	-0.002	-0.191	-0.085	-0.049	-0.055	-0.069	-0.019
Gov Spend on Prim (share)	0.176	-0.144*	-0.098**	0.156	-0.133	0.019	0.436**	-0.137	0.057
	-0.131	-0.085	-0.04	-0.144	-0.138	-0.066	-0.215	-0.278	-0.075
Constant	77.268***	116.529***	-1.819	13.516	109.102***	-21.396**	17.9	105.162***	-22.877***
	-11.16	-9.756	-4.733	-46.684	-22.671	-10.597	-17.163	-18.611	-5.462
Observations	322	256	299	322	256	299	311	249	290
Model fit	0.193841	0.671729	0.464944	0.527203	0.032774	0.205581	0.0010	0.1073	0.0582

Table 6.4: Secondary: Total:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	1.007**	0.644***	0.05	0.891	-0.305	0.054	0.936	-0.192	0.061
	-0.416	-0.159	-0.122	-0.793	-0.245	-0.147	-0.571	-0.341	-0.104
Gov Spend on Sec (amnt)	0.241***	-0.076*	-0.101***	0.133	-0.014	-0.021	0.114*	-0.002	-0.021
	-0.066	-0.045	-0.026	-0.137	-0.06	-0.022	-0.065	-0.051	-0.013
GNI	-0.000**	0	-0.000***	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	-1.186***	-0.500***	0.247***	-0.798	-0.579**	-0.056	-0.758**	-0.660***	-0.061
	-0.13	-0.083	-0.051	-0.773	-0.268	-0.115	-0.361	-0.23	-0.064
Child Mortality	-0.371***	-0.150***	0.071***	-0.306***	-0.055	-0.007	-0.309***	-0.048	-0.007
	-0.032	-0.023	-0.012	-0.112	-0.058	-0.037	-0.095	-0.05	-0.015
Urban	-0.002	-0.001	0	-0.015	-0.053**	-0.001	-0.01	-0.054*	-0.001
	-0.003	-0.001	0	-0.071	-0.021	-0.005	-0.045	-0.028	-0.005
Gov Spend on Sec (share)	-0.220**	0.130*	0.130***	0.075	0.016	0.032	0.056	0.133	0.039
	-0.09	-0.073	-0.035	-0.146	-0.075	-0.042	-0.246	-0.178	-0.04
Constant	108.351***	106.904***	1.38	98.936**	118.886***	7.272	99.350***	115.433***	7.135**
	-9.102	-6.623	-3.631	-38.408	-14.713	-5.38	-16.923	-13.97	-2.829
Observations	601	368	444	601	368	444	581	354	437
Model fit	0.726723	0.7511466	0.5235631	0.0842648	0.0448032	0.0195312	0.7184	0.0734	0.2188

Table 6.5: Secondary: Advanced:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	3.481***	-0.238*	-0.229**	4.071*	-0.11	-0.32	3.771***	-0.106	-0.324***
	-0.63	-0.129	-0.113	-2.108	-0.177	-0.201	-1.29	-0.24	-0.104
Gov Spend on Sec (amnt)	0.358	-0.043	-0.203***	1.024	0.084	-0.036	1.112***	0.083	-0.035
	-0.269	-0.029	-0.045	-0.71	-0.057	-0.028	-0.257	-0.058	-0.023
GNI	-0.000***	0	-0.000***	0	0	0	-0.000*	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	-0.453**	0.036	-0.105	2.09	-0.068	0.061	1.826*	-0.065	0.055
	-0.228	-0.039	-0.065	-2.084	-0.253	-0.155	-0.965	-0.225	-0.082
Child Mortality	-1.020***	-0.445***	-0.123**	-2.219	-0.333	-0.281	-1.358	-0.341	-0.260***
	-0.202	-0.071	-0.048	-1.414	-0.277	-0.177	-0.932	-0.232	-0.078
Urban	-0.003	0	-0.000**	0.008	-0.019*	-0.001	0.023	-0.019	-0.001
	-0.004	0	0	-0.112	-0.01	-0.004	-0.069	-0.013	-0.003
Gov Spend on Sec (share)	-0.537***	0	-0.069	-0.081	0.05	0.003	-0.737**	0.056	-0.014
	-0.108	-0.023	-0.042	-0.228	-0.073	-0.034	-0.364	-0.11	-0.026
Constant	91.092***	105.701***	28.169***	-29.062	96.629***	8.122	-10.922	96.463***	8.675***
	-24.501	-2.873	-4.587	-103.789	-3.915	-5.118	-34.315	-8.105	-2.953
N	297	143	193	297	143	193	289	141	192
Model fit	0.2552367	0.2437267	0.2193931	0.1227361	0.0675854	0.1967045	0.0779	0.0001	0.0727

Table 6.6: Secondary: Developing:

	OLS Enrol	OLS Persist	OLS Repeat	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend on Educ	-0.811***	0.409*	0.127	-0.191	-0.345	0.257	-0.114	-0.179	0.249
	-0.307	-0.22	-0.153	-0.347	-0.269	-0.172	-0.418	-0.53	-0.18
Gov Spend on Sec (amnt)	0.222***	-0.110**	-0.087***	-0.025	-0.026	-0.012	-0.044	-0.009	-0.013
	-0.063	-0.048	-0.029	-0.085	-0.069	-0.021	-0.041	-0.078	-0.019
GNI	0	0	-0.000***	0	0	0	-0.000*	0	0
	0	0	0	0	0	0	0	0	0
Pop Age	-1.185***	-0.791***	0.265***	-1.850***	-0.647**	0.056	-2.064***	-0.741**	0.053
	-0.148	-0.128	-0.056	-0.539	-0.315	-0.119	-0.242	-0.336	-0.106
Child Mortality	-0.313***	-0.110***	0.068***	-0.221**	-0.085	0.003	-0.205***	-0.081	0.005
	-0.032	-0.027	-0.013	-0.094	-0.078	-0.04	-0.061	-0.082	-0.022
Urban	-0.001	-0.014***	-0.006***	-0.035	-0.094**	0.019	-0.022	-0.097	0.02
	-0.005	-0.002	-0.001	-0.062	-0.041	-0.028	-0.042	-0.061	-0.02
Gov Spend on Sec (share)	-0.059	0.176**	0.246***	0.031	-0.009	0.089**	0.128	0.143	0.078
	-0.111	-0.087	-0.051	-0.194	-0.092	-0.042	-0.222	-0.285	-0.085
Constant	108.264***	119.248***	-3.353	146.501***	127.460***	-0.141	148.434***	123.170***	0.327
	-10.398	-8.441	-4.337	-26.353	-19.151	-6.424	-15.197	-23.776	-6.173
N	304	225	251	304	225	251	292	213	245
Model fit	0.7553761	0.7016096	0.5099074	0.4161922	0.0538572	0.053728	0.7015	0.1820	0.0090

