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Does Economic growth reduce Child labour?

A Portrait of Peru 2001-2009

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A Portrait of Peru 2001-2009*

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Abstract

The present paper analyzes if the strong economic growth Peru experienced during the years 2001 to 2009 helped in reducing its high child labour rate. It is a crucial task to tackle the issue of child labour for Peru, which as a strong developing economy could find in its high child labour rates an impediment to sustainable growth in the future. To determine the cause of child labour micro and macro data will be used. A special contribution makes the application of a bivariate probit model which estimates the joint probability for a child to both study and work or to study and to not work during the period 2001 to 2009. First results show that and increase in GDP per capita and the employment status of parents both increase the probability of attending school although reduction in child labour is small. Social protection policies could therefore play an important role in further reducing child labour by incentivizing households not to rely on child labour generated income.

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Introduction

Today, Peru finds itself is in the middle of an economic boom which started in 2001. After decades of a mismanaged and inflation ridden economy, in 2008 Peruvian economic growth reached a record high of 9.8% within the region. Even if the global financial crisis of 2009 reduced its growth rate to 0.8%, the IMF predicts strong and lasting recoveries from 2010 onwards with an increase of 6.3% in GDP growth (Graph 1).

Yet, Peru has also repeatedly achieved record numbers in child labour rates, especially compared to its South American neighbours[1]. Even though Peru ratified the 2002 ILO Convention 182 which prohibits the worst forms of child labour and postulates immediate action for its elimination, high rates of child labour are still present at national level. The lack of objective monitoring procedures at national level to assess the evolution of child labour over the years may act as further impediment to its reduction. It is yet a crucial task to tackle the issue of child labour for Peru, which as a strong developing economy, could find in its high child labour rates an impediment to a sustainable and well distributed growth in the future.

Assuming that high poverty levels are the cause of child labour then why and how link economic growth to child labour and vice versa? To answer this question we can picture two mechanisms operating at different levels in the economy:
On one side, general economic theory tells us that economic growth brings about higher per capita income. Higher income at individual and household level would lead to reduced poverty rates which in turn could and should facilitate a reduced deployment of child labour. This mechanism is also known as the "trickle down" effect. On the other side, child labour does allow only little or no time for schooling. Yet, endogenous growth theory has demonstrated that the accumulation of human capital can lead to higher levels of development. This development can be translated into higher future earnings and higher social benefits, while offering an opportunity to break the cycle of inter-generational poverty. This process forms one of the cornerstones for national growth and the development of an economy.

Which of the two mechanisms has imposed itself on the Peruvian economy: Has growth been such that it reduced poverty levels and with it the child labour rate? Or have poverty levels and child labour been so persistent as to not have been affected by the continuous economic growth in Peru?

The present paper will try to answer these questions by constructing an indicator measuring the evolution of child labour in Peru for the period 2001-2009. It will then test if there is an inverse relationship between economic growth and child labour during the same period of study. More specifically it will analyze if the continuous economic growth Peru experienced in the present decade

[1] Figures recorded for the years 2001 and 2007 in
http://white.oit.org.pe/ipec/documentos/trab_inf_causa_efecto_pobreza.pdf

helped in reducing the child labour rate. This will be done by contrasting the evolution of the child labour indicator with the corresponding GDP data for the same period.

The structure of the paper will be as follows: Section I will present a brief literature review on similar studies which have tried to analyze the dual links between child labour and economic growth, it will also intend to put the present study into a theoretical framework. Section II gives an overview of the data sources used for the present paper. Section III presents the general features of the Peruvian economy during the period of 2001 to 2009. Section IV introduces the available statistics on child labour in Peru. Section V outlines the methodology and the results of estimating child labour rates versus GDP growth. Section VI concludes summarizing the findings and implications for future policy making.

Section I: Literature Review on the link between Child Labour and Economic Growth

1. Child labour and its influence on economic growth

Child Labour and the Accumulation of Human Capital

Insight gained from endogenous growth theory points to the importance of human capital in fostering economic growth. As such, child labour, to the extent that it competes with education, can be argued to hinder economic growth through a failure to develop a skilled labour force[2]. Additionally, under-investment in human capital may perpetuate a poverty trap where child labour and a consequent underinvestment in human capital results in poverty for the next generation[3].

That child labour significantly affects economic growth through underinvestment in human capital is dependent on a significant trade-off between the two activities. Although there appears to be a general consensus that a trade-off exists, the issue is complicated for several reasons. Firstly, child labour and human capital accumulation are not mutually exclusive. Secondly, child labour is far from homogenous. Lastly, there is the possibility that schooling does not equate to human capital accumulation. This is as schools must be of a sufficiently adequate quality[4]. Several empirical studies are drawn upon to assess the significance of the trade-off.

Using panel data from Vietnam, Beegle et al. lend support to the existence of a substantial trade-off by finding that child labour tends to have a significant negative impact on both educational attainment and school participation[5]. This result is furthered by Akabayashi and Psacharopoulus who, using time-log

[2] Galli, Rossana. "The Economic Impact of Child Labour." Discussion Paper 128, International Institute for Labour Studies (2001): 1-24.
[3] Udry, Christopher. "Child Labor." Center Discussion Paper No. 856, Economic Growth Center, Yale University (2003): 1-20.
[4] Galli, Rossana. "The Economic Impact of Child Labour." Discussion Paper 128, International Institute for Labour Studies (2001): 1-24.
[5] Beegle, Kathleen, Rakeev Dehejia, and Roberta Gatti. "Why Should We Care About Child Labour? The Education, Labor Market, and Health Consequences of Child Labor." NBER Working Paper No. 10980 (2004).

data from a Tanzanian household survey, find that hours of work are inversely related to mathematical and reading skills. Notably, this is largely attributed to "a reduction of human capital investment activities" such as studying at home[6]. Ravallion and Wodon, through the use of an enrolment subsidy in Bangladesh, find cause to doubt a strong degree of substitution between child labour and schooling. However, this is not to say that child labour does not affect human capital accumulation as it is noted that child labour possibly reduces the time spent on, for example, homework[7].

Child Labour and the Perpetuation of Low-Level Skill Intensive Technology

The growth of an economy tends to be heavily contingent on technological progress. A one-shot game is used to show the negative effect child labour may have on technological progress and consequently, economic growth.

Assume that "children's time has an economic value" and that education results in an opportunity cost for the parents[8]. Further assume that gains from education will result only in the long-term and are contingent on firms investing in high-skill intensive technology. Lastly, suppose that "investing in an economy with low human capital is a risky venture.[9]" Figure 1 shows that if parents choose 'child labour,' the pure strategy Nash equilibria would be for the firm to not invest in technological progress[10].

Empirically, Dessy and Palage find reason to believe that the low-levels of high-skill technology investment in sub-Saharan Africa are inextricably linked to the preference of child labour over education[11].

Figure 1: Child Labour and Technological Progress[12]

		FIRM	
		Invests	Does not invest
PARENTS	Child labour	2, -20	2,0
	Education	5, 100	-1, 0

[6] Akabayashi, Hideo, and George Psacharopoulos. "The Trade-Off Between Child Labour and Human Capital Formation: a Tanzanian Case Study." Journal of Development Studies 35 (1999): 120-140.
[7] Ravallion, Martin, and Quentin Wodon. "Does Child Labour Displace Schooling? Evidence on Behavioural Responses to an Enrollment Subsidy." The Economic Journal 110 (2000): c158-c175.
[8] Dessy, Sylvain E., and Stephane Pallage. "Child Labor and Coordination Failures." Working Paper No. 109, Center for Research on Economic Fluctuations and Employment, University of Quebec (2000): 1-12.
[9] Ibid
[10] Ibid
[11] Ibid
[12] Ibid

Child Labour and Income Inequality

Assuming that there is a negative relationship between income inequality and economic growth, short- and long-term income inequality can be seen as a further channel through which the effects of child labour are felt[13].

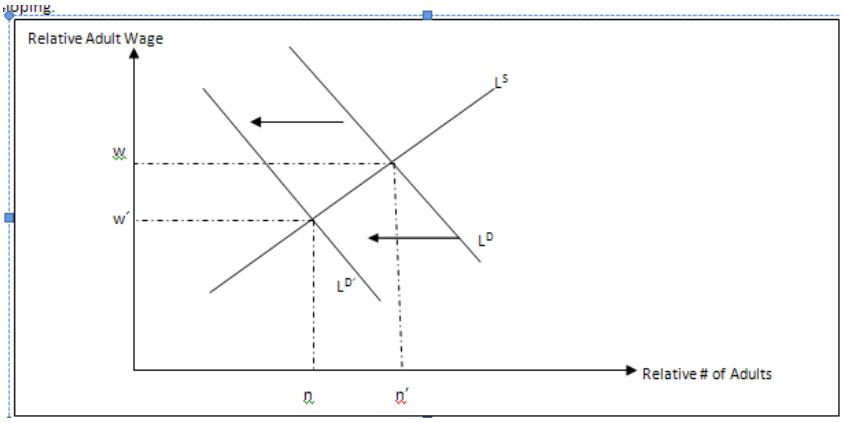
In the short run it is thought that child labour may increase income inequality through adding to the unskilled labour pool thus depressing the relative adult wage[14]. This is illustrated in Figure 2 where an exogenous increase in child labour shifts the demand curve for unskilled adults from D to D' leading to a decrease in wages from w to w'.

Notably the extent to which child labour decreases unskilled adult wages is contingent on the degree of substitutability between adults and children[15]. Alternatively it is also possible that child labour actually lessens the degree of inequality in the economy through adding to the immediate income of poor families[16].

In the long run, however, child labour may unambiguously increase the level of income inequality through the perpetuation of low education and high fertility levels. Furthermore, the consequent shortage of highly-skilled labourers in the economy tends to increase the wages of skilled labourers leading to a further increase in the income disparity[17].

Figure 2: The Effect of Child Labour on the Unskilled Adult Labour Market[18]

*Assuming that the average rate is constant, labour supply is upward sloping and labour demand is downward sloping.



