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Master in Economic Development and Growth

Is poverty an obstacle for economic growth? A dynamic panel data approach

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Abstract: Despite global modern economic growth, most countries remained stuck in persistent poverty. Jeffrey Sachs suggested considering poverty itself as the explanation for persistent levels of poverty and low growth. The theory is based on the existence of poverty traps, which keep families and countries caught in poverty. This research contributes to the poverty trap literature by evaluating the effect that poverty has on growth by means of a dynamic panel data approach. In so doing, we find evidence of a negative effect of poverty on growth. Moreover, this text aims to identify the channels of transmission of such effect by means of a theoretical and empirical analysis.

Key words: Poverty, growth, poverty traps, dynamic panel data

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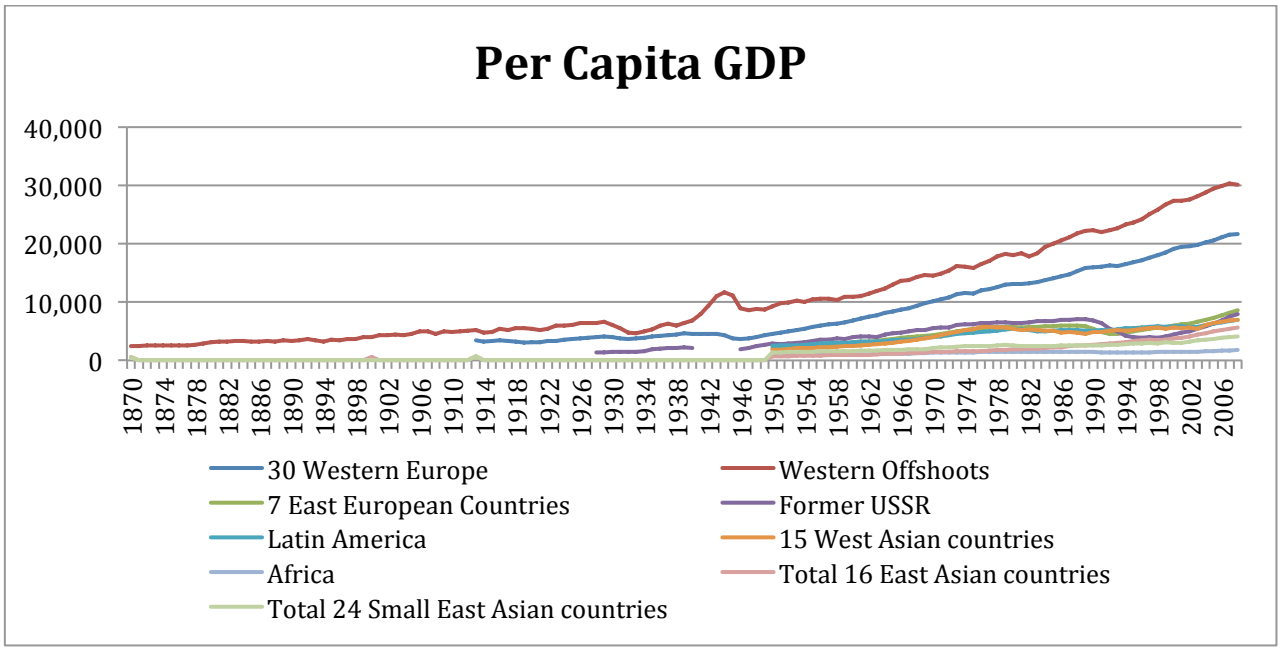
1. Introduction

The historical statistics of Professor Angus Maddison suggest that economic growth remained quite stagnant throughout the centuries until the first Industrial Revolution at the end of the XVIIIth century. Technological advances allowed productivity levels to rise, causing what we name modern economic growth. Later, after World War II, a second period of high growth rates came along. However, not all countries took part of this growth *explosion*. During the Industrial Revolution only Europe, Japan and some Western Offshoots truly experienced significant and sustained economic growth derived from modernization (Maddison, 2004). From that point in time, as it can be seen in Graph 1, the gap between the first group of countries and the rest (from now on developing or poor countries) has been widening.

Graph 1. World Per Capita GDP, 1870-2008.

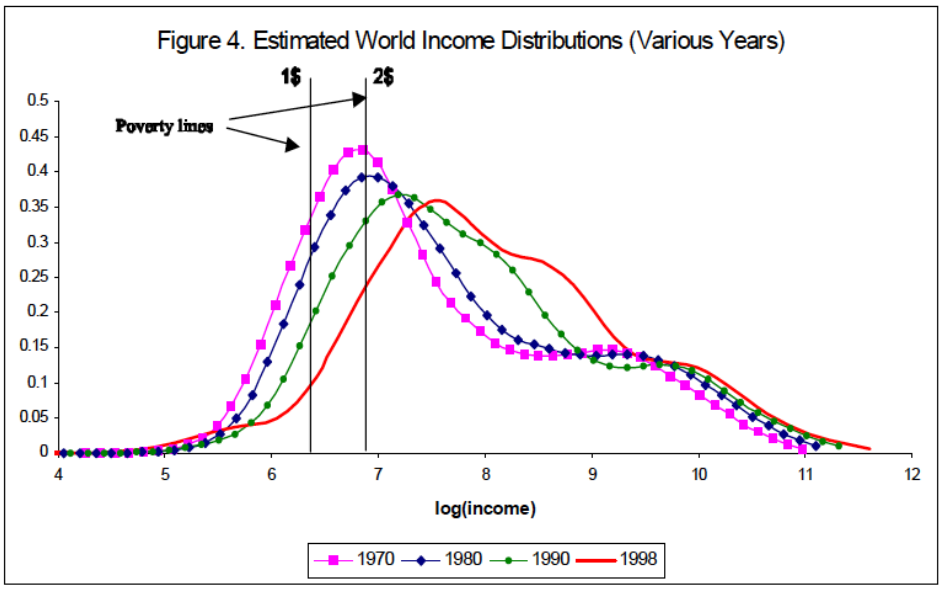


Source: Angus Maddison. Historical Statistics of the World Economy 1-2008 AD. University of Gröningen.

Graph 2 shows how this evolution led to the emergence of a bimodal income distribution. Sala i Martin (2002) estimates the Gaussian kernel density function of the World income distribution for years 1970, 1980, 1990 and 1998. We can

clearly observe that in 1970 the world population clustered around a high- and low-income level. Moreover, almost half of the population belonged to the low-income level, which corresponds to those living at the 1$ or 2$ poverty line. This phenomenon supported the hypothesis of the existence of two convergence groups. Over time, the two modes have become less significant and in 1998 it is possible to observe a third mode revealing the generation of a middle class. Furthermore, the low-income mode has moved right, suggesting a reduction in poverty. Nonetheless the largest share of the population still belongs to the low-income group (Sala i Martin, 2002).

Graph 2. Estimated World Income Distribution (Sala-i-Martin, 2002)



Source: X. Sala-i-Martin (2002) calculations

Despite global growth most of the countries not only did not manage to grow as fast as the first group, but also their income levels remained so low that they are considered to be consistently stuck in perpetuate poverty. This has become a source of concern among economists, who have long been trying to explain the absence of growth and persistence of poverty in certain regions. The extensive literature on economic growth suggests different answers, for instance differences in physical and human capital accumulation (Lucas, 1988). Acemoglu et al. (2001) and Engerman and Sokoloff (2005) instead suggest that factor

endowments and geography determine the institutions that will later shape economic development. Furthermore, the literature also stresses the role inequality plays in economic growth and poverty reduction (Ravallion, 2001). An alternative approach developed by Professor Jeffrey Sachs in his book "The End of Poverty: Economic Possibilities of our time" (2005) consists in considering poverty itself as an explanation for persistent poverty and absence of economic growth. The idea is that poverty represents an obstacle to engage in growth-conductive actions, thus countries get caught in a poverty trap. A poverty trap is defined as "any self-reinforcing mechanism, which causes poverty to persist" (Azariadis and Stachurski, 2004).

The purpose of this research text is to analyze the effect that poverty might have on aggregate economic growth. In so doing, we aim at expanding the literature on poverty traps in the following ways. Firstly, we thoroughly discuss the potential mechanisms that can generate such traps. The underlying block of international and regional economic analysis is the household. Thus, in order to understand the persistence of poverty and its effects at aggregate level, it is crucial to analyze the factors that prevent poor households from walking out of poverty. Second, in our aim of explaining the absence of growth based on the existence of poverty traps, we discuss and bring together different types of poverty traps. Furthermore, we consider them as channels of transmission of the effect of poverty on growth. To the best of our knowledge, López and Servén (2009) conducted a similar analysis but considered underinvestment as the only channel of transmission. In third place, we use a different and more recent database of that used in similar analysis by López and Servén (2009). Our dataset contains information about 80 countries and covers the period from 1980-2012. Finally, in the dynamic panel data analysis we make use of different estimators (Anderson-Hsiao, Arellano-Bond and Biased Corrected OLS) to test the effect of poverty on growth.

By means of these contributions we aim at answering the following two questions: Based on the existence of poverty traps, can persistent poverty explain the absence of economic growth? If so, which are the mechanisms of transmission?

In order to answer these two questions a dynamic panel data approach is followed. We estimate an augmented growth equation that includes a poverty indicator using data from the World Development Indicators online database provided by the World Bank. In order to avoid endogeneity problems we use the instrumental variable approach suggested by Anderson and Hsiao (1982) and Arellano and Bond (1991). Second, we further add a set of variables aiming to identify the channels of transmission of the effect that poverty has on growth.

The rest of the text is organized as follows. In section 2 the theoretical framework and literature review are presented and the hypothesis is stated. Section 3 explains the model used to answer the research question and test the hypothesis. In section 4 the data used to perform the empirical analysis is described and section 5 presents the results. Finally section 6 concludes.