Table 6.7: Tertiary: All

	Total			Advanced			Developing		
	OLS	FE	IV	OLS	FE	IV	OLS	FE	IV
Gov Spend on Educ	2.136***	3.754**	4.306***	2.056**	2.046*	2.003***	1.761***	4.329***	5.496***
	-0.462	-1.461	-0.561	-0.86	-1.032	-0.777	-0.655	-1.633	-0.798
Gov Spend on Ter (amnt)	0.366***	0.160*	0.204***	0.441***	0.118	0.230**	0.260***	0.144*	0.189***
	-0.066	-0.081	-0.054	-0.142	-0.14	-0.092	-0.074	-0.078	-0.069
GNI	0.000***	0.000*	0	0.000***	0	0.000*	0.000***	0.000**	0.000**
	0	0	0	0	0	0	0	0	0
Pop Age	-1.429***	-4.474***	-4.407***	-0.791***	-1.839	-1.848***	-1.409***	-3.746***	-3.902***
	-0.105	-0.62	-0.389	-0.28	-1.204	-0.634	-0.107	-0.725	-0.557
Child Mortality	-0.116***	0.24	0.231**	-0.134	-4.036**	-3.466***	-0.082***	0.17	0.063
	-0.034	-0.15	-0.091	-0.361	-1.683	-0.484	-0.029	-0.153	-0.13
Urban	-0.017***	-0.069	-0.076*	-0.027***	0.005	0.026	-0.002	-0.14	-0.284***
	-0.002	-0.1	-0.043	-0.002	-0.079	-0.04	-0.004	-0.097	-0.096
Gov Spend on Ter (share)	0.594***	0.696**	0.613**	0.897***	0.453*	0.471*	0.275**	0.808*	0.493
	-0.093	-0.315	-0.24	-0.18	-0.251	-0.276	-0.109	-0.439	-0.364
Constant	28.422***	107.928***	103.471***	7.684	81.263**	63.390***	39.626***	104.849***	132.329***
	-7.165	-27.735	-15.717	-12.829	-29.738	-19.227	-9.732	-34.223	-27.584
N	598	598	514	293	293	273	305	305	241
Model fit	0.6762836	0.5425242	0.5947	0.3793638	0.6269842	0.0077	0.6843862	0.6016081	0.2375

6.2) Results: Without Lagged Effects

6.2.1) Primary

In table 6.1; in the Ordinary Least Squares (OLS) model; enrolment is negatively correlated with total public spending on education. A relationship like this is not expected. However; this relationship is insignificant. With persistence; if expenditure on education, measured as a percentage of GDP, increases by 1 % then the rate to which pupils persist to the end of primary increases by 45 %, ceteris paribus. The repeater rate is negatively correlated with public spending, as expected but is insignificant. In the Fixed Effects (FE) & Instrumented Variables (IV) models; the enrolment and repeater rates have the expected direction of correlation reflected in the expected signs. Enrolment is significant in both. However; persistence is negatively correlated with public spending which is not what one would expect.

Current spending on primary is just another measure of the previously discussed government expenditure variable. The difference in measure is that it measures the amount of government spending on a particular level of education; in this case it measures the amount of expenditure on primary education, in local currency units. In the OLS model; enrolment is the expected sign but both the persistence and repeater rates are the incorrect and unexpected signs. In the FE & IV models; enrolment, persistence and repeater rates all have the expected correlation in some cases and then in other cases, the correlation is unexpected. But these variables are insignificant. And these incorrect correlations have already been observed in the previous chapter during the descriptive statistics.

Gross National Income (GNI), per capita, has a value of zero for all the regressions. This means that the influence of this variable is very small, very close to zero. Although being such a small value; it is still a very significant influence in some of the models. Thus; it does have an effect, even if it is extremely little. For the cases where it is significant; an increase in income has a positive effect on persistence. So as income for an individual increases, the rate of persistence will increase since they will have more money to be able to stay in school. One would expect repeater rates to be negatively correlated with income; since as incomes increase, individuals will have more money available for extra tuition and extra books if the child is struggling to pass. For negative correlations between income and enrolment or persistence rates; one could interpret this as public schooling being an inferior good; so as

incomes increase; the individual will enrol at a private school and drop out of public schooling.

The population age variable captures the affect that the age of the population has on the various educational outcome variables. This can be understood as the more of the population that is a certain age; the higher the educational outcomes are going to be for the level of education that is appropriate for that age. So if a country has a young population, then the most of the population will be the age to attend primary. The variable used in all of the models, secondary & tertiary included, is the population that is the official age for primary school. So one would expect it to be positively correlation with primary and negatively correlated with tertiary. In this case; it is positively correlated with primary enrolment rates, and significantly so. But due to overcrowding in schools; persistence and repeater rates are negatively affected.

Child Mortality rates are the largest, most significant contributor to educational outcomes; decreasing enrolment and persistence rates, whilst increasing repeater rates. There is a negative correlation with enrolment, because children will die before they reach enrolment age. If child mortality rate increases by 1 %, then the enrolment rate will decrease by 18 %, ceteris paribus. To interpret persistence and repeater rates; mortality can be viewed as a proxy for nutrition. If children are malnourished, they will not have the energy to be able to perform in school so they will not persist and may also have to repeat grades.

Urbanisation should have a positive effect on educational outcomes through ease of access to schools and better infrastructure for schools. It should be noted that this variable is not a direct measure of urbanisation. It is an indirect proxy for urbanisation and actually a measure of population density, which could be understood as the more densely populated an area is the more urbanised it is since rural areas tend to be less populated when compared with an urban area. So this variable may be susceptible to measurement error. This variable is significant in the IV model; where if the population density increases by 100 people, then the enrolment rate will increase by 13 %, ceteris paribus.

For share of public expenditure on primary education; in the IV model; which accounts for circular causality; a 1 % increase in the share of public expenditure on primary education leads to a 50 % increase in the primary enrolment rate, ceteris paribus. This variable is negatively correlated with persistence which is not expected. But looking at the number of

observations; the persistence model has the least amount of observations available for the regression and so inaccuracy due to limited data availability is expected.

Looking at the overall model fit; the R- squared value is very low except for 73 % and 58 % in the OLS models. So in the OLS model for persistence; 73 % of the variation in the persistence rate can be explained by the model presented here.

