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ESSAYS IN DEVELOPMENT ECONOMICS: POVERTY, FOREIGN DIRECT INVESTMENT AND HUMAN CAPITAL

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Declaration

I, Chiara Amini, confirm that the work presented in this thesis is entirely my own. Where information has been derived from other sources, I confirm that it has been indicated in the thesis.

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Abstract

This thesis addresses three keys issues in economic development. The first relates to the interplay between foreign direct investment, institutions and natural resources. The second issue explored is the extent to which economic growth contributes to poverty reduction. The third question relates to the determinants of human capital, as proxied by secondary school grades. I explore the first two points with cross-country panel econometric analysis of developing economies, while for the last I first explore cross section variation and then focus specifically on the case of a middle-income country of transition: Russia. These topics are important not only from a scholarly point of view but also for practical policy purposes.

In the first case I find that the presence of natural resources modifies the relationship between FDI and institutions. In particular, higher levels of natural resources, notably oil, mitigate the positive effect of good institutions on the amount of foreign direct investment. If this is the case the usual policy recommendation that improved institutions should attract more foreign investments may not be relevant in resource rich economies. In the second case I find, in line with the literature, that economic growth is an important instrument for poverty reduction. However I extend the literature by showing that a number of factors have a significant effect on the poverty elasticity of growth. The empirical analysis demonstrates how changes in human capital, as measured with health or schooling, have substantial impact on the poverty elasticity of growth. Finally, turning to the determinants of students' performances, I find that in Russia, as in other countries, educational scores are robustly linked to the characteristics of students' families and schools. In particular, I find some evidence that increased school resources and autonomy have a positive impact on student performance in Russia. This suggests therefore that policy makers can improve student performance by facilitating lower student-teacher ratios and increasing autonomy.

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Introduction

Between 1815 and 1914, and then again from 1945 onwards, the world witnessed sustained periods of economic growth leading to significant improvements in living standards. In the first of these periods, this growth was mainly concentrated in Western Europe and the Western offshoots, which had already established economic positions at the beginning of the 1800s (Maddison, 1995). More recently, a significant number of countries outside the Western world, notably the East Asian economies, have also made tremendous economic progress. However, it is well known that the gains of widespread economic growth have not been equally distributed and many countries are still beset by conditions of chronic poverty. For instance, the World Bank has calculated that today there are still 1.5 billion people living in absolute poverty (Chen and Ravallion, 2008).

Economists have long been interested in why some countries fare better than others. The literature on economic development, in part aimed at explaining this range of economic performance, has advanced both theoretically and empirically. Despite this, many of the questions related to what promotes or hampers economic development remain open. While old questions remain unanswered sources of controversy, the continuously changing economic, social and political environment has presented new challenges for researchers. For instance, while it is well known that economic growth results in reductions in monetary poverty, the extent of these reductions is highly debated.

Closely related to the role of growth in economic development is that of foreign and domestic investments. As countries have become more and more interconnected, the number of firms relocating to foreign countries has continued to increase, a phenomenon that has generated much interest both among business scholars and economists. One of the key questions that emerges in this context relates to the impact of foreign direct investment (FDI) on developing and emerging economies. While economic theory is able to establish a robust and positive link between FDI and growth, the empirical evidence, especially relating to low and middle-income countries, is somewhat controversial. Not only is there no consensus on the effect of FDI on host countries, but also the factors driving investors to relocate abroad remain subject to debate. There is no doubt that a country's market potential, resource availability,

political risks and macroeconomic environment, to name a few factors, do influence internationalisation decisions. However, the inter-linkages between these factors are less clear. This is especially the case for resource-rich economies, where foreign investments are often concentrated in the primary resource sector. It has been argued that, in this instance, unlike in other countries, democracy could discourage FDI (Asiedu and Lien, 2011).

Although economic growth and investments, both domestic and foreign, are fundamental aspects of economic development, they are by no means sufficient to ensure an improvement in living standards. Human capital has long been seen as an important determinant of both individual and country-level performance. Economic theory explains that human capital has a positive effect on economic outcomes for at least three reasons. First, as predicted by the neoclassical growth models, human capital leads to a short-run increase in growth via its effect on labour productivity (Mankiw, Romer, and Weil, 1992). Second, human capital can also lead to a long-run increase in economic growth as explained by endogenous growth theory. These models modify the production function to allow for a range of factors that can explain long-run growth, such as increasing returns and externalities (Romer, 1986; Lucas, 1988). Third, human capital indirectly affects growth through technological catch-up and diffusion of knowledge, as explained by Nelson and Phelps (1966). Hence, innovation from human capital can generate spillovers and externalities that can feed back into faster economic growth. Given the importance of human capital, many economists have empirically investigated its determinants. Recently, the focus has shifted from simple measures of schooling, such as enrolment rates or the duration of education, to the quality of education. This shift has been made possible by the development and implementation of large cross-country educational surveys. The determinants of and changes in schooling quality are particularly relevant to transition countries, where persistent economic shocks in the 1990s had large implications for both physical and human capital. When looking at human capital, transition countries present an interesting case as they have inherited high enrolment rates from previous regimes but not necessarily a market-oriented provision of schooling. Nevertheless, the transition process has had a complex impact on schooling. On the one hand, it has led to a reallocation of labour from heavy industry and agriculture towards manufacturing and services. As a consequence of this, many of the existing skills, such as those linked to vocational

schools, have become obsolete. On the other hand, the liberalisation of labour markets means there are greater potential returns to be gained from education, especially for graduates (Campos and Joliffe, 2002; Mickiewicz, 2010).

Taking the above discussion into consideration, this thesis strives to advance our knowledge on issues that are central to development. Our aim is therefore threefold:
(i) to analyse the impact of economic growth on poverty reduction, taking into account a set of conditioning factors that can affect the poverty-growth relationship;
(ii) to explore the interrelationship between foreign direct investment in the primary sector, institutions and natural resource endowment in low and middle-income countries;
(iii) to investigate the determinants of human capital, as proxied by educational scores, by first exploring cross-country variations, and then focusing on variations within Russia.

This is an empirical thesis and therefore, to examine the aforementioned questions, it makes use of advanced econometric techniques. The econometric tools used were selected on the basis of the existing theoretical and empirical literature. In addition, the empirical estimations carried out were made possible by the availability of quality datasets containing information on poverty, institutions, FDI, natural resources and education. The thesis relies on data from a few commonly used sources: the World Bank's World Development Indicators Database (WDI); the World Bank's Adjusted Net Saving dataset; the UNCTAD FDI statistics; the International Country Risk Guide Dataset (ICRG); the Organisation for Economic Cooperation and Development's (OECD) Programme for International Students Assessment (PISA); the Trends in International Mathematics and Science Study (TIMSS).

The topics discussed in this thesis are not purely an object of academic interest but are also relevant for policy purposes. First, growth has been considered until now the major factor in alleviating poverty. However, my investigation of the growth elasticity of poverty argues that the proposition that countries simply need to follow a growth-maximising strategy in order to reduce poverty is too simplistic. The impact of economic growth on the rate of poverty reduction is in fact dependent on a number of conditioning factors. Investigating the variation in the growth elasticity of poverty can

help us to understand which policies governments should focus on when designing poverty reduction strategies.

Second, as FDI has the potential to increase growth and productivity, policies to promote FDI are crucial parts of a country's industrialisation strategy (UNIDO, 2003). However given the increasing number of instruments available, designing effective policies can be challenging, especially in developing countries that often have low institutional capacities. A better understanding of the determinants of FDI can support governments' efforts to design policies that promote FDI effectively. Furthermore, analysing the effects of host countries' characteristics on the different types of FDI (resource, market or efficiency-seeking) can offer lessons for governments that target specific types of investments.

Finally, promoting human capital is central to any economic development strategy as it is key to a country's competitive advantage in the globalised economy (Grek, 2009). Understanding the determinants of human capital, as measured by individual students' performance, can help policy makers to design focused educational policies. Research based on complex educational surveys, containing detailed information about the social and institutional contexts in which education takes place, can provide guidance for those wishing to devise evidence-based policies, aimed directly at improving teaching and learning.

The thesis is organised into three main parts. In the first part, we deal with the role of growth in poverty reduction. Before analysing the question empirically, we offer a detailed overview of the different approaches available for defining and measuring poverty. We critically review the two main conceptual approaches to poverty used in the economic discipline, namely the monetary approach and the capabilities approach, and we discuss the advantages and disadvantages of each. After making the case for using the monetary approach, we discuss the practical issues related to the construction of a poverty index within that approach. Building on this, in the second chapter, we empirically investigate to what extent economic growth reduces poverty. In particular, we assess how initial conditions of poverty and inequality, as well as human capital, institutions and credit, impact the growth elasticity of poverty.

In the second part of the thesis (Chapters 3), we review the theories on international production and we explore the determinants of FDI in resource-rich countries. The literature review in the first part of Chapter 3 provides guidance for choosing an adequate theoretical framework for the subsequent empirical analysis. In this chapter, we argue that the internalisation approach and the Ownership, Location and Internalisation paradigm (OLI) offer a sound analytical framework to support the formulation of testable hypotheses on the operation of multinational corporations (MNCs) and the pattern of FDI. In turn, the chapter empirically analyses how country-level characteristics affect the inflow of foreign investment. Specifically, we focus on the interplay between natural resources and institutions.

In the third and final part (Chapter 4), we focus on educational quality in Russia. The chapter first discusses how the educational system in Russia has changed since the beginning of the transition period. Then, we extensively analyse descriptive statistics on students' educational performance in Russia and selected other countries. This allows us to examine Russia's educational performance in a comparative light. Finally, making use of cross-country and within-Russia variations, we explore how student, parent and school variables impact on students' scores.

Each section of the thesis contributes to the existing economic knowledge in a distinct way. The second chapter brings new empirical evidence on the factors that affect the growth elasticity of poverty. Specifically, we find that increased health, schooling, credit and less conflict decrease the growth elasticity of poverty. The most important contextual features that affect the growth elasticity of poverty are initial conditions of inequality and poverty, and human capital, as measured by health and education.

The third chapter responds to the call to investigate the role of FDI in resource-rich economies. The empirical analysis carried out in the chapter shows that natural resources significantly affect the impact of property rights and political stability on FDI. Namely, higher resource endowment mitigates the positive effect of the institutions analysed on FDI. We also contribute to the discussion on the impact of different types of natural resources on economic development. We show that only oil, and not minerals or agricultural products, plays a significant role in the FDI-institutions relationship.

Lastly, in the fourth chapter, we make use of the existing data on educational performance in a novel way. The chapter investigates the determinants of educational scores, by pooling the available survey data of PISA and TIMMS. In this way we are able to exploit cross-country and time variations, while existing studies only make use of individual surveys. The pooled cross-country estimations using PISA and TIMMS find a clear association between educational outcomes and a number of individual and family background variables. In particular, both the number of books at home and the parents' educational level have a strong positive association with educational outcomes. The evidence regarding school-level variables highlights the importance of location. The results show that students in cities tend to perform consistently better than those in small towns and villages. We also use the same data sources to explore within-Russia variations in educational scores. There have to date been no quantitative studies on Russian educational performance. When exploring the Russian data we find some similarities with the cross-country evidence. However, in the Russian case we find that resources, as measured by the student-teacher ratio, and autonomy are robustly associated with students' performance levels.

Overall, this thesis contributes to the existing knowledge by analysing issues that are either novel or have already been discussed but to date remain unresolved. The emphasis is on empirical analysis, which is carried out using the most relevant econometric techniques. Saying that, any sound empirical analysis needs to be rooted in economic theory. Hence, in each section I identify an adequate theory that supports the empirical work.

References

Campos, N. and D. Jolliffe (2002): "After, before and during: Returns to education in the Hungarian transition", *IZA Discussion paper*, No. 475.

Chen, S. and Ravallion, R. (2008) "The Developing World Is Poorer Then We Though, But No Less Successful in the Fight against Poverty", *World Bank, Policy Research Working Papers*, N.4703.

Lucas, R. E. (1988) "On the mechanics of economic development." *Journal of Monetary Economics* , Vol. 22, No 1, p. 3-42.

Grek, S. (2009) "Governing by Number: the 'PISA' effect in Europe" *Journal of Educational Policy*, 24 (1) pp. 23-37.

Maddison, A. (1995) "Monitoring the World Economy,1820- 1992" OECD, Paris.

Mickiewicz, T. (2010) Economics of Institutional Change: Central and Eastern Europe Revisited. Basingstoke ; New York : Palgrave Macmillan, 2010.

Nelson, R.R., and Phelps, E. (1966). "Investment in humans, technology diffusion and economic growth." *American Economic Review* 56,no.2 (May):69-75.

Romer, P. M. (1986) "Increasing returns and long-run growth". *Journal of Political Economy*, Vol. 94, No 5, p. 1002-1037.

Solow, R. (1957) "Technical change and the aggregate production function." *Review of Economics and Statistics*, Vol. 39, p. 312-320.

UNIDO, 2003, *Guidelines for Investment Promotion Agencies: Foreign Direct Investment Flows to Developing Countries*, Vienna: UNIDO.

Chapter 1 – "Defining and Measuring Poverty"

1. Introduction

In the last two decades poverty eradication has been at the top of the political agenda at both the national and international level. The political and economic importance of poverty is reflected in international development goals such as the Millennium Development Goals (MDGs). The MDGs' main objective is to halve the global poverty level of the 1990s by 2015. Despite the World Bank's claim that the world is on the right track to achieve this target (World Bank, 2011), there are still many areas of concern. In particular, low-income countries, such as those in Sub-Saharan Africa and South Asia, and fragile states have showed slow progress in reducing poverty. For example in Sub-Saharan Africa, between 1981 and 2005, the number of people living in extreme poverty increased substantially (World Bank, 2011). Moreover, new estimates by the World Bank (2008c) show that the increase in food and energy prices between 2007-2008 led to an increase in the global number of poor people by as many as 155 million in 2008. The recent economic crisis is expected to further increase the number of poor people in developing countries by 60 million (World Bank, 2008c). This brief overview shows that, in today's global economy, poverty is a central and controversial issue. Policy makers, academics, and non-governmental organisations have long discussed how to define and how to measure poverty, its causes and socio-economic implications, and finally policies for poverty reduction. The discussion has developed both at empirical and theoretical levels. Before we undertake any empirical analysis, a crucial preceding issue which merits discussion revolves around how to define and measure poverty. While there is broad agreement that poverty reduction is beneficial for society and is a goal that should be pursued by governments and policy makers, there is still debate over what poverty reduction actually is. Poverty reduction strategies are necessarily influenced by the definition and measurement of poverty. This matters because many countries seem to have multiple and diverging poverty estimates. For example, in the case of Bangladesh, the World Bank estimates that the poverty headcount, based on $1 a day in purchasing power parity (PPP), increased by 1.8% between 1990 and 2000 (McLeod, 2007). However, for the same period, the Bangladesh national statistics office, using a national poverty line of $1.19 a day, estimates that the poverty headcount decreased by 3.7% (McLeod, 2007). In light of the fact that the

overall number of poor is estimated to be at 1.4 billion and that scholars are still debating whether global poverty is increasing or not, it is clear that measurement issues are of crucial importance. Defining and measuring poverty is not only important for policy purposes; it should also precede any sound empirical work. In fact, as shown by the above example, different poverty measures can lead to diverging estimates, which in turn can influence policy makers. In empirical studies, it is therefore necessary to choose the most appropriate poverty measure depending on the goals of the analysis. In the context of this thesis, the review carried out here aims to provide guidance which is then used to choose the most appropriate poverty indicator for the cross-country analysis undertaken in the following chapter.

In this chapter we review the main approaches used to define and measure poverty. Although a number of disciplines across the social sciences have contributed to these issues, in this chapter we focus on the approaches and methodologies commonly used in economics. In the second section, we focus on the monetary and capabilities approaches and discuss advantages and disadvantages of each framework. In the third part, we discuss issues related to the measurement of absolute monetary poverty. The chapter thus provides a rationale for using an absolute monetary poverty line in the empirical work carried out in the following chapter.

2. Defining and measuring poverty

In this section we review two core conceptual approaches adopted in the economics literature: the monetary approach and the capabilities approach[1]. Despite great differences between the two methodologies, they should both be considered within a

[1] We are aware that the recent literature has developed new approaches to analyse poverty. Two examples are the theories of social exclusion (SE) and the economics of happiness (EH). SE is a concept that aims to assess marginalisation and deprivation in developed countries. It is one of the main aspects of European Union (EU) social policy. There are disagreements on what SE is, but the main idea is that it is a dynamic concept and is socially determined. This is in contrast to the capabilities and monetary approaches that aim to identify an absolute condition of poverty. According to Stewart et al. (2007), the SE approach is more difficult to define and interpret than the capabilities and monetary approaches. EH aims to capture the idea that well-being depends on income and non-income factors. The approach is drawn from psychology and economics and relies, in large part, on surveys of self-reported well-being. The surveys typically ask individuals questions on a range of monetary and non-monetary issues. Key contributions to the EH are found in, among others, Easterlin (1974), Clark and Oswald (1994), Oswald (1997), and Frey and Stutzer (2002). Within the economics discipline, EH represents an important theoretical step towards recognising that individuals have different preferences over material and non-material goods. Despite this, there are several challenges, especially regarding the definition and measurement of happiness. As Graham (2005) pointed out, EH should be seen as a complement rather than an alternative to standard monetary measures of welfare.

set of normative guidelines that define the adequacy or otherwise of conceptualising poverty. First, any poverty framework needs to define the space in which poverty is observed (monetary, cultural, social). Second, the concept of poverty may not be transferable across time and countries, in which case the comparability of studies across different periods and countries will be limited (Stewart et al., 2007). Third, a poverty definition needs to be empirically realisable. Fourth, any poverty measurement needs to choose a poverty line that enables us to distinguish the poor from the non-poor. Fifth, a poverty measure must specify clearly the unit of analysis. Finally, it must be able to provide us with aggregated information on the population of interest. These are the issues around which we structure this chapter. The following sections, 2.1 and 2.2, compare the capabilities and monetary approaches and argue that the latter approach is a more suitable framework for making comparisons across time and countries. Section 2.3 analyses different types of poverty lines and distinguishes between relative and absolute lines, and between subjective and objective lines. We conclude by explaining why an absolute poverty line is suitable for cross-national comparisons over time.

2.1 The monetary approach

The monetary approach is the most well-known approach to defining poverty and is the most commonly used, especially among economists. In this framework, poverty is an analytical category where income or consumption falls below a certain threshold (e.g. the poverty line). Monetary poverty can be defined and measured in terms of income or consumption. In either case, the monetary approach sees poverty only as an indicator or proxy for material well-being[2]. In this section we review the origin of the approach and its theoretical foundation, and then we move on to discuss how this approach suggests building a measure of poverty.

The first scholars to explore the monetary approach were Booth in 1887 and Joseph Rowntree in 1902 (Stewart et al., 2007). The focus of Booth and Rowntree was on statistical analysis, and their definition of poverty was mainly aimed at facilitating quantitative analysis rather than providing a conceptual framework in which to study poverty (Laderchi, 2007). These studies represent major contributions to the analysis of

[2] The difference between income and consumption poverty will be discussed in the third section of the chapter.

poverty; indeed, some of the main elements of Rowntree's methodology are still followed today[3]. What characterised these early contributions on poverty is that poverty was measured in a standard way and poverty was viewed as a condition affecting the individual: these remain salient features of today's version of monetary poverty. Monetary poverty, since its early incarnations, stresses that poverty is linked to individual circumstances and is an individual experience rather than a social outcome. The methodologies of Rowntree and Booth, although developed outside economics, were well-suited to economists because of their compatibility with microeconomic assumptions and their focus on measurements. Indeed, Rowntree's work is often regarded as the first scientific contribution on poverty. The approach was soon adopted by economists, and was the main way to measure poverty until the 1970s, when Sen presented a strong critique of the traditional poverty framework and formulated the capabilities approach.

Although monetary poverty is an analytical tool and there is little discussion on its theoretical foundation, there have been some attempts to ground it in economic theory[4]. The theoretical justification of monetary poverty is rooted in consumer theory. Ravallion (1998) argues that a poverty line is "the minimum utility needed to be not poor given a certain consumer expenditure function", which in turn depends on price level, household characteristics and the utility function. This definition expresses poverty in terms of utility and not in terms of income or consumption. Therefore, for practical applications poverty needs to be converted from a function of utility to a function of money[5]. Another attempt to integrate the monetary definition of poverty with microeconomic theory is found in Lewis and Ulph (1988). They propose a model

[3] Rowntree (1902) defined a primary and a secondary monetary poverty line. The primary poverty line is defined by the monetary means needed to afford diet, clothing and rent. The secondary line is where basics needs (in terms of diet, clothing and rent) are met, but individuals live in "inadequate conditions". The poverty lines set by Rowntree were used by many other scholars. However, Laderchi (2007) notes that Rowntree did not set the poverty lines with the intent to provide a normative device.

[4] According to Laderchi (2007), there have been two main attempts to give a theoretical economic foundation to the definition of monetary poverty. The first is the welfarist view. This defines poverty as a lack of economic welfare. The second is the rights-based approach, which assumes that households and individuals are entitled to a minimum income (Atkinson, 1989). In this chapter we focus on the welfarist view, as it is the most commonly used within the economic discipline.

[5] Ravallion (1998) describes two methods to convert poverty in terms of utility to poverty in terms of money: the welfare ratio method and the equivalent expenditure method. The first approach involves calculating the ratio of each person's poverty line to a base poverty line. This gives an index that can be used to normalise income into comparable units. The latter approach uses a cost function to calculate a money metric utility measure. Ravallion (1998) notes that these two methods are only equivalent when consumer preferences are homothetic (in the sense that the budget devoted to a certain good is independent from its utility), an assumption that is not supported by empirical results.

in which a minimum amount of consumption is required to escape poverty and this minimum consumption also provides indirect benefits through participation in social activities. This model shows how poverty matters for the individual and for society (Laderchi, 2007). The model offers an interesting attempt to theoretically justify the notion of monetary poverty, although it is open to the reductionist critique, due to its extreme focus on the individual acting rationally (Laderchi, 2007). Sen (1997) has provided a thorough critique of this welfarist approach to poverty. Without going into details of Sen's well-known arguments, we can summarise them in four main points. First, poverty is strictly linked to utility and utility itself may not be an adequate measure of welfare[6]. Sen points out that the human existence is not limited to achieving utility. While utility is important there are other factors that play a crucial role, such as freedom or rights. Second, microeconomics assumes that individuals have consistent preferences, an assumption that is far from necessarily satisfied. Third, the assumption of utility maximisation is clearly limited, both in the context of personal well-being and of market transactions. That is, market transactions and personal well-being are determined by factors other than utility maximisation. Fourth, poverty is a multidimensional concept and therefore the identification of poverty as a purely monetary phenomenon is a limited approach.

Notwithstanding these theoretical critiques, it is the monetary approach that has dominated empirically. We now turn to the equally controversial issue of how the monetary definition of poverty is translated into a poverty measure that reliably identifies the poor. A poverty measure is determined by four choices: the variable that measures the welfare, the unit of analysis, the poverty line and the aggregate indicator. In what follows, we discuss each point. First the variables used to measure monetary poverty are usually income and/or expenditure. It is often argued that expenditure is better than income as it is a better proxy for consumption (and hence utility) since, if well measured, it is more closely linked to actual welfare than income is[7]. Moreover, income data is less reliable, especially in developing countries. Second the identification of the poor is linked to the unit of analysis. Consistent with the welfarist logic, poverty is an individual phenomenon. However individuals typically exist within the household.

[6] The notion of utility is a contested domain and can have different meanings for different approaches—an observation which lies at the heart of Sen's (1997) critique.

[7] The multiple issues related to measuring and comparing income and expenditure in different countries will be discussed in the third part of the chapter.

Income is pooled within the household and most of the household's consumption happens collectively (Laderchi, 2007), thus complicating the effort to measure individual poverty experiences. A solution to this problem is to take the household as the survey's unit of observation (Deaton, 1997) and to develop empirical means of incorporating the fact that households are of different sizes and compositions. These empirical tools are 'equivalence scales', which allow for household level information to be adjusted for individual level analysis (e.g. through taking into account the demographics of the household, the sizes and/or the location). Therefore, individuals are treated as the unit of analysis but taking into account, through equivalence scales, that they live in a shared budgetary environment. Although much technical progress has been made in measuring household welfare, translating this into an individual measure of poverty remains problematic. Currently, the procedures for the estimation of equivalence of scale remain controversial and there is no established consensus on how to correct for different household sizes and composition (Deaton and Grosh, 2000)[8]. This is mainly because the level of resources to which the individual has access is not observable.

The third step in creating a monetary poverty measure is the choice of a poverty line. A poverty line is essential for defining monetary poverty as it allows us to distinguish the poor from the non-poor. A poverty line is usually defined in terms of some minimum amount of income, consumption or needs that have to be satisfied. The fact that poverty can be defined only after having assessed utility leads to what is known as a "referencing problem" (Sen, 1976; Ravallion, 1998). The referencing problem relates to the utility level that anchors the poverty line (Ravallion, 1998). As economic theory does not clearly indicate how to distinguish the poor from the non-poor, setting the poverty line remains an arbitrary decision. For example, a country's poverty line may be set in relation to a common standard across countries (e.g. by defining a minimum income level, comparable across countries) or in relation to its own standard (e.g. by defining a national level of minimum needs) (Sen, 1979). This does not imply that one approach is correct while the other one is not. Rather, the two approaches are different, and should be used for different purposes. The fourth step in choosing a poverty indicator entails combining individual characteristics into an aggregate measure (Sen, 1976). Once an individual poverty line has been selected, aggregation is necessary to define poverty at the regional or country level. In the aggregation process, the difference between

[8] Citro and Michaele (1995) provide a good survey of the equivalence scale issue as it pertains to the economic literature.

individual incomes (if using an income-based poverty line) and the poverty line should be taken into account. However, one question is whether these differences should be weighted differently. The literature has come up with a variety of measures that take these issues into consideration[9].

The above discussion highlights that the monetary approach presents several theoretical and practical challenges related to the construction of poverty measures. From a theoretical point of view, the main criticisms are linked to the grounding of the approach within the utility maximisation framework. From a more practical point of view, the monetary approach requires four steps to build a meaningful poverty measure. Each step, as summarised above, presents some challenges. Despite the conceptual limitations and practical problems inherent in building a monetary poverty measure, however, there are two main arguments for using the monetary approach. First, from a practical point of view, a unidimensional approach is well suited to making comparisons over time and across countries. By focusing on one aspect of poverty, comparison is easier than when using multidimensional poverty measures. This is particularly important, especially in light of current international development targets such as the MDGs. The MDGs state that halving poverty, as defined in monetary terms, should be central to international economic policies. The focus on monetary poverty allows the setting of common goals across countries. Overall, this approach is typically used because monetary resources provide a convenient proxy for welfare and a ready measure of poverty (Stewart et al., 2008).

Second, there is a large amount of data available on monetary poverty. Many efforts have been made to collect data to measure monetary poverty and the measuring techniques have improved greatly over the years. The increase in availability of data has been made possible because most governments and international organisations have focused on the measurement of monetary poverty. The monetary poverty indicators are thus now a sophisticated and popular way of analysing poverty. Overall, the theoretical foundations of the monetary approach remain subject to much criticisim, but its empirical implementation has much improved since the first contributions made at the beginning of the last century. Notwithstanding this, even the more sophisticated monetary measures of poverty developed by contemporary economists are, of course,

[9] A discussion of the methods used for aggregating individual data can be found in the following chapter.

not able to be capture multidimensional aspects of poverty, a topic to which we now briefly turn.

2.2 The capabilities approach

The capabilities approach was pioneered by Sen (1985, 1999) and was first introduced in Sen's essay "Equality of What?". The approach, originally designed to evaluate inequality, was soon applied in the context of poverty (Saith, 2007). Central to Sen's theory is the criticism of the utility and commodities-based approach to defining poverty, part of which was reviewed in the previous section. Sen (1985, 1999) argued that the possession of income or commodities does not necessarily translate into welfare, as this depends on personal and social characteristics. According to Sen, well-being depends on a person's ability to achieve certain goals; these capabilities are what enable an individual to live a valuable life (Stewart et al., 2007). In this context, monetary conditions are just one of the factors needed to enhance well-being. Different people and societies have different abilities to convert income or commodities into certain aims. For example, an individual may eat some rice with the purpose of being nourished and he/she will achieve the goal of being nourished by eating; however, an unhealthy individual may not be nourished by only consuming rice. Sen calls the ability to achieve a personal goal using a commodity a "functioning". Functioning is different from capability, which is the potential to achieve something. An individual has the capability to nourish him/herself, although he/she may choose not to do so. A "functioning" refers to the achievement of being nourished. Given the commodities available to an individual, he/she may achieve a certain functioning. If we consider all the commodities owned, an individual can achieve a number of functionings. The set of these functionings is called a functioning vector. The mode of utilisation of commodities can result in different functioning vectors. The capabilities set, defined as all the possible functionings that a person can achieve, is thought of as a set of alternative possibilities that a person can choose from (Saith, 2007). Sen thus emphasises that individual welfare relies on capabilities, which differ from utility maximisation and the possession of commodities. In sum, if we aim at comparing welfare across individuals, income and commodities do not provide sufficient information. Instead, according to Sen, we should consider the ability of people to achieve certain goals given the goods that they have available.

Sen's contribution represents an important development in the theorisation of poverty. The capabilities approach changed the perspective on poverty and moved from a unidimensional approach, based on income, to a multidimensional. A multidimensional view of poverty considers that a person's well-being depends on both market and non-market variables. The approach suggests that income as a sole indicator of welfare is inadequate and other variables should be considered (Bourguigon and Chakravarty, 2003). The main advantage of Sen's framework lies in its flexibility, which allows researchers to apply it to different contexts (Alkire, 2002). The author does not prescribe a unique and fixed list of capabilities necessary to achieve well-being. Rather, he is aware that capabilities are context-specific, although some, such as health, education and freedom, have intrinsic value.

Despite its popularity, the capabilities approach has not been exempt from criticism. We review here some of the main arguments against it. The most well-known is that of Townsend (1985). Sen (1983) argued that there is an absolute core to the concept of poverty, namely the satisfaction of food needs, which is independent from society. Townsend criticised this point. He argued that, in fact, social needs are crucial in defining poverty and even physical needs are socially determined. In a sense, Townsend's argument is more a criticism of an absolute approach to poverty than of the capabilities theory itself. Sen (1985) later replied to Townsend's critique, explaining that if, in order to be non-poor, an individual must reach some minimum level of capabilities, this does not imply that the minimum criteria cannot vary across space and time. Sen (1983, 1985) does therefore recognise the relative element to poverty. What Sen (1983, 1985) argues is not for a simple absolute concept of poverty but that individual well-being is assessed not just in comparison to others in society but also according to some absolute standard.

Second, there are criticisms related to the practical application of the capability approach. There are four main problems related to using this approach empirically. First, it is difficult to identify the basic capabilities that are needed so as not to be in poverty. Some scholars have criticised Sen for failing to provide a list of capabilities essential to achieving well-being (e.g. Williams, 1987; Nussbaum, 1988). There have been various attempts to define basic capabilities. An important step in formulating a

set of capabilities that are applicable internationally can be found in Nussbaum (2000)[10]. The second issue relates to the measurement of these capabilities. As argued by Stewart et al. (2007), capabilities represent a potential set of outcomes and as such they are difficult to measure. Furthermore, measuring capabilities requires a substantial amount of information and, in many cases, the indicators are not available (Clark, 2006). In practice scholars tend to measure functionings (life expectancy and literacy for example) rather than capabilities. The third and fourth issues, also inherent in the monetary approach, relate to how to set a poverty line once the basic capabilities have been defined and how to aggregate the results into an overall indicator. Notwithstanding these practical challenges, several innovative attempts have been made to measure poverty using a multidimensional approach, although the amount of data available remains limited.

Despite its practical limitations, the capabilities approach remains an important theoretical contribution to the study of poverty. Moreover, recent years have seen an increasing number of practical applications of Sen's approach. The most well-known attempt at measuring poverty using the capabilities approach is the Human Development Index (HDI). This is a composite index that includes income, life expectancy and education. The HDI is an example of a measure based on functioning rather than capabilities.

So far, we have reviewed the capabilities and the monetary approach as two conceptually distinct frameworks, although theoretical efforts have been made to unite them[11]. In the next section we turn to how to choose a poverty line, which, as discussed, is an issue in both approaches.

2.3 Choosing a poverty line

Once poverty is defined according to either the monetary or the capabilities approach, the next step should be to define a poverty line. Poverty lines are essential to measuring and studying poverty as they allow us to distinguish between the poor and the non-

[10] Other attempts have been made by Alkire (2002), Qizilbash (1998), and Desai (1995).
[11] Stewart et al. (2007) note that the two approaches have similar features. Ravallion (1998) develops a formal model that links the capabilities function to the utility function.

poor[12]. There are different types of poverty line: objective and subjective, relative and absolute. These differences apply to both monetary and non-monetary poverty. In this section, we critically discuss the different approaches used to set the poverty line. We first discuss the difference between relative and absolute poverty lines, and then we turn to the difference between subjective and objective poverty lines.

An absolute monetary poverty line defines a condition where people cannot attain a certain level of basic consumption[13], or certain basic capabilities, consistent with some minimum level of "welfare". Poverty in this case is seen as insufficient income or an inability to obtain a minimum amount of welfare, independent of the characteristics of the society. Several points have been put forward to support the use of absolute poverty lines. First, absolute poverty lines have been praised for facilitating comparison across time and countries. For example, absolute monetary poverty lines have constant value across time (although adjustments are made for inflation) and countries (by using PPP exchange rates). Second, from the point of view of anti-poverty policies, a measure of absolute poverty should be favoured because it guarantees that any two individuals are treated the same way (Ravallion, 1998). Third, the concept of poverty is associated with conditions of deprivation, malnutrition and visible hardship that are independent of relative conditions (Sen, 1981)[14]. Especially in poor countries, where individuals live with a minimum amount of goods, the use of absolute poverty seems more relevant (Coudouel et al., 2002). The criticisms of the absolute poverty line focus on the difficulty of identifying basic capabilities or a minimum amount of income independently from a society's characteristics (Stewart et al., 2007). Atkinson (1975, p. 186) explains the problem well: "It is misleading to suggest that poverty may be seen in terms of an absolute standard which may be applied to all countries and at all times, independent of the social structure and the level of development. A poverty line is necessarily defined in relation to social conventions and the contemporary living standards of a particular society".

[12] We should acknowledge that much work has been carried out without the use of the poverty lines reviewed here. This type of analysis is usually referred to as poverty dominance analysis (PDA). PDA uses a range of poverty lines to verify certain statements about poverty. For example, it may be that rural populations are poorer than urban populations when looking at different poverty lines over a certain range. Other scholars have avoided using threshold-based analysis by using fuzzy poverty measures (Cheli and Lemmi, 1995; Qizilbash and Clark, 2005). These measures try to capture the idea that it is difficult to identify whether an individual is poor when they are very close to the poverty line. These are interesting developments; however, given the subject matter of the chapter, they will not be discussed here.

[13] Part 3.1 will analyse different types of absolute monetary poverty line.

[14] Sen (1985) later modified his definition of poverty, arguing that poverty varies with location.

A relative property line, to which we now turn, is used to try to address the issues identified by Atkinson (1975). A relative poverty line defines poverty as a condition determined in relation to others in society. In the case of a monetary approach, a relative poverty line would be defined in relation to the overall distribution of income (Coudouel et al., 2002)[15]. One way of calculating the relative poverty line would be to increase it in line with the mean income of the country (Ravallion, 2003). In terms of purchasing power, an absolute poverty line implies that the poverty line has a fixed purchasing power while relative poverty implies that the purchasing power should be higher in richer countries or in richer areas of the same country (Ravallion, 2003). More generally, a relative poverty line entails considering different norms across countries or groups. The acceptable norm in a richer country will require higher consumption, or a greater number of capabilities, depending on the approach adopted, than a poorer country (Deaton, 2003). While there is a consensus and evidence that relative deprivation matters—and therefore when analysing economic welfare relative income is important—there is an open debate over whether poverty *per se* should be considered in relative terms. Townsend, a supporter of the use of a relative poverty line, argued that the concept of poverty should relate to space and time, as the necessities of life are not fixed but continuously changing (Sen, 1984). Scholars have also argued that the use of a relative poverty line is appropriate when analysing richer countries, where people have fewer issues with accessing basic needs (Ravallion, 2003).

We should mention that, despite the strong dichotomy between relative and absolute poverty, there are intermediate approaches. These methods consist of taking into account inequality, while acknowledging the importance of an absolute minimum (Coudouel et al., 2002). For example, Foster (1998) discusses a hybrid poverty line that is sensitive to changes in living standards, but not as much as purely relative approaches.

Poverty lines can be distinguished not only on the basis of whether they define poverty in an absolute or relative way, but also on the basis of who chooses the poverty line. Objective poverty lines are externally determined. For example, a researcher or an institution can decide on the threshold under which a person should be considered poor

[15] In the EU, poverty targets are mainly defined in terms of relative poverty. Typically, individuals with an income below 60% of the median income in the EU are defined as being at risk of poverty (Eurostat, 2011).

in absolute terms or in relation to others in society. Subjective poverty lines, meanwhile, are determined by the entity being analysed, and are based on individual perceptions of welfare, which may be income based or may include non-monetary dimensions[16]. In the case of the monetary approach, one way of calculating a subjective absolute poverty line has been to use surveys asking individuals "what is the minimum income or consumption needed to meet basic needs"[17]. Economists have often refrained from using subjective poverty lines, either in absolute or relative terms, although recently there have been an increasing number of attempts to include the information needed for interpersonal comparison (Ravallion, 1998). An obvious drawback of such methods is that the measure is affected by the individual characteristics of the people surveyed. This can create inconsistent measurements of poverty, and difficulties when trying to aggregate multiple individuals. A subjective poverty line also makes inter-temporal and cross-country comparisons complicated, as values and norms that drive individual responses are likely to change with time and space. Moreover, subjective measures could reproduce discrimination or exclusion patterns (for example, in the case of women or other particular groups), in which case these measures would fail to identify certain groups of the population (Coudouel et al., 2002). Although poverty measures have traditionally been dominated by objective methods, recently, academics and policy makers have taken an increasing interest in subjective methods. This is due to the recognition of the importance of understanding the views of the poor (Veenhoven, 2002) and has been taken up by the EH approach discussed earlier.

In this section we have discussed different approaches to constructing poverty lines. Poverty analysis and policy need to distinguish the poor from the non-poor. However, the choice of poverty threshold, no matter what aspect of poverty is being emphasised, is fraught with difficulties. This matters because, for example, the choice of a poverty line is crucial in economic policy, as different thresholds may change people's eligibility for benefits. The choice of a poverty line remains to some extent arbitrary, although theoretical discussions and the existing empirical evidence can guide researchers in choosing the most appropriate method. In the following and final section, we explain

[17] A multidimensional approach to subjective poverty is found in participatory methods. The participatory approach was pioneered by Chambers (1994). The approach involves asking people what poverty means, across a number of dimensions (political, cultural, economic and so on).
17 This approach has been adopted by Goedhart et al. (1977) and Hagenaars (1986).

why choosing an absolute poverty line based on the monetary approach is appropriate for the goals of this thesis.

2.4 Choosing the approach and the poverty line

Choosing a framework to define poverty is crucial, as poverty definitions have an impact on empirical studies and on the understanding of poverty determinants. The results of previous empirical studies on poverty have varied greatly, according to the definition and measurement of poverty adopted. For example, just looking at poverty trends over the last two decades, while some claim that poverty in the developing world has decreased substantially, other scholars argue that poverty has increased (Ravallion, 2003). The choice of poverty measure is also important for policy making. Different poverty measures identify different areas of deprivation. The monetary approach can identify a lack of income or consumption, while the capabilities approach might measure a lack of public services (Stewart et al., 2007). Depending on the empirical findings, policy makers should design different ways of targeting poverty. It is therefore crucial to know whether different poverty indices identify the same people as poor and the same number of people.

In the above sections we have reviewed two main approaches used to identify the poor. There are advantages and limitations to both approaches but, ultimately, if we are interested in finding out how macro and institutional variables affect aggregate well-being then we seemingly have only one choice and that is to use a monetary approach to poverty. The data on monetary poverty is widely available across time and countries, making comparative analysis possible.

Within the monetary approach, we choose an absolute poverty line for this study. As previously discussed, objective and absolute measures of poverty are more suited to making international comparisons between developing countries than are subjective and relative measures. International comparisons are important for international policy, and for analysing and monitoring global poverty trends and progress towards meeting the MDGs. An objective poverty line, like the World Bank's (WB) dollar-a-day discussed below, provides a more transparent tool for inter-country comparisons (Deaton, 2003). Moreover, the use of an absolute rather then a relative poverty line seems to be more

relevant in the case of developing countries, where large parts of the population survive on low levels of consumption (Coudouel et al., 2002).

3. Measuring absolute poverty within the monetary approach

Having discussed the conceptual frameworks used to define poverty, we shall now turn to the issues related to the measurement of absolute poverty within the monetary approach. The absolute monetary poverty line can be calculated in different ways, and Section 3.1 reviews a number of available alternatives. A separate section (3.2) reviews whether monetary poverty should be measured using surveys or national income accounts, and we discuss some issues related to household surveys. The remaining section, 3.3, is dedicated to the WB bank dollar-a-day poverty line, which is the poverty line adopted in our econometric analysis of Chapter 2 but—as with all empirical proxies—is not without controversy.

3.1 What is an absolute poverty line?

Determining whether an individual (or a household) is poor requires setting a threshold under which he/she is considered poor. In the preceding section we discussed different methods that can be used to estimate this threshold, i.e. the poverty line, and made the case for using an absolute monetary poverty line. In this section we review how scholars can calculate a monetary poverty line in practice and how it is possible to estimate an individual's economic resources, which in turn define whether he/she is below or above the set threshold. We discuss caloric intake, food energy intake and the cost of basic needs approach, all of which are popular ways of measuring monetary poverty lines.

The calculation of an absolute poverty line has often been linked to nutritional requirements. The simplest way to do this is by calculating the caloric intake as a measure of welfare (Citro and Michael, 1995). So, for example, if the threshold is 2,000 calories per day then any individual/household with an intake less than that will be classified as poor. One practical way of calculating this is to look at whether per capita consumption meets the minimum caloric requirement (Wodon, 1997). Another way of calculating a food-based poverty line is the "food energy intake" (FEI) method (Greer and Thorbecke, 1986; Paul, 1989). This method aims at identifying the consumption or

income level at which food intake is just sufficient to carry out a basic array of activities (Ravallion, 1998)[18]. The poverty lines are computed at the level at which food consumption can satisfy a normative requirement (Wodon, 1997). Although both methods focus on nutrition, the FEI may be preferable to the caloric intake method as it does at least consider the ability of the household to control some of its actions, while the caloric intake method is purely based on nutrition (Wodon, 1997).

Slightly more sophisticated than the two approaches reviewed above is the "cost of basic needs method" (CBN)[19]. This method involves setting a consumption bundle that defines basic needs, in terms of goods and services (food, housing, health). Then, it is necessary to calculate the income/consumption needed to achieve the basic needs, for each subgroup analysed. The CBN approach may be preferable to the FEI in light of the fact that there is some agreement that consumption of goods and service is a better indicator of welfare than consumption of food only (Wodon, 1997; Ravallion, 1998). For example, Laderchi (2007) observes that, while it is justifiable to be concerned with nutritional adequacy, there is no reason to confine the analysis to one kind of good. Despite this, the poverty line set with the CBN approach will always have an arbitrary element, as there is no agreement on what constitutes basic needs. Poverty lines such as the CBN are composed of food and non-food components. The food component of the CBN, as is the calculation of the FEI, is determined by requirements for "good" health. Although most scholars agree on this, in practice it is difficult to calculate as the demand for food is unknown. Another problem is that the relationship between food and income varies with time, location and tastes. What should be included in the non-food component is also much debated. There is no fixed bundle of non-food goods that is widely accepted as necessary to qualify a person as non-poor, and that would stay relevant over time. One way to approach this problem is to set an upper and lower bound for the poverty line. Ravallion (1998) proposes a hierarchy of basic needs that includes survival food needs, basic non-food needs, and then basic food needs for economic and social activity. The upper bound of the non-food component of the poverty line is set by the non-food needs. The lower bound of the poverty line is when neither basic food nor non-food needs are met. Stewart et al. (2007) also argue that it is not possible to build a unique poverty line; it is better to set up a lower and upper

18 This method has also been used by Dandekar and Rath (1971), Osmani (1982) and Paul (1989).
19 This method has been used by Orshansky (1965) and Hagenaars and de Vos (1988).

bound. People below the lower bound are certainly in poverty, while those above the upper bound are not poor.

The caloric intake, FEI and CBN approaches are popular ways of measuring monetary well-being and setting a poverty line; however, for the reasons discussed above, the CBN may be preferable to the nutrition-based approaches. The CBN approach has been used regularly to calculate domestic poverty lines. CBN poverty lines are meaningful and can be associated with the amount of resources needed to achieve basic human necessities (e.g. food, shelter…) (Reddy and Pogge, 2002). These poverty lines also offer ways to assess poverty across countries and time.

To conclude, the approaches for calculating a poverty line reviewed above are not necessarily expressed in terms of income but define poverty using other proxies, such as food and satisfaction of needs. Nevertheless, within the monetary approach, income or consumption expenditures are necessary to estimate food intake or the ability to satisfy basic needs. In the section below, we discuss what data are available.

3.2 Data availability: Survey vs. national accounts

Once we have defined poverty and assessed which measure of poverty would be the best to adopt, the next issue concerns data availability. Monetary poverty may be measured using income or consumption. Which of these variables gives a better measure of poverty is itself subject to debate, as mentioned above[20]. The income and consumption information needed to estimate poverty is typically obtained from either household surveys or countries' national accounts. National accounts and household surveys are both designed to measure the income and/or expenditure of households (Ravallion, 2003), although the methods of calculating consumption differ. Household surveys estimate consumption using household interviews, asking questions about expenditure on all commodities consumed, while also imputing expenditure values based on bartered goods and home production. National accounts calculate consumption as residuals of output in the national accounts, so that consumption is estimated by subtracting the domestic consumption of firms and government from the total output (Ruggles and Ruggles, 1986). In this section, we review the issues associated

20 Deaton (1997) argues that consumption is a better measure of welfare, while Atkinson (1989) makes the case for using income.

with each source of data and assess which is the most appropriate for the measurement of poverty.

Typically, both income and consumption estimates from surveys are lower than those from national accounts (Deaton, 2003)[21]. There are several possible explanations for this discrepancy. First, scholars have noted that there is a tendency for richer households not to respond (Deaton, 2003) and thus for there to be a selection bias, resulting in an overestimation of the poverty headcount by surveys. This could explain why consumption growth is lower according to household surveys compared to national accounts (Deaton, 2003). Moreover, individuals may forget, or may prefer not to report, some items consumed, and some sources of income, leading to a further overestimation of poverty (Ravallion, 2003). Second, there is a difference in coverage and definition (Ravallion, 2003). Surveys tend to capture more information on non-exchange production, which, especially in developing countries, represents a significant part of consumption. National accounts are based on production data and therefore have more difficulty capturing illegal and household-based transactions. Third, the two types of data are designed for different purposes; more precisely, national accounts are geared towards macroeconomic applications, while surveys are designed with microeconomic studies in mind (Ravallion, 2003).

A problem common to both surveys and national accounts is the heterogeneity in practices, which may have some implications for the comparability of results across countries (and time). Surveys are more likely to vary year by year, due to changes in sampling methods and survey design. Moreover, surveys have different recall periods (e.g. the period over which individuals are interviewed). There is little understanding of the implications of different recall periods on consumption estimates (Deaton, 2003). In India, shorter recall periods have been associated with higher consumption, although the estimates may not be accurate (Deaton, 2003). Surveys also differ in the amount of items reported and in their treatment of seasonality. In this respect, national accounts present fewer issues as there are some international standards. Since 1993, national accounts have been compiled following a protocol that defines what is and what is not a

21 We do not deal with measurement issues in developed countries here, as our study is more concerned with poverty in less developed countries. For a discussion of surveys and national accounts in the USA and the UK, see Deaton (2003).

part of consumption and GDP (Deaton, 2003). The general principle is that GDP includes goods and services exchanged, and non-exchanged goods (e.g. food produced for one's own consumption) but excludes non-exchanged services (e.g. the home education of children). However, these international standards are not consistently implemented (Ravallion, 2003), therefore the comparability of national accounts estimates may be only marginally better.

Finally, we should bear in mind that different surveys, countries and periods require different equivalence of scale and this complicates comparative analysis further.

In sum, neither source of data is without its problems: surveys present more challenges compared to national accounts in terms of comparability over time and across countries. This is mainly due to issues in coverage and procedures such as equivalence of scale. However, despite this disadvantage we argue that surveys are still better suited to measuring poverty in developing countries, for two main reasons. First surveys provide a direct measure of poverty while national accounts are design to provide information about macroeconomic aggregates (Deaton, 2003). Second, surveys provide better estimates of non-market transactions, which are especially important when analysing developing countries as we are. With these issues in mind, we now discuss how the WB estimates monetary poverty.

3.3 The World Bank poverty line

In the previous sections we argued in favour of using an absolute monetary measure of poverty. In this final section, we explain the rationale for using a specific monetary measure: that developed by the WB. The "dollar-a-day poverty line" is the most well-known indicator calculated by the WB that is based on a monetary approach. Using 675 household surveys, the WB provides estimates of the poverty line from 1981 to 2005 at three-year intervals for 116 developing countries. The approach consists of calculating a poverty line according to a common standard, set with reference to the poorest countries. In this way, individuals with the same purchasing power are treated in the same way regardless of whether they live in rich or poor countries (Chen and Ravallion, 2008). The new WB poverty line has been calculated as the mean of the national

poverty line of the poorest 15 countries[22]. The method involves converting national poverty lines into a common currency in order to calculate the minimum standard, and then converting the common poverty line back into national currency. It is necessary to do the latter in order to calculate the number of poor in each country using household surveys (Deaton, 2001). These calculations are carried out using PPP exchange rates[23], so as to reflect differences in the prices of goods and services across countries. PPP exchange rates are based on the local International Comparison Program (ICP). ICPs collect data on basic goods and services deemed to be comparable across countries. Several ICPs have been employed over the years to estimate PPP exchange rates. The most recent ICP dates back to 2005 and was used to estimate the poverty count for 2005 and to update all poverty estimates as far back as 1981[24]. Using the most recent data, the poverty line has been set at $1.25 per day. The WB also calculates an upper threshold of poverty. For example, the $2 per day poverty line is the median across all developing countries. The WB poverty lines are then used to calculate the number of poor in each country using household surveys.

The WB poverty measure has the strength of defining poverty in a simple and accessible way that is suitable for international comparison (United Nations, 2010). Moreover, the household surveys used for the poverty calculation provide the greatest internationally comparable coverage in terms of time and countries. Ravallion (2003) notes that, despite their limitations, the surveys used by the WB are the only ones to meet certain quality criteria, namely to be nationally representative, to include comprehensive consumption or income aggregates and to allow for the construction of a weighted distribution of consumption or income per person. The WB researchers worked on the last of these requirements quite recently. In the WB's surveys, poverty is assessed using per capita income or consumption, although, whenever possible, consumption is used rather than income. Chen and Ravallion (2008) explain that consumption is a better measure than income for both practical and theoretical reasons, as discussed above.

[22] In most cases the national poverty lines used by the WB are based on the CBN (Ravallion et al., 2008).

[23] "The number of currency units required to buy goods equivalent to what can be bought with one unit of the currency of the base country; or with one unit of the common currency of a group of countries" (United Nations, 1992).

[24] The first time that the dollar-a-day poverty line was calculated was in 1985. To do this, the bank calculated the poverty line in eight poor countries to determine a typical poverty line. The calculation converted the national currencies into 1985 PPP. In 2000, the WB revised its estimate and calculated the poverty line on the basis of 33 countries.

Indeed, income is harder to measure, especially in poorer countries, as it may be subject to fluctuation due to risks and seasonality, or simply because income is a looser concept. Out of 675 surveys, 417 estimate the distribution of consumption. This holds for all regions except South America, where income surveys are more common. The WB acknowledges that consumption is by no mean a perfect indicator of personal welfare, as it neglects many non-market components, such as sanitation and infrastructure, and therefore additional indicators should be used to assess living standards.

The use of the poverty line as defined by the WB has attracted much criticism, both at conceptual and practical levels. Most of the conceptual arguments are related to the monetary approach itself and, as such, they were discussed in Section 2.1 of this chapter. We therefore now focus on the practical caveats.

First, despite improvements, many issues remain in terms of comparability across surveys, as survey design tends to vary across time and countries (Deaton and Grosh, 2000; Ravallion, 2003). The WB has tried to address the comparability problem. One attempt is the Standardized Files and Standardized Indicators (SFSI) that aims to improve comparability through the development of a framework for the implementation of household surveys. The SFSI recommend a common set of variables to ensure good quality and transparency of data (World Bank, 2011).