2. Literature Review and Theoretical Framework

This section reviews the theoretical framework and literature upon which the analysis will be based. In first place, a brief survey of the growth-poverty relationship is presented. Next, the discussion is directed towards the growth-deterrent effect of poverty. It starts with an analytical definition of poverty traps, with the aim of understanding the mechanism through which persistent poverty can affect growth. Then, different forms of poverty traps are discussed.

2.1. The poverty-reduction effect of growth

The relationship between growth and poverty is complex and causality runs in both directions. Moreover, inequality[1] also plays a role in shaping this entangled relationship. The primarily objective of this text is to study the effect that poverty has on growth, nevertheless we considered important to discuss briefly the extensive literature on the poverty-reduction effect of growth. A revision of the

[1] Income inequality refers to how material resources are distributed across individuals.

opposite direction of causality will provide a deeper understanding of the relationship between poverty and growth.

The most striking evidence that economic growth raises income level and therefore reduces poverty (sometimes omitted because of its obviousness) is the experience of Europe and its Western Offshoots. 200 years of modern economic growth raised the income level of a share of the population while the rest of the World lagged behind (Maddison, 2004). According to A. Maddison's estimates[2], before 1800 per capita income should have been around 500$ (in terms of 2000 U.S. dollars). The entire World then had a similar income level as today's tenth poorest countries. With the Industrial Revolution some countries took of, escaped from poverty and achieved welfare levels that are well above those enjoyed by the richest deciles of the 18th century population distribution (Maddison, 1999).

The recent literature on the topic focuses on a much shorter period; good quality and complete data is only available for recent times. The results of these studies broadly suggest that economic growth is important for poverty reduction. Most of the countries that experienced long periods of growth also achieved a substantial reduction in poverty levels (Perry, Arias, López, Maloney, and Servén, 2006). However there is an ongoing debate of the role played by inequality. For instance, Deininger and Squire (1996) construct a new cross-country database and find that periods of positive economic growth were accompanied by a reduction in poverty. Moreover growth episodes cannot be significantly associated with variations in inequality levels. Therefore the authors suggest that all quintiles of the income distribution benefited from growth independently of rising or declining levels of inequality. In the same line of reasoning Dollar and Kraay (2006) also claim to have found cross-country evidence that growth is good for the poor. Based on a sample of 92 countries spanning 4 decades, their results suggest that as average income rises, the average income of the poorest 20% of society rises proportionately. Thus, growth cannot be associated with increasing levels of inequality, nor does the effect of poverty on growth. The authors conclude that

[2] Historical Statistics of the World Economy, Angus Maddison. University of Gröningen.

even though growth is not sufficient condition to reduce poverty, it is definitely necessary and beneficiary. As a response to the just mentioned articles, Ravaillon (2001) suggested to look beyond averages before making any concluding statements about the effects of growth on poverty. According to the author, there is an elasticity of poverty to growth that depends negatively on inequality. In countries with high levels of inequality, the poorest groups of the population did not share the potential benefits of economic growth. That is, inequality can be a barrier for poverty reduction in periods of positive growth rates. Therefore, Ravaillon (2001) claims that poverty-reduction effect of growth depends negatively on inequality.

While the above mentioned authors treat inequality as exogenous, some economists have studied the effect that inequality has on economic development by identifying the factors contributing to generate an unequal society. Engerman and Sokoloff (2002, 2005) use the colonization of the Americas as an example to explain how factor endowments and geography determined the level of inequality of a society and eventually affected long-term development. The production possibilities given by the climate and resources of the Caribbean originated a tremendously unequal society, where wealth, human capital and political power belonged only to a reduced group of European descendants. Contrary to the experience of North America, the institutions created by this small elite limited the access to economic opportunities and resulted in an underinvestment in public infrastructure, both considered being growth-promoting. Similarly, Acemoglu et al. (2002) argue that the nature of the institutions imposed by European colonialists in the New World determined the extent to which regions could participate and benefit in the Industrial Revolution, and thus experience high rates of economic growth. Regions with extractive institutions generated a highly unequal society who was not able to take advantage of the industrialization process, which required the participation of a large share of skilled population and secure property rights. Thus according to Engerman and Sokoloff (2002, 2005) and Acemoglu et al. (2002), inequality plays a significant role in shaping the paths of long-term growth and determines the extent to which the society will share the benefits of such development.

Given the entangled relationship between growth, inequality and poverty, a group of economists suggested a different approach to measure the role that growth and inequality play in poverty reduction. Datt and Ravallion (1991), proposed decomposing changes in poverty into growth and redistribution component. They applied a newly developed methodology to the cases of Brazil and India. Later, other economists applied this to other countries' experiences. A general conclusion of the relative contribution of each component is not possible, given the idiosyncratic development process of each country.

The existing literature on growth, poverty and inequality illustrates the complexity of this threefold relationship. The direction of causality runs in multiple directions between the three variables, making it difficult to disentangle the pure effect of one on the other. Nevertheless a significant part of the academic society supports the two following statements: in first place growth has a positive effect in poverty reduction. Second, this poverty-reduction effect will be larger the lower the level of inequality.

2.2. Poverty trap theory

2.2.1. Does poverty affect growth?

In the last decades economists have tried to explain the persistence of poverty and low levels of economic growth that characterizes the least developed countries. Based on the theory discussed in the previous section it could be argued that the persistence of poverty in these countries is due to the absence of economic growth and high inequality levels. However, an alternative approach that has gained importance in the recent time suggests that poverty begets poverty itself. That is, poverty itself contributes to the persistence of poverty and absence of growth (Sachs J. , 2005). Could then poverty be an obstacle for future growth?

This approach is formalized with the concept of *Poverty Trap*, which allows linking poverty at the micro level with absence of aggregate economic growth. The basic idea is that poverty itself is an impediment to take *actions* that would allow raising the income level and thus contributes to the persistence of poverty.

At the same time, these *actions* are necessary to promote economic growth both at individual and regional level. This phenomenon is what we call a poverty trap (Sachs J. , 2005). Formally, "a poverty trap is any self-reinforcing mechanism which causes poverty to persist" (Azariadis and Stachurski, 2004). Moreover, poverty traps can work at macro, meso and micro level and be self-reinforcing through feedback effects (Barret and Swallow, 2005). Hence, a country can be caught in a poverty trap if a large share of its population is poor. The existence of poverty traps could therefore explain the suggested negative effect of poverty on growth Perry et al. (2006).

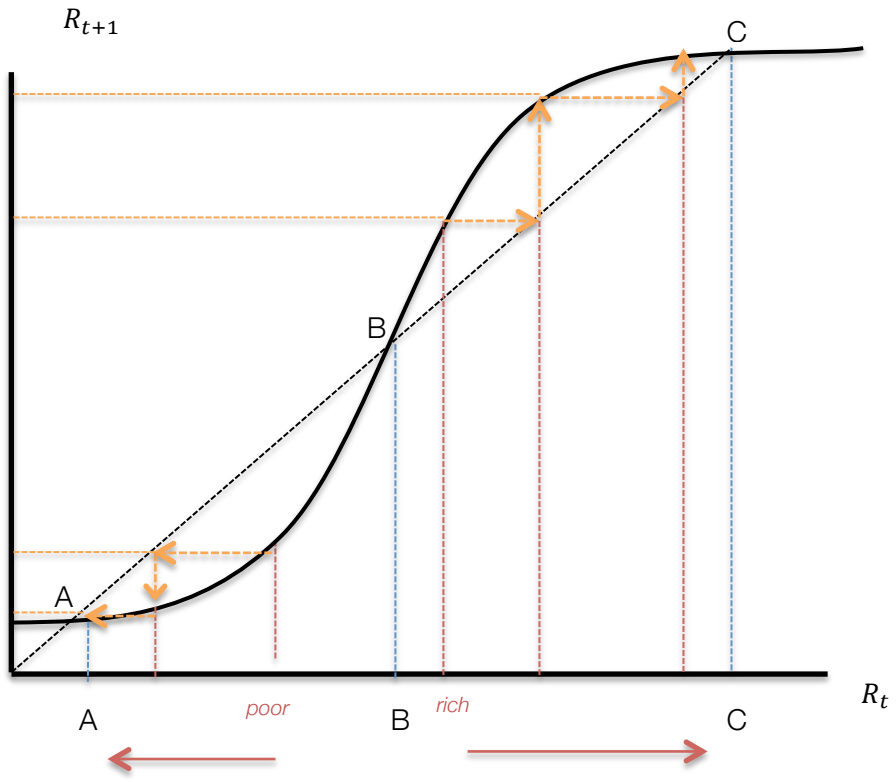
Economists Esther Duflo and Abhijit Banerjee offer a simple and adequate description of the poverty trap mechanism in their book on economics of poverty - Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty. The basic framework is based on a simplified Solow Model of capital accumulation. In Graph 3, the x-axis shows the present level of resources (in time t) and the y-axis shows the future level of resources (one period from now, that is $t+1$). The S-shaped curve represents the relationship between present and future resources or input-output, which is complexly driven by economic, social and institutional dimensions. The 45° dashed line indicates the point where the level of resources remains constant from one period to the other (i.e. the individual will have the same income today and tomorrow). In this model, if the current level of resources hits a point where the S-shape curve is above the 45° line and has a concave form, resources will be higher in the next period. On the contrary, if the S-shape curve is below the 45° line and has a convex form, then resources will decrease in $t+1$. The orange arrows in Graph 3 describe this behavior[3].

We observe 3 equilibriums, determined by the intersections of the two curves. Given the nature of the relationship between current and future resources, the equilibrium in the middle (B) is unstable. Equilibrium in point A is a stable "poor equilibrium" (low level of resources) and point C is a stable "rich equilibrium"

[3] The orange dashed arrows indicate the evolution of resources, blue lines indicate the equilibrium points. Take the *poor* individual in red, given that her level of resources belongs to the convex part of the curve, her future income will be reduced until it reaches the equilibrium point A.