In tables 6.2 & 6.3; comparing advanced and developing countries; total public expenditure on education appears to have more of an effect on educational outcomes in advanced countries than it does in developing. This could be explained by the fact that governments in advanced countries produce larger amounts gross domestic production (GDP) and since this variable is measured as a % of GDP, then advanced countries will have larger values of this variable. Governments in advanced countries also have more money and resources available to be able to spend and so total public expenditure on education appears to have more of an effect on educational outcomes in advanced countries than it does in developing. Population density and urbanisation seems to have more of a significant affect in developing countries since they tend to have larger population and not as much infrastructure when compared to advanced countries.

6.2.2) Secondary

In table 6.4; public spending on education in OLS model is significant. It is positively correlated with enrolment and persistence rates, as expected. However; it is also positively correlated with repeater rates, which is not as expected but insignificant. In secondary education; if total public expenditure on education increases by 1 % then the persistence rate increases by 64 %, ceteris paribus. The current spending on level of education variable is more significant in secondary than it is in primary. This could be interpreted as governments spending more effectively on secondary than on primary education.

Similarly to primary; GNI has a small but significant effect on educational outcomes. The population age variable still represents the amount of the population that is primary school aged. In other words; if the population is young then there would be more children available to enrol in primary and less to enrol in secondary and so one would expect this variable to be negatively correlated with secondary educational outcomes. And this variable is negatively

correlated with educational outcomes for secondary education as expected. This variable is also fairly significant across all of the models.

Urbanisation has the same effect on secondary as it does in primary. In the FE & IV models; increases in population density significantly decreases persistence rates. Child mortality is significant, same as primary. Thus the more children under the age of five die and the worse nutrition levels are for children, the lower educational outcomes will be. If children die when they are young then they will not live long enough to enrol and persist through to secondary. This will be reflected in low secondary enrolment rates, with a decrease in persistence rates due to malnutrition and higher repeater rates due to poor performance from lack of food.

Similar to primary; share of spending per level of education is significant. In this case; it is spending on secondary and not primary. The correlations with this variable and the educational outcome variables are as expected except for repeater rates. But like persistence rates; repeater rates are also difficult to measure. Unlike enrolment; persistence takes time to measure as well as with repeater rates. Since it occurs over time; one would expect it to be affected by lagged effects and hence lags have been included, to further analyse the data, in the next subsection of this results section.

Overall, the OLS models are well defined, with R squared values all above 50 %. The other models are, however, poorly specified.

In tables 6.5 & 6.6; one can compare advanced and developing countries as was done in primary only now it is done for secondary. In advanced countries; government spending has a large, significant, positive effect on enrolment when compared to developing countries. Similar to what was seen in primary education; this can be explained by the fact that governments in advanced countries have more resources available than governments in developing countries.

Persistence is negatively correlated with government spending throughout these results. One way that it can be explained is due to the push towards large scale enrolment across the world as stated by the Millennial Developmental Goals (MDG), as discussed in previous chapters. If enrolment is pushed to be increased, children may not have the ability or the resources to continue through school even if they have been enrolled. Enrolment does not reflect effort or ability. A child can only persist if they have the ability and the support structure. At home, for example, if a child has been enrolled in school but they do not have the books, stationary or

help at home to assist them in completing the level of schooling that they are enrolled in. They may need to repeat if they are lacking in ability. They may also not persist through to completion. So increases in spending will push towards enrolment, as stated by the MDGs, which will have a negative effect on persistence and repeater rates and hence the unexpected correlation is explained.

Population age has more of a significant effect in developing than in advanced. This could be a reflection on the type of population in developing countries. They have high birth rates thus they would have young populations. This is also seen in primary for developing countries. Similarly to primary again; urbanisation is also less significant in advanced countries.

6.2.3) Tertiary

With primary & secondary education; there seemed to not be much fixed correlation between government spending, in all measures, and educational outcomes, in all the models. In some cases, the government spending variables had the correct, expected signs, and in other cases and they had an unexpected sign. Sometimes, they were significant and sometimes they were insignificant. There were a few odd correlations; such as a negative correlation between enrolment or persistence rates and government expenditure, and a positive correlation between repeater rates and government expenditure.

It gave rise to this random pattern and this idea that the link between government spending and educational outcomes is not a "one size fits all" process. Thus; governments cannot simply "through money at a problem" to fix it. In other words; spending on education for the sake of spending on education does not guarantee results. One can conclude that in terms of lower levels of education, in the light of the data analysis presented here, government expenditure on education is ineffective. Simply put; in some cases it delivers results and in other cases, it does not. And it is fairly random when it comes to which cases it is effective and when it is not.

But it is not the same case when it comes to tertiary education. In table 6.7; for tertiary education; all of the government spending variables are positive and significant. There are only enrolment variables. So in all cases; as government expenditure increases; tertiary enrolment rates increase. Same as primary and secondary; GNI has a small but significant effect on enrolment rates. The more income individuals have, the more inclined they are to be

able to afford to study at a tertiary level. Child mortality is also significant, same as in primary and secondary. If a child suffers from malnutrition as it grows up, the more chances that they will be unable to reach tertiary education since they will struggle to think throughout their primary and secondary years of education.

The population age variable shows the correlation that one would expect. Seeing as this variable captures the effects of a young population, it has a negative effect on tertiary education. Since this is at a tertiary level of education; individuals may have children. This negative correlation could reflect the fact that adults forgo their own education for the sake of educating their children or bringing up children. Either this is a time factor; where parents cannot spend time in tertiary classes since they need to be at home and caring for children. Or this could be a money factor; where parents either have to spend the money that they would spend on pursuing their own education on their children's education or not on their children's education but on other items needed to raise their children; food, clothes, etc.

With high R squared values, one can see that these models, OLS, FE & IV, are well specified and significant representation of what affects tertiary enrolment rates, overall and in developing and advanced countries separately.

6.2.4) Concluding remarks:

From the data analysis; one can see a few key aspects. Firstly; child mortality rates affect all levels of education. The age of the population is important. Income also has a small but significant effect on educational outcomes. Urbanisation does not have as much of a significant affect as one would expect it to have on educational outcomes. There are also very low model fit for the IV models, except for the enrolment models. Government spending is also not as significant in primary and secondary education. But in tertiary education, government expenditure is very significant. This implies that government expenditure on primary and secondary is ineffective since it does not matter if governments spend or not. But government expenditure on high education is very effective. There was also a problem with unexpected correlations and so the next subsection presents results that include lags in an attempt to correct the unexpected correlations.

