

POVERTY, GROWTH, STRUCTURAL CHANGE AND SOCIAL INCLUSION PROGRAMS: A REGIONAL ANALYSIS OF PERU

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Abstract: Under a relative liberal market model of growth and social inclusion programs, in the last decade Peru has had one of highest rate of economic growth and declining levels of poverty and its severity in Latin America. However, more than 60% of the labor force in its 24 regions is still employed in informal activities of low productivity indicating absence of a significant structural change. This paper presents evidence suggesting that such declining rates may be explained by the regional labor reallocation measure of structural change between informal and formal activities rather than social inclusion programs and regional economic growth.

Key Words: Structural change, Peru, Poverty, Growth, Informal activities

JEL: R11, R5, I32,

1. Introduction

In the last ten years Peru has been one of the Latin American and Caribbean countries with an impressive rate of GDP growth (with an annual average of 6.5%) and declining poverty headcount rate (from 42.4% in 2007 to 25.8% in 2012¹). On the other hand, the fact that labor force² is still mainly employed in informal activities³ (71.6% in 2012) and output concentrated in primary goods, and services of low labor productivity would suggest that significative structural change has not occurred yet in Peruvian economy. Furthermore, main social programs devoted to alleviate poverty represented in 2012 an average transference of only 0.40 dollar a day per poor⁴. On this matter, recent literature point out that to the extent that growth is accompanied by ‘structural change’ or economic development, poverty reduction can be achieved. Thus, Rodrik & McMillan (2011) argue that: *“one of the earliest and most central insights of the literature on economic development is that this entails structural change. The countries that manage to pull out of poverty and get richer are those that are able to diversify away from agriculture and other traditional products. As labor and other resources move from agriculture into modern economic activities, overall productivity rises and incomes expand”*.

Given these facts and based upon a household regional panel data, this paper presents an exploratory empirical analysis of the association between poverty, its severity and three of their potential key determinants: economic growth, structural change, and public social programs. This analysis is organized in five sections. The first section describes the economic and social heterogeneity of the regions of Peru. The second section estimates three measures structural change. The third one briefly summarizes the literature on the subject and presents the ad-hoc specification to assess the relationship between poverty, growth, structural change and public social programs. The fourth section estimates such as specification and reports the results. The last section sums up the main results.

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2. Economic and social features of Peruvian regions

There are 24 regions in Peru, wherein the region of Lima is taken together with the region of Callao (the main maritime port of Peru). As shown in Tables 1, 2 and 3 there are large differences between regions in terms of per capita income, productivity, informality, and poverty indicators.

Table 1: Development Indicators of Peru by Regions 2011

Region	Y	g _Y	Pov1	Pov2	Pov3	Population 2011	Base Economic Sectors, 2001-2011 Sector Share out of total GVA% ³
Huancavelica	1491	1.99	58.4	54.6	49.5	0.48	A.13.46 Min.9.29, S.74.03
Apurimac	952	5.59	63.4	57.0	55.5	0.45	A.24.14 [S.62.67]
Huánuco	1045	3.22	53.8	54.1	44.9	0.83	A.28.07 [S.57.55]
Puno	1425	4.07	47.2	39.1	35.9	1.36	A.18.12, Min.7.96 [S.61.52]
Ayacucho	1398	5.62	61.1	52.7	52.6	0.66	A.21.81 [S.61.35]
Pasco	2850	2.11	50.7	40.7	41.9	0.30	Min.53.96, A.10.02 [S.33.03]
Cajamarca	1515	3.07	34.4	55.8	54.2	1.51	Min.29.18, A.19.17 [S.40.42]
Amazonas	1383	5.18	42.6	44.6	44.5	0.42	A.39.50 [S.49.63]
Loreto	1772	3.26	48.6	48.1	41.8	1.00	A.16.28, Fish.0.83, Min.8.42 [S.62.25]
Cuzco	2156	8.16	38.2	29.7	21.9	1.28	Min.12.40, A.11.75 [S.63.33]
Poor regions	1583	4.10	49.8	47.6	44.3	8.28	A.18.21, Min.15.99 [S.55.31]
Piura	2062	5.21	36.0	35.2	34.9	1.78	Fish.4.51, Man.20.54 [S.60.17]
San Martin	1488	4.93	33.0	31.0	29.6	0.79	A.28.40 [S.57.95]
Junín	2186	4.07	25.9	24.1	23.7	1.31	A.14.62, Min.10.44 [S.60.62]
Ucayali	1918	3.25	31.7	13.5	13.2	0.47	A.18.55, Fish.0.67 [S.63.72]
Ancash	2716	4.09	30.1	27.2	27.4	1.12	Min. 31.04, Fish.1.99 [S.47.07]
La Libertad	2473	5.65	24.0	29.4	30.6	1.77	A.20.87, Min.9.10, Man.19.82
Lambayeque	2035	4.35	15.4	30.4	25.2	1.22	A.10.93, S.75.24
Middle Inc.	2188	4.70	28.0	27.3	26.4	8.47	A.13.99, Fish.1.44, Min.10.86 [S.57.46]
Moquegua	6324	3.06	22.5	10.9	9.6	0.17	Min.23.82, Fish.1.68, Man.28.78 [S.40.31]
Arequipa	4197	5.58	15.6	11.5	11.9	1.23	A.14.14, Man. 19.60, Min.7.36 [S.58.41]
Lima-Callao	4844	5.18	12.6	15.8	14.4	10.21	Man.18.23, S.75.24
Tacna	3666	3.03	11.8	16.6	11.7	0.32	Min.18.71 [S.65.40]
Madre de Dios	3029	4.20	15.8	4.1	2.4	0.12	Min.39.47, A.9.72 [S.46.05]
Tumbes	1906	4.41	8.2	13.9	11.7	0.22	Fish.7.55, S.78.83
Ica	3799	7.60	5.4	10.9	8.1	0.76	Fish.1.17, A.16.80, Man.21.56 [S.54.92]
Rich Regions	4645	5.10	13.1	12.0	10.0	13.04	Man.18.37, S.72.99
Total Peru	3432	5.09	28.3	27.8	25.8	29.80	[S.67.02, Man.16.70, A.9.11, Min.6.63, Fish.0.54]