Second, there are a number of issues related to PPP exchange rates. It has long been discussed that, for carrying out comparisons of macroeconomic aggregates across countries, market exchange rates are inadequate. Market exchange rates tend to equate purchasing power in terms of traded goods but not non-traded goods. It is now established that comparisons based on market exchange rates tend to underestimate developing countries' real income (Summer and Heston, 1991). For this reason, international comparisons have been made using PPP exchange rates, which take into account traded and non-traded goods. A crucial problem with this is that PPP varies according to the weights assigned to various commodities[25]. Choosing a set of goods and services and assigning weights is challenging as the importance of goods and services varies across countries, due to different prices, income distributions and tastes. The Ryten Report (UN, 1998) strongly criticised the previous measure of PPP used by

[25] Rogoff (1996) provides a full review of the issues related to PPP.

the WB as it did not clearly identify a set of internationally comparable items. The report highlighted how non-traded goods are harder to compare than traded goods, and it stressed the need for a detailed list of comparable products. The ICP 2005, which was used to calculate current PPP rates, took on board many of the recommendations from the Reyten Report (UN, 1998). Ravallion et al. (2008) discuss the improvements made to the most recent ICP. They include better surveys, stricter criteria for comparing the quality of goods, new and more detailed product listings and pricing. For example, the number of countries participating in the price surveys grew from 117 in 1993 to 146 in 2005 (Ravallion et al., 2008). In terms of price information, the ICP collected region-specific prices of goods and services, which it grouped into 155 categories, comparable across countries (Ravallion et al., 2008). The 2005 ICP and the related PPP rates have therefore improved upon several weaknesses of the previous poverty calculations. Notwithstanding the improvements, some issues remain. For example, the current selection of goods and services used to calculate PPP is still open to discussion. An alternative solution would be to build a PPP that weights the consumption bundle of the poor (Deaton, 2001; Ravallion, 2002). However, this would be difficult, as there is currently no data available on the consumption bundles of different income groups.

The new PPP rates led the WB to recalculate previous poverty estimates, which has caused some concerns. Different PPP exchange rates weight commodities in different ways, as they reflect changing patterns of consumption. This in turn can have a substantial effect on poverty estimates (Reddy and Pogge, 2002). One concern is that, while recent PPP measures are more appropriate for assessing recent poverty, they are less adequate to assess poverty in the past (Reddy and Pogge, 2002). Revising PPP has had a large effect on poverty estimates, both in terms of levels and changes, undermining confidence in the calculations (Deaton, 2001; Ravallion et al., 2008). The WB argues that the bias affects the old rather than the new estimates. In fact, the old poverty calculation underestimated the PPP of the poorest countries (Ravallion et al., 2008). Recently, the bank's new poverty estimates have found that the number of people living below the poverty line is much higher than previously thought (Chen and Ravallion, 2008).

In this section, we have discussed how the WB calculates the widely used "dollar-a-day" line. The methodology has some clear advantages, such as providing a wide amount of

data, comparable across space and time. Moreover, both data and methods are highly transparent, and the WB has made public all the changes implemented. Over the years, the WB has made progress in several areas of the measurement of poverty, especially concerning the quality of the data. Nevertheless, there is still scope for improving both the data and the methodology. For instance, the ICP collects data on the price paid by consumers at a specific point of sale, which is often the price paid in the formal sector in urban centres. One issue is that the price paid by the poor may differ because of where they buy, the quantity they buy or their social status; this may result in some bias (Ravallion et al., 2008). In the future, the availability of better quality data should allow similar issues to be dealt with.

4. Conclusion

Poverty reduction is at the top of international and national political agendas, especially in developing countries, where poverty rates are undeniably high. Despite being a commonly accepted political goal (e.g. through the MDGs), the definition of poverty remains controversial. In this chapter, we first discussed the most common conceptual approaches to poverty and then we focused on measurement issues. As the choice of poverty measurement has significant implications for the quantification of poverty, the issues addressed in this chapter need to be discussed before undertaking any empirical analysis. The discussion on definition and measurement carried out here provides a sound foundation for the choice of indicator used in the following empirical chapter. Moreover, the definition and measurement of poverty are important not only for analytical purposes but also for policy making. Measurement is especially important in the policy context as it provide guidelines and targets to be achieved.

In terms of the theories of poverty, we reviewed the monetary and capabilities approaches, that are often used by economists. Within the monetary approach, poverty is interpreted as deprivation of income. Traditional microeconomic theory underpins the monetary approach, with welfare seen as the outcome of actions taken by utility-maximising individuals. Utility is achieved through consumption or income. Fundamental theoretical criticism of the monetary approach has led to the formulation of the capabilities approach (Sen, 1983, 1985). Within Sen's framework, poverty is seen as a failure to achieve multiple objectives, which are not purely confined to the

monetary space. For example, Sen highlights that other dimensions of poverty, such as lack of education, health or human rights, are crucial to human well-being. The capabilities theory represents a major contribution to the theoretical and practical discussion on the meaning of poverty. The contributions of Sen's work are not confined to the academic world but can also be seen in policy work. For example, especially in developed countries, there has been an increasing emphasis on targeting deprivation in housing, health and education (United Nations, 2010). Thus, the concern with poverty as a purely monetary phenomenon has expanded. Despite this, there are difficulties when measuring multiple aspects of poverty, and it is particularly challenging to create a multidimensional indicator that can be used for cross-country and temporal comparisons. In spite of the increasing consensus that poverty is a multidimensional phenomenon, empirically, the monetary approach remains dominant.

In terms of the measurement of poverty within the chosen approach, we discussed the steps needed to build a poverty indicator. Once the space in which poverty is to be investigated has been defined, it is necessary to choose a welfare indicator and its associated poverty line. The monetary approach measures poverty as a shortfall from a set threshold known as the poverty line. The poverty line is usually defined in terms of consumption or income. Although there are different ways of defining a poverty line, the choice between alternatives is often driven by data availability. The WB's "dollar-a-day" is an established instrument for measuring poverty and is widely used in international comparative studies. It relies on a large amount of data and the methodologies it uses to construct the indicators are highly transparent. On this basis, the chapter makes a case for using the dollar-a-day poverty line in the empirical analysis of the following chapter, highlighting the difficulties over consistency in the other methods. The choice of poverty indicator is driven by a desire to investigate the drivers of poverty reduction across countries and time using the best data available. This is a meaningful objective as academics and policy makers are still debating the best ways of reducing poverty. Moreover, our empirical analysis relates to important policy debates. For instance, the reduction of monetary poverty, as defined by the WB, is a central target of the MDGs.

References

Alkire, S. (2002), *Valuing Freedoms: Sen's Capability Approach and Poverty Reduction*, Oxford: Oxford University Press.

Atkinson, A.B. (1975) *The economics of inequality*. Oxford: Oxford University Press,

Atkinson, A.B. (1989) *Poverty and Social Security*, London: Harvester, Wheatsheaf, 1989

Bourguigon, F. And Chakravarty, S.R. (2003) "The Measurement of Multidimensional Poverty*" Journal of Economic Inequality*, 1: 25-49

Citro, F. and. Michael, R. T. eds.,(1995) *Measuring Poverty: A New Approach* Washington, DC: National Academy Press,

Chambers, R. (1994) "The origins and practice of participatory rural appraisal" *World Development*
Volume 22, Issue 7, July 1994, Pages 953-969

Cheli, B. And Lemmi, A. "A Totally Fuzzy and Relative Approach to the Measurement of Poverty" Economic Notes, 24 (1), pp.115-134, 1995

Chen, S. and Ravallion, M. (2008) "The Developing World is Poorer than we thought, but not less successful is the fight against poverty" Policy Research Working Paper, 4703, World Bank

Clark, A. E. and Oswald, A.J. (1994) "Unhappiness and Unemployment". *Economic Journal*, 104(424), pp. 648–659.

Clark, A.D. (2006) The *Elgar Companion to Development Studies* , Chelteman, Edward Elgar

Coudouel,A., Hentschel, J.S. and Wodon, Q.T. (2002), *Poverty Measurement* and Analysis, in the PRSP Sourcebook, *World Bank*, Washington D.C.

Dandekar, V.M, and Nilkanth Rath (1971), Poverty in India, Indian School of Political Economy.

Deaton, A. (1997) "The Analysis of Household Surveys: A Microeconometric Approach to Development Policy" The World Bank, Washington Dc

Deaton, A. (2001) "Counting the World's Poor: Problems and Possible Solution," *World Bank Research Observer* 16, 125-148.

Deaton, A. (2003) "Measuring poverty in a growing world (or measuring growth in a poor world)", NBER Working Paper, 9822,

Deaton, A. and Grosh, M. (2000) "Consumption", in Grosh, M, and Glewwe, P. Designing *Household questionnaires for developing countries: Lesson from fifteen years of the living standard measurement study,* Washington DC, WB (1), 91-133,

Desai, M. (1995) "Poverty and Capability: towards and Empirically implementable measure" in *Poverty, Famine and Economic Development: Selected Essay of Meghnad Desa*i, Volume II, Adelshot, UK and Vermont, Edward Elgar Publishing Company, pp.185-204

Easterlin, R. A. (1974). "Does Economic Growth Improve the Human Lot? Some Empirical Evidence." In *Nations and Households in Economic Growth,* edited by Paul A. David and Melvin W. Reder. New York: Academic Press.

Eurostat, (2011) "Living Condition Statistics" available at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Living_conditions_statistics#At-risk-of-poverty_rate_and_threshold

Frey, B. S. and Stutzer, A. (2000) "The Economics of Happiness," *World Economics*, 3(1): 1-17.

Foster, J.E. (1998) "Absolute versus Relative Poverty" *The American Economic Review*, Vol.88, No.2,

Hagenaars, A and de Vos, K. (1988) "The Definition and Measurement of Poverty", *The Journal of Human Resource*s, Vol. 23 No.2, pp. 211-222

Hagenaars, A. J.M. (1986) *The Perception of Poverty*, Amsterdam, North Holland, Publishing

Greer, J. and Thorbecke, E. 1986, 'A Methodology for Measuring Food Poverty Applied to Kenya', *Journal of Development Economics,* Vol.24, pp.59-74.

Graham, C. (2005) "The Economics of Happiness. Insight from Globalisation of a Novel Approach" *World Economics*, Vol. 6, No. 3.

Goedhart, T., Halbertadt, V., Kapteyn, A. and Van Praag, B.M.S. (1977) "Poverty Line Concept and Measurement", *Journal of Human Resources*, 12 (4), 503-20

Laderchi, C. (2007) "The Monetary Approach to Poverty: A Survey of Concepts and Methods" In Stewart, F., Saith, R. and Harris-White, B. *Defining Poverty in the Developing World*, Palgrave MacMillan, New York, 2007

Lewis, G. W. and Ulph D. T. (1988) "Poverty, Inequality and Welfare" *The Economic Journal*, Vol. 98, No. 390, Supplement: Conference Papers, pp. 117-131

McLeod, D. (2007**) "**Is Poverty increasing in Bangladesh**?** Reconciling national and global monitoring estimates". Final report to UNDP-BDP Poverty Group, New York

Nussbaum, M. C. (1988) "Nature, Function and Capability: Aristotle on Political Distribution" *Oxford Studies in Ancient Philosophy*, Supl. Vol., 145.84.

Nussbaum, M. (2000) *Woman and Human Develoment: A Study in Human Capabilities*, Cambridge, Cambridge University Press

Orshansky, M. (1965) "Counting the Poor another look at the poverty profile", *Social Security Bullettin*, 28:3-29,

Quizilbash, M. (1998) "Poverty, Concept and Measurement" Sustainable Development Policy Institute Research Report Series 21, Islamabad, Pakistan

Qizilbash, M. And Clark, DA (2005) "The capability approach and fuzzy poverty measures: an application to the South African context", *Social Indicators Research,* Volume 74, Number 1, 103-139

Osmani, S. (1982). Economic Inequality and Group Welfare. Oxford: Oxford University
Press

Oswald, A. J. (1997) "Happiness and Economic Performance," *Economic Journal*, 107(445), 1815-1831.

Paul, S. (1989) 'A Model of Constructing the Poverty Line', *Journal of Development Economics,* Vol.30, pp. 129-44.

Ravallion, M. (1998) "Poverty Line in theory and practice" World Bank, Working Paper 133

Ravallion, M. (2002) *How not to count the poor: A replay to Reddy and Pogge,* Washington DC, World Bank,

Ravallion, M. (2003) "The debate on globalisation poverty and inequality: Why Measurement Matter", *International Affair* Vol. 79, No. 4, July 2003, pp.739-753

Ravallion, M., S. Chen, and P. Sangraula (2008). "A Dollar a Day Revisited." World Bank Policy Research Working Paper WPS 4620 ,

Reddy, S.G. And Pogge, T.W. (2002) *How not to count the poor*. New York, Barnard College

Rogoff, K. "The Purchasing Power Parity Puzzle", *Journal of Economic Literature*, Vol.34 : 647-68; 1996

Rowntree, B.S. (1902) *Poverty: A Study of Town Life. Centennial edition.* Bristol: The Policy Press, 2000

Ruggles, R. and Ruggles, N.D. (1986) "The Integration of Macro and Micro Data for the Household Sector", *Review of Income and Wealth,* 32, 245- 276.

Saith, R. (2007) Capabilities: The Concept and Its Implementation in Stewart, F., Saith, R. and Harris-White, B. (2007) *Defining Poverty in the Developing World*, Palgrave MacMillan, New York

Sen, A.K. (1976) "Poverty an Ordinal Approach to Measurement" *Econometrica*, vol. 44, no.2:219-31,

Sen, A.K. (1979): "Issues in the Measurement of Poverty," Scandinavian Journal of Economics, 81, 285-307.

Sen, A.K. (1981) *Poverty and Famines: an Essay on Entitlement and Deprivation*, Oxford, Oxford University Press

Sen, A.K. (1983) *Choice, Welfare and Measuremen*t, Cambridge Massachusetts and London: Harvard University Press,

Sen, A. (1983), "Poor, Relatively Speaking", Oxford Economic Papers, 35.

Sen, A.K. (1985) *Commodities and Capabilities,* Amsterdam, Elsevier, New Delhi: Oxford University Press,

Sen, A.K. (1997) *On Economic Inequality: with a substantial annexe on "On Economic Inequality after a Quarter Century" by J.Foster and A.Sen,* 2nd Edition, Oxford Claredon Press,

Sen, A. K. (1999), *Development As Freedom*, Oxford: Oxford University Press.

Stewart, F., Saith, R. and Harris-White, B. (2007) *Defining Poverty in the Developing World*, Palgrave MacMillan, New York.

Summer, R. And Heston, A. (1991) "The Penn World Table (Mark5): an Extended Set of International Comparisons, 1950-1988" *Quarterly Journal of Economics*, 106: 327-368

Townsend, P. (1979) *Poverty in the United Kingdom*, Harmondsworth, Penguin Book,

Williams, B. (1987), .The Standard of Living: Interests and Capabilities., in Geoffrey Hawthorn (ed.), *The Standard of Living*, Cambridge: Cambridge University Press, pp. 94.102.

Wodon, Q.T. (1997) Food energy intake and cost of basic needs: Measuring poverty in Bangladesh *Journal of Development Studies*, Volume 34, Issue 2

World Bank*, (*2008a) "Comparison of new 2005 PPP with Previous Estimate*"*, Revised appendix G to, Washington DC, World Bank,

World Bank (2008b) "Global Purchasing Power Parities and the Real Expenditure. 2005 International Comparison Program" Washington DC, World Bank

World Bank. (2008c) "Lessons from World Bank Research on Financial Crises." World Bank
Policy Research Working Paper 4779. Washington, D.C.

World Bank (2011) "Millennium Development Goals" available at http://www.worldbank.org/mdgs/

Veenhoven, R. (2002) Why Social Policy Needs Subjective Indicators, Social *Indicators Research Series*, 2002, Volume 11, Part I, 33-45,

United Nations (1992) *Handbook of the International Comparison Program,* Series F No. 62., United Nations, New York.

United Nation (1998). *Evaluation of the International Comparison Programme, (Ryten Report).* United Nations**,** New York

United Nation (2010). *Rethinking Poverty. Report on the World Social Situation 2010*. United Nations**,** New York

Chapter 2 – "Inequality, Economic Growth and Poverty Reduction: What Can We Learn from Macro Data?"

Abstract

In this paper we employ the system generalised method of moments (GMM) estimator to investigate the responsiveness of poverty to growth in a balanced panel of 111 countries observed at three-year intervals from 1981 to 2005. In particular, we assess the direct and indirect effects on poverty change, of initial poverty, initial inequality and other relevant factors that plausibly condition the impact of economic growth on poverty. To capture the role these variables play in shaping the growth-poverty relation, we consider the interaction between them and mean income change. Our results provide new empirical evidence, in support of Sen (2000), that the ability of the poor to benefit from the proceeds of economic growth is dependent on the presence of certain enabling conditions. In particular, our finding that initial disadvantage decreases the growth elasticity of poverty, confirms that poverty reduction is harder to achieve at higher initial poverty levels, and therefore poverty tends to perpetuate underdevelopment (Azariadis and Stachurski, 2004).

1. Introduction

The eradication of poverty is a central objective of global development policy (World Bank, 2001) and a key component of the Millennium Development Goals (MDGs). Social scientists have long debated means to achieve poverty reduction. In particular, the discussion has centred on two main issues: the actual contribution of economic growth to poverty reduction (i.e. poverty elasticity to growth) and the role of equity (Bourguignon, 2003; Kalwij and Verschoor, 2007). In fact, economic growth and income distribution are interconnected in numerous ways and the effectiveness with which growth translates into poverty reduction depends crucially on the initial distribution of income (Helberg, 2004). Moreover, it has been shown that the poverty elasticity to mean income is influenced by a number of factors that have been identified by the theoretical and empirical literature as sound policy tools for reducing poverty (Besley and Burgess, 2003; de Janvry and Sadoulet, 2000).

In this chapter we empirically investigate the responsiveness of poverty to growth in a panel of 105 countries observed at three-year intervals from 1981 to 2005[26]. In particular, the reduced form we estimate encompasses different lessons that can be retrieved from the literature. First, poverty's response to economic growth depends on both changes in mean income and inequality (Datt and Ravallion, 1992). Second, as suggested by Bourguignon (2003), we take the likely non-linear relation between poverty, growth and inequality into account. That is, following the formal demonstrations by Bourguignon (2003) and Kalwij and Verschoor (2006), we consider how the level of initial (under)development, as measured by initial poverty and inequality, affects the relationship between growth and poverty reduction[27]. Finally, we correct the growth elasticity of poverty for (some of) the factors that condition the impact of economic growth on poverty. These factors include human capital (i.e. schooling, mortality and life expectancy), credit constraints and the institutional environment. Specifically, we consider the interaction between the aforementioned variables and the mean income change. In doing so, we endeavour to unveil the link between economic growth and non-income measures of well-being[28]. In the spirit of

[26] As the motivation behind the chapter is to carry out an empirical analysis of poverty over time and across countries, the chosen measure of poverty is the absolute monetary poverty indicator provided by the World Bank (WB). The previous chapter discussed in detail the features of the indicator used.

[27] This aims at capturing recent discussions on the importance of inequality in poverty reduction.

[28] By doing so, we take into account the lessons from capability theory that were discussed in the previous

Sen (1999), in fact, these factors not only have a direct effect on poverty reduction but also an indirect one, in so far as they provide the poor with greater capabilities to benefit from aggregate economic growth (Foster and Szekely, 2008; de Janvry and Sadoulet, 2000).

Our exercise is implemented using the system generalised method of moments estimator (i.e. sys-GMM) of Arellano and Bover (1995) and Blundell and Bond (1998). This technique has various advantages in the context of dynamic panel data. First, it allows us to control for endogeneity between left and right hand side variables (Foster and Szekely, 2008).[29] Second, it has been proven to be the most efficient of the consistent estimators (Bond et al., 2001). Finally, it allows us to control for cross-country heterogeneity, which is crucial in designing poverty reduction strategies (Bourguignon, 2003).

The present work adds to the existing economic development literature in four distinct ways. First, we carry out an extensive empirical analysis of how the structural context within which growth happens affects growth's capacity to reduce poverty. This provides new empirical evidence on the factors that affect the poverty elasticity to growth. Second, we take advantage of the most up-to-date panel data on poverty from the World Bank's (WB) PovcalNet website. This dataset comprises reliable and comparable poverty estimates, which until now, as far as we know, have been employed only in the work of Lenagala and Ram (2010). Third, we use the dynamic sys-GMM estimator. To date, the majority of studies have employed either the mathematical definition of poverty elasticity, as Lenagala and Ram (2010) did, or ordinary least squares (Adams, 2004; de Janvry and Sadoulet, 2000). Finally, in correcting the poverty elasticity to growth, in the sense explained above, we consider a broad spectrum of developing countries and do not limit our analysis to sub-national units or specific countries. The latter fact implies that the recommendations stemming from our study will be informative for developing countries in general.

Turning to the results, first we show, in line with the existing literature (Bourguigon, 2003; Ravallion 2001, 2009), that while changes in mean income and income distribution are significant and robust determinants of changes in poverty, the effect of growth on the poverty rate is attenuated by past levels of poverty and inequality; more precisely, higher initial poverty and inequality decrease the effect of growth on poverty

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chapter.

[29] See Caselli et al. (1996) for a detailed treatment of endogeneity issues in the context of dynamic panel data.

reduction. Second, we bring new empirical evidence on specific conditions that generate poverty-trap-like mechanisms. We find that increased health, schooling, credit and less conflict decrease the poverty elasticity to growth. The findings suggest that poverty and conditions related to a lower level of development prevent the full realisation of the beneficial effects of growth.

The rest of the chapter is organised as follows. The next section briefly reviews the related literature. Section 3 presents the methodological approach, concentrating in turn on the decomposition proposed by Datt and Ravallion (1992), the reduced form of the estimated model and the sys-GMM estimator. In the fourth section we describe the results, together with some robustness checks. Final comments and possible lines for future research conclude. Details on the variables employed and the data sources are reported in the Data Appendix.

2. Related literature

In the 1990s, improvements in the quantity and quality of available data triggered new research on the relationship between growth and poverty. For example, national accounts were made internationally comparable and more national household surveys were implemented (Heltberg, 2004).

The economic literature on poverty has investigated three key issues: the direct effects of growth on poverty; the interconnections between growth, inequality and poverty; and the relations between growth, poverty and other variables, such as human capital, institutional and financial development, macroeconomic stability and structural change. Obviously, given their objects of interest, these studies overlap to a large extent.

Concerning the first stream of literature (i.e. the direct effects of growth on poverty), a number of researchers have argued that growth is good for the poor. This claim is supported by empirical research showing that, in the 1980s and 1990s, the number of poor people decreased substantially (Ravallion and Chen, 1996; Romer and Gugerty, 1997; Ravallion, 2001; Dollar and Kraay, 2000; Bhalla, 2002; Bourguigon and Morrison, 2002; Dollar and Kray, 2004). This type of work usually regresses growth in the income of the poor (defined as the lowest quintile of income distribution) on GDP per capita or average mean income. One of the key contributions to this literature is the study by Dollar and Kraay (2004). Their empirical analysis shows that the income of the poor increases equiproportionately with the average income. Dollar and Kraay's result is

particularly important as it has been used to actively promote the idea that economic growth is the prime factor in reducing poverty. Notwithstanding its popularity and policy impact, the study has been criticised on both conceptual and technical grounds (Ravallion, 2001; Lubker et al., 2002; Mosley, 2004). Without going into detail about all these critiques, two points are particularly important. First, observing a one-to-one relationship between the lowest quintile and GDP per capita does not imply that growth affects all income quintiles in the same way. Rather, as Ravallion (2001) points out, the finding simply shows that lower income groups gain less from growth when compared to other income groups. Second, empirical evidence shows that growth alone is not sufficient to reduce poverty and that a number of variables can have a detrimental effect on poverty[30]. The strands of literature discussed in the following section further investigate these issues.

Turning to the inter-relations between poverty, mean income growth and inequality, the literature has analysed the direct and indirect effects of inequality and income growth on poverty reduction. Concerning inequality, the models formalising the income growth – inequality nexus argue that inequality tends to retard growth (Persson and Tabellini, 1991; Alesina and Perotti, 1993; Alesina and Rodrik, 1994; Keefer and Knack, 2000). This might be due to credit market imperfections (Piketty, 1993; Galor and Zeira, 1993; Aghion and Bolton, 1997;), taxation and redistribution (Perotti, 1993; Benabou, 1996; Alesina and Perotti, 1996; Aghion and Bolton, 1997), political instability (Alesina and Perotti, 1996; Glaeser et al., 2003) or downwardly flexible wages (Akerlof and Yellen, 1990; Galor and Tsiddon, 1997; Hassler and Mora, 2000). In the context of poverty reduction, greater inequality negatively affects poverty through its effect on economic growth. One empirical study that explicitly links poverty, growth and inequality is that of Chen and Ravallion (1996). The authors regress the change in the poverty headcount against changes in income and distribution in a cross-section of countries, estimating the relationship using ordinary least squares (OLS). They find strong evidence that higher rates of growth are associated with poverty reduction. They also find that changes in income distribution do not have a significant impact on poverty. This, in turn, leads to the conclusion that the distributional changes linked to growth do not offset the positive effect of growth on poverty reduction. Dollar and Kraay (2004),

[30] For example, Mosley (2004) regresses the change in poverty headcount against GDP growth, pro-poor expenditure proxies, a social capital indicator, the Gini coefficient and a conflict indicator. The pro-poor expenditures considered are primary health, agricultural research and extension, rural water and sanitation. He finds that when all variables except inequality are included, the only significant regressor is agricultural wage, while GDP growth is not significant.

meanwhile, use variance decomposition to assess the contributions of growth and inequality to poverty. Their findings reinforce Chen and Ravallion's (1996) conclusion, showing in fact that, although poverty is largely accounted for by the sum of growth and distribution components, growth is relatively more important than inequality. However, the contribution of growth to poverty seems to be lower in the medium-run than in the long-run, and when poverty measures are bottom-sensitive. Voitchovsky (2005) analyses, instead, the effects of inequality on economic growth in a panel of 25 industrialised countries, observed at 5-year intervals between 1970 and 1995. Her GMM estimates show that inequality at the bottom end of the income distribution is negatively related to subsequent growth. Thus, inequality undermines the "trickle-down" effects of growth. Other empirical studies showing that inequality hampers poverty reduction are those by Birdsall and Londono (1997) and Ghura et al. (2002). Concerns that distributional changes may offset growth changes have been raised by the results of White and Anderson (2001) and Bourguignon (2003).

The literature on the inter-relation between growth, poverty and inequality has also analysed the role of initial inequality and income. It is usually assumed that a higher level of inequality at the beginning of a spell[31] negatively affects the impact of growth on absolute poverty. This is because higher initial inequality means that the poor have a lower share of both total income and its growth (Ravallion, 1997). There is increasing empirical evidence in support of the hypothesis that high inequality decreases the effectiveness of growth in reducing poverty (Fosu, 2009; Lopez and Serven, 2006; Bourguignon, 2003; Epaulard, 2003; Ravallion, 1997, 2001)[32]. Turning now to initial income, the rationale for analysing its effect on the poverty elasticity to growth can be regarded as an extension of convergence theory. Typically, convergence theory predicts that lower levels of GDP per capita are associated with faster growth and therefore with greater poverty reduction (Sala-I-Martin, 1996). This is controversial though, as it may be that countries with higher growth have better economic institutions (e.g. labour markets) that enhance the beneficial effects of growth (de Janvry and Sadoulet, 2000). In the study of poverty reduction, scholars have also investigated how the level of development (Bourguigon, 2003; Kalwick and Verschoor, 2007) and initial poverty

[31] Heltberg (2004) defines spells as "instances where two or more comparable household surveys are available from the same country at different points of time".

[32] The role of initial inequality has also been analysed in the growth literature. Alesina and Rodrik (1994), Persson and Tabellini (1994), Birdsall et al. (1995), Clarke (1995), Perotti (1996), Deininger and Squire (1998) and Knowles (2005) all find evidence that higher initial inequality retards growth. However, not all the evidence has been supportive of this argument; see for example Barro (2000) and Forbes (2000).

(Ravallion, 2009; Lopez and Serven, 2006) affect the growth-poverty relationship. Empirical evidence shows that higher initial poverty and low development reduce the poverty elasticity to growth (Ravallion, 2009; Kalwij and Verschoor, 2007; Lopez and Serven, 2006; de Janvry and Sadoulet, 2000). This could be due either to numerical effects (Bourguignon, 2003) or to the higher "unequalising" effects of growth (de Janvry and Sadoulet, 2000).

The last relevant strand of the literature is that investigating which variables, other than the initial level of income and inequality, might affect the poverty elasticity to growth. The majority of these studies have been carried out in the last decade, and most have an empirical focus. This literature places increasing research emphasis on the so-called pro-poor growth factors. Paraphrasing Chen and Ravallion (2003), these can be defined as policy tools that allow growth to be pro-poor or, put differently, can help in reducing poverty. This in turns means that the growth elasticity of poverty might change in the presence of such factors. Typically, such pro-poor growth variables have been related to human capital, financial and institutional development, macroeconomic stability and greater openness. Good reviews of these topics can be found in Besley and Burgess (2003) and de Janvry and Sadoulet (2000). In what follows we review the available evidence on the relevant pro-poor factors that we have employed in our empirical exercise.

Starting with human capital, this concept encompasses both education and health (i.e. nutrition, life expectancy, infant mortality and so on). Intuitively, improving human capital facilitates pro-poor growth through its impact on living standards, employment opportunities and entrepreneurial opportunities, as well as through positive externalities (Dreze and Sen, 2002). There is some empirical evidence that human capital affects the poverty elasticity to growth. For example, de Janvry and Sandoulet (2000) and Chibber and Nayyar (2007) find that higher levels of secondary schooling make income growth more effective at reducing poverty. However, education also has a direct effect on poverty. Psacharopoulos et al. (1995) discuss the idea that a higher enrolment ratio can increase the productivity of the poor. Empirically, Duflo (2001) finds that an increase in education leads to an increase in income, which is consistent with other evidence. This suggests that education can be used to reduce poverty both directly and indirectly (by encouraging growth and redistribution). Similar reasoning can be applied to health conditions. In this respect, the work of Sahn and Younger (2006) appears particularly interesting.

Passing on to credit availability and financial development, despite economic growth, many poor individuals remain credit constrained due to their inability to secure assets (Binswanger et al., 1995; Carter, 2004). Chibber and Nayyar (2007) argue that increasing credit to the private sector can augment the effectiveness of growth as it allows more entrepreneurs to start businesses[33]. In particular, they find that the interaction between credit and income growth significantly increases poverty elasticity to growth. Financial development also has direct impacts on poverty by facilitating access to credit and improving risk sharing and resource allocation (Ghura et al, 2002). Moreover, Beck, Demirguc-Kunt and Levine (2004) find that financial development disproportionately reduces poverty through its impact on income inequality.

Institutions have also been discussed as factors that may affect the growth elasticity of poverty. However, the role that institutions play in the poverty-growth relationship has received less attention compared to the channels discussed above. Chibber and Nayyar (2007) find that a reduction in regulations enhances the poverty elasticity to growth. Employing instrumental variable estimators, Tebaldi and Mohan (2010) show that the control of corruption, together with governmental effectiveness and the stability of the political system, creates the conditions required to promote economic growth, minimise income distribution conflicts, and reduce poverty.

Overall, the literature reviewed here highlights that growth is undeniably important to economic development. Despite this, there is a substantial debate on the effectiveness of economic growth in reducing poverty. In what follows, we explore this issue by analysing how the initial levels of poverty and inequality and selected pro-poor factors affect the poverty elasticity to growth.

3. Methodology

3.1 Growth elasticity of poverty

We follow the literature in assuming that poverty is measured through one of the family of Foster-Greer-Thorbecke (FGT) (1984) poverty measures[34]. This allows the researcher to fully characterise poverty as a function of the poverty line (z), the mean of the distribution (m), and the Lorenz curve (L) (Sahn and Younger, 2006). Slightly more formally, poverty in country i at time t is written as:

[33] Rajan and Zingales (1998) provide an extensive literature review on financial development and growth.

[34] The FGT poverty measures include the poverty headcount, the poverty gap and its square. A detailed discussion of these measures can be found in Deaton (2003).

$$P_{it} = P(z/\mu_{it}, L_t) \tag{1}$$

where μ_{it} is the country- and time-specific mean income and L_t is a vector of parameters which define the Lorenz curve at time *t*.

Thus, as discussed by Datt and Ravallion (1992) and Kakwani (1993), if poverty is defined as in equation (1), a change in poverty in country *i* between any two time periods can be decomposed into two distinct terms: the "growth effect", which is a proportional change in individuals' income that leaves the distribution of income unchanged; and the "distribution effect", which is a change in the distribution of relative income that leaves mean income unchanged[35]. Formally, the so-called Datt and Ravallion decomposition is written as:

$$P_{it} - P_{it-1} = (\mu_{it} - \mu_{it-1}) + (G_{it} - G_{it-1}) \quad i = 1....N; t = 1....T \tag{2}$$

On the right hand side, we have the growth effect, the distribution effect and the error term, in terms of first differences because we are interested in the poverty *change*.

Taking equation (2) as the starting point and following Bourguignon (2003) it is possible to derive the growth elasticity of poverty as:

$$\delta_{it} = \lim_{t-1 \to t} \frac{[\Delta G_{it}]/G_{it-1}}{(\overline{\mu}_{it} - \overline{\mu}_{it-1})/\overline{\mu}_{it}} \tag{3}$$

If income distribution is assumed to be lognormal, it can be shown that the income elasticity of poverty, defined as the percentage change in poverty given the percentage change in growth, for a constant level of relative inequality (σ), is:

$$\delta_{it} = \frac{\Delta P}{\Delta \log(\overline{\mu}_i) P_{it-1}} = \frac{1}{\sigma_i} \lambda \left[\frac{\log(z/\overline{\mu}_{it-1})}{\sigma_i} + \frac{1}{2}\sigma_i \right] \tag{4}$$

In equation (4), λ is the ratio of the density to the cumulative function of the normal distribution. Equation (4) implies that the poverty elasticity to growth is a decreasing function of the level of relative inequality and an increasing function of the level of development at time *t*-1 (as defined by the ratio of the poverty line to mean income).

[35] More formal and detailed proofs of the poverty decomposition can be found in Datt and Ravallion (1992) and Bourguigon (2003).

An advantage of deriving the poverty elasticity to growth formally is that it makes it clear that poverty, mean income and inequality are inter-related as they are aspects of the same income distribution (Kalwij and Verschoor, 2007).

3.2 Basic empirical specification

The simplest way of identifying the income elasticity of poverty is by taking the logarithm of equation (2)[36] and estimating the following:

$$\Delta \log P_{it} = \alpha + \beta_1 \Delta \log \mu_{it} + \beta_2 \Delta \log g_{it} + \Delta \varepsilon_{it} \quad (5)$$

In equation (5) the changes in poverty depend on changes in the distribution of income, as measured by Gini, and changes in mean income. Bourguignon (2003) calls this type of model, where the poverty elasticity to growth is taken as constant, the "standard model".

Equation (5) can be extended by allowing the poverty elasticity to growth to vary with the initial level of development and initial inequality, as shown in equation (4). Empirically, this is feasible by estimating the following:

$$\Delta \log P_{it} = \alpha + \beta_1 \Delta \log \mu_{it} * (1 + P_{it-1} + g_{it-1}) + \beta_2 \Delta \log g_{it} + P_{it-1} + g_{it-1} + \Delta \varepsilon_{it} \quad (6)$$

In equation (6) we correct the growth elasticity of poverty for initial inequality and the initial level of development, here measured as the initial level of poverty. The effect of initial inequality has been estimated empirically using a similar specification, by Chen and Ravallion (1997), Bourguigon (2003), Ram (2006), Kalwij and Verschoor (2007) and Ravallion (2009). The literature that corrects the growth elasticity of poverty for the level of development has made less progress; however, examples can be found in Bourguigon (2003), Epaulard (2003) and Kalwij and Verschoor (2007). In this respect, it is worth underlining that we follow Ravallion (2009), and consider the poverty elasticity to growth corrected for initial poverty rather than for the level of development. Of course the two are highly correlated, but as we estimate our model using sys-GMM, it is arguably more appropriate to include the past poverty levels.

[36] As in Adams (2004).

Equation (6) cannot be consistently estimated using OLS as the error terms and explanatory variables may be correlated for two reasons. First, there is simultaneity between left and right hand side variables (i.e. poverty and mean income change). Second, there may be some omitted variables that affect both the dependent and the independent variables. Third, the necessary non-orthogonality between unobserved heterogeneity and the lagged dependent variable is not satisfied. We follow Kalwij and Verschoor (2007) and estimate equation (6) using the generalised method of moments estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). This estimator is preferred to the first-differenced GMM (diff-GMM) developed by Arellano and Bond (1991) because the latter suffers from a downward finite sample bias due to weak instrumental variables. That is, when the number of time series observations is small, such as those based on three-year intervals, lagged levels of the variables are only weak instruments for subsequent first differences. The sys-GMM improves on the performance of diff-GMM in small samples by adding further valid instruments. Specifically, a system of equations, in both first differences and levels, is estimated, where the instruments used in the first-differenced equations are the lagged levels of the series, as in diff-GMM, and the instruments used in the level equations are the lagged first differences. Technically, the identification assumptions, from which the necessary moment restrictions are derived, are as follows: no τ order of serial correlation of the idiosyncratic errors, where τ is the time interval considered (i.e. three years); predeterminacy of the initial conditions; mean stationarity restrictions on the initial conditions process. The first two hypotheses are employed to derive the first-differenced GMM estimator. Adding the last one allows the use of lagged first differences of the series instruments for the level equations, so as to obtain the sys-GMM. In particular, such a condition requires that the first moments of the dependent variable series are constant. That is, in this specific case, the means of the dependent autoregressive series, whilst differing across individuals, are constant through time periods for each individual.

The validity of the previous assumption is formally tested through the Arellano-Bond test, which is designed to assess the absence of τ order autocorrelation, and the Hansen test, which is employed to validate the choice of instruments. Nevertheless, there are some caveats to keep in mind. In sys-GMM, the number of instruments tends to increase rapidly with the endogenous variables. This weakens Hansen's test for over-identification and increases the finite-sample bias. To this end, we adopt a specification

that limits the number of instruments. We achieve this, following Roodman (2006), both by limiting the number of lags we use and by collapsing the instrument matrix. The estimates were performed using the "collapse" option that is available in Stata 10 which implies that one instrument is created for each variable and lag distance, instead of for each time period, variable and lag distance. Further, we confirm that our results are consistent with pooled OLS and fixed effects estimates and are robust to plausible specification changes.

3.3 Extensions

We next ask whether the variation in the relationship between growth and poverty is still significant when extending equation (5) by including the effect of a number of pro-poor factors that may condition the poverty elasticity. We consider some of the explanatory variables that have been employed in the most recent literature for shaping the relation between poverty reduction and income growth. We build upon the work of de Janvry and Sadoulet (2000) in considering the direct and indirect roles of human capital, credit constraints and institutions in poverty reduction. The direct effects of the aforementioned factors are measured by the estimated coefficients of the relevant variables. The indirect effects are retrieved from the interaction term between the variable of interest and the mean income change. The latter allows us to present a set of corrected poverty elasticities to growth.

Specifically, we estimate:

$$\Delta \log P_{it} = \alpha + \beta_1 \Delta \log \mu_{it} + \beta_2 \Delta \log g_{it} + P_{it-1} + g_{it-1} + \beta_k X_{ikt-1} + \beta_k (X_{ikt-1} * \Delta \log \mu_{it}) + \Delta \varepsilon_{it} \quad (7)$$

$\Delta \log \mu_{it}$ indicates the mean income change and the k variables are life expectancy, infant mortality, primary and secondary school enrolments, corruption, internal conflict and credit constraints. The values of all these variables are taken at the beginning of the spell so as to minimise the risk of endogeneity. Hence, the sys-GMM specification assumes that the lagged values of these conditioning factors are exogenous, and as such these are included in the instrumental variables set of instruments.

Computationally, the "corrected" poverty elasticities of growth are calculated as the sum of the estimated coefficient of the mean income change (i.e. β_1) and that of the

interacted term (i.e. β_k), conditional on the mean value of the variable involved in the interaction. For example, then, the growth elasticity of poverty, corrected for life expectancy, is calculated as $(\beta_1 + \beta_k * \overline{LE})$, where $\overline{LE}$ stands for the mean life expectancy in the countries included in the estimated regression. Moreover, to analyse the effects of distinct policy manoeuvres in a comparative light, we calculate the corrected growth elasticity of poverty, adding a standard deviation to the base-reference mean value. In this way, we are able to assess how changes in the pro-poor factors analysed may affect the poverty elasticity to growth.

4. Data and Measurement

The data on inequality, income and poverty is taken from the WB's Poverty Monitoring Data Base, developed by Ravallion and Chen (1997). The data set is based on nationally representative household surveys that are used to estimate mean income, inequality and poverty at the country level. The latest estimates are available from 1981 to 2005 at three-year intervals and are based on 675 household surveys in more than 105 low and middle-income countries. The WB has developed an online tool, PovcalNet, that allows users to calculate aggregate poverty at different levels of the poverty line. We used PovcalNet to calculate the poverty headcount, the gap and its square at $38 per month and $60 per month. The $38 per month poverty line is the threshold for extreme poverty[37]. This poverty line, equivalent to consumption of $1.25 a day at 2005 prices, replaces the old "dollar a day". The change in the extreme poverty threshold was the result of the implementation of new price comparison surveys[38]. The $2 a day threshold represents the median poverty line (measured in 2005 PPP terms) of all developing countries.

The poverty headcount, the gap and its square are part of the FGT (1984) class of poverty measures, which includes the indicators most widely used in empirical work[39].

The measures are given by the general expression:

(8)

[37] A detailed discussion of the methodology used to set the WB's poverty line can be found in the previous chapter.

[38] The WB converts national poverty lines into a common currency, and then converts the international poverty line back into local currency to calculate the various poverty indices. The calculations are based on "purchasing power parity" (PPP) exchange rates, which reflect differences in the prices of goods and services across countries. The latest version of PovcalNet uses the PPPs obtained from the 2005 International Comparison Program (ICP).

[39] These measures provide a solution to the aggregation issues mentioned in the previous chapter.

$$P_\alpha = \int_0^z \left[\frac{z-x}{z}\right]^\alpha f(x)d(x)$$

where $\alpha \in \{0,1,2\}$ is a parameter of inequality aversion, z is the poverty line, x is income, and $f(x)$ is the density function of income. When $\alpha=0$, equation (8) gives the headcount ratio, the most frequently used poverty indicator, which measures the share of the population that is below the poverty line, z. In principle the headcount ratio should fall if resources are transferred from the very poor to the less poor. However, this may have a worsening effect on inequality, raising some individuals above the poverty line while pushing others below it. When $\alpha=1$, we get the poverty gap, which weights each poor individual by his/her distance from the poverty line. The poverty gap provides a measure of the depth of poverty. Deaton (2003) comments that this index gives a direct measure of the cost of taking the poor out of poverty. A weakness of both the poverty headcount and the poverty gap, however, is that they are insensitive to income distribution, especially the headcount ratio, as just discussed. Finally, when $\alpha=2$, we have the squared poverty gap, which weights each individual by the square of his/her income shortfall; thus, larger shortfalls are weighted more, proportionately (Lopez, 2006). The squared poverty gap is sensitive to inequality but it is difficult to interpret, therefore few policy makers rely on it.

In our calculation, we focus principally on the headcount index, calculated at two different levels of the poverty line, $1.25 per day and $2.00 per day at 2005 PPP. However, to check for robustness, we also use the poverty gap and its square. The poverty headcount is not only easier to interpret than the poverty gap; it is also the most commonly cited poverty statistic (Collier and Dollar, 2001).

Growth is measured by changes in mean income. We are aware of the debate on whether it is better to use consumption data from surveys or from national accounts (Deaton, 2003), but as there is no consensus, we follow previous studies on poverty (Kalwij and Verschoor, 2007) and use the estimates from household surveys, as provided by the WB.

Inequality is measured using the Gini coefficient. The Gini coefficient is derived from the Lorenz curve, which plots the percentage of the population on the x axis, against the cumulative percentage of income on the y axis. A 45 degree line indicates a situation of perfect equality, with 20% of the population receiving 20% of the income and so on. The Gini coefficient is the ratio between the Lorenz curve and the 45 degree line. It is important to note that there are aspects of inequality which are not captured by

common measures such as the Gini coefficient. For example, it may not capture changes in the middle of the distribution. Despite its limitations, the Gini coefficient does have some advantages. Chen and Ravallion (1996) argue that conventional measures of inequality should satisfy the transfer principle, which states that inequality falls if the new distribution can be obtained from the old one through a set of transfers in which the poorer are the gainers. Of the numerous measures of inequality, the Gini coefficient is the most commonly used one that satisfies the transfer principle.

The sources of the other variables employed in our analysis and the list of usable observations by country are included in Tables A1 and A2 in the appendix. Table A3 contains the summary statistics.

5. Results

In this section we estimate equation (7) in stages so that we can clearly identify the direct and indirect effects of the variables of interest on poverty reduction. In section 5.1 we estimate how the initial distribution of income, as defined by initial poverty and inequality, affects the poverty growth rate and the growth elasticity of poverty. In section 5.2 we analyse how factors, other than initial poverty and inequality, might complement economic growth in reducing poverty. In both parts we focus on the poverty elasticity to growth. Our calculations allow us to analyse how changes in the distribution of income and structural factors (such as education, health and credit) at the beginning of the spell affect the growth elasticity of poverty.

5.1 The effect of initial inequality and poverty

Tables B1and B2, included in the appendix, present four models that analyse the effects of economic growth and the distribution of income on poverty growth, as measured by the poverty headcount at $1.25 a day and $2 a day. In the first model, we only control for inequality and income growth, and the initial levels of poverty and inequality. The second and the third model correct the growth elasticity of poverty, respectively, for initial poverty and inequality. The fourth model corrects the growth elasticity of poverty for both initial poverty and initial inequality. All models include year and regional dummies, which are always jointly significant. The diagnostic tests reported in the tables show that, in all specifications, we can reject the hypothesis that there is second order

auto correlation and the Hansen J statistic is not significant. These statistics support the choice of instruments and therefore indicate that our estimates are reliable.

In all the estimated models, in line with the literature, income changes are negatively related to the poverty rate, while distributional changes have a negative effect. The coefficients of income and inequality are both highly significant. These results hold for both poverty lines analysed ($1.25 and $2 per day). As expected, higher levels of inequality at the beginning of spells increase the poverty rate, while higher levels of initial poverty are negatively correlated with the poverty rate. The latter result on the effect of initial poverty indicates convergence, and contrasts with Ravallion (2009), who does not find evidence of convergence. The poverty elasticity to inequality, as estimated in the fourth model, is 4.6 % for the poverty headcount at $38 per month and 2.4 % for the poverty headcount at $60 per month[40]. The results indicate that the impact of inequality is higher when poverty is more severe. Our estimates of the poverty elasticity of inequality seem slightly higher than other recent studies. For example, Besley and Burgess (2003), using OLS, estimate the poverty elasticity to inequality for the poverty line at $1 dollar a day to be 2.7%.

In determining the growth elasticity of poverty, we need to distinguish model 1 from the others. In the first model, the coefficient of the mean income change gives the unconditional growth elasticity of poverty. In models 2 to 4, because we add the interactions between initial poverty and inequality and changes in mean income, the income growth coefficient gives an estimate of the growth elasticity of poverty conditional on the value of the variable involved in the interaction. The coefficients of the interactive terms are significant, at least when entered in the regression individually. This indicates that both initial inequality and poverty significantly affect the growth elasticity of poverty. In Table 1, we compare the growth elasticity of poverty predicted by the four models (from Tables B1 and B2). We do so for two values of the variables interacted with mean income growth: their mean value and one standard deviation above the mean value.

Table 1

Predicted Income Elasticity of Poverty				
	(1)	(2)	(3)	(4)

[40] As a robustness check we carried out the same calculation for the poverty gap and its square. We found that the poverty elasticity of inequality was higher when we measured poverty by the poverty gap or its square. In this instance, our calculations show that the elasticity of inequality, calculated for model 4, is 5.5 for the poverty gap and 6.2 for the squared poverty gap.

Poverty Headcount at $38 per month			
	-1.2		
At mean value of the interaction	-1.05	-1.12	-2.6
+ one standard deviation	-.18	0.39	-1.76*
% change	82%	65%	36%
Poverty Headcount at $60 per month			
	-0.76		
At mean value of the interaction	-0.72	-0.71	-0.8
+ one standard deviation	-0.1	-0.1	-.09*
% change	86%	85%	88%

In column 1, when we control for initial conditions but the mean income changes are taken as constant with respect to the initial conditions, the growth elasticity of poverty is 1.2% and the distributional changes are significant[41]. Our estimate of the poverty elasticity is in line with other studies that do not take into account the effect of initial conditions on the growth elasticity of poverty. Epaulard (2003), using OLS, estimates the growth elasticity of poverty to be -1.36%. Adams (2004), again using OLS, finds that the growth elasticity of poverty for a poverty line of $1.08 per day, calculated using mean income from a survey, is -5.2%, but obtains a noticeably lower result when using GDP per capita in PPP, of -1.7%. Ram (2006, 2010) instead takes a "direct" approach to estimating the growth elasticity, calculating it as the percentage change in the poverty rate over the percentage change in income. He finds that the elasticity of poverty at a poverty line of $1.25 a day is 1.5 for the 1990s, and 1.6% for the period 1999-2005. In our case, the non-corrected poverty elasticity to growth, as estimated using OLS, is -1.64$. To sum up, Table 1 shows that our GMM estimates of the "non-corrected" growth elasticity of poverty are somewhat lower than estimates obtained with simpler econometric techniques. This indicates that, by not taking into account the endogeneity issues discussed above, empirical studies risk overestimating the effect of economic growth on poverty reduction.

The figures in column 2 show that an increase of one standard deviation in the poverty level from its mean value, which is roughly from the poverty level of Sri Lanka to that of Rwanda or Tanzania, would reduce the poverty elasticity to growth by as much as 82%. In column 3, we show that an increase of one standard deviation in the Gini coefficient from its mean value, which is roughly from the poverty level of Cambodia to that of Guatemala or Angola, would decrease the growth elasticity of poverty by 65%.

[41] In models 1 to 4 all variables are endogenous except the year and region dummies.

Finally, as shown in column 4, an increase in both poverty and inequality would reduce the poverty elasticity by 36%. These calculations, in line with recent literature (Chen and Ravallion, 1997; Bourguigon, 2003; Ram, 2006; Kalwij and Verschoor, 2007; Ravallion, 2009), confirm that higher poverty and inequality at the beginning of the spell decrease the growth elasticity of poverty. For example, Kalwij and Verschoor (2007), using GMM, calculate a poverty elasticity corrected for initial inequality and level of development, and obtain values of -1.5% and -1.43% for the 1980s and 1990s, respectively. Table 1 also shows that the estimates of the growth elasticity of poverty calculated for the poverty headcount at $2 a day are considerably lower than those at the poverty line of $1.25 a day. This result is in line with recent estimates that find lower elasticity at higher poverty lines (Lenagal and Ram, 2010).

Overall, our calculations show that worsening conditions of poverty and inequality substantially decrease the effect of income growth on poverty. While the poverty elasticity estimates are mostly between 1% and 2%, increasing poverty and inequality can render the growth elasticity of poverty extremely low.

5.2 The effect of health, education, credit and institutions on the growth elasticity of poverty

The "Washington consensus" that emerged in the 1980s as the dominant approach to poverty reduction placed great emphasis on the role of economic growth (Besley and Burgess, 2003). However, today there is a growing consensus, supported by theoretical developments and empirical evidence, that growth in income or consumption is not sufficient to reduce poverty. Other conditions are necessary to enable the poor to participate in the growth process (Sen, 1999). As discussed in our literature review, several variables can affect the growth elasticity of poverty. In Tables C1 to C4 in the appendix we show the results of testing the effects of health, education, credit constraints and institutions on the poverty rate and the growth elasticity of poverty. We do this by introducing one term at a time in separate regressions and by interacting each term with the mean income change. In each table, we control for the core variables discussed in section 5.1 above: inequality, income growth and the initial levels of poverty and inequality. The interactive terms between these variables and income growth are highly significant. Again, all estimates include year and region dummies. The Arellano-Bond test for autocorrelation of the residuals and the Hansen test are also

reported. These diagnostic tests mostly show acceptable results, indicating that our estimates are reliable. There are some exceptions, however, for instance when we estimate the effect of corruption and internal conflict, where the Arellano-Bond test rejects the first-order autocorrelation in the residual when it should be accepted. In this instance, the estimates should be interpreted with caution.

Table 2 shows how the introduction of the aforementioned variables affects the growth elasticity of poverty[42]. We calculate the predicted income elasticity of poverty and we do so for two values of the variable interacted with mean income: its mean value and one standard deviation higher than its mean. The effect of an increase in these variables on the growth elasticity of poverty is striking. For instance, an increase of one standard deviation above the mean level of infant mortality, which is equivalent to an increase in mortality from the level of Mongolia to the level of Zambia, decreases the growth elasticity of poverty by 46%, from -1.31% to -0.7%. Similarly, increases in life expectancy, schooling and credit substantially increase the growth elasticity of poverty. For instance, an increase in life expectancy from the level of Bangladesh to the level of Albania would increase the poverty elasticity by 33%. Although the role human capital plays in development is well known (Hanushek and Wößmann, 2008), in the empirical literature its effect on the poverty elasticity to growth seems ambiguous. While Janvry and Sandoulet (2000) and Chibber and Nayyar (2007) find that health and schooling have a significant impact on the growth elasticity of poverty, Epaulard (2003), using a combined indicator of adult literacy, primary schooling and mortality, does not find any significant effects. We provide clear evidence that human capital, as measured by health or schooling, plays a crucial role in enabling economic growth to reduce poverty.