Table 6.8: Primary: Total:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	1.351**	-0.648	-0.303	1.500***	-0.633	-0.306**
	-0.564	-0.749	-0.203	-0.328	-0.484	-0.13
Gov Spend L1	0.028	-0.527	-0.067	0.13	-0.528	-0.069
	-0.3	-0.353	-0.097	-0.34	-0.517	-0.13
Gov Spend L2	0.166	-0.078	0.045	0.052	-0.089	0.048
	-0.348	-0.413	-0.116	-0.305	-0.467	-0.123
Current Spend Prim	0.187***	0.061	-0.012	0.192***	0.062	-0.012
	-0.058	-0.064	-0.024	-0.04	-0.058	-0.017
Current Spend Prim L1	0.182***	-0.180*	-0.053*	0.195***	-0.180**	-0.054**
	-0.049	-0.093	-0.03	-0.053	-0.081	-0.022
Current Spend Prim L2	0.086	0.131	0.05	0.087*	0.135**	0.050**
	-0.063	-0.103	-0.036	-0.047	-0.065	-0.02
GNI	0	0	0	0	0	0
	0	0	0	0	0	0
Pop Age	-0.057	-0.512	-0.11	0.035	-0.512	-0.113
	-0.355	-0.4	-0.141	-0.253	-0.329	-0.103
Child Mortality	0.198	1.734	0.098	0.207	1.751	0.109
	-0.685	-2.588	-0.711	-0.858	-2.394	-0.682
Child Mortality L1	-0.338	-3.637	-1.326	-0.554	-3.641	-1.337
	-1.426	-4.678	-1.058	-1.656	-4.2	-1.124
Child Mortality L2	-0.116	2.504	1.477*	0.054	2.493	1.479***
	-0.862	-3.236	-0.792	-0.879	-2.104	-0.545
Urban	-0.011	-0.016	0.012	-0.018	-0.017	0.012
	-0.048	-0.031	-0.02	-0.027	-0.044	-0.013
Share Spend Prim	0.401***	-0.381	0.012	0.690***	-0.331*	0.007
	-0.126	-0.268	-0.076	-0.157	-0.198	-0.065
Share Spend Prim L1	0.121	-0.285	-0.007	-0.068	-0.312*	-0.003
	-0.108	-0.187	-0.068	-0.143	-0.18	-0.06
Share Spend Prim L2	0.005	0.324	0.032	-0.004	0.314*	0.032
	-0.108	-0.207	-0.059	-0.112	-0.186	-0.047
Constant	45.520**	111.280***	0.428	39.860***	110.427***	0.507
	-22.29	-15.324	-4.969	-9.662	-14.693	-3.864
Observations	348	228	290	347	227	289
Model Fit	0.3461642	0.4009032	0.5457199	0.0200	0.4339	0.3802

Table 6.9: Primary: Advanced:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	2.474***	-0.042	-0.031	2.399***	-0.185	-0.017
	-0.585	-0.369	-0.086	-0.544	-0.465	-0.071
Gov Spend L1	-1.02	-0.62	-0.136	-0.918	-0.445	-0.155
	-0.662	-0.593	-0.124	-0.741	-0.546	-0.099
Gov Spend L2	1.996***	0.221	-0.047	1.952***	0.232	-0.04
	-0.711	-0.528	-0.065	-0.651	-0.503	-0.086
Current Spend Prim	0.14	0.012	-0.007	0.129	-0.034	-0.005
	-0.095	-0.052	-0.015	-0.085	-0.079	-0.012
Current Spend Prim L1	0.085	-0.022	-0.002	0.095	0.014	-0.004
	-0.105	-0.056	-0.012	-0.096	-0.081	-0.012
Current Spend Prim L2	0.303	0.154	-0.015	0.301***	0.166**	-0.015
	-0.18	-0.095	-0.014	-0.093	-0.078	-0.012
GNI	0	0.000*	0	0	0	0
	0	0	0	0	0	0
Pop Age	-0.443	-0.327	-0.069	-0.458	-0.188	-0.069
	-0.466	-0.217	-0.083	-0.358	-0.379	-0.046
Child Mortality	0.281	-0.167	-0.024	0.346	0.231	-0.045
	-2.062	-1.412	-0.313	-2.171	-1.95	-0.278
Child Mortality L1	0.52	-0.295	0.699	0.384	-1.455	0.737*
	-2.218	-2.405	-0.495	-3.325	-2.931	-0.415
Child Mortality L2	-0.985	0.577	-0.576*	-0.932	1.023	-0.587***
	-1.47	-1.294	-0.298	-1.696	-1.43	-0.206
Urban	-0.039	-0.014	-0.012***	-0.039	-0.014	-0.012***
	-0.03	-0.023	-0.003	-0.027	-0.024	-0.004
Share Spend Prim	0.821***	-0.167	0.028	0.745***	-0.482*	0.041
	-0.213	-0.133	-0.019	-0.227	-0.252	-0.031
Share Spend Prim L1	0.148	-0.157	-0.018	0.211	0.074	-0.027
	-0.145	-0.244	-0.032	-0.245	-0.239	-0.031
Share Spend Prim L2	-0.369	0.221	0.041*	-0.364**	0.241	0.040*
	-0.218	-0.205	-0.02	-0.174	-0.163	-0.022
Constant	34.71	94.736***	5.499***	35.812***	95.578***	5.371***
	-31.037	-11.711	-1.482	-12.627	-10.114	-1.653
Observations	226	125	174	226	125	174
Model Fit	0.4295751	0.2470198	0.2595507	0.0006	0.0290	0.0008