[13] Galli, Rossana. "The Economic Impact of Child Labour." Discussion Paper 128, International Institute for Labour Studies (2001): 1-24.
[14] Ibid
[15] Galli, Rossana. "The Economic Impact of Child Labour." Discussion Paper 128, International Institute for Labour Studies (2001): 1-24.
[16] Ibid
[17] Ibid
[18] Ibid

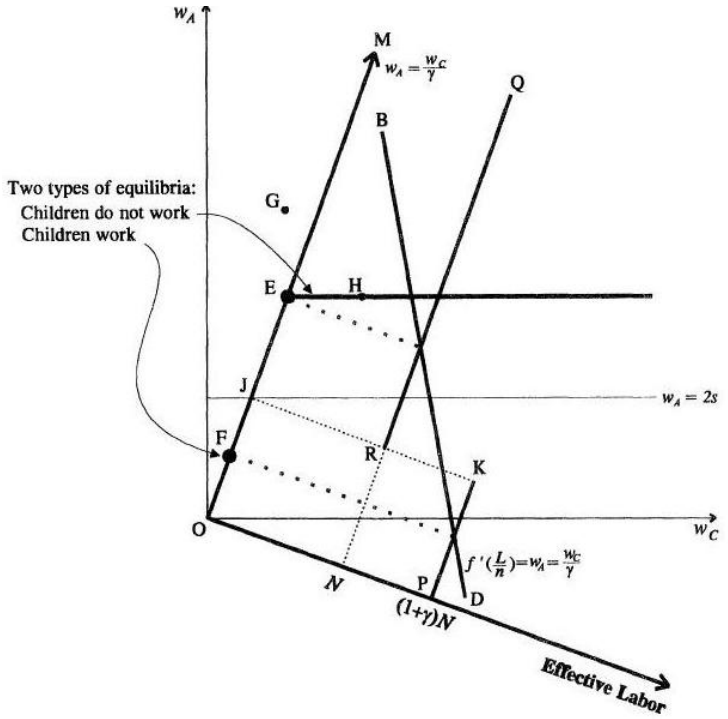
2. Economic Growth and its influence on Child Labour

Economic Growth and Poverty Alleviation

Child labour is often seen as a symptom of poverty[19]. Economic growth can thus be argued to go some way to alleviating poverty and reducing the incidence of child labour[20].
This is shown through using a theoretical model by Basu and Van, and empirical studies.

Figure 4 illustrates the effect economic growth, proxied through an increase in wage rates, may have on child labour. Assuming both the luxury and substitution axioms (see Figure 4); there exist multiple equilibria in the labour market (points E and F). When adult wages are low it can be seen that both adults and children will work (point F). A sufficient increase in the adult wage, however, can be seen to lead to a new equilibrium (point E) where only adults work[21].

Figure 3: Economic Growth and Child Labour[22]



The Luxury Axiom: A family will send the children to the labour market only if the family's income from non-child-labour sources drops very low.
The Substitution Axiom: From a firm's point of view, adult labour and child labour are substitutes.

w_A: market wage for adult labour;
w_C: market wage for child labour

Line Segments QR and KP: aggregate effective supply of labour
Line Segment BD: aggregate demand for labour

[19] Udry, Christopher. "Child Labor." Center Discussion Paper No. 856, Economic Growth Center, Yale University (2003): 1-20.
[20] Ibid
[21] Basu, Kaushik, and Pham Hoang Van. "The Economics of Child Labor." The American Economic Review 88 (1998): 412-427.
[22] Ibid

Numerous empirical studies have seemingly verified the relationship between economic growth, poverty alleviation and child labour. Blunch and Verner use household data from Ghana and observe a statistically significant positive relationship between poverty and child labour[23].

In a study of Vietnam, Edmonds finds that "improvements in per capita expenditure…explain 80% of the decline in child labour that occurs in households whose expenditures improve enough to move out of poverty," although the wide-spread generalisation of this result is questioned[24]. Lastly, Bhalotra hypothesises that if poverty compels a higher incidence of child labour then a negative wage elasticity of child labour supply should be observed. Using data from rural Pakistan, it is found that male children tend to work due to poverty[25].

Economic growth and the alleviation of poverty, however, are also empirically seen to increase the incidence of child labour. Using a dataset from Bhavnagar in India, Swaminathan finds that economic growth has led to an aggregate increase in the number of child labourers over the past 15 years. This is largely attributed to the expansion of an informal labour market in conjunction with economic growth. Any relationship between economic growth, poverty alleviation and child labour must thus be observed with a degree of caution[26].

Economic Growth and More Complete Credit Markets

Economic growth is generally associated with more complete credit markets[27]. As such, it is possible that the increased availability of credit to households may reduce child labour levels in favour of investment in human capital[28]. This is observed through theoretically and empirically examining the implications of incomplete credit markets on child labour.

Baland and Robinson's dynamic model of child labour is presented in Figure 4. Of particular interest is the third proposition which postulates that there is an inefficiently high level of child labour when parents cannot borrow due to incomplete credit markets. Importantly, this is the case even when bequests are interior[29]

[23] Blunch, Niels-Hugo, and Dorte Verner. "Revisiting the Link Between Poverty and Child Labor: the Ghanaian Experience." Working Paper No. 01-03, Center for Labor Market and Social Research, the Aarhus School of Business (2001).
[24] Edmonds, Eric V. "Does Child Labour Decline with Improving Economic Status?" NBER Working Paper No. 10134 (2003).
[25] Bhalotra, Sonia. "Is Child Work Necessary?" Oxford Bulletin of Economics and Statistics 69 (2007): 29- 55.
[26] Swaminathan, Madhura. "Economic Growth and the Persistence of Child Labor: Evidence From an Indian City." World Development 26 (1998): 1513-1528.
[27] Levine, Ross. "Financial Development and Economic Growth: Views and Agenda." Journal of Economic Literature 35 (1997): 688-726.
[28] Udry, Christopher. "Child Labor." Center Discussion Paper No. 856, Economic Growth Center, Yale University (2003): 1-20.
[29] Baland, Jean-Marie, and James A. Robinson. "Is Child Labor Inefficient?" The Journal of Political Economy 108 (2000): 663-679.

Figure 4: Child Labour and Credit Constraints[30]

Assume that there are two time periods, $t = 1,2$
In $t = 1$ parents decide on the allocation of their children's time between child labour and human capital accumulation and control all income.
In $t = 2$ children, now adults, work and control their income.
$L\,p$: number of parents alive
A : efficiency of labour
$AL\,p$: parental labour supply
n : number of children that every parent has
$l\,c$: the fraction of a child's time allocated to work, $l\,c \in 0,1$
$nL\,p\,l\,c$: child labour supply
Assume that $n = 1$
Total Amount of Labour Supplied in Period 1: $ALp + nLplc$
Number of Effective Units of Labour in Period 2: (1) $nL\,p\,h\,(1- l\,c)$

h : human capital accumulation, h is strictly increasing and $h(0) =1$
$h\,(1- l\,c)$: additional units of human capital possessed by an adult who worked $l\,c$ when a child

Assume that, in $t = 1$, parents can give bequests to children in $t = 2$
b : bequest, $b \geq 0$

Further assume that income can be transferred between periods through saving and that capital markets are imperfect (saving must be non-negative)
s : saving, $s \geq 0$

Parental Utility: $U_p= U\,(c^1{}_p) + U\,(c^2{}_p) + n\delta W_c\,(C_c)$
$C^1{}_p$: consumption of parent in $t =1$
$C^2{}_p$: consumption of parent in $t = 2$
δ : altruism of parents, $1> \delta > 0$
$W\,c$: utility function of child
$c\,c$: consumption of child in $t =2$
Therefore Parental Utility: $U_p= U\,(A+ l_c – s) + U\,(A+ s – b) + n\delta W_c\,(h\,(1 – l_c) + b)$

It can be seen that the first-order conditions with respect to b , $l\,c$, s are:
If $b > 0$ then $U\,'(c^2{}_p) = \delta W_c\,'(C_c)$
If $b = 0$ then $U\,'(c^2{}_p) > \delta W_c\,'(C_c)$
If $s > 0$ then $U\,'(c^1{}_p) = U\,'(c^2{}_p)$
If $s = 0$ then $U\,'(c^1{}_p) > U\,'(c^2{}_p)$

[30] Ibid

Suppose that there exists an interior optimum level of child labour which satisfies
$U'(c^1_p) = \delta W_c'(C_c)\, h'(1 - l_c)$

Can be seen that child labour is efficient when the marginal cost of working today is equal to the marginal benefit of education and working tomorrow: $h'(1 - l_c) = 1$
Therefore: Child labour is inefficiently high when $h'(1 - l_c) > 1$ where $l_c^* > 0$

l_c^*: the efficient level of child labour

Proposition 1: If bequests and savings are interior, then $h'(1 - l_c) = 1$
Proposition 2: If bequests are at a corner, then $h'(1 - l_c) > 1$ and l_c^* is too high
Proposition 3: If savings are at a corner, then $h'(1 - l_c) > 1$ and l_c^* is too high

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The impact of incomplete credit markets on child labour is also present empirically.

Using panel data from Vietnam, Beegle et al. find that the benefits of investment in human capital tend to accrue over a longer time horizon relative to the more immediate benefits of engaging in child labour. As such, the net benefits of child labour are calculated to be positive for discount rates equal to or greater than 11.5%. Taking into account the inordinately high real interest rates asked by informal moneylenders, and that microcredit interest rates are approximately 12-14% per annum, the development of an improved credit market would theoretically incentivise more households to invest in human capital and consequently decrease the incidence of child labour. Notably, this is contingent on formal sector interest rates being below 11.5% per annum[31].

Economic Growth and a Higher Level of Skill-Intensive Technology

Bearing in mind the key role of technological innovation in endogenous growth models, it seems reasonable to postulate that economic growth is complemented by a higher level of skill-intensive technology. Economic growth may thus reduce child labour levels through the demand- and supply-side effects of high skill-intensive technology on the labour market[32].

A higher level of skill-intensive technology tends to require a relatively higher level of education and, especially in areas of mechanization, a higher intensity of effort per hour worked. Essentially the effect of these two requirements is a reduction in the demand for both unskilled labour in general (including child labour) and a preference for adults over children[33]. This is illustrated in Figure 5 where, due to the

[31] Beegle, Kathleen, Rakeev Dehejia, and Roberta Gatti. "Why Should We Care About Child Labour? The Education, Labor Market, and Health Consequences of Child Labor." NBER Working Paper No. 10980 (2004).
[32] Chakraborty, Shankha, and Mausumi Das. "Mortality, Fertility, and Child Labor." Economics Letters 86 (2005): 273 278.
[33] Chakraborty, Shankha, and Mausumi Das. "Mortality, Fertility, and Child Labor." Economics Letters 86 (2005): 273 278.

increased productivity of higher skill-intensive technology, the aggregate demand curve (BD) shifts 'right' resulting in a single equilibrium with no demand for child labour[34].