As regards the institutional environment, the effect of corruption is not significant, but internal conflict, as measured by the International Country Risk Guide (ICRG) indicators, has a significant effect on the growth elasticity of poverty. Our calculations show that if the risk related to internal conflict decreases (i.e. the ICRG score increases)

[42] We have also looked at how the structural composition of GDP affects poverty reduction. The labour intensity of growth has been mentioned as one of the factors that may affect the income elasticity of poverty (World Bank, 1990). In Table 3e in the appendix we include in our model three measures of the composition of GDP: employment in agriculture, in industry and in services as a share of GDP. In line with Janvry and Sandoulet (2000), we find that agricultural employment does not significantly affect the poverty rate or the elasticity of poverty to growth. The estimates show that employment in services and in industry increase the poverty elasticity of growth. However, these effects are not robust across the two poverty lines used. The results are not surprising given that existing studies show that the impact of sector-specific employment is likely to vary across countries. For instance, agriculture has played a particularly effective role in reducing poverty in China (Ravallion and Chen, 2007), while in India and Brazil the service sector has played a bigger role (Datt and Ravallion, 1998, 2002).

then the growth elasticity of poverty can increase by as much as 30% if measured using the poverty headcount at $38 per month.

Our results also support recent evidence that credit can improve the effectiveness of growth in reducing poverty. In line with Chibber and Nayyar (2007), we find that the interaction between credit and income growth significantly increases the growth elasticity of poverty. Our calculations indicate that an increase of one standard deviation in credit from its mean, which roughly equates to an increase from the credit level of Senegal to that of Panama, would increase the poverty elasticity to growth by as much as 30%.

Table 2

Predicted Income Elasticity of Poverty		
Interaction	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)
	Health	
Income * mortality (mean)	-1.31	-0.93
Income * mortality (mean + 1sd)	-0.7	-0.35
% change	46%	62%
Income * life expect(mean)	-1.14	-1.05
Income * life expec(mean + 1sd)	-1.64	-1.65
% change	43%	57%
	Schooling	
Income * primary enroll (mean)	-1.8	-1.8
Income * primary enrol(mean + 1sd)	-2.4	-2.4
% change	33%	33%
Income * secondary enroll (mean)	-1.38	-1.4
Income * secondary enrol(mean + 1sd)	-1.7	-1.75
% change	23%	25%
	Institutions	
Income * corruption(mean)	-1.3	-1.2
Income * corruption(mean + 1sd)	-1.49	-1.4
% change	14%	16%
Income * conflict (mean)	-1.38	-1.4
Income * conflict (mean + 1sd)	-1.7	-1.75
% change	30%	25%
	Credit	
Income * credit (mean)	-1.5	-1.1

Income * credit(mean + 1sd)		-1.89	-1.48
% change		26%	34%

6. Robustness checks

Econometric analysis is notably sensitive to the methodology employed and the specification estimated. Moreover, results based on sys-GMM should be interpreted with considerable caution. In fact, the Arellano-Bond and Hansen J tests are sensitive to the choice and number of instruments. Therefore, in order to increase the credibility of our results, we explore the robustness of our main findings using two checks.

6.1 Alternative estimators

Tables D1 and D2 report the core results using the pooled OLS and fixed effects estimators[43]. The estimated coefficient on the lagged dependent variable estimated using OLS (Table D1) is likely to be upwardly biased. This is because it is positively correlated with the unobserved country-specific effects (Hoeffler, 2002). In contrast, the fixed effects estimator (D2) is likely to produce downwardly biased estimates (Nickell, 1981). Therefore, the GMM estimates for the lagged dependent variable should fall between these upper (OLS) and lower (fixed effects) bounds. If this is not the case, the GMM estimates are biased. In most of our estimates, the coefficients on the lagged dependent variable lie in the expected range or are very close to it. Moreover, the reported results show that the interactive terms analysed remain significant and have the expected sign. Hence, this check confirms the appropriateness of the sys-GMM approach.

6.2 Different specification

We also test whether the interactive terms analysed in this section are robust to the inclusion of additional variables. These results are reported in Tables E1 and E2 in the appendix. For each level of poverty line analysed ($38 per month and $60 per month), we estimate five equations. Each specification includes life expectancy, mortality, schooling, credit and internal conflict, the variables we have identified as having a

[43] We report this check only for the poverty line at $38 a month.

significant effect on the growth elasticity of poverty. As additional controls, we also add inflation and trade as a share of GDP. Finally, we control for macroeconomic stability (using the inflation rate) and trade openness. High inflation rates can affect the poor both directly, through the inflation in tax and oscillations in real income (Carduso, 1993; Agenor, 2004), and indirectly through the effect on income distribution (Datt and Ravallion, 1998). The effects of trade openness on poverty have been effectively reviewed by Winter et al. (2004). The identified channels are related to static and dynamic comparative advantages, changes in relative prices and wage increases. The interactive terms between the variable of interest and income growth are introduced individually. Our robustness checks reveal that the interactive terms between growth, and health, schooling, conflict and credit, are robust to the inclusion of additional variables. These terms retain the expected sign and are significant for both levels of the poverty line.

Overall, our empirical analysis stresses that, because of the complexity of the growth-poverty relationship, the pattern of growth is crucial to poverty reduction. We have identified several channels that influence the effectiveness of economic growth in reducing poverty. Our calculations clearly show that, while in some instances growth can have large proportional effects on poverty reduction, an increase in inequality can more than offset this. Moreover, the absence of education, credit and health, and the presence of conflict, can affect the extent to which economic growth trickles down to the poor. Our calculations show that improvements in health and human capital have the largest effects on poverty elasticity, although the relative importance of the various factors analysed is likely to be country and time-specific.

7. Conclusion

The importance of understanding the impact of economic growth on poverty reduction has long been discussed. Despite it now being widely recognised that increases in income and consumption are necessary to reduce poverty, the extent to which the poor benefit from economic growth is still debated. There are two opposing views on the relationship between growth and poverty (Heltberg, 2002). The first is the "trickle-down" theory, according to which the benefits of economic growth automatically enrich the poor. Within this line of thought, growth is the main tool for poverty reduction.

The second view places emphasis on the role of income inequality, and argues that inequality affects the ability of growth to reach the poor. Highlighting the role of inequality does not imply that the importance of economic growth is overlooked. Rather, within this view, growth and inequality are interconnected, and the literature has discussed how inequality can influence the effectiveness with which growth benefits the poor. Although the debate has centred mainly on developing countries, this is a question that is also relevant to developed economies, as shown by a recent debate on the relationship between poverty, inequality and civil unrest, between John Redwood and John Harris, published in the Guardian[44] in the wake of the London riots in August 2011. The debate shows that, while the goal of poverty reduction is commonly shared among political parties, how to achieve it is a more controversial subject. While conservative parties typically support the "trickle-down" view, leftist movements tend to place more emphasis on the importance of income redistribution.

Our paper addresses this question using up-to-date data on developing countries. We make three central claims:

i. Economic growth is a necessary but not a sufficient condition for effectively reducing global poverty.

ii. At the country level, poverty is self-perpetuating. Those countries that start off at low levels of development benefit least from economic growth. The development trap is real.

iii. Institutions matter, not only for economic growth per se, but also for conditioning the impact that economic growth has on poverty alleviation. Where systems of health, education and good governance are in place, the growth elasticity of poverty is highest.

We join an emerging empirical literature analysing the poverty elasticity to growth. We contribute to this literature with a detailed econometric analysis exploring the factors that affect the elasticity, based on the most recent data from the WB database PovcalNet. Following Chen and Ravallion (1997) and Bourguignon (2003), we first estimate the poverty elasticity to growth, corrected for the initial levels of poverty and inequality. In line with the existing literature, we find that higher initial levels of poverty and inequality decrease the effect of economic growth on poverty. In addition to this, we reach out to the broader development studies literature, by testing whether and to what extent the growth elasticity of poverty is influenced by a number of other factors,

[44] http://www.guardian.co.uk/commentisfree/2011/aug/17/rightwingers-care-about-inequality

such as health, education, conflict and credit. The study uncovers a large variation in the growth elasticity of poverty, which depends on the initial levels of poverty and inequality and the aforementioned relevant factors: human capital, and financial and institutional development. Our detailed calculations show that the context within which growth happens conditions the beneficial effect of growth on poverty reduction. The most important contextual features that affect the poverty elasticity to growth are the initial conditions in terms of inequality and poverty, and human capital, as measured by health and education. An increase in inequality by one standard deviation can reduce the impact of economic growth on poverty reduction by as much as 86%. When analysing the role of human capital, our calculations show that an increase of one standard deviation in mortality can decrease the poverty elasticity to growth by 46%. Overall, our results provide new empirical evidence that the ability of the poor to participate in economic growth depends on the presence of some enabling conditions (Sen, 1999). In this instance, economic growth and boosting consumption alone are unlikely to address poverty reduction. By showing that an initial disadvantage, due to greater poverty and inequality, decreases the growth elasticity of poverty, we are confirming that, the higher the poverty level, the harder it is to achieve poverty reduction, and therefore poverty may tend to perpetuate underdevelopment (Azariadis and Stachurski, 2006).

The present study could be extended with a detailed analysis on the responsiveness of poverty to inequality changes. The effect of inequality on poverty is still relatively unexplored. In the spirit of Kalwij and Verschoor (2007), it would be possible to assess how initial conditions of poverty and inequality affect the poverty elasticity of inequality.

References

Adams, R.H. (2004), "Economic growth, inequality and poverty: estimating the growth elasticity of poverty", *World Development,* Vol. 32, pp. 1989-2014.

Agenor, P.R. (2004) "Macroeconomic Adjustment and the Poor: Analytical Issue and Cross Country Evidence" *Journal of Economic Surveys*, Vol. 18(3), pp.351-408.

Aghion, P and Bolton, P (1997) "A Trickle-Down Theory of Growth and Development" *Review of Economic Studies*, Vol 64, pp. 151-172.

Alesina, A. and Perotti, R., (1994). "The Political Economy of Growth: A Critical Survey of the Recent Literature," *World Bank Economic Review*, , vol. 8(3), pages 351-71, September.

Alesina, A. and Perotti, R. (1996). 'Income distribution, political instability, and investment', *European Economic Review*, vol. 40(6), pp. 1203-28.

Alesina, A. and Rodrik, D. (1994) "Distributive Politics and Economic Growth", *Quarterly journal of Economics*, vol. 109 (2), pp. 465-490.

Akerlof, G. A. and. Yellen, J.L. (1990) "The Fair Wage-Effort Hypothesis and Unemployment." *Quarterly Journal of Economics*, Vol. (CV), pp. 255-283.

Arellano, M. and Bover, O (1995) "Another Look at the Instrumental Variable Estimation of Error Component Models." *Journal of Econometrics*, Vol. (68), pp. 29-51.

Azariadis, C. and Stachurski, J. (2004). Poverty traps. In: Aghion, Durlauf (Eds.), *Handbook of Economic Growth.*

Barro, R.J. (2000). "Inequality and Growth in a Panel of Countries." *Journal of Economic Growth*, Vol. 5(1), pp. 5-32.

Beck, T., Demirguc-Kunt, A. and Levine, R. (2004). "Finance, Inequality, and Poverty: Cross-Country Evidence," NBER Working Papers 10979

Besley, T. and Burgess, R. (2003) "Halving Global Poverty," *Journal of Economic Perspectives,* Vol. 17(3), pp. 3-22.

Bénabou, R. (1996) "Inequality and Growth," CEPR Discussion Papers 1450, C.E.P.R. Discussion Papers

Bhalla, S. (2002), Imagine There's No Country: Poverty, Inequality and Growth in the Era of Globalization, Washington, D.C.: Institute for International Economics.

Bhalla, S.S (2004), "Pro-Poor Growth: Measurement and Results", Ahmed, Sadiq and Suman Bery ed. Annual World Bank Conference on Development Economics 2003, World Bank and NCAER, New Delhi.

Binswanger, H., Deininger, K. and Feder, G. (1995), "Power, Distortions, Revolt, and Reforms in Agricultural Land Relations" in Behrman, J. and Srinivasan, T.N. (eds.), *Handbook of Development Economics*, Volume 3, North-Holland: Amsterdam.

Birdsall, N., D. Ross and R. Sabot, (1995) "Inequality and Growth Reconsidered: Lessons from East Asia." *World Bank Economic Review*, Vol. 9, pp.477-508

Birdsall, N. and Londono, J.L. (1997) "Asset Inequality Matters: An Assessment of the World Bank's Approach to Poverty Reduction." *American Economic Review*, Vol. 87, pp. 32-37

Bond, S., Hoeffler, A. and Temple, J. (2001), "GMM Estimation of Empirical Growth Models", mimeo, September 2001.

Blundell, R. and Bond, S. (1998) "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics*, Vol. 87, pp. 115-143

Bourguigon, F. (2003) "The Growth Elasticity of Poverty Reduction: Explaining Heterogeneity across Countries and Time Perdiod", in T. Eicher and S. Turnovsky eds. Inequality and Growth. Theory and Policy IMplications. Cambridge: The MIT Press

Bourguignon, F. and Morrisson, C., (2002) "Inequality among world citizens: 1890-1992. " *American Economic Review*, vol. 92 (4), pp. 727-744, September.

Cardoso, A.T., (1993). "Regional Inequalities in Europe--Have They Really Been Decreasing?" *Applied Economics*, vol. 25(8), pp. 1093-1100, August.

Carter, M. (2004), "Landownership Inequality and the Income Distribution Consequences of Economic Growth" in Cornia, G.A. (ed.), *Inequality, Growth and Poverty in an Era of Liberalization and Globalization*.

Caselli, F., Esquivel, G. and Lefort, F. (1996) "Reopening the Convergence Debate: a New Look at Cross-country Growth Empirics." *Journal of Economic Growth*, Vol. 1(3), pp.363-89.

Clarke, G. (1995) . "More Evidence on Income Distribution and Growth." *Journal of Development Economics*, Vol. 47(2), pp. 403-27.

Chen, S. and Ravallion, M. (1996) "What can new survey data tell us about recent changes in distribution and poverty?," Policy Research Working Paper Series 1694, The World Bank.

Chen, S. and Ravallion, M. (2007) "Absolute Poverty Measures for the Developing World, 1981-2004" World Bank Policy Research Working Paper 4211.

Chen, S. and Ravallion, M. (2008), "The developing world is poorer than we thought, but no less successful in the fight against poverty", Policy Research Working Paper No. 4703, World Bank, Washington, DC, August.

Chibber, A. & Nayyar, G. (2007). "Pro-Poor Growth: Explaining the Cross-Country Variation in the Growth Elasticity of Poverty," Brooks World Poverty Institute Working Paper Series 1407, BWPI, The University of Manchester.

Collier, P. and Dollar, D. (2001), 'Can the World Cut Poverty in Half? How Policy Reform and Effective Aid Can Meet the International Development Goals', *World Development*, Vol.29 (11), pp.1787-1802.

Datt, G. And Ravallion, M. (1992) "Growth and Redistribution Components of Changes in Poverty Measure: A Decomposition with Application to Brazil and India in the 1980s" *Journal of Development Economics,* 38 (2), pp.275-295.

Deaton, A. (2003). "Measuring Poverty in a Growing World (or Measuring Growth in a Poor World)," NBER Working Papers 9822, National Bureau of Economic Research, Inc.

Drèze, J. and Sen. , A. (2002). India: Development and Participation. Oxford and New Delhi: Oxford University Press.

Dollar, D. and Kraay, A. (2002), "Growth is good for the poor", *Journal of Economic Growth*, Vol. 7, pp. 195-225.

Dollar, D. and Kraay, A. (2004), "Trade, Growth, and Poverty," *Economic Journal,* vol. 114(493), pp. F22-F49

Esther Duflo, 2001. "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment," *American Economic Review*, vol. 91(4), pp. 795-813, September

de Janvry, Alain, and Elisabeth Sadoulet. 2000. "Growth, Poverty, and Inequality in Latin America: A Causal Analysis, 1970-94". *The Review of Income and Wealth*, vol. 46(3), pp. 267-288.

Deninger, K. And Squire, L. (1996) "A New Dataset Measuring Income Inequality", *World Bank Economic Review* 10 (3), pp.565-91.

Epaulard, A. (2003), Macroeconomic Performance and Poverty Reduction. IMF Working Paper, Vol. , pp. 1-36.

Forbes, K.J. (2000). "A Reassessment of the Relationship between Inequality and Growth," *American Economic Review*, vol. 90(4), pages 869-887, September.

Foster, J., Greer, J., Thorbecke, E., (1984) "A class of decomposable poverty measures." *Econometrica,* vol. 52, pp. 761–776.

Foster, J.E. and Székely, M. 2008. "Is Economic Growth Good For The Poor? Tracking Low Incomes Using General Means," *International Economic Review*, vol. 49(4), pp.1143-1172.

Fosu, A.K. (2009)"Inequality and the Impact of Growth on Poverty: Comparative Evidence for Sub-Saharan Africa", Brooks World Poverty Institute, BWPI Working Paper 98, (*also in Journal of Development studies*)

Galor, O. and Tsiddon, D. (1997), "Technological progress, mobility and economic growth." *American Economic Review*, Vol. 87(3), 363-382.

Galor, O. and Zeira, J. (1993) "Income Distribution and Macroeconomics," *Review of Economic Studies*, vol. 60(1), pp.35-52.

Ghura, D., Leite, C.A., and Tsangarides, C. (2002) "Is growth enough?: Macroeconomic Policy and Poverty Reduction." IMF Working Paper WP/02/118, International Monetary Fund.

Glaeser, E., Scheinkman, J. and Shleifer, A. (2003) "The injustice of inequality." *Journal of Monetary Economics*, vol. 50, pp. 199–222.

Hassler, J. and Rodriguez Mora, Jose V. (2000) "Intelligence, Social Mobility, and Growth," *American Economic Review*, Vol. 90 (4), pp. 888-908.

Heltberg, R. (2002) "The Growth elasticity of poverty" WIDER Discussion Paper N. 2002/21

Hoeffler, A. (2002) "The Augmented Solow Model and African Growth Debate." *Oxford Bulletin of Economics and Statistics*, vol.64 (2), pp. 135-158

Lenagala, C. and Ram, R. (2010) "Growth elasticity of poverty: estimates from new data", *International Journal of Social Economics*, Vol. 37 (12), pp.923 – 932

Lopez, H. and Serven, L, (2006) "A normal relationship? Poverty, growth, and inequality" Policy Research Working Paper Series 3814, The World Bank

Lubker, Malte, G. Smith and J. Weeks, (2002) 'Growth and the poor: a comment on Dollar and Kraay'*, Journal of International Development,* vol. 14 (July), pp. 555-573.

Keefer, P. & Knack, S. (2000) "Polarization, politics, and property rights: links between inequality and growth," Policy Research Working Paper Series 2418, The World Bank.

Kalwij, A. and Verschoor, A. (2007) "Not by Growth Alone: The Role of the Distribution of Income in Regional Diversity in Poverty Reduction." *European Economic Review*, vol. 51(4), pp. 805-829.

Knowles, Stephen (2005) "Inequality and economic growth: The empirical relationship reconsidered in the light of comparable data." *Journal of Development Studies*, vol. 41, pp.135-159.

Mosley, P. (2004) "Severe Poverty and Growth: a Micro-Macro Analysis", University of Sheffield, Chronic Poverty Research Centre.

Nickell, S.J., (1981) "Biases in Dynamic Models with Fixed Effects" *Econometrica*, vol. 49, pp. 1417-1426.

Perotti, R. (1993) "Political equilibrium, income distribution, and growth" *Review of Economic Studies*, vol. 60, pp. 755-76.

Perotti, R. (1996) " Growth, Income Distribution, and Democracy: What the Data Say" *Journal of Economic Growth*, vol. 1(2), pages 149-87, June.

Persson, T. & Tabellini, G. (1991) "Is Inequality Harmful for Growth? Theory and Evidence" CEPR Discussion Papers 581, C.E.P.R. Discussion Papers.

Piketty, T. (1993) "Imperfect Capital Markets and the persistence of initial wealth inequalities" London School of Economics Suntory Toyota Centre for Economics and Related Discipline Working Paper No. TE/92/255.

Psacharopoulos, G., Morely, S., Fiszbein, A., Lee, H. and Wood, W. (1995). "Poverty and Income Inequality in Latin America during the 1980s" *Review of Income and Wealth*, vol. 41(3), pp.245-64.

Rajan, R. and Zingales, L. (1998) "Financial Dependence and Growth", *American Economic Review*, vol. 88, pp. 559-586.

Ram, R. (2006) "Growth Elasticity of Poverty: Alternative Estimates and a Note of Caution." *Kyklos*, Vol. 59, pp. 601–610

Ravallion, M. (1997) "Can High-Inequality Developing Countries Escape Absolute Poverty?" *Economic Letters,* Vol. 56, pp. 51-7

Ravallion, M. (2001) "Growth, inequality and poverty: looking beyond averages" *World Development,* vol. 29, pp.1803-1815.

Ravallion, M. (2009) "Why don't we see poverty convergence?" Policy Research Working Paper Series 4974, The World Bank.

Romer, M. And Gugerty, M.K. (1997) "Does Economic Growth Reduce Poverty" Harvard institute for International Development.

Roodman, D. (2006). "How to do xtabond2: an introduction to "Difference" and "System" GMM in Stata." Center for Global Development Working Paper Number 103.

Sala-I-Martin, X. (1996), The Classical Approach to Convergence Analysis, *The Economic Journal ,* Vol. 106(437), pp. 1019-36

Sen, A. (1999) *Development as Freedom*. Oxford: Oxford University Press.

Sahn, D.E. and Younger, S.D. (2006) "Changes in inequality and poverty in Latin America: Looking beyond income to health and education," *Journal of Applied Economics*, vol. 0, pages 215-234, November

Tebaldi, E. and Mohan, R. (2010) "Institutions and Poverty," *The Journal of Development Studies*, vol. 46(6), pp. 1047-1066

Voitchovsky, S. *2005*. "Does the Profile of Income Inequality Matter for Economic Growth?," *Journal of Economic Growth*, vol. 10(3), pp.273 -296

White, H. and Anderson, E. (2001) "Growth versus Distribution: Does the Pattern of Growth Matter?" *Development Policy Review*, Vol. 19, pp. 267–289.

Winters, L. A. McCulloch, N. and McKay, A. (2004) "Trade Liberalization and Poverty: The Evidence so Far" *Journal of Economic Literature,* Vol. 42, No. 1 (Mar.), pp. 72-115

World Bank. 2001. World Development Report 2000/01: Attacking Poverty

Data Appendix

Table A1

Country	Freq.
Albania	8
Algeria	8
Angola	8
Armenia	8
Azerbaijan	8
Bangladesh	8
Belarus	3
Benin	8
Bhutan	8
Bolivia	8
Botswana	8
Brazil	8
Bulgaria	2
Burkina Faso	8
Burundi	8
Cambodia	8
Cameroon	8
Cape Verde	8
Central African Republic	8
Chad	8
Chile	8
Colombia	4
Comoros	8
Congo, Dem. Rep.	8
Congo, Rep.	8
Costa Rica	8
Cote d'Ivoire	8
Djibouti	8
Dominican Republic	8
Ecuador	8
Egypt, Arab Rep.	8
El Salvador	8
Estonia	3
Ethiopia	8
Gabon	8
Gambia, The	8
Georgia	8
Ghana	8
Guatemala	7
Guinea	8
Guinea-Bissau	8
Guyana	8
Haiti	8
Honduras	6
Iran, Islamic Rep.	8
Jamaica	8
Jordan	5
Kazakhstan	5
Kenya	8
Kyrgyz Republic	5
Lao PDR	8
Latvia	1
Lesotho	8
Liberia	8
Lithuania	2
Macedonia, FYR	2
Madagascar	8
Malawi	8
Malaysia	8
Mali	8
Mauritania	8
Mexico	8
Moldova	8
Mongolia	8
Morocco	8
Mozambique	8
Namibia	8
Nepal	6
Nicaragua	8
Niger	8
Nigeria	8
Pakistan	8

Panama	8
Papua New Guinea	8
Paraguay	8
Peru	8
Philippines	8
Poland	5
Romania	4
Russian Federation	8
Rwanda	8
Senegal	8
Sierra Leone	2
Slovak Republic	1
South Africa	8
Sri Lanka	8
St. Lucia	8
Suriname	8
Swaziland	8
Tajikistan	8
Tanzania	8
Thailand	8
Timor-Leste	8
Togo	8
Trinidad and Tobago	6
Tunisia	8
Turkey	8
Turkmenistan	8
Uganda	8
Ukraine	8
Uzbekistan	5
Venezuela, RB	8
Vietnam	8
Yemen, Rep.	8
Zambia	8
Total	762

Table A2- Definition & Source of Variables

Variable Name	Variable Definition	Variable Source
Povchange	Logarithmic change of poverty headcount at $38 per month	PovcalNet, WB
Pov2change	Logarithmic change of poverty headcount at $60 per month	PovcalNet, WB
Incchange	Logarithmic change of mean income	PovcalNet, WB
Ginichange	Logarithmic change of gini coefficient	PovcalNet, WB
Lhpl38	Logarithm poverty headcount at $38 per month	PovcalNet, WB
Lhpl60	Logarithm poverty headcount at $38 per month	PovcalNet, WB
Lgini	Logarithm Gini coefficient	PovcalNet, WB
Lmortality	Log infant mortality	World Development indicator, WB
Llife	Log life expectancy	World Development indicator, WB
Lschenrol1/2	Log school enrolment primary (1)& secondary (2)	World Development indicator, WB
Lcredit	Log credit to private Sector as share of GDP	World Development indicator, WB
Ltrade	Log trade as share of GDP	World Development indicator, WB
inflation	Consumer price index	World Development indicator, WB
Internal conflict	Internal conflict Risk	International Country Risk Guide (ICRG)
Corruption	Corruption risk	International Country Risk Guide (ICRG)

Table A3- Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
povchange	766	-.0497443	.5194534	-4.65396	4.60517
pov2change	800	-.0173445	.4717279	-4.287167	4.727388
incchange	800	.0242525	.195313	-1.024522	1.168869
ginichange	794	.008597	.1896828	-.7741492	4.987849
Lhpl38	775	2.79677	1.561316	-3.912023	4.527749
Lginipl38	795	3.744231	.2860483	-1.237874	4.308515
Lmortality	613	3.877283	.7388069	1.740466	5.11259
Llife	794	4.091211	.1693642	3.273747	4.363576
Lschenrol1	579	4.514629	.2968048	3.127194	5.048485
Lschenrol2	550	3.714124	.7754926	1.569242	4.695886
Lcredit	690	3.382933	.928007	-2.379193	7.067512
Laid	725	-3.406966	1.761346	-10.11568	.0799655
internalco~t	555	7.854907	2.519575	0	12
corrup	555	2.575225	1.03775	0	6
Ltrade	749	4.181312	.5203407	2.208899	5.539717
inflation	652	54.92416	383.5607	-11.44946	7481.664

Table A4- Correlation

	povcha~e	pov2ch~e	inccha~e	ginich~e	Lhpl38	Lgini~38	Lmort~12
povchange	1.0000						
pov2change	0.8835	1.0000					
incchange	-0.6051	-0.5864	1.0000				
ginichange	0.0996	0.1126	0.0370	1.0000			
Lhpl38	0.2473	0.1261	-0.0605	0.0205	1.0000		
Lginipl38	0.0411	0.0277	0.0198	0.0183	0.2167	1.0000	
Lmortality	0.1483	0.1165	-0.0827	0.0246	0.7538	0.0722	1.0000
Llife	-0.0816	-0.0454	0.0496	-0.0461	-0.6497	-0.0504	-0.8238
Lschenrol1	-0.0572	-0.0560	0.0460	0.0434	-0.2959	0.1094	-0.4901
Lschenrol2	-0.0521	-0.0122	-0.0200	0.0629	-0.6495	-0.1692	-0.7662
Lcredit	-0.0197	-0.0108	-0.0874	0.0145	-0.3024	0.0614	-0.3751
Laid	0.0333	0.0233	-0.0016	0.0304	0.5286	-0.0331	0.5962
internalco~t	-0.1059	-0.1301	0.0948	0.0154	-0.3073	-0.0473	-0.4050
corrup	0.0070	0.0189	0.0664	0.0257	-0.0985	0.0819	-0.1698
Ltrade	-0.0713	-0.0411	0.0370	-0.0216	-0.2107	0.0355	-0.3787
Inflation	0.0807	0.0386	-0.0500	0.0155	-0.0529	0.0547	0.0551

	Llife	Lsche~12	Lsche~22	Lcred~12	Laid3	intern~t	corrup
Lschenrol1	0.5506	1.0000					
Lschenrol2	0.8212	0.6724	1.0000				
Lcredit	0.3895	0.2544	0.4007	1.0000			
Laid	-0.5385	-0.3706	-0.5822	-0.2957	1.0000		
internalco~t	0.3193	0.2067	0.3105	0.0506	-0.1688	1.0000	
corrup	0.1812	0.0544	0.0442	0.1508	-0.0668	0.2109	1.0000
Ltrade	0.2949	0.2421	0.3883	0.0863	0.0700	0.3646	0.0080
Inflation	-0.0272	0.0648	-0.0059	-0.0231	-0.0763	-0.1228	0.0310

	Ltrade2	inflat~2
inflation	-0.0769	1.0000

Table B1

Rate of Change of Poverty Headcount ($38 per month)

VARIABLES	(1) GMM	(2) GMM	(3) GMM	(4) GMM
Income change	-1.207***	-2.699***	-10.46***	-2.355
	(0.212)	(0.377)	(2.839)	(2.950)
Gini change	5.001***	5.475***	4.271***	4.642***
	(1.121)	(0.984)	(1.039)	(0.991)
Lagged poverty	-0.281**	-0.288***	-0.277***	-0.256***
	(0.113)	(0.0739)	(0.0969)	(0.0739)
Lagged gini	4.856***	5.323***	3.964***	4.477***
	(1.097)	(0.957)	(1.045)	(0.991)
Lagged poverty *income change		0.574***		0.610***
		(0.0951)		(0.0974)
Lagged gini *income change			2.488***	-0.126
			(0.731)	(0.800)

Constant	-16.57***	-18.23***	-13.36***	-15.31***
	(4.055)	(3.471)	(3.712)	(3.539)
Observations	762	762	762	762
Number of Countries	105	105	105	105
N. Instruments	37	40	40	43
AR (1) Pr > z	0.025	0.107	0.039	0.073
AR (2) Pr > z	0.365	0.185	0.140	0.154
Hansen Prob > chi2	0.093	0.224	0.075	0.101

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option

Table B2

Rate of Change of Poverty Headcount ($60 per month)

VARIABLES	(1) GMM	(2) GMM	(3) GMM	(4) GMM
Income change	-0.766***	-3.088***	-8.553***	-3.744**
	(0.186)	(0.484)	(2.294)	(1.700)
Gini change	3.506***	3.567***	2.706**	2.434**
	(1.052)	(0.973)	(1.059)	(1.020)
Lagged poverty	-0.565***	-0.460***	-0.543***	-0.362***
	(0.120)	(0.106)	(0.116)	(0.115)
Lagged gini	3.418***	3.498***	2.483**	2.317**
	(1.039)	(0.963)	(1.068)	(1.033)
Lagged poverty *income change		0.685***		0.715***
		(0.114)		(0.109)
Lagged gini *income change			2.094***	0.127
			(0.585)	(0.441)
Constant	-10.05***	-10.78***	-6.761*	-6.944*
	(3.874)	(3.477)	(3.830)	(3.715)
Observations	794	794	794	794
Number of Countries	108	108	108	108
N. Instrument	37	40	40	43
AR (1) Pr > z	0.309	0.578	0.273	0.260
AR (2) Pr > z	0.157	0.810	0.665	0.765
Hansen Prob > chi2	0.472	0.734	0.553	0.399

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option

Table C1- Health: Mortality & life expectancy

GMM

VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)	(3) Rate of change of PH ($38 per month)	(4) Rate of change of PH ($60 per month)
Income change	-4.542***	-3.850***	10.87***	10.45***
	(0.780)	(0.768)	(2.976)	(2.531)
Gini change	5.012***	3.192***	4.349***	2.714***
	(1.078)	(1.009)	(1.027)	(0.978)
Lagged poverty	-0.483***	-0.600***	-0.360***	-0.543***
	(0.0958)	(0.145)	(0.0956)	(0.120)
Lagged gini	4.992***	3.197***	4.281***	2.685***
	(1.062)	(1.020)	(1.031)	(0.998)
Lag life expectancy			-2.092***	-1.632***
			(0.693)	(0.557)
Income * life exp			-2.948***	-2.752***
			(0.759)	(0.643)
Lag infant mortality	0.881***	0.697***		
	(0.218)	(0.191)		
Income * mortality	0.840***	0.766***		
	(0.185)	(0.165)		
Constant	-19.93***	-11.92***	-5.593	-0.778
	(4.019)	(3.751)	(4.546)	(3.487)
Observations	498	515	754	782
Number of Countries	105	107	105	108
N. Instruments	38	38	41	41
AR(1)- p value	0.0633	0.494	0.0385	0.432
AR(2)-p value	0.409	0.305	0.237	0.501
Hansen- p value	0.410	0.188	0.129	0.0585

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option.

Table C2- Primary and Secondary enrollment School enrollment

	GMM			
VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)	(3) Rate of change of PH ($38 per month)	(4) Rate of change of PH ($60 per month)
Income change	6.484***	6.934***	1.742**	2.001***
	(1.629)	(1.999)	(0.725)	(0.692)
Gini change	3.201***	3.193***	3.737***	3.611***
	(0.968)	(0.933)	(0.860)	(0.862)
Lag poverty	-0.165	-0.0945	-0.102	-0.0404
	(0.106)	(0.165)	(0.102)	(0.143)
Lag gini	0.0882	0.205	0.556	0.592
	(0.669)	(0.640)	(0.665)	(0.680)
Lag sch enrol1	-0.131	-0.0999		
	(0.126)	(0.111)		
income* sch enroll1	-1.854***	-1.945***		
	(0.383)	(0.464)		
Lag sch enrol2			-0.117	-0.0756
			(0.0827)	(0.0610)
Income change* sch enrol2			-0.935***	-0.976***
			(0.205)	(0.199)
Constant	0.786	0.0340	-1.332	-1.818
	(2.167)	(2.327)	(2.335)	(2.636)
Observations	483	482	462	461
Number of Countries	103	103	102	102
N. instruments	41	41	41	41
AR(1)- p value	0.000382	0.00339	0.000287	0.00271
AR(2)-p value	0.585	0.455	0.908	0.870
Hansen- p value	0.381	0.105	0.518	0.151

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option.

Table C3-Institutions

	GMM			
VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)	(3) Rate of change of PH ($38 per month)	(4) Rate of change of PH ($60 per month)
Income change	-0.878**	-0.972**	-0.349	-0.431
	(0.412)	(0.412)	(0.526)	(0.545)
Gini change	3.871***	3.188***	4.155***	4.274***
	(1.203)	(0.884)	(1.195)	(1.086)
Lag poverty	-0.120	-0.351***	-0.0881	-0.0741
	(0.0942)	(0.133)	(0.0987)	(0.165)
Lag gini	3.786***	3.096***	4.069***	4.193***
	(1.193)	(0.876)	(1.179)	(1.074)
Corruption	-0.103**	-0.108**		
	(0.0514)	(0.0454)		
Corrup * income	-0.165	-0.117		
	(0.164)	(0.148)		
Internal conflict			0.0131	0.0178
			(0.0282)	(0.0285)
Internal conflict* income			-0.135*	-0.129**
			(0.0732)	(0.0640)
Constant	-12.76***	-9.313***	-14.07***	-14.52***
	(4.171)	(3.062)	(4.235)	(3.745)
Observations	462	462	462	462
Number of Countries	77	77	77	77
N. Instruments	40	46	40	40
AR(1)- pvalue	0.116	0.146	0.135	0.172
AR(2)-p value	0.586	0.506	0.606	0.598
Hansen- p value	0.436	0.294	0.275	0.266

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and

region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option. Corruption and Internal conflict are ICRG indicator where lower scores indicates greater risks.

Table C4 – Credit Constraints

	GMM	
VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)
Income change	-0.0271	0.347
	(0.581)	(0.441)
Gini change	5.154***	3.223***
	(1.051)	(0.991)
Lag poverty	-0.219**	-0.304***
	(0.104)	(0.110)
Lag gini	5.021***	3.147***
	(1.026)	(0.981)
Credit	-0.154	-0.0898
	(0.102)	(0.0665)
Credit* income	-0.433**	-0.423***
	(0.170)	(0.148)
Constant	-16.65***	-9.698***
	(3.694)	(3.505)
Observations	636	657
Number of Countries	103	105
N. Instruments	41	41
AR(1)- pvalue	0.194	0.906
AR(2)-p value	0.422	0.138
Hansen- p value	0.520	0.559

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option.

Table C5 – Structural Change

	GMM	
VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($60 per month)
Income change	6.667**	0.835
	(3.223)	(2.272)
Gini change	5.196***	3.792***
	(0.813)	(0.619)
Lag poverty	-0.0441	-0.0615
	(0.0731)	(0.0726)
Lag gini	1.085	1.029***
	(1.003)	(0.372)
Agricul. Emp.	-0.00122	-0.0204
	(0.0726)	(0.0369)
Income * Agricul. Emp.	-0.397	0.227
	(0.377)	(0.195)
Industry Emp.	0.0551	-0.0555
	(0.141)	(0.105)
Income * Industry Emp.	-1.478	-1.505***
	(0.922)	(0.495)
Sevice Emp.	-0.122	-0.113
	(0.124)	(0.131)
Income * Service Emp	-0.820***	0.342
	(0.317)	(0.391)
Constant	-3.511	-2.864**
	(3.626)	(1.142)
Observations	283	293
Number of Countries	65	66
N. Instruments	37	37
AR(1)- p value	0.0971	0.0467
AR(2)- p value	0.182	0.546
Hansen- p value	0.769	0.753

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option

Table D1

	OLS						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Rate of change of PH ($38 per month)						
Income change	-3.361***	-12.87***	-5.175***	13.55***	6.052***	-0.707*	-0.618**
	(0.330)	(3.107)	(1.086)	(2.437)	(1.159)	(0.388)	(0.294)
Gini change	0.671*	0.714*	0.893**	0.455	3.483***	0.591	0.676*
	(0.397)	(0.377)	(0.435)	(0.312)	(0.628)	(0.401)	(0.377)
Lag poverty	-0.0449**	-0.0458*	-0.157***	-0.0121	-0.0458	-0.0553	-0.0492
	(0.0213)	(0.0272)	(0.0461)	(0.0264)	(0.0364)	(0.0362)	(0.0359)
Lag gini	0.287*	0.165	0.597**	0.201	0.139	0.386	0.370*
	(0.146)	(0.151)	(0.260)	(0.136)	(0.163)	(0.269)	(0.190)
Lag poverty *incchange	0.657***						
	(0.0937)						
Lag gini*incchane		3.018***					
		(0.814)					
Mortality			0.294***				
			(0.0705)				
Mortality *incchange			0.886***				
			(0.255)				
Life Expc.				-0.0254			
				(0.0877)			
Life Expc. *incchange				-3.619***			
				(0.617)			
sch enrol1					-0.0796		
					(0.0571)		
sch enrol2* incchange					-1.802***		
					(0.285)		
L.internalconflict						0.00582	
						(0.00748)	
Internalconflict incchange						-0.0994*	
						(0.0554)	
credit							-0.0325*
							(0.0185)
Credit* incchange							-0.322***
							(0.0993)
Constant	-0.863*	-0.402	-2.733***	-0.544	0.168	-1.167	-1.008
	(0.522)	(0.562)	(0.969)	(0.691)	(0.641)	(0.949)	(0.690)
Observations	762	762	498	758	483	462	636
R-squared	0.552	0.458	0.486	0.506	0.549	0.376	0.401

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included.

Table D2

	FE						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Rate of change of PH ($38 per month)						
Income change	-3.088***	-11.43***	-5.132***	13.56***	5.993***	-0.342	-0.492
	(0.319)	(2.559)	(0.778)	(2.563)	(1.025)	(0.329)	(0.299)
Gini change	1.520***	1.556***	2.672***	1.108**	3.499***	1.289***	1.638***
	(0.544)	(0.559)	(0.866)	(0.503)	(0.900)	(0.488)	(0.550)
Lag poverty	-0.195***	-0.233***	-0.481***	-0.0802**	-0.388***	-0.293***	-0.282***
	(0.0473)	(0.0577)	(0.0836)	(0.0403)	(0.0974)	(0.0782)	(0.0782)
Lag gini	1.047**	0.976**	2.426***	0.771**	1.026**	1.153***	1.341***
	(0.417)	(0.423)	(0.815)	(0.389)	(0.476)	(0.445)	(0.465)
Lag poverty *incchange	0.600***						
	(0.0877)						
Lag gini*incchane		2.678***					
		(0.672)					
Mortality			0.288				

			(0.307)				
Mortality *incchange			0.969***				
			(0.182)				
Life Expc.				0.284*			
				(0.157)			
Life Expc. *incchange				-3.609***			
				(0.649)			
sch enrol1					0.240*		
					(0.128)		
sch enrol2* incchange					-1.705***		
					(0.252)		
L.internalconflict						0.0149*	
						(0.00760)	
Internalconflict incchange						-0.118**	
						(0.0480)	
credit							-0.0270
							(0.0272)
Credit* incchange							-0.299***
							(0.0966)
Constant	-3.376**	-2.972*	-8.917**	-3.822**	-3.689*	-3.702**	-4.165**
	(1.592)	(1.610)	(3.965)	(1.771)	(1.962)	(1.724)	(1.748)
Observations	762	762	498	758	483	462	636
R-squared	0.603	0.527	0.644	0.521	0.644	0.456	0.496
Number of ID	105	105	105	105	103	77	103

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included.

TABLE E1

	GMM				
VARIABLES	(1) Rate of change of PH ($38 per month)	(2) Rate of change of PH ($38 per month)	(3) Rate of change of PH ($38 per month)	(4) Rate of change of PH ($38 per month)	(5) Rate of change of PH ($38 per month)
Income change	-4.829***	13.82***	5.035**	-0.290	0.0903
	(0.583)	(4.064)	(2.546)	(0.607)	(0.778)
Gini change	4.132***	4.140***	4.106***	4.118***	4.062***
	(0.993)	(0.953)	(0.952)	(0.966)	(0.944)
Lag poverty	-0.299**	-0.227	-0.226	-0.225	-0.247
	(0.151)	(0.176)	(0.167)	(0.149)	(0.172)
Lag gini	2.166***	1.967**	1.847**	1.968**	1.781*
	(0.786)	(0.916)	(0.772)	(0.855)	(0.917)
Mortality	0.327*	0.306*	0.307*	0.318**	0.335*
	(0.171)	(0.177)	(0.172)	(0.157)	(0.175)
Life Expectancy	0.914	1.016*	0.879	1.015*	0.907
	(0.631)	(0.600)	(0.565)	(0.588)	(0.601)
Primary Enrol	-0.168	-0.171	-0.132	-0.190	-0.152
	(0.132)	(0.128)	(0.126)	(0.125)	(0.129)
Credit	-0.0466	-0.0334	-0.0381	-0.0524	0.00328
	(0.0529)	(0.0519)	(0.0496)	(0.0476)	(0.0581)
Aid	0.106***	0.0942**	0.0908**	0.0912**	0.0972**
	(0.0407)	(0.0445)	(0.0400)	(0.0409)	(0.0445)
Internal conflict	0.0124	0.0127	0.00912	0.0219	0.00774
	(0.0160)	(0.0154)	(0.0152)	(0.0152)	(0.0148)
Trade	-0.0642	-0.0443	-0.0428	-0.0520	-0.0580
	(0.0945)	(0.0910)	(0.0864)	(0.0840)	(0.0874)
Inflation	4.48e-05	4.59e-05	4.02e-05	8.12e-05*	4.54e-05
	(4.07e-05)	(4.26e-05)	(4.14e-05)	(4.68e-05)	(4.02e-05)
Mortality* income	0.851***				
	(0.158)				
Life Ex * income		-3.772***			
		(0.983)			
Primary enroll* income			-1.508***		
			(0.580)		
Internal Conflict* income				-0.171**	
				(0.0701)	
Credit * Income					-0.580**
					(0.225)
Constant	-10.26**	-10.29**	-9.477**	-10.27**	-9.345**
	(4.101)	(4.310)	(3.853)	(4.165)	(4.373)

Observations	290	290	290	290	290
Number of Countries	70	70	70	70	70
N. Instrument	45	45	45	45	45
AR(1)- p value	0.00355	0.00946	0.0113	0.00395	0.00961
AR(2)-p value	0.606	0.272	0.255	0.392	0.165
Hansen- p value	0.535	0.504	0.465	0.385	0.468

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option. Mortality, Life expectancy, Primary Enrolment, Credit, Aid, Conflict, Inflation are used as lag and in logarithm excluding internal conflict and inflation.

TABLE E2

	GMM				
VARIABLES	(1) Rate of change of PH ($60 per month)	(2) Rate of change of PH ($60 per month)	(3) Rate of change of PH ($60 per month)	(4) Rate of change of PH ($60 per month)	(5) Rate of change of PH ($60 per month)
Income change	-5.475***	16.59***	6.527***	0.892	0.584
	(0.582)	(4.489)	(2.431)	(0.812)	(0.577)
Gini change	3.484***	3.492***	3.486***	3.431***	3.362***
	(0.970)	(0.970)	(0.961)	(0.990)	(0.964)
Lag poverty	-0.192*	-0.148	-0.171*	-0.134	-0.177*
	(0.108)	(0.0934)	(0.0987)	(0.108)	(0.105)
Lag gini	1.863**	1.707**	1.693**	1.596**	1.449**
	(0.730)	(0.775)	(0.735)	(0.752)	(0.721)
Mortality	0.108	0.139	0.167	0.139	0.182
	(0.133)	(0.114)	(0.125)	(0.116)	(0.123)
Life Expectancy	0.796	0.908*	0.838*	0.860*	0.830*
	(0.529)	(0.491)	(0.489)	(0.467)	(0.481)
Primary Enrol	-0.192	-0.194	-0.157	-0.218*	-0.168
	(0.121)	(0.120)	(0.124)	(0.114)	(0.114)
Credit	-0.00271	0.00415	-0.00246	-0.0172	0.0476
	(0.0370)	(0.0343)	(0.0329)	(0.0304)	(0.0399)
Aid	0.0697**	0.0619**	0.0628**	0.0553**	0.0653**
	(0.0284)	(0.0272)	(0.0261)	(0.0267)	(0.0258)
Internal conflict	0.0119	0.0113	0.00757	0.0256**	0.00564
	(0.0124)	(0.0125)	(0.0129)	(0.0116)	(0.0120)
Trade	-0.0393	-0.0250	-0.0307	-0.0348	-0.0462
	(0.0772)	(0.0726)	(0.0690)	(0.0657)	(0.0630)
Inflation	7.45e-05**	6.34e-05**	5.47e-05**	0.000118***	6.17e-05**
	(3.29e-05)	(2.74e-05)	(2.69e-05)	(4.07e-05)	(2.57e-05)
Mortality* income	1.090***				
	(0.152)				
Life Ex * income		-4.381***			
		(1.102)			
Primary enroll* income			-1.770***		
			(0.560)		
Internal Conflict* income				-0.280***	
				(0.101)	
Credit * Income					-0.645***
					(0.197)
Constant	-8.335**	-8.640**	-8.420**	-8.042**	-7.590**
	(3.561)	(3.600)	(3.445)	(3.420)	(3.395)
Observations	300	300	300	300	300
Number of Countries	73	73	73	73	73
N. instrument	45	45	45	45	45
AR(1)- p value	0.00158	0.00618	0.0234	0.00558	0.0180
AR(2)-p value	0.963	0.667	0.541	0.557	0.227
Hansen- p value	0.511	0.431	0.511	0.419	0.559

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and region dummies included. Endogenous variables: income and gini change, lagged poverty and gini, interactive terms. Gmm instrument uses collapse option. Mortality, Life expectancy, Primary Enrolment, Credit, Aid, Conflict, Inflation are used as lag and in logarithm excluding internal conflict and inflation.

Chapter 3- FDI, Political Stability and property Rights in Resource-Rich Countries

Abstract

The literature on the drivers of the internationalization of multinational companies (MNC) that operate in the primary sector remains poorly developed. In particular, little is known about the relationship between host country institutions and FDI in natural resources. Addressing this gap in knowledge, we focus on low- and middle-income countries, and investigate the relationship between political stability, property rights and foreign investment in resource-rich economies. We employ the system GMM (Generalized Method of Moments) estimator to analyse the interplay between natural resource endowments and institutions. The results provide broad support for the argument developed in the paper that the presence of natural resource affects the institutions-FDI relationship. Our findings indicate that the sensitivity of foreign investors to local institutions varies across countries and types of investments. Namely, in resource-rich countries, where FDI is concentrated principally in the primary sector, institutions may be less important for attracting FDI.

1. Introduction

The recent wave of liberalization in developing and emerging economies has prompted a significant growth of multinational companies (MNC) and foreign direct investment (FDI), a phenomenon that has generated much interest within academia, international organizations and governments. Many academics and policy makers have been optimistic about the economic consequences of FDI. This has led them to consider foreign investment a necessary instrument for economic development. The theoretical literature in support of this view argues that FDI can promote growth and development by generating knowledge and technological spillovers. However, the empirical evidence on this is rather mixed (Alfaro et al., 2009). Scholars have shown that positive effects arising from FDI are likely to depend on the host country characteristics, such as the level of human capital, financial markets and the institutional frameworks (De Mello, 1999; Blömstrom and Kokko, 2003). Moreover, the activities of MNCs have aroused controversy and concern, especially in the case of international companies in extractive industry and natural commodities, where resources are often located in conflict-prone regions. Recent research has highlighted that in some cases foreign companies in extractive industry have aggravated violence and conflict, for example, by providing arms or finance (Ballentine, 2004). In such cases, the beneficial effect of FDI is likely to be limited due to the potential effects on real exchange rate and loss of competitiveness (Sachs and Warner, 2001; Le Billon, 2005), worsening social inequality (Ross, 1999; Renner, 2002) and instability (Collier, 2004). In addition, recent research highlights that the role played by host country characteristics in attracting investors differs compared to other types of investments. Novel empirical studies, for example, have shown that the relationship between democracy and FDI in the primary sector may be atypical (Aisedu and Lien, 2011; Shultz, 2007). In this instance, there is no evidence of the expected positive relation between foreign investment and democracy. Until now, the literature on resource-rich economies has only investigated the relationship between democracy and FDI, while the link between FDI and other aspects of the institutional environment remains unexplored. In light of the issues and concerns related to investments in natural resources, understanding the interplay between institutions and foreign investor in resource-rich countries seems particularly important. Addressing this gap in knowledge, we focus on low- and middle-income countries, and investigate the

relationship between political stability, property rights and foreign investment in resource-rich economies. We extend the literature by examining the effect of political stability and property rights on FDI using a dataset of up to 92 developing and emerging countries over a fourteen years period. We estimate a model of FDI determinants using the Blundell-Bond system GMM (Generalized Method of Moments) estimator (Blundell and Bond, 2000). This allows us to attenuate the effects of unobserved heterogeneity, the endogeneity of regressors, while also capturing the dynamic aspects of observed interrelations – issues often overlooked by existing studies. In our analysis we investigate the interaction between natural resource endowments and institutions. We must point that our analysis uses aggregate FDI data and therefore implicitly assumes that that resource rich economies attract mainly resource-seeking investment. The assumption is in line with current research (Asiedu and Line, 2011). Moreover it seems a reasonable assumption since recent empirical findings confirm that natural resource production significantly decreases non-resource FDI (Poelhekke and van der Ploeg, 2010). Hence resource production is significantly correlated with a concentration of investment in the resource sector. The results provide broad support for the argument developed in the paper that the presence of natural resource affects the institutions–FDI relationship. Our results are important as they indicate that the sensitivity of foreign investors to local institutions varies across countries and types of investments. More precisely, in resource-rich countries, where FDI is concentrated principally in the primary sector, institutions may be less important for attracting FDI. Existing research stresses that institutional weakness are negatively correlated with FDI. However, our discussion indicates that the risk posed by frail institutions can be offset by the investment potential and by the MNC's ability to negotiate favourable entry conditions with the host government.

We proceed as follows. Section two reviews the main theories of firm internationalization. Section three discusses the relationship between the institutions, FDI and natural resources. The fourth and fifth sections present the econometric model and the data used in our estimations. Finally, we discuss the results and draw conclusions.

2. Theories on International Production

As the aim of the chapter is to investigate empirically what drives foreign entry, the section intends to provide a theoretical foundation for the subsequent empirical analysis. We review the existing theories of international production in chronological

order and we select a theoretical framework relevant to our analysis.