Table 6.10: Primary: Developing:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	0.429	-1.162	-0.536*	1.280*	-1.235	-1.007***
	-0.58	-0.892	-0.292	-0.71	-0.869	-0.375
Gov Spend L1	-0.164	-0.922	-0.152	0.37	-0.99	-0.496
	-0.314	-0.576	-0.149	-0.551	-0.851	-0.318
Gov Spend L2	0.015	0.173	0.068	-0.32	0.269	0.373
	-0.263	-0.435	-0.195	-0.446	-0.781	-0.294
Current Spend Prim	0.179***	0.078	-0.022	0.199***	0.081	-0.026
	-0.046	-0.08	-0.035	-0.053	-0.096	-0.038
Current Spend Prim L1	0.200***	-0.230*	-0.077	0.286***	-0.235	-0.125**
	-0.046	-0.122	-0.05	-0.091	-0.149	-0.056
Current Spend Prim L2	0.026	0.151	0.086*	0.015	0.139	0.104**
	-0.045	-0.113	-0.048	-0.064	-0.113	-0.051
GNI	0	0	0	0	0	0
	0	0	0	0	0	0
Pop Age	0.853	0.158	0.171	0.681	0.257	0.016
	-0.522	-0.865	-0.266	-0.56	-0.898	-0.403
Child Mortality	0.473	3.162	2.626*	0.381	2.465	3.451
	-0.494	-5.315	-1.376	-1.078	-5.397	-2.128
Child Mortality L1	-0.757	-7.933	-5.825**	-0.837	-7.084	-6.865*
	-0.979	-9.977	-2.231	-2.127	-9.586	-3.598
Child Mortality L2	-0.034	5.229	3.484***	0.079	5.03	3.751**
	-0.583	-5.504	-1.101	-1.138	-4.8	-1.751
Urban	0.016	-0.202	0.03	0.069	-0.244	0.007
	-0.084	-0.261	-0.043	-0.088	-0.236	-0.064
Share Spend Prim	-0.175	-1.104*	-0.164	0.75	-1.357***	-0.753***
	-0.151	-0.558	-0.157	-0.579	-0.423	-0.252
Share Spend Prim L1	0.081	-0.206	0.04	-0.346	-0.115	0.343**
	-0.153	-0.228	-0.116	-0.307	-0.323	-0.175
Share Spend Prim L2	-0.123	-0.168	-0.125	0.251	-0.197	-0.270*
	-0.106	-0.445	-0.101	-0.299	-0.369	-0.152
Constant	60.172*	156.807***	0.335	14.334	168.701***	27.715
	-31.05	-33.993	-9.513	-36.833	-54.218	-20.445
Observations	122	103	116	121	102	115
Model Fit	0.6065241	0.5356994	0.6930054	0.0070	0.0202	0.2542

Table 6.11: Secondary: Total:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	1.700*	0.286	-0.105	1.026	0.213	-0.145
	-1.004	-0.279	-0.094	-1.014	-0.371	-0.12
Gov Spend L1	0.167	0.257	-0.231*	0.304	0.15	-0.257*
	-0.501	-0.265	-0.12	-1.125	-0.427	-0.138
Gov Spend L2	0.602	-0.329	0.002	0.693	-0.206	0.065
	-0.987	-0.358	-0.101	-1.002	-0.393	-0.133
Current Spend Sec	0.021	0.04	0.002	-0.057	0.042	0.004
	-0.089	-0.047	-0.009	-0.11	-0.041	-0.016
Current Spend Sec L1	0.112	-0.08	0.035*	0.16	-0.102**	0.028
	-0.171	-0.063	-0.02	-0.132	-0.051	-0.018
Current Spend Sec L2	0.205	0.063*	-0.021	0.221*	0.08	-0.016
	-0.197	-0.035	-0.021	-0.122	-0.055	-0.018
GNI	0	0	0	0	0	0
	0	0	0	0	0	0
Pop Age	2.465	-0.277	-0.181	2.593***	-0.282	-0.166**
	-2.114	-0.241	-0.139	-0.702	-0.283	-0.084
Child Mortality	-1.368	1.685	-1.480*	-2.341	1.503	-1.541***
	-1.61	-1.581	-0.748	-2.553	-1.963	-0.592
Child Mortality L1	3.637	-0.958	1.631	5.383	-0.675	1.780*
	-3.46	-2.961	-1.236	-4.903	-3.5	-1.032
Child Mortality L2	-3.258	-0.479	-0.296	-4.012	-0.569	-0.379
	-2.147	-1.637	-0.608	-2.579	-1.771	-0.514
Urban	0.007	0.012	-0.027**	0.022	0.009	-0.025**
	-0.1	-0.02	-0.01	-0.078	-0.031	-0.01
Share Spend Sec	-0.147	0.529**	0.043	-0.973***	0.338*	-0.018
	-0.179	-0.249	-0.053	-0.367	-0.177	-0.046
Share Spend Sec L1	0.06	-0.179	-0.089*	0.568*	-0.095	-0.045
	-0.182	-0.152	-0.045	-0.307	-0.156	-0.041
Share Spend Sec L2	0.041	-0.049	0.029	0.119	-0.016	0.036
	-0.21	-0.135	-0.026	-0.229	-0.099	-0.025
Constant	18.411	81.253***	14.050*	26.392	84.824***	13.672***
	-90.516	-12.067	-7.229	-27.866	-13.782	-3.354
Observations	346	196	257	336	190	255
Model Fit	0.0961074	0.228272	0.2393024	0.1007	0.1556	0.0733

Table 6.12: Secondary: Advanced:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	2.563	0.445	-0.123	2.18	0.419	-0.124
	-1.563	-0.303	-0.131	-1.784	-0.43	-0.148
Gov Spend L1	0.122	-0.738	-0.429*	-0.787	-0.729	-0.422**
	-1.457	-0.433	-0.226	-2.386	-0.567	-0.209
Gov Spend L2	1.28	0.286	0.072	2.937	0.317	0.064
	-1.878	-0.4	-0.242	-2.224	-0.52	-0.205
Current Spend Sec	0.278	0.125	-0.013	0.288	0.127	-0.014
	-0.348	-0.083	-0.026	-0.32	-0.097	-0.032
Current Spend Sec L1	0.371	-0.029	-0.017	0.119	-0.038	-0.016
	-0.303	-0.061	-0.019	-0.344	-0.094	-0.034
Current Spend Sec L2	1.266*	0.148**	-0.026	1.576***	0.166**	-0.026
	-0.682	-0.053	-0.023	-0.31	-0.081	-0.03
GNI	0	0.000***	0	-0.000**	0.000*	0
	0	0	0	0	0	0
Pop Age	3.526*	-0.242	0.078	3.473***	-0.269	0.079
	-1.8	-0.401	-0.14	-1.092	-0.405	-0.101
Child Mortality	-6.762	-1.047	-0.399	-7.724	-1.125	-0.391
	-6.181	-2.124	-0.453	-7.172	-2.124	-0.668
Child Mortality L1	9.749	-2.716	0.743	10.283	-2.77	0.735
	-8.283	-3.442	-0.976	-11.142	-2.929	-1.012
Child Mortality L2	-5.989	3.500*	-0.697	-5.385	3.637**	-0.701
	-5.933	-1.774	-0.557	-5.768	-1.639	-0.51
Urban	-0.109	-0.01	-0.031**	-0.105	-0.009	-0.032***
	-0.119	-0.013	-0.012	-0.093	-0.028	-0.009
Share Spend Sec	-0.371	0.121	0	-1.268***	0.096	0.005
	-0.322	-0.14	-0.022	-0.467	-0.237	-0.04
Share Spend Sec L1	0.032	-0.051	-0.039	0.965*	-0.006	-0.042
	-0.381	-0.078	-0.027	-0.526	-0.193	-0.041
Share Spend Sec L2	0.049	0.056	0.056	-0.234	0.031	0.056*
	-0.395	-0.107	-0.036	-0.387	-0.133	-0.031
Constant	-100.899	75.503***	15.577**	-99.275**	75.286***	15.640***
	-126.64	-6.289	-6.234	-40.19	-12.186	-4.004
Observations	226	112	156	220	110	155
Model Fit	0.2936869	0.2466933	0.3603228	0.0411	0.0068	0.0287