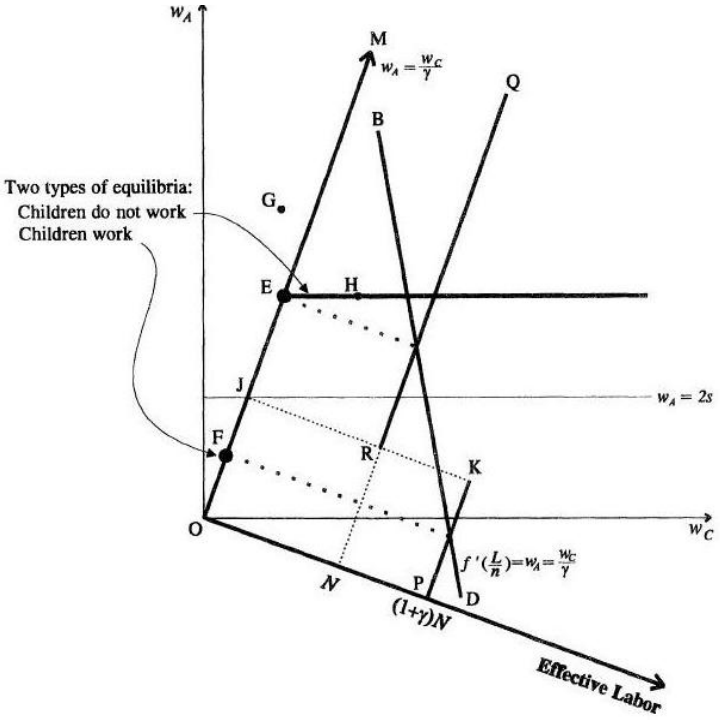
Figure 5: Child Labour and High-Skill Intensive Technology[35]

*Assuming Luxury and Substitution Axiom (see Figure 4)

w_A : market wage for adult labour; w_C : market wage for child labour

Line Segments QR and KP: aggregate effective supply of labour

Line Segment BD: aggregate demand for labour



On the supply side it is possible that the existence of high-skill intensive technology raises the return of investing in human capital relative to engaging in child labour. This is illustrated by re-modelling Figure 2 into a two-stage game. Using firm investment as a proxy for the proliferation of high-skill intensive technology in the economy, Figure 6 shows that if the firm invests the Nash equilibrium is for parents to educate their children instead of sending their children to work[36].

[34] Basu, Kaushik, and Pham Hoang Van. "The Economics of Child Labor." The American Economic Review 88 (1998): 412-427.

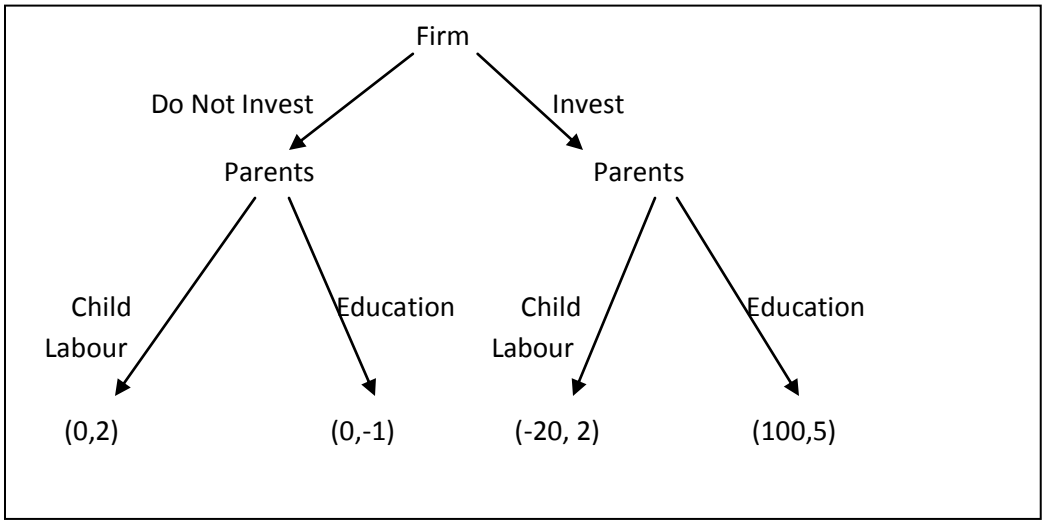
[35] Ibid.

[36] Based on Dessy, Sylvain E., and Stephane Pallage. "Child Labor and Coordination Failures." Working Paper No. 109, Center for Research on Economic Fluctuations and Employment, University of Quebec (2000): 1-12.

Figure 6: Child Labour and Technological Progress (Two-Stage Game)[37]

*Assume that: children's time has an economic value; education results in an opportunity cost for the parents; gains from education will result only in the long term and are contingent on firms investing in high-skill intensive technology; investing in an economy with low human capital is a risky venture

**Further assume that pay-off functions for firms and parents are as in Figure 2



The application of higher skill-level technology can be seen to have reduced child labour empirically. Indeed, both the Green Revolution in India and the mechanization of agriculture in Egypt are found to have reduced child labour significantly[38].

One potential caveat with this argument, however, is the possibility that a subset of new production methods may lead to an increase in child labour. One example is the possibility of an increase in the demand for "nimble fingers" due to the production processes of increasingly miniaturized electronics such as semi-conductors[39].

[37] Ibid.
[38] Grootaert, Christiaan, and Ravi Kanbur. "Child Labor: a Review." The World Bank (1994): 1-36.
[39] Ibid.

Section II: Data description

This study will be based on two different sources from which data has been taken. The macro source consists of the annual Peruvian GDP per capita from 2001 to 2009 which has been retrieved from the Peruvian National Institute of Statistics (INEI). Data on micro level is obtained from the annual national household surveys – NHS (Encuesta Nacional de Hogares, ENHAO) performed by the INEI for the same period of time. NHS data, allows us to identify children, parents and household characteristics as well as their corresponding details in income, employment status and poverty levels. In addition, the survey contains information on rural and urban areas, which is organized by geographical domains.

Available NHS Data for the years 2001 and 2002 is based on the fourth quarter of each year while for the years 2003-2009 annual data has been used. It is also important to note that the design of the survey in 2001 and 2002 differs from the remaining years regarding questions whose purpose is to identify child labour in each household.[40] Additionally, in some cases, data for the year 2002 and in few cases also 2003 had to be omitted due to the lack of comparability with other years. While researching and comparing on discrepancies with 2002 and 2003 data on child and labour characteristics at household level it has been found that in official INEI report on child labour in Peru[41], data for 2002 has been completely omitted.

Table 1 Number of observations for 6 to 17 year olds in ENHAO 2001 – 2009

	Children´s activitiy			
	Total	**School**	**Employed**	**School & Employed**
Total Children	212,719	193,034	69,506	59,677
Total Households	105,784	100,543	42,567	37,378
Children per household	2.01	1.92	1.63	1.60

Source ENHAO

The homogenized survey consist in total of 765, 265 individual observations. This makes on average 85,029 annual observations for individuals for the years 2001 to 2009. As can be seen in table 1, the section regarding the population aged 6 to 17 years contains 212,719 observations and 105,784 per household. In the present paper only children who live with either of the parents will be considered. The number of children who could not be allocated any parents in the sample is 9,730. Therefore the total number of children taken into account in the observation sample is reduced to 202,989.

[40] See Annex 1 (p.39) for further information

[41] INEI (Dec. 2009) "Niños, Niñas y Adolescentes que Trabajan 1993-2008" p.23

Section III: General Features of the Peruvian economy

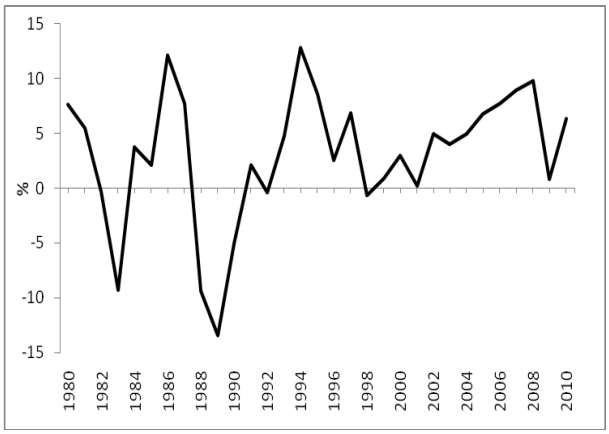
1. Patterns of Economic Growth in Peru

The past 25 years have brought about important variations in Peruvian economy, at some periods triggering (hyper-) inflation and negatively affecting GDP growth. The first signs of economic stability started during the Fujimori government in the 1990´s. This was however the result of severe stabilization programs which brought about a high social cost (Thorp 2002). It was eventually weakened again by the international financial crisis of 1997-1998. From 2001 economic growth took off once more to start its longest recorded period of growth in history. Signs of full recovery presented itself in 2002 where recorded GDP growth was at 4.9% until reaching its peak at 9.8% in 2008, outperforming all other countries in the region (Graph 1). Even though the international financial crisis of 2008-2009 decreased growth in 2009, IMF[42] and ECLAC[43] forecasts predict strong growth to take off again in 2010. It is expected that by 2011 Peru has good chances to be again the leading country at regional level.

According to the Peruvian national statistics Institute (INEI, 2008)[44] the strong expansion rates, from 2001 onwards, have been driven by a particular strong growth in mining and manufacturing. Other important sectors that contributed to Peruvian growth where services and trade. This pattern also shows how Peruvian economic growth model is moving away from pure commodity driven growth towards a more diversified growth model including different sectors of the economy. Mendoza (2006) shows that from the 2.9% points of average growth during 2001-2005, mining contributed 0.9% points, while services contributed with little less than 1% point, followed by industry with 0.6%point and trade with 0.4% point.

Graph 1

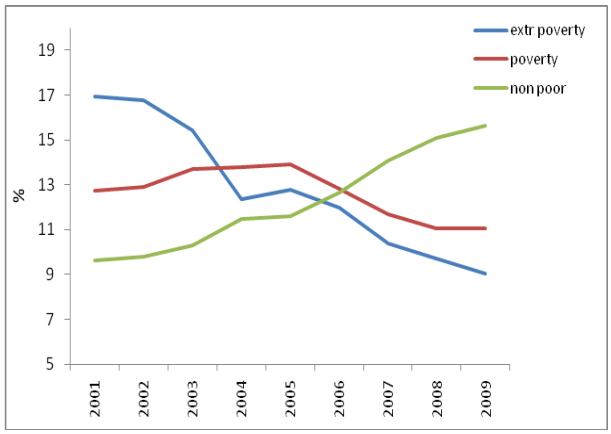
Peru´s Economic growth



Source INEI

Graph 2

Evolution of poverty



Source ENHAO

[42] Regional Economic Outlook (Western Hemisphere) May 2010
[43] Data for July 2010
[44] *Sistema de cuentas nacionales,* Lima, Peru: INEI. <http://www.inei.gob.pe>,

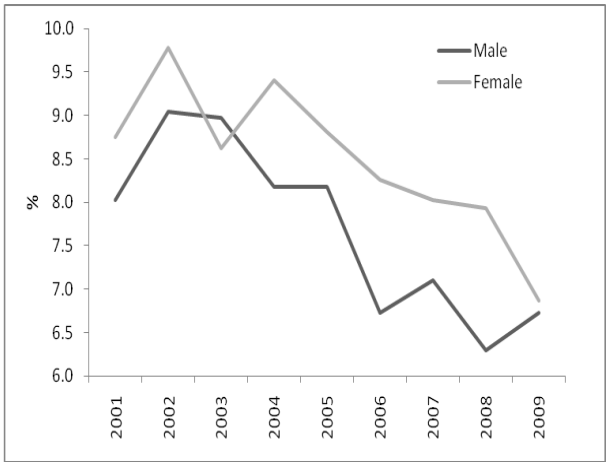
2. Economic growth and poverty levels

Yet several studies (Thurlow 2009, Mendoza 2006) pointed out that this experienced growth has been uneven and concentrated mostly around the coastal and central regions of Peru. The authors find that even if all households in Peru benefit from faster growth of the coastal economy, there is a widening income gap between coastal and inland households. This in turn is accompanied by a greater regional divergence in economic growth. Graph 2 confirms the above mentioned, showing a 6% increase in the non-poor population during the time of economic growth. Likewise the proportion of population living in extreme poverty drastically reduced itself by about 8%, followed by a reduction of 1.7% in the population living in poverty. Yet poverty rates are still an important factor, although reduced slightly during the years of growth, it remains high at two-fifths of the population living below the poverty line in 2007 (INEI 2009[45]).