(high level of resources). The idea is that if an individual in period *t* has a resource level below B, her future resources will always end up in the low equilibrium point A, meaning that she will never be able to move up to equilibrium point C and see her resources increase in the future. In order to reach the "rich equilibrium", it is necessary to push up the level of resources above B. Then the dynamic forces will lead the individual to C instead of being trapped in a low level equilibrium (Duflo and Banerjee, 2011).

Graph 3.



To better understand how this model applies to real world issues, we can imagine that if an individual's level of income is below point B she will spent most of her income in minimum consumption for survivorship and will not be able to save enough to invest in a business that will raise her future income, thus remaining poor. Similarly, being below a level of income B can be insufficient to pay for schooling, which should help individuals to get a better-paid job and escape poverty (López and Servén, 2009). Therefore, in the case that the relationship between current and future income has an S-shape form, poverty (understood as

being below a particular income level, i.e. not having enough resources) will act like a barrier to engage in income-raising actions, thus creating a poverty trap. If a large share of the population cannot invest in business creation, save, go to school and other activities considered growth-conductive, the whole country can find itself caught in a poverty trap unable to take off in terms of economic growth (López and Servén, 2009).

In the next subsections we will discuss a number of situations that can contribute to generate a poverty trap. The literature has identified numerous poverty traps, however in this text we will only discuss the credit-, health-, education-, infrastructure- and risk-based poverty traps. The analysis tries to follow in each case the same line of reasoning: first the growth-conductive nature of the factor will be explained. Second, we will discuss how poverty limits the access to that factor, creating a poverty trap and impeding economic growth.

2.2.2. Financial market imperfections

Recent findings suggest that financial development is not only beneficial for growth but also has a positive impact in poverty reduction. Specifically a deeper financial development increases the growth rate of the poor's income well above average growth rate, which in turn reduces income inequality. A consequence of financial underdevelopment or financial market imperfections is limited access to fincance. Theory suggests that lacking access to finance represents an obstacle for individuals, firms and countries to accumulate human and physical capital and thus to participate in the engine of growth and escape poverty (Beck, Demirgüc-Kunt, and Levine, 2007). Next we will describe some of the above-mentioned financial market imperfections that limit access to credit and other financial services.

At a micro level, poor individuals face several constraints to access financial markets. In first place, poor individuals are seen as high-risk individuals. The fear of adverse selection and moral hazard leads to tremendously high credit interest rates. The price of borrowing is then too high for many poor households,

excluding them from the financial system. (Demirgüç-Kunt, Beck, and Honohan, 2008). Another way to cover the costs derived from adverse selection and moral hazard is asking for collateral. Poor households usually don't own many assets or land, which is often used as collateral, thus access to credit is being again denied (Demirgüç-Kunt et al., 2008). Moreover, the lack of property rights in several developing countries impedes legally assuring the economic potential of their assets, for example to be used as collateral for credits (de Soto, 2001).

Banking penetration is substantially low in many rural areas in developing countries, where poverty rates are usually higher. The small size of economies and even more of firms and customers base make it unattractive for banking institutions to settle. These face high fixed costs, which won't be covered with such a small market size. Moreover the isolation and remoteness of some areas make distances to point of services even larger, thus increasing costs even more. Poor rural regions become unaffordable to banks and in consequence the supply of formal financial services in those areas is inexistent, leaving a big part of the low-income population unbanked (Beck and Honohan, 2007).

It then becomes clear that given the imperfections of financial markets, poverty results in a barrier to access financial services such as credits. Different economists have explored the consequences of such limited access to finance due to poverty. Their conclusions are in line with the theory relating financial access and aggregate economic growth. For instance, Galor and Zeira (1993) relate financial market imperfections to underinvestment in education. The authors argue that given the high borrowing costs, poorer individuals are not able to afford schooling costs. As a consequence they will always remain in the unskilled sector and receive low return to labor. As we know from the growth theory, education is a key element to promote growth. Banerjee and Newman (1993) suggest that when there are market imperfections, initial wealth is an important determinant in investments. Thus, poorer individuals do not meet the requirements and are not able to invest in physical capital. As a consequence, high levels of poverty translate into underinvestment and therefore into lower growth.

These two cases relate to the S-shape form relationship between current and future earnings and the generation of a poverty trap explained before. Poor individuals are caught in a poverty trap because their low level of income is a barrier to access credit, which could help them escape poverty by investing in education or starting a business. Moreover, some of these investment opportunities are considered to be growth-conductive. However, if a large share of the population is poor and cannot engage in such investments, the entire country is at risk of being caught in a poverty trap and deprived of growth opportunities (Perry et al. 2006). Overall, this discussion suggests that poverty is an impediment for growth because it limits the access to finance. In other words, the limited access to finance can be understood as one of the channels of transmission of the effect of poverty on growth.

2.2.3. Human Capital

The role of human capital in shaping economic growth has been widely studied and debated. First exposed by Lucas (1988) and Romer (1990) human capital is considered to be a critical contributor to economic development. It is defined as the ”skills and capacities that reside in people and are put into productive use” (World Economic Forum, 2013). Traditionally, human capital was thought to be accumulated through education and experience. Lately, health has also been considered an important input in human capital, since it affects people’s cognitive and productive skills (World Economic Forum, 2013). Given its crucial role promoting economic growth, and therefore rising incomes, lack of human capital could be an impediment to escape poverty. In this section I will describe and analyze with more detail education and health’s contribution to growth and how an ”educational- ”or ”health-poverty trap” can emerge.

Poor health and nutrition

Health, regarded as one main contributor of human capital, should have a positive impact on economic growth (Bloom, Canning, and Sevilla, 2004). This effect is transmitted through different channels. In first place, life expectancy determines the accumulation of skills. Becker (1962) argues, that returns to education

investments increase as the survivorship probabilities raise. This occurs because individuals engage in educational costs at earlier ages and the returns are only perceived at more advanced ages. The rise in life expectancy then allows individuals to enjoy the returns in education for a longer period of time (Becker, 1964). Thus, an increased life expectancy will encourage individuals to invest in education (the importance of education as a determinant of growth will be later discussed). Second, health has also an impact on skills accumulation by directly affecting the learning capacity and reducing school absenteeism (Miguel and Kremer, 2004). Finally, health is supposed to increase productive efficiency. Healthy individuals make the most of their capacities and obtain better outputs, shifting up the production productivity frontier. Moreover, the higher the productivity the higher will be the income earning capacity. (López-Casasnovas, Rivera, and Currais, 2007). We can therefore conclude that a healthy population will accumulate more and better quality skills and make the most out of them, thus positively contributing to economic growth. Likewise, the acquisition of higher skills and the enhanced productivity derived from a good health status will also contribute to reduce poverty (Duflo and Banerjee, 2011).

According to Peters et al. (2008), the causality between poverty and health status runs in both directions. Unhealthy people, as just explained, are not fully productive and thus their income earning capacity diminishes. However, at the same time poor individuals face several contstraints to access health services which worsen their health status. The authors identify three cases where poverty limits the access to health services in developing countries. Poor and isolated regions usually have a high underprovision of any kind of services and individuals have to travel long distances to reach health service delivery points. Thus poverty due to the lack of resources at regional level limits the access to health services. In second place, health centers in poor areas are not always available either because of short opening hours or due to high medical personnel absenteeism. And third, financial accesibility also becomes a major problem when public health care provision is not universal. In this matter we observe how poverty at individual and regional level becomes an obstacle to access health services. As a result, developing countries tend to rank lowest in health rankings. Despite remarkable

progress in achieving the Millenium Development Goals, child mortality rate in developing countries is 13 times higher than in rich countries, being undernutrition the principal cause of death. Moreover maternal mortality is still at unacceptable levels in developing countries (99% of deaths occur in these countries), given that medical interventions to avoid it do exist. A consequence of such high mortality rates is the gap of 20 years in life expectancy between poor and rich countries (World Health Organization, 2014).

This situation favors the creation of a poverty trap. Being bellow a certain income level or living in a poor area is an obstacle to receive health care and thus enjoy a healthy life. This in turn represents a threat to the accumulation of skills and improved productivity, which are important poverty-reduction factors. As a consequence, if access to health care is not ensured the risk of being caught in a poverty trap increases. At country level, if a large share of the population is unhealthy, aggregate capital accumulation and eventually economic growth will be threatened. Thus, we consider that the effect of poverty on growth could work through the health condition of the population.

A particular case of helath-based poverty trap that has received remarkable atention in the last decades is that related to nutrition. Health economists have long been researching about the effect of calorie intake on labor productivity, as for example Dasgupta and Ray (1986). The idea behind is that, in case of not sufficent calorie intake workers become less productive, implying that they receive lower wages or even lose their jobs. As a consequence their income earning capacity is reduced. Not sufficent calorie intake occurs at low income levels or during food shortages (Raghbendra, Raghav and Anurag, 2009). Therefore, poor individuals whose income level is not sufficient to provide a minimum calorie intake will remain less productive and therefore unable to increase their earning capacity. Nevertheless, the existing literature offers evidence in favor and against the existence of nutrion-based poverty traps, keeping the debate open.

Poor education

From the endogenous growth models we know that human capital is a key element to the engine of growth (Romer, 1999). As mentioned before, human capital can be accumulated with education and experience, which are the tools to equip people with higher skills. Educated people are better prepared and therefore are more efficient in performing tasks that are more demanding in literacy and thinking terms, thus raising overall productivity (Hanushek and Wössmann, 2007). Moreover, individuals at any skill level are more productive if they live in a high skilled environment compared to a low skilled environment. On the other hand, in an open economy framework trade is driven by specialization and comparative advantage in a particular sector. This specialization is only achieved through investments in education (Schultz, 1989). Henceforth, education matters for growth since it is a powerful tool to accumulate human capital. Moreover, education is positively associated with higher incomes, given that higher levels of education imply better-paid jobs (Miguel and Kremer, 2004). Several studies also find a strong positive correlation between education and a more equal income distribution (Hanushek, 2013). Investing in education has therefore become one of the primary policies to reduce poverty and give people the opportunity to participate in the engine of growth.