Table 6.13: Secondary: Developing:

	FE Enrol	FE Persist	FE Repeat	IV Enrol	IV Persist	IV Repeat
Gov Spend	-0.151	0.218	0.009	-0.637	0.019	0.029
	-0.343	-0.42	-0.254	-0.481	-0.739	-0.229
Gov Spend L1	-0.15	0.487	-0.037	-0.23	0.302	-0.027
	-0.336	-0.344	-0.103	-0.398	-0.768	-0.199
Gov Spend L2	0.146	-0.383	-0.016	0.025	-0.029	-0.025
	-0.306	-0.514	-0.158	-0.367	-0.755	-0.183
Current Spend Sec	0.023	0.055	0.005	-0.028	0.05	0.005
	-0.034	-0.055	-0.012	-0.044	-0.069	-0.019
Current Spend Sec L1	-0.086**	-0.056	0.055***	-0.091*	-0.092	0.057**
	-0.042	-0.08	-0.02	-0.049	-0.093	-0.024
Current Spend Sec L2	-0.107**	0.038	-0.003	-0.144***	0.098	-0.003
	-0.04	-0.064	-0.024	-0.046	-0.119	-0.026
GNI	0	0	0	0	0	0
	0	0	0	0	0	0
Pop Age	-0.853**	-0.039	-0.375	-0.890**	-0.032	-0.373**
	-0.378	-0.466	-0.241	-0.387	-0.708	-0.186
Child Mortality	-0.904*	-0.697	-1.056	-0.921	-2.548	-1.019
	-0.469	-2.145	-1.095	-0.854	-4.678	-1.204
Child Mortality L1	2.249*	3.866	-0.48	2.376	7.837	-0.589
	-1.28	-3.804	-1.562	-1.668	-8.589	-2.3
Child Mortality L2	-1.523*	-2.978	1.378**	-1.640*	-5.091	1.449
	-0.841	-2.052	-0.606	-0.885	-4.32	-1.197
Urban	-0.044	-0.018	-0.045***	0.082	-0.09	-0.047
	-0.058	-0.092	-0.014	-0.069	-0.182	-0.029
Share Spend Sec	0.230**	0.625*	0.216**	-0.317	0.219	0.235*
	-0.105	-0.339	-0.095	-0.291	-0.357	-0.136
Share Spend Sec L1	0.002	-0.278	-0.091	0.007	-0.008	-0.099
	-0.14	-0.262	-0.085	-0.123	-0.355	-0.078
Share Spend Sec L2	0.049	-0.036	-0.002	0.04	0.071	-0.003
	-0.086	-0.181	-0.034	-0.097	-0.2	-0.038
Constant	124.216***	72.820**	14.119*	138.888***	82.905*	13.658
	-18.582	-34.849	-7.842	-22.945	-49.019	-9.127
Observations	120	84	101	116	80	100
Model Fit	0.5275483	0.3484955	0.4955174	0.4010	0.0178	0.0032

Table 6.14: Tertiary: All:

	FE Enrol	FE Enrol	FE Enrol	IV Enrol	IV Enrol	IV Enrol
Gov Spend	2.968***	2.795***	1.924*	1.596	3.074	2.971
	-1.033	-0.937	-1.085	-1.09	-1.956	-2.158
Gov Spend L1	1.498***	1.108	1.418	2.253	2.026**	1.11
	-0.509	-0.969	-1.145	-1.462	-0.942	-1.673
Gov Spend L2	2.137**	2.150**	2.358	1.391	2.344*	2.58
	-0.823	-0.862	-1.996	-1.373	-1.257	-1.615
Current Spend Tertiary	0.187	0.216**	0.02	0.078	0.349*	0.332*
	-0.126	-0.095	-0.1	-0.106	-0.198	-0.196
Current Spend Tertiary L1	0.056	0.105	-0.013	-0.021	-0.191	-0.123
	-0.082	-0.107	-0.12	-0.115	-0.155	-0.261
Current Spend Tertiary L2	-0.073	0.077	0.007	0.129	-0.247	-0.037
	-0.133	-0.095	-0.17	-0.108	-0.176	-0.203
GNI	0	0	0	0	0	0
	0	0	0	0	0	0
Pop Age	-5.275***	-4.312***	-2.991*	-3.751***	-6.245***	-5.002**
	-1.105	-0.829	-1.678	-0.827	-1.338	-2.09
Child Mortality	-3.822	-8.531*	-7.032	-6.64	-0.551	-11.454
	-4.337	-4.588	-5.456	-4.47	-6.004	-11.03
Child Mortality L1	2.86	8.345	7.23	9.406	-2.375	10.224
	-5.91	-7.36	-5.283	-7.211	-9.73	-18.085
Child Mortality L2	1.103	-1.037	-2.707	-4.312	3.71	0.089
	-3.134	-3.71	-4.068	-3.824	-5.39	-9.033
Urban	0.190*	0.122*	0.198**	0.211***	-0.137	-0.437*
	-0.106	-0.073	-0.091	-0.064	-0.191	-0.258
Share Spend Tertiary	0.444	0.757**	0.186	0.126	0.635	1.149
	-0.387	-0.338	-0.311	-0.326	-0.634	-0.84
Share Spend Tertiary L1	-0.025	-0.233	0.087	-0.227	-0.096	-0.239
	-0.28	-0.296	-0.229	-0.311	-0.505	-0.603
Share Spend Tertiary L2	-0.095	-0.044	0.166	0.311	-0.385	-0.368
	-0.243	-0.223	-0.308	-0.24	-0.366	-0.51
Constant	74.793**	59.172**	53.898	50.889**	162.616***	188.639***
	-34.361	-24.319	-48.268	-23.599	-48.259	-70.652
Observations	359	316	226	213	133	103
Model Fit	0.5681654	0.3737	0.5932369	0.0732	0.6509017	0.2120

6.3) Results: With Lagged Effects

6.3.1) Primary

In tables 8, 9 & 10; lags were included in an attempt to explain the incorrect signs and unexpected correlations between the government expenditure variables and the persistence and repeater rates. As mentioned before; unlike enrolment; persistence and repeater rates are variables that take time to be achieved.