Increase in economic growth has also affected welfare of the population through changes in the labour market. Overall the unemployment rate experienced a decrease for both the male and female population of 2.7% and 2.1% respectively (graph 3). Especially the female population has seen a relative strong decrease in its unemployment rate, which by 2009 has leveled up to the male unemployment rate (6.8% for female versus 6.7% for male population). Looking at unemployment rate by age groups we see however that especially young people are suffering from unemployment. Unemployment rate among 14 to 17 year olds has not only been the highest but also the one that instead of following the decreasing trend, increased. However, unemployment rates for people older than 18 years where steadily decreasing.

Graph 3

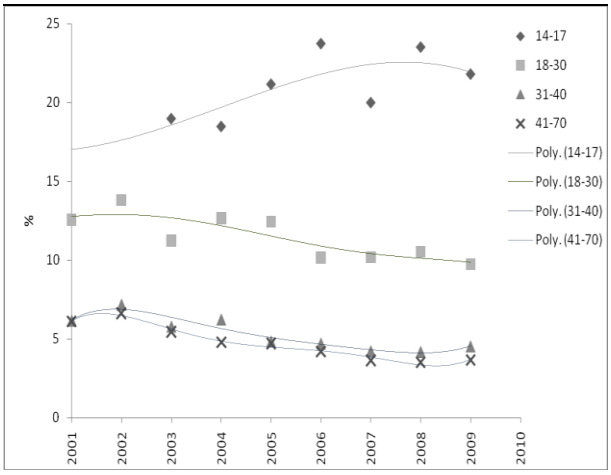
Unemployment rate by gender (14 years+)



Source ENHAO

Graph 4

Unemployment rate by age[46]



Source ENHAO and own calculations

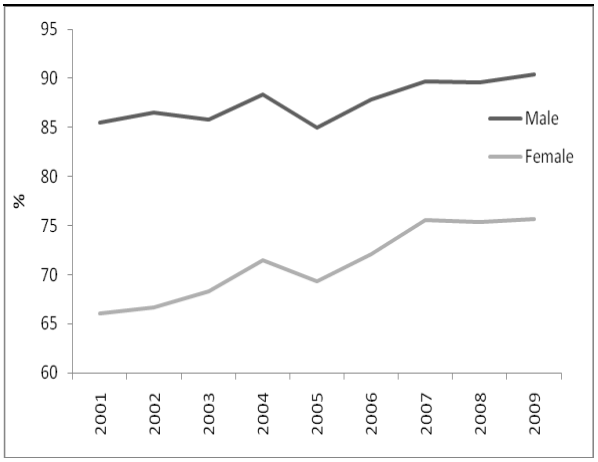
[45] *La pobreza en el Perú en el año 2007*. Lima, Peru: INEI.

[46] Due to its lack of comparability, data for the years 2001 and 2002 has been taken out for age group 14-17. A polynomial approximation has been done to better observe the tendency for the affected age group. For further information see Section on Methodology and Data used.

On the other hand, economic growth caused an increase in the participation rate as the labour market generated more opportunities. The strongest increase has seen the female population (graph 5). In addition, age groups 18 to 30 and 41 to 70 experienced the strongest increase in the participation rate. The younger population (14 to 17) kept a low but stable participation rate oscillating around 52% to 57% (graph 6). These movements can in part be explained by a demand of more labour, especially higher skilled labour. This would also explain the low participation rate of young people with low educational levels who also faced high unemployment rates.

Graph 5

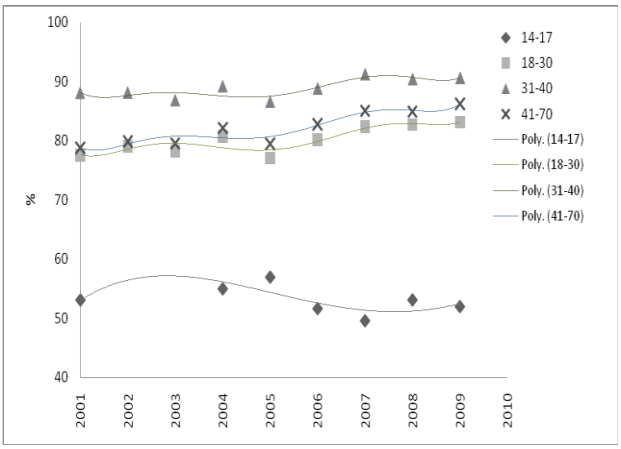
Participation[47] rate by gender



Source ENHAO

Graph 6

Participation rate by age



Source ENHAO and own calculations

Table 2 summarizes the participation rates of men and women older than 18 years and of boys and girls between 14 and 17 years. As can be seen women participation rate in the labour market sharply increases by 8.6 % points from 2001 to 2009. This implies an average of 0.9 percentage point per year. Nevertheless, between 2003 & 2004 and 2006 & 2007 participation growth rate doubled, reaching 2 % point in only one year. Boy's participation rates have been decreasing steadily, which could indicate either higher unemployment rates due to low education level as stated above, or prolonged school attendance which keeps this segment of the population out of the labour force. The picture for girls is different: starting with a relative low level of participation rate in 2001 the participation rate increases 5.5%points to its peak in 2008 only to decrease again in 2009 2.7%point. These figures would indicate a pull of the labour market, which especially attracts young female with low education levels. These findings are complementary to the World Bank (2005[48]) publications whose results show that employment creation in Peru during 2001 – 2009 is still dominated by low-paying informal services.

[47] Participation rates are calculated as the sum of employed plus unemployed people divided by the population older than 14 years who are those who can work.

[48] World Bank. 2005. *Opportunities for all: Peru poverty assessment*. Report No. 29825-PE. Washington D.C.: World Bank.

Table 2 Participation rate by gender (%)

	2001	2004	2008	2009
Male (18+)	90.8	91.9	93.0	93.8
Female (18+)	69.7	74.1	77.5	78.3
Boys (14 - 17)	59.7	58.5	54.2	54.7
Girls (14 - 17)	46.5	51.4	52.0	49.3

Source ENHAO and own calculations

The present paper will focus on studying the consequences of the economic growth on the labour market for the population segment younger than 18 years. Although in Peru the population older than 14 years is considered part of the labour force, it is important to emphasize in this context that basic education in Peru is completed after 11 years of schooling, with an official enrolment age at 6 years of age. This implies that a child finishes basic education at age 17. Hence this study will define child labour according to the ILO – IPEC standard[49], as work performed by the population under 18 years of age, for at least one hour per week to earn a living for themselves, for their families, or for others, whether or not such children work in the formal or informal sector of the economy, and whether or not such children are legally or illegally employed.

[49] For more information http://www.ilo.org/ipec/facts/lang--en/index.htm

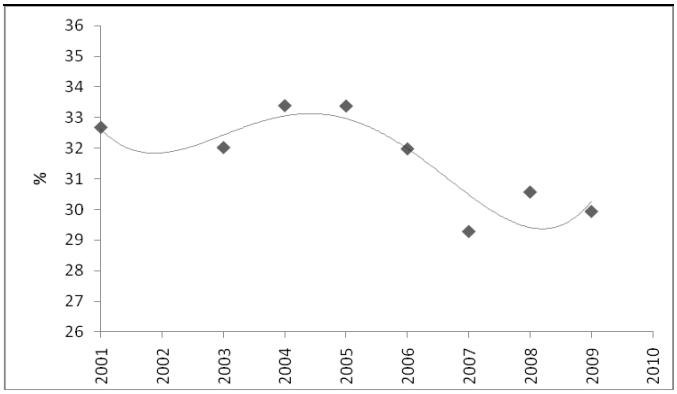
Section IV: Descriptive analysis of Child labour statistics

1. Participation rates

In order to assess the evolution of child labour during the 2001-2009 period an indicator has been constructed from two sets of information. The first set is based on the information given by two questions of the annual ENHAO survey which tries to identify the working conditions of boys and girls aged 6 years and older. The informant who answers these questions is however not the child itself but always an adult (either the head of household or spouse)[50], which might cause underreporting on children's actual employment status. The second set of information is based on several questions regarding employment and income conditions where the population of 14 years onwards is considered. Information for children aged 14 to 17 is taken from these survey questions. The present indicator for child labour has therefore tried to homogenize labour conditions for 6 to 13 years old with 14 to 17 years old. It has been calculated by following the structure of the adult occupation rate. The result is a child occupation rate which is calculated as the ratio of employed children aged 6 to 17 to the population of 6 to 17 year olds. As mentioned in section 2, data for the year 2002 had to be omitted due to its lack of comparability. As an alternative a polynomial approximation has been made to substitute the missing data and to better observe the tendency of the child occupation rate during the first years of the observation period.

Graphically, the child occupation rate has experienced a slight decline of 2.8% when comparing 2001 (32.7%) with 2009 (29.9%). During the years 2001 to 2009 the highest rate are found in 2004 and 2005 at 33.3 % and the lowest rate in 2007 at 29.2% (graph 7).

Graph 7 Child occupation rate (6 to 17 year olds)



Source ENHAO and own calculations

In other words it is reasonbale to state that in Peru, 3 out of 10 children between 6 and 17 years are working. At first glance it does not seem that the continous economic growth and reduced poverty levels (graph 1 and 2 respectively) have had any impact on the child occupation rate between 2001 and

[50] See Annex 1 (p.39) for detailed information on survey questions.

2009. However there seem to be timid indications of a decrease in the child labour rate in the long term. It is also important to keep in mind that child labour rates may lag behind economic growth. This might explain the peak of 2004 and 2005 which could be a manifestation of uncertainty associated with Fujimori austerity programs of the 1990´s and the previous drop in GDP per capita in 2001 (as seen in graph 1). Hence it is reasonable to assume that the child labour rate might increase in the following years as a response to the deceleration that the peruvian economy suffered in 2009 due to the global financial crisis.

2. Type of activity

Data coverage which gathers information on child labour activity and sector is national. Hence the principal activity of child work reported in table 3 is agriculture with nearly every second working child being active in that sector in 2001 and 2004. Some other specific activities can be identified such as wholesale and retail where 20% of active children work. Another activity in which a large number of children work are private households, a number which is slightly increasing between 2001 (6.8% of children) and 2004 (7.2%). Data for the year 2008 is referential as the total number of observation for working children is much lower than the years 2001 and 2004. Nevertheless the same structure can be identified where agriculture is the main activity followed by wholesale and retail and private households.