Source: INEI (2013a, 2012). Author work. Regional poverty baselines vary per region. y refers to per capita gross value added in US dollars of 1994 and g_Y its annual average rate of growth for period 2002-2011. Population in millions of people. Sectors in brackets are not base sectors. Notes: A.=Agriculture, S.=Services, ¹Pov1= Old Poverty Headcount Rate-2011¹; Pov2= New Poverty Headcount Rate 2011²; Pov3=Poverty Headcount Rate 2012²

Thus, in poor regions 44.3% of their population lived in poverty conditions in 2012. These ten poor regions in 2011 had a weighted average per capita gross real value added (GVA) of 1583 dollars of 1994 (denoted by 'y' in Table 1), i.e., less than a half of the respective value of Peru. Middle income regions are seven. Close to a quarter of the population living in these regions was considered poor and their weighted average per capita GVA in the same year was of 2188 dollars of 1994, i.e., more than a half of the respective value of Peru. On the other hand, the eight rich regions had a weighted average

¹ This rate is computed by multiplying the rate of change of the poverty headcount rate based upon per capita expenditure baseline of 2011 by the poverty headcount rate of 2010 which uses the per capita expenditure of baseline of 2010. ² Rate based upon the new per capita expenditure baselines methodology for the years 2011 and 2012 respectively. ³ The Poverty Index is the share of poor people out of the total regional population. Poor people spend less or equal than the poverty line expenditure.

per capita GVA of 4645, i.e., 35% higher than the respective value of Peru. In these regions one out of ten individuals were considered poor in 2012. With the exception of the Lima-Callao, most of the ‘base sectors’⁵ in the rest of regions were concentrated in primary goods (such as agriculture, fish and mining products), services and manufacturing (with lower share out of total GVA than the respective shares of the previous two sectors). Another difference among regions of Peru is the share their labor force (or economically employed active population, EEAP) employed in informal activities⁶ shown in Table 2. Thus, in 2011-2012 close to 84% of the labor force of poor regions was working on informal activities. The respective figures for middle income and rich regions were 78% and 60%. This means that 72% of the labor force in Peru was engaged in informal activities. This figure has slightly decreased from 2002 to 2012. Informal labor force in Peru has low levels labor productivity as shown in Tables from 3 to 5. By 2011, the size of labor productivity of informal workers was 4.8% of the size of the labor productivity of formal workers for poor regions. For middle income regions the respective figure was 7.4% and for the rich regions 8.8%. Taken all the regions, the ratio for Peru was 5.7% for 2011. This low ratio between both labor productivities is obtained despite of the higher rate of growth of labor productivity of informal workers than the respective rate of formal workers for period 2003-2011.