Perry et al. (2006) suggest that there exist a reverse causality effect between education and poverty. As just explained education has a poverty-reduction effect, however poverty can also result in lower levels of skills accumulation. In first place, several poor households face financial constraints to invest in education. In the case of no free universal access to education, poor families cannot tuition fees. Even if access to education is free, education materials, transport costs in case of large distances to education centers, etc. also represent a burden for poor households. In some countries where child labor is still not abolished, school enrollment has a high opportunity costs for the poorest households. Second, as already mentioned in the previous section, unhealthy children cannot take full advantage of education. Undernourishment and infections reduce school attendance and the probabilities of completing school (Miguel and Kremer, 2004).

In third place, poor rural regions are characterized by an underprovision of public infrastructure. Children often have to travel long distances to attend classes, reducing school attendance (Perry et al. 2006). Finally, quality of education is gaining importance in acquisition of skills debate. A major problem in poor regions is the high pupil-teacher ratio, teacher absenteeism and low teacher morale, which diminish the quality of education (Hanushek & Wössmann, 2007). As a result, education levels in developing countries tend to be rather low compared to the industrialized countries (UNESCO, 2009).

Again we observe how poverty, both at individual and regional level, becomes an obstacle to access education and acquire high skills, which has a high poverty reduction power. Hence an education-based poverty trap emerges: families below a certain income level will not be able to invest and reap the benefits of quality education, staying trapped in poverty. Similarly, if a large share of the population has poor resources and will not be educated, the country level of human capital will be low. As theory predicts, low levels of human capital are detrimental for economic growth (Perry et al. 2006). Similar to the case of *health* we can think of education levels as a possible channel of transmission of the effect of poverty on growth.

2.2.4. Risk and limited access to formal insurance

Developing countries are characterized by having a more volatile economy compared to industrialized regions. The greater dependence on commodity export prices due to the low diversification of economic activities (most of these economies rely on agriculture or natural resources) and the limited access to external finance makes them more vulnerable international shocks (Perry et al. 2006). The same occurs at micro level: the poorest groups of the society tend to be employed in agriculture and their income is largely dependent to weather conditions and commodity prices. Moreover, low-income households are especially vulnerable to business failures, illness shocks or recessions. As a consequence, income volatility is much higher for poor households (Morduch, 1995).

High income volatility creates a riskier and uncertain environment, against which poor households wished to be insured. Nevertheless low-income families have limited access to formal insurance (Banerjee and Duflo, 2006). In order to manage the risk, poor households rely on a variety of informal mechanisms, which sometimes tend to reduce the probabilities of raising their incomes or becoming more productive. A very simple form of insurance in times of economic stress is to cut down spending. Food consumption is reduced and children leave school and start working. As we know from the previous section, undernourishment and under-education will only reinforce the poverty circle. Another strategy to diversify risk is engaging in different jobs. By diversifying their income source, they become less dependent to particular external shocks. These jobs are usually low skilled and do not need high degrees of specialization, which imply they are not well paid. Finally, the limited access to formal insurance prevents poor individuals of investing in risky but profitable new technologies that would both raise their income and productivity (Banerjee and Duflo, 2006).

Poverty itself implies living under riskier conditions, since poor households are especially vulnerable to shocks and face limited access to formal insurance. The informal mechanisms used to handle risk do not contribute to reduce poverty, catching poor individuals in a poverty trap. Moreover, these same mechanisms will hamper aggregate economic growth.

2.2.5. Infrastructure

Up to now the discussion has been centered in the micro-level origin of a poverty trap. Nevertheless, poverty at *macro level*[4] (or regional level) can also generate vicious circles that lead to the creation of a poverty trap (Barrett and Swallow, 2006). Big regional infrastructure such as roads, energy providers, ICT and water

[4] *"Macro-level refers to macro entities as a constellation of institutions with centralized authority to originate and implement policies and mechanisms regarding the allocation of resources and policies related to structural issues including those intended to stimulate free market mechanisms, for example through privatization and trade measure s. The macro is distinguishable from micro entities by the extent to which its scope and domain of authority span the whole (or significant parts of) the country."* (UNDP Evaluation Office, 2003)

sanitation are usually public funded. In this section we will discuss the consequences of underinvestment in infrastructure due to regional poverty.

The fact that infrastructure has a key role in economic development is well documented in the literature on the topic. Empirical evidence suggests a positive impact of infrastructure on GDP growth and poverty alleviation (Calderón and Servén, 2004). We can identify 4 types of infrastructure: energy, transport, telecommunications and water and sanitation. Next we will describe the mechanisms through which each of these types affects growth and poverty reduction.

Telecommunications

ICT development has reduced telecommunication costs and thus facilitated access to information. Transaction costs are reduced and markets become more integrated. As a consequence, productivity rises and so does economic growth (Brenneman and Kert, 2002). Telecommunications infrastructure in developing countries can also have a positive impact in poverty reduction. In rural areas, where poverty levels tend to be higher, the disadvantages associated with isolation are reduced thanks to rapid telecommunication. For instance, improving responses to emergency situations or the delivery of consultative health services (Röller and Waverman, 1996). The improvement in telecommunication infrastructure is also related to a reduction in consumer prices (Jensen, 2007).

Energy

It is undeniable that the industry cannot function without energy. Apart from its crucial role in production and therefore economic growth, energy has also a potential to reduce poverty. For instance, in enables the generation of local industry in rural areas, street lightening improves safety at night, electricity permits carrying out activities after the sunset such as studying (specially important in equatorial countries). The use of electrified devices also frees up women from time-consuming home-activities such as laundry (Kanagawa and Nakata, 2008). All these advantages are related to poverty reduction mechanisms.

Transport

The role of transport infrastructure in economic development has been deeply analyzed in an endless number of articles. Road infrastructure is supposed to have a positive impact on growth by reducing transportation costs and connecting markets. Moreover, developing an extensive road network also has a poverty reduction effect. For instance, rural and agricultural areas become connected to core economic areas: the distance between producers and buyers is reduced. On the other hand, safer roads also facilitate the journey to schools and hospitals, which help raise school attendance and health care attention (Calderón and Servén, 2004).

Despite the positive externalities just mentioned, infrastructure in developing countries is poor. Big infrastructure is expensive and the major obstacle governments from poor regions face to deliver adequate infrastructure is funding. Nevertheless, bad governmental performance, institutions processes and capabilities also weaken the supply of needed infrastructure. As a consequence some of the developing regions face an underprovision of public infrastructure (Woetzel and Pohl, 2013).

Africa is the continent with the largest infrastructure deficit. The poor energy infrastructure is a worrying issue for development. For instance, power consumption is only a tenth of that in other developing regions (just enough to light a 100-watt bulb per person three hours a day) and only 35% of Sub-Saharan African population enjoys access to electricity. The continent is not doing better in the transport sector. Only one third of the population living in rural areas is within a radius of 2km of an all-season road. Despite the abundant water resources, these are underutilized due to poor water and sanitation infrastructure. ICT sector is the only one converging to other region's development. An increasing share of the population is becoming mobile phone subscribers. Internet access is, however, still lagging behind. Within the continent, rural areas are specially disadvantaged, since the largest part of infrastructure is concentrated in big cities (Foster, 2008). South Asia's infrastructure deficit is perhaps the second worse after SSA. Despite the encouraging growth rates and poverty reduction of

the last decade, the infrastructure gap with other developing regions is still worrisome. Regarding the power sector, only 71% has access to electricity. South Asia's transport infrastructure is half of the industrialized countries, with 2.9 km length of road network per 1000 people compared to 4.7 km of world average. Rural areas are still isolated from main national road networks. Water access has improved in the recent times and nowadays 90% of the population has access to drinking water. However, most of the accesses are provided through public stands and only 25% of the population has access to private drinking water. Despite the recent ICT revolution, telecom penetration is still low compared to developed countries, especially dramatic in rural areas (Andrés, Biller, and Herrera Dappe, 2013).

In this particular case, a poverty trap is generated by the following mechanism. Poverty at macro-level (for instance governments with low resources) will lead to an underinvestment in public infrastructure. This will further isolate poor families in rural areas or will limit the access to crucial services such as drinking water, schools, hospitals and markets. The lack of adequate infrastructure will then contribute to the persistence of poverty, creating a poverty trap. Moreover, given that infrastructure is considered to be growth-conductive, countries with low resources and underinvestment in infrastructure will have a limited growth potential (Perry et al. 2006). Therefore, we could also assume that poverty has an effect on growth through infrastructure.