They are therefore affected by lagged effects and so in these regression results, lagged variables have been included. Only the first and second lags have been included. The length to which effects are lagged could be longer than two years, so included the first and second lag may not be enough lags to fully capture the lagged effects. However; due to data constraints, only the two years are available for analysis.

The result of including lagged variables in the regression seems positive in terms of the government spending variables. In all measures of government spending; the signs that are incorrect in the current time period corrects in the first and second lag. The child mortality rate becomes significant in terms of repeater rates at the second lag. As a proxy for nutrition, this could be explained as increases in malnutrition in the child's early year's leads to the child having to repeat grades later in life.

6.3.2) Secondary

In tables 11; one can see that lags do not appear to have much of an effect on the public expenditure on education variables. Mortality seems to become very significant over time. Model fit seems to increase with the inclusion of lags, in the FE and IV models. In tables 12 & 13; again same as primary, child mortality seems to become significant over the years; more so in developing countries than in advanced. This is expected since developing countries are more affected by lack of food and high mortality rates.

The models presented here better explains variations in educational outcomes in developing than it does for advanced countries. But both of these models suffer from a small amount of observations so any inaccuracies or insignificant results can be purely due to a lack of data.

6.3.3) Tertiary

In tables 14; there are large, significant effects of government spending over time. This can lead to the conclusion that government expenditure is affected by lagged effects particularly on a tertiary level. So government expenditure in the past affects current educational outcomes. In other words; the effects of government spending on not fully felt in the current period but rather take up to two years, or may be more, to be reflected in educational outcomes. This can simply be because of the nature of the market. Changes take time and so time is important and so are lags.

There are still large negative effects of a young population on enrolment rates, same as in the results without lags and similarly with population density or urbanisation. And mortality rates also become significant in the first and second lags and this shows that mortality rates also take time to fully impact educational outcomes. In terms of model fit; there is not much difference in significance across all the models that have included lags.

6.3.4) Concluding remarks:

After the inclusion of lags; there are a few more key aspects that can be observed. Firstly; child mortality rates are affected by lagged effects. In other words; child mortality rates of the past affect future educational outcomes. Government expenditure is also affected by lagged effects particularly on all levels of education. Similar to child mortality rates; government expenditure in the past affects future educational outcomes. Lagged variables were included so as to correct unexpected correlations and in some cases; in the first and second lag these correlation corrects but not in all cases. Similar to the results without lags; there are also very low model fit for the IV models. This suggests that the instruments used in the models may not be accurate. Good instruments are, however, difficult to find.

6.4) Tests for Autocorrelation & Heteroscedasticity

In chapter 4 a number of issues concerning the data were discussed. Two of these were autocorrelation and heteroscedasticity. In this subsection, the results for the tests are discussed. The Breusch–Pagan test for heteroscedasticity was conducted. The Breusch-Godfrey test for autocorrelation was conducted. The null hypothesis for no autocorrelation is rejected for all levels of education. Autocorrelation was found to be present. Similarly, the null hypothesis for no heteroscedasticity was rejected at all conventional significance levels and for all models. Thus, heteroscedasticity was present. The results for the tests can be found in tables B.1 & B.2 in Appendix B. Since the data is auto-correlated and heteroscedastic, which biases the variances of the coefficient estimates, robust standard errors are used (Gujarati & Porter, 2009).

6.5) Concluding Remarks

These concluding remarks provide a brief overview of the data analysis in this chapter. This study is similar to Gupta et al (2002) in its aims, but there are three main differences in terms of scope, data and methodology. With regards to scope, this study has broader scope since it compared the effectiveness of government spending at different levels of education. In terms of data, this study includes more countries as well as more repeated observations. The results produced by Gupta et al look at the mentioned two years but there are no repeated observations of any country in their study. It is useful to briefly compare the results of Gupta et al's study with the work that has been presented here. Although both of the results of the two studies are not directly comparable, one can note the similarities. The analysis presented here show that government expenditure on education has a limited impact on educational outcomes. In the concluding remarks, Gupta et al notes that definitive evidence for a causal relationship between public spending and education attainment is lacking such that greater public spending on primary and secondary education does not result in a positive impact on widely used measures of education attainment (2002). They further conclude that educational outcomes are more affected by child mortality rates and are correlated with other influences such as per capita income and urbanization (Gupta et al, 2002). This is similar to what was presented in the data analysis of this study. Gupta et al further note that there may be other influences such as private sector spending, literacy rates as well as access to safe sanitation

and water (2002). These effects have neither been included in the data analysis of this study nor in the data analysis of the work presented by Gupta et al (2002).

Chapter 7

Conclusion

The ideas that have been presented here do not strive so much for novelty as they do strive to offer a different approach to interpreting already existing ideas. This study has established what impacts educational outcomes; from government spending, all the way to nutrition and urbanisation. This study was done not with the aim to 'think out of the box' as it were, but to build up the box, reinforce it with further research, data and argument.

The research objectives that were set out in chapter one were achieved. First; to review literature to determine what impacts educational outcomes. This was accomplished in the literature in chapter two. Second; to establish relevant models that will express what affects educational outcomes. This was accomplished in chapter three; the education model. Third; to analyse the data from selected countries over the time period of 2000 to 2010 by use of the models that have been established. This was achieved during the data analysis process; chapters six, seven and eight. Lastly; to answer the question does government spending influence educational outcomes? After analysing the data; one can conclude this study by saying that government spending does influence educational outcomes.