Table 3 Child labour by economic activity (for years 14 to 17)

Sector	2001	%	2004	%	2008	%
Agriculture	579,286	53.84	535,016	51.75	406,844	77.43
Mining and quarr	125	0.01	3,143	0.30	3,473	0.66
Manufacturing	69,109	6.42	58,284	5.64	72,727	13.84
Electricity/Water	160	0.01	n/a	n/a	2,863	0.54
Construction	14,144	1.31	20,720	2.00	24,349	4.63
Wholesale and retail	204,336	18.99	209,664	20.28	167,075	31.80
Hotel & Restaurant	74,708	6.94	74,846	7.24	82,024	15.61
Transport	23,367	2.17	25,594	2.48	42,584	8.10
Finance	386	0.04	224	0.02	n/a	n/a
Real state, renting	5,532	0.51	4,478	0.43	5,842	1.11
Publ. adm	1,696	0.16	1,163	0.11	1,622	0.31
Education	5,018	0.47	784	0.08	8,625	1.64
Services	26,236	2.44	24,525	2.37	30,937	5.89
Private household	71,890	6.68	75,308	7.28	50,521	9.61
Total	1,075,993	100	1,033,748	100	525,456	100

Source ENHAO

In general there have not been large changes from 2001 to the end of the decade in the type of economic activities in which children are involved. The most important feature in that respect is that a higher number if children are working in private households and a smaller number of children work in agriculture over the decade.

3. School attendance

The decision to work or to attend school is not necessarily independent of each other. In most cases the decision is taken together so that work and school attendance might be complementary. This is also the case in Peru as can be seen from table 4. In 2001 the percentage of children who attended school and were working at the same time was 24%. This number has been increasing by 3.3% in 2004 and stabilized at 26% in 2008 and 2009. The number of children who attend school and study has increased overall by 2% over the decade of strong economic growth in Peru. Likewise the number of children who only work has also been decreasing steadily during the last nine years. These prove to be positive numbers and might be a consequence of the reduced poverty rates, especially concerning extreme poverty rates as shown in table 1.

Table 4 Children who work and attend school (for years 6 to 17)

	2001	%	2004	%	2008	%	2009	%
Only School	4,974,354	65.45	3,998,000	64.81	3,421,090	67.01	3,426,174	67.70
Only Work	438,932	5.78	253,405	4.11	192,923	3.78	184,094	3.64
School and Work	1,865,428	24.54	1,717,500	27.84	1,343,047	26.31	1,326,183	26.21
Total	7,600,357	100	6,168,390	100.00	5,105,538	100.00	5,060,665	100.00

Source ENHAO

Section V: Methodology and results

1. Graphical analysis

The first part of section 4 will analyze the graphical relation between the Peruvian child labour and its growth rate. The aim of this analysis is twofold; first it will try to determine if there were significant changes on the level of children participation rate during the economic growth of 2001 to 2009 and second the analysis aims at contrasting GDP growth and the child labour rate.

To do so, the participation rate of children will be regressed on time dummies, to identify each year of the sample between 2001 and 2009[51], and departamento dummies, to control for each of the 24 provinces in Peru, using OLS estimation. To control however for autocorrelation between years due to time invariant and time variant characteristics of the regression, a Haussman test has been run. It identifies if the regression has to be controlled for either fixed or random effect[52]. The result of the Hausmann test is to control the regression for random effects due to the presence of random and uncorrelated variance across years which could influence on the dependent variable, the child participation rate.

Table 5 contains the result of the estimation. The estimated coefficients for years are all significant at the 1% level and show reductions in children participation rates from 2004 onwards until 2008. For 2001 and 2003 rates are lower than for the period 2004 to 2008, and the rate increases again for 2009. Graph 8 shows the fitted values of the participation rate obtained from the above regression. What can be seen is that there has been an estimated (nearly) 4% level change in the child participation rate between 2003 and 2004, where it maintained its high rate until 2006. The years of the highest growth rate, 2007 and 2008, show an estimated reduction in the child participation rate, compared to previous years. The second peak in the child labour rate accounts for the year 2009. The explanation might be found in the decreasing growth Peru experienced during this crisis hit year. Graph 8 plots the fitted values obtained from the previous regression. It is not possible to see an evident tendency; although values are oscillating over the observation period. However within this context it is also important to keep in mind that not only economic factors are included in the time dummies, therefore other political or sociological effects could have had effects in households causing these changes.

[51] 2002 was the dropped year

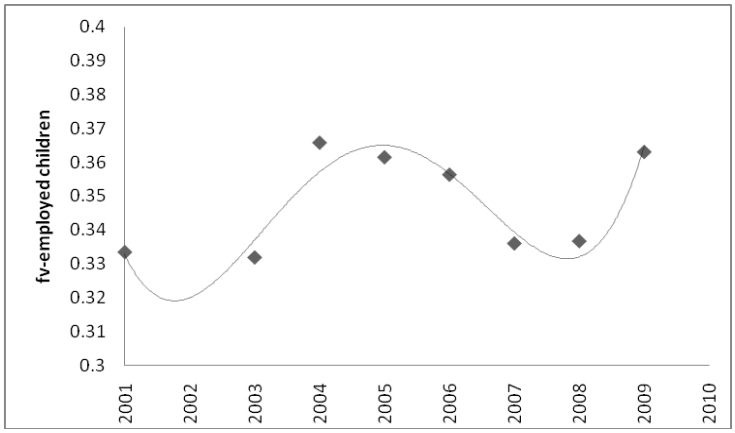
[52] The Hausmann test identifies whether the unique errors are correlated with the regressors, the null hypothesis is they are not (that the preferred model is random effects).

Table 5 Estimation of the child occupation rate on time and departamento dummies

	y2001	y2003	y2004	y2005	y2006	y2007	y2008	y2009
Child_OR	0.068**	0.067*	0.101***	0.096***	0.091***	0.071***	0.071***	0.098***
	-0.02	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	Ancash	**Apurímac**	**Arequipa**	**Ayacucho**	**Cajamarca**	**Cusco**	**Huanca-velica**	**Huánuco**
Child_OR	-0.025	0.114*	-0.253***	-0.028	-0.044	0.063	0.172***	0.134*
	-0.05	-0.06	-0.05	-0.06	-0.06	-0.06	-0.05	-0.06
	Ica	**Junín**	**La Libertad**	**Lamba-yeque**	**Lima y Callao**	**Loreto**	**Madre de Dios**	**Moquegua**
Child_OR	-0.264***	-0.101*	-0.186***	-0.271***	-0.292***	-0.209***	-0.178**	-0.13
	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
	Pasco	**Piura**	**Puno**	**San Martín**	**Tacna**	**Tumbes**	**Ucayali**	
Child_OR	-0.065	-0.065	0.217***	-0.214***	-0.200***	-0.231***	-0.231***	
	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
	Constant	**Obs.**	**R-sq within:**	**between**	**overall**			
Child_OR	0.361***	216	0.1755	1	0.8512			
	-0.05							

* p<0.05, ** p<0.01, ***p<0.001 // 1. Child_OR : Child occupation rate for employed children 6 to 17 years

Graph 8 Fitted child occupation rate vs years

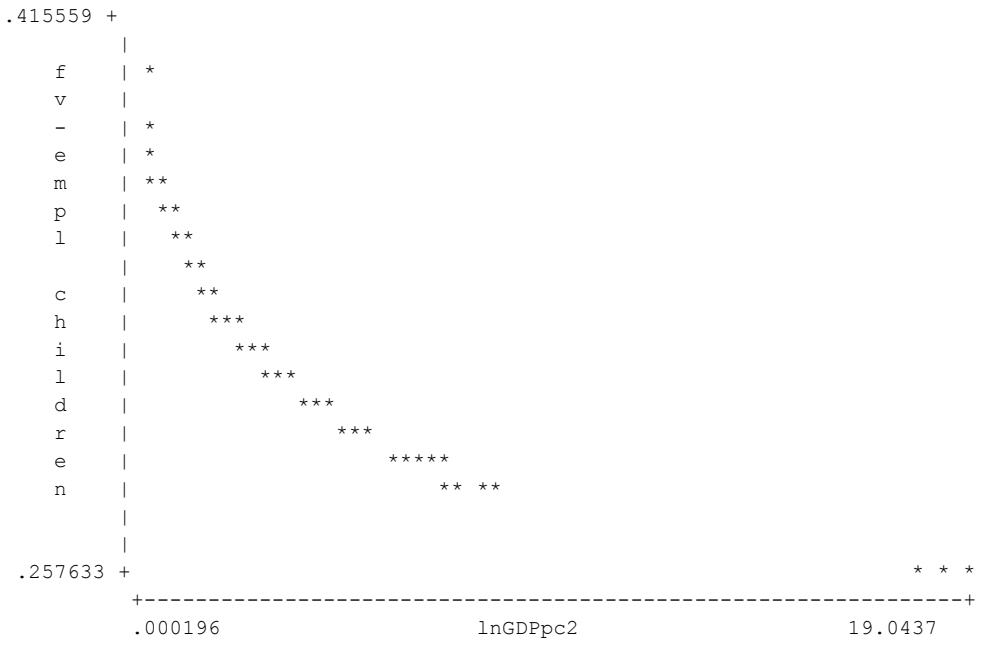


The second analysis aims at contrasting GDP growth with the child participation rate. It consisted in regressing, by OLS, children´s participation rate on the natural logarithm of total GDP per capita (lnGDPpc) and its square. Estimation results are shown on table 6, showing a negative and significant coefficient for lnGDPpc. Graph 9 plots the fitted values of employed child against its corresponding lnGDPpc which results in a negative relation: the higher the rate if child participation is, the lower is GDP per capita. Therefore as GDP per capita grows, the participation rate of children will tend to decrease. This relation might possibly be explained by the GDP per capita-poverty relation. The lower GDP per capita, the higher tend to be the poverty levels, inducing children to work in order to preserve and contribute to the standard of living of their corresponding households.

Table 6 Estimation of the child participation rate on GDPpc.

	Constant	lngdppc	lnGDPpc2	Obs	R-sq
Child_OR	0.647***	-0.297***	0.046***	216	0.3309
	-0.04	-0.04	-0.01		
* p<0.05, ** p<0.01, ***p<0.001					

Graph 9 Fitted Child participation rate against GDPpc



2. Estimation model

The second part of section 4 specifies a model to estimate the probability of a child working and its probability of attending school. However, as already mentioned in section 3, the decision making process of whether or not to attend school and whether or not to participate in the labour force are not substitutable but strongly interdependent. This means that the estimation will need to include observations and analysis of two variables at a time, employment and school attendance. To take this interdependency into account a multivariate analysis will be used.

An approach is used which allows for the possibility that decision making process towards school attendance and participation in the labour force are jointly determined, rather than the result of independent processes. More specifically, what will be analyzed is the probability of two different decision making processes happening. The first decision is for a child to attend school and to participate in the labour force, the second decision to attend school and to not participate in the labour force.