Summing up …

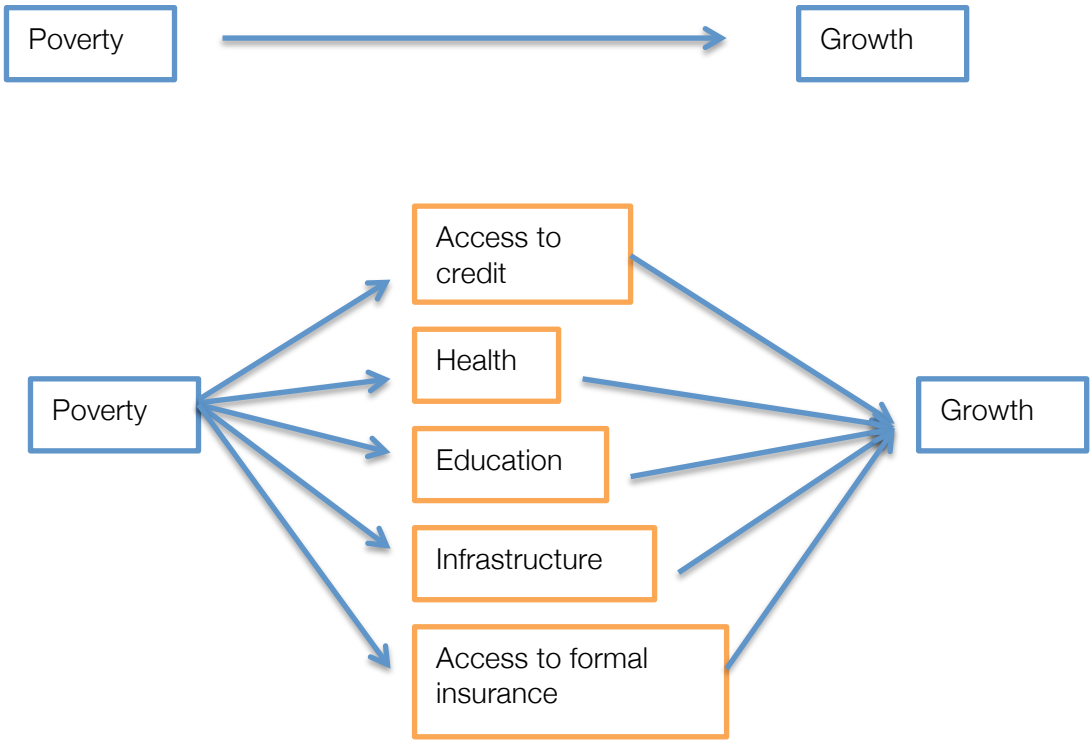
This section has analyzed and explained the channels through which poverty can become self-reinforcing, creating poverty traps that endanger economic development at micro and macro level. Low-income households have limited access to health care services either because of unaffordability issues or insufficient supply, a characteristic of developing countries. Thus, poor families are at a higher risk of becoming unhealthy. Consequently their earning potential is negatively affected, which reinforces poverty. An unhealthy population represents a low level of human capital, so that the country will lack one of the main inputs

to generate economic growth and unable to stop poverty persistence. Poverty can also be a barrier in itself to acquire education. Again, financial restrictions and low schooling supply limit poor households the access to education. As explained, education is a powerful tool for poverty reduction and the lack of it may condemn individuals to remain poor, i.e. to be caught in a poverty trap. Moreover, low education level results in low human capital accumulation, which is detrimental for aggregate growth. Credit markets represent an opportunity for those who don't have the financial means to invest in human capital. However, being below a certain income level represents an obstacle to invest in the way out of poverty due to imperfections in the financial system. On the other hand, it has been explained how poor households face higher risks when it comes to economic stress situations or uncertainty because of their volatile incomes. The limited supply of insurance services to low-income people leads them to adopt informal self-insurance mechanisms that will only reinforce poverty. Finally, Poverty at macro-level results in poor infrastructure that inhibits the development opportunities of households and regions.

The extensive discussion on poverty traps presented in this section leads to the hypothesis that poverty can explain the low levels of economic growth experienced by some developing regions due to the existence of poverty traps. That is, if poverty hampers growth, then countries with high poverty rates should present lower or zero growth rates.

The discussion also suggests that access to education, health, credit, risk insurance and infrastructure are strongly determined by poverty. These factors in turn play a role in poverty reduction and growth promotion. Thus the second hypothesis of this analysis is that if poverty has a negative effect on growth, this should work through education, health, credit, risk insurance and infrastructure.

The diagram below summarizes the two hypotheses in a more illustrative way.



2.3. Empirical evidence of poverty effect on growth

Despite the large literature and theory on the topic, empirically testing the existence of poverty traps is not straightforward. The existing literature offers both empirical evidence in favor and against it suggesting that the concept of poverty trap, despite backed up by economic theory, is rather elusive.

For instance, McKay and Perge (2011) and Kraay and Raddatz (2006) do not find evidence of the convexities characterizing the S-shape form of the relationship between present and future resources. On the other hand, a strong argument against the existence of poverty traps is that in the past 50 years almost all countries in the world have seen their national incomes rise. This contradicts the

theory of poverty traps, which predicts zero growth. However we could relax this assumption and admit that even though growth was not zero, poor countries are indeed at some growth disadvantage compared to the developed countries (Easterly, 2005). The remark made by Easterly (2005) suggests that in case poverty traps do exist, they are not permanent. There must exist some realizing mechanisms that allow escaping from the poverty trap and take off.

On the other hand, Bloom et al. (2006) test the hypothesis that cross-country differences in income level are due to geographical factors against the alternative that are caused by poverty traps. For that purpose they test the existence of multiple equilibrium points in the level of national GDP per capita. They do find evidence in favor of the existence of a low- and high-level equilibrium. Countries with adverse geography present very low levels of income in the low-income equilibrium, making it more difficult to jump up to the high-income equilibrium.

Lopez and Servén (2009) contribute to the poverty trap literature by empirically testing the effect of poverty on growth. The existing literature has studied the topic either by testing for non-convexities in aggregate variables or by finding evidence of convergence clubs. López and Servén (2009) use a different approach: to include poverty measures in a standard growth equation. The aim is to test whether the coefficient of lagged poverty has a significant effect on growth. Using a dynamic panel data approach, they find a significant and negative effect of poverty on growth. Moreover, the authors hypothesize that this effect works through investment and they do find positive and significant evidence for it.

3. Methodology

In this section the econometric model chosen to test the hypotheses will be presented. In first place, a dynamic panel data model at country level is used to test the hypothesis that poverty is growth deterrent, i.e. it has a negative effect on growth based on the existence of poverty traps. Panel datasets allow exploiting not only cross-country differences but also time variations, providing a larger

number of observations. Following López and Servén (2009), an augmented growth equation that includes an indicator for poverty is estimated.

$$G_{it} = \alpha + \rho G_{i,t-1} + \delta GDPpc_{i,t-1} + \beta P_{i,t-1} + \delta I_{it} + \gamma Z_{it} + \varepsilon_{it} \quad (1)$$

According to equation (1), economic growth of country i in time t is expressed as a function of lagged growth, initial income level and poverty rates of country i and a set of country-specific control variables. Given the relevance of inequality in the growth-poverty relationship, an indicator of inequality levels is also included. We are interested in β, the coefficient on the past levels of poverty. Thus, β indicates the effect that past levels of poverty have on current growth (G_{it}). According to the theory, it is expected that β has a negative sign, which would confirm the hypothesis that poverty is growth deterrent.

However equation (1) presents three drawbacks that threat the unbiasedness and consistency of the parameters to be estimated. The error term in this framework is a two-way error component, composed by a time-invariant country effect, a time effect and a random error term.

$$\varepsilon_{it} = \eta_i + \lambda_t + \nu_{it} \quad (2)$$

In first place, there could be unaccounted time-invariant country-specific effects (η_i) that affect both the explanatory variables and the dependent variable. For instance, the evolution of poverty and growth rates might be different depending on whether a country is landlocked or has access to the sea (Faye et al. 2004). If the error term is correlated with both the dependent and the explanatory variables then the estimated parameters will be biased (Baltagi, 2005).

Second, the lag of the dependent variable ($G_{i,t-1}$) is by definition correlated with ε_{it} through η_i

$$G_{it-1} = \alpha + \rho G_{i,t-2} + \delta GDPpc_{i,t-2} + \beta P_{i,t-2} + \delta I_{it} + \gamma Z_{it-1} + \varepsilon_{it-1} \quad (3)$$

$$\varepsilon_{it-1} = \eta_i + \lambda_{t-1} + \nu_{it-1} \quad (4)$$

So that $Cov(G_{it-1}, \eta_i) \neq 0$, which also implies a biased estimation even when the errors are not serially correlated (Baltagi, 2005).

Finally, from the theory discussed in previous sections we know that there exist a reverse causality relationship between economic growth and poverty. Given that present poverty is potentially endogenous, P_{it} is not included in the regression. The estimated equation only includes past levels of poverty, which are unlikely to be affected by current growth. Thus, concerns of simultaneous causality should be reduced (López and Servén, 2009). However, it is still possible that the lagged value of poverty is correlated with some unobserved factors in the error term, which will cause our estimators to be biased.

$$Cov\ (P_{it-1}, \nu_{it}) \neq 0 \quad (5)$$

When using a panel data set, the most common method to overcome the correlation between the explanatory variables and the error term is to take first differences (Baltagi, 2005).

$$\Delta G_{it} = \alpha + \rho \Delta G_{it-1} + \delta \Delta GDPpc_{i,t-1} + \beta \Delta P_{it-1} + \delta \Delta I_{it} + \gamma Z_{it} + \Delta \varepsilon_{it} \quad (6)$$

Where,

$$\Delta \varepsilon_{it} = (\eta_i + \lambda_t + \nu_{it}) - (\eta_i + \lambda_{t-1} + \nu_{it-1}) = (\lambda_t - \lambda_{t-1}) + (\nu_{it} - \nu_{it-1}) \quad (7)$$

The time-invariant country-specific effects disappear and the explanatory variables are no longer correlated with the error term in that sense. However, when taking first differences a second endogeneity problem arises. By construction, ΔG_{it-1} will be correlated with $\Delta \varepsilon_{it} = \nu_{it} - \nu_{it-1}$. Furthermore, ΔP_{it-1} can also be correlated with the error term (ν_{it-1}) due to unobserved country specific time-variant effects (Angrist and Pischke, 2005).

The literature offers two potential solutions that use instrumental variables to overcome this endogeneity problem. Anderson and Hsiao (1982) suggest using the second lag of the differenced dependent variable (ΔG_{it-2}) or simply G_{it-2} to instrument ΔG_{it-1}. Recall that a valid instrument should be highly correlated with the explanatory variable but uncorrelated with the error term. Given the following relationship:

$$G_{it} - G_{it-1} = \beta(G_{it-1} - G_{it-2}) + (\nu_{it} - \nu_{it-1}) \quad (8)$$

G_{it-2} is a valid instrument, since it is correlated with ΔG_{it-1} but not with $\Delta \upsilon_{it}$ under the assumption that the errors are not serially correlated. This approach will lead to consistent estimates, however efficiency is not guaranteed. The same procedure is applied to instrument ΔP_{it-1}.