2.1 Early Theories of International Production

Globalization and international businesses are not unique to today's society. Indeed, many scholars (Cox, 1997; Bordo, 2004) have observed that the period from 1800 to the First World War was characterized by a high level of interdependence in the markets for goods, services and the factors of production. During this time trade was progressively liberalized and foreign investments by western companies grew to a considerable amount. However in the nineteenth and early twentieth century no theory had evolved that attempted to explain international production; instead, scholars were concerned with exploring the motivation behind the perceived imperialism of western nations.

In the first half of the twentieth century, neoclassical economics developed a theory of foreign investments. The neoclassical explanation of foreign investments views foreign direct investment as a special case of capital movement, driven by interest rate differentials. Despite its popularity, the neoclassical theory on foreign investment has a very poor explanatory power and indeed was cogently criticized by Hymer (1960)[45]. Hymers' theory identifies three main drivers of foreign investments. The first determinant is the firm's specific advantages, which are the competitive advantages of a firm over its rivals. The second factor relates to the firm's behaviour in the foreign country. Because one of the main goals of the firm, according to Hymer, is to gain monopoly power, firms tend to collude with rivals. Hence, collusion is a main driver of the firm's international expansion. That is, the explanation for the internationalization process lies in the pursuit of direct control over operations. The firm's behaviour grants the MNE a monopolistic advantage that allows some superiority over foreign firms. According to Hymer (1976), a crucial advantage of MNEs is their superior knowledge of the various stages of production (manufacturing, processing, branding and marketing, human resources, etc.). The third factor is that firms aim to expand internationally to diversify risk. Hymer's key insight probably lies in the idea that follows from his logic: FDI should be analysed in terms of industrial organization and not as part of international economics (Graham, 2002). Recent developments of Hymer's theory are therefore associated with literature on industrial organization,

45 See Ietto-Gillies (2005) for a criticism of the neoclassical theory of foreign investments.

Parallel to Hymer, in the 60s Vernon developed the Product life cycle theory (Vernon, 1966). The theory states that a firm's location, and therefore its foreign expansion, is determined by the stage of the product life cycle that it is in. Vernon identifies three stages of product development. In the first stage (the introduction), the firm (in Vernon's case it is a US entrepreneur) introduces a new product into the market. At this point, the firm's location and targeted market coincide. Moreover, the firm faces low price elasticity of demand and it is mainly concerned with maintaining the freedom to adjust inputs and the ability for prompt and effective communication. In the second stage (growth), the product demand expands and the market becomes more standardized. In the third and final stage (standardization), the product becomes completely standardized and requires processes with high capital intensity and unskilled labour. Because of this, firms will tend to relocate abroad mainly on the basis of cost considerations. Hence, the product life cycle theory stresses that firms make direct foreign investments only after products mature and competition becomes cost-based. Like all theories, Vernon's was a product of his time and his ideas were based on the experience of American firms relocating abroad. Vernon mainly analysed products that once in the maturity stage are characterized by a high level of standardization, such as textile products, steel, electronic items and so on. The changes in economic environment from the 1950s to the 1970s and 1980s (for example, the narrowing of macroeconomic differences between the US and Europe) made his theory less applicable. Despite the limited applicability of Vernon's theory, Ietto-Gillies (2005) argues that it may still be useful for analysing the innovation of small firms and the spread of innovation from developed to developing countries.

2.2 Williamson and the Transaction Cost Approach

During the 1970s an important contribution to the literature on firm internationalization is found in the transaction cost approach, also known as internalization theory. Scholars of internalization theory (McManus, 1972; Buckley and Casson, 1976; Teece, 1977; Rugman, 1981; Hennart, 1982 and 2000; Caves, 1971 and 1982) mainly draw on the approach of Coase[46] and Chandler. The main contribution is

46 Coase's main contribution is found in his seminal paper 'The Nature of the Firm' (1937). In this, he argues that the traditional economic theory explanation that the market mechanism is regulated by prices is inadequate to explain the functioning of firms in which we observe planning by individuals. The price mechanism works outside the firm, but inside the firm transactions are co-ordinated by entrepreneurs. Therefore the question that Coase aimed to answer is 'Why do firms exist?' Coase's

found in Williamson (1973; 1985). One of the main questions in Williamson's research, as in Coase's, is precisely why firms exist. Williamson draws upon Coase by using the concept of transaction costs, but supplements the existing discussion by introducing three additional conditions that generate transaction costs and justify both the existence of the firm and the specific governance structures adopted. Williamson (1973) discusses three key transaction costs that favour the creation of firms over markets. These are the costs of informing traders (information costs), the costs of reducing bargaining as to the terms of trade (bargaining costs) and the costs of enforcing the terms of trade (enforcement costs) (Rugman, 1986). In turn, these contractual costs are generated by three conditions (Rugman, 1986). First, the ability of the individual to take rational decisions is constrained by cognitive imperfections and a limitation in the availability of information, a condition that Williamson calls 'bounded rationality'. The problem of bounded rationality refers to the inability to make rational decisions due to limitations in the amount of information and the ability to process it. Organizations such as firms, that pool together resources, may facilitate the decision-making process by either increasing the amount of information available or limiting informational requirements by appropriating governance structures. Second, the internalization of transactions can help firms to control the opportunistic behaviour of external parties. Third, firms develop skills and assets that, if used in conjunction with others within the firm, lead to higher return than if they were used in their second-best alternative. Moreover, if they were used in such a way, the lack of integration would typically lead to hold-up problems and underinvestment; this is the concept of asset specificity. Firms have specific assets that are inherent to the transaction being carried out. Williamson (1983) argues that asset specificity may be related to the following: sites, human or physical specificity or dedicated asset.[47] One of the conclusions of Williamson's discussion is that, because of the transaction costs stemming from bounded rationality, opportunistic behaviour and asset specificity, it may be desirable (from an efficiency perspective) for organizations to grow larger. Thus, Williamson offers a counter-argument to the traditional neoclassical aversion towards large firms, which that tradition views as

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main argument is that firms exist to reduce transaction costs that are inherent to any co-ordination mechanism. He argues that the size of the firm can be ascertained by weighing up the cost of organising economic activity in the market against the benefit of organising the activity internally to the firm.

47 'Site specificity' relates to the decision of buyers and sellers on where to locate their operations. 'Physical asset specificity' arises from the equipment used in the transactions. 'Human asset specificity' arises from the specialization of skills and learning by doing. 'Dedicated asset' refers to general investment by the seller. Joskow (1987) provides some practical evidence on asset specificity.

having a harmful effect on society. However, he is aware of trade-offs between larger size and greater 'bureaucratic costs' (Williamson, 1985). Williamson (1983) has shown that bounded rationality, opportunism and asset specificity are necessary conditions for transactions to take place within organizations rather than in the market (Rugman, 1986).

The transaction cost approach has proved to be a very successful concept for the development of international business theory; indeed, today it is still a dominant theory in the field of international business. In line with this, then, the transaction cost approach has generated a considerable amount of research over the last four decades. Partly as a consequence of its breadth over time as well as scope, the theory is difficult to present as one coherent body of work.

Drawing upon Williamson, a number of scholars[48] have tried to explain the production of the firm as a market replacing activity (Dunning, 2003). This literature has departed from previous discussions on international firms, as scholars have really started to question why international transactions occur within the firm, which is perceived as a co-ordinating institution, rather than in the market (Dunning, 2003). Transaction costs are what drives firms to establish foreign subsidiaries, controlled by a central organization, and therefore to internalize transactions and operations, instead of operating through the market. However, the internalization of transactions presents benefits and costs, and it is the balance between the two that determines the extent of internalization. Transaction costs vary according to whether economic activity is undertaken within the market or within a hierarchical relationship, such as the firm. If transaction costs from operating within the firm are lower than operations within the market, then the former is more efficient.

Scholars have identified different sources of transaction costs that can shape entry and entry mode decisions. Overall, internalization theory has focused on two main sets of factors, one at micro level and the other at macro level. The first set of forces includes firm and industry characteristics (R&D and advertising intensity; profitability; parent firm size and experience; and the size of the subsidiary firm), while the second consists of regional- and country-level variables (macroeconomic policy and outcome variables such as exchange rates, labour market conditions, taxes, trade protection and inflation, market size, culture and fundamental institutional setup).

48 Important contributions are found in McManus (1972); Buckley and Casson (1976); Rugman (1981); Hennart (1982); and Caves (1982).

Over time the internalization theory has identified how a large number of factors can affect the evolution of MNEs. In some cases, the theoretical prediction on the effect of these variables is ambiguous, as in the case of trade openness or firm size. Despite this, it is now largely recognized that firm and country characteristics are important determinants of firm entry and entry mode, and this phenomenon is explained in terms of transaction costs. Nevertheless, despite its popularity, the transaction cost approach is not immune to criticism, which we review in the section below.

First, Kogut and Zander (1993) have argued that the main driver of internalization is not market failures related to transaction costs, but knowledge. The knowledge-based view is a slight modification of the transaction cost approach. According to Kogut and Zander (1993), the firm's expansion is driven by its ability to exploit competitive advantage (transferring knowledge). In turn, the characteristics of knowledge affect the way the firm can transfer it, for example, by licensing or subsidiaries. What distinguishes Kogut and Zander (1993) from the traditional internalization approach is that they do not see knowledge as a public good that can be easily transferred at no cost. Differences in knowledge and in firm capabilities determine the boundary of the firm. Using a survey of manufacturing firms, Kogut and Zander find support for the theory that the choice of entry is influenced by how complex the knowledge involved in production is, and to what degree it can be taught.

Second, some scholars have criticized the theory of transaction cost for being tautological (Rugman, 1986). For example, Kay states that 'internalization does not satisfy the conditions of refutability that is required of a theory' (Kay 1983, page 305). Similarly, Casson (1982, page 26) argues: 'Internalization is in fact a general theory of why firms exist, and without additional assumptions it is almost tautological. To make the theory operational it is necessary to specify assumptions about transaction costs for particular products and for trade between particular locations.' Rugman (1986) and Buckley and Casson (1985) note that internalization can be seen as an approach rather than a theory, as the latter requires additional conditions to predict exactly when one entry mode prevails over another one. However, this does not invalidate the predictive power of this conceptual framework, which (as summarized above) has been able to identify the various factors that shape the process of internationalization.

Third, the theory works in a similar fashion to the neoclassical model, according to which the firm's decisions are efficiency-driven and market imperfections are purely exogenous (Ietto-Gilles, 2005). In this framework, firms are analysed as profit-

maximising economic agents, without taking into consideration that firms may engage in foreign production for other reasons, such as to gain political power or because they are unable to conceive alternative solutions (Powell and DiMaggio, 1983). Moreover, the alternative between firms and market is at time limited as firms have abilities (for example, learning) that cannot be replaced by the market (Dunning, 2000). Building on the previous points, the New Institutionalism approach provides a more fundamental critique of the transaction cost approach (Powell and DiMaggio, 1983). For example, Powell (1990) argues that the dichotomy between market and institutions is simply too restrictive. For instance, he notes that firms are more and more involved in multiple collaborative ventures, which leads to the creation of business networks. Networks can be classified neither as market nor as internal transaction. More generally, the New Institutionalists, in contrast to the internalization theory, tend to emphasize that economic exchange is embedded in the social context in which it takes place.

Despite the criticisms, transaction costs theories provide a useful and widely used framework within which to analyse firms' foreign expansion. The factors identified by this literature have proved to be important predictors of entry mode decisions. As Dunning (2000) has pointed out, the criticisms of the internalization theory do not invalidate the theory but suggest that it should be extended so as to incorporate new aspects of corporate activities.

2.3 Dunning and the OLI Paradigm

In the early 1980s Dunning merged previous theories on internationalization and created the 'Eclectic Paradigm', also known as the OLI paradigm, a model designed to explain MNE activities. Cantewell (2000) observes that the theory emerged as an attempt to summarize the two main existing theories on international production, of transaction costs and of market power. However, the eclectic paradigm differs from the earlier theories as it aims more at providing a general framework to facilitate the analysis of international economic activity.

At the core of the eclectic paradigm lies the idea that the firm's internationalization process is driven by three sets of factors. The first group of factors relates to 'ownership advantages', which are also called competitive and monopolistic advantages; these are the advantages of the investing firm over other foreign firms. Assets and skills needed

to effectively compete with foreign companies form the 'ownership advantage'. According to Dunning, one can distinguish two types. The first are intangible assets, which might include, for example, the ownership of a specific technology. The second is the ownership of complementary assets, which could include, for example, the ability to create new technology (Cantwell, 2000). Ownership advantages have been the subject of much research, usually centred around firm capabilities, experience and technology.

The second set of forces relates to 'location advantages'. The main location advantages are given by the size of the market, opportunities for lower costs and the availability of natural resources. Political and economic institutions are also important, as weak governance and instability increase the risk of expropriation. Overall, this part of Dunning's paradigm predicts that firms favour entry in more attractive markets.

The third sets of forces are 'internalization advantages'. These are given by the governance structure used by firms to exploit competitive and location advantages through the internationalization process. This section of the OLI paradigm explains what drives the firm's entry mode. More precisely, the decision is determined by the benefits and costs of internalizing production compared to exporting or licensing.[49]

This 'paradigmatic' approach allows for the significance of the three sets of forces described above to vary across industries, regions, countries and firm.

Dunning's theory implies that firms' decisions, such as those relating to entry and ownership choices, are determined by ownership advantages, location advantages and internalization advantages. With regard to ownership advantages, which are firm and industry variables, Dunning's OLI theory makes the same prediction as the transaction cost approach. However, Dunning's theory adds a focus on country characteristics. Given that the transaction cost approach has been criticized for not taking into account country characteristics (Asiedu and Estefani, 2001), the OLI paradigm is a useful complement to the original transaction cost theory as it integrates a focus on the firm with a broader macro prospective. It is this that largely defines Dunning's main contribution, namely, the ability to integrate a micro-level analysis (typical of internalization theories) with a macro perspective (typical of trade theory) (Ietto-Gillies, 2005). Dunning's paradigm has been extremely successful and many scholars have used

49 Cantewell (2000) argues that there is an overlap between ownership and internalization advantages. However, the distinction is that ownership advantages refer to the advantages due to a particular technology while internalization advantages are those due to retaining control over its use.

it to analyse FDI and international business activities. Despite its popularity, the OLI paradigm has also been subject to several criticisms, to which we now turn.

First, the number of variables identified by the paradigm is very large, making it empirically and theoretically difficult to identify its unique predictive value. Second, the paradigm treats these variables as independent from one another. However, the forces that shape a firm's decisions are likely to influence each other.[50] Third, it has been argued that that the theory does not take into account the role of the firm's strategy as a response to different sets of, and developments in, ownership, location or internalization advantages and that therefore the theory is only suitable for static analysis. Dunning (1988) explains that differences between firms' behaviour may be incorporated so long as they correspond to identifiable actions forming a systematic pattern of behaviour. Fourth, Kojima (1978, 1982) has criticized Dunning for overlooking the role of government policies. Dunning has responded to these criticisms,[51] and some of these problems have been rectified in his later development of the eclectic paradigm.[52]

Dunning (2001) has recently extended the original theory and reconfigured it in what he called 'The Investment Development Path' (IDP). IDP discusses how, for firms investing inside and outside a certain country, the OLI advantages change over time, as the country develops. This theory analyses the conditions that allow for the changes and how this affects firms' choices; IDP also considers the relationship between foreign and domestic firms. The theory explains that MNC activities are linked to a country development path, which affect all three set of advantages described in the earlier eclectic paradigm. As countries develop, the structural conditions of their economies change and this affects inflows and outflows of FDI, which in turn modify the countries' economic structure. IDP it is a useful complement to the earlier paradigm as it adds a dynamic element to Dunning's theory. However, the essence of IDP is still linked to the OLI paradigm.

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50 This point will be discussed further in the second chapter

51 A response to the above criticism can be found in Dunning, J.H, 'The eclectic paradigm of international production: a personal perspective', in Pitelis, C.N. and Sugden, R. The Nature of the Transnational Firm, Routledge 2000.

52 See Dunning (1988) for a discussion of the various criticisms of the OLI paradigm.

Despite being formulated over 30 years ago, the eclectic paradigm is widely recognized to be still of relevance today. Overall, the essence of both the transaction costs and the OLI paradigms is that the probability of a firm entering a foreign market and choosing greater ownership over lower forms of controls are a decreasing function of the risk and costs represented by firm, industry and country variables and the available governance modes. As noted by Zaho et al. (2004), the transaction cost approach has some limitations,[53] but, if integrated with an evaluation of the country characteristics, it becomes a sound framework within which one can analyse both entry and entry mode. While internalization theory is mainly concerned with firm-level variables, Dunning's theory focuses on international production at the country level and this is perhaps why the two approaches act as good complements to each other.

2.4 Dynamic Theories of FDI and Recent Developments

The Scandinavian school emerged parallel to the development of the transaction cost theory and the eclectic paradigm in the 1970s–80s. The main scholars of this school are Valne, Johanson and Loustarinen. These scholars were mainly interested in understanding the process that firms follow when expanding internationally (Dunning, 2000). Vahlne and Johnason (1977) develop a model according to which the firm engages in a gradual process of international activities. The internationalization process is seen as a sequential series of events, during which the firm gradually increases its commitment as it increases its knowledge of the host country. The Scandinavian school represents valuable contribution in its attempt to analyse firms' decisions dynamically, an approach lacking in most theories on international production. However the main drawback of the theory is that it predicts that the internationalization process will follow a linear pattern, leaving little scope for strategic decision-making (Ietto-Gillies, 2005). Moreover the theory seems to overlook the role of the external environment, which, as discussed in the previous section, plays an important role in shaping firms' decisions.

Another dynamic approach to explain firms' international expansion can be found in Cantwell (1989, 1995). Technology and innovation allow firms to gain a competitive advantage, but this is not confined to a single firm. Successful innovation spreads to other firms, encouraging additional innovations. Through this mechanism, ownership

53 A critique of the application of the transaction cost approach to explain strategic and organizational business issues can be found in Ghoshal and Moran (1996).

advantages affect location advantages through the process of innovation. Individual firms' innovation and technology spill-over increases the attractiveness of a location, which in turn induces other firms to invest.

Dunning (2000) notes that recent developments in theories of international production aim at explaining different aspects of FDI and MNC, either at firm, country or industry level. First, there are scholars who explain firm internationalization as an attempt to gain competitive advantages or strengthen existing ones (Doz et al., 1997; Wesson, 1994; Makino, 1998; Lecraw, 1993; Chen and Chen, 1998; Makino and Delios, 1996; Kumar, 1998; Frost, 2001). Second, scholars have integrated the studies of MNC and FDI into mainstream economics, for example, into new trade theories. These developments of trade theories use general equilibrium models to explain why a firm may choose to expand internationally using direct production instead of exporting. There are a number of exogenous factors used to explain this, which can be classified into three main categories: technology-related factors and economies of scale, country-level characteristics, and the cost of international business. These factors are then used to explain horizontal or vertical multinationals (Markusen, 2002). The literature presents interesting attempts at modelling MNE within sophisticated general equilibrium models (Rugman, 1986). However, the approach advances in formal models have not been matched by progress in empirical work.

2.5 Selecting an Appropriate Theoretical Framework

Economic exchange between countries has existed for several centuries, and the reasons why it takes place have long interested economists and social scientists. Trade between countries is one of the factors that has shaped the globalized economic world as we know it today. In the last few decades, another important driver of globalization has been the increasing importance of international production. In attempting to explain international production, economics and business scholars have formulated a wide range of theories. In this section we have reviewed the main theories on international production and in doing so we have given an overview of the mechanisms and processes of MNCs. We have chosen to review the theories in chronological order, which should highlight that all the explanations are a product of the time at which they were written.

As the various explanations are context-specific, we should not expect paradigms to remain unchallenged over time. Nevertheless, some explanations have proved to remain relevant over time, provided necessary modifications are added. Namely, the internalization approach and the OLI paradigm have remained the main analytical frameworks capable of supporting the formulation of testable hypotheses on the operation of MNC and the pattern of FDI. We believe that the eclectic paradigm and the theory of internalization offer a sound analytical framework for the empirical analysis that will be carried out in this chapter. Baring this in mind, we now move on to analyze how institutions affect foreign entry and, in particular, we do this with reference to resource rich economies.

3 Property rights, Political Stability and FDI: a literature review

3.1 Property rights and political stability

Both Dunning's OLI paradigm and the internalisation theories highlight that country level variables, such as institutions, play an important role in shaping foreign investment decisions. Dunning would interpret institutions as a main determinant of the 'location advantages', while in Williamson's approach institutions are seen as a sources of transaction costs. Despite the different interpretation, both theories would predict that better institutions should attract more foreign investments. In turn the literature has analysed the impact of different types of formal and informal institutions on FDI. The theoretical literature argues that both political stability and the characteristics of the legal system, in particular property rights, are vital components of a country's institutional set-up and they matter for FDI. In the section below we review the existing theoretical and empirical literature on the relationship between the institutions analysed and FDI. We then assess what role natural resources play in this relationship.

North (1990) defines property rights as "the rights individuals appropriate over their own labor and the goods and services they possess. Appropriation is a function of legal rules, organizational forms, enforcement, and norms of behavior – that is, the institutional framework." In Demsetz's (1967) argument, property rights allow the internalization of externalities and the reduction of costs. In Libecap (1989), property rights provide the basic economic incentives that shape resource allocation; they are the social institutions that define or delimit the range of privilege granted to an individual. North (1981) argues that property rights and contract enforcement are crucial to create

incentives to invest, principally because rules and regulations define the terms of exchange between economic actors. Property rights and state laws are all formal rules which constrain the range of behaviour open to people, but at the same time enhance economic opportunities by making mutual expectations consistent with each other (Crawford and Ostrom, 1995). Academics have then analysed the importance of property rights to foreign investments. Gray and Jarosz (1995), for example, argue that the legal system affects the incentives of foreign investors because it modifies ex-ante transaction costs associated with setting up the venture and ex-post-transaction costs associated with monitoring the original agreement and settling disputes. The theoretical proposition that better property rights facilitate foreign and domestic investment has been tested empirically in a growing body of cross-country studies. Gani (2007) estimates the relationship between FDI inflows and the six dimensions of Kaufmann's institutional indicators using data from 1996 to 2000 for a sample of 17 Asian and Central American countries. He finds, using OLS estimates, that the rule of law and political stability are both significant. Biglaiser and Staats (2010) use a panel of developing countries from 1976 to 2004 and find that property rights protection is highly significant in determining the decision to invest abroad. The data are estimated using OLS augmented with panel corrected standard errors. Ali et al. (2010) use data on 69 developing countries between 1981 and 2000 and measure institutions with the International Country Risk Guide indicators. The authors, using a random effect estimator, find that that, once property rights security is controlled for, other institutional aspects have no significant impact on FDI. Yet the contribution that these studies bring to our knowledge on the relation between the legal system and foreign investments is somewhat limited. The studies mentioned above make use of simple econometric techniques, fail to address endogeneity issues and overlook the fact that the FDI process may be dynamic. Studies that take into account these issues tend to find weaker evidence on the link between foreign investment and legal system. For instance, Daude and Stein (2007), using an instrumental variable estimator, find that the quality of the legal environment is a not robust predictor of FDI.

We shall now discuss how political stability may affect FDI. There are at least four channels through which stability affects foreign investments. First, political instability imposes additional costs by increasing uncertainty. It affects FDI because of the close linkage between political stability and the stability of an existing framework of property rights within that economy. In fact, property rights are determined by political

processes, involving negotiation or lobbying activities (Libecap, 1989). Second, distributional conflict and disruption of the political process that is any aspect of political instability, can stop or alter the institutional set-up. Third, political instability and political change are likely to have an impact not only on formal institutions such as property rights but also on informal rules. In societies characterized by a strong reliance on personal ties and loyalties, a change in government and administration can lead to uncertainty in local business practices (Comptom et al., 2010). Finally, political instability affects investments through its effect on inflation and economic policy stability, which in turn are important determinants of investments (Satyanath and Subramanian, 2004; Rowthorn, 1977; Hirschman, 1985; Dornbusch and Edwards, 1991; Sachs 1989).

The effect of political stability on economic outcomes has been the subject of much empirical research. An issue which has received much attention, especially during the 1990s, is the relationship between stability and economic growth,[54] although several scholars have also analysed the relationship between stability and foreign investment. Most empirical studies on FDI and political instability find that political instability negatively affects FDI.[55] Lucas (1990) argues that many multinationals do not go to developing countries because of the political risk associated with these countries, though a stable political environment itself is not sufficient to attract FDI. Busse and Hafeker (2006) identify types of political risk that matter most for multinationals. In their study political stability loosely refers to government stability, and lack of internal and external conflicts. Henisz (2000) shows that multinationals face an increasing threat of expropriation if political hazard in the host country increases. Stevens (2000) argues that political instability (defined somewhat ambiguously as capital control, costly regulation, threat of expropriation, and international disruption) increases uncertainty and therefore affects the investor's expected profit function. Brada and others (2004) argue that political instability, as proxy by war with a neighbouring country, foreign embargo or economic sanctions, affects FDI because of its disruptive effect on sales, demand and production facilities. Moreover, political instability affects the exchange rate, reducing the value of the asset invested in the host country. While the majority of studies indicate a negative relationship between political instability and foreign

[54] Examples of this literature can be found in: Mankiw (1995), Barro (1991), Ross and Levine (1992), Campos (1999), Kaufman (2002).

[55] In addition to the studies reviewed here we should also mention Schneider and Frey (1985) and Edwards (1990) as studies that find a negative relation between political instability and FDI.

investment, some studies do not find a significant relationship (Bennet and Green, 1972; Fatehi-Sedeth and Safizadeh, 1989; Olibe and Crumbley, 1997; Lorre and Gruisinger, 1995; Jaspersen et al., 2000; Hausmann and Fernandez-Arias, 2000).
On the basis of the above discussion we posit:

H1) The effect of political stability on FDI inflows is expected to be positive and significant.
H2) The effect of property rights on FDI inflows is expected to be positive and significant.

3.2 Adding natural resources

Conflicting findings on the effects of political stability and the efficiency of the legal system may be due to differences in time and country coverage, which in turn may reflect differences in the composition of FDI flows. In fact, FDI can be market-, efficiency- or resource-seeking (Caves, 1996) and this may affect the interactions between host countries' characteristics and FDI. For example, labour costs are particularly important for efficiency-seeking FDI, market size is crucial for market-seeking investments, and the presence of natural resources is the main driver of resources-seeking investment. Building on this approach and with reference to the existing literature, we discuss below the effect of political stability and property rights on FDI in natural resources.

The first discussion on the interaction between host countries and MNC in natural resources stems from Vernon's (1971) obsolescing bargain model (OBM). This framework aimed at explaining the wave of expropriation of natural resources-based FDI that occurred in the 1970s in developing countries by analysing the relationship between the MNC and the host country's bargaining power. Vernon and his followers (Moran, 1974 and Tugwell, 1975) argue that the bargaining power of MNC in extractive industries is weaker than that of other industries because these firms commit to high fixed costs, which transfer bargaining power to the host country's government (Vernon 1971). A new take on the OBS argues that the risk of expropriation, as represented by weak property rights or low political stability, is particularly important to MNC in natural resources because of the high asset specificity of locations with large sunk cost and long gestation period associated with these types of ventures (Asiedu and Lie, 2011; WRI 2007; Nunnenkanp and Spatz, 2003). This view can be criticized on several

grounds. First, it is only partly correct to assume that the government has a stronger position than the MNC, as the withdrawal of FDI and technical expertise may lead to disruption of income for the host government. Therefore, what we see is a mutual dependence where, using Williamson's (1987) terminology, the cost of breaking a transaction is high for both sides. Second, the OBS has overestimated the power of the local government, and MNC can put pressures on the host countries to protect their interests (Jenkings, 1986). Several case studies have shown that MNCs have been able to retain some bargaining power and prevent government expropriation (Eden et al., 2005).[56] The critics of Vernon's predictions have also noted that in recent times the MNC-host countries relationship is more co-operative than conflictual and therefore today the OBS framework is less relevant (Dunning, 1993; Luo, 2001).

Concerning the interplay between investment in the primary sector and institutions, scholars have discussed the finding that foreign investors in the primary sectors have preferences for types of political regime that are different from those preferred by investors in other sectors. Typically, resources-based investments may display an inclination towards autocratic regimes. Asiedu and Lie (2011) argue that the stability that characterizes autocratic regimes facilitates the development of close relationships between investors and the host government. The development of close ties is a necessary condition to access natural resources, which are usually tightly controlled by the local government. There is some empirical evidence in support of this hypothesis. Schults (2007) finds some evidence that the relationship between formal institutions (democracy vs. autocracy) is sector dependent, and resource-seeking FDI is less sensitive to democracy. In a similar fashion, Asiedu and Lien (2011) find that democracy is positively correlated with FDI only if the share of minerals and oil in total exports is less than some critical value. While these authors focus on democracy, their discussion can be easily rephrased in terms of property rights, as constitutional democracy and security of property rights are closely related concepts (Acemoglu and Johnson, 2005; Aidis et al., 2010). Thus, developing their argument would lead us to the conclusion that the general security of property rights may be less important for FDI in the resources sector, as it can be substituted with a specific protection by an autocratic and otherwise arbitrary government. In support of this conclusion we also note that

[56] For example, Kramer and von Tulder (2009) mentioned the agreement between the Libyan government and Mittal Steel as an example of a foreign investor having been able to negotiate favourable conditions. The agreement includes tax incentives, facilitation of corporates' rights over those of local communities, and forbids the application of new law to the company.

FDI in natural resources tend to have few linkages to the local product and labour markets (Nunnenkanp and Spatz, 2003). This feature of natural resource-based FDI has been proposed as an explanation for the limited spillover from this type of investment. However, a lack of linkages to other sectors of economic activity may also imply that FDI in the natural resource sector may be less sensitive to the general institutional framework shaping economic interactions in most of the economy.

A different argument comes from Agarwal and Ramaswami (1992). They have suggested that some transaction costs induced by weak institutions may be balanced out by expected returns. The institutional framework is not a precondition to attract investment: if the comparative advantage of the host country is high (e.g.. large amount of natural resources or large market), investors may be willing to accept the risks associated with a weak legal system and institutions. This could be illustrated by the presence of resource-seeking FDI in fragile states characterized by weak governance and institutions.

The above discussion highlights that property rights and political instability may pose different constraints on different types of investment. Nevertheless, there is still little evidence on the interaction between the type of FDI and host countries' characteristics.

Yet, based on the discussion above, we expect that institutional weakness should have less impact on MNC in natural resources because (i) the latter can be isolated from most of the other sectors in the economy and institutional risk may be decreased by colluding with a local government; and (ii) high transaction costs can be compensated for by higher returns results from participating in the resource rents. The first of these arguments suggest H3a below, and the second leads us to formulate H3b:

H3a) When FDI are concentrated in the primary sector this is expected to attenuate the effect of property rights on FDI.
H3b) When FDI are concentrated in the primary sector this is expected to attenuate the effect of political stability on FDI.

4. Data, Variables and Descriptive Statistics

Our empirical analysis uses a panel data of 92 low- and middle-income countries over the period 1996-2009.[57] As the aforementioned hypotheses require some proxies of institutions and natural resources and measuring both have proved controversial, in this section we discuss our choice of indicators. We also make a first attempt at exploring the interrelationship between FDI, natural resources and institutions by presenting some descriptive statistics and correlations. We conclude the section by briefly discussing the control variables included in the econometrics specifications. Table 1 in the appendix summarizes the source of the data and measurements used for each variable. Full descriptive statistics and the correlation table for the variables described in table 1 are found in tables 2 and 3 in the appendix.

4.1 Measurements: Institutions and Natural Resources

For the period analysed (1996-2009), a number of institutional indicators are available from the International Country Risk Guide (ICRG). The dataset has been widely used in the economics literature and it provides de facto indicators intended to measure the actual institutional outcome. The data are obtained through surveys of knowledgeable individuals who are asked about their perceptions of institutions.[58] Amongst other institutional measures, the dataset supplies measures of the effectiveness of the legal system and political stability.

Concerning political stability, the ICRG dataset provides four indicators that are related to political risk: government stability, ethnic tension, internal and external conflict. In order to capture the multidimensional nature of stability we aggregate the four variables by principal component analysis and we analyse the effect of this composite index on foreign investments.[59] Our measure of property rights is the ICRG's "law and order" that measures both the strength and impartiality of the legal system, and the extent to which the law is observed.

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[57] We defined low- and middle-income countries using the distribution of GDP per capita in PPP. Low-income countries are those in the lower 20% of the income distribution; lower-middle-income countries are between the 20% and 50% of the income distribution; and symmetrically, upper-middle-income countries are between the 50% and the 80% of the income distribution.

[58] Kaufmann and Kraay (2008) provide an in-depth discussion of de-jure vs de facto indicators.

[59] We have also tried to aggregate these variables into one scale, using the Alpha Cronbach coefficient that was confirmed justified. As the results using this aggregation methods are the same as those obtained with the principal component analysis, in the following discussion the former estimates are not reported.

Moving to natural resources, the economics literature has traditionally measured resource endowment using the amount of natural resources produced or exported (Hodler, 2005). We are aware of the difficulties in defining and measuring natural resource endowment, but in this instance we follow the literature and we measure natural resources with the share of three primary commodities in merchandise export; namely, we take the share of ores and metal, fuel and agricultural goods in total export (Sachs and Warner, 1995; Asiedu and Lien, 2011).

Turning now to the analysis of some descriptive statistics, we first look at the trend of FDI over time. As shown in figure 1, over the period analysed, FDI has increased substantially across all income groups, although there are large fluctuations, especially in low-income countries. We then look at the change of FDI over time in resource-rich and non-resource-rich countries. We divide countries according to their export intensity of two types of natural resources: oil and metal; and agricultural raw materials. Following UNCTAD (2011), countries are defined as major natural-resource exporters if the share of natural resource export to total export is greater than 50%. In our sample, this corresponds roughly to the 80 percentile of the distribution of the export intensity variables (e.g. oil and metal to total export; agricultural raw material to total export). Figures 2 and 3 show that FDI has increased in both resource and non-resource-exporting countries. However, in the case of resource-exporting countries the trend of FDI over time shows greater variability. Regarding the relationship between FDI and institutions, as shown in the correlation table in the appendix, FDI flows are, as expected, positively correlated with the chosen measures of political stability and legal system. As we are interested in the interplay between institutions and FDI, we first plot FDI as a percentage of GDP against political stability and law and order by income groups, and we repeat the same exercise by geographic region. The figures show a clear positive correlation between the foreign investment and the institutions analysed, however, we cannot identify any discernable difference across regions or income groups (figures 4 to 7). We then restrict our attention to low- and middle-income countries, and we investigate whether the level of resource endowment, as measured by natural resource export intensity, affects the relationship between FDI and institutions. Figures 8 to 11 indicate that here is a significant difference in the correlation between FDI and both political stability and "law and order" depending on the degree of export intensity.

For major natural-resource exporters, the correlation between FDI and institution seems much weaker compared to other countries.

In this section we made a first attempt at analysing the interplay between natural resources, FDI and institutions. Our descriptive statistics and correlations highlight that there is a clear positive relationship between the institutions analysed and FDI flow. However, there seems to be some difference in the relationship between FDI and institutions across countries, and in particular it seems to differ according to the level of resource endowment, as proxies by resource export intensity. This will be further investigated in the following econometric analysis.

4.2 Controls

To test our hypotheses on the interaction between natural resources and institutions, we should include adequate controls. In selecting our control variables we follow the existing empirical literature. The empirical literature on FDI inflows determinants is large and the evidence on the effects of many variables is mixed. Where consensus has emerged it is around the finding that high GDP should attract FDI. Moreover, there is an agreement that country-level variables such as institutions, GDP, inflation and trade are important determinants of FDI inflows. We therefore include in our specification the aforementioned variables. Below we briefly review how these variables should influence FDI.

Most empirical studies include GDP, a measure of the size of the market, as an explanatory variable for FDI (Chakrabarti, 2001; Globerman and Shapiro,2003; Lipsey, 1999; Brewer, 1993; Crenshaw, 1991; Grosse, 1997). GDP has been shown to positively affect FDI. This is because larger markets imply lower distribution costs if production facilities are located in the same countries. More generally, larger markets may increase economies of scale. GDP and population should be of particular interest for "market-seeking" FDI that aims to sell and distribute their products/services in the host country.

A variable related to GDP, often used in FDI studies, is GDP per capita. In the literature on FDI, GDP per capita has been used as a measure of how well-off consumers are or as a proxy for return on investments. If GDP per capita is taken as a measure of the population's wealth, its effect varies according to the type of investments analysed. When investments are market-seeking, we should expect a positive relation between GDP per capita and FDI. However, when foreign

investments are resource-seeking, the effect of GDP per capita on FDIs is less clear and could potentially be negative. This is because GDP per capita can also be a proxy for labour costs, and higher cost of factors of production should discourage resource-seeking FDI. Schneider and Frey (1985) and Tsai (1994) find a positive relationship between GDP per capita and FDI, and they explain this by pointing out that higher GDP per capita implies better investment prospects. As mentioned above, scholars have also used GDP per capita as a measure of returns on investments. The traditional argument is that GDP per capita is inversely related to FDI because the returns to investment are higher in poorer countries and therefore FDI should be attracted to countries with lower GDP per capita. Edwards (1990) and Jaspersen et al. (2000) find some evidence of a negative effect of GDP per capita on FDI. Asiedu (2002) also finds evidence of this negative relationship except in sub-Saharan Africa. Finally, other studies find that the variable is not a significant determinant of FDI (Loree and Guisinger, 1995; Wei. 2000; Hausman and Fernandez-Arias, 2000).

Aside from wealth measures, proxies for macroeconomic stability are often included in the empirical analysis of FDI. Theoretical discussions stress that macroeconomic instability is an important source of uncertainty which can discourage investment.[60] Indeed, the "Washington consensus" which guided policy-making in developing countries during the 1980s and 1990s was focused on controlling inflation, the budget and current account deficit (Muqtada, 2003). The literature has mainly focused on the relationship between FDI and common measures of macroeconomic instability such as inflation and exchange rate. The reason for using inflation as the proxy for macroeconomic instability is that prices are the main means of signalling information in a market economy (Satyanath and Subramanian, 2004).[61] Agenor (2004) explains that macroeconomic instability affects investments both through the direct effect of inflation and through inflation volatility. On a related theme, in principle, a fixed exchange rate should be preferred over floating currency because it ensures more stability and therefore it should encourage trade and investments (Campa, 1993; Goldberg and Kolstad, 1995). The existing evidence on the relationship between FDI and exchange rate is rather inconclusive, making it difficult to formulate sound

[60] The impact of uncertainty on investments has been discussed in section 2.

61 However, Gerry et al. (2008) have criticized this approach, as inflation is only an output measure of instability in the sense that it is an outcome of economic policies which are related to country institutions. In addition, when using inflation as a proxy for macroeconomic instability in empirical work, it should be considered that inflation is potentially endogenous and may suffer from reverse causation with the outcome analysed.

hypotheses.[62] Aside from inflation, another macroeconomic variable closely related to FDI is trade openness, most commonly measured as the share of import and export to GDP. The impact of openness on FDI depends on the type of investments taken into consideration. When investments are market-seeking, trade restrictions (and therefore less openness) can have a positive impact on FDI. Higher import tariffs can lead to tariff-jumping, meaning that when tariffs increase, firms are likely to prefer local affiliates to exports so that they can reduce the tariff paid (Blonigen, 2005). This assumption indicates that higher tariffs could lead to an increase of FDI. The empirical support for the tariff-jumping activity of FDIs is typically mixed (Grubert and Mutti, 1991; Kogut and Chang, 1996; and Blonigen, 1997). Interestingly, Belderbos (1997) and Blonigen (2002) find that tariff jumping is carried out mainly by large organizations that can afford to set up local affiliates. This suggests that the impact of trade policy's outcomes varies with firm sizes, and, if this is the case, it may be difficult to capture its effect in aggregate cross-country analyses. The studies mentioned above assume that FDI and trade are substitutes and that there is therefore a negative relationship between the two variables. The literature has also analysed cases in which FDI and trade are complements and therefore greater trade openness stimulates FDI. Stone and Jeon (2000) use a dataset on Asia Pacific countries and find that FDI and trade are complements, although they do not test for causality. Leu, Wang and Wei (2001) analyse bilateral trade and FDI between China and 19 other countries and also find evidence of complementarity. Interestingly, the authors identify a two-stage process. First, the growth of Chinese imports from a country increases that country's FDI into China, and afterwards the increases in FDI affect China's exports to that country positively. Cuadros, Orts and Alguacil (2004) give a more nuanced view on the FDI-trade relationship as they argue that there are important country effects. Their empirical analysis shows that, while in Mexico FDI and trade are complements, they are substitutes in Brazil, while there is no significant relationship in Argentina. Bende-Nabede (2000), using a sample on sub-Saharan countries, also argues that the impact of trade on FDI varies across regions of the world.

The above discussion shows that, while economic theory can explain the existence of both a positive and a negative relationship between trade and FDI, most empirical

62 Cushman (1985 & 1988) finds a positive relationship between US FDI and exchange rate uncertainty, and Benass y-Quere et al. (2001) find a negative relationship between FDI investment by OECD countries and exchange rates in transition economies. Swenson (1994), and Kogut and Chang (1996) find that short-run exchange rate movements have an impact on FDI.

studies do not support the idea that trade and FDI are substitutes. Despite this, we should beware of oversimplifications as the relationship varies across types of FDI, region and sectors.

Finally, the literature has stressed the importance of institutions as determinants of FDI. As we focus our analysis on property rights and political stability, it is important to control for democracy. Stability, legal system and democracy are closely interrelated, so not taking the latter into account may cause an omitted variable problem. It could be argued that democracy is associated with stronger institutions, in particular, rule of law. The existing evidence on the impact of democracy on FDI is ambiguous. On the one hand, the most common view argues that democracy should have a positive impact on FDI as it is associated with independent judiciary and electoral system, which guarantee property rights and therefore decrease the risk of expropriation (Olson, 1993; Li and Resnick, 2003). On the other hand, democracy may have a negative effect on FDI through competition policy, industrial policy or fiscal incentives (Li and Resnik, 2003). Moreover, foreign investors may favour autocratic regimes if they can grant protection from social pressures (e.g. high wages, labour regulation) and or if collusion with such governments can lead to privilege, such as access to natural resources or preferential treatment (O'Donnell, 1978; Asiedu and Lien, 2011).

Having discussed the variables included in our econometric model, we now turn to the empirical strategy used to test the aforementioned hypotheses.

5. Empirical Strategy

5.1 Model Estimated

The main question we aim at answering is whether the presence of natural resources play a moderating role in the institutions-FDI relationship. However we need to take into account the role of a number of variables that have been shown to typically affect FDI. Hence the model chosen to test our hypotheses is the following:

$$LFDI_{it} = \beta_0 + \beta_1 l.LFDI_{it-1} + \beta_2 LGDP_{it} + \beta_3 LGDPpercapita_{it} + \beta_4 Democracy_{it} + \beta_5 propertyrights_{it}$$
$$+\beta_6 politicalstability_{it} + \beta_7 \inf lation_{it} + \beta_8 Ltrade_{it} + \beta_9 propertyrights_{it} * naturaresources_{it} + \beta_{10} natu$$

where $LFDI_{it}$ is the logarithm of FDI inflow as share of GDP, in country i at time t.

Equation (1) models the inflow of FDI as a dynamic process where the dependent variable in year t depends in part on its value in year t-1. The specification principally follows Cheng and Kwan (2000),[63] and Noorbakhsh et al. (2001). FDI often involves high initial costs and therefore tends to be persistent over time. At the aggregate level, this can be captured by a positive feedback effect of past FDI onto current FDI. Additionally, foreign investors tend to prefer to operate in familiar environments, therefore, the existing foreign investments serve to encourage the operations of new and existing companies by creating a more familiar environment and increasing investors' confidence.

For our purposes, we use the flows of FDI, rather than the stock, as our dependent variable. This is because FDI stocks may not reflect recent changes in investments where FDI has been present for a long time (Globerman and Shapiro, 2002). In terms of the functional form, whenever possible, we use our variables in logarithmic form. This garners two advantages: first, it normalizes the variable's distribution; and second, the coefficient estimated has the direct economic interpretation representing elasticity.

5.2 Estimator

The empirical estimation of the model presented above is problematic as the lagged dependent variable as well as some regressors are endogenous. While the lagged dependent variable is endogenous by construction, the relationship between inflation and GDP per capita is likely to suffer from reverse causality. High GDP and low inflation may attract FDI; however, FDI inflows raise GDP and possibly inflation. In addition, there are likely to be some omitted variables correlated to our dependent and independent variables.

We therefore estimate the model with System GMM, a method designed for fixed effects-idiosyncratic errors that are heteroskedastic and correlated within but not across individuals. System GMM estimates a system of level and difference equations, where the level equation is instrumented with the contemporaneous first difference and the difference equation is instrumented with levels dated t-1 or earlier. System GMM allows us to attenuate the bias and inconsistencies stemming from the two issues mentioned

[63] Cheng and Kwan (2000) apply a similar model to FDI stock. Dynamic model in the context of FDI inflow has been applied empirically by Carsternsen and Toubal (2005).

above. First, by first differencing the equation, the unobserved individual level fixed effect is eliminated and this removes a source of omitted variables. Second, and most importantly, GMM is a way of dealing with endogenous variables by creating instruments with exiting data. We can distinguish between the lagged dependent variable and other endogenous covariates. The OLS and fixed effect estimates of dynamic model present well-known difficulties. With OLS, the lagged dependent variable is endogenous to the fixed effect of the error term. The lagged dependent variable is positively correlated with the error term and OLS overestimate the coefficients. In the fixed effect estimator the lagged dependent variable is negatively correlated with the error term and the fixed effect estimator underestimates the coefficients (Roodman, 2006). Good estimates of the true parameter should therefore lie in the range between the OLS and fixed effect estimate, or at least near it (Roodman, 2006). There are alternative transformations that can eliminate the panel bias such as differentiation or orthogonal deviations, but these methods have drawbacks.[64]

When implementing GMM estimates particular attention should be given to two diagnostic tests. First, the Arellano-Bond test for autocorrelation in the differenced residuals: while AR(1) is expected, higher order autocorrelation indicates that lags of any variable used as instruments are endogenous. Second, the Sargan and Hansen tests for over-identifying restrictions report whether the instruments are exogenous.

Before turning to the discussion of our results, we conclude this section with some details on our estimation strategy. In our estimates reported below we used two sets of instruments: 'GMM' style instruments, which can be predetermined variables (i.e. correlated with the past but not the present values of the error term), and 'iv' style instruments, which should be strictly exogenous variables. In all specifications we do not make use of external instruments.

We estimate two models. In the first model, all variables except the lag dependent variable are assumed to be exogenous and used as IV instruments. In the second model, we relax the assumption of exogeneity, and we allow all the regressors, except the year dummies, to be endogenous. In this instance, all endogenous variables are included as

[64] Difference GMM, for example, takes the first difference and by doing so eliminates the fixed effect but leaves a problem with the potential endogeneity of all predetermined variables. A drawback of this transformation is that in unbalanced panels it amplifies gaps. Also, it tends to make successive errors correlated even if they are uncorrelated. Orthogonal deviations instead of subtracting previous observations form the contemporaneous, subtract all the future available observations of a variable. However, in unbalanced panel with heteroscedasticity both transformations tend to give similar results, holding the set of instrument fixed.

GMM instruments. This is clearly a realistic assumption, as all independent variables (GDP, inflation, trade, resource export and institutions) suffer from reverse causality. It is well-known that foreign investors are not passive agents but they can affect the economic and institutional characteristics of the host countries. However, introducing many variables as GMM instruments has the drawback of creating a large number of instruments, which can cause concerns (Roodman, 2009). In order to limit the number of instruments, the estimates have been performed using the "collapse" option available in STATA 10. With this option, one instrument is created for each variable and lag distance, instead of for each time period, variable and lag distance. Although the number of instruments may remain high even using the collapse option, Hayakawa (2007) showed that, in small samples, System GMM remains less biased than Difference GMM. For consistency, we limit the number of instruments also when we assume the variables to be exogenous. Finally, we control for heteroscedasticity between individuals using the robust option in Stata 10.

6. Results

We now turn to our empirical findings. In our analysis we aim to shed some light on how natural resources endowment – here, proxies by natural resources export intensity – affect the FDI-institutions relationship. We distinguish between export intensity in oil, metal and agricultural raw material. In tables 1a and 1b in the appendix, we analyse the effect of oil and metal export, in order to capture the effect of natural resources in extractive industry. In table 1a we assume that all variables except the lag dependent variables are exogenous. In all columns the lagged values of FDI and trade openness are positive and highly significant. The results confirm previous findings that FDI and trade are very much complements rather than substitutes, and also that FDI is a dynamic process, characterized by persistence. GDP and GDP per capita are positive, while inflation, as expected, is consistently negative, although these variables are not significant. The variable "nat", which stands for oil and metal export intensity, has a positive and at times significant effect on FDI flows. The estimates reported show that property rights, as measured by the law and order indicator, political stability (ICRG), and democracy (polity2) are positively correlated with FDI. Law and Order and democracy have a robust and significant effect, while political stability is significant in only one instance.

In columns two to four of table 1a we explore whether the relationship between FDI and institutions is affected by the natural resources endowment by introducing some interactive terms. Columns two and three indicate that the interaction between political stability and natural resources, and the interaction between natural resource and "law and order", are negative and significant. The sign of the coefficient indicates that for increasing level of oil and metal exports the impact of the legal system and of political stability on FDI is decreasing. In column four, when we include both interactive terms they turn insignificant. However, "law and order" and its interaction with natural resources are jointly significant at 5% level (p-0.027). We are now interested in exploring in greater depth how different levels of export intensity affect the interrelationship between the institutions analysed and natural resources. Table A reports the effect of law and order and political stability on FDI inflow for meaningful levels of oil and metal export intensity.[65] Our calculations show that an increasing level of natural resource export has a substantial effect on the impact of both political stability and property rights on FDI. For instance, an increase in oil and metal export intensity from 4%, the level of Thailand, to 36%, the level of South Africa, decreases the impact of "law and order" from 0.84 to 0.16. In the case of political stability the effect is less sizeable, as an increase in export intensity from 1.6% to 11% decreases the effect of political stability on FDI from 0.07 to 0.04. Our calculations also show that at certain levels of natural resource export the relationship between institutions and natural resource is reversed.

Table A

$\delta Lfdi/\delta institutions = \hat{\alpha} + \hat{\beta} oil \,\&\, metal\exp ort$ evaluated at various levels of oil and metal export

Value of Oil and Metal Export Intensity	Quartile	Corresponding Country	Political Stability	Law & Order
1.651257	10th	Paraguay	0.070108972	0.906357065
4.441002	25th	Thailand	0.061635401	0.847055176
11.29105	50th	Honduras	0.040829065	0.701443021
36.67997	75th	South Africa	-0.036287241	0.16174821
74.38813	90th	Russia	-0.150822006	-0.639817918

Moving now to table 1b, we estimate the same model, but we allow all independent variables, except the year dummies, to be endogenous. The lag dependent variable is

[65] For law and order, we used the coefficient reported in colum three of table one. For political stability, we used the coefficient reported in column two of table one.

positive and highly significant, indicating that our choice of dynamic model is appropriate. As far as our control variables are concerned, trade and GDP are positive although on GDP is significant. GDP per capita is now negatively signed, while the effect of natural resource is ambiguous, as it appears to be positive and significant only in the second and fourth column. Turning now to the effect of institutions, only "law and order" is positive and significant in the four columns. The interactive effect between law and order and natural resource is again negative and significant, confirming our hypothesis that an increasing level of natural resources decreases the positive effect of property rights on FDI.

In tables 2a and 2b and 3a and 3b we analyse whether the impact of political stability and property rights on FDI is conditional on the type of resources exported. Recent discussion has shown that the impact of resources on economic development depends on the type of resources produced (Boschini et al., 2007). Namely, resources that are highly appropriable (due, for example, to ease of transportation) may have a negative impact on economic growth, while this may not be the case for other types of resources. As such, minerals and oil tend to be more problematic than agricultural products, as the former are more lootable.[66] In what follows, we therefore test whether the type of natural resources determines the effect of the institutions analysed on FDI.

In tables 2a and 2b, we analyse the effect of metal and oil export intensity independently. We estimate the same regressions reported in table one, but we include two measures of export intensity, one for oil and one for metal. In columns two and three of table 2a and 2b we interact these two variables with political stability and "law and order" in order to capture the effect of institutions conditional on natural resources endowment. Starting with table 2a we discuss our findings on the variables of interest. In column two of table 2a we interact "law and order" with metal export and oil export separately. The interaction between the property rights indicator and fuel export is negative and significant, pointing that an increasing intensity in fuel export decreases the positive effect of property rights on FDI. However the interaction between "law and order" and metal export is not significant. The variable is jointly significant with the property rights indicator, although does not have the expected sign. In column three of table 2a we explore whether the two measures of natural resources, metal and oil export

[66] Several theories can explain the negative impact of extractive industry on development. The main explanations are centred on the negative impact of oils and metal on the following: conflict (Collier and Hoeffler, 2004), state institutions (Fearon & Laitin, 2003; Snyder & Bhavnani, 2005) and trade shocks (Humphreys, 2005).

intensity, affect the impact of political stability on FDI. Again the interaction between political stability and fuel export is negative and highly significant. The interaction with metal export is not significant, although is jointly significant with political stability at 5% level (p.0.02). Looking at table 2b, where we allow the regressors to be endogenous, the results seem to broadly confirm the findings summarized in table 2a. "Law and order" is positive and highly significant across the three specifications, while we do not find political stability to be significant. In column two of table 2b, the interaction between fuel export intensity and "law and order" is negative and significant, while the interaction with metal export intensity is negative but only jointly significant with "law and order". In column three we do not find any evidence that metal and oil export intensity moderates the impact of political stability on FDI.