This will be done by using a bivariate probit model. According to Green (2003)[53] the bivariate probit model being an extension of the classic multi-equation regression models where error terms are correlated. The general specification for the bivariate probit model is as follows: We let Y_{1i} be the first dependent variable that denotes the probability that a child will attend school, which is dependent on personal and family characteristics and the province of residence (x_{1i}). Moreover, we let Y_{2i} be the second dependent variable that denotes the probability that a child is participating in the labour force, which also depends on personal characteristics, the area of settlement, and the province of residence (x_{2i}).

$Y^*_{1i}=X_{1i}\beta_1+\mu_{1i}$ with $Y_{1i}=1$ if $Y^*_{1i} > 0$ $Y_1i=0$ if otherwise

$Y^*_{2i}=X_{2i}\beta_2+\mu_{2i}$, with $Y_{2i}=1$ if $Y^*_{2i} > 0$ $Y_{2i}=0$ if otherwise

Error terms:

$\mu_{1i} = \eta_i + \varepsilon_{1i}$
$\mu_{2i} = \eta_i + \varepsilon_{2i}$

Typically, a bivariate normal distribution for two standard-normally distributed μ's, their joint density will be:

$$\emptyset(u_1, u_2) = \frac{1}{2\pi\sigma u_1 \sigma u_2 \sqrt{1-\rho^2}} \exp\left[-\frac{1}{2}\left(\frac{u_1^2 + u_2^2 - 2\rho u_1 u_2}{1-\rho^2}\right)\right]$$

where ρ is a "correlation parameter" denoting the extent to which the two μ's covary.

[53] GREENE, W. (2003). *Econometrics Analysis*. Prentice Hall, New Jersey: Fifth Edition.

The probability of both dependent variables equaling one is:

$$\Pr(Y_{1i} = 1, Y_{2i} = 1) = \emptyset_2(X_{1i}\,\hat{\beta}_1, X_{2i}\hat{\beta}_2, \hat{\rho})$$

where ϕ_2 denotes the bivariate normal cumulative distribution function given above.

The joint probabilities for the other possible outcome which will be taken into account is:

$$\Pr(Y_{1i} = 1, Y_{2i} = 0) = \emptyset_2(X_{1i}\,\hat{\beta}_1) - \emptyset_2(X_{1i}\,\hat{\beta}_1, X_{2i}\hat{\beta}_2, \hat{\rho})$$

The matrix of independent variables X_{1i} and X_{2i} identify household and environment characteristics the child faces and they capture micro and macro time effects. In total 59 variables are used, but not all of them entered in all of the estimations. Table 7 contains the description of these variables.

Table 7 Variables description

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
year		258309	2005.158	2.568035	2001	2009
dpto	Departamento	212719	12.92898	6.881314	1	25
child	1=boy 0=girl	212719	0.506734	0.499956	0	1
tniño	Number of siblings	212719	2.630122	1.284302	1	9
age_ch	age child (6 to 17)	212719	11.54816	3.389699	6	17
eduyr_ch	years of education child	152533	3.57973	4.106016	0	16
hhsize	household size	166864	5.928283	2.164834	1	23
poverty	poverty level	196240	2.181732	0.805045	1	3
schoolatt	child attends school 1=yes, 0=no	210128	0.91865	0.273373	0	1
employ617	child works 1=yes, 0=no	212718	0.375535	0.790427	0	9
mother	1=present 0=not present	258309	0.931671	0.25231	0	1
age_m	age mother	240659	42.50138	12.29813	12	98
eduyr_m	years of education mother	194995	5.722065	4.962436	0	21
inc_m	income mother per month	189338	1438.398	1771.278	0	101466.3
pea_m	mother 1=employed, 0=unemployed	240657	0.702955	0.456958	0	1
father	1=present 0=not present	258309	0.821837	0.38265	0	1
age_f	age father	212284	46.1705	12.79332	16	98
eduyr_f	years of education father	169618	7.555743	4.506052	0	23
incm_f	income father per month	167100	1448.059	1818.792	0	101466.3
pea_f	father 1=employed, 0=unemployed	212288	0.929732	0.255598	0	1
GDPpc	GDP per capita year base=2001	212719	119.3689	14.62646	100	140.9993
lnGDPpc	ln (GDP per capita)	212719	4.774783	0.12167	4.60517	4.948755
lnGDPpc2	ln (GDP per capita) squared	212719	22.81335	1.164287	21.20759	24.49017
y1	dummy var for year 2001	258309	0.10218	0.302885	0	1
y2	dummy var for year 2002	258309	0.114851	0.318842	0	1
y3	dummy var for year 2003	258309	0.076594	0.265947	0	1

y4	dummy var for year 2004	258309	0.116388	0.32069	0	1
y5	dummy var for year 2005	258309	0.115892	0.320096	0	1
y6	dummy var for year 2006	258309	0.117646	0.322189	0	1
y7	dummy var for year 2007	258309	0.122868	0.328287	0	1
y8	dummy var for year 2008	258309	0.116852	0.321245	0	1
y9	dummy var for year 2009	258309	0.116728	0.321097	0	1
dpt2	dpto==Ancash	212719	0.042319	0.201316	0	1
dpt3	dpto==Apurímac	212719	0.033406	0.179694	0	1
dpt4	dpto==Arequipa	212719	0.032409	0.177084	0	1
dpt5	dpto==Ayacucho	212719	0.044251	0.205652	0	1
dpt6	dpto==Cajamarca	212719	0.051885	0.221796	0	1
dpt7	dpto==Cusco	212719	0.040932	0.198133	0	1
dpt8	dpto==Huancavelica	212719	0.040138	0.196282	0	1
dpt9	dpto==Huánuco	212719	0.049093	0.216063	0	1
dpt10	dpto==Ica	212719	0.033777	0.180655	0	1
dpt11	dpto==Junín	212719	0.042422	0.201551	0	1
dpt12	dpto==La Libertad	212719	0.038234	0.19176	0	1
dpt13	dpto==Lambayeque	212719	0.040974	0.198231	0	1
dpt14	dpto==Lima y Callao	212719	0.113319	0.316983	0	1
dpt15	dpto==Loreto	212719	0.053568	0.225164	0	1
dpt16	dpto==Madre de Dios	212719	0.029584	0.169436	0	1
dpt17	dpto==Moquegua	212719	0.02028	0.140958	0	1
dpt18	dpto==Pasco	212719	0.03184	0.175575	0	1
dpt19	dpto==Piura	212719	0.050127	0.218208	0	1
dpt20	dpto==Puno	212719	0.038558	0.192539	0	1
dpt21	dpto==San Martín	212719	0.043226	0.203366	0	1
dpt22	dpto==Tacna	212719	0.022913	0.149626	0	1
dpt23	dpto==Tumbes	212719	0.025184	0.156682	0	1
dpt24	dpto==Ucayali	212719	0.039376	0.194488	0	1

Two alternative sets of estimations will be carried out to analyze the incidence of GDP on child labour and school attendance in Peru. The first model will be an estimation including time dummies, which has the purpose to identify changes in probabilities of child labour and school attendance over the period 2001 to 2009. The second model consists in weighting micro effects against macro effects as determinants of child labour.

i. Time effects

The argument that will frame the estimation is that during period of economic growth, the probability for children of attending school is higher and the probability of participation in the work force will decrease. The dependant variables in the estimation are therefore school attendance and employ617 respectively.

Variables used for the estimation are first child's characteristics such as gender, total number of siblings, age and years of educations, on a second basis household characteristics are included such as its size and details on parental age, education, income and employment status. These variables have been chosen according to previous studies who have identified these variables as crucial in the decision making process on attending school and being employed[54]. The variables y1 to y9 are the dummy time variables for the observation period, where the omitted year is 2002.These are included to allow effect for economic growth. Therefore GDP per capita is not included in the regression since it is collinear to the time dummy variables. Finally dummy variables for provinces (Departamentos) have been included to control for the geographical, urban and rural effect.

Table 8 lists the estimated coefficients of the bivariate probit estimation. It should be noted that the observation number of children has been reduced to 105,922. This is explained due to missing observation for children and their corresponding information on parents. The value of rho(ρ) being different from zero, shows that the error term of both decision making processes are correlated. Consequently it is adequate to use the bivariate probit analysis instead of the separate and independent probit for each decision making process.

We can observe from table 8 that the probability of school attendance is significant for all of the parameters except for fathers income, employment status and age. We can further observe that all coefficients have the expected negative or positive probability on school attendance. In the case of probability for being employed or not as a child, the estimation shows that all coefficients are significant except for household size, age of the mother and the dummy year 2003. In this case, also most coefficients have the expected sign.

[54] For examples se Bhalotra and Tzannatos (2002)

Table 8 Bivariate probit regression time effects (Departmentos aside see Annex 2, p.39)

	_cons	child	siblings	edu_child	age_child	hhsize	edu_f	income_f
schoolatt	1.280***	0.099***	0.018**	0.060***	-0.135***	-0.022***	0.035***	0
	-0.08	-0.01	-0.01	0	0	0	0	0
employ617	-2.600***	0.154***	0.043***	-0.016***	0.186***	0	-0.032***	-0.000***
	-0.07	-0.01	-0.01	0	0	0	0	0
	pea_f	**age_f**	**edu_m**	**pea_f**	**age_m**			
schoolatt	-0.017	0.001	0.026***	0.047***	0.004***			
	-0.03	0	0	-0.01	0			
employ617	0.364***	-0.005***	-0.043***	0.571***	0			
	-0.03	0	0	-0.01	0			
	y2001	**y2003**	**y2004**	**y2005**	**y2006**	**y2007**	**y2008**	**y2009**
schoolatt	0.596***	0.828***	0.863***	0.805***	0.858***	0.859***	0.951***	0.960***
	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
employ617	0.217***	0.027	0.197***	0.226***	0.231***	0.237***	0.322***	0.360***
	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05

Obs	/athrho	rho	Wald chi2(86)	Prob > chi2	Log pseudolikelihood	Wald test of rho	chi2(1)	Prob > chi2
105922	-0.1517	-0.1505	29500.88	0	-76348.083	0	304.003	0

* p<0.05, ** p<0.01, ***p<0.001

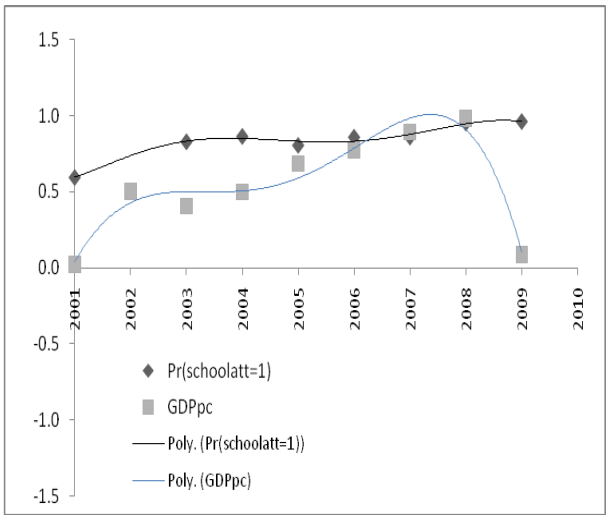
The coefficients of the above mentioned estimation have been plotted with GDP per capita growth against the years 2001 to 2009 to compare the estimated evolution of child labour and economic growth during the observation period (graph10 and 11). As the year 2002 has been the dropped dummy variable, a polynomial approximation has been undertaken to better predict the missing value of school attendance and child employment.