Arellano and Bond (1991) developed a more efficient approach based on the generalized method of moments (GMM) procedure. The authors suggest using additional lagged values as instruments to improve the efficiency of the estimators. Notice that additional lags are also valid instruments. Therefore, the set of valid instruments is $(G_{it-3}, G_{it-4}, \dots, G_{it-T})$. A test of overidentification is then used to decide the appropriate number of lags to be used as instruments.

The second part of the analysis is a continuation of the previous one. Recall the second hypothesis that stated that if there was an effect of poverty on growth, this should work through human capital, credit access, infrastructure and the lack of access to formal insurance. In first place, each of these channels of transmission will be regressed on poverty to test whether the latter has any significant effect. Second, a set of lagged variables proxying these channels of transmission will be included in the augmented growth equation. It is then expected that poverty loses its significance, since its effect on growth will be transmitted through the above-mentioned channels. In order to avoid endogeneity problems, the same instrumental variable approach will be followed.

The model presented is inspired in the work of López and Servén 2009, however it differs in a number of aspects. In first place, the authors ignore the possibility that education level, health and infrastructure development work as channels of transmission of the effect of poverty on growth. Instead they control for education and infrastructure just to avoid a potential omitted variable bias. Second, we use a completely different and updated dataset, where all data is obtained from the same source (World Bank's Databank) contrary to López and Servén (2009)'s data.

4. Data

A panel dataset is used to perform this analysis, which is obtained from the World Development Indicators online database (World Bank)[5]. The dataset covers the period of 1980 to 2012 and contains a sample of 80 countries. To construct the growth indicator, per capita GDP measured in constant 2005 US$ is used. The chosen poverty indicator is the Head Count Ratio at $1.25 a day (PPP) and the Gini index is used to proxy inequality. López and Servén (2009) stress that despite the advances made in cross-country data collection, poverty data is still scarce for several developing countries. In fact, the dataset presents a high variation in poverty data availability across countries. Scarcity becomes therefore a problem for this analysis, since a minimum of 3 consecutive observations will be needed to run the regression and instrument the endogenous variables. Given that some panels contain significant gaps in their time observations, non-overlapping 5-years averages of each variable are taken. In this way, the probabilities of finding consecutive observations in all panels increase. Moreover since the time-span used will be larger, concerns about endogeneity caused by serially correlated errors should be mitigated.

Data on inflation rate and trade openness will be used as controls, since they are country-specific factors that can change over time and are directly related to growth (López & Servén, 2009). There is a vast literature suggesting that trade promotes economic growth. For instance, trade leads to specialization in the

[5] Online database provided by the World Bank Databank. Last accessed in 05/2014.

sector where the country has comparative advantage and thus increases TFP Loayza et al. (2004). Moreover, trade could have both positive and negative effects on poverty according to Winters (2000). Openness to trade is measured by the sum of exports and imports of goods and services measured as a share of gross domestic product. On the other hand, macroeconomic stability is positively associated with long-run growth since it reduces uncertainty and incentivizes investment. Inflation is commonly chosen to proxy macroeconomic stability Loayza et al. (2004).

In order to perform the second analysis where we want to test if the effect of poverty on growth works through health, education, access to credit markets and formal insurance and infrastructure, data on these variables is needed. This is also obtained from the World Bank's World Development Indicators database. The variables chosen to proxy for education level are adult literacy rate and secondary enrollment level. Literacy rate is the most commonly used indicator to proxy the accumulated achievement of education and the effectiveness of an education system (World Development Indicators, 2014). It is measured as the percentage of the adult population able to read and write. However, data on literacy rate is rather scarce for several countries in the database. Hence, we decided to also include secondary enrollment rates, which is a participation measure that will complement the output indicator (literacy rate). It is measured as the percentage of children enrolled in secondary school. According to the World Bank's indications, secondary education provides more skill-oriented instruction, which will contribute to strengthen lifelong learning and human development.

To measure the overall health conditions of the population academics tend to use life expectancy data. This mortality indicator reflects the incidence and prevalence of diseases (usually difficult to measure) and is easily comparable across countries.

Infrastructure is an important determinant both for poverty persistence and economic growth. In the existing literature on the topic, several different variables have been used to proxy the infrastructure development of a country. The most

common ones are road density, fixed telephone lines, water and sanitation (Calderón and Servén, 2004). However, due to data availability we chose to use fixed telephone lines (per 100 people) as the solely indicator for infrastructure development. Calderón and Servén (2004) find a high correlation between the different infrastructure variables; hence concerns about omitting relevant information because of using one single indicator should disappear. On the other hand, given the ICT revolution, the number of mobile phone subscriptions has leapfrogged that of fixed telephone lines in several developed countries in the recent years. Thus, it could be argued that fixed telephone lines are not an appropriate indicator of communication infrastructure development anymore. However, the data used in this research analysis covers the period up to 2010 (variables are lagged). By then mobile phone technology was not developed at its fullest in developing countries and fixed telephone lines still played an important role (GSM Association, 2011). Nevertheless, we are aware of the limitations derived of using fixed telephone lines as the only infrastructure indicator.

Following López and Servén (2009), domestic credit to private sector by banks (% of GDP) was chosen to account for the poverty trap emerging from imperfect credit markets. According to the World Bank, private investment is critical for poverty reduction and growth. Thus, credit to private sector is considered a good indicator of the well functioning of the credit market and its potential to reduce poverty and promote growth. Finally it will not be possible to control for the effect of limited access to formal insurance due to data availability issues.

Table 1 presents the summary statistics for income, poverty and inequality for each of the 7 five-years periods analyzed for the whole sample of countries. We observe a wide range in GDP per capita in all periods. Furthermore, these differences have practically doubled over time, indicating that some countries have remained at a low-income level.[6] The table also shows that on average poverty has declined. However we find an increasing variability in poverty levels over time: in some countries around 80% of the population lives with less than

[6] Table A1 in the Annex presents summary statistics for national income level disaggregated by income group: Low-income, lower-middle income, upper-middle income and high-income level.

1.25 $US a day while some others have almost eradicated poverty. A more in deep analysis of the data tells us that the average decline in poverty levels is not due to an overall poverty reduction but due to some countries reducing they national poverty HCR while some others continuing to face alarmingly high levels of poverty[7]. The Gini Index measures the inequality at national level. We observe that there have not been substantial changes in inequality over time.

Table 1. Income level, Poverty rates and Inequality

		Period						
		1980-84	1985-90	1990-94	1995-2000	2001-05	2005-10	2011-12
Income level (GDP pc constant 2005 $US)	Mean	1912	2007,98	2190,98	2331,87	2660,81	3301,67	3785,01
	Min	154,79	141,99	124,89	131,564	139,56	147,76	151,96
	Max	11086,98	14055,17	17030,07	19031,35	21578,56	23417,61	22910,01
Head Count Ratio at 1.25$ Poverty Line	Mean	31,9	19,74	26,62	22,58	23,2	17,35	18,16
	Min	-	0	0	0,02	0,03	0,04	0,06
	Max	76,72	78,15	86,08	86,43	84,57	81,32	74,45
Gini Index	Mean	42,51	37,14	41,47	41,62	41,96	41,33	40,17
	Min	25,88	19,54	19,49	25,81	27,77	27,69	25,62
	Max	59,13	59,69	61,33	60,65	60,42	65,27	57,49

Source: Author's own calculations

Table 2 shows summary statistics for life expectancy, education, access to credit and infrastructure. We observe wide variability in life expectancy all over the period. The lowest levels are in some periods below the 30 years of age while the highest have improved from 73 to almost 80 years of age. Proxies for education also present a high variability. The interpretation is slightly more complicated since the education variable is a composite index of literacy rate and secondary enrollment[8]. Domestic credit to private sector by banks and the number of

[7] Table A2 in the Annex.

[8] The range of values should be between 0 and 100, values above 100 are due to children enrolled in secondary education who do not belong to the secondary shool age range.

telephone lines also present a wide range of values. Overall, all indicators have improved over time.

Table 2. Life expectancy, Education, Credit and Infrastructure

		Period						
		1980-84	1985-90	1990-94	1995-2000	2001-05	2005-10	2011-12
Life Expectancy	Mean	60,04	61,75	62,58	63,4	64,69	66,43	67,92
	Min	40,75	39,25	28,76	36,51	39,68	43,42	44,97
	Maxi	73,47	75,08	76,14	77,17	78,03	78,74	79,83
Education (Literacy and Secondary enrollment)	Mean	56,53	59,08	62,76	58,85	67,9	68,41	74,37
	Min	2,4	2,93	5,92	5,74	15,46	9,6	16,71
	Max	102,75	100,41	100,91	99,59	104,43	106,24	104,45
Credit to private sector	Mean	24,37	24,49	24,84	25,59	27,46	35,53	41,4
	Min	1,91	0,33	2,77	2,17	2,3	4,43	7,19
	Max	62,01	91,58	102	148,11	121,1	112,45	130,18
Fixed telephone lines (per 100 people)	Mean	3,41	4,51	6,19	9,06	11,63	13,27	13,67
	Min	0,05	0,03	0,04	0,16	0,23	0,16	0,11
	Max	18,59	21,56	26,91	34,87	42,2	49,2	44,46

Source: Author's own calculations

5. Results

5.1. Effect of Poverty on Growth

This section presents the results from the empirical implementation of the econometric model presented in the previous pages. Table 3 shows the results of different model specifications for the growth equation. The first and second column reports the estimates of the Arellano and Bond GMM approach, using only the second lag of the growth rate as instrument, with and without controls respectively. The third column shows the results of the same approach but using the second and third lag as instruments. Finally, the fourth column reports the estimates of a biased corrected OLS model using the Anderson-Hsiao approach.