In tables 3a and 3b finally, we explore the role of agricultural export intensity. As shown in columns two to four we find that agricultural exports do not moderate the impact of political stability and property rights on FDI.

Overall, our results highlight that high resources endowments undermine the positive effect of institutions on FDI. When we measure natural resource as the share of metal and oil export to total export, we find robust evidence that the effect of both property rights and political stability on FDI is affected by natural resources. This is likely to be due to the ability of MNC to negotiate preferential treatments and to collude with governments. However, as shown by our calculations in table A, changes in resources export intensity seem to have a greater effect on the impact of property rights on FDI compared to the impact of political stability on FDI. Moreover, by analysing the interaction terms between different types of natural resources export intensity and institutions, we are also able to explore whether the effect of institutions on FDI is conditional on the type of resources produced. We find strong evidence that in oil-rich countries the effects of efficient property rights, and to some extent the effects of political stability, are undermined. Our results also show that the effects of metal export intensity, on its own, is less robust than the impact of oil export intensity. This seems to be in contrast to the discussion that stresses the similarities between oil and metal industry. Recent empirical evidence has shown that both oil and metal have a negative impact on economic outcomes (Sala-i-Martin and Subramanian, 2003; Asiedu and Lien, 2011). However, scholars have pointed out that the measure "ores and metal export" may be a poor proxy for the importance of extractive industry. The measure includes items such as crude fertilizer and scrap metal that are not part of extractive industry (de

Soysa and Neumayer, 2007), and it fails to include diamonds and other precious gem which can notably have a deleterious effect on economic outcome (Fearon, 2005). Interestingly, we find that agricultural export does not significantly affect the institutions-FDI relationship, confirming recent discussion that agricultural sector, compared to extractive industries, have a lees detrimental effect on economic development (Isham et al., 2005).

6.1 Robustness

In order to give some credibility to our results, we carry out a number of robustness checks.

First, we use alternative measures of natural resources. In the economics literature, common measures of natural resources used are: resources production (per capita or as share of GDP) and resources rent (as share of GDP). Data on oil production, oil rent and mineral rent are available from the World Bank adjusted net saving dataset.[67] Oil production, calculated as the unit price multiplied total production, provides a measure of the economic importance of resource extraction. Natural resources rent is calculated as the unit rent, that is, price net of cost, multiplied by the amount of resource extracted. Some scholars argue that rents are a better measure than resource export, especially when analysing the interplay between institutions and resources (de Soysa and Neumayer, 2007). This is because rents are a direct measure of the gains from natural resources. Again, we estimate two set of models. In the first one, only the lagged dependent variable is taken as endogenous; in the second set of specifications all regressors, except the year dummies, are treated as endogenous. Starting with tables 4a and 4b we analyse the impact of oil production relative to GDP on the interplay between FDI and institutions. In column four of table 4a the interactions of oil production with political stability and legal system are both negative and highly significant. In table 4b only the interaction between "law and order" and oil production is significant. In table 5a and 5b we measure natural resources with oil rent relative to GDP. The results in table 5a seem to confirm the findings in table 4a. Oil rents are positive and significantly related to FDI. The interactions between oil rent, stability and property rights are again significant and negative. In table 5b, however, only "law and order" and its interaction with oil rent are jointly significant at 5%. In tables 6a and 6b

[67] Minerals included in the calculations of rent are the following: tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite and phosphate.

we do not find any evidence that mineral rent as a share of GDP or its interactions with political stability and "law and order" are significant determinants of FDI.

In sum, when using alternative measures of natural resources, our robustness checks seem to confirm the findings summarized in the previous section. First, the extraction of oil has a significant impact on the interplay between political stability, property rights and FDI. Second, oil has a greater impact on the relationship between property rights and FDI compared to the relationship between stability and FDI. When we relax the exogeneity assumption, the interaction term between stability and FDI is no longer significant. Third, we do not find evidence that mineral extraction moderate the FDI-institutions relationship.

As a second check we use an alternative measure of FDI. In Table 7a and 7b we measure FDI in per capita term. First, in table 7a we replicate the results reported in table 1a, where we explored the impact of oil and metal export intensity on the interplay between FDI and institutions. Second, in table 7b we replicate the results reported in table 4a, where we measure resources endowment with oil production as a share of GDP. In both cases we can see that the interactive terms between the institutions analysed and natural resource remain significant.

7. Conclusions

The theoretical discussion and the econometric analysis carried out in this study aim to untangle the role of different institutions in attracting foreign investment. In particular, we wanted to analyse whether the presence of natural resources plays a moderating role in the institutions-FDI relationship. The existing theoretical and empirical literature has emphasized that good institutions are important for both foreign and domestic investors. Accordingly, we should expect political stability and property rights to be positively correlated with FDI. However, this may not be the case for MNC in natural resources because: (1) the latter can be isolated from most of the other sectors in the economy and institutional risk may be decreased by colluding with a local government, (2) high transaction costs can be compensated by higher returns results from participating in the resource rents. Our econometrics results show clearly that institutions do not act in isolation and that their effect on FDI is influenced by the natural resources, confirming recent findings of Asiedu and Lien (2011). However, this chapter adds to Asiedu and Lien (2011) in several ways. First, we explore the interplay

between stability, property rights and FDI, while Asiedu and Lien (2011) focus merely on democracy. As we argued above, although stability and property rights are closely related to democracy, they represent separate dimensions of a country's institutional environment and they therefore merit a separate analysis. Our results show that natural resources significantly affect the impact of property rights and political stability on FDI. However, out of the two institutional characteristics analysed, the effect of property rights on FDI is more robust than that of political stability. Second, we contribute to the discussion on the impact of different types of natural resources on economic development. Our study finds that only oil, and not minerals or agricultural products, has a robust and significant moderating impact on the FDI-institutions relationship. The evidence on the effect of different types of natural resources on economic outcomes has stressed that lootable resources may be more harmful than diffuse resources, such as agricultural products. The economics literature has traditionally considered the effect of oil to be similar to that of minerals; however, political scientists have argued that oil-rich countries are different than other resource-rich countries. In particular, recent studies have found that the institutional environment of oil-producing economies does not reflect the country's level of development, as measured by per capita income; they are weaker than expected and this in turn can have a negative impact on political instability and conflict (Fearon and Laitin, 2003; Fearon, 2005). Our study therefore shows how the distorted institutional setting of oil-rich countries may have a negative effect on development. Namely, we find that in oil-based economies investors are less sensitive to weak property rights protections and to some extent to political instability. If this is the case, the influence of FDI on the host country institutional environment may be of concern. We believe that what explains the different effects of oil as contrasted with that of metal ores, is that the former generates particularly strong economic rents given the current trend in energy prices. Thus, our findings give indirect support to a recent literature arguing that it is the amount of rent generated rather than the presence of natural resources that is a key factor in how natural resources affect development (Fearon, 2005).

Third, we make use of alternative measures of natural resources and we not limit our analysis to resource export intensity. Unlike Asiedu and Lien (2011), which only use resource export intensity as a measure of resource endowment, we also replicate our results measuring resources with production and rent relative to GDP. Our robustness

checks ensure that the effect of oil endowment is robust to the use of alternative measures.

Fourth, our preferred specification, as in Asiedu and Lien (2011), assumes all variables except the lag dependent variable to be exogenous. When we relax the exogeneity assumption we allow all independent variables to be included as GMM instruments, unlike Asiedu and Lien (2011), which only allow democracy and its interaction with resources export to be endogenous. Clearly, given that controls such as trade and GDP are likely to be endogenous, our choice of instruments seem more appropriate.

In sum, our study contributes to the existing literature on the determinants of FDI, as we find novel evidence that the importance of institutions, in particular property rights and political stability, is mitigated by the presence of natural resources. Moreover, we have more trust in our results as these are based on stronger methodology and robustness checks as just argued.

In term of future research the question addressed in this study may be better explored with the use of sector-level FDI data, which is currently not available for the period and the countries analysed. A limitation of this study is the use of aggregate data, which do not allow one to distinguish between the types of FDI. Instead, we have to rely on the assumption that in developing countries with high levels of natural resources, FDI tend to be concentrated in the resources sector.

References

Acemouglu, D. and Johnson, S. (2005) "Unbundling Institutions," *Journal of Political Economy*, University of Chicago Press, vol. 113(5), pp. 949-995

Aidis, R., S. Estrin, T. Mickiewicz (2009) 'Entrepreneurial Entry: Which Institutions Matter?', Centre for Economic Policy Research, Discussion Paper No. 7278.

Alfaro, L., Kalemli-Ozcan, S. and Sayek, S. (2009), FDI, Productivity and Financial Development. The World Economy, 32: 111–135.

Ali, F.A., Fiess, N., MacDonald, R. (2010) "Do institutions matter for foreign direct investment?" Open Economies Review 21 (2), pp. 201-219

Agarwal, S. and Ramaswami, S. (1992). "Choice of foreign market entry mode: Impact of ownership, location and internalization factors." *Journal of International Business Studies*, Vol. 23 (1), pp. 1-27

Agenor, P.R. (2004) "Macroeconomic Adjustment and the Poor: Analytical Issue and Cross Country Evidence" *Journal of Economic Surveys*, Vol. 18(3), pp.351-408.

Asiedu, E. (2001) "On the Determinant of Foreign Direct Investment in Developing Country: Is Africa Different?" *World Development*, Vol. 30, issue 1, pp.107-119.

Asiedu, E. and Esfahani, H. (2001) "Ownership Structure In Foreign Direct Investment Projects," *The Review of Economics and Statistics*, vol. 83(4), pp. 647-662

Asiedu, E., Lien, D., (2011). "Democracy, foreign direct investment and natural resources." Journal of International Economic, Vol. 84 (1), pp. 99-111

Ballentine, K.and Nitzschke, H. (2004). "Business in Armed Conflict: An Assessment of Issues and Options" *Journal of International Peace and Security*, Vol. 79 (1-2): 35-56.

Barro, R. J. (1991) "Economic Growth in a Cross Section of Countries," *The Quarterly Journal of Economics*, MIT Press, vol. 106(2), pages 407-43

Belderbos, R. (1997) "Antidumping and Tariff Jumping: Japanese Firms'DFI in the European Union and United States," *Weltwirtschaftliches Archiv*, Vol. 133, pp. 419-57.

Bénassy-Quéré, A.; Fontagné, L.; Lahrèche-Révil, A. (2001): "Exchange-rate strategies in the competition for attracting foreign direct investment", *Journal of the Japanese and international Economies*, Vol. 15 (2), pp. 178-198.

Bende-Nabende (2002)"Foreign Direct Investment Determinants in Sub-Sahran Africa: A cointegration Analysis" *Economics Bulletin*, Vol. 6 (4), pp.1-19

Bennet, P. and Green, R. (1972) "Political instability as Determinant of Foreign Direct Investment in Marketing", *Journal of Marketing Research,* Vol. 9 No.2

Blomstrom, M. and A. Kokko. (2003) "The Economics of Foreign Direct Investment Incentives." NBER Working Paper 9489

Blonigen, B.A. (1997) "Firm-Specific Assets and the Link Between Exchange Rates and Foreign Direct Investment" *American Economic Review,* Vol. 87(3), pp. 447-65.

Blonigen, B. (2002) "Tariff Jumping anti-dumping duties" *Journal of International Economics*, Vol. 57(1), pp. 31-49

Blonigen, B. (2005) "A Review on the Empirical Literature on FDI Determinant" *Atlantic Economic Journal*, Vol. 33(4), 383-40

Blundell, R. and Bond, S. (2000) "GMM estimation with persistent panel data: an application to production functions" *Econometric Reviews*, Vol. 19 (3), pp.321

Bordo, M.D. (2001) "Globalisation in Historical Perspective" in NBER Session "International Economy Globalisation and Crisis"

Boschini, A.D., Pettersson, J., Roine, J., (2007). "Resource curse or not: a question of appropriability" *Scandinavian Journal of Economics* 109 (3), 593–617.

Brada, J., Kutan, A. and Yigit, T.M. (2004) "The effect of Transition and Political Instability on Foreign Direct Investment on ECE Emerging Market" William Davidson Institute, Working Paper 729

Brewer, T. (1993) Foreign direct investment in emerging market countries. In *The global race for foreign direct investment*, ed. L. Oxelheim, 177-204. New York: Springer- Verlag.

Buckley, P.J. and Casson, MC. (1976) "A Long Run Theory of the Multinational enterprise", in P.J. Buckley and MC Casson (eds) *The Future of the Multinational Enterprise*, London, Mcmillan, pp.32-65

Busse, M. and Hafeker, C. (2007) "Institution and Foreign direct Investment, European" *Journal of Political Economy*, Vol. 23, issue 2, pp.397-415

Campa, J. M. (1993) "Entry by Foreign Firms in the U.S. Under Exchange Rate Uncertainty," *Review of Economics and Statistics*, 75(4), pp. 614-22.

Campos, N. and Nugent, J. (2002) "Who is afraid of political instability?," *Journal of Development Economics*, Elsevier, vol. 67(1), pp. 157-172,

Campos, N. and Nugent, J. (2002) "Who is afraid of political instability?," *Journal of Development Economics*, vol. 67(1), pp. 157-172, February

Cantwell, J. *Technological Innovation and Multinational Corporations*, Oxford Blackwell, 1989

Cantwell, J. (1995) "The Globalisation of Technology: what Remains of the product Cycle Model?" *Cambridge Journal of Economics*, Vol. 19 (1), pp. 155-74

Cantwell, J. (2000) "A Survey of Theories of International Production" in Pitelis, C.N. And Sudgen, R. The Nature of The Transnational Firm, Routledge London

Carstensen, K. and Toubal, F. (2004) "Foreign direct investment in Central and Eastern European countries: a dynamic panel analysis," *Journal of Comparative Economics*, Elsevier, vol. 32(1), pp. 3-22

Caves, R.E. (1971) "International corporations: The industrial economics of foreign investment." *Economica*, Vol. 38, pp. 1-27

Caves, R.E. (1982) *Multinational Enterprise and Economic Analysis*, 1982, Cambridge, Cambridge University Press

Caves, R. (1996) *Multinational Enterprise and Economic Analysis*. Cambridge, England: Cambridge University Press.

Chakrabarti, A. (2001) "The determinants of foreign direct investment: sensitivity analyses of cross-country regressions." *Kyklos*, Vol. 54, pp. 89–113.

Chen, H. and Chen, T. (1998). "Network Linkage and Location Choice in Foreign Direct Investment." *Journal of International Business Studies*, Vol. 29(3), pp. 445-467.

Cheng, L.K. And Kwan, Y.K. (2000) "What are the Determinants of the Location of Foreign Direct Investments ? The Chinese Experience" *Journal of International Economics*, 51 (2), pp. 379-400

Collier P. and Hoeffler A. (2004) "Greed and grievance in civil war." *Oxford Economic Paper*, Vol. 56, pp. 663–95

Compton, R.A, Giedeman, D.C. and Johnson, N.D (2010) "Investing in Institutions" *Economics and Politics*, Vol. 22, pp.419-445

Crawford, S.E and Ostrom, E (1995)"A Grammar of Institutions" *The American Political Science Review*, Vol. 89 (3), pp. 582-600.

Coase, R.H. (1937)"The Nature of the Firm" *Economica*, Vo.4(16), pp. 386-405

Cox, H. (1997) "The evolution of international Business enterprise" in R. John et al Global Business Strategy, London ITBP, ch: 9-46

Crenshaw, E. (1991) "Foreign direct investment as a dependent variable." *Social Forces,* Vol. 69, pp.1169-82.

Cuadros, A., Orts, V. and Alguacil, M.T. (2004) "Openness and Growth Re-examining Foreign Direct Investments, Trade and Output Linkages in Latin America" *Journal of Development Studies*, Vol. 40 (4), pp.167-192

Cushman, D.O. (1985), "Real exchange rate risk, expectations and the level of direct investment", *Review of Economics and Statistics*, Vol. 67, pp.297-308.

Cushman, D.O. (1988), "Exchange rate uncertainty and foreign direct investment in the United States", *Weltwirtschaftliches Archiv*, Vol. 124, pp.322-336.

Daude, C. and Stein, E. (2007) "The Quality of Institutions and Foreign Direct Investment", Economics & Politics Volume 19(3), pp. 317–344

De Mello, L. (1999) "Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data," Oxford Economic Papers, Vol. 51(1), pp. 133–51.

Demsetz, H. (1967) "Towards a Theory of Property Rights", *American Economic Review*, Vol. 57(2), pp.347-359

de Soysa, I., and E. Neumayer (2007), "Natural Resources and Civil War: Another Look with New Data", *Conflict Management and Peace Science*, Vol. 24(3), pp.201-218

DiMaggio, P.J. and Powell, W.W. (1983) "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields" *American Sociological Review*, Vol. 48(2), pp. 147-160

Dornbusch, R. and Edwards, S. (1991) Macroeconomic Populism in Latin America," NBER Working Papers 2986, National Bureau of Economic Research

Doz, Y. L., Asakawa, K., Santos, J. F. P., & Williamson, P. J. (1997). "The Metanational corporation." Fontainebleau, France: INSEAD Working Paper 97/60/SM.

Dunning, J. H. (1993) Multinational Enterprise and Global Economy. Wokingham United Kingdom and Reading, Mass: Addison Wesley

Dunning, J.H. (1988). "The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions." *Journal of International Business Studies*, Vol. 19 (1), pp. 1-31.

Dunning, J.H (2000) "The Key literature on IB Activity: 1960-2000" in Rugman A.M. and Brewer, T.L. *The Oxford Handbook of International Business*,

Dunning, J.H. (2001) "The eclectic (OLI) paradigm of international production: past, present and future." *Journal of International Business Studies*, Vol. 8, pp. 173–190

Dunnig, J.H. (2003) "The Key Literature on IB Activities 1960-2000" in *The Oxford Handbook of International Business*

Eden, L., S. Lenway and D. A. Schuler (2004), "From the Obsolescing Bargain to the Political Bargaining Model", *Bush School Working Paper No. 403*, Texas A&M University, January

Edwards, S. (1990) "Capital flows, foreign direct investment, and debt—equity swaps in developing countries" NBER working paper no. 3497. Cambridge, MA: NBER.

Fatehi-Sadeth, K. and Safizadeh, H. (1989) "The Association between Political Instability and Flow of Foreign Direct Investment", *Management International Review,* Vol. 29, pp.4 -13,

Fearon, J. D. (2005) "Primary Commodity Exports and Civil War." *Journal of Conflict Resolution*, Vol. 49(4), pp. 483-507.

Fearon J. D and Laitin DD. (2003). "Ethnicity, insurgency, and civil war." *American Political Science Review*, Vol. 97, pp. 75–90

Frost, T. S. (2001). "The Geographic Sources of Foreign Subsidiaries Innovations." *Strategic Management Journal*, Vol. 22(2), pp. 101-123.

Gani, A. (2007) "Governance and foreign direct investment links: Evidence from panel data estimations" *Applied Economics Letters*, Vol. 14 (10), pp. 753-756

Garland, M. W. and Biglaiser, G. (2009) "Do Electoral Rule Matters? Political institutions and Foreign Direct Investment in Latin America" *Comparative Political Studies*, vol. 42 no. 2, pp. 224-251

Gerry, C.J. and Lee, J.-K. and Mickiewicz, T.M. (2008) "Macroeconomic stability, governance and growth: empirical lessons from the post-communist transition" Economics Working Papers 89, Centre for the Study of Economic and Social Change in Europe, SSEES, UCL

Ghoshal, S. and Moran, P. (1996) "Bad for Practice: A Critique of the Transaction Cost Theory" *The Academy of Management Review*, Vol. 21, No. 1, pp. 13-47

Globerman S., D. Shapiro (2002), "Global Foreign Direct Investment Flows: The Role of Governance Infrastructure" *World Development*, Vol. 30 (11), pp.1899-1919

Globerman, S. and D. Shapiro (2003). 'Governance infrastructure and US foreign direct investment', *Journal of International Business Studies*, Vol. 34, pp.19-39.

Goldberg, L.S. and Kolstad, C.D. (1995) "Foreign Direct Investment, Exchange Rate Variability and Demand Uncertainty," *International Economic Review*, 36(4), pp. 855-73.

Graham, E.M. (2002) "The Contribution of Steven Hymer: One View" *Contributions to Political Economy,* Vol. 21(1), pp. 27-41

Gray, C. W and Jarosz, W.W. (1995) "Law and the Regulation of Foreign Direct Investments: The Experience from Central and Eastern Europe" *Columbia Journal of Transnational Law*, Vol. 33 No.1, pp. 1-40

Grosse, R. (1997) "Foreign Direct Investment in Latin America." In Robert Grosse (Ed.), Generating Savings for Latin American Development (pp. 135-153). Coral Gables (FL): North-South Center Press, University of Miami.

Grubert, H. and Mutti, J. (1991) "Taxes, Tariffs and Transfer Pricing in Multinational Corporate Decision Making," *Review of Economics and Statistics*, 73(2), pp. 285-293

Hausmann, R., & Fernandez-Arias, E. (2000) "The new wave of capital inflows: Sea change or just another title?" Inter-American Development Bank working paper no. 417.

Hayakawa, K. (2007) "Small sample bias properties of the system GMM estimator in dynamic panel data models." *Economics Letters*, Vol. 95 (1), pp. 32–38.

Henisz, W.J. (2000) "The Institutional Environment for Multinational Investment" *The Journal of Law, Economics and Organizations*, Vol. 16(2), pp. 334-364

Hennart, J.F. (1982) *The Theory of Multinational Enterprise*, Ann Arbor, MI: University of Michigan Press

Hennart,J .F. (2000) Transaction costs theory and the multinational enterprise, C. Pitelis, R. Sugden, Editors , *The Nature of the Transnational Firm*, (second ed.), Routledge, London

Hirschman, A., (1985) "Reflections on the Latin American Experience," in The Politics of Inflation and Economic Stagnation, ed. by Lindberg. L.N., and C.S. Maier, Washington: The Brookings Institution.

Hodler, R. (2005) "The curse of natural resources in fractionalized countries" *European Economic Review* Volume 50 (6), pp. 1367-1386

Humphreys, M. (2005) "Natural resources, conflict, and conflict resolution: uncovering the mechanisms." *Journal of Conflict Resolution,* Vol. 49, pp.508-537

Hymer, S. H. (1976). *The international operations of national firms: A study of direct foreign investment.* Cambridge, MA: MIT Press.

Ietto-Gillies, G. (2000) "What Role for Multinationals in the New Theories of International Trade and Location?" *International Review of Applied Economics*, Vol. 14(4), pp.413-426

Isham, J., L. Pritchett, M. Woolcock, and G. Busby (2005). "The Varieties of Resource Experience: Natural Resource Export Structures and the Political Economy of Economic Growth." *World Bank Economic Review,* Vol. 19, pp. 141-174.

Jaspersen, F.Z., Aylward, A.H. and Knox, A.D. (2000) The effects of risk on private investment: Africa compared with other developing areas. In: P. Collier and C. Pattillo, Editors, *Investment and risk in Africa*, St Martin's Press, New York, pp. 71–95.

Jenkins, B. (1986) "Reexamining the 'obsolescing bargaining. A Study of Canada National Energy Program" *International Organization*, Vol. 40, pp. 139-165

Johanson, J & Vahlne, J. (1977) Internationalization Process of the Firm, Journal of management studies: Stockholm.Almquist and wiksell International.

Joskow, P.L. (1987) "Contract Duration and Relation-Specific Investment: Empirical Evidence from Coal Markets" *American Economic Review*, Vol. 77 (1), pp.168-185

Kaufmann, D. and Kraay, A. (2008)"Governance Indicators: Where Are We, Where Should We Be Going? World Bank Research Observer" WBRO, January

Kay, Neil M. (1983). 'Multinational Enterprises: A Review Article', *Scottish Journal of Political Economy,* Vol. 30, No. 3, pp. 304-12.

Kojima, K. (1978) *Direct Foreign Investment: A Japanese Model of Multinational Business Operations*. Croom Helm, London

Kojima, K. (1982) "Macro Economic Versus International Business Approaches to Foreign Direct Investment." *Hotosubashi Journal of Economics*, Vol. 23, pp. 1-19.

Kogut, B. and Chang, S. J. (1996) "Platform Investments and Volatile Exchange Rates: Direct Investment in the U.S. by Japanese Electronic Companies" *The Review of Economics and Statistics*, Vol. 78, pp. 221-231.

Kogut, B. and Zander, U. (1993) "Knowledge of the Firm and the Evolutionary Theory of the Multinational Corporation" *Journal of International Business Studies*, Vol. 24 (4), pp. 625-645

Kraemer, R. and van Tulder, R. (2009) "Internationalization of TNCs from the extractive industries: a literature review" *Transnational Corporations,* Vol. 18, No. 1

Kumar, N. (1998). *Globalization, Foreign Direct Investment and Technology Transfers: Impacts on and Prospects for Developing Countries*. New York: Routledge.

Le Billon, P. (2005) *Fuelling War: Natural Resources and Armed Conflict*. Abingdon and New York: Routledge, for the International Institute for Strategic Studies.

Lecraw , D. J. (1993.) "Outward Direct Investment by Indonesian Firms: Motivation and Effects." *Journal of International Business Studies*., Vol. 24(3), pp. 589-600.

Li, Q. & Resnick, A. (2003) "Reversal of Fortunes: Democratic Institutions and Foreign Direct Investment Inflows to Developing countries" *International Organisation*, Vol. 57, pp.175-211

Libecap, G. (1989) *Contracting for Property Rights*. New York: Cambridge University. Press

Lipsey, R. E. (1999). "The location and characteristics of US affiliates in Asia." NBER working paper no. 6876.

Liu, X., C. Wang and Y. Wei (2001), "Causal Links between Foreign Direct Investment and Trade in China", *China Economic Review*, Vol. 12(2), pp. 190-202

Loree, D.W. and Guisinger, S. (1995) "Policy and non-policy determinants of US equity foreign direct investment" *Journal of Business Studies*, Vol. 26 (2), pp. 281–299.

Lucas, R.E. (1990) "Why Doesn't Capital Flow from Rich to Poor Country?" *American Economic Review*, Vol.80 (2), pp.92-96

Luo, Y. (2001) "Toward a cooperative view of MNC–host government relations: building blocks and performance implications", *Journal of International Business Studies*, Vol. 32, pp. 104–419

Makino, S. (1998). *Towards a theory of asset seeking foreign direct investment.* Hong Kong: The Chinese University, mimeo.

Makino, S, & Delios, A. (1996). "Local Knowledge Transfer and Performance: Implications for Alliance Formation in Asia." *Journal of International Business Studies*, Vol. 27(5), pp. 905-927.

Mankiw, G. (1995) "The Growth of Nations," Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution, vol. 26(1, 25th A), pp. 275-32

Markusen, J. R. (2002). *Multinational Firms and the Theory of International Trade.* Cambridge, Mass.: MIT Press.

Mcmanus, J. (1972) "The Theory of the International Firm" in Gilles Paquet (ed), The Multinational Firm and the Nation State, Don Mills, Ontario: Collier-Macmillan, pp.66-93

Muqtada, M. (2003) "Macroeconomic stability, growth and employment. Issues and consideration behind the Washington consensus", Employment Sector, International Labour Office, Geneva

Noorbakhsh, F., Paloni, A. & Youssef, A. (2001) "Human capital and FDI inflows to developing countries: new empirical evidence" *World Development*, 29, pp. 1593–1610.

North, D. (1981) *Structure and Change in Economic History*. W.W. Norton and Company, Inc., New York

North, D. (1990) *Institution, institutional change and economic performances*. Cambridge University Press

Nunnenkamp, P. and Spatz, J. (2003) "Intellectual Property Rights and Foreign Direct Investment: The Role of Industry and Host-Country Characteristics," Kiel Working Papers 1167, Kiel Institute for the World Economy

O'Donnell, G. (1978) "Reflections on the patterns of change in the bureaucratic authoritarian state" *Latin American Research Review*, Vol. 13(1), pp. 3–38.

Olibe, K. and Crumbley, L. (1997) "Determinant of US Private Foreign Direct Investment in OPEC Nations: from Public and Non Public Policy Perspectives" *Journal of Public Budgeting, Accounting and Financial Management,* pp. 331-55

Olson, M. (1993) "Dictatorship, Democracy, and Development." *American Political Science Review*, Vol. 87 (Sept), pp. 567-576

Poelhekke, S. and van der Ploeg, R. (2010) "Do Natural Resources Attract non-resources FDI" Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford in its series OxCarre Working Papers with number 051.

Powell, W.W. (1990) "Neither Market nor Hierarchy: Network Forms of Organisation" *Research in Organisational Behaviour* , Vol.12, pp. 295-336

Renner, M. (2002). "The anatomy of resource wars." Worldwatch Paper, 162. Worldwatch Institute.

Roodman, D. (2006). "How to do xtabond2: an introduction to "Difference" and "System" GMM in Stata." Center for Global Development Working Paper Number 103.

Ross, M.L. (1999). "The Political Economy of the Resource Curse," *World Politics*, Vol. 51(1), pp. 297–322

Ross, M. L. (2006). "A closer look at oil, diamonds, and civil war" Annual Review of Political Science, Vol. 9, pp. 265-300.

Rowthorn, R.E. (1977) "Conflict, inflation and money" Cambridge Journal of Economics, Vol. 1(3), pp.215-239.

Rugman, A. M. (1986) "New Theories of the Multinational Enterprise: An assessment of Internalization Theory." *Bulletin of Economic Research*, Vol. 2, pp.101-118.

Rugman, A.R. and Brewer, T.L. (2003) *The Oxford Handbook of International Business*. Oxford: Oxford University Press

Sachs, J.D., (1989) "Social conflict and populist policies in Latin America" Working paper no.
2897, NBER, Cambridge, MA.

Sachs, J.D., Warner, A.M., (1995). "Natural resource abundance and economic growth." National Bureau of Economic Research Working paper No. 5398, Cambridge,

Sala-i-Martin, X. and Subramanian, A. (2003). "Addressing the natural resource curse: an illustration from Nigeria" NBER Working Paper No. 9804.

Satyanath, S. and Subramanian, A. (2004) "What determine Long-Run Macroeconomic Stability? Democratic Institution" *International Monetary Fund Working Paper*, no.215

Schneider, F. & Frey, B. (1985) Economic and political determinants of foreign direct investment, *World Development*, 13(2), pp. 161–175.

Schulz, H. (2007) "Political Institutions and Foreign Direct Investment in Developing Countries: Does the Sector Matter?" University of Pennsylvania Working Paper

Snyder R, Bhavnani R. (2005). "Diamonds, blood, and taxes: a revenue-centered framework for explaining political order." Journal of Conflict Resolution 49:563–97

Stevens, G. (2000) "Politics, Economics and Investment: Explaining, Plant & Equipment Spending by US Direct Investor in Argentina, Brazil and Mexico" *Journal of International Money and Finance*, vol. 19

Stone, B. and Jeon, S. (2000) "Foreign Direct Investment and Trade in the Asia-Pacific Region: Complementarity, Distance and Regional Economic Integration" *Journal of Economic Integration*, Vol.15(3), pp. 460-485

Swenson, D. (1994) "The Impact of US tax Reform on Foreign Direct Investment on the United States" *Journal of Public Economic,* Vol. 54 (2), pp. 243-66

Teece, D. (1977) "Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Knowhow." *Economic Journal*, Vol. 87 (346), pp. 242-261

Tsai , P.L. (1994) " Determinants of foreign direct investment and its impact on economic growth." *Journal of Economic Development*, Vol. 19**,** pp. 137–163.

Tugwell, F. (1975) *The Politics of Oil in Venezuela*. Stanford University Press, Stanford California.

Vernon, R. (1971), *Sovereignty at Bay: The Multinational Spread of US Enterprise*, Basic Books, New York.

Vernon, R. (1966) "International Investment and International Trade in the Product Cycle" The Quarterly Journal of Economics, Vol. 80, No. 2, pp. 190-207

Vernon, R (1979)"The Product Cycle hypothesis in the New International Environment" *Oxford Bulletin of Economics and Statistics*, Vol. 41,pp. 225-267

UNCTAD (2006). Statistical Database. World Investment Report . United Nations. New York and Geneva. from: www.unctad.org

UNCTAD (2011) "Classification Update, Economic Grouping" available from: www.unctad.org/fdistatistics

Wei, S. (2000) "How Taxing is Corruption on International Investors?" *Review of Economics and Statistics*, Vol. 82(1), pp. 1-11.

Wesson, T. J. (1993). *An alternative motivation for foreign direct investment*. Unpublished Doctoral Dissertation, Harvard University.

Williamson, O.E. (1973) "Markets and hierarchies: some elementary considerations" *The American Economic Review*, Vol. 63 (2), pp.316-25

Williamson, O.E. (1983) "Credible Commitment: Using hostage to Support Exchange" *American Economic Review*, Vol. 73(4), pp.519-549

Williamson, O.E. (1985) The economic institutions of capitalism: Firms, markets, relational contracting Free Press (New York and London)

Williamson, O.E., (1987) *The economic institutions of capitalism: firms, markets, relational contracting*. Free Press, New York.

Zhao, H., Lou, Y. and Suh, T. (2004) "Transaction Cost Determinants and Ownership Based Entry-Mode Choice: A Meta Analytical Review" *Journal of International Business Studies*, Vol.35 (6), pp. 524-544

Table 1

Variable name	Variable Label	Source
Lfdigdp	Log FDI inflow as % of GDP	UNCTAD
l.LFDIpercap	Lagged FDI inflow as % of GDP	UNCTAD
LGDPcons	Log GDP in constant us $	World Bank (WB)- World Development indicators (WDI)
LGDPPPcons	Log GDP per capita in constant us $	WB- WDI
inflation	Inflation, consumer price annual %	WB- WDI
Ltrade	Log trade (import and export as percentage of GDP)	WB- WDI
nat	Fuel and Metal Export as percentage of total export	WB- WDI
fuelex	Fuel Export as percentage of total export	WB- WDI
Oresex	Ores and metal export as percentage of total export	
agriex	Agricultural Export as percentage of total export	WB- WDI
Polstab2	Political stability (principal component of internal/external conflict, government	International Country Risk Guide (ICRG)

	stability and ethnic tension)	
Law1	Law and Order	ICRG
Polity2	Democracy indicator	PolityIV

Table 2

Variable	Obs	Mean	Std. Dev.	Min	Max
Lfdigdp					
--.	2543	.1955234	1.774239	-10.55869	4.522919
L1.	2420	.1618515	1.777313	-10.55869	4.522919
Ltrade	2646	4.148804	.6030345	-1.175052	5.636078
Lgdpcons	2731	23.41773	1.779727	18.6116	28.83838
Lgdppcppp	2627	8.247082	1.094083	5.016001	10.00149
inflation	2444	73.41398	787.4922	-100	24411.03
nat	2032	26.48632	29.36973	0	99.73957
oresex	2071	8.701103	15.48403	0	88.81229
fuelex	2045	17.76398	28.41176	0	99.73948
agriex	2078	5.629801	10.06563	.0005647	93.82378
polstab2	1472	-.2573426	1.390298	-6.199394	2.555989
law1	2499	.5381363	.2199914	0	1
polity2	2696	1.684718	6.867579	-10	10

Table 3

	Lfdigdp	L.L~igdp	Ltrade	Lgdpcons	Lgdppc~p	inflat~n	nat
Lfdigdp	1.0000						
L.Lfdigdp	0.7979	1.0000					
Ltrade	0.3552	0.3560	1.0000				
Lgdpcons	-0.0390	-0.0270	-0.2811	1.0000			
Lgdppcppp	0.1662	0.1818	0.2858	0.5448	1.0000		
inflation	-0.0510	-0.0761	-0.0301	-0.0153	-0.0510	1.0000	
nat	-0.0652	-0.0797	-0.0098	-0.0160	-0.0042	0.0234	1.0000
oresex	0.0859	0.0608	0.0246	-0.2298	-0.1867	0.0660	0.3378
fuelex	-0.1128	-0.1092	-0.0172	0.1226	0.1134	-0.0094	0.8542
agriex	-0.0995	-0.0829	-0.1466	-0.2537	-0.3042	0.0035	-0.1601
polstab2	0.1693	0.1916	0.2884	0.0748	0.4018	-0.0442	-0.1914
law1	0.2142	0.2040	0.2100	0.2797	0.4493	-0.0730	-0.1027
polity2	0.2821	0.2819	0.1540	0.2016	0.3482	-0.0015	-0.3997

	oresex	fuelex	agriex	polstab2	law1	polity2	
oresex	1.0000						
fuelex	-0.2008	1.0000					
agriex	-0.0131	-0.1696	1.0000				
polstab2	0.0034	-0.2036	-0.0792	1.0000			
law1	-0.0575	-0.0772	-0.0634	0.5395	1.0000		
polity2	-0.0143	-0.4057	-0.0703	0.1490	0.1529	1.0000	
oresex	0.0645	0.0468	0.0031	-0.2477	-0.2078	0.0683	0.3288
fuelex	-0.1112	-0.1111	0.0122	-0.0229	0.0721	-0.0065	0.8759
agriex	-0.0949	-0.0801	-0.1587	-0.2567	-0.3298	0.0090	-0.1335
polstab2	0.1655	0.1728	0.3097	0.1884	0.5044	-0.0461	-0.1683
law1	0.2182	0.2035	0.2176	0.4613	0.6445	-0.0784	-0.1549