The graph shows a counter cyclical pattern between economic growth and child labour. Note that the probability of being a child and in the labour force is countercyclical in 2001 where GDP per capita is low, the same happens in 2009 where GDP per capita strongly decreased. Between 2001 and 2009 we can identify a slight countercyclical behaviour in the probability of child labour. Although overall it is more appropriate to state that the probability of child labour has maintained itself stable throughout the observation period. It might be interesting to note that after 2003 the probability of being employed increases slighlty. This might be explained through the increased pull of the labour market towards less qualified labour during the time of strong economic growth, which would be in accordance to the results

of the World Bank[55] study mentioned above. On the other side, graph 10 plots the probability of attending school. It is possible to identify a pro cyclical behavior: the higher the GDP per capita growth rate, the higher the probability of attending school. The tendency of the probability is increasing, which is interesting to see. Higher GDP per capita might have induced more demand for adult and qualified labour which in turn had a positive effect on household income, allowing them the "luxury" of sending their children to school. Incentives to send more children to school or keep them in education might have additionally increased as public basic education in Peru is free, thus lowering the cost of education.

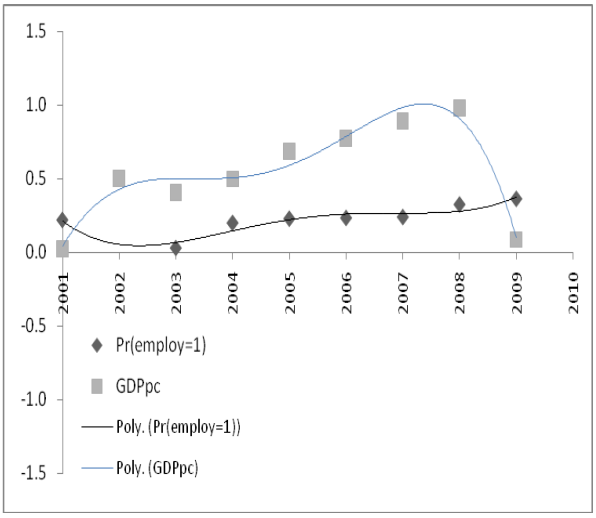
Graph 10

Probability of School attendance vs GDPpc growth



Graph 11

Probability of child labour vs GDPpc growth



A preliminary conclusion which can be derived from the above results could be that the increase in GDP per capita did not necessarily decrease the probability of employed children. Yet it did however increase the probality of attending school. As it is assumed that working and attending school are two interrelated decisions, an option for interpretation is to think that the number of children who work and simulatenously attend school has increased, as opposed to the number of children who work and do not attend school.

[55] World Bank (2005) publications results show that employment creation in Peru during 2001 – 2009 is still dominated by low-paying informal services. World Bank. 2005. *Opportunities for all: Peru poverty assessment*. Report No. 29825-PE. Washington D.C.: World Bank.

ii. Micro versus Macro effects in the determination of child labour

Another way to evaluate the effects of GDP on child labour is including GDP per capita as an independendant variable. This will be done, as the previous estimation might have a disadvantage regarding time dummies which not only reflect economic patterns of the country throughout the year, but also political, social or environmental impacts.

It is also important to note that monthly income of father and mother has been included. The variable has been constructed from household income extracting any other sources of income which are not generated by the parent. This is to guarantee that no child labour income is included in the overall household income. The estimation will follow the same model as above, the bivariate probit. Dependant variables are the same as above, school attendance and participation in the labour force (employ617). GDP per capita will be included in the estimation as it natural logarithm, the rest of the variables are kept the same as in the above estimation.

Table 9.a provides the result of this model. GDP per capita has a stronger effect on the probaility of school attendance than on child labour, it does however not reduce it. For the rest of the variables significance and effects are as in the previous model. Education of child and of father increase probablity of school attendance while decreasing probaility of child labour. On the other side, the age of the child decreases the probability of school attendance. It is also intresting to note that father income has no significant coefficent. These results are according to other studies on child labour in Peru[56].

Table 9.a MICRO MACRO (Departmentos aside see Annex 3, p.40)

	_cons	lnGDPpc	child	siblings	edu_child	age_child	hhsize	edu_f
schoolatt	-1.600***	0.769***	0.099***	0.019**	0.058***	-0.133***	-0.022***	0.035***
	-0.28	-0.06	-0.01	-0.01	0	0	0	0
employ617	-5.303***	0.613***	0.154***	0.043***	-0.015***	0.186***	0	-0.032***
	-0.23	-0.05	-0.01	-0.01	0	0	0	0
	income_f	**pea_f**	**age_f**	**edu_m**	**pea_m**	**age_m**		
schoolatt	0	-0.018	0.001	0.026***	0.055***	0.005***		
	0	-0.03	0	0	-0.01	0		
employ617	-0.000***	0.365***	-0.005***	-0.044***	0.569***	0		
	0	-0.03	0	0	-0.01	0		

Obs	/athrho	rho	Wald chi2(86)	Prob > chi2	Log pseudolikelihood	Wald test of rho	chi2(1)	Prob > chi2
105922	-0.1511	-0.1500	29500.88	0	-76567.037	0	303.979	0

* p<0.05, ** p<0.01, ***p<0.001

[56] OIT (2009) "El trabajo infantil en el Perú: Magnitud y Perfiles Vulnerables"

Table 9.b evaluates what impact these variables have on the joint decision to study and to work or alternatively to study and to not work. The method applied evaluates the absolute change in the joint probability when a change in each of the independent variable occurs (measuring marginal effects). The additional method measures the change in the joint probability as elasticity towards the dependant variables. Marginal effects measure the quantity of percentage points in which the joint probability will change when one of the independent variable changes. In this case, if GDP per capita increases by one unit, the probability of assisting to school and to work increases by 23.3%points. Likewise if the age of the child changes by one year the probability of assisting to school and to work increases by 5.3%points. Especially interesting is to see that when the employment status of either father or mother changes to employed then the probability of attending school and working increases by 10.5% points and 17.1%point respectively.

Elasticity measures sensitivity and is therefore able to standardize variance as measurement is made in percentages. Hence it is possible to measure which will be the % variance in the probability when facing variation in one of the independent variables. Therefore if GDP per capita increases a 100% the probability for a child to attend school and to work would increase fourfold. Likewise if the child is a boy, then the probability for this child to attend school and to work would increase is 0.1. Again, very high elasticity shows the variables on employment status of father and mother: these are employed than the probability of the child to attend school and to work would increase is 40% and 49% respectively.

Taking into account the joint probability of attending school and to not work as a child, we can see that very high sensitivity has GDP per capita and the age of the child. Medium sensitivity is shown by employment status of father and mother in determining the probability of a child to study and not to work.

Table 9.b Effects on probabilities vs changes in independent variable

	Marginal Effect			Elasticity		
	sign of effect	dy/dx	Statistical Significance	sign of effect	ey/ex	Statistical Significance
Probability of school attendance and work						
independent variables						
Ln GDP per capita	+	0.2331	yes	+	4.0918	yes
Child (being a boy)	+	0.0545	yes	+	0.1013	yes
Number of siblings in household	+	0.0147	yes	+	0.1441	yes
Education of child	-	0.0022	yes	-	0.0273	yes
Age of child	+	0.0539	yes	+	2.2549	yes
Household size	-	0.0008	no	-	0.0185	no
Education of father	-	0.0087	yes	-	0.2386	yes
income of father	-	0.0000164	yes	-	0.0883	yes
employment status of father	+	0.1056	yes	+	0.4093	yes
age of father	-	0.0015	yes	-	0.2509	yes
education of mother	-	0.0129	yes	-	0.2612	yes
employment status of mother	+	0.1710	yes	+	0.4951	yes
age of mother	+	0.0004	no	+	0.0533	no
Probability of school attendance and non-work						
independent variables						
Ln GDP per capita	-	0.1440	yes	-	1.0359	yes
Child (being a boy)	-	0.0425	yes	-	0.0324	yes
Number of siblings in household	-	0.0125	yes	-	0.0504	yes
Education of child	+	0.0089	yes	+	0.0454	yes
Age of child	-	0.0693	yes	-	1.1887	yes
Household size	-	0.0017	no	-	0.0161	no
Education of father	+	0.0129	yes	+	0.1443	yes
income of father	+	0.0000	yes	+	0.0373	yes
employment status of father	-	0.1076	yes	-	0.1707	yes
age of father	+	0.0016	yes	+	0.1105	yes
education of mother	+	0.0160	yes	+	0.1326	yes
employment status of mother	-	0.1649	yes	-	0.1964	yes
age of mother	+	0.0002	no	+	0.0110	no

A general conclusion which we can draw from this second estimation is that employment status of parent's matters in determining the probability of a child attending school and working or not working. Parents who are employed have a higher probability to generate income and well being for their households. Additionally if the employment of parents requires higher human capital, then it is most likely that these household are able to guarantee a socio-economic level which allow children to stay in school and/or not to work. Also the macro variable GDP per capita is relevant, according to results it might lead us to think, that as the economy grows and the population is better off, children will not need to work more to contribute to household expenditures. On the other side, economic growth might also encourage children to study, as the probability of attending school is higher.
Macro and Micro variables are relevant for the household decision making process regarding education and work of children. Where poverty is the principal reason why children work according to the negative relation between employment of parents and child labour and the positive relation between employment of parents and school attendance.

iii. Macro effects

What will be done in the following estimation model is to analyze if macro effects are important on its own as a determinant of child labour. Hence the bivariate probit model will be constructed as above, yet without allowing for micro effects such as the income of parents.

Results of this estimation are shown in table 10.a. The coefficients of the estimation for GDP per capita are both significant for school attendance and child labour. The magnitudes of the coefficients are not altered significantly either, especially for school attendance coefficient are nearly identical.

Evaluating the impact of these variables on the joint decision to study and to work or to study and not to work, the marginal effects of GDP per capita do not differ significantly. It has however a lower elasticity than the above model, although the change in probability I still highly sensitive to change in GDP per capita.