We observe that in all four specifications the coefficient on lagged poverty appears with a negative and statistically significant sign. These results confirm the hypothesis that poverty is an obstacle for economic growth. Nevertheless we cannot prove the more restrictive predictions of the poverty trap theory, that persistent levels of poverty cause zero growth, since the summary statistics showed that almost all countries experienced an episode of economic growth in at least one period. Instead the results are in line with Easterly (2005)'s suggestions, that even though there is no absence of growth, poverty could be responsible for growth disadvantages compared to industrialized countries. The magnitude of the effect is, however, rather small in economic terms. In all four specifications if poverty HCR increases by one unit, ceteris paribus growth in the next period will be reduced by less than 1%.

Regarding the control variables, initial level of income (GDPpc in *t-1*) carries as expected a negative and statistically significant coefficient. According to the Solow Model, the lower the initial capital level of a country the higher will be the growth rates (López and Servén, 2009). The coefficients on inequality, inflation and openness to trade are not significant at any confidence level, contrary to López and Servén (2009) findings. However, it is in line with the results of Deininger and Squire (1996) who suggest that inequality does not play a role in shaping the relationship between growth and poverty. In the biased corrected OLS model the coefficients on inflation and trade do have a significant coefficient and the results are in accordance with López and Servén (2009).

In order to assess the validity of the instruments, the last two rows of Table 3 show the results of the Hansen test and second order serial correlation tests. For the first two models the null hypothesis of the Hansen test that the instruments are valid is rejected. However, in the third model where 2 lags have been used as instruments, we cannot reject the null hypothesis at the 1% significance level meaning that both lags are valid instruments. The test for second order serial correlation does not allow rejecting the null hypothesis, suggesting that the instruments could be invalid. These results suggest that further lags of GDP

growth and poverty HCR would be needed to instrument the variables in order to get unbiased results.

Table 3. IV Regressions: Poverty effect on growth

Variables	(1) GMM (1 lag)	(2) GMM (1 lag)	(3) GMM (2 lags)	(4) Biased corrected OLS
log GDPpc (t-1)	-0,2172***	-0,2076***	-0,1984***	-0,4704***
	(0,0549)	(0,0685)	(0,0659)	(0,0705)
HCR (t-1)	-0,0084***	-0,0066**	-0,0065**	-0,0054***
	(0,0549)	(0,0028)	(0,0027)	(0,0018)
GINI		0,0012	0,0004	0,0021
		(0,0070)	(0,0068)	(0,552)
Inflation		-0,0004	-0,0004	-0,0002**
		(0,0005)	(0,0005)	(0,0000)
Trade		0,0034	0,0024	0,0038***
		(0,0017)	(0,0017)	(0,0006)
Num of countries	82	80	80	80
Observations	321	243	243	243
Hansen Test p-value	0,000	0,001	0,011	
AR(2) p-value	0,735	0,164	0,115	

(a) Robust standard errors in parenthesis

*(b) *, ** and *** correspond to 1%, 5% and 10% level of significance respectively*

5.2. Assessment of the channels of transmission

In order to test the second hypothesis (poverty traps based on education, health, access to credit and infrastructure are the transmission channels of the effect of poverty on growth), a two-step analysis was followed. In first place, we assessed the effect that poverty has on each variable regressing them on the poverty indicator. To solve a potential simultaneous causality problem between poverty and the dependent variable, the Arellano and Bond estimation approach is used. Second, the same augmented growth equations of Table 3 are estimated but including life expectancy, education, credit to private business and fixed telephone lines as explanatory variables. If these variables do represent channels of transmission, we expect that the coefficient on poverty becomes insignificant. In other words, the effect that poverty has on growth will be captured by these other variables.

Table 4 summarizes the coefficient and p-values of poverty in each regression. Poverty HCR carries a negative and significant coefficient when the dependent variable is life expectancy, education or fixed telephone lines. These results are in line with the previously discussed theory on how poverty was an obstacle to access health (Peters, et al., 2008) and education services and therefore enjoy a healthy life or acquire a high education level (Perry et al. 2006). It has also been discussed how poverty at a more macro level had a negative impact on the provision of infrastructure such as telephone lines (Calderón and Servén, 2004). This is also reflected in the estimated regression of telephone lines on the poverty index. However, when the variable for credit is regressed against poverty HCR, the coefficient appears to be statistically insignificant. This result contradicts the theory that poverty is an obstacle to access credit markets (Demigürç-Kunt et al. 2008).

Table 4. Poverty effect on education, health, infrastructure and access to credit

Dependent Variable	Coefficient	P-value
Life Expectancy	-0,226	0,000
Education	-0,479	0,000
Credit	-0,299	0,222
Telephone lines	-0,289	0,000

Table 5 reports the results of the augmented growth equations including education, life expectancy, access to credit markets and infrastructure as explanatory variables. In the first and second column we observe that the coefficient on the HCR becomes statistically insignificant as expected. Furthermore life expectancy and education carry statistically significant coefficients and with the expected positive sign, in accordance with the previously discussed theory about the importance of human capital in promoting growth and reducing poverty (Perry et al. 2006). However, the coefficient on credit to private businesses by banks has a negative and significant sign. This result is contrary to our expectations. According to theory, the credit flowing from households to private businesses through banks is an indicator of the well functioning of credit markets. Thus, we would expect a positive sign since access to credit is considered to have a positive effect on growth (Demigürç-Kunt et al. 2008). Last, telephone lines (as a proxy for infrastructure) do not carry a statistically significant coefficient although the sign is the expected one. The results of the Biased Corrected OLS model reported in the third column lead to less conclusive results. The coefficient on poverty HCR is not significant as expected, however only the coefficient on life expectancy is significant.

Table 5. IV Regressions: poverty effect on growth including possible channels of transmission

Variables	(1) GMM (1 lag)	(2) GMM (2 lags)	(3) Biased corrected OLS
log GDPpc (t-1)	-0,0503*	-0,0491**	-0,4325***
	(0,0181)	(0,0249)	(0,0799)
HCR (t-1)	0,0015	0,001	-0,0023
	(0,0012)	(0,0012)	(0,0019)
GINI	-0,0002	-0,0005	-0,0005
	(0,0017)	(0,0016)	(0,0039)
Inflation	-0,0008	-0,0015	-0,0010***
	(0,0013)	(0,0016)	(0,0003)
Trade	0,0005	0,0005	0,0007
	(0,007)	(0,0006)	(0,0010)
Life Exp (t-1)	0,0071**	0,0058*	0,0258***
	(0,0034)	(0,0033)	(0,0067)
Education (t-1)	0,0024***	0,0025***	-0,0008
	(0,0007)	(0,0006)	(0,0011)
Credit Markets (t-1)	-0,0028**	-0,0024**	0,0007
	(0,0012)	(0,001)	(0,0013)
Infrastructure (t-1)	0,001	0,0003	0,0032
	(0,0026)	(0,0021)	(0,0029)
Num. of countries	76	76	
Observations	179	179	
Hansen Test p-value	0,296	0,574	
AR(2) p-value	0,545	0,733	

(a) Robust standard errors in parenthesis

*(b) *, ** and *** correspond to 1%, 5% and 10% level of significance*

Overall, the results are in line with the theory on poverty traps and confirm the two hypotheses. In the previous sections it has been discussed how persistent poverty can become an obstacle to undertake growth-conductive actions. The hypothesis that poverty will therefore have a negative impact on future growth is confirmed by the negative and significant coefficient on the lagged poverty HCR in the augmented growth equation. Furthermore, the theory of the generation of poverty traps based on limited access to education, health services, credit markets and infrastructure is also reflected in the results. The fact that once we include these variables in the augmented growth equation poverty loses its significance confirms the hypothesis that the negative effect of poverty on growth works through these channels.

5.3. Robustness Check

Up to now the analysis has been based in a solely indicator of poverty: the Poverty Head Count Ratio at 1.25$. However there are alternative indicators to measure poverty such as the Poverty Gap Ratio or the Foster-Greer-Thorbecke poverty indicator. As a robustness check of the results we conducted the same analysis but using the PGR instead as poverty indicator. The results are presented in Table 6. We observe that the coefficient on the poverty indicator carries a negative and statistically significant sign, supporting the results obtained in the principal analysis. Table 7 shows the results of the augmented growth equation when we include the hypothesized transmission channel of the effect of poverty on growth. As in the primary analysis, the coefficient on poverty loses its significance, further supporting the previous results. However, only education carries a significant coefficient.