Figure 1

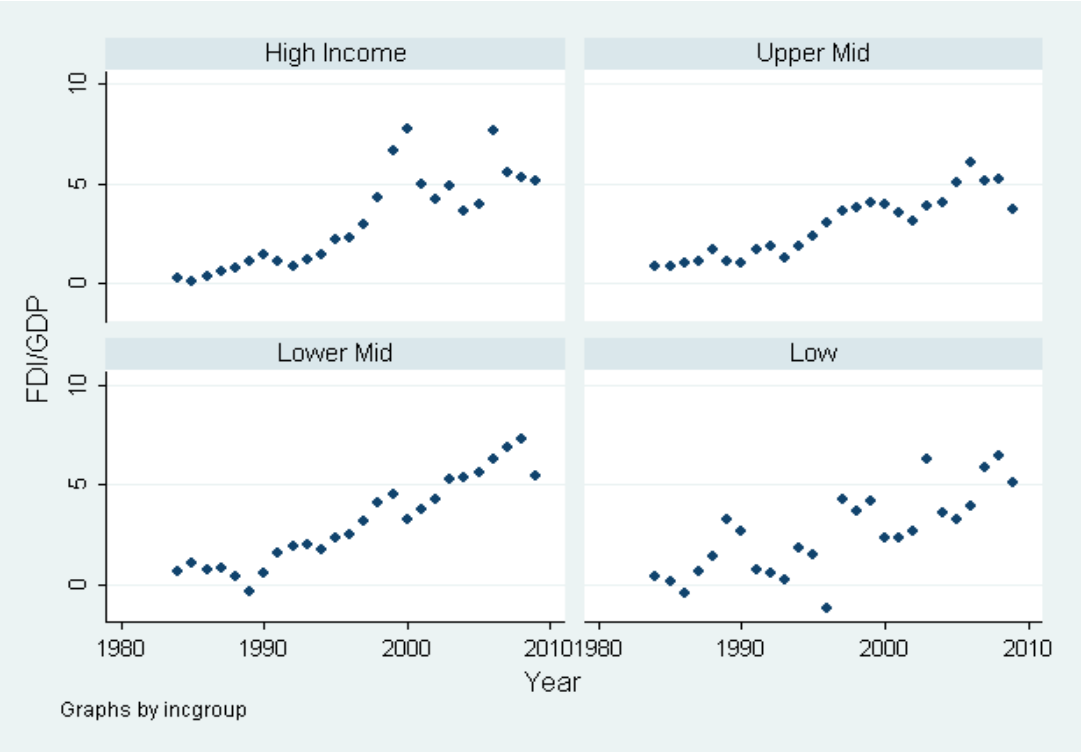

Figure 2

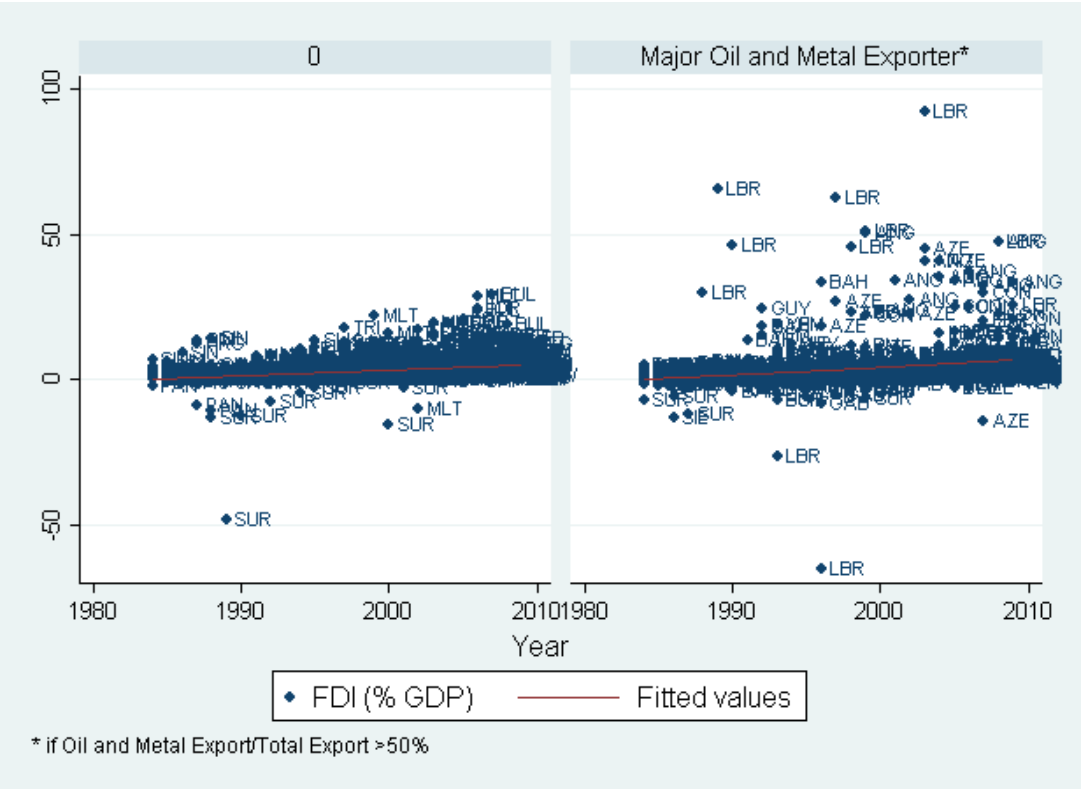

Figure 3

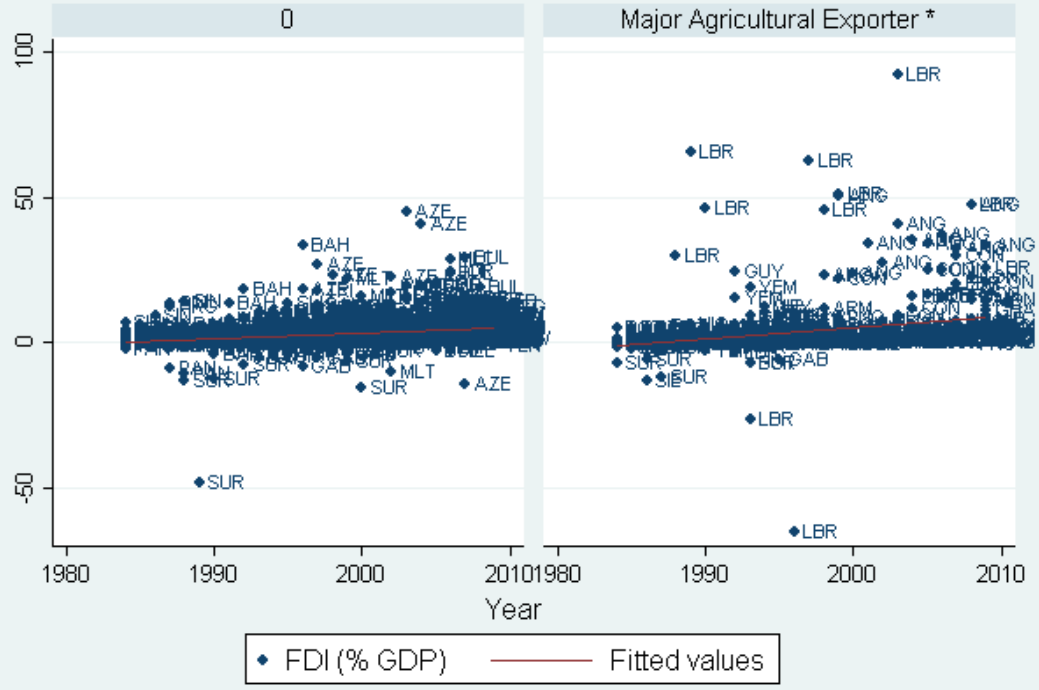

Figure 4

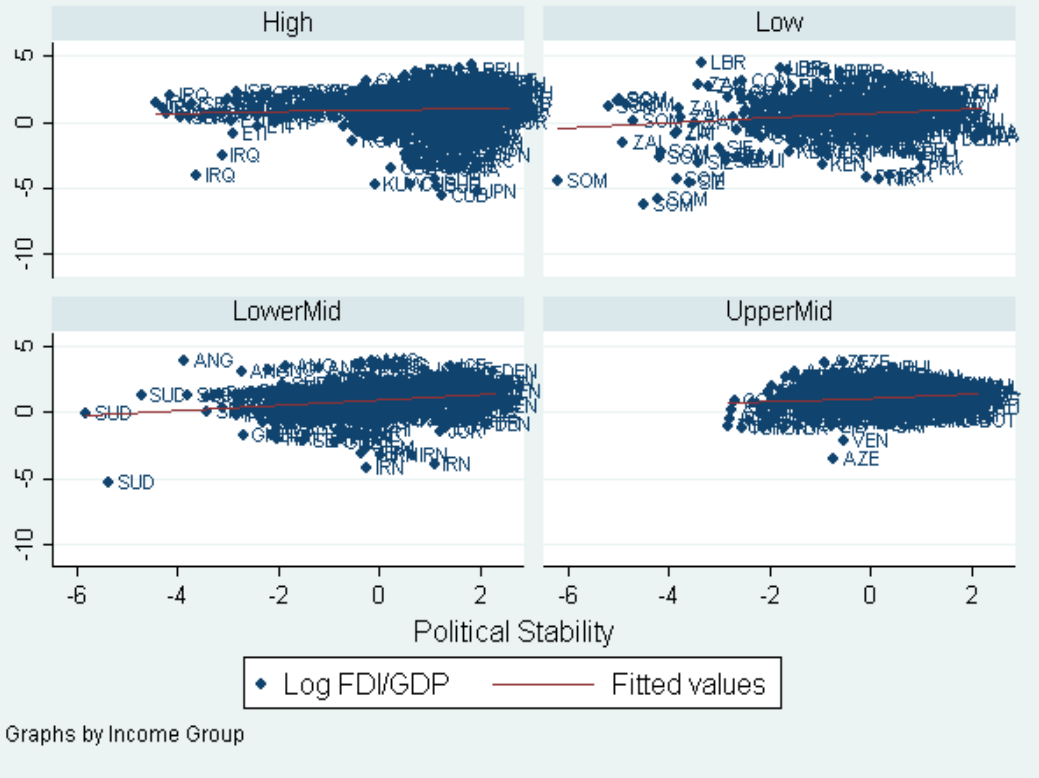

Figure 5

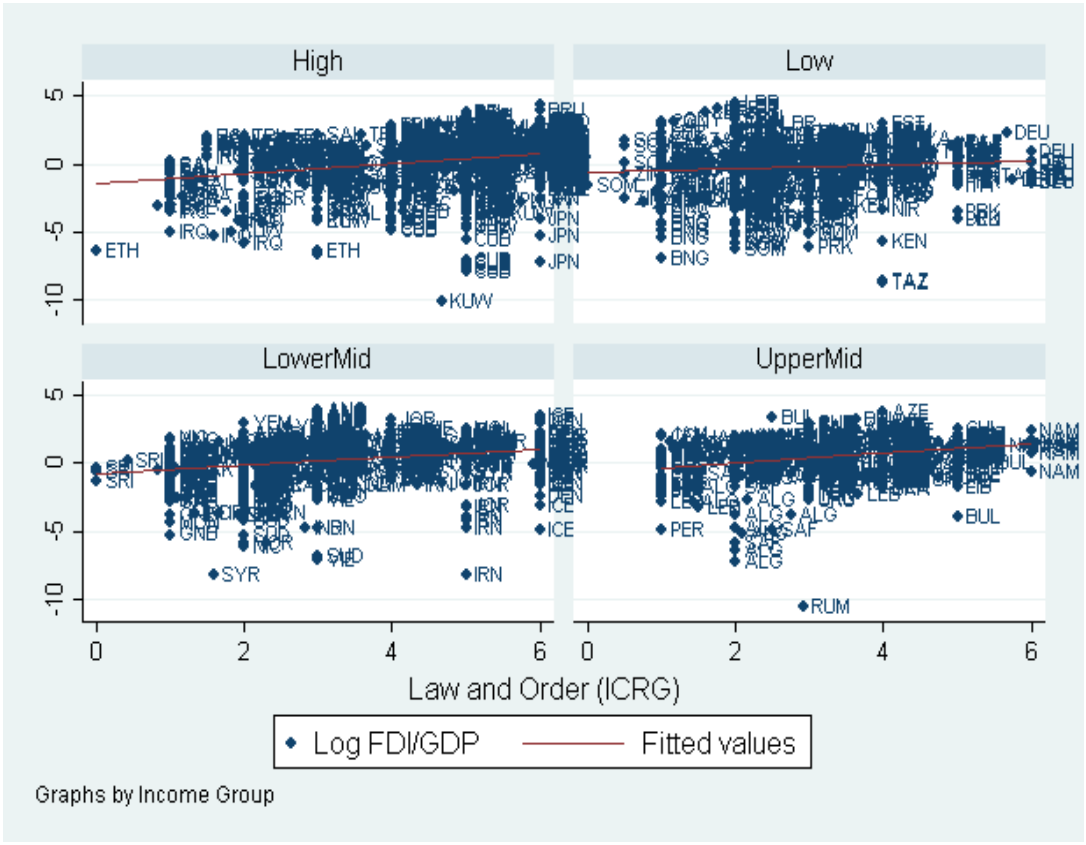

Figure 6

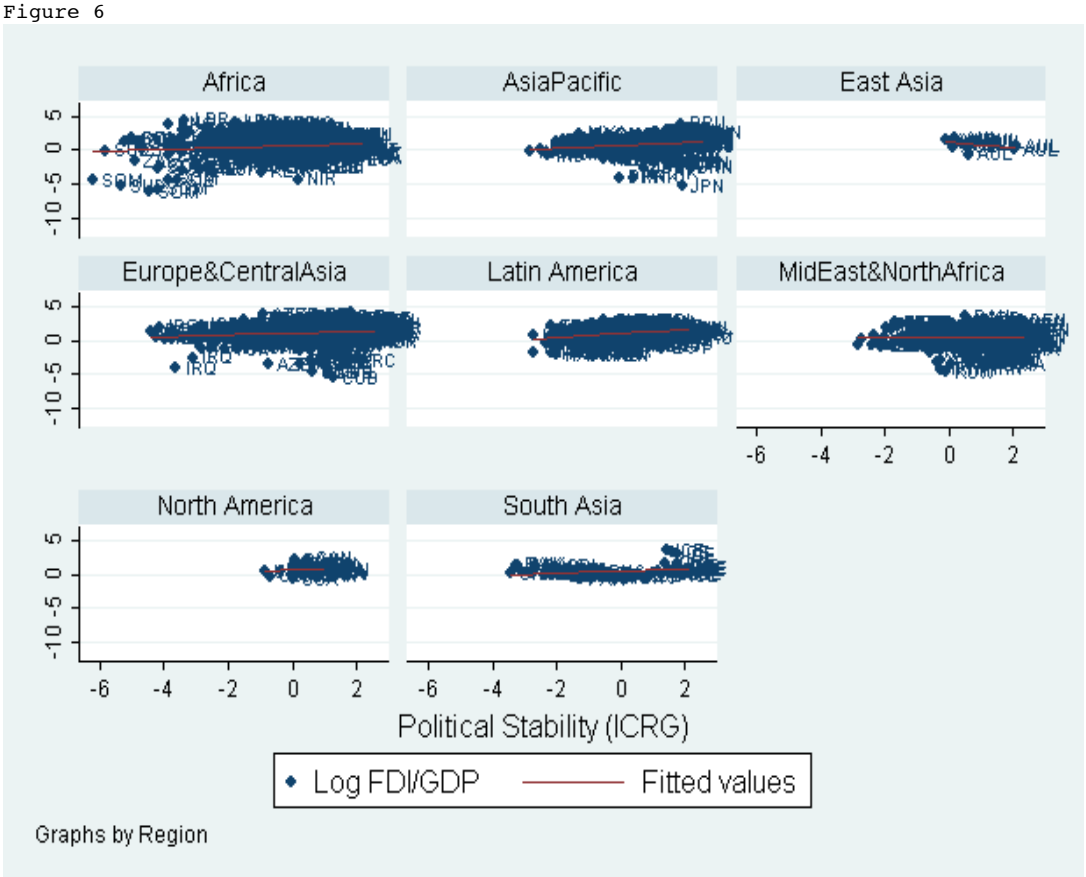

Figure 7

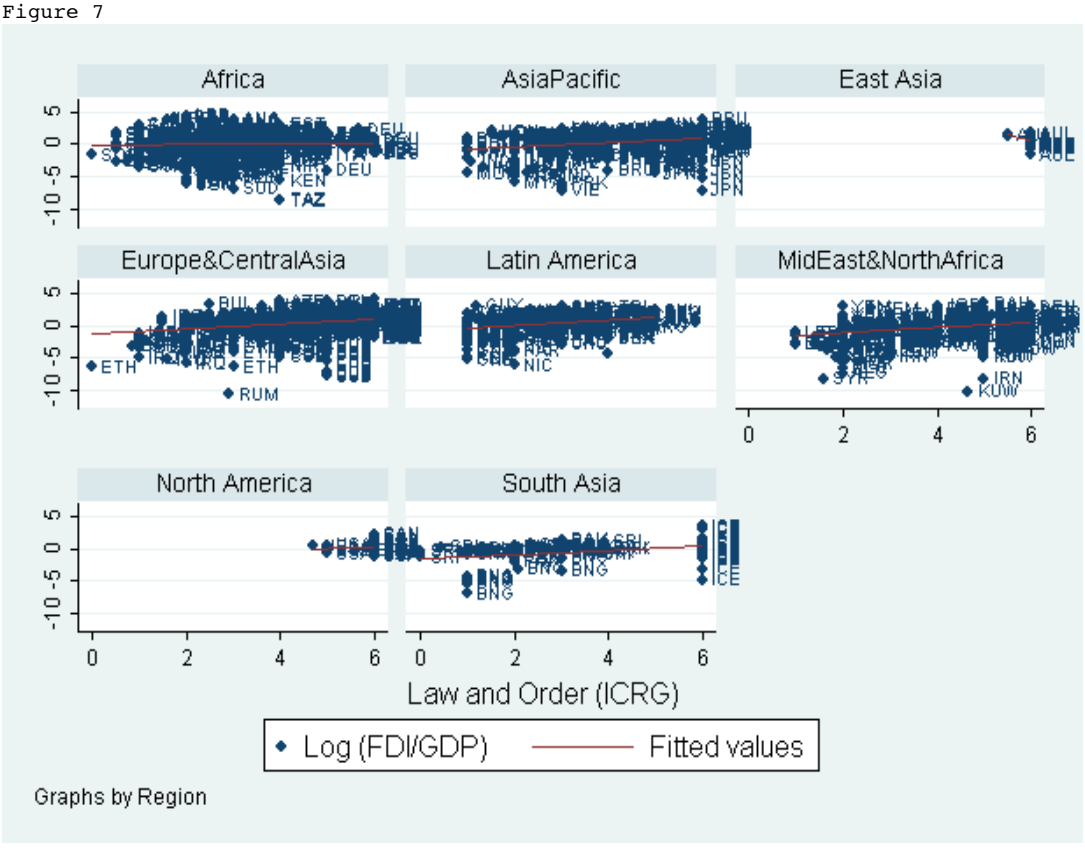

Figure 8

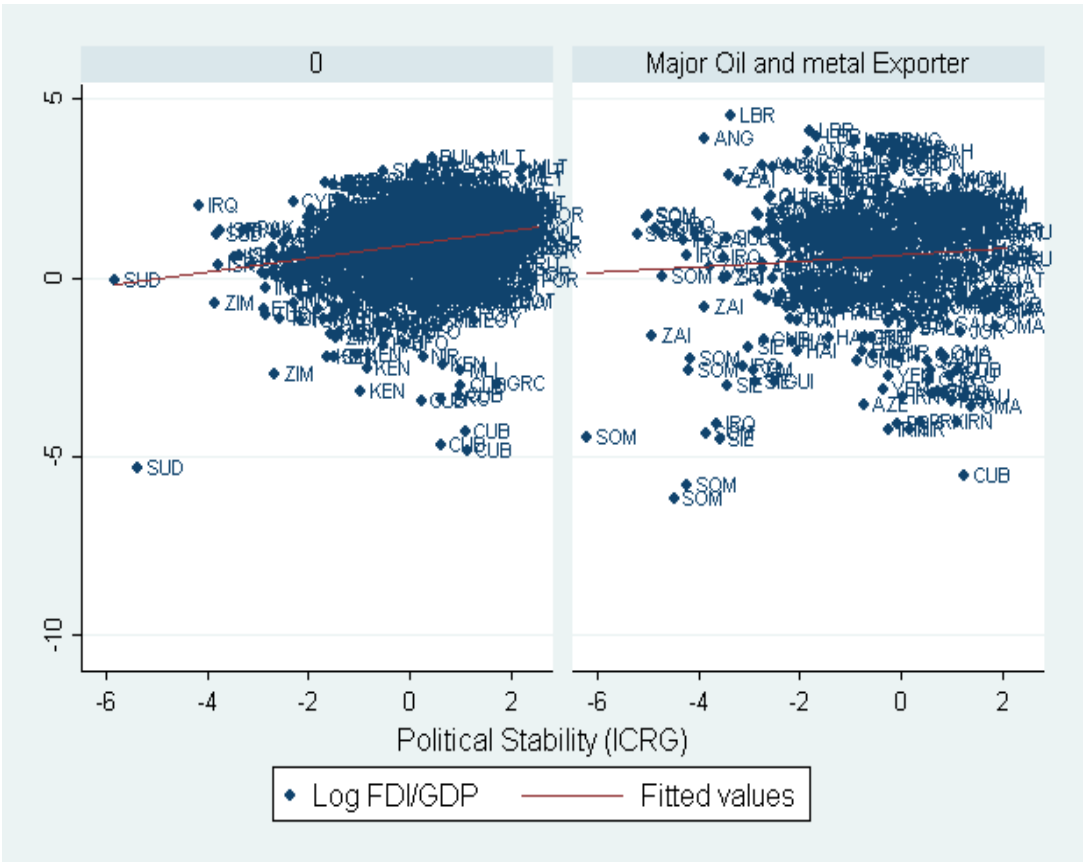

Figure 9

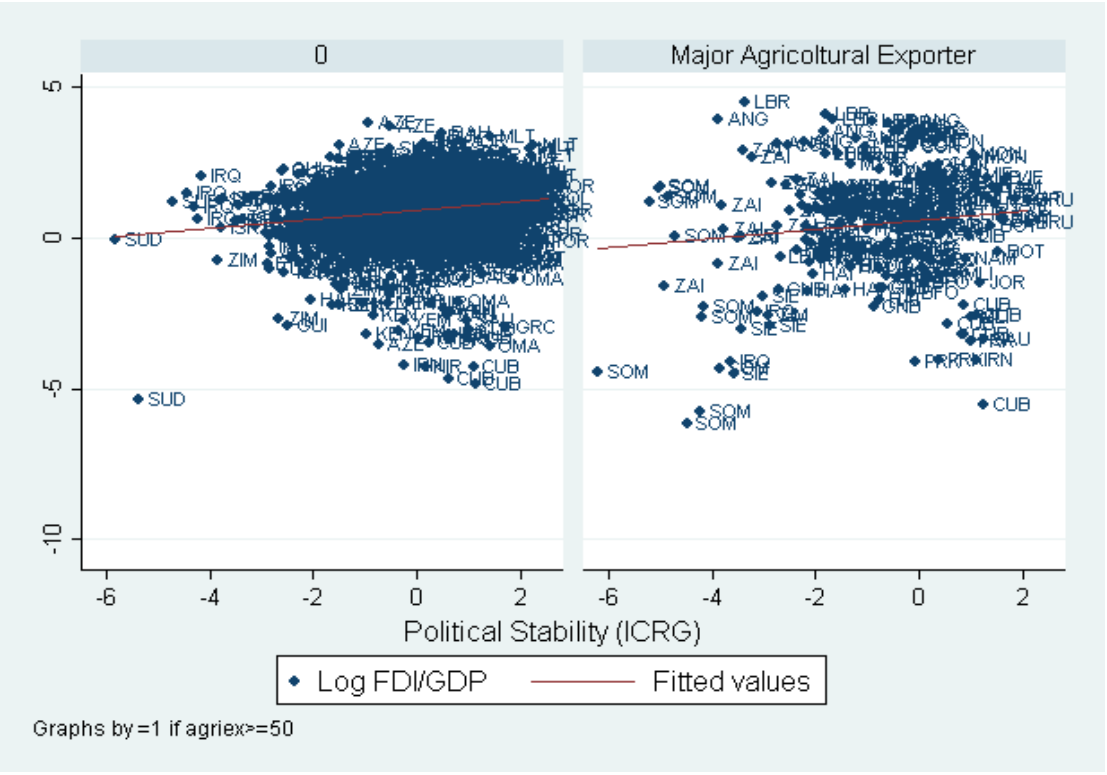

Figure 10

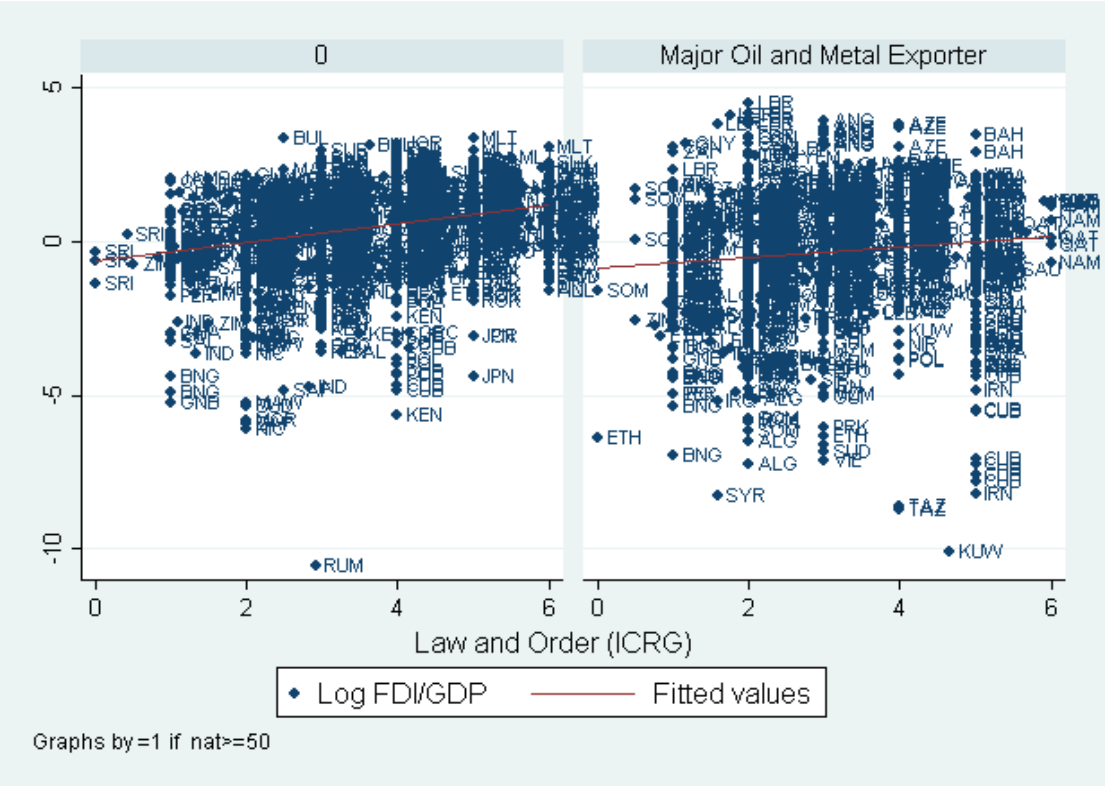

Figure 11

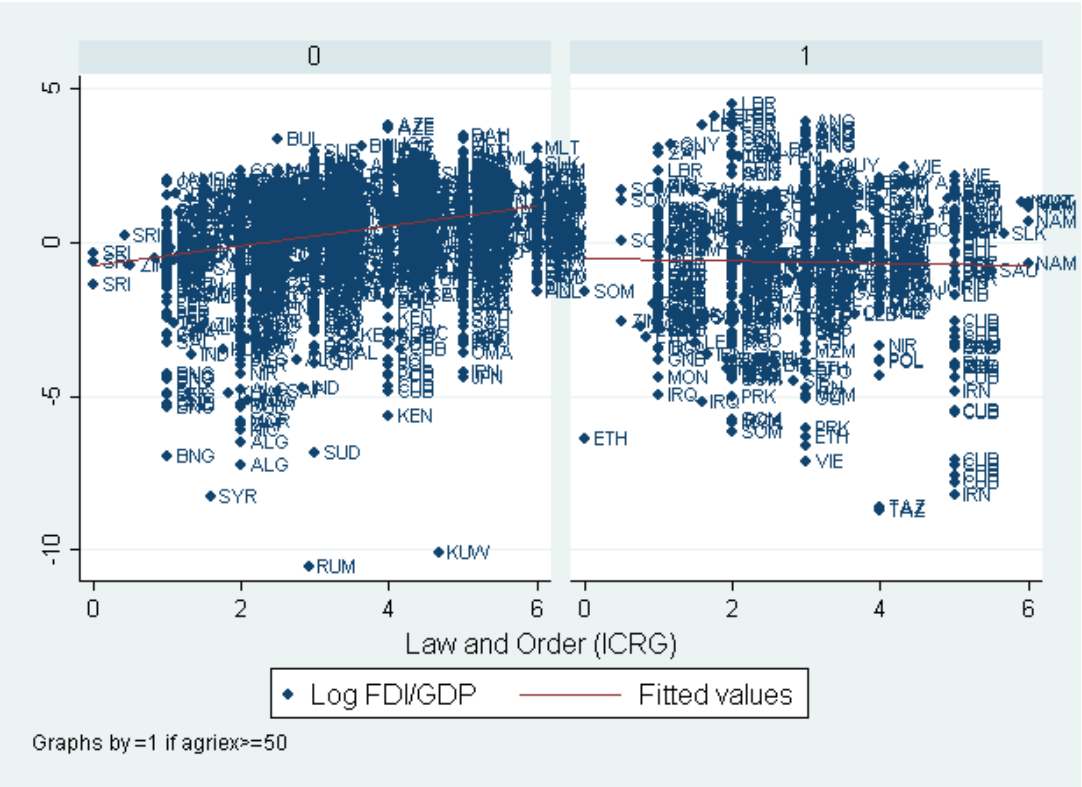

Table 1a- GMM

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.330***	0.342***	0.327***	0.337***
	(0.0790)	(0.0798)	(0.0769)	(0.0800)
Ltrade	0.381***	0.350***	0.360***	0.348***
	(0.129)	(0.125)	(0.126)	(0.125)
Lgdp	-0.0353	-0.0420	-0.0428	-0.0440
	(0.0363)	(0.0325)	(0.0348)	(0.0329)
Lgdp per capita	-0.00928	0.0108	-0.0127	0.00334
	(0.0675)	(0.0599)	(0.0661)	(0.0621)
Inflation	7.76e-06	7.26e-05	0.000133	0.000120
	(0.000586)	(0.000550)	(0.000493)	(0.000504)
Nat	0.000727	0.0128**	-0.000421	0.00879
	(0.00214)	(0.00541)	(0.00226)	(0.00716)
Political Stability	0.00879	0.0279	0.0751*	0.0572
	(0.0333)	(0.0335)	(0.0393)	(0.0386)
Law & Order	0.535*	0.941***	0.646**	0.885***
	(0.307)	(0.327)	(0.315)	(0.330)
polity2	0.0204**	0.0153*	0.0189**	0.0160*
	(0.0100)	(0.00912)	(0.00945)	(0.00931)
nat*law		-0.0213**		-0.0153
		(0.00977)		(0.0126)
nat*polstab			-0.00304**	-0.00159
			(0.00137)	(0.00167)
Constant	-0.167	-0.253	0.111	-0.0837
	(0.977)	(0.929)	(0.963)	(0.942)
Observations	895	895	895	895
Number of ID	92	92	92	92
AR(1)- pvalue	1.26e-07	2.11e-07	1.24e-07	2.33e-07
AR(2)-p value	0.331	0.342	0.365	0.358
Hansen- p value	0.0464	0.0405	0.0506	0.0446
Instrument Number	23	24	24	25

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year dummies included but not reported. Dependent variable is the log of FDI per capita.

Table 1b – GMM Endogenous variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.388***	0.425***	0.376***	0.415***
	(0.0879)	(0.0936)	(0.0873)	(0.0892)
Ltrade	0.717	0.673	0.397	0.684
	(0.897)	(1.119)	(1.039)	(1.241)
Lgdpcons	0.313*	0.297*	0.329*	0.286
	(0.166)	(0.179)	(0.185)	(0.178)
Lgdppcppp	-0.575**	-0.589*	-0.649**	-0.621**
	(0.280)	(0.309)	(0.310)	(0.307)
Inflation, consumer prices (annual %)	8.03e-05	5.66e-05	0.000130	3.75e-05
	(0.000713)	(0.000783)	(0.000691)	(0.000819)
Nat	-0.0129	0.0547**	-0.0200*	0.0476*
	(0.00877)	(0.0240)	(0.0107)	(0.0276)
Political Stability	0.00277	-0.119	0.141	-0.0489
	(0.0904)	(0.119)	(0.138)	(0.168)
law1	1.796*	4.521***	2.002*	4.343***
	(0.940)	(1.540)	(1.023)	(1.497)
polity2	0.0518	0.0505	0.0592	0.0535
	(0.0465)	(0.0491)	(0.0488)	(0.0466)
nat*law1		-0.122***		-0.113**
		(0.0451)		(0.0452)
	(0.0936)	(0.101)	(0.0996)	(0.101)
nat*polstab2			-0.00461	-0.00241
			(0.00419)	(0.00405)
Constant	-5.844	-6.692	-4.147	-6.053
	(4.452)	(5.851)	(5.272)	(6.378)
Observations	895	895	895	895
Number of ID	92	92	92	92
AR(1)- pvalue	5.10e-06	1.34e-05	5.01e-06	7.51e-06
AR(2)-p value	0.209	0.401	0.225	0.406
Hansen- p value	0.666	0.624	0.651	0.770
Instrument Number	39	42	42	45

TABLE 2a- GMM – Exogenous variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp
L.Lfdigdp	0.336***	0.349***	0.332***
	(0.0788)	(0.0793)	(0.0763)
Ltrade	0.382***	0.331***	0.349***
	(0.128)	(0.118)	(0.124)
Lgdpcons	-0.0258	-0.0334	-0.0324
	(0.0358)	(0.0314)	(0.0328)
Lgdppcppp	0.0261	0.0551	0.0471
	(0.0683)	(0.0584)	(0.0635)
Inflation, consumer prices (annual %)	-9.45e-06	-4.77e-05	9.40e-05
	(0.000612)	(0.000612)	(0.000537)
Ores and metals exports (% of merchandise exports)	0.00601**	-0.00974	0.00629**
	(0.00266)	(0.0109)	(0.00259)
Fuel exports (% of merchandise exports)	-0.00116	0.0131**	-0.00388
	(0.00270)	(0.00536)	(0.00284)
Political Stability	-0.00505	0.0202	0.0647*
	(0.0326)	(0.0316)	(0.0380)
law1	0.485	0.653**	0.604**
	(0.305)	(0.318)	(0.304)
polity2	0.0141	0.00699	0.00819
	(0.0102)	(0.00870)	(0.00991)
oresex*law		0.0277	
		(0.0183)	
fuelex*law		-0.0252***	
		(0.00916)	

oresex*pol.stab.			-0.00135
			(0.00167)
fuelex*polstab			-0.00433***
			(0.00158)
Constant	-0.678	-0.590	-0.557
	(1.003)	(0.886)	(0.946)
Observations	895	895	895
Number of ID	92	92	92
AR(1)- pvalue	1.14e-07	1.96e-07	1.11e-07
AR(2)-p value	0.342	0.322	0.398
Hansen- p value	0.0464	0.0332	0.0505
Instrument Number	24	26	26

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year dummies included but not reported. Dependent variable is the log of FDI per capita.

TABLE 2b- GMM – Endogenous variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp
L.Lfdigdp	0.398***	0.409***	0.388***
	(0.0914)	(0.0967)	(0.0881)
Ltrade	0.753	0.742	0.490
	(0.848)	(0.863)	(0.843)
Lgdpcons	0.346*	0.305*	0.358*
	(0.180)	(0.181)	(0.194)
Lgdppcppp	-0.663**	-0.588**	-0.719**
	(0.285)	(0.289)	(0.307)
Inflation, consumer prices (annual %)	2.87e-05	-2.55e-05	6.83e-05
	(0.000726)	(0.000780)	(0.000723)
Ores and metals exports (% of merchandise exports)	0.00450	0.0159	0.00549
	(0.0170)	(0.0633)	(0.0203)
Fuel exports (% of merchandise exports)	-0.0156	0.0526**	-0.0231**
	(0.0103)	(0.0230)	(0.0112)
Political Stability (ICRG)	0.0284	-0.0817	0.184
	(0.101)	(0.115)	(0.153)
Law (ICRG)	1.970**	4.073**	2.136**
	(0.913)	(1.582)	(0.978)
polity2	0.0717	0.0542	0.0791
	(0.0490)	(0.0481)	(0.0492)
Metal ex*law		-0.0165	
		(0.103)	
Fuel ex*law		-0.118***	
		(0.0454)	
Metal ex*polstab			-0.00578
			(0.00487)
Oil ex*polstab			-0.00665
			(0.00488)
Constant	-6.376	-7.136	-5.033
	(4.659)	(5.289)	(5.115)
Observations	895	895	895
Number of ID	92	92	92
AR(1)- pvalue	8.35e-06	2.05e-05	5.79e-06
AR(2)-p value	0.219	0.383	0.264
Hansen- p value	0.695	0.587	0.895
Instrument Number	42	48	48

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year dummies included but not reported. Dependent variable is the log of FDI per capita.

TABLE 3a- GMM

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.299***	0.299***	0.303***	0.302***
	(0.0968)	(0.0965)	(0.0992)	(0.0988)
Ltrade	0.583***	0.579***	0.587***	0.587***
	(0.197)	(0.200)	(0.193)	(0.194)
Lgdpcons	-0.0553	-0.0568	-0.0533	-0.0533
	(0.0631)	(0.0650)	(0.0604)	(0.0611)
Lgdppcppp	-0.239	-0.244	-0.230	-0.229

	(0.230)	(0.251)	(0.216)	(0.229)
Inflation, consumer prices (annual %)	-0.000229	-0.000234	-0.000277	-0.000276
	(0.000676)	(0.000693)	(0.000709)	(0.000714)
Agricultural raw materials exports (% of merchandise exports)	-0.0116**	-0.00472	-0.0129**	-0.0126
	(0.00484)	(0.0290)	(0.00576)	(0.0210)
Political Stability	-0.0491	-0.0496	0.00703	0.00695
	(0.0649)	(0.0667)	(0.0565)	(0.0560)
Law	1.042	1.113	0.957	0.958
	(0.672)	(0.938)	(0.599)	(0.785)
Polity	0.100	0.102	0.0972	0.0969
	(0.0858)	(0.0936)	(0.0809)	(0.0860)
agriex*law1		-0.0125		-0.000580
		(0.0574)		(0.0444)
agriex*polstab2			-0.00862	-0.00858
			(0.00800)	(0.00805)
Constant	0.789	0.840	0.709	0.706
	(1.708)	(1.868)	(1.597)	(1.696)
Observations	1,172	1,172	1,172	1,172
Number of ID	113	113	113	113
AR(1)- pvalue	3.00e-07	2.72e-07	2.24e-07	2.05e-07
AR(2)-p value	0.160	0.161	0.111	0.112
Hansen- p value	0.733	0.732	0.686	0.687
Instrument Number	22	23	23	24

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year dummies included but not reported. Dependent variable is the log of FDI per capita.

TABLE 3b- GMM – Endogenous variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.306***	0.302***	0.306***	0.302***
	(0.101)	(0.101)	(0.101)	(0.101)
Ltrade	1.984***	1.675**	2.122***	1.951***
	(0.756)	(0.763)	(0.676)	(0.746)
Lgdpcons	0.0646	0.143	0.0635	0.136
	(0.155)	(0.144)	(0.165)	(0.151)
Lgdppcppp	-0.345	-0.183	-0.520	-0.476
	(0.336)	(0.336)	(0.333)	(0.384)
Inflation, consumer prices (annual %)	-0.000325	-0.000260	-0.000332	-0.000288
	(0.000947)	(0.000898)	(0.000933)	(0.000887)
Agricultural raw materials exports (% of merchandise exports)	0.00645	-0.138	0.000917	-0.120
	(0.0133)	(0.0926)	(0.0140)	(0.106)
Political Stability	-0.00674	-0.0505	0.0836	0.0944
	(0.0829)	(0.0780)	(0.113)	(0.0921)
law1	1.211	-0.120	1.292*	0.277
	(0.772)	(0.856)	(0.725)	(1.065)
polity2	0.0139	-0.0168	0.0355	0.0167
	(0.0451)	(0.0439)	(0.0488)	(0.0512)
agriex*law1		0.246		0.192
		(0.156)		(0.189)
agriex*polstab2			-0.00613	-0.0107**
			(0.00638)	(0.00442)
Constant	-7.121	-8.138*	-6.269	-6.928
	(4.604)	(4.519)	(4.995)	(4.808)
Observations	1,172	1,172	1,172	1,172
Number of ID	113	113	113	113
AR(1)- pvalue	1.39e-06	2.26e-06	1.38e-06	2.00e-06
AR(2)-p value	0.187	0.209	0.135	0.124
Hansen- p value	0.787	0.730	0.728	0.692
Instrument Number	36	39	39	42

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year dummies included but not reported. Dependent variable is the log of FDI per capita.

ROBOUSTNESS

TABLE 4a-GMM- Exogenous instruments

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp

L.Lfdigdp	0.391***	0.376***	0.392***	0.384***
	(0.0808)	(0.0813)	(0.0809)	(0.0809)
Ltrade	0.337**	0.311**	0.268**	0.260**
	(0.137)	(0.134)	(0.121)	(0.121)
Lgdpcons	-0.0364	-0.0450	-0.0460	-0.0500
	(0.0368)	(0.0352)	(0.0329)	(0.0327)
Lgdppcppp	-0.0951	-0.0686	-0.0581	-0.0465
	(0.0658)	(0.0663)	(0.0608)	(0.0619)
Inflation, consumer prices (annual %)	-0.000188*	-	-	-
		0.000222***	0.000363**	0.000363***
	(0.000112)	(7.81e-05)	(0.000144)	(0.000122)
Oil prod/GDP	5.682***	2.763	20.76***	17.21***
	(2.016)	(2.912)	(5.430)	(5.740)
Polstab	0.0357	0.0632*	0.0462	0.0613*
	(0.0331)	(0.0343)	(0.0319)	(0.0327)
Law	0.425	0.405	0.703***	0.657**
	(0.262)	(0.262)	(0.254)	(0.257)
Polity2	0.0295***	0.0235**	0.0217**	0.0190**
	(0.00998)	(0.0103)	(0.00894)	(0.00931)
oilprodgdp*polstab		-2.291*		-1.370*
		(1.285)		(0.796)
oilprodgdp*law			-29.64***	-26.11***
			(10.43)	(10.01)
Constant	0.729	0.911	0.837	0.933
	(0.951)	(0.925)	(0.860)	(0.861)
Observations	881	881	881	881
Number of ID	88	88	88	88
AR(1)- pvalue	3.91e-07	4.44e-07	4.14e-07	4.35e-07
AR(2)-p value	0.489	0.514	0.495	0.499
Hansen- p value	0.0143	0.0171	0.0116	0.0141
Instrument Number	23	24	24	25

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 4b-GMM-Endogenous variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.421***	0.416***	0.447***	0.443***
	(0.0913)	(0.0889)	(0.0851)	(0.0830)
Ltrade	2.181**	2.403**	0.300	0.308
	(0.973)	(1.022)	(0.784)	(0.768)
Lgdpcons	0.203	0.144	0.251	0.219
	(0.240)	(0.270)	(0.188)	(0.176)
Lgdppcppp	-0.675**	-0.675**	-0.386*	-0.363*
	(0.289)	(0.282)	(0.219)	(0.219)
Inflation, consumer prices (annual %)	-	-	-	-
	0.000378***	0.000406***	0.000591***	0.000591***
	(0.000102)	(0.000107)	(0.000149)	(0.000162)
Oil production/GDP	1.415	-2.225	37.82***	36.91**
	(4.385)	(5.742)	(13.52)	(15.06)
Polstab	0.0321	0.0960	0.0732	0.0988
	(0.103)	(0.107)	(0.100)	(0.105)
law	1.289	1.184	2.388**	2.407***
	(0.938)	(0.985)	(0.938)	(0.924)
Polity2	0.0486*	0.0383	0.0228	0.0166
	(0.0268)	(0.0269)	(0.0228)	(0.0220)
oilprodgdp*polstab		-2.102		-0.640
		(1.709)		(0.833)
oilprodgdp*law			-59.65**	-59.68**
			(25.35)	(27.10)
Constant	-8.751*	-8.139*	-4.677	-4.123
	(4.631)	(4.859)	(4.539)	(4.415)
Observations	881	881	881	881
Number of ID	88	88	88	88
AR(1)- pvalue	1.86e-05	1.42e-05	3.59e-06	2.79e-06
AR(2)-p value	0.454	0.449	0.423	0.421
Hansen- p value	0.453	0.579	0.458	0.530
Instrument Number	39	42	42	45

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 5a- GMM – Exogenous Variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.390***	0.379***	0.399***	0.389***
	(0.0809)	(0.0822)	(0.0810)	(0.0816)
Ltrade	0.383***	0.332**	0.323**	0.305**
	(0.145)	(0.137)	(0.131)	(0.127)
Lgdpcons	-0.0350	-0.0454	-0.0395	-0.0453
	(0.0372)	(0.0348)	(0.0328)	(0.0326)
Lgdppcppp	-0.0903	-0.0630	-0.0511	-0.0431
	(0.0685)	(0.0657)	(0.0626)	(0.0625)
Inflation, consumer prices (annual %)	-4.41e-05	-0.000144	-0.000118	-0.000166
	(9.33e-05)	(9.43e-05)	(0.000103)	(0.000110)
Oil Rent GDP	0.877*	0.505	3.420***	2.483***
	(0.528)	(0.463)	(0.906)	(0.838)
Political Stability	0.0187	0.0651*	0.0262	0.0555*
	(0.0341)	(0.0346)	(0.0332)	(0.0330)
law1	0.396	0.439	0.627**	0.593**
	(0.270)	(0.272)	(0.265)	(0.263)
polity2	0.0273**	0.0216**	0.0187*	0.0171*
	(0.0111)	(0.0101)	(0.00967)	(0.00953)
Oilrentgdp*polstab		-0.873***		-0.591*
		(0.278)		(0.311)
Oiilrentgdp*law			-4.978***	-3.638**
			(1.416)	(1.540)
Constant	0.461	0.739	0.414	0.615
	(0.989)	(0.917)	(0.901)	(0.879)
Observations	881	881	881	881
Number of ID	88	88	88	88
AR(1)- pvalue	3.35e-07	3.82e-07	4.65e-07	4.30e-07
AR(2)-p value	0.540	0.572	0.537	0.560
Hansen- p value	0.0138	0.0164	0.0122	0.0150
Instrument Number	23	24	24	25

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 5b- GMM – Endogenous Variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.437***	0.432***	0.434***	0.438***
	(0.0882)	(0.0886)	(0.0846)	(0.0848)
Ltrade	2.191***	2.415***	1.869***	2.014***
	(0.635)	(0.633)	(0.654)	(0.601)
Lgdpcons	0.155	0.160	0.309	0.299
	(0.234)	(0.252)	(0.215)	(0.219)
Lgdppcppp	-0.607**	-0.659***	-0.602**	-0.654***
	(0.249)	(0.252)	(0.253)	(0.239)
Inflation, consumer prices (annual %)	-0.000411***	-0.000441***	-0.000567***	-0.000632***
	(0.000112)	(0.000115)	(0.000207)	(0.000187)
Oil Rent/GDP	0.474	0.430	6.408	7.318
	(1.080)	(1.099)	(4.608)	(4.629)
Political Stability	-0.0355	0.0213	0.0189	0.0456
	(0.105)	(0.107)	(0.0904)	(0.0972)
Law	1.316	1.269	1.466	1.553*
	(0.912)	(0.944)	(0.975)	(0.917)
polity2	0.0505	0.0485	0.0296	0.0349
	(0.0375)	(0.0385)	(0.0342)	(0.0343)
Oilrentgdp*polstab2		-0.0539		-0.00896
		(0.530)		(0.543)
Oilrentgdp*law1			-11.20	-12.61
			(8.709)	(8.563)
Constant	-8.286*	-8.875*	-10.59**	-10.62**
	(4.439)	(4.823)	(4.398)	(4.452)
Observations	881	881	881	881
Number of ID	88	88	88	88
AR(1)- pvalue	6.78e-06	7.81e-06	5.90e-06	5.73e-06

AR(2)-p value	0.453	0.448	0.489	0.482
Hansen- p value	0.479	0.562	0.552	0.516
Instrument Number	39	42	42	45

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 6a- GMM- Exogenous Variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.421***	0.422***	0.422***	0.422***
	(0.0678)	(0.0678)	(0.0679)	(0.0678)
Ltrade	0.441***	0.446***	0.447***	0.447***
	(0.145)	(0.145)	(0.146)	(0.146)
Lgdpcons	-0.0176	-0.0153	-0.0150	-0.0154
	(0.0316)	(0.0317)	(0.0317)	(0.0318)
Lgdppcppp	-0.0210	-0.0217	-0.0204	-0.0198
	(0.0607)	(0.0607)	(0.0607)	(0.0605)
Inflation, consumer prices (annual %)	3.16e-05	2.51e-05	2.39e-05	2.45e-05
	(8.49e-05)	(8.39e-05)	(8.42e-05)	(8.46e-05)
Mineral rents (% of GDP)	-0.00854	-0.00637	-0.0537	-0.0720
	(0.0157)	(0.0111)	(0.0497)	(0.0445)
Political Stability	-0.0148	-0.0196	-0.0177	-0.0161
	(0.0333)	(0.0345)	(0.0335)	(0.0348)
law1	0.365	0.352	0.323	0.314
	(0.252)	(0.251)	(0.256)	(0.259)
polity	0.0137	0.0134	0.0132	0.0132
	(0.00909)	(0.00906)	(0.00904)	(0.00904)
minrent*polstab		0.00958		-0.00540
		(0.0138)		(0.0159)
	(0.0774)	(0.0776)	(0.0779)	(0.0771)
minrent*law			0.0887	0.122
			(0.0830)	(0.0782)
Constant	-0.644	-0.711	-0.722	-0.712
	(0.954)	(0.965)	(0.961)	(0.966)
Observations	980	980	980	980
Number of ID	99	99	99	99
AR(1)- pvalue	5.17e-08	5.11e-08	5.21e-08	5.23e-08
AR(2)-p value	0.504	0.502	0.502	0.501
Hansen- p value	0.0361	0.0326	0.0339	0.0343
Instrument Number	23	24	24	25

TABLE 6b- GMM- Endogenous Variables

VARIABLES	(1) Lfdigdp	(2) Lfdigdp	(3) Lfdigdp	(4) Lfdigdp
L.Lfdigdp	0.458***	0.450***	0.459***	0.451***
	(0.0711)	(0.0712)	(0.0707)	(0.0715)
Ltrade	1.706***	1.715***	1.743***	1.827***
	(0.471)	(0.480)	(0.469)	(0.480)
Lgdpcons	0.260*	0.282**	0.282**	0.308**
	(0.135)	(0.137)	(0.136)	(0.139)
Lgdppcppp	-0.529**	-0.563**	-0.554**	-0.594***
	(0.220)	(0.224)	(0.222)	(0.228)
Inflation, consumer prices (annual %)	-0.000298***	-0.000290***	-0.000324***	-0.000324***
	(0.000102)	(0.000107)	(9.78e-05)	(9.96e-05)
Mineral rents (% of GDP)	0.0167	0.0184	-0.0754	0.0831
	(0.0145)	(0.0193)	(0.0876)	(0.156)
Political Stability	-0.0575	-0.0497	-0.0562	-0.0488
	(0.0909)	(0.0920)	(0.0922)	(0.0923)
law1	1.158*	1.078	0.929	0.932
	(0.696)	(0.701)	(0.709)	(0.724)
polity2	0.0228	0.0257	0.0258	0.0267
	(0.0250)	(0.0247)	(0.0249)	(0.0254)
=minrent*polstab2		0.0385		0.0532
		(0.0259)		(0.0484)
minrent*law			0.169	-0.110
			(0.160)	(0.270)
Constant	-9.141***	-9.362***	-9.496***	-10.13***
	(2.914)	(2.997)	(2.908)	(2.999)
Observations	980	980	980	980
Number of ID	99	99	99	99
AR(1)- pvalue	5.68e-07	5.02e-07	5.57e-07	4.89e-07

AR(2)-p value	0.417	0.418	0.412	0.409
Hansen- p value	0.768	0.818	0.785	0.544
Instrument Number	42	45	45	48

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE 7a- GMM

VARIABLES	(1) LFDIpp	(2) LFDIpp	(3) LFDIpp	(4) LFDIpp
L.LFDIpp	0.237***	0.255***	0.228***	0.248***
	(0.0886)	(0.0864)	(0.0874)	(0.0874)
Ltrade	0.362**	0.320**	0.336**	0.318**
	(0.156)	(0.146)	(0.154)	(0.146)
Lgdpcons	-0.0627	-0.0710*	-0.0726	-0.0735*
	(0.0457)	(0.0409)	(0.0443)	(0.0415)
Lgdppcppp	0.876***	0.882***	0.881***	0.882***
	(0.138)	(0.133)	(0.136)	(0.134)
Inflation, consumer prices (annual %)	-0.00125	-0.00114	-0.00111	-0.00110
	(0.00104)	(0.000981)	(0.000923)	(0.000936)
Nat	-0.000641	0.0157**	-0.00212	0.0115
	(0.00292)	(0.00738)	(0.00310)	(0.00937)
Political Stability	0.0192	0.0446	0.104*	0.0761
	(0.0425)	(0.0428)	(0.0562)	(0.0519)
law1	0.615	1.165***	0.758*	1.107***
	(0.378)	(0.403)	(0.388)	(0.408)
polity2	0.0242*	0.0172	0.0224*	0.0179
	(0.0127)	(0.0120)	(0.0122)	(0.0122)
nat*law1		-0.0288**		-0.0225
		(0.0133)		(0.0167)
nat*polstab2			-0.00386**	-0.00169
			(0.00184)	(0.00213)
Constant	-4.289***	-4.306***	-3.986***	-4.165***
	(1.347)	(1.265)	(1.292)	(1.258)
Observations	895	895	895	895
Number of ID	92	92	92	92
AR(1)- pvalue	3.60e-07	4.13e-07	5.06e-07	5.69e-07
AR(2)-p value	0.449	0.465	0.527	0.494
Hansen- p value	0.260	0.218	0.291	0.246
Instrument Number	23	24	24	25

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Dependent variable if the log of FDI per capita;

Table 7b- GMM

VARIABLES	(1) LFDIpp	(2) LFDIpp	(3) LFDIpp	(4) LFDIpp
L.LFDIpp	0.292***	0.312***	0.294***	0.310***
	(0.107)	(0.102)	(0.104)	(0.101)
Ltrade	0.319*	0.256	0.282	0.249
	(0.182)	(0.156)	(0.175)	(0.156)
Lgdpcons	-0.0502	-0.0575	-0.0588	-0.0605
	(0.0447)	(0.0385)	(0.0423)	(0.0385)
Lgdppcppp	0.705***	0.748***	0.733***	0.754***
	(0.146)	(0.148)	(0.146)	(0.147)
Inflation, consumer prices (annual %)	-0.000227***	-0.000345***	-0.000260***	-0.000341***
	(8.13e-05)	(8.17e-05)	(7.25e-05)	(8.02e-05)
Oil production/GDP	5.118**	10.39***	2.729	8.284**
	(2.452)	(2.346)	(2.739)	(3.391)
Political Stability	0.0585	0.0697	0.0935**	0.0851*
	(0.0443)	(0.0431)	(0.0475)	(0.0447)
law1	0.432	0.478	0.451	0.479
	(0.327)	(0.295)	(0.320)	(0.297)
polity2	0.0342***	0.0188	0.0273**	0.0180
	(0.0127)	(0.0127)	(0.0124)	(0.0126)
oilprodgdp*law1		-3.226***		-2.665**
		(1.202)		(1.343)
oilprodgdp*polstab2			-0.809**	-0.402
			(0.367)	(0.413)
Constant	-3.152**	-3.030**	-2.993**	-2.972**
	(1.499)	(1.338)	(1.414)	(1.330)
Observations	881	881	881	881
Number of ID	88	88	88	88

AR(1)- pvalue	3.58e-05	1.53e-05	2.47e-05	1.31e-05
AR(2)-p value	0.664	0.620	0.690	0.631
Hansen- p value	0.0960	0.116	0.100	0.113
Instrument Number	23	24	24	25

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Dependent variable if the log of FDI per capita. Years Dummy included but not reported

Table 8- GMM

VARIABLES	(1) Low Income Countries	(2) Middle Income Countries	(3) Low Income Countries	(4) Middle Income Countries
L.Lfdigdp	0.333***	0.318***	0.412***	0.341***
	(0.126)	(0.0920)	(0.112)	(0.0969)
Ltrade	0.609*	0.283**	0.0253	0.311**
	(0.345)	(0.111)	(0.456)	(0.123)
Lgdpcons	0.111	-0.0802**	-0.0717	-0.0554
	(0.0796)	(0.0354)	(0.125)	(0.0376)
Lgdppcppp	-0.793**	-0.00395	-0.598**	-0.0613
	(0.375)	(0.0828)	(0.299)	(0.0883)
Inflation, consumer prices (annual %)	-0.00532	0.000203	-0.00149	-0.000357***
	(0.00744)	(0.000450)	(0.00106)	(0.000137)
nat	-0.00723	0.00397		
	(0.0103)	(0.00830)		
Political Stability	-0.0317	0.0633	0.122**	0.0509
	(0.0760)	(0.0474)	(0.0503)	(0.0404)
Law	1.654**	0.517	0.907	0.462
	(0.807)	(0.333)	(0.806)	(0.284)
polity2	-0.00156	0.0127	-0.0159	0.0221**
	(0.0147)	(0.0104)	(0.0246)	(0.0101)
nat*law	0.0288	-0.0118		
	(0.0199)	(0.0139)		
nat*polstab2	-0.00308	-0.00193		
	(0.00260)	(0.00208)		
Oil production/GDP			45.08***	15.15**
			(9.275)	(6.160)
oilprodgdp*law			-54.70***	-23.10**
			(14.04)	(10.68)
oilprodgdp*polstab			3.620	-1.503*
			(2.483)	(0.879)
Constant	0.191	1.492	6.170*	1.142
	(2.314)	(0.940)	(3.626)	(0.922)
Observations	195	700	154	727
Number of Countries	21	77	16	78
AR(1)- pvalue	0.0125	3.51e-06	0.00466	6.31e-06
AR(2)-p value	0.359	0.149	0.194	0.176
Hansen- p value	1	0.0723	1	0.0384
Instrument Number	25	25	25	25

Chapter 4 – 'Educational Scores: How does Russia fare?'*

Abstract

This paper uses two large multi-country datasets on educational scores – PISA and TIMSS – to examine the performance of Russia in comparative light as well as the factors associated with differences in educational outcomes in Russia. Despite the perception of a positive educational legacy, Russian scores are not stellar and have mostly deteriorated. Using an education production function, we distinguish between individual and family background factors and those relating to the school and institutional environment. We use pooled data, as well as cross sectional evidence, to look at the variation across countries before looking at within-country variation in Russia. We find - both in the cross-country estimates as also those using just Russia data – that a number of individual and family variables in particular - such as parental educational levels - are robustly associated with better educational outcomes. Institutional variables also matter – notably student-teacher ratios and indicators of school autonomy – but there are also some clear particularities in the Russian case.

*This is a paper version of the chapter currently under review at the Journal of Comparative Economics. The paper is co-authored with Simon Commander.

1. Introduction

A substantial body of research now exists that examines the impact of different measures of educational outcomes on both individual and economy-wide performance. This work has reflected a shift away from measures of educational inputs, such as years of schooling, to those that attempt to capture the value of the education that has been imparted. Hanushek and Woessman (2007, 2009, 2010), for example, have argued that differences in the quality of education matter more in explaining cross-country differences in productivity growth than differences in the average number of years of schooling or enrolment rates.

Our paper extends this emphasis to look in detail at the quality of the education in a country – Russia - that as a previously planned economy was widely assumed to have generated better human capital than economies at broadly comparable levels of income. Although subsequent research has rather qualified this assumption – at least in the context of other transition economies[68] - little analysis has yet been done using individual educational scores, let alone in a way that allows cross-country and within-country comparison.

Transition has involved large and persistent shocks to physical capital stocks and, in some instances, large shifts in the composition of output. This has had implications for human capital, both through a shift in demand for particular skills as well as through the direct effect of resource allocations to education spending. In Russia, two significant processes have been at work. The first has involved the destruction or contraction of broad based manufacturing and the growing preponderance of natural resources in the structure of output and trade. One expectation could be that as the productive base of the economy has narrowed so will have the underlying skills or capability set. This narrowing might in turn have limited the ability to induce any further diversification of the economy.

The second has been the impact of policy in the education sector, where a series of attempts at institutional change have been put in place. There have also been significant annual fluctuations in the volume of resources allocated by government to education. Indicatively, in the early 1970s roughly 7% of GDP was allocated to education. By the early 1990s this had fallen to around 3.5%, approaching 4% by 2006/7. In 1992 a new

[68] See, for example, Svejnar et al (199?), Brunello et al (2011)

law mandated that spending on education should not fall below 10% of the federal budget. In the last decade, this threshold has been reached or exceeded.

Our paper uses two sets of international achievement scores – PISA and TIMMS – to examine differences in scores across a large group of countries sampled in these datasets, including Russia. It then tries to explain the variation in scores within Russia. By using both datasets, we are able to cover not only a range of disciplines from reading to mathematics and science but also to introduce a comparative element into the analysis.

Needless to say, there are important caveats when using large multi-country datasets like PISA and TIMSS. Countries have very different educational systems – Russia and its Soviet legacy is a clear case in point – and there is a large set of possible country attributes that could be used to explain differences across countries[69]. Further, while these scores can be helpful in seeing how students perform in standardised tests in key disciplines, they are not necessarily very informative about the actual skills being acquired by those students, and hence their labour market prospects. Evidence from other transition countries that has looked explicitly at the relation between education and skills has found a surprisingly weak association. This has led employers to make hiring decisions based on attributes – such as age – rather than on reported educational attainment or degrees[70]. This apparent decoupling obviously raises some important questions as to the possible policy conclusions that can be drawn.

As regards the measurement of educational attainment, TIMSS explicitly measures achievements relative to the curriculum, much of which in Russia remains only partially reformed. TIMSS is focussed on mathematics and science. By contrast, in PISA there is an explicit attempt to measure abilities that are needed to function in a modern economy and the instrument is hence explicitly dissociated from the formal curriculum. As well as mathematics and science, PISA also measures reading abilities. Using both datasets, despite their different methodologies provides the widest possible angle on how students, Russians in particular, perform across different disciplines as well as across time. In the text, we report results from the PISA dataset, presenting complementary results from the analysis of TIMSS mostly in appendices.

[69] A point made by Freeman et al (2010) who further note that cross-country studies will not give as robust conclusions about educational processes as random assignment studies or analysis based on particular inputs.

[70] See, for instance, Kollo (2007)

Our approach involves estimating education production functions that relate educational outcomes to characteristics in order to identify the relative impact of student, parent and school variables. For both PISA and TIMSS we pool the data over multiple rounds. In the pooled regressions with multiple country observations, we are able to pick out country-specific effects. We also offer alternative specifications that take account of the multilevel nature of the data.

2. Russian Education in context

The Russian education system, despite many changes, is still coloured by the legacy of the previous system and the incomplete reforms started since 1991. The Soviet system certainly achieved very strong enrolment results. These have subsequently declined. Between 2003 and 2008 alone gross enrolment rates for secondary education fell from 93 to 85 and for primary education from 117 to 97.

The legacy also included a highly centralised system of control – including of curricula, personnel, management as well as financing. A feature of the changes introduced since 1991 has been the greater devolution of authority by the federal government to lower levels. This has not necessarily been positive. Financial constraints have been significant but have also varied widely across jurisdictions. There has been a creeping *de facto* privatisation of education. Schools and teachers have commonly imposed fees and levies, while some schools have also launched revenue-earning schemes of a non-educational nature. Some explicitly private institutions have also been established.

The shift to greater decentralisation has been accompanied by great heterogeneity in spending and decision-making across regions and municipalities. For example, in 2001 over 35% of oblasts or regions spent between 500-1000 roubles per student, while just over 10% of regions spent over 1500. There has also been the emergence of special institutions, such as gymnasia, lycees, colleges, outside the basic public system.

While there is considerable debate about the appropriate policies to be pursued, there is relatively broad agreement that Russian education has only weakly focussed on educational outcomes, giving priority instead to standardised measures of inputs. These in turn have been compromised by varying budgetary means across regions. Antiquated curricula, low standards of pedagogy and management have been highlighted. This has

led some to promote policies designed to achieve new standards, the overhaul of curricula and teaching methods, more and better assessment of students and greater emphasis on learning outcomes, as well as more autonomy for schools[71].

Institutionally, the system has maintained a requirement for 10 years of compulsory education. Entry to primary school begins at 7 years, lower secondary at 10/11 years and upper secondary at 15/16 years. As such, basic general education lasts for 9 years. At that point, students can pursue higher secondary or enter a vocational school. The 8th grade or 15 year reference for the PISA and TIMSS datasets that we use in this paper thus captures students at the end of their lower secondary phase.

3. Data

We use two complementary data sources - the OECD's Programme for International Student Assessment (PISA) and the International Association for the Evaluation of Educational Achievement's Trends in International Mathematics and Science Study (TIMSS). Both databases have been quite widely used and described. PISA is an international, standardised assessment of 15-year-old students' performance in mathematics, science, and reading. It has been administered in all OECD countries as well as a growing number of non-OECD countries, of which Russia has been one. To date, 4 rounds have been collected in 2000, 2003, 2006 and 2009. 35 countries, including Russia, have been included in each round. For each country, students have been randomly sampled within schools[72]. Students have been given a reading, mathematics and science literacy test. In addition, information on the students - such as family background, attitudes towards schooling and learning strategies - has been collected. Further, each round of PISA has collected information from school principals on school resources, such as the number of teachers in the school. This provides multi-level information on students, their family environment and the schools they attend.

TIMSS consists of international tests of mathematics and science for both 4th and 8th grade students. In this paper we use the information for the 8th grade equivalent to 15 years of age and hence comparable to PISA. For TIMSS, schools in each country that have classes at 4th and 8th grades are sampled with classes within schools and students within classes sampled to achieve representativeness. TIMSS has now been

[71] See, for example, Canning (2004)
[72] See description in Anderson et al (2010). The primary sampling unit has been the school.

implemented in 1995, 1999, 2003 and 2007. In 1995 and 1997 40 countries were surveyed, rising to 59 by 2007. Russia and 14 other countries, including the USA, England, Italy, Japan and Korea, have been present in each of the four rounds. Unlike PISA which is disconnected from national curricula and aims to measure skills required to function in a modern economy, TIMSS aims to align its tests with the curricula taught in each of the surveyed countries. However, given that our interest is primarily in understanding whether Russian human capital is fit for purpose in a modern economy, the PISA approach has some advantage and hence priority in the text is given to presenting results from analysis of the PISA data.

Both PISA and TIMSS have a broad coverage of students and apply a substantial number of questions by dividing tests into sub-clusters. In this design, each student responds to a fraction of the entire assessment[73]. Testing students only on a subset of questions could lead to substantial measurement error if the aim of the test is to measure students' ability to answer all questions. Plausible values are a sample of scores from the distribution of a student's scores as if the student had responded to all questions in the test. Plausible values are based on student responses to the subset of items they receive conditional on the background characteristics[74]. In PISA, these individual test scores are standardized in a subsequent step so that the unconditional sample mean of each round equals 500 and their unconditional sample standard error equals 100. TIMSS similarly standardises the average score across countries to 500 with a standard deviation of 100.