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A

Table of Countries: Appendix

Table A1) Table of All Countries

(1) Afghanistan	(50) Curacao	(99) Kazakhstan	(148) Pakistan	(197) Tunisia
(2) Albania	(51) Cyprus	(100) Kenya	(149) Palau	(198) Turkey
(3) Algeria	(52) Czech Rep.	(101) Kiribati	(150) Panama	(199) Turkmenistan
(4) American Samoa	(53) Denmark	(102) Korea Dem. Rep.	(151) Papua New Guinea	(200) Turks & Caicos Islands
(5) Andorra	(54) Djibouti	(103) Korea Rep.	(152) Paraguay	(201) Tuvalu
(6) Angola	(55) Dominica	(104) Kosovo	(153) Peru	(202) Uganda
(7) Antigua	(56) Dominican Rep.	(105) Kuwait	(154) Philippines	(203) Ukraine
(8) Argentina	(57) Ecuador	(106) Kyrgyz Rep.	(155) Poland	(204) United Arab Emirates
(9) Armenia	(58) Egypt (Arab Rep.)	(107) Lao	(156) Portugal	
(10) Aruba	(59) El Salvador	(108) Latvia	(157) Puerto Rico	(205) United Kingdom
(11) Australia	(60) Equatorial Guinea	(109) Lebanon	(158) Qatar	
(12) Austria	(61) Eritrea	(110) Lesotho	(159) Romania	(206) United States
(13) Azerbaijan	(62) Estonia	(111) Liberia	(160) Russia Fed.	
(14) Bahamas	(63) Ethiopia	(112) Libya	(161) Rwanda	(207) Uruguay
(15) Bahrain	(64) Faeroe Islands	(113) Liechtenstein	(162) Samoa	(208) Uzbekistan
(16) Bangladesh	(65) Fiji	(114) Lithuania	(163) San Marino	(209) Vanuatu
(17)Barbados	(66) Finland	(115) Luxembourg	(164) Sao Tome	(210) Venezuela
(18) Belarus	(67) France	(116) Macao (China)	(165) Saudi Arabia	(211) Vietnam
(19) Belgium	(68) French Polynesia	(117) Macedonia	(166) Senegal	(212) Virgin Islands
(20) Belize	(69) Gabon	(118) Madagascar	(167) Serbia	
(21) Benin	(70) Gambia	(119) Malawi	(168) Seychelles	(213) West Bank & Gaza
(22) Bermuda	(71) Georgia	(120) Malaysia	(169) Serra Leone	
(23) Bhutan	(72) Germany	(121) Maldives	(170) Singapore	(214) Yemen Rep.
(24) Bolivia	(73) Ghana	(122) Mali	(171) St. Maarten	
(25) Bosnia	(74) Gibraltar	(123) Malta	(172) Slovak Rep.	(215) Zambia
(26)Botswana	(75) Greece	(124) Marshal Islands	(173) Slovenia	(216) Zimbabwe
(27) Brazil	(76) Greenland	(125) Mauritania	(174) Solomon Islands	
(28) Brunei Darussalam	(77) Grenada	(126) Mauritius	(175) Somalia	
(29) Bulgaria	(78) Guam	(127) Mayotte	(176) South Africa	
(30) Burkina Faso	(79) Guatemala	(128) Mexico	(177) South Sudan	
(31) Burundi	(80) Guinea	(129) Micronesia	(178) Spain	
(32) Cambodia	(81) Guinea-Bissau	(130) Moldova	(179) Sri Lanka	
(33) Cameroon	(82) Guyana	(131) Monaco	(180) St. Kitts	
(34) Canada	(83) Haiti	(132) Mongolia	(181) St Lucia	
(35) Cape Verde	(84) Honduras	(133) Mongolia	(182) St Martin	
(36) Cayman Islands	(85) Hong Kong (China)	(134) Morocco	(183) St. Vincent	
(37) Central Africa	(86) Hungary	(135) Mozambique	(184) Sudan	
(38) Chad	(87) Iceland	(136) Myanmar	(185) Suriname	
(39) Channel Islands	(88) India	(137) Namibia	(186) Swaziland	
(40) Chile	(89) Indonesia	(138) Nepal	(187) Sweden	
(41) China	(90) Iran (Islamic Rep.)	(139) Netherlands	(188) Switzerland	
(42) Colombia	(91) Iraq	(140) New Caledonia	(189) Syrian Arab Rep.	
(43) Comoros	(92) Ireland	(141) New Zealand	(190) Tajikistan	
(44) Congo (Dem. Rep.)	(93) Isle of Man	(142) Nicaragua	(191) Tanzania	
(45) Congo (Rep.)	(94) Israel	(143) Niger	(192) Thailand	
(46) Costa Rica	(95) Italy	(144) Nigeria	(193) Timor-Leste	
(47) Cote d'Ivoire	(96) Jamaica	(145) Northern Mariana Islands	(194) Togo	
(48) Croatia	(97) Japan	(146) Norway	(195) Tonga	
(49) Cuba	(98) Jordan	(147) Oman	(196) Trinidad	

Source: World databank

Table A2) Table of Advanced Countries

(11) Australia
(12) Austria
(19) Belgium
(34) Canada
(51) Cyprus
(52) Czech Republic
(53) Denmark
(62) Estonia
(66) Finland
(67) France
(72) Germany
(75) Greece
(85) Hong Kong
(87) Iceland
(92) Ireland
(94) Israel
(95) Italy
(97) Japan
(102) Korea
(108) Latvia
(115) Luxembourg
(123) Malta
(139) Netherlands
(141) New Zealand
(146) Norway
(156) Portugal
(163) San Marino
(170) Singapore
(172) Slovak Republic
(173) Slovenia
(178) Spain
(187) Sweden
(188) Switzerland
(205) United Kingdom
(206) United States

Source: International Monetary Fund

B

Data Analysis: Appendix

Table B.1: Breusch-Godfrey test results for autocorrelation:

Where the null hypothesis is no autocorrelation;

	Primary	Secondary	Tertiary
Enrolment	0.0000	0.0000	0.0000
Persistence	0.0258	0.0359	-
Repeater	0.0000	0.0000	-

Source: Own calculations using the World Development Indicators databank

Table B.2: Breusch–Pagan test results for heteroscedasticity:

Where the null hypothesis is no heteroscedasticity;

	Primary	Secondary	Tertiary
Enrolment	0.0000	0.0000	0.0000
Persistence	0.0000	0.0000	-
Repeater	0.0000	0.0000	-

Source: Own calculations using the World Development Indicators databank

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

30 July 2013

Miss Emma Jessica Lansdell 208519004
School of Accounting, Economics & Finance
Westville Campus

Dear Miss Lansdell

Protocol reference number: HSS/0700/013M
Project title: The Effectiveness of Government Spending on Higher Education

NO- RISK APPROVAL

In response to your application dated 18 July 2013, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....

Dr Shenuka Singh (Acting Chair)
Humanities & Social Science Research Ethics Committee

/pm

cc Supervisor: Ralitza Dobreva
cc Academic Leader: Mr B Strydom
cc School Admin.: Mr Sihle Khuzwayo/Ms Gina Mshengu