Table 10.a Macro effects (Departmentos aside see Annex 4, p.40)

	_cons	lnGDPpc	child	siblings	edu_child	age_child	hhsize	edu_f
schoolatt	-1.626***	0.773***	0.099***	0.018**	0.058***	-0.133***	-0.021***	0.036***
	-0.28	-0.06	-0.01	-0.01	0	0	0	0
employ617	-4.753***	0.512***	0.154***	0.050***	-0.016***	0.185***	-0.008*	-0.035***
	-0.21	-0.04	-0.01	-0.01	0	0	0	0

	pea_f	age_f	edu_m	pea_m	age_m
schoolatt	-0.018	0.001	0.026***	0.055***	0.005***
	-0.03	0	0	-0.01	0
employ617	0.359***	-0.005***	-0.047***	0.565***	0
	-0.03	0	0	-0.01	0

Obs	/athrho	rho	Wald chi2(86)	Prob > chi2	Log pseudolikelihood	Wald test of rho	chi2(1)	Prob > chi2
105922	-0.1506	-0.1495	29289.69	0	-76668.004	0	302.62	0

* p<0.05, ** p<0.01, ***p<0.001

Table 10.b Effects on probabilities vs changes in independent variable

	Marginal Effect			Elasticity		
	sign of effect	**dy/dx**	**Statistical Significance**	**sign of effect**	**ey/ex**	**Statistical Significance**
Probability of school attendance and work						
independent variables						
Ln GDP per capita	+	0.2008	yes	+	3.5149	yes
Child (being a boy)	+	0.0545	yes	+	0.1011	yes
Nr of siblings in household	+	0.0170	yes	+	0.1661	yes
Education of child	-	0.0025	yes	-	0.0303	yes
Age of child	+	0.0539	yes	+	2.2471	yes
Household size	-	0.0035	no	-	0.0779	no
age of father	-	0.0017	yes	-	0.2706	yes
Education of father	-	0.0097	yes	-	0.2651	yes
employment status of father	+	0.1043	yes	+	0.4027	yes
age of mother	+	0.0001	no	+	0.0187	no
education of mother	-	0.0140	yes	-	0.2826	yes
employment status of mother	+	0.1702	yes	+	0.4910	yes
Probability of school attendance and non-work						
independent variables						
Ln GDP per capita	-	0.1107	yes	-	0.7972	yes
Child (being a boy)	-	0.0426	yes	-	0.0325	yes
Nr of siblings in household	-	0.0149	yes	-	0.0599	yes
Education of child	+	0.0092	yes	+	0.0467	yes
Age of child	-	0.0693	yes	-	1.1892	yes
Household size	+	0.0010	no	+	0.0091	no
age of father	+	0.0018	yes	+	0.1194	yes
Education of father	+	0.0139	yes	+	0.1560	yes
employment status of father	-	0.1063	yes	-	0.1685	yes
age of mother	+	0.0004	no	+	0.0255	no
education of mother	+	0.0172	yes	+	0.1422	yes
employment status of mother	-	0.1641	yes	-	0.1954	yes

These effects might be associated to household level of risk aversion and expectations regarding the national economy. As the impact of GDP on school attendance is high and significant it suggests that economic growth promotes higher educational level possibility as it generates more employment opportunities for higher skilled individuals. In addition, if the economy as a whole faces a positive period of growth, families will in turn be affected by the positive effect on the labour market. This will increase their security levels regarding consumption smoothing and generation of income, making them more confident to keep children in school, instead of using them as insurance to unexpected income loss.

Section VI: Conclusions and policy implications

The present paper analyzed if the continuous economic growth in Peru has helped reducing the high child labour rates during the years 2001 to 2009. To do so, the data used is composed of a micro data set taken from the Peruvian national household surveys (ENHAO) and from a Macro data set available at the National Statistics Institute of Peru (INEI).

The methodology takes into account that the decision to work or to attend school are interlinked and decided jointly for a child. In other words the household can decide to send their child to study and to work at the same time. Specifically, the methodology determines the probability of a child attending school and working, as well as attending school and not working. This is done by applying the bivariate probit model. First graphical results show that the child occupation rate has experienced a slight decline when comparing 2001(32.7%) with 2009 (29.9%). Although peaks in child labour rates have been recorded for 2004 and 2005, estimates show that in the long run the higher the GDP per year the more decreases the child labour rate in Peru.

Through empirical results it has been shown that probability of school attendance had a tendency to increase during the economic growth while probability to participate in the labour force keeps relatively stable during the same year. Further estimated results on the occurrence of child labour and school attendance show that the employment status of parents and GDP per capita has a strong influence. These variables increase the probability for a child to study and to work, but also to study and not to work if employment status of parents is positive and or GDP per capita is high. These variables are especially favorable to an increase in school attendance.

These results imply that child labour in Peru is mainly a cause of poverty given the importance of GDP per capita and the employment status of parents in determining child work. The impact of the continuous economic growth has translated into households having increased confidence level in the future, due to favourable labour market conditions. This in turn allows parents to keep children attending school without having to worry about consumption smoothing in the future. However, the other side of the coin, still shows relatively high child labour rates which have decreased only slightly during the economic growth period.

These findings also translate into potential policy implications to reduce and prevent further increases in child labour. Special emphasis may be attributed to social protection policies which offer opportunities to each household to manage consumption smoothing without relying on income generated through child labour. In addition such programs are also able to positively alter the time allocation between work and school activities. Programs within social protection policies, such as “Juntos” might seek to increase incentives for parents and for children to continue with education trough reducing its costs and improving its access. “Juntos” acts as a conditional cash transfer (CCT) program, especially designed for household with children under 14 years of age and/or to pregnant women living in extreme poverty under the condition that children assist school. Other programs include “Foncodes” which promote improvements in per capita expenditure through generating employment and improve access to basic

services such as infrastructure, sanitary and education.[57] It is however left for further research to evaluate the impact of those programs in reducing and preventing child labour within the context of continuous economic growth in Peru.

Economic growth, although a necessary condition, is yet not enough to reduce sustainably present child labour rates. The actual economic growth does not reduce child labour rates unless it creates secure, guaranteed long term employment and income for parents might it be trough above mentioned programs or a better distribution of growth on a national scale.

[57] For further information on social protection networks in Peru see: World Bank. 2007. "Protección Social en el Perú ¿Cómo mejorar los resultados para los pobres?" Lima, Perú: World Bank.

ANNEX 1 - 4

Annex 1 ENAHO Survey question trying to identify labour condition of children of 6 years and older

Questions are directed to the head of household:

1) "Last week from … to … where you working or undertaking any task in or outside the household?"
   i. Yes
   ii. No

2) "Last week from … to … which of tasks did you undertake in or outside the household?

   i. helping out in the family business
   ii. helping out in household tasks
   iii. helping out in making product to sell
   iv. helping out on the fields, shepherding of animals
   v. selling products such as candy, sweets, etc.
   vi. offering services: cleaning cars, as shoeshine boy, etc.
   vii. making products at home such as sweaters, etc.
   viii. doing domestic work.
   ix. other

It is important to note that ENHAO Survey of the year 2001 does not include question 2. ENAHO Survey of the year 2002 has a different version of question 2 which does not include responses v. to viii.

Annex 2 Table 8 Departamentos

	Ancash	Apurímac	Arequipa	Ayacucho	Cajamarca	Cusco	Huanca velica	Huánuco
schoolatt	0.323***	0.548***	0.442***	0.304***	-0.044	0.238***	0.289***	0.088**
	-0.04	-0.05	-0.05	-0.04	-0.03	-0.04	-0.04	-0.03
employ617	-0.171***	0.079**	-0.803***	-0.521***	-0.517***	-0.001	0.115***	0.182***
	-0.03	-0.03	-0.04	-0.03	-0.03	-0.03	-0.03	-0.03
	Ica	Junín	La Libertad	Lamba yeque	Lima y Callao	Loreto	Madre de Dios	Moquegua
schoolatt	0.251***	0.127**	-0.177***	0.069	0.147***	0.012	0.302***	0.367***
	-0.05	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.06
employ617	-0.774***	-0.356***	-0.652***	-0.874***	-1.051***	-0.831***	-0.473***	-0.520***
	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04
	Pasco	Piura	Puno	San Martín	Tacna	Tumbes	Ucayali	
schoolatt	0.167***	0.053	0.243***	-0.077*	0.502***	0.301***	0.03	
	-0.04	-0.03	-0.04	-0.03	-0.06	-0.05	-0.04	
employ617	-0.295***	-0.382***	0.366***	-0.907***	-0.474***	-0.734***	-0.779***	
	-0.03	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03	

Annex 3 Table 9 Departamentos

	Ancash	Apurímac	Arequipa	Ayacucho	Cajamarca	Cusco	Huanca velica	Huánuco
schoolatt	0.321***	0.546***	0.443***	0.303***	-0.046	0.243***	0.291***	0.088**
	-0.04	-0.05	-0.05	-0.04	-0.03	-0.04	-0.04	-0.03
employ617	-0.173***	0.076*	-0.802***	-0.525***	-0.516***	-0.003	0.109***	0.178***
	-0.03	-0.03	-0.04	-0.03	-0.03	-0.03	-0.03	-0.03

	Ica	Junín	La Libertad	Lamba yeque	Lima y Callao	Loreto	Madre de Dios	Moquegua
schoolatt	0.250***	0.129***	-0.174***	0.058	0.138***	0.015	0.311***	0.380***
	-0.05	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.06
employ617	-0.775***	-0.357***	-0.653***	-0.869***	-1.049***	-0.828***	-0.473***	-0.521***
	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04

	Pasco	Piura	Puno	San Martín	Tacna	Tumbes	Ucayali	
schoolatt	0.169***	0.048	0.243***	-0.082*	0.515***	0.308***	0.029	
	-0.04	-0.03	-0.04	-0.03	-0.06	-0.05	-0.04	
employ617	-0.295***	-0.381***	0.363***	-0.906***	-0.475***	-0.738***	-0.778***	
	-0.03	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03	

Annex 4 Table 10 Departamentos

	Ancash	Apurímac	Arequipa	Ayacucho	Cajamarca	Cusco	Huanca velica	Huánuco
schoolatt	0.321***	0.545***	0.443***	0.303***	-0.046	0.243***	0.291***	0.088**
	-0.04	-0.05	-0.05	-0.04	-0.03	-0.04	-0.04	-0.03
employ617	-0.176***	0.090**	-0.814***	-0.515***	-0.511***	0.004	0.126***	0.184***
	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03

	Ica	Junín	La Libertad	Lamba yeque	Lima y Callao	Loreto	Madre de Dios	Moquegua
schoolatt	0.250***	0.129***	-0.173***	0.059	0.141***	0.015	0.313***	0.381***
	-0.05	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.06
employ617	-0.780***	-0.355***	-0.659***	-0.872***	-1.086***	-0.824***	-0.507***	-0.531***
	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.04

	Pasco	Piura	Puno	San Martín	Tacna	Tumbes	Ucayali	
schoolatt	0.168***	0.049	0.242***	-0.081*	0.516***	0.309***	0.029	
	-0.04	-0.03	-0.04	-0.03	-0.06	-0.05	-0.04	

employ617	-0.281***	-0.384***	0.382***	-0.907***	-0.488***	-0.763***	-0.783***
	-0.03	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03

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