3.1 Descriptive statistics

Figures 1-3 provide the PISA scores for Reading, Mathematics and Science for a subset of countries, including Russia, that have been present in all rounds (viz., 2000, 2003, 2006 and 2009). For mathematics, Russia scores consistently higher than Brazil – and indeed other emerging markets covered by PISA. Its score is roughly comparable to that of the USA in all rounds, but notably lower than Asian countries, such as Japan or Korea, as well as the leading European countries, like Finland. The ratio of the top countries – Korea and Hong Kong - to Russia in 2009 was around 1.18. At the start of the period, Russia ranked 25th out of 35 countries for mathematics and this was stable

[73] Willms and Smith (2005)
[74] Mislevy (1991)

through to 2009[75]. For both reading and science, Russian scores tend to be weaker relative to most of Europe, including other transition countries, as well as to Asia, although they still remain superior to emerging markets, such as Brazil. The ratio of the top countries to Russia was 1.17 and 1.14 respectively. For reading and science, Russia ranked 29/30th out of 35 at the start and end periods. By 2009 Russia's mean reading score was statistically significantly lower than the OECD average, being roughly equivalent to Chile and Turkey.

Figures 4-5 repeats the same exercise for TIMSS. With this measure, Russia performs significantly better in both mathematics and science than in PISA. In the case of mathematics, Russian scores are slightly superior to the USA or England, as well as many European, including other transition, countries. They are significantly higher than other emerging markets in the sample, but lower than the leading Asian countries, such as Taipei, Japan or Korea. For science, Russian scores are also relatively high. The ratio of the top countries' mean scores to Russia in 2007 was 1.15 in mathematics and 1.04 in science.

With respect to dispersion in scores, the percentile ratio of the ($90^{th}/10^{th}$)/10^{th} for each of the three disciplines ranges in PISA between 0.51-0.54 and is larger than the mean for the full sample (0.48-0.5) as well as for most countries in Western Europe, although quite comparable to the USA. In the TIMSS date, dispersion in Russia for both mathematics and science is below the mean for the sample, comparable to the European countries and significantly lower than for other emerging markets. More generally, Freeman et al (2010) note that in the TIMSS, lower inequality in test scores tends to be associated with higher average scores.

Country average scores suggest several initial conclusions. The first is that there are clear and significant differences in how Russia has scored depending on the instrument. The TIMSS scores give consistently higher outcomes in mathematics and science. This difference may reflect the different survey strategies that have been pursued. In PISA, in particular, although Russia has performed better than most other emerging markets, it has under-performed relative to the main body of OECD countries. The reading score has been particularly weak. Second, with the exception of the TIMSS science score, there has been no improvement in Russian scores since the mid-1990s.

[75] This compares to countries included in all rounds. By 2009 the total number of countries in the PISA sample had risen to 57.

Given the policy objectives of diversifying the economy and raising productivity, a further facet is also troubling. *Figures 6* provide evidence from PISA concerning the upper part of the scores distribution. This indicator may be particularly relevant when considering the ability of an economy to innovate. It shows that by 2009 the share of top performers – defined as those attaining Level 5 or above - in reading, mathematics and science ranged between *10*-5%, compared with 13-25% for the leading countries. In mathematics, for example, the top share in 2009 was around 6% in Russia compared to 20-25 for Japan, Korea and Finland. Further, the top share had fallen sharply from around 10% in 2000. There has been no improvement in the reading share while that for sciences betrays no clear trend. In sum, Russia has a relatively low share of top performers that has declined in the case of mathematics and registered little or no improvement in the other disciplines over the past decade. In TIMSS the share in the top 10% of the distribution for mathematics and science was 11% and 14% respectively[76]. This again contrasts unfavourably with the leading countries, Japan and Korea, with shares of 20-37%, although is relatively high when compared with either Western Europe or North America.

Other research has signalled the fact that there are non-trivial differences in scores across gender. As in Machin and Pekkarinen (2008), we use three indicators: the gender gap, the variance ratio and the ratio male to female top performers[77]. In general for both PISA and TIMMS, the gender gap favours boys in mathematics and girls in reading while the picture for science is mixed. The variance ratio and the ratio of male to female top performers also show that boys' scores have greater variability compared to girls and that boys dominate in terms of top performers in mathematics and girls in reading. However, for Russia any advantage of boys over girls is smaller when compared to other countries. Figure 6 shows the gender gap in math and reading, calculated using PISA data from 2000 to 2009, for a selected number of countries. In Russia the gender gap for math is 0.06. This is well below the gender gap for the all sample, 0.13, and also lower than for other emerging economies, such as Brazil and Mexico with values of 0.26 and 0.2, respectively. The gender gap for reading in Russia is -0.39 which is slightly higher than for the whole sample (-0.36) and considerably higher then Brazil (-0.28) or

[76] We do not have a comparable (Level 5 and above) measure for TIMSS so use the top 10% instead.

[77] The gender gap is the standardized mean difference in scores at mean value. The variance ratio is defined as the ratio of male to female variance. The ratio of male to female top performers is the ratio of the number of boys to the number of girls that have attained level 5 or above.

Mexico, (-0.26). The ratio of male to female top performers in mathematics is also lower than for other emerging markets.

4. Determinants of Educational Performance

4.1 Estimation Strategy

We adopt an educational production function approach. Such a function can most generally be described by;

$$F(y,x) \leq C \qquad (1)$$

where y is a vector of educational outcomes and x is a vector of inputs. C is a positive scalar and F represents the educational technology that transforms x into y. Inputs comprise a set of school related factors such as class size, student-teacher ratios, measures of teacher quality and experience. Educational outcomes represent the cognitive development of the student as given by standardised test scores or examination results. If an educational technology changes, the production possibilities frontier can either shift inwards or outwards as F is a strictly quasi-concave, twice differentiable function which forms a convex production set. Educational production functions can be estimated empirically. Frontier estimation aimed at evaluating the performance of schools in relation to the production frontier can be either parametric or non-parametric. This approach would be particularly relevant when the aim is to identify those schools which have the best possible outcomes for a given level of inputs. An alternative approach, which we rely on in this paper, is to estimate the educational production function using parametric methods in order to examine whether higher resource levels are associated with better outcomes, when controlling for attributes, both individual and family as well as institutional[78].

Despite being widely used in helping design policy[79], education production functions have obvious shortcomings. Aside from the matter of getting good, comparable measures of outcomes, they may be poor tools for measuring the complex classroom processes that underpin learning[80]. Further, modeling outcomes without

[78] For example, see Mayston and Jesson (1999).
[79] See Kann and Kiefer (2007)
[80] Goldhaber and Brewer (1997).

allowing for the hierarchical nature of the data – such as clusters of students in classrooms, classes within schools and schools within educational management systems – may be problematic[81]. However, the most common critique concerns the potential endogeneity of educational outcomes. For example, parents may be able to select better schools. As such if the link between socio-economic characteristics and funding is not fully controlled for, a model of educational attainment may generate a spurious negative correlation between school resources and achievement[82]. One way of addressing issues of endogeneity is to estimate a model that controls for the pupil's initial ability and socio-economic background as well as other variables, such as gender and ethnicity. Information on parents' origin, education and the number of books at home[83], variables that will not, or are unlikely to, change over time can serve as a proxy for prior inputs, allowing a causal relationship to be imputed[84].

Aside from family background variables, we could also expect there to be other factors that affect the educational performance of individuals and which may be considered as inputs into the production of education. These include teaching and administrative inputs as well as other institutional factors. The type of relevant variables include, teacher-pupil ratios, measures of teaching experience (such as years), teacher education, library size, number of computers, audio-visual equipment, number and quality of laboratories as well as information on the ownership of the school[85]. Interestingly, existing research has found a weak or absent systematic relationship between school expenditures and student performance, particularly in developing and emerging markets[86]. Moreover, there may be measurement issues as commonly used variables —such as teacher experience or education – may not be closely correlated with actual ability in the classroom. Similarly, although there is some evidence that students tend to perform better in schools that have autonomy in personnel and day-to-day decisions, measures of autonomy are hard to implement as it is generally a decision for a country (or state) as a whole, leaving no comparison group within countries[87].

[81] See Goldstein (1987), (1995).
[82] See Vignoles et al (2000) where there is a wider discussion of the theoretical and empirical strengths and shortcomings of this approach.
[83] See Cooper and Chon (1997), Gyimah-Brempong and Gyapong (1991)
[84] Ammermueller (2007)
[85] See the discussion in Cooper and Chon (1997)
[86] See Banerjee et al (2007); Duflo et al (2009), Hanushek and Woesmann (2010)
[87] See Hanushek and Woesmann (2007), (2010)

In sum, the educational performance of individuals is likely to be affected by several types of inputs ranging from family background to teaching and administrative inputs as well as institutional factors.

4.2 Implementation

We pool the PISA data for four rounds (viz., 2000, 2003, 2006 and 2009). We include only individual observations from 35 countries that have been included in all rounds, which yield over 405,000 observations. For TIMSS, we pool the data from the first two rounds (1995 and 1997) as well as from the later rounds (2003 and 2007) yielding nearly 157,000 and over 237,000 observations respectively. This separation is because the survey instrument changed significantly between 1997 and 2003 rounds, thereby limiting comparability. Year and country dummies are included in all estimates[88]. To ensure that pooling is appropriate, we implemented a Chow test to see whether the coefficients from the pooled estimation were significantly different from those done on the cross sections. A cumulative test on all the coefficients of the variables that we have used shows that is appropriate to pool[89].

We estimate initially by ordinary least squares (OLS),

$$ES_{ics} = \alpha + \beta X_{ics} + \gamma Y_{ics} + \delta Z_{ics} + \lambda C + \chi T + \varepsilon_{ics} \quad (2)$$

where ES = educational score for mathematics, science or reading, X is a vector of individual characteristics, Y is a vector of family attributes, Z is a vector of school-specific features, while C and T signify country and year controls. The ES variables are the individual test scores for each discipline registered in either PISA or TIMSS by each student. For the PISA estimates, the vector, X, contains a combination of an individual's age, gender, where born and language spoken at home. Family attributes, Y, comprise where a parent has been born and parents' educational level, as well as the number of books in the household. The school or institutional variables (Z) include school size, the share of females in the school, student/teacher ratio, share of certified

[88] For TIMSS 1995 and 1997, 25 country dummies are introduced; for the later rounds, 36.
[89] Results available on request

teachers, ratio of computers to students, whether a school is private or public as well as its location (urban or otherwise)[90].

To look at whether the explanatory variables affect individuals differently contingent on their position in the educational scores distribution, we also estimate quantile regressions, using the 10^{th}, 50^{th} and 90^{th}. In contrast to the OLS mean regression, a median regression estimator minimizes the sum of absolute errors instead of squared errors. Correspondingly, all other conditional quantile functions minimize an asymmetrically weighted sum of absolute errors[91]. Throughout, we report results from the baseline OLS specification as well as from the 10^{th}, median and 90^{th} quantiles.

Tables 1a-1c provide results with the PISA data estimated separately for each of the three disciplines. Several things stand out. In the first place, family background variables have a strong, significant association with educational scores. In particular, parents with low education and/or being born abroad has a clear negative association with scores, suggesting that migrants may do systematically worse in tests. This conclusion is reinforced by the finding that speaking the test language at home is also positive and highly significant for all disciplines. This appears to have the largest effect for the lowest quantile. Similarly, having many books at home has a strong positive association with a student's performance.

Turning to the institutional variables, as regards school location, being in a larger towns or city is associated with higher scores in all disciplines. A higher ratio of students to teachers is consistently negatively signed, with the coefficient being larger for the upper quantile. Having a higher share of certified teachers is unambiguously good for test scores across all disciplines, as is having a higher share of girls among the students. In terms of school ownership, being private has no clear association with educational outcomes. An indicator of school resources – the ratio of PCs to students – seems to be significantly correlated with reading scores but not robustly with scores in the other disciplines. The results of the pooled regressions are confirmed when implementing using cross sections. Although there are shifts in the size of coefficients

[90] Not that with the TIMSS estimates reported in the appendices, we have slightly different variables available both relative to PISA and across the two panels.

[91] For a discussion of the properties of quantile regressions, see Buchinsky (1998). Applications can be found, inter alia, in Chamberlain (1994), Eide and Showalter (1998), Fertig and Schmidt (2002)

across years, the signs are largely stable and congruent with those from the pooled model[92].

Appendix Tables 1a-1d contain similar estimations for science and mathematics for the pooled TIMSS data. The results broadly confirm the findings from the PISA estimates whether with regard to the sign and significance of family background variables or institutional features of the school. Due to the nature of the available variables, we are able to explore more the effect of greater autonomy, such as a school having its own mathematics or science curriculum. More autonomy seems to be associated with better scores, while budget shortfalls for instructional material act adversely on the test score. Interestingly, for 2003 and 2007, we can look at school composition effects. We find that having a higher share of disadvantaged children has a clear negative association with scores. Indeed, the effect of moving from a high (>50%) to a low (<10%) share is both large and highly significant[93].

We now extend the analysis by looking at how Russian scores relate to the rest of the sample in the pooled dataset. We do this by interacting each of the explanatory variables with a Russia dummy. *Table 2* reports the results using only the 50% quantile. It shows that with regard to most explanatory variables, the interaction terms mostly indicate an amplification of the association between that variable and performance in the Russia case. The exceptions are the number of books at home, the share of certified teachers and the ratio of PCs to students where the signs of the interaction term switch and where each of these variables has a smaller association in Russia relative to other countries.

4.2 Within-country estimates for Russia

We now shift the analysis and use only Russian data to look at within-country variation. We start by running pooled estimations before exploring further some cross-sections. The latter also allows us to use explanatory variables that are available only in particular

[92] These estimates are available on request.

[93] Freeman et al (2010) use the 2007 TIMSS to estimate the relationship between scores and characteristics separately for each country, rather than by pooling. They also find large cross-country variation in the impact of background on educational scores. The Russia coefficients for the amount of books at home and parents' education are not trivial, being at around the median point for the latter. There is a small positive coefficient on the female variable and no apparent effect from the native-born dummy.

years. Unfortunately, although both PISA and TIMSS are collected at a regional level, neither dataset provides region identifiers, except in the case of PISA 2009.

Table 3 presents the pooled estimates for mathematics, reading and science using PISA. For brevity, the results for only the 50% quantile are reported. It can be seen that student-specific variables, such as age and gender have explanatory power. Age and being female mostly enters negatively and is often significant. Being female has a clear negative impact on maths scores and to a lesser extent on science scores, at least for the 90% quantile. The reverse is true for reading where females perform better and across the distribution. The variables for the individual or family's migration status are mostly insignificant. However, speaking the test language at home is positive and highly significant for all disciplines. This has the largest effect for the lower quantiles. Having many books at home has a strong positive impact on a student's performance and there is relatively little variation in the coefficient sizes across quantiles. As with the pooled country estimates, having a parent with low education predictably exerts a negative and significant effect.

With regard to the institutional variables, the estimations paint a more mixed picture. School location unambiguously affects performance with students located in larger towns or cities doing consistently better[94]. Indeed, performance declines almost monotonically with the size of the location in which the student studies. School size is linked with a small but consistently positive impact on scores while a higher ratio of students to teachers is consistently negative. However, the computer/student ratio is always insignificant, while the share of certified teachers appears to have some positive association only with reading and science. Interestingly, a school being in private ownership is negative and significant. This may result from the fact that outright privatisation of schools has been very limited in Russia (although de facto privatisation of many school functions is widespread) with private schools not offering any quality premium.

Looking at this evidence for Russia, variables capturing the student's background, as well as school or institutional features are, as in the pooled cross-country estimates, important in individual performance. Students whose parents are poorly educated and/or have fewer books at home do unambiguously worse at these

[94] We would have liked to control for region or oblast but were unable as yet to get the data from the Russia national teams collecting the data.

tests, while being schooled in a village or small town also has a negative association with performance. Resource based views gain some credence, in that fewer teachers and, in some cases, fewer certified teachers have a deleterious effect on scores. Private ownership also has a negative effect. With TIMSS data, *Appendix Tables 2a-2b* report results that are largely consistent with those using PISA.

In an extension of this analysis using individual cross-sections for 2000, 2003, 2006 and 2009 the broad findings reported here are upheld. In addition, some additional variables available for selective years can be used. Thus, in 2000 and 2003 having a parent in full time work had positive association with scores for all disciplines, although this was weakest for the 90th quantile. Having a parent with tertiary education similarly had a strong positive association. Turning to measures of pedagogy or school management, the 2003 data allow looking at whether the number of instructional weeks and the frequency of testing have any association with scores. Both variables have a negative impact, although this is not always significant. Having streaming for students appears to have had a positive impact, particularly for mathematics scores in 2006, but had no impact when used in the 2003 cross-section estimate. A measure of greater school autonomy - derived from responses to questions concerning school level discretion over decisions on admissions, as well as hiring/firing and compensation of teachers - has some positive – but weak – correlation with scores with varying significance over disciplines and years. The 2006 round further introduced indicators for the extent to which a school was responsible for allocating resources and its curricula. Interestingly, greater autonomy by these measures has no evident impact on scores suggesting that decentralisation has not necessarily yielded beneficial results. Indeed, both private ownership and delegation appear not to have had any significant positive effect on scores in Russia.

We also explore the sub-national dimension using the 2009 PISA data where region or oblast identifiers are available[95]. As shown by the distributional plot of the mathematics scores in *Figure 8*, the main cities of Moscow and Saint Petersburg largely dominate other regions. This is also confirmed by quantile and OLS regressions where a dummy for the city of Moscow and Saint Petersburg is positive and significant,

[95] In Russia, PISA is implemented in a three stage sampling. In the first stage, geographical areas are sampled using probability proportional to size sampling. In the second stage, schools are sampled and finally, students are sampled within schools.

indicating that students in these cities perform consistently better then students from other regions[96].

Finally, the quantile regressions generally suggest that there are relatively few statistically significant differences between different parts of the performance distribution regarding the impact of individual and family background variables. Estimating inter-quantile differences – specifically the 90%-10% difference - for the different discipline scores - for individual and family background variables in PISA, only age and sex and having many books at home have any significant differential effect. With TIMSS, among individual attributes, age and sex have some statistically different impact for the 10th versus the 90th quantiles[97]. With regard to school level variables, the PISA results again pick out almost no significant differences, except for the share of girls in a school and, in the case of reading, the ratio of computers to students. With TIMSS, some of the location variables matter differentially as does shortage of teaching materials.

What do the Russian estimates tell us that are different from the pooled, cross-country estimates? The answer is that the same individual and family background variables have explanatory power but it is with respect to the school or institutional features that differences enter. In particular, private schools have no positive impact on scores, the effects of teacher certification are either absent or weak, while the impact of financial resources – whether in aggregate or disaggregated – has a smaller and less significant association than in the larger multi-country estimates. Other factors, such as the student/teacher ratio, the share of girls, the location of the school and the share of disadvantaged students maintain similar signs and significance as in the larger sample. With the TIMSS data, having some autonomy over the curriculum is associated with better mathematics and science scores.

4.3 Multilevel specification

PISA and TIMMS have a multistage sampling design where schools are sampled first followed by students. As such, the dataset has multi-levels that may be selected with unequal probabilities that may make estimates, such as those we have used above,

[96] Results available on request

[97] For brevity, we do not report the results from the inter-quantile differences for reading, mathematics and science estimated using both PISA and TIMSS data.

biased. One way to deal with this is to use sampling weights in a multilevel linear model[98], aimed at modelling the natural clustering of observations in groups (e.g. students in schools). Below, we use a two level random intercept model where the response y_{ij} of unit *i* in cluster *j* can be specified as follows,

$$v_{ij} = x_{ij}^{'}\beta + z_{ij}^{'}\zeta_j$$

$x_{ij}^{'}$ and $z_{ij}^{'}$ are vectors of the explanatory variables, β are the fixed regression coefficient and ζ_j are the multivariate random effect varying over cluster. β contains cluster specific effects of the covariates *x* given the random effects ζ_j.

Table 4 report results from the Russia pooled PISA data. It can be seen that the signs and significance closely replicate the results we have reported above. There are some differences, for example in PISA being located in a village is the only location variable that is significant in the case of mathematics. Yet, overall these estimates strongly confirm our earlier estimates that do not explicitly take into account the multilevel nature of the data. The TIMSS random intercept estimates indicate that student/teacher ratios, shortage of available resources are associated with lower scores[99]. An indicator of autonomy – whether a school can develop its own math and science curricula enters with a strongly positive and significant sign.

5. Conclusion

Our paper has used two large datasets of educational scores – PISA and TIMSS - with repeated cross-sections to look at the association between scores and individual and family attributes as well as school and institutional features. The results presented in the main text of the paper are mostly from PISA due to the way in which scores are measured in that dataset and their cross-country comparability. However, throughout we complement the analysis by use of TIMSS which evaluates relative to a country's curriculum. Our approach involves estimating an education production function using OLS and quantile regressions for a series of pooled datasets with multi-country observations over time. We also use interactions of the explanatory variables with a Russia dummy to examine whether Russia is different and, if so, in what ways. Further,

[98] Hesketh and Skrondal 2006
[99] TIMSS results available on request

we analyse only the Russia data, pooling across years. As a cross-check, we also estimated discrete regressions using the cross-sectional evidence. Finally, we explicitly took into account the multilevel nature of the data and estimated using random intercepts and school weighting. The results were broadly consistent with our earlier estimates.

Clearly measuring educational achievements across and within countries is challenging for a variety of reasons, some of which we have mentioned above. The cross-country descriptive statistics highlight – particularly in the case of PISA – that Russia suffers from a relative weakness in reading skills. There has been no improvement over time. In both mathematics and science, Russian scores are un-trended and remain slightly below the OECD core. Moreover - and likely to be particularly relevant when discussing the scope for innovation – top performers account for a relatively low share of students in all disciplines with either a deterioration over time (as with mathematics) or no discernible trend. Put in cross-country perspective, the share of top students in all disciplines has remained very significantly below the leading Asian and European countries, although superior to another leading emerging market, Brazil. Further, in PISA particularly, there is a relatively large dispersion in scores across all disciplines for Russia. While scores from TIMSS show relatively strong performance in both mathematics and science this may be because of the way they are measured, viz., being related to the current curriculum. Given the problems that have been widely reported with the curricula[100], these scores may flatter.

The paper is able to pin down a robust association between scores and characteristics in common with findings from the wider literature. For the pooled cross country estimations using PISA, we find clear evidence that educational outcomes are robustly correlated with a number of individual and family background variables. For the latter, in particular, the number of books at home and parents' educational level has a strong association. The evidence regarding institutional factors pins down the importance of location – with an unambiguous negative association between scores and size of the location in which a student resides, as well as the student-teacher ratio and the share of certified teachers in a given school. The evidence from TIMSS largely confirms these results with some extensions, due to the nature of the available variables.

[100] See, for example, Canning (2004), as well as various World Bank reports on the educational sector; www.worldbank.org

In particular, measures signalling greater autonomy at the level of the school and the intensity of classes are positively signed and also significant.

When turning to the Russia data from PISA and TIMSS and looking at the within country variation, we find some similarity with the base estimates using the cross-country evidence. Thus, broadly the same individual and family background variables have explanatory power but it is with respect to the institutional measures that the picture becomes more mixed. Location – as in the multi-country sample – matters, while school size seems to have a positive association. Ownership has no significance, although this may well be related to the fact that the number of *de jure* private schools in Russia is fairly small. There is also some support for a resource-based view in that fewer teachers have an adverse association with scores. The student-teacher ratio is consistently significant. Indeed, looking at the marginal effects in cross-sectional estimates using the Russia PISA data, we found that the elasticity was around -0.1. The cross-sectional evidence also identifies – using a number of variables – greater autonomy, notably with respect to curriculum setting, as being positively related to scores. The quantile regressions suggest relatively few significant differences across the distribution, whether from individual, family or institutional factors.

Finally, while measures such as PISA and TIMSS are particularly helpful for cross-country comparison and benchmarking, they are less suitable for designing policy at national or sub-national level. Nevertheless, our paper suggests that aside from persistent and hard-to-shift factors relating to family background, there are a number of policy options that are likely to help student scores. They range from providing additional resources, including facilitating lower student-teacher ratios, to greater autonomy for schools. Local changes to curricula, for example, appear to be positively correlated with scores. The variation in scores across locations (and likely across regions) is substantial. Students in larger urban centres – particularly Moscow and St. Petersburg - perform notably better than those in smaller settlements, again suggesting considerable scope for policy driven improvements aimed at reducing the large spatial variation that exists in the country.

References

Anderson, J.O., Chiu, M.-H., Yore, L.D 'First cycle of PISA (2000-2006)-international perspectives on successes and challenges: Research and policy directions 2010' International Journal of Science and Mathematics Education, Vol. 8 (3), pp. 373-388

Ammermueller, A. (2007) 'PISA: What makes the difference?: Explaining the gap in test scores between Finland and Germany' Empirical Economics, Vol. 33 (2), pp. 263-287

Buchinsky, M., (1998) 'Recent advances in quantile regression models: A practical guideline for empirical research' Journal of Human Resources, Vol. 33 (1), pp. 88-126

Bray, M. and Boreskaya, N. (2001) 'Financing education in transitional societies: Lessons from Russia and China' Comparative Education, Vol. 37 (3), pp. 345-365

Brunello, G, Crivellaro, E. and Rocco, L. (2011) 'Lost in Transition? The Returns to Education acquired under Communism', IZA Working Paper 5409

Canning, M. (2004), 'The Modernisation of Education in Russia', World Bank, Washington DC

Card, D. and Krueger, A. B. (1996) 'Labor Market Effects of School Quality: Theory and Evidence' in Burtless, Gary (ed.), *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success.*, Washington D.C.: Brookings Institution, 97-140.

Chamberlain, G. (1994), Quantile Regression, Censoring, and the Structure of Wages, in Sims, Christopher A. (ed.), Advances in Econometrics, Cambridge, Cambridge University Press, 171-209.

Cooper, S.T., and Cohn, E. (1997), 'Estimation of a Frontier Production Function for the South Carolina Educational Process', *Economics of Education Review*, Vol. 16(3), pp.313-327.

Currie, J and Thomas, D. (1999) "The Intergenerational Transmission of "Intelligence": Down the Slippery Slopes of The Bell Curve" *Industrial Relations*, Vol. 38

Dincer, M.A., Uysal, G., (2010) The determinants of student achievement in Turkey, International Journal of Educational Development, Vol. 30 (6)

Duflo, E., Dupas, P. and Kremer, M. (2009) 'Additional Resources versus Organizational Changes in Education: Experimental Evidence from Kenya', Harvard University and MIT, May

Eide, E. and Showalter, M.H. (1998) 'The Effect of School Quality on Student Performance: A Quantile Regression Approach.' Economics Letters, Vol. 58, pp. 345-350.

Fertig, M.,(2003) 'Who's to Blame? The Determinants of German Students' Achievement in the PISA 2000,' IZA DP No. 739

Fertig. M and Schmidt, C. (2002) 'The role of background factors for reading literacy' IZA Discussion Paper N.545

Goldstein, H. (1987), *Multilevel Models in Educational and Social Research*, Charles Griffin.

Goldstein, H. (1995), *Multilevel Statistical Modelling*, Edward Arnold: London.

Haisken-DeNew, J. P. and Schmidt, C. (1997), 'Inter-Industry and Inter-Region Differentials: Mechanics and Interpretation.' *Review of Economics and Statistics*, Vol. 79, pp. 516-521.

Hanushek, E.A. (1986) 'The Economics of Schooling: Production and Efficiency in Public Schools.' *Journal of Economic Literature*, Vol. 24, pp. 1141-1177.

Hanushek, E.A., Rivkin, S.G. and Taylor, L.L. (1996), 'The Identification of School Resource Effects', *Education Economics*, 4(2), pp.105-125.

Hanushek, E.A. (1997), 'Effects of School Resources on Economic Performance', *Education Evaluation and Policy Analysis*, Vol. 19(2), pp.141-164.

Hanushek, E. and Luque, J. (2003) 'Efficiency and equity in schools around the world.' *Economics of Education Review,* 22:481–502

Hanushek, E.A. and Woessman, L., (2009), 'Do better schools lead to more growth? Cognitive skills ,economic outcomes and causation.' IZA Discussion Paper N. 4575

Hanushek, E.A. and Woessman, L., (2010), 'The Economics of International Differences in Educational Achievement.' IZA Discussion Paper N. 4925, May

Khan, S.R., Kiefer, D. (2007) 'Educational production functions for rural Pakistan: A comparative institutional analysis' Education Economics, Vol. 15 (3), pp. 327-342

Levin, J. (2001) 'Where the Reductions Count: A Quantile Regression Analysis of Effects of Class Size and Peer Effects on Scholastic Achievement' *Empirical Economics*, Vol. 26, pp. 241-246.

Organisation for Economic Co-Operation and Development (OECD), *Knowledge and Skills for Life: First Results from PISA 2000*. Paris, 2002.

Machin, S. and Pekkarinen, T. (2008) 'Global Sex Differences in Test Score Variability' *Science,* Vol. 322(5906), pp. 1331-2

Mayston, D.J. and Jesson, D. (1999), 'Linking Educational Resourcing with Enhanced Educational Outcomes', DfEE Research Report No.179.

Munich, D, J. Svejnar and K. Terrell, (2005) 'Returns to human capital under the communist wage grid and during the transition to a market economy', *Review of Economics and Statistics,* Vol. 87 (1), pp. 100-123

Vignoles, A, R. Levacic, J Walker, S Machin and Reynolds, D. "The relationship between resource allocation and pupil attainment: a review" September 2000, Centre for the Economics of Education

Wilson, P. (2005) "Efficiency in Education Production among PISA countries, with emphasis on Transition Economies" Mimeo

Woessmann, L. (2003), 'Schooling resources, educational institutions, and student performance: The international evidence' *Oxford Bulletin of Economics and Statistics,* Vol. 65, pp. 117–170

Figure 1 PISA Reading Scores, 2000-2009

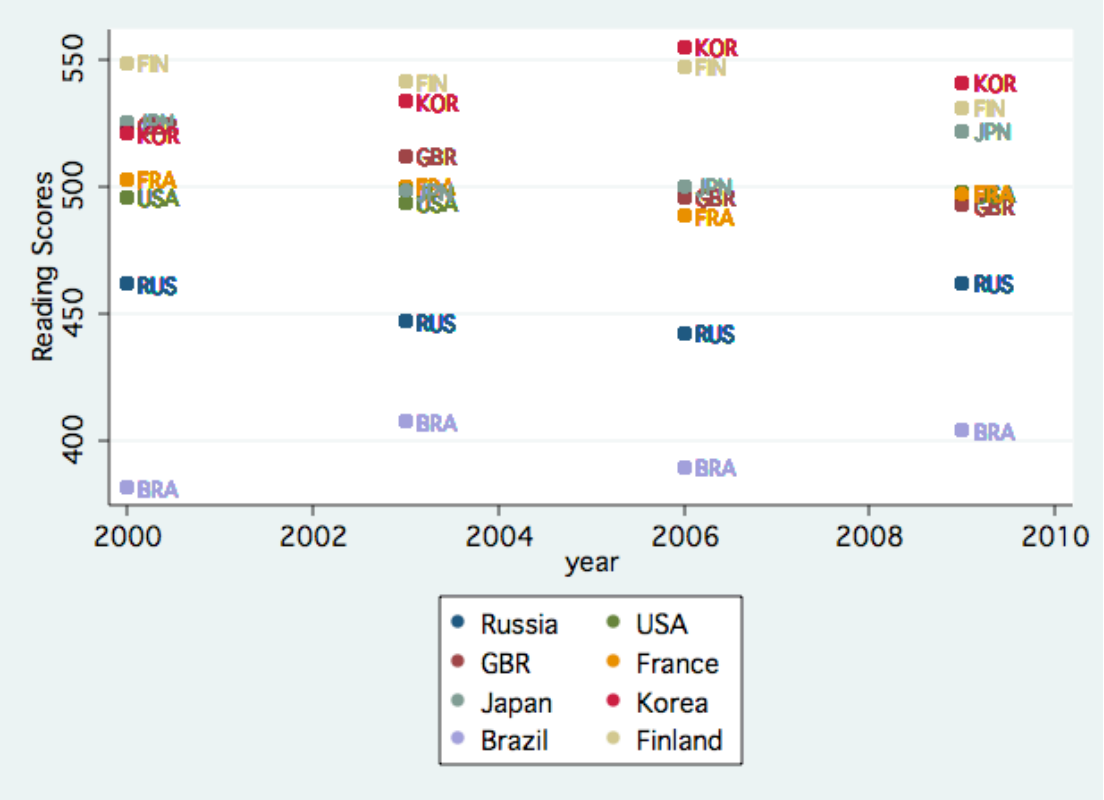

Figure 2 PISA Mathematics Scores, 2000-2009

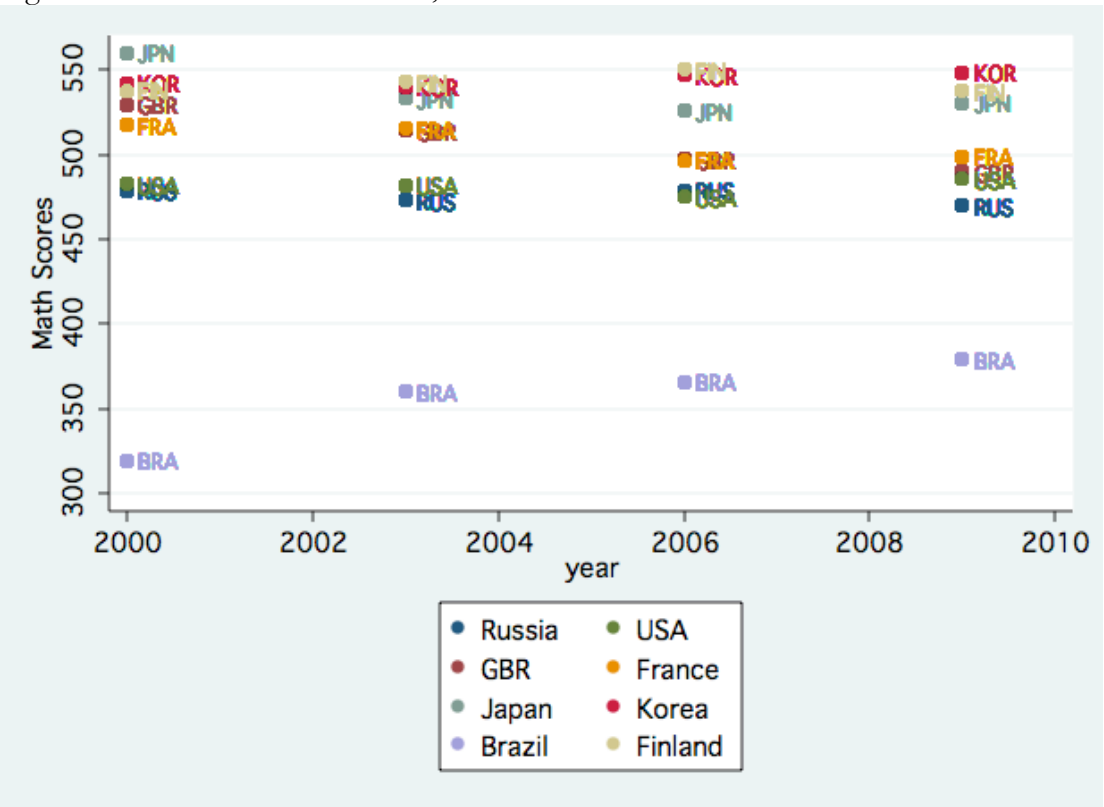

Figure 3: PISA Science Scores: 2000-2009

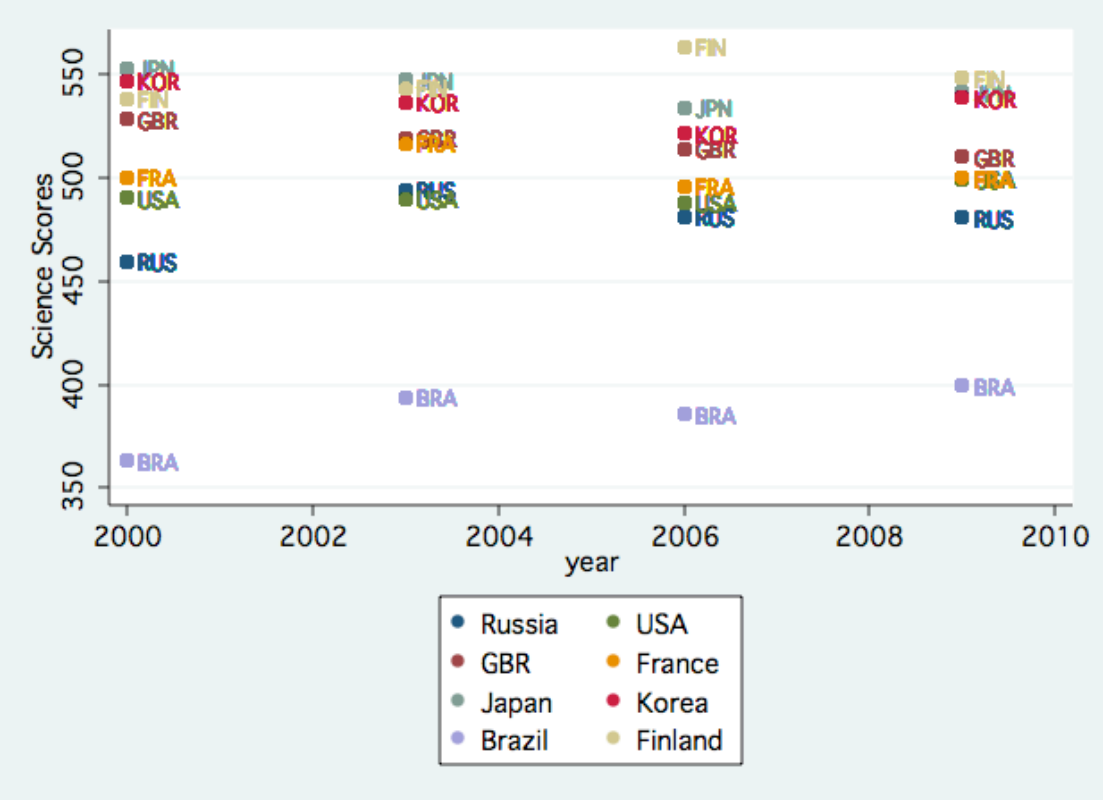

Figure 4: TIMSS Scores, 1995-2007

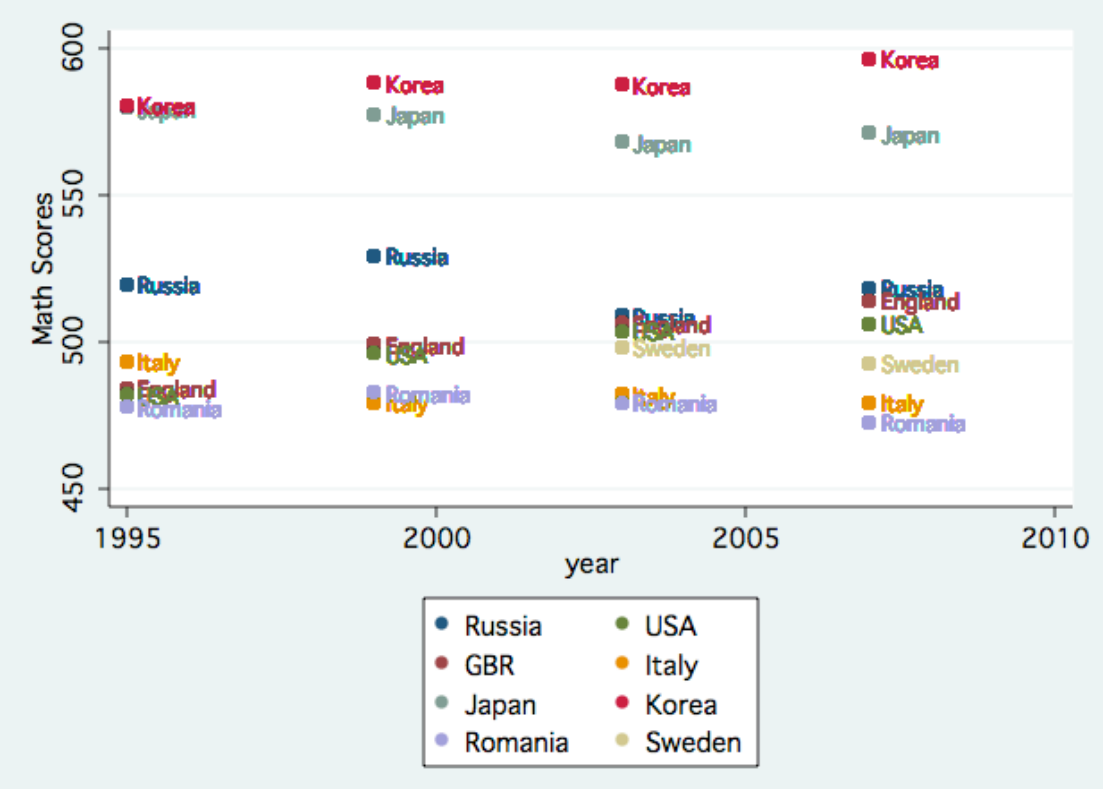

Figure 5 TIMSS Scores, 1995-2007

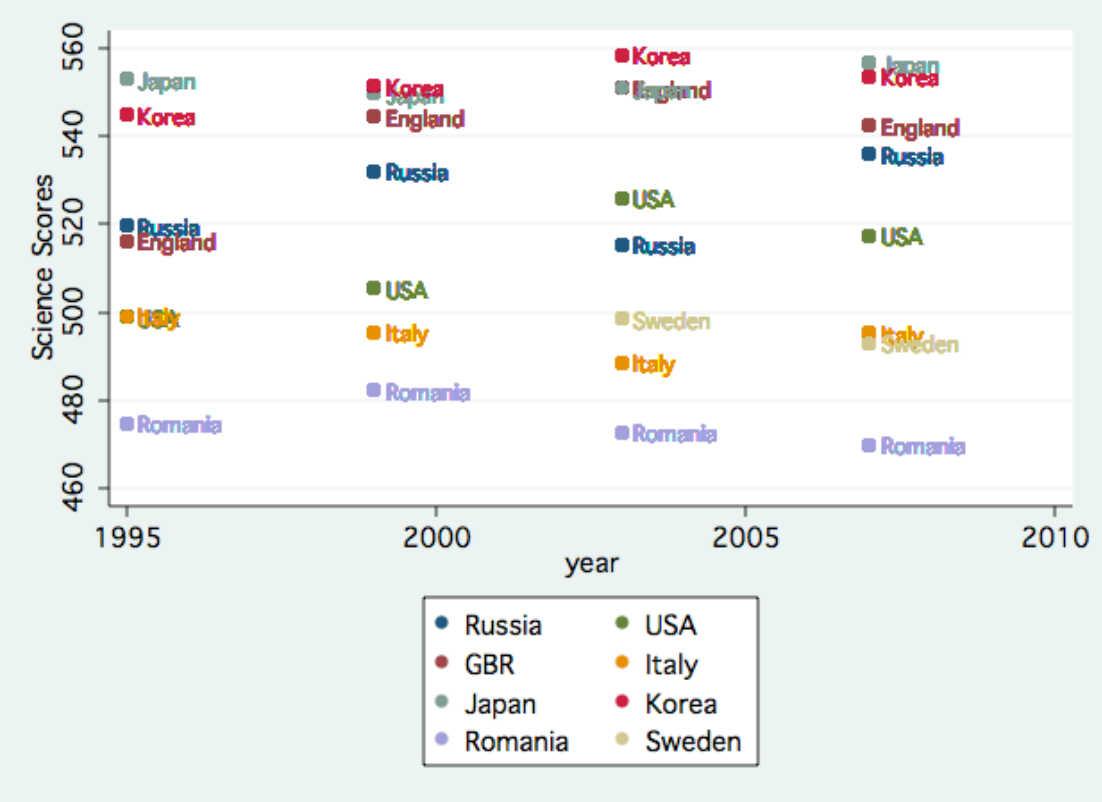

Figure 6: PISA Russia percentage of top performer

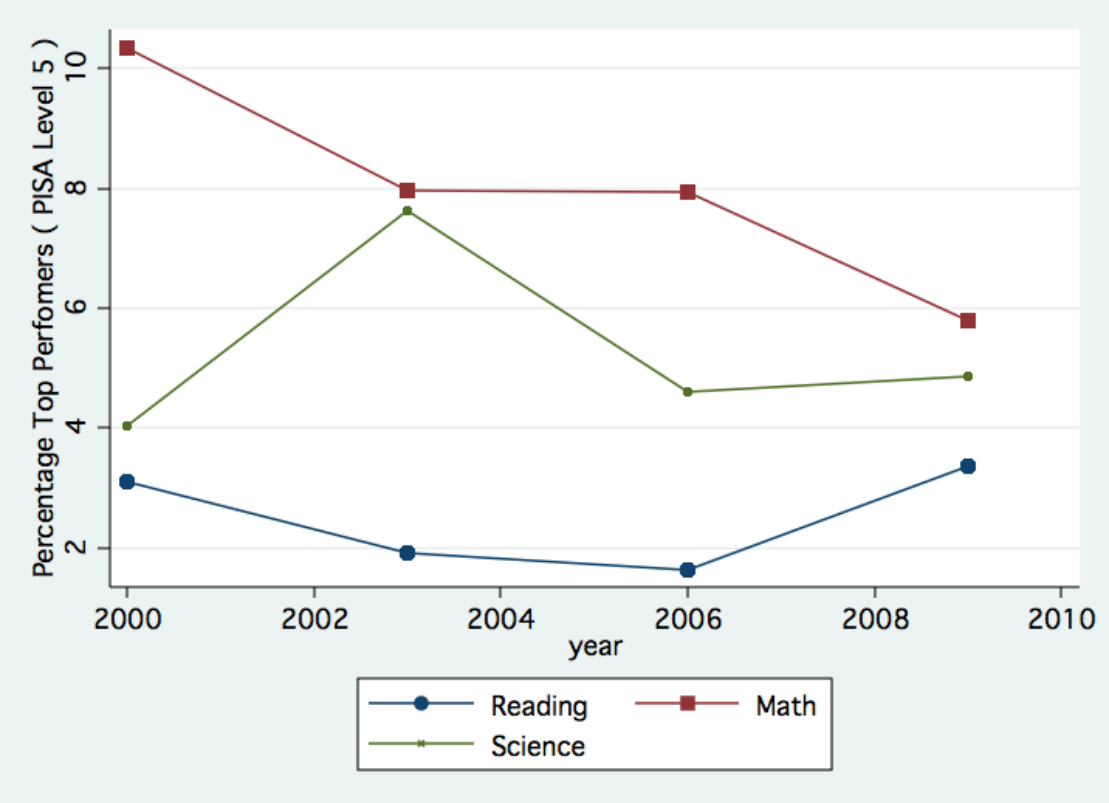

Figure 7: Gender Gap in Mathematics and Reading (PISA)

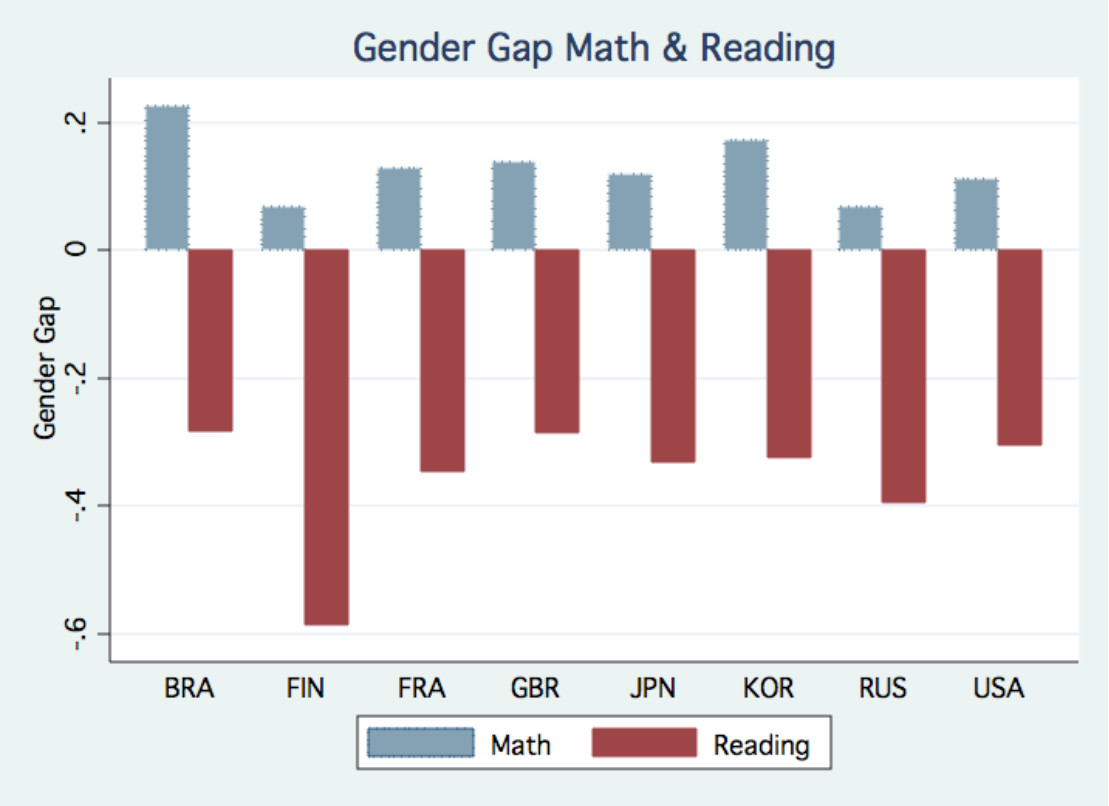

Figure 8: PISA 2009 – Russia Region Scores

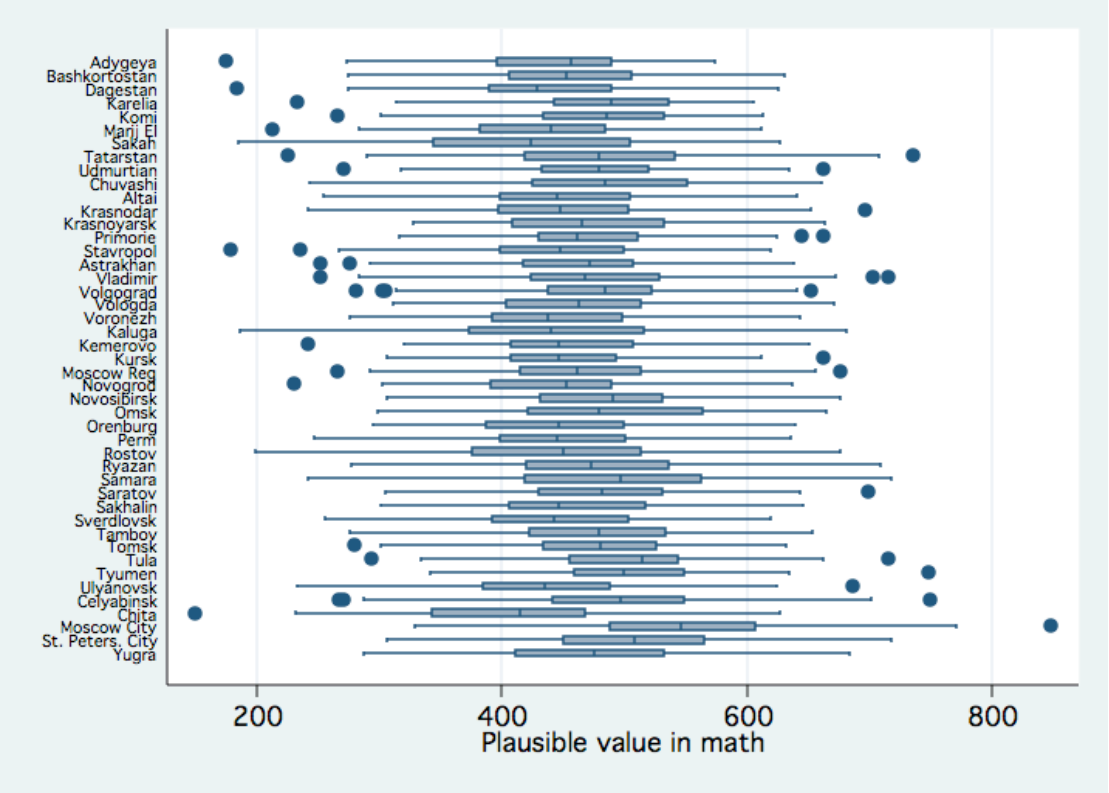

Table 1a PISA Pooled – All Countries

	OLS	Quantile 50%	Quantile 10%	Quantile 90%
	(1)	(2)	(3)	(4)
VARIABLES		MATH		
Individual Characteristics and Family Background				
age	-10.83***	-11.02***	-10.53***	-9.027***
	(1.124)	(1.201)	(1.772)	(1.419)
Female Dummy	-15.90***	-15.84***	-10.93***	-21.70***
	(0.626)	(0.676)	(0.950)	(0.826)
Student Born in Foreign Country	-2.649	-4.083**	-2.092	-0.354
	(1.766)	(1.856)	(2.454)	(2.357)
Mother Born in Foreign Country	-3.596**	-4.985***	-4.489**	-1.697
	(1.567)	(1.552)	(2.194)	(2.086)
Father Born in Foreign Country	-7.566***	-8.945***	-9.272***	-7.247***
	(1.553)	(1.542)	(2.213)	(2.095)
Test Language Spoken at Home	16.35***	13.85***	15.98***	15.12***
	(0.907)	(0.957)	(1.499)	(1.108)
Low mother edu	-14.62***	-15.46***	-9.920***	-20.58***
	(0.817)	(0.902)	(1.388)	(0.950)
Low father edu	-12.53***	-12.92***	-7.318***	-17.04***
	(0.773)	(0.868)	(1.336)	(0.934)
Many books at home	35.11***	35.30***	36.07***	29.32***
	(0.740)	(0.773)	(1.127)	(0.964)
School Characteristics				
Schl size	0.00600***	0.00648***	0.00492***	0.00612***
	(0.000556)	(0.000628)	(0.000925)	(0.000613)
Pc girls	16.52***	14.82***	23.58***	9.905***
	(1.596)	(1.704)	(2.424)	(2.059)
Student/teacher	-0.620***	-0.563***	-0.513***	-0.853***
	(0.0538)	(0.0592)	(0.0871)	(0.0709)
Prop certified teacher	7.704***	7.492***	10.56***	1.420
	(1.218)	(1.345)	(1.935)	(1.681)
Computer/sch size	0.187	0.302	-19.39***	1.483
	(0.695)	(0.566)	(0.339)	(0.996)
Private school	-0.289	-2.298*	0.414	-1.663
	(1.179)	(1.313)	(1.797)	(1.607)
Village	-2.547**	-2.936**	3.252**	-7.217***
	(1.068)	(1.185)	(1.608)	(1.406)
Small Town	-3.687***	-5.479***	2.075	-6.379***
	(0.841)	(0.918)	(1.306)	(1.092)
Town	-1.740**	-2.168**	-0.942	-3.910***
	(0.800)	(0.849)	(1.232)	(1.048)
	(3.961)	(1.721)	(2.325)	(2.103)
Constant	596.9***	523.6***	393.3***	630.2***
	(18.54)	(19.11)	(28.31)	(22.55)
Observations	430,745	430,745	430,745	430,745
R-squared	0.429			

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year, Countries and Grades dummy included but not reported. Countries included: AUS, AUT, BEL, BRA, CAN, CHE, CZE, DUE, DNK, ESP, FIN, FRA, GBR, GRC, HKG, HUN, IND, IRL, ISL, ITA, JPN, KOR, LIE, LUX, LVA, MEX, NDL, NOR, NZL, POL, PRT, RUS, SWE, THA, USA.