Table 6. IV Robustness check: Alternative poverty indicator

Variables	(1) GMM (1 lag)	(2) GMM (1 lag)	(3) GMM (2 lags)	(4) Biased corrected OLS
Poverty Gap Ratio				
log GDPpc (t-1)	-0,1912***	-0,1610***	-0,1543**	-0,4526***
	(0,0472)	(0,0616)	(0,010)	(0,0683)
PGR (t-1)	-0,0146***	-0,010**	-0,0104**	-0,0111***
	(0,0046)	(0,0047)	(0,0048)	(0,0034)
GINI		0,0002	-0,0005	0,0031
		(0,0071)	(0,0068)	(0,0036)
Inflation		-0,0008	-0,0008	-0,0001**
		(0,0006)	(0,0007)	(0,0000)
Trade		0,0026	0,0026	0,0037***
		(0,107)	(0,0016)	(0,0006)
Num. of countries	82	80	80	80
Observations	322	243	243	243
Hansen Test p-value	0,000	0,001	0,011	
AR(2) p-value	0,528	0,05	0,115	

(a) Robust standard errors in parenthesis

*(b) *, ** and *** correspond to 1%, 5% and 10% level of significance respectively*

Table 7. IV Regressions: poverty effect on growth including possible channels of transmission using alternative poverty indicator

Variables	(1) GMM (1 lag)	(2) GMM (2 lags)	(3) Biased corrected OLS
Poverty Gap Ratio			
log GDPpc (t-1)	-0,0749**	-0,01142***	-0,47972***
	(0,0312)	(0,039)	(0,1278)
PGR (t-1)	-0,0004	0,0027	-0,0038
	(0,0030)	(0,0034)	(0,0047)
GINI	0,0005	0,001	0,0030
	(0,0020)	(0,0027)	(0,0043)
Inflation	-0,0009	-0,0016	0,005
	(0,0014)	(0,0034)	(0,0019)
Trade	0,0007	0,0007	0,0036***
	(0,0006)	(0,0007)	(0,001)
Life Exp (t-1)	0,0055	0,0085	0,0121
	(0,0039)	(0,0048)	(0,0079)
Education (t-1)	0,0016***	0,0039***	0,0034***
	(0,0006)	(0,0011)	(0,0008)
Credit Markets (t-1)	-0,0026*	-0,0023	-0,0040**
	(0,0013)	(0,0011)	(0,0017)
Infrastructure (t-1)	0,0022	-0,0018	0,0048
	(0,0029)	(0,0032)	(0,0046)
Num. of countries	63	63	63
Observations	117	117	117
Hansen Test p-value	0,054	0,249	
AR(2) p-value	0,126	0,116	

(a) Robust standard errors in parenthesis

*(b) *, ** and *** correspond to 1%, 5% and 10% level of significance*

6. Conclusions

Despite global modern growth several countries have remained stuck in poverty. Economists have long been trying to explain the enormous income gap that distances the industrialized countries from the poorest ones. A popular explanation is the existence of poverty traps. Sachs (2005) suggested that poverty could become self-reinforcing through a series of mechanisms. As a consequence, little growth is expected from those countries caught in a poverty trap.

By means of a dynamic panel data approach we aimed at answering the research questions of whether persistent poverty can explain the absence of economic growth (based on the existence of poverty traps) and if that was the case, which were the mechanisms of transmission. For that purpose the effect of poverty on growth was estimated using Arellano and Bond and Anderson-Hsiao estimators. Moreover, we also tested different channels of transmission of the effect of poverty on growth. The results of an augmented growth equation including a poverty indicator show a negative and statistically significant effect of poverty on growth. These results imply that countries with high levels of poverty will experience less growth in comparison to those with lower levels of poverty. However the economic magnitude of the effect is rather small: a one-point increase in the poverty HCR is translated into less than 1% reduction in future growth. The results are in line with those obtained in previous literature: López and Servén (2009) find a negative effect of poverty on growth of similar magnitude. Moreover, the results obtained back up to a certain extent the literature on poverty traps. Poverty traps are actually associated with total absence of growth. However, our results indicate that poverty hampers or reduces growth but it does not completely offset economic development. In line with the results obtained, Easterly (2005) suggested that poverty could represent a disadvantage for growth.

In the second part of the analysis we tried to identify the channels of transmission of such effect. For that purpose, the previously discussed candidates (education,

health, credit markets and infrastructure) were regressed against the poverty indicator using an instrumental variable approach. We found indeed that education, health and infrastructure were negatively affected by poverty. In order to test if this effect was further transmitted to economic growth we estimated the same growth equation and included these variables in the regression. As expected, the coefficient on the poverty indicator lost its significance. Moreover, we found a significant effect of education, health and credit on growth. This tells us that poverty affect growth through education and health. Despite the fact that the variable proxying access to credit was initially not affected by poverty, we find that it does have an independent effect on growth. Overall the results are in accordance with the previously discussed theory about the generation of poverty traps and the transmission of the poverty effect through the above-mentioned channels. Moreover, they also reflect the concerns expressed by Duflo and Banerjee (2011) about the means to escape poverty.

Despite the consistent results obtained, it is worth noting that the analysis suffers from critical limitations mainly concerning the data used. In first place, the sample of countries is rather small (80 out of 194). This is due to two sources of data scarcity. On one hand the World Bank does not provide poverty indicators for high-income countries, which automatically excludes them from the analysis. On the other hand, small and very poor countries present an overall shortage of data, thus excluding them from the sample as well. Second, quality historical data is also difficult to find. As a consequence the analysis was limited to a 33-years period. Third, consecutive yearly observations are a gift difficult to obtain. To overcome the large number of missing values, five-years average were used. However, it allowed to exploit a larger time-span and reduced the potential serial correlation of the errors. Fourth, due to data limitations it was not possible to empirically test the effect of lack of formal insurance. Finally, the tests for the validity of the instruments did not confirm the adequacy of them, suggesting that the results could suffer from endogeneity problems.

It is also worth pointing out that several other *poverty traps generators* have not been discussed. The pervasive effects of poverty reach every corner of life, thus

the situations where a poverty trap can emerge are countless. Just to mention a few, a sexist society can contribute to deny women with low-resources the opportunity to stand by themselves and escape poverty (Jackson, 1996). Political institutions can also be responsible for poverty persistence just as Engerman and Sokoloff (2005) and Acemoglu et al. (2001) pointed out.

A last note is to recall the actual ambiguity of the results. Despite having found a negative effect of poverty on growth we know that poverty does not always necessarily condemn countries to remain poor. There are numerous examples of countries that despite suffering from high levels of poverty were able to take off and leave poverty behind. The most prominent example is the Republic of Korea. Historical evidence thus keeps the debate alive on whether poverty traps are permanent or if they even exist. Further research will be needed to address this issue.

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8. Annex

Table A1. Income level (GDP pc constant 2005 $US) by income group

		Period						
		1980-84	1985-90	1990-94	1995-2000	2001-05	2005-10	2011-12
Low income countries	Mean	279,51	305,19	282,6	273,35	303,48	362,1	410,7
	Minimum	154,79	141,99	124,89	131,564	139,56	147,76	151,9
	Maximum	522,11	770,28	527,81	513,53	501,44	549,36	638,0
Lower-middle income	Mean	972,33	1039,74	979,94	984,5	1086,1	1298,99	1437
	Minimum	239,25	242,534	274,54	333,56	409,92	532,15	667,5
	Maximum	2978	3092,56	2106,69	2379,5	2638,54	2940,68	2993
Upper-middle income	Mean	3050,36	3130,9	3006,84	3179	3508,87	4393,97	4875
	Minimum	254,09	401,43	573,6	705,11	1058,02	2178,05	2827,3
	Maximum	7680,68	8374,33	7545,12	7895,43	9612,29	11205,92	11019,8
High income	Mean	6230,99	6949,85	6826,01	7535,94	9029,98	11266,76	12710,9
	Minimum	3173,48	3581,79	3975,13	3450,54	4377,79	5771,97	6617,5
	Maximum	11086,98	14055,17	17030,07	19031,35	21578,56	23417,61	22910,0
All	Mean	1912	2007,98	2190,98	2331,87	2660,81	3301,67	3785,0
	Minimum	154,79	141,99	124,89	131,564	139,56	147,76	151,9
	Maximum	11086,98	14055,17	17030,07	19031,35	21578,56	23417,61	22910,0

Source: Author's own calculations

Table A2. Head Count Ratio at 1.25$ Poverty Line by income group

		Period						
		1980-84	1985-90	1990-94	1995-2000	2001-05	2005-10	2011-12
Low income countries	Mean	63,39	67,77	68,76	64,05	59,19	49,69	46,5
	Minimum	60,57	60,98	33,46	19,57	28,1	10,61	24,8
	Maximum	66,22	78,15	86,08	86,43	84,57	81,32	63,1
Lower-middle income	Mean	59,17	34,72	33,93	28,22	26,06	18,04	22,7
	Minimum	55,51	1,77	0,03	1,97	0,32	0,08	0,0
	Maximum	62,84	68,16	64,71	78,59	64,45	68,51	74,4
Upper-middle income	Mean	21,2	8,7	9,09	8,53	7,61	3,98	2,2
	Minimum	3,22	0	0,02	0,17	0,122	0	0,0
	Maximum	76,72	54,03	59,36	44,37	28,36	15,56	8,1
High income	Mean	-	0,874	1,23	0,69	0,47	0,31	0,1
	Minimum	-	0	0	0,02	0,03	0,04	0,0
	Maximum	-	7,45	3,64	2,54	2,12	1,24	0
All	Mean	31,9	19,74	26,62	22,58	23,2	17,35	18,1
	Minimum	-	0	0	0,02	0,03	0,04	0,0
	Maximum	76,72	78,15	86,08	86,43	84,57	81,32	74,4

Source: Author's own calculations

Table A3. List of countries

Albania	Guinea	Romania
Argentina	Honduras	Russia
Armenia	Hungary	Rwanda
Azerbaijan	India	Senegal
Bangladesh	Indonesia	Serbia
Belarus	Iran	Sierra Leone
Bhutan	Jordan	Slovakia
Bolivia	Kazakhstan	South Africa
Brazil	Kenya	Sri Lanka
Bulgaria	Lao PDR	Swaziland
Burkina Faso	Latvia	Tajikistan
Burundi	Lesotho	Tanzania
Central African Republic	Lithuania	Thailand
Cambodia	Malawi	Turkey
Cameroon	Malaysia	Uganda
Chile	Mali	Ukraine
China	Mauritania	Uruguay
Colombia	Mexico	Venezuela
Costa Rica	Moldova	Vietnam
Cote d'Ivoire	Morocco	Zambia
Croatia	Mozambique	
Dominican Republic	Nepal	
Ecuador	Nicaragua	
Egypt	Nigeria	
El Salvador	Pakistan	
Estonia	Panama	
Ethiopia	Paraguay	
Georgia	Peru	
Ghana	Philippines	
Guatemala	Poland	