Table 1b PISA Pooled – All Countries

	OLS	Quantile 50%	Quantile 10%	Quantile 90%
	(1)	(2)	(3)	(4)
VARIABLES		READING		
Individual Characteristics and Family Background				
age	-10.12***	-9.613***	-11.61***	-7.273***
	(1.027)	(1.175)	(1.721)	(1.252)
Female Dummy	23.62***	21.99***	29.23***	16.45***
	(0.587)	(0.666)	(0.934)	(0.745)
Student Born in Foreign Country	-5.417***	-3.968**	-12.73***	-4.400**
	(1.803)	(1.837)	(2.434)	(2.178)
Mother Born in Foreign Country	-2.411*	-5.109***	-2.052	-1.799

	(1.460)	(1.521)	(1.992)	(1.870)
Father Born in Foreign Country	-7.370***	-7.968***	-8.345***	-3.036
	(1.465)	(1.502)	(2.083)	(1.863)
Test Language Spoken at Home	24.35***	21.16***	23.59***	20.46***
	(0.822)	(0.918)	(1.426)	(0.990)
Low mother edu	-15.31***	-15.35***	-9.888***	-20.08***
	(0.760)	(0.896)	(1.367)	(0.943)
Low father edu	-10.58***	-10.28***	-7.262***	-14.94***
	(0.719)	(0.869)	(1.307)	(0.902)
Many books at home	29.32***	29.41***	34.54***	17.42***
	(0.691)	(0.755)	(1.101)	(0.865)
School Characteristics				
Schl size	0.00840***	0.00851***	0.00831***	0.00841***
	(0.000562)	(0.000639)	(0.00101)	(0.000579)
Pc girls	22.92***	20.70***	31.85***	14.70***
	(1.426)	(1.613)	(2.342)	(1.741)
Student/teacher	-0.548***	-0.555***	-0.156*	-0.840***
	(0.0467)	(0.0568)	(0.0806)	(0.0613)
Prop certified teacher	8.090***	7.266***	11.34***	6.216***
	(1.039)	(1.272)	(1.798)	(1.389)
Computer/sch size	0.836**	1.530***	-9.357***	0.836
	(0.333)	(0.420)	(0.245)	(0.537)
Private school	-2.058**	-4.101***	-5.251***	-3.154**
	(1.041)	(1.241)	(1.728)	(1.415)
Village	-8.274***	-9.831***	-3.815**	-10.96***
	(0.980)	(1.147)	(1.576)	(1.225)
Small Town	-9.610***	-10.38***	-8.000***	-10.19***
	(0.800)	(0.904)	(1.327)	(0.989)
Town	-4.230***	-5.062***	-4.312***	-6.919***
	(0.742)	(0.832)	(1.183)	(0.925)
Constant	541.7***	473.9***	351.7***	578.0***
	(16.76)	(18.64)	(27.37)	(19.79)
Observations	482,119	482,119	482,119	482,119
R-squared	0.373			

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year, Countries and Grades dummy included but not reported. Countries included: AUS, AUT, BEL, BRA, CAN, CHE, CZE, DUE, DNK, ESP, FIN, FRA, GBR, GRC, HKG, HUN, IND, IRL, ISL, ITA, JPN, KOR, LIE, LUX, LVA, MEX, NDL, NOR, NZL, POL, PRT, RUS, SWE, THA, USA.

Table 1c PISA Pooled – All Countries

	OLS	Quantile 50%	Quantile 10%	Quantile 90%
	(1)	(2)	(3)	(4)
VARIABLES		SCIENCE		
Individual Characteristics and Family Background				
age	-6.867***	-7.662***	-7.671***	-6.547***
	(1.120)	(1.331)	(1.839)	(1.503)
Female Dummy	-8.280***	-8.539***	-1.501	-15.27***
	(0.635)	(0.749)	(1.021)	(0.878)
Student Born in Foreign Country	0.255	3.336	-4.894*	0.879
	(1.880)	(2.052)	(2.754)	(2.451)
Mother Born in Foreign Country	-6.868***	-10.57***	-8.337***	-6.934***
	(1.633)	(1.727)	(2.487)	(2.122)
Father Born in Foreign Country	-10.60***	-12.28***	-10.68***	-9.585***
	(1.583)	(1.684)	(2.425)	(2.039)
Test Language Spoken at Home	17.33***	13.57***	16.62***	14.19***
	(0.867)	(1.047)	(1.549)	(1.137)
Low mother edu	-15.83***	-16.78***	-10.21***	-21.72***
	(0.783)	(0.990)	(1.399)	(1.039)
Low father edu	-12.54***	-11.32***	-6.848***	-17.82***
	(0.747)	(0.960)	(1.342)	(0.999)
Many books at home	37.00***	37.65***	35.06***	30.16***
	(0.743)	(0.854)	(1.226)	(1.018)
School Characteristics				
Schl size	0.00644***	0.00726***	0.00531***	0.00578***
	(0.000571)	(0.000699)	(0.00103)	(0.000691)
Pc girls	22.50***	21.65***	24.82***	14.62***
	(1.614)	(1.887)	(2.681)	(2.173)
Student/teacher	-0.550***	-0.541***	-0.441***	-0.642***
	(0.0534)	(0.0658)	(0.0975)	(0.0739)

Prop certified teacher	12.63***	11.27***	15.41***	9.029***
	(1.188)	(1.486)	(2.108)	(1.685)
Computer/sch size	0.260	0.349	-12.11***	0.684
	(0.533)	(0.582)	(0.353)	(0.722)
Private school	3.680***	1.626	1.326	1.569
	(1.212)	(1.459)	(1.904)	(1.860)
Village	-3.277***	-1.637	1.643	-9.354***
	(1.069)	(1.302)	(1.778)	(1.459)
Small Town	-3.096***	-3.976***	0.460	-5.100***
	(0.862)	(1.017)	(1.408)	(1.191)
Town	0.176	-0.599	1.185	-2.302**
	(0.816)	(0.942)	(1.294)	(1.116)
	(0)			
Constant	445.4***	470.0***	334.2***	593.3***
	(17.74)	(21.19)	(29.10)	(23.70)
Observations	430,667	430,667	430,667	430,667
R-squared	0.348			

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year, Countries and Grades dummy included but not reported. Countries included: AUS, AUT, BEL, BRA, CAN, CHE, CZE, DUE, DNK, ESP, FIN, FRA, GBR, GRC, HKG, HUN, IND, IRL, ISL, ITA, JPN, KOR, LIE, LUX, LVA, MEX, NDL, NOR, NZL, POL, PRT, RUS, SWE, THA, USA.

Table 2 PISA – Russia interactions

Quantile 50%			
VARIABLES	(1) MATH	(2) READING	(3) SCIENCE
Individual Characteristics and Family Background			
age	-9.098***	-7.264***	-7.939***
	(1.209)	(1.089)	(1.255)
Female Dummy	-17.26***	20.90***	-9.401***
	(0.688)	(0.627)	(0.715)
Student Born in Foreign Country	-4.346**	-7.595***	-1.209
	(1.986)	(1.812)	(2.061)
Mother Born in Foreign Country	-5.107***	-4.462***	-13.28***
	(1.645)	(1.474)	(1.712)
Father Born in Foreign Country	-11.19***	-11.17***	-15.07***
	(1.649)	(1.473)	(1.676)
Test Language Spoken at Home	12.64***	18.49***	10.23***
	(0.948)	(0.834)	(0.969)
Low mother edu	-15.07***	-15.77***	-16.13***
	(0.871)	(0.792)	(0.893)
Low father edu	-12.87***	-9.861***	-11.01***
	(0.840)	(0.774)	(0.870)
Many books at home	36.07***	29.94***	38.69***
	(0.780)	(0.703)	(0.806)
School Characteristics			
Schl size	0.00589***	0.00724***	0.00696***
	(0.000623)	(0.000584)	(0.000649)
Pc girls	13.67***	18.47***	19.54***
	(1.680)	(1.459)	(1.741)
Student/teacher	-0.406***	-0.395***	-0.417***
	(0.0597)	(0.0528)	(0.0622)
Prop certified teacher	7.902***	7.656***	8.940***
	(1.366)	(1.203)	(1.413)
Computer/sch size	0.484	1.563***	0.470
	(0.539)	(0.366)	(0.534)
Private school	-2.092*	-3.422***	1.444
	(1.259)	(1.090)	(1.309)
Village	0.465	-5.042***	1.964
	(1.236)	(1.107)	(1.271)
Small Town	-4.902***	-8.876***	-3.299***
	(0.930)	(0.843)	(0.965)
Town	-1.570*	-3.152***	0.948
	(0.865)	(0.782)	(0.900)
Interaction Terms			
Russia * age	-17.65***	-24.84***	-9.636***
	(3.285)	(2.835)	(3.400)
Russia * Female Dummy	7.927***	8.050***	5.816***
	(1.896)	(1.645)	(1.968)

Russia * Student Born in Foreign Country	0.179	11.26***	15.36***
	(4.331)	(3.839)	(4.463)
Russia * Mother Born in Foreign Country	2.338	3.002	12.22***
	(3.670)	(3.260)	(3.822)
Russia *Father Born in Foreign Country	8.249**	13.26***	11.32***
	(3.564)	(3.146)	(3.678)
Russia * Test Language Spoken at Home	13.74***	25.15***	28.20***
	(3.494)	(3.048)	(3.628)
Russia * Low mother edu	-2.153	-9.305**	-10.71**
	(5.028)	(4.133)	(5.300)
Russia * Low father edu	0.717	-4.844	-8.348*
	(4.232)	(3.525)	(4.476)
Russia * Many books at home	-10.87***	-7.060***	-15.00***
	(2.296)	(1.970)	(2.385)
Russia * Schl size	0.00434*	0.0133***	0.00544**
	(0.00226)	(0.00199)	(0.00232)
Russia * Pc girls	11.13*	29.89***	21.82***
	(6.466)	(5.672)	(6.706)
Russia * Student/teacher	-2.317***	-2.092***	-2.866***
	(0.179)	(0.153)	(0.186)
Russia * Prop certified teacher	-8.027**	-8.492***	14.37***
	(3.742)	(3.017)	(3.879)
Russia * Computer/sch size	-48.57***	-59.00***	13.03
	(8.661)	(8.013)	(8.999)
Russia * Private school	-16.92	-30.19***	-36.75***
	(10.35)	(9.687)	(10.75)
Russia * Village	-30.18***	-31.06***	-34.73***
	(3.141)	(2.680)	(3.245)
Russia * Small Town	-11.67***	-13.27***	-14.43***
	(2.755)	(2.425)	(2.858)
Russia * Town	-11.58***	-14.29***	-15.89***
	(2.385)	(2.066)	(2.471)
Constant	847.6***	863.7***	682.0***
	(49.61)	(42.57)	(51.41)
Observations	430,745	482,119	430,667

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year, Countries and Grade dummies included but not reported.

Table 3 PISA Russia estimates

	Quantile 50%		
VARIABLES	(1) MATH	(2) READING	(3) SCIENCE
Individual and Family Characteristics			
Age	-21.59***	-19.64***	-14.68***
	(4.295)	(3.742)	(4.318)
Female Dummy	-9.606***	29.48***	-2.861
	(2.225)	(1.940)	(2.243)
Student Born in Foreign Country	-4.499	2.777	12.22**
	(4.847)	(4.325)	(4.845)
Mother Born in Foreign Country	-1.548	-2.981	-4.128
	(4.127)	(3.712)	(4.188)
Father Born in Foreign Country	-2.961	5.653	-3.129
	(3.973)	(3.546)	(4.011)
Test Language Spoken at Home	27.39***	40.67***	40.31***
	(4.230)	(3.738)	(4.246)

Low mother edu	-17.00***	-24.52***	-28.99***
	(6.229)	(5.183)	(6.355)
Low father edu	-13.80***	-17.89***	-16.80***
	(5.229)	(4.403)	(5.364)
Many books at home	26.44***	22.20***	25.33***
	(2.736)	(2.358)	(2.762)
School Characteristics			
Schl size	0.0106***	0.0214***	0.0120***
	(0.00273)	(0.00243)	(0.00275)
Pc girls	29.77***	43.34***	41.76***
	(7.867)	(7.001)	(7.937)
Student/teacher	-2.560***	-2.729***	-2.844***
	(0.215)	(0.186)	(0.217)
Prop certified teacher	-0.169	10.67***	14.90***
	(4.682)	(3.759)	(4.711)
Computer/sch size	-5.832	6.779	6.755
	(12.10)	(11.49)	(12.23)
Private school	-14.54	-30.41**	-29.55**
	(12.81)	(12.32)	(13.07)
Village	-29.05***	-40.77***	-29.04***
	(3.659)	(3.140)	(3.673)
Small Town	-13.52***	-21.68***	-16.09***
	(3.292)	(2.918)	(3.317)
Town	-10.97***	-17.40***	-14.20***
	(2.796)	(2.437)	(2.817)
Constant	689.7***	543.8***	539.2***
	(70.47)	(61.84)	(70.55)
Observations	12,719	15,308	12,716

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Year and Grades dummy included but not reported.

Table 4 PISA: Multilevel estimation

	GLLAMM		
VARIABLES	(1) MATH	(2) READING	(3) SCIENCE
Individual Characteristics and Family Background			
Age	17.72***	12.38***	15.53***
	(3.184)	(2.258)	(2.992)
Female dummy	-12.37***	27.93***	-7.654***
	(1.775)	(1.299)	(1.932)
Student born in foreign country	-5.730*	-3.405	2.529
	(3.400)	(2.919)	(3.910)
Mother born in foreign country	-2.590	-3.521	-2.124
	(2.931)	(2.468)	(3.182)
Father born in foreign country	-3.581	0.652	-5.136
	(2.974)	(2.373)	(3.308)
Test language at home	19.05***	27.36***	29.28***
	(6.642)	(2.909)	(5.110)
Low mother education	-26.27***	-22.67***	-35.43***
	(5.704)	(5.314)	(5.588)
Low father education	-12.19*	-10.16**	-15.68***
	(6.510)	(4.607)	(5.495)
Many books at home	33.52***	29.20***	28.04***
	(1.918)	(1.439)	(1.954)
School Characteristics			
School size	0.00209	0.00451*	0.00135
	(0.00657)	(0.00265)	(0.00586)
Percentage of girls	26.96	22.72***	17.43
	(24.89)	(7.881)	(18.88)
Student/teacher	-1.621***	-1.245***	-1.494***
	(0.618)	(0.217)	(0.578)
Proportion certified teachers	16.59*	8.433	17.93**

	(9.331)	(5.543)	(7.895)
Computers/school size	-9.488	15.70	-1.840
	(28.86)	(12.42)	(25.90)
Private School dummy	-25.52**	-40.79***	-29.93***
	(10.33)	(3.963)	(7.778)
School in village	-9.194	-18.60***	-17.61**
	(9.349)	(3.463)	(7.349)
School in small town	-5.352	-17.23***	-12.74**
	(8.805)	(3.060)	(6.412)
School in town	33.41	12.98	18.11
	(144.8)	(31,687)	(941.7)
Lns1	4.385	4.341	4.429***
	(0.0102)	(0.00583)	(0.00773)
School	47.45	41.65	42.34***
	(2.387)	(1.679)	(2.259)
Observations	12,719	15,308	12,716

Standard errors in parentheses;*** p<0.01, ** p<0.05, * p<0.1; Year and Grade Dummy and constant included but not reported.

Gllamm estimates use the following weight (weighting follows Longford 1995a, 1996):

```
gen sqw= w_fstuwt^2
egen sumsqw=sum(sqw), by( schoolid2 )
egen sumw=sum( w_fstuwt ), by ( schoolid2 )
gen pwt1s1= w_fstuwt* sumw/ sumsqw
final weight is the inverse of pwt1s1
```

APPENDIX

Table 1a TIMSS Pooled – All Countries 1995 and 1999

DEPENDENT VARIABLE- MATH SCORES VARIABLES	(1) OLS	(2) Quantile 50%	(3) Quantile 10%	(4) Quantile 90%
Individual Characteristics and Family Background				
Student Age	-0.07*	-0.11***	0.00	0.05
	(0.031)	(0.034)	(0.047)	(0.049)
Female Dummy	-9.14***	-10.34***	-3.43**	-13.23***
	(0.670)	(0.823)	(1.153)	(1.039)
Test language at home	23.54***	22.87***	22.45***	24.22***
	(1.104)	(1.282)	(1.796)	(1.715)
Student born in test country	11.94***	11.32***	16.06***	5.01*
	(1.478)	(1.721)	(2.532)	(2.127)
Mother born in test country	-2.78	-2.29	5.71*	-8.80***
	(1.643)	(2.038)	(2.849)	(2.387)
Father born in test country	5.76***	4.92*	5.14	7.19**
	(1.584)	(2.020)	(2.720)	(2.348)
Books at home 0-10	-74.20***	-74.03***	-74.76***	-72.53***
	(1.322)	(1.542)	(2.262)	(1.965)
Books at home 11-25	-55.79***	-58.19***	-52.99***	-54.60***
	(1.147)	(1.395)	(1.987)	(1.740)
Books at home 26-100	-34.25***	-35.17***	-31.30***	-35.52***
	(0.980)	(1.206)	(1.666)	(1.519)
Books at home 101-200	-12.69***	-13.04***	-9.10***	-14.21***
	(1.079)	(1.335)	(1.853)	(1.714)
School Characteristics				
Student/teacher	-0.24***	-0.26***	-0.07	-0.31***
	(0.033)	(0.039)	(0.056)	(0.055)
School in isolated area	-16.10***	-16.54***	-13.00***	-15.13***
	(1.736)	(2.155)	(3.160)	(2.518)
School in village	-21.42***	-20.56***	-19.43***	-21.37***
	(0.954)	(1.162)	(1.634)	(1.463)
School in outskirt of town	-4.42***	-4.84***	-2.63	-5.10***
	(0.800)	(0.985)	(1.406)	(1.237)
School own math curriculum	11.21***	10.46***	10.51***	11.18***
	(0.834)	(1.048)	(1.408)	(1.261)
Shortage instructional material- a little	-6.66***	-6.39***	-5.16***	-7.60***
	(0.850)	(1.040)	(1.488)	(1.303)
Shortage instructional material- some	-9.64***	-9.80***	-6.28***	-10.74***
	(0.968)	(1.198)	(1.680)	(1.535)
Shortage instructional material- a lot	-10.23***	-10.89***	-6.52**	-10.44***
	(1.185)	(1.424)	(2.059)	(1.788)
Observations	156,820	156,820	156,820	156,820
R-squared	0.43			

Robust standard errors in parentheses ; *** p<0.001, ** p<0.01, * p<0.05; Constant, year and country dummies included but not reported below. Countries included: Australia, Canada, Cyprus, Check Rep, Hong Kong, Hungary, Iran, Israel, Italy, Japan, Korea, Latvia, Lithuania, Neatherland, New Zealand, Romania, Russia, Singapore, Slovak Rep, Slovenia, South Africa, Thailand, USA, England, Belgium
Omitted dummies: the number of books at home > 200; school location is school located close to town/city centre; Shortage instructional material none.

Table 1b TIMSS Pooled – All Countries 1995 and 1999

DEPENDENT VARIABLE- SCIENCE SCORES VARIABLES	(1) OLS	(2) Quantile 50%	(3) Quantile 10%	(4) Quantile 90%
Individual Characteristics and Family Background				
Student Age	0.05	-0.01	0.01	0.15***
	(0.032)	(0.038)	(0.048)	(0.044)
Female Dummy	-20.76***	-22.91***	-13.91***	-24.41***
	(0.709)	(0.905)	(1.211)	(0.978)
Test language at home	33.08***	31.13***	30.78***	28.60***
	(1.192)	(1.412)	(2.025)	(1.604)
Student born in test country	10.55***	8.77***	18.25***	2.70
	(1.578)	(1.894)	(2.715)	(1.952)
Mother born in test country	1.66	1.55	6.72*	-2.46
	(1.816)	(2.254)	(2.915)	(2.345)
Father born in test country	10.54***	10.42***	11.86***	9.75***
	(1.770)	(2.219)	(2.914)	(2.281)
Books at home 0-10	-78.50***	-77.87***	-76.29***	-78.31***
	(1.379)	(1.696)	(2.372)	(1.856)
Books at home 11-25	-59.85***	-60.51***	-55.60***	-62.22***
	(1.232)	(1.534)	(2.117)	(1.641)
Books at home 26-100	-38.04***	-38.85***	-33.69***	-41.22***
	(1.042)	(1.325)	(1.730)	(1.438)
Books at home 101-200	-15.28***	-15.83***	-11.98***	-18.12***
	(1.161)	(1.468)	(1.959)	(1.596)
School Characteristics				
Student/teacher	-0.31***	-0.32***	-0.04	-0.40***
	(0.034)	(0.042)	(0.055)	(0.054)
School in isolated area	-7.79***	-4.99*	-8.30*	-9.41***
	(1.816)	(2.365)	(3.406)	(2.292)
School in village	-15.52***	-14.02***	-14.41***	-13.39***
	(1.033)	(1.275)	(1.724)	(1.399)
School in outskirt of town	0.07	-0.02	2.87*	-1.72
	(0.836)	(1.084)	(1.448)	(1.182)
School own math curriculum	10.97***	10.36***	9.91***	9.60***
	(0.853)	(1.116)	(1.529)	(1.148)
Shortage instructional material- a little	-6.19***	-5.39***	-6.47***	-7.27***
	(0.906)	(1.145)	(1.563)	(1.250)
Shortage instructional material- some	-8.45***	-7.33***	-4.09*	-11.14***
	(1.014)	(1.317)	(1.738)	(1.449)
Shortage instructional material- a lot	-9.16***	-7.62***	-7.46***	-8.97***
	(1.264)	(1.569)	(2.167)	(1.676)
Observations	156,391	156,391	156,391	156,391
R-squared	0.38			

Robust standard errors in parentheses ; *** p<0.001, ** p<0.01, * p<0.05; Constant, year and country dummies included but not reported below. Countries included: Australia, Canada, Cyprus, Check Rep, Hong Kong, Hungary, Iran, Israel, Italy, Japan, Korea, Latvia, Lithuania, Neatherland, New Zealand, Romania, Russia, Singapore, Slovak Rep, Slovenia, South Africa, Thailand, USA, England, Belgium.
Omitted dummies: the number of books at home > 200; school location is school located close to town/city centre; Shortage instructional material no

Table 1c TIMSS Pooled – All Countries 2003 and 2007

DEPENDENT VARIABLE- MATH SCORES	(1)	(2)	(3)	(4)
VARIABLES	OLS	Quantile 50%	Quantile 10%	Quantile 90%
Individual Characteristics and Family Background				
AGE	-14.76***	-15.42***	-15.30***	-14.09***
	(0.442)	(0.498)	(0.711)	(0.507)
Female dummy	-3.44***	-4.91***	1.25	-7.57***
	(0.544)	(0.642)	(0.834)	(0.728)
books at home 1 shelf	7.12***	7.43***	9.46***	5.02***
	(0.828)	(0.956)	(1.215)	(1.096)
books at home 1 bookcase	26.13***	27.28***	27.21***	26.51***
	(0.863)	(0.995)	(1.312)	(1.137)
books at home 2 bookcase	38.26***	39.26***	36.99***	38.25***
	(1.041)	(1.207)	(1.634)	(1.372)
books at home >=3 bookcase	46.21***	49.85***	41.50***	47.59***
	(1.038)	(1.217)	(1.680)	(1.343)
Mother has ISCED 2	0.73	0.10	3.62*	1.41
	(0.992)	(1.140)	(1.508)	(1.282)
Mother has ISCED 3	7.16***	7.24***	7.15***	6.65***
	(0.935)	(1.089)	(1.414)	(1.257)
Mother has ISCED 4	13.31***	13.54***	13.09***	13.67***
	(1.005)	(1.188)	(1.522)	(1.446)
Mother has ISCED 5	16.35***	16.08***	18.24***	13.96***
	(1.410)	(1.697)	(2.239)	(1.984)
Mother has 1st degree	23.47***	22.31***	22.34***	22.66***
	(1.231)	(1.488)	(1.961)	(1.735)
Mother has > 1st degree	16.48***	16.04***	15.83***	14.99***
	(1.229)	(1.511)	(1.978)	(1.722)
Father has ISCED 2	-1.67	-0.17	-3.75*	-4.72***
	(1.030)	(1.176)	(1.576)	(1.298)
Father has ISCED 3	4.29***	4.07***	4.57**	1.64
	(0.924)	(1.084)	(1.403)	(1.245)
Father has ISCED 4	6.55***	7.02***	7.21***	3.87**
	(0.981)	(1.168)	(1.527)	(1.397)
Father has ISCED 5	11.24***	10.72***	11.65***	10.76***
	(1.475)	(1.694)	(2.224)	(2.009)
Father has 1st degree	24.36***	24.81***	25.60***	21.46***
	(1.171)	(1.414)	(1.854)	(1.639)
Father has > 1st degree	20.40***	20.60***	19.65***	17.31***
	(1.125)	(1.368)	(1.806)	(1.563)
mother born in country of test= no	3.49**	3.82**	-2.95	12.34***
	(1.320)	(1.482)	(1.985)	(1.682)
father born in country of test= no	-3.42**	-2.66	-6.54***	-2.91
	(1.273)	(1.452)	(1.953)	(1.650)
student born in country of test= no	-38.28***	-38.63***	-42.34***	-32.36***
	(1.122)	(1.226)	(1.624)	(1.380)
School Characteristics				
School in town > 500000	10.87***	11.11***	9.52***	6.64***
	(1.129)	(1.339)	(1.727)	(1.528)
school in town 100001 – 500000 PEOPLE	8.14***	5.64***	11.45***	3.27*
	(1.161)	(1.392)	(1.781)	(1.592)
school in town 50001 – 100000 PEOPLE	9.12***	9.04***	11.65***	2.30
	(1.224)	(1.468)	(1.876)	(1.702)
school in town 15001- 50000 PEOPLE	2.99**	1.52	6.32***	-1.53
	(1.134)	(1.376)	(1.736)	(1.601)
school in town with 3001 -15000 PEOPLE	0.28	1.02	2.13	-4.37**
	(1.109)	(1.326)	(1.697)	(1.540)
% students disadvantaged background: 0-10	32.69***	34.00***	35.36***	28.93***
	(0.848)	(1.007)	(1.328)	(1.153)
% students disadvantaged economic background:11-25	22.19***	23.95***	24.62***	20.87***

	(0.798)	(0.937)	(1.221)	(1.096)
students disadvantaged economic background:26-50	11.78***	12.53***	13.94***	10.98***
	(0.797)	(0.927)	(1.220)	(1.057)
math classes are split by group ability	0.52	0.99	-0.44	1.19
	(0.628)	(0.753)	(0.978)	(0.840)
Additional math classes	8.17***	7.20***	7.06***	10.50***
	(0.607)	(0.727)	(0.944)	(0.821)
math remedial classes	-0.69	-0.85	-0.73	-1.79
	(0.683)	(0.813)	(1.066)	(0.928)
Shortage budget for supply – none	-1.99	-2.53	-0.24	-3.18*
	(1.158)	(1.359)	(1.772)	(1.459)
Shortage budget for supply – little	-8.25***	-8.71***	-9.27***	-6.96***
	(1.164)	(1.350)	(1.762)	(1.476)
Shortage budget for supply – some	-6.69***	-7.81***	-6.17***	-7.40***
	(1.165)	(1.355)	(1.760)	(1.468)
Shortage budget for materials- none	9.23***	9.41***	7.43***	11.58***
	(1.187)	(1.376)	(1.799)	(1.501)
Shortage budget for materials- a little	4.96***	6.83***	2.80	5.21***
	(1.185)	(1.360)	(1.801)	(1.481)
Shortage budget for materials-some	7.23***	8.49***	7.82***	6.14***
	(1.180)	(1.368)	(1.784)	(1.488)
Shortage budget for teachers- a little	5.55***	6.81***	2.59	7.05***
	(0.964)	(1.139)	(1.517)	(1.216)
Shortage budget for teachers- some	2.35*	3.46**	-0.88	5.56***
	(1.038)	(1.222)	(1.604)	(1.304)
Shortage budget for teachers- a lot	3.94***	4.59***	1.40	5.11***
	(1.105)	(1.292)	(1.733)	(1.355)
Observations	237,363	237,363	237,363	237,363
R-squared	0.51			
		.	.	.

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05; Constant, year and country dummies included but not reported below.
Countries included: Australia, Bahrain, Armenia, Botswana, Bulgaria, Taipei, Cyprus Palestine, Ghana, Hong Kong, Hungary, Indonesia, Iran, Israel, Italy, Japan , Jordan Korea, Lebanon, Lithuania, Malaysia, Morocco , Norway, Romania, Russia, Saudi Singapore, Sweden, Syria, Tunisia, Egypt, USA, Serbia, England, Scotland. Omitted country for OLS regression is Cyprus & Romania; Omitted country for quantiles are Romania & Bahrain.
Omitted variables: n of books at home none or very few; mother/father has ISCED 1 or did not go to school; school in town with < 3000 people; Shortage budget/material/teachers – a lot;

Table 1d TIMSS Pooled – All Countries 2003 and 2007

DEPENDENT VARIABLE- SCIENCE SCORES	(1)	(2)	(3)	(4)
VARIABLES	OLS	Quantile 50%	Quantile 10%	Quantile 90%
Individual Characteristics and Family Background				
AGE	-13.40***	-13.35***	-14.15***	-11.52***
	(0.423)	(0.434)	(0.695)	(0.502)
Female dummy	-8.93***	-10.04***	-4.42***	-13.29***
	(0.521)	(0.552)	(0.823)	(0.724)
books at home 1 shelf	10.46***	10.40***	11.56***	8.11***
	(0.788)	(0.825)	(1.209)	(1.094)
books at home 1 bookcase	28.00***	28.44***	27.05***	26.89***
	(0.830)	(0.857)	(1.331)	(1.112)
books at home 2 bookcase	40.31***	41.28***	38.08***	39.56***
	(1.008)	(1.037)	(1.621)	(1.412)
books at home >=3 bookcase	51.14***	54.12***	48.28***	52.52***
	(1.013)	(1.045)	(1.637)	(1.335)

Mother has ISCED 2	-1.31	-1.02	0.60	-2.26
	(0.946)	(0.989)	(1.464)	(1.296)
Mother has ISCED 3	5.61***	6.86***	5.80***	3.44**
	(0.891)	(0.937)	(1.367)	(1.240)
Mother has ISCED 4	13.33***	14.20***	14.31***	10.86***
	(0.964)	(1.020)	(1.495)	(1.351)
Mother has ISCED 5	13.26***	14.62***	16.09***	11.22***
	(1.344)	(1.455)	(2.203)	(1.933)
Mother has 1st degree	20.70***	21.93***	20.94***	18.07***
	(1.204)	(1.276)	(1.889)	(1.701)
Mother has > 1st degree	16.43***	18.08***	14.41***	14.66***
	(1.240)	(1.302)	(1.991)	(1.766)
Father has ISCED 2	-2.46*	-2.64**	-2.64	-1.27
	(0.982)	(1.020)	(1.529)	(1.321)
Father has ISCED 3	4.94***	4.08***	6.80***	4.27***
	(0.885)	(0.933)	(1.367)	(1.220)
Father has ISCED 4	7.74***	7.79***	8.72***	5.35***
	(0.943)	(1.003)	(1.469)	(1.320)
Father has ISCED 5	8.86***	7.91***	9.83***	5.50**
	(1.364)	(1.451)	(2.245)	(1.930)
Father has 1st degree	20.73***	20.24***	25.30***	16.12***
	(1.121)	(1.213)	(1.783)	(1.620)
Father has > 1st degree	17.46***	18.25***	17.99***	14.44***
	(1.120)	(1.180)	(1.773)	(1.566)
mother born in country of test= no	-1.12	-0.76	-3.15	2.43
	(1.316)	(1.271)	(2.081)	(1.685)
father born in country of test= no	-8.13***	-10.22***	-11.39***	-6.18***
	(1.283)	(1.247)	(2.053)	(1.672)
student born in country of test= no	-39.23***	-39.80***	-43.13***	-30.51***
	(1.068)	(1.055)	(1.572)	(1.365)
School Characteristics				
School in town > 500000	4.47***	4.55***	4.89**	3.56*
	(1.093)	(1.166)	(1.692)	(1.530)
school in town 100001 – 500000 PEOPLE	3.33**	3.83**	3.73*	0.44
	(1.120)	(1.206)	(1.749)	(1.586)
school in town 50001 – 100000 PEOPLE	5.21***	6.61***	3.77*	1.71
	(1.184)	(1.275)	(1.846)	(1.681)
school in town 15001-50000 PEOPLE	1.85	2.49*	3.04	-0.04
	(1.102)	(1.194)	(1.672)	(1.582)
school in town with 3001 -15000 PEOPLE	-1.79	-0.39	-1.93	-2.47
	(1.087)	(1.152)	(1.660)	(1.535)
% students disadvantaged background: 0-10	31.04***	30.46***	36.75***	27.76***
	(0.817)	(0.863)	(1.323)	(1.140)
% students disadvantaged economic background:11-25	22.29***	22.34***	24.53***	20.33***
	(0.774)	(0.806)	(1.232)	(1.080)
students disadvantaged economic background:26-50	11.55***	12.45***	13.74***	11.03***
	(0.766)	(0.799)	(1.207)	(1.056)
math classes are split by group ability	-1.27	-1.63*	-0.87	-1.52
	(0.683)	(0.713)	(1.052)	(0.945)
Additional math classes	5.49***	5.61***	5.11***	7.37***
	(0.610)	(0.641)	(0.984)	(0.851)
math remedial classes	3.83***	4.73***	5.75***	1.08
	(0.622)	(0.646)	(0.983)	(0.853)
Shortage budget for supply – none	1.23	0.22	4.57*	-2.63
	(1.106)	(1.169)	(1.797)	(1.470)
Shortage budget for supply – little	-4.51***	-5.18***	-4.44*	-4.91***
	(1.110)	(1.162)	(1.805)	(1.477)
Shortage budget for supply – some	-3.47**	-5.25***	-1.81	-4.95***
	(1.099)	(1.163)	(1.815)	(1.477)
Shortage budget for materials- none	3.96***	3.88**	2.65	6.80***

	(1.130)	(1.194)	(1.790)	(1.518)
Shortage budget for materials- a little	0.88	0.76	-1.84	3.36*
	(1.119)	(1.180)	(1.798)	(1.495)
Shortage budget for materials-some	3.81***	3.61**	4.27*	4.84**
	(1.107)	(1.187)	(1.808)	(1.503)
Shortage budget for teachers- a little	4.76***	5.89***	3.27*	7.70***
	(0.922)	(0.985)	(1.515)	(1.217)
Shortage budget for teachers- some	-1.18	0.35	-3.37*	2.80*
	(0.982)	(1.057)	(1.618)	(1.305)
Shortage budget for teachers- a lot	0.17	1.43	-2.16	3.30*
	(1.036)	(1.117)	(1.736)	(1.361)
R-squared	0.45			
Adj. R-squared	0.45	.	.	.

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05; Constant, year and country dummies included but not reported below.
Countries included: Australia, Bahrain, Armenia, Botswana, Bulgaria, Taipei, Cyprus Palestine, Ghana, Hong Kong, Hungary, Indonesia, Iran, Israel, Italy, Japan , Jordan Korea, Lebanon, Lithuania, Malaysia, Morocco , Norway, Romania, Russia, Saudi Singapore, Sweden, Syria, Tunisia, Egypt, USA, Serbia, England, Scotland.
omitted countries: Cyprus & Romania. Constant Included but not reported.
Omitted variables: n of books at home none or very few; mother/father has ISCED 1 or did not go to school; school in town with < 3000 people; Shortage budget/material/teachers – a lot;

Table 2a TIMSS Russia estimates: 1995 and 1999

	(1) MATH	(2) SCIENCE
VARIABLES	Quantile 50%	Quantile 50%
Individual Characteristics and Family Background		
Student Age	-1.67**	-2.42***
	(0.584)	(0.555)
Female Dummy	-3.11	-20.11***
	(2.643)	(2.671)
Test language at home	-12.23	7.44
	(6.331)	(6.396)
Student born in test country	3.03	-1.20
	(5.926)	(6.008)
Mother born in test country	0.57	-1.74
	(5.118)	(5.186)
Father born in test country	5.16	0.94
	(4.943)	(5.013)
Books at home 0-10	-78.31***	-74.02***
	(8.619)	(8.754)
Books at home 11-25	-54.95***	-38.44***
	(4.943)	(4.998)
Books at home 26-100	-33.75***	-27.53***
	(3.487)	(3.521)
Books at home 101-200	-14.44***	-9.49**
	(3.597)	(3.631)
School Characteristics		
Student/teacher	-0.70*	-1.01**
	(0.324)	(0.323)
School in isolated area	-42.73***	10.06
	(12.669)	(12.814)
School in village	-34.98***	-31.52***
	(3.232)	(3.297)
School in outskirt of town	-16.24	-11.38
	(8.368)	(8.448)
School own math curriculum	35.94***	11.36**
	(4.508)	(3.613)
Shortage instructional	-19.33*	-33.13***

material- a little		
	(8.779)	(8.949)
Shortage instructional material- some	-12.80	-13.29
	(7.105)	(7.198)
Shortage instructional material- a lot	-12.97	-14.45*
	(6.977)	(7.099)
Observations	7,195	7,221

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05; Constant and year dummies included but not reported below.
Omitted dummies: the number of books at home > 200; school location is school located close to town/city centre; Shortage instructional material none.

Table 2b TIMSS Russia estimates: 2003 and 2007

VARIABLES	(2) MATH Quantile 50%	(3) SCIENCE Quantile 50%
Individual Characteristics and Family Background		
Age	-13.97***	-8.76***
	(1.862)	(1.918)
Female dummy	1.22	-15.62***
	(2.133)	(2.201)
Books at home 1 shelf	4.23	7.90
	(5.899)	(6.105)
books at home 1 bookcase	18.03**	26.80***
	(5.672)	(5.883)
books at home 2 bookcase	27.05***	28.85***
	(5.855)	(6.070)
books at home >=3 bookcase	31.01***	39.58***
	(6.058)	(6.275)
mother has ISCED 2	-12.05	-7.15
	(6.648)	(6.769)
mother has ISCED 3	-4.33	-7.80
	(4.895)	(5.011)
mother has ISCED 4	15.16***	16.99***
	(3.803)	(3.929)
mother has ISCED 5	23.81***	19.66***
	(4.878)	(5.001)
mother has 1st degree	27.02***	22.91***
	(4.407)	(4.555)
mother has > 1st degree	25.51***	32.59***
	(4.873)	(5.061)
father has ISCED 2	-25.20***	-24.08***
	(6.144)	(6.349)
Father has ISCED 3	-12.66**	-0.73
	(4.403)	(4.483)
Father has ISCED 4	3.34	3.91
	(3.169)	(3.280)
Father has ISCED 5	16.90***	9.60*
	(4.721)	(4.862)
Father has 1st degree	13.11**	19.56***
	(4.106)	(4.226)
father has > 1st degree	10.73*	7.67
	(4.632)	(4.799)
mother born in country of test= no	3.98	-1.10
	(4.309)	(4.482)
father born in country of test= no	-3.48	-5.17
	(3.979)	(4.123)
student born in country of test= no	-4.61	-7.66
	(4.717)	(4.892)
School Characteristics		
school in town > 500000	16.37***	18.23***

	(3.606)	(3.768)
school in town 100001 - 500000 PEOPLE	3.29	7.04
	(3.705)	(3.752)
school in town 50001 - 100000 PEOPLE	-7.27	-0.61
	(4.302)	(4.405)
school in town 15001- 50000 PEOPLE	-13.78***	-5.61
	(4.038)	(4.272)
school in town with 3001 -15000 PEOPLE	-13.45***	-5.32
	(3.791)	(3.848)
% students disadvantaged background: 0-10	21.78***	3.63
	(3.736)	(3.820)
% students disadvantaged economic background:11-25	12.52***	5.28
	(3.387)	(3.457)
students disadvantaged economic background:26-50	1.93	-2.62
	(3.505)	(3.653)
math classes are split by group ability	5.90**	5.57*
	(2.142)	(2.266)
Additional math classes	17.87***	10.48***
	(2.408)	(2.662)
math remedial classes	-3.42	-3.18
	(2.282)	(2.315)
Shortage budget for supply – none	-1.71	14.14***
	(4.111)	(4.077)
Shortage budget for supply – little	5.31	14.11***
	(4.118)	(4.076)
Shortage budget for supply – some	4.75	7.53*
	(3.868)	(3.808)
Shortage budget for materials- none	0.74	0.92
	(3.997)	(4.149)
Shortage budget for materials- a little	2.46	5.40
	(4.295)	(4.485)
Shortage budget for materials-some	-6.27	-1.79
	(3.814)	(3.929)
Shortage budget for teachers- a little	-2.18	-9.97**
	(3.282)	(3.435)
Shortage budget for teachers- some	-3.06	-10.08*
	(4.674)	(4.847)
Shortage budget for teachers- a lot	-4.07	-7.06
	(4.134)	(4.248)
Observations	7,917	7,929

Robust standard errors in parentheses; *** p<0.001, ** p<0.01, * p<0.05; Constant and, year dummies included but not reported below. Omitted variables: no of books at home= none or very few; mother/father has ISCED 1 or did not go to school; school in town with < 3000 people; Shortage budget/material/teachers=a lot

Conclusion

This PhD dissertation investigates themes that are central to economic and social development. In particular we analyse three keys aspects of development: poverty, foreign direct investment and education. By focusing on monetary and non-monetary issues, we endorse a broad view of economic development. Accordingly, the thesis consists of three parts that aim at answering three distinct but interrelated questions: (i) to what extent does economic growth reduce poverty, and what are the factors enhancing or hampering the effects of growth on poverty; (ii) how does the institutional setting typical of resource-rich countries affect the inflow of foreign investment; (iii) taking Russia as a case study, what are the socioeconomic and institutional factors associated with individual educational performance.

The first part of the thesis (chapter 1 and 2) deals with poverty. Reducing poverty is one of the main national and international development goals, however this target is often ambiguous as poverty has complex and multiple meanings. The conceptual complexity of poverty has been mirrored by the proliferation of definitions and indicators. From a policy perspective, clarifying it is particularly important as different poverty indicators do not identify as poor the same individuals, and in turn lead to diverging poverty estimates. Therefore researchers and policy makers should carefully choose among the available poverty definitions and indicators. Chapter 1 reviews the conceptual approaches to poverty and the issues related to its measurement. We present a set of arguments for adopting a monetary approach to poverty. Among the monetary poverty measures available, we make the case for using the World Bank's "dollar a day" poverty line. We stress that, despite its limitations, the Word bank indicators are the only one suitable for comparing countries over time. In sum, we highlight that, although there is no "right" poverty measure, researchers should select the most appropriate indicator by considering the goals of the analysis to be carried out. In our case the chosen measure allows us to quantify and compare poverty across countries. Accordingly, the second chapter studies in depth the determinants of poverty rates; in particular it focuses on the role of economic growth. Our main findings concerning poverty are both consistent with the literature and extend it. First, we find that economic growth, as measured by changes in mean income, is positively associated with lower poverty rates. However, we go further and find that past levels of poverty and inequality influence the effect of

growth on the poverty rate; in particular, higher initial levels of poverty and inequality *decrease* the effect of growth on poverty reduction. Concerned to better understand the persistence of poverty in parts of the developing world we then explore the specific country level conditions that can generate a poverty-trap like mechanism. We find powerful evidence that increased health, schooling, credit and lower conflict decrease the growth elasticity of poverty (i.e. poverty is reduced more in response to growth). Our findings therefore suggest that both poverty itself and non-monetary conditions related to the level of development prevent the full realization of the beneficial effects of growth. That is, poverty – broadly defined – begets poverty and tackling the persistence of poverty therefore requires tackling the poverty trap and the institutions which shape it. Of course, intuitively, this has been known, but our aggregate analysis quantifies these links more precisely and highlights that it is this set of self-reinforcing institutional and policy deficiencies which explain the persistence of poverty.

From this, we draw several distinctive policy conclusions. First and foremost, factors other than economic growth play a significant role in the process of poverty reduction. Hence, when addressing poverty, heavier accent should be put on policy measures that influence non-monetary dimensions. Put differently, poverty reduction strategies should take a longer-term perspective. In this respect, policy measures enhancing health and education could have a tremendous effect on decreasing poverty both directly and indirectly by increasing the poverty response to growth.

Policy makers aiming to promote development, have not only focused on poverty, but have also adopted a number of measures to promote foreign direct investment (FDI). FDIs are a crucial part of the development process as they have the potential of promoting growth and generating positive externalities (e.g. improving management practices, promoting technology and innovation). As such it is important to understand the motives of firms' internationalisation. Accordingly, the second part of the thesis (chapter 3) analyses the location drivers of foreign direct investments, paying particular attention to the interplay between political stability, property rights, FDI and natural resources. Our empirical analysis is undertaken on a panel dataset of 92 low and middle-income countries spanning the period between 1996 and 2009. We employ system GMM technique to control for endogeneity and reverse causality in particular.

Our headline contribution to the existing literature establishes that the presence of natural resources significantly affects the institutions-FDI relationship. The results clearly show that institutions (political stability and property rights), do not act in isolation, but their effect on FDI is influenced by the presence of natural resources. Our analysis extends previous findings that FDI in the primary sector are less sensitive to the level of democracy. However our results are novel as, to our knowledge, we are the first to analyse the interaction between political stability, property rights and natural resources. Most specifically we find evidence that it is oil, but not minerals or agricultural products, that has a robust and significant moderating impact on the FDI-institutions relationship. This suggests that it is not just any resource rents that matter, but particularly those highly concentrated resource rents (as in the oil sector) which have potentially negative effects under weak institutional environments.

Building on our results from chapter 2 that highlight the importance of human capital, the third part of the thesis, chapter 4, examines Russia's educational performance in a comparative light and analyses the factors associated with educational outcomes. Russia is a particularly relevant example of a quickly growing country undergoing substantial social and economic change, and also a country where the economy, politics and society is influenced by the special interests originated in the oil and gas sector. Since the early 90s a number of political and economic reforms were launched to support the transition from a planned to a market economy. As part of the transition process, the education system also underwent substantial modernisation. The most significant change has been an increasing decentralisation. In spite of the efforts made, the legacy of the Soviet system persists and the education system has often been criticised for having inadequate curricula and management. Russia's contemporary history makes it an interesting case in which to investigate educational performance. In chapter 4, we make use of two large educational surveys, PISA and TIMMS, to explore cross-country and within Russia variation in educational scores.

The cross country as well as the Russia 'case-study' results show that a number of individual and family variables in particular - such as parental educational levels - are robustly associated with improved educational outcomes. In terms of school level variables both analyses show that schools in cities perform consistently better than those in small towns and in rural locations. This is consistent with the literature. However, the within country estimates allow us to better explore more directly which

institutional setup is most effective in improving educational quality. We find that the student-teacher ratios and indicators of school autonomy have a positive and significant impact on educational scores. This seems important in the Russian context as the evidence on the effect of school resources and autonomy on students' performances remains controversial. Our results on the Russian data indicate that policy measures aimed at improving student-teacher ratios and autonomy are likely to improve educational performances. Moreover the results point that there is scope for policies aimed at reducing the disparities in educational scores across urban and rural locations. Addressing education inequality can help in tackling Russia's growing economic inequality and social polarization related to it imbalances in sectoral structure of production. Therefore appropriate public intervention in education can help in raising human capital and reducing inequality, which, as also highlighted by our discussion in chapter 2, can reduce poverty and promote development.

Overall, we add to the existing literature in several crucially important ways: (i) we investigate the role of economic growth in poverty reduction by exploring a set of conditioning factors which prove to significantly affect the poverty elasticity of growth. We find that, among the variables analysed, initial conditions in inequality and poverty, and human capital, as measured by health and education, have the largest impact on the response of poverty to growth. We therefore conclude that economic growth alone is unlikely to address poverty reduction, but that it needs to be complemented by a set of policies targeting inequality and human capital; (ii) we determine that in resource-rich countries, the presence of natural resources, in particular oil, significantly impacts the effect of institutions on FDI. Our results show that the positive impact of institutions on FDI is mitigated by the presence of natural resources. It is clear that in this instance, institutional reforms alone are unlikely to promote foreign investments. Moreover the distorted intuitional setting of resource rich economies is likely to attenuate the positive impact of FDI on the host country; (iii) we explore the cross-country and within Russia variation in educational scores by making novel use of the data available from PISA and TIMMS. Our empirical analysis establishes a robust correlation between educational scores and a set of individual, family and school characteristics. The analysis on both the Russia and cross-country sample shows that parental educational levels are robustly associated with better educational outcomes. The evidence on the institutional factors shows the specificity of Russia compared to the cross-country evidence. In this instance

the student-teacher ratio and level of autonomy positively impact on students' educational scores.

Finally, as this is an empirical project, there are typical caveats to keep in mind when interpreting the results. First of all, like in other empirical studies, some of the proxies adopted in this thesis have been subject to criticisms. In particular, in the second chapter we used the "dollar a day poverty line". This indicator has attracted critics, both at conceptual and at practical levels. For instance there are issues in terms of comparability across surveys and PPP exchange rates used to calculate the poverty line. However, we spent considerable amounts of time arguing that alternative measures are at least as problematic. The educational surveys employed in the last chapter have also been criticised. Most concerns surround the practical implementation of the surveys, for example, how students are tested and how the data is collected. Moreover, researchers noted that the international comparability of the surveys may be limited. This is because the students' response is likely to be affected by the country's cultural context.

Second, econometric analyses are sensitive to specification, sample coverage and estimators employed. To address these problems, we have tried to implement a wide range of appropriate robustness checks. For instance, in the second chapter, we replicate our results for different levels of the poverty line. In the fourth chapter we used different measures of FDI and natural resources. Finally in the last chapter we employ two datasets and for each one we replicate the estimates of the educational production function with three estimators.

Third, for what concerns chapter 2 and 3, we do acknowledge the limitations of a cross-country research study. Chapter 2 focuses on aggregate measures of poverty. However as discussed in out first chapter, poverty is essentially an individual phenomenon. Hence, a good way forward in strengthening our research would be to complement our analysis with a microanalysis of poverty determinants. In terms of chapter 4 we have to rely on the assumption that in developing countries with a high level of natural resources, FDI are concentrated in the resources sector. Therefore the question addressed in this chapter may be better explored with the use of sector-level FDI data, which is currently not available for the period and the countries analyzed. There is a

difficult tradeoff between depth and width of the data and the quality of estimators is conditional on the latter.

Notwithstanding these inevitable caveats, we argue that this thesis contributes substantively to the existing economic literature through its exploration of three key issues at the heart of development: poverty, education and foreign investments. These strongly inter-related topics have long attracted the attention of economists and social scientists and they remain central to today's global economy.