Table 2: Share of the EEAP and Informal Jobs by Region of Peru

Regions	Share of EEAP (%)				Share of Informal Jobs (%)			
	2002-08	2009-10	2011-12	2001-12	2002-08	2009-10	2011-12	2001-12
Huancavelica	1.66	1.57	1.59	1.64	90.73	88.44	88.22	89.92
Apurimac	1.63	1.54	1.55	1.61	88.09	87.90	88.20	88.14
Huánuco	2.97	2.84	2.79	2.92	91.07	88.60	85.51	89.83
Puno	5.27	5.02	4.96	5.21	88.57	87.03	87.02	88.05
Ayacucho	2.24	2.14	2.12	2.21	88.16	85.28	85.66	87.80
Pasco	0.92	1.00	0.98	0.94	77.93	76.24	76.99	77.71
Cajamarca	5.89	5.42	5.10	5.68	90.88	87.20	84.09	89.00
Amazonas	1.52	1.50	1.46	1.51	89.66	87.72	88.10	88.82
Loreto	3.11	3.03	3.08	3.08	79.65	78.39	77.81	79.03
Cuzco	4.87	4.67	4.70	4.83	85.93	81.76	79.96	84.33
Poor Regions	30.08	28.71	28.34	29.64	87.79	85.11	83.91	86.68
Piura	5.68	5.72	5.55	5.67	83.27	79.53	78.85	81.83
San Martin	2.74	2.71	2.74	2.73	85.90	81.14	82.27	84.28
Junín	4.54	4.35	4.39	4.49	84.53	81.27	79.15	83.28
Ucayali	1.47	1.64	1.66	1.53	78.55	77.85	78.34	78.55
Ancash	4.01	3.81	3.75	3.93	81.60	76.53	76.79	80.18
La Libertad	5.58	5.87	5.79	5.66	78.97	76.47	75.01	78.04
Lambayeque	3.91	4.08	3.98	3.95	81.62	81.72	80.42	81.08
Middle Inc. Reg.	28.00	28.18	27.85	27.96	82.15	79.12	78.35	81.04
Moquegua	0.64	0.62	0.62	0.63	66.95	61.83	63.87	66.12
Arequipa	4.18	4.06	4.09	4.15	72.20	65.99	66.58	70.53
Lima-Callao	32.28	33.60	34.20	32.82	62.25	61.03	58.14	61.81
Tacna	1.13	1.08	1.10	1.12	71.45	66.68	67.42	70.23
Madre De Dios	0.40	0.46	0.46	0.42	79.36	76.55	74.56	78.32
Tumbes	0.80	0.79	0.79	0.80	79.74	72.67	75.42	77.79
Ica	2.44	2.49	2.54	2.47	67.78	65.05	65.67	66.95
Rich Regions	41.91	43.11	43.81	42.41	64.39	62.26	60.17	63.72
Peru	100	100.00	100.00	100.00	76.40	73.57	71.96	75.36

Source: INEI-ENAH0 (2002-2011). Author's own work

Table 3: Labor Productivity of Formal and Informal Jobs by Region of Peru

Indicator	Period	Loreto	Cuzco	Poor	Piura	San Martin	Junín	Ucayali	Ancash	La Libertad	Lamba yegue
Average Total Labor Productivity (1994 US\$)	03-11	3282	2818	2738	3618	2336	3716	3519	4870	4247	3452
	03-08	3123	2486	2628	3396	2161	3541	3500	4673	4008	3267
	09-10	3490	3289	2898	3910	2650	3978	3551	5235	4590	3700
	2011	3815	3869	3077	4368	2755	4247	3572	5324	4992	4064
Growth Rate Total Labor Productivity	03-11	1.98	8.55	3.27	4.10	3.66	3.25	0.07	1.25	4.28	1.87
	03-08	0.78	8.13	3.11	4.19	4.03	3.75	0.01	1.25	5.28	0.94
	09-10	3.30	9.26	3.42	1.11	2.61	1.32	0.48	1.36	0.47	2.39
	2011	6.52	9.64	3.94	9.55	3.51	4.07	-0.39	1.02	5.91	6.36
Growth Rate Informal Labor Productivity	03-11	11.93	12.34	10.33	9.14	11.18	19.43	9.90	7.72	10.77	13.13
	03-08	11.57	15.34	11.07	8.34	17.60	27.00	13.20	5.27	16.34	16.76
	09-10	23.64	12.57	15.16	11.85	-1.55	-1.00	1.24	25.35	-4.11	4.89
	2011	-9.37	-6.11	-3.80	8.48	-1.93	14.89	7.42	-12.91	7.16	7.81
Growth Rate in Formal Labor Productivity	03-11	2.70	6.11	1.35	4.67	2.99	-3.61	-1.16	-1.82	1.77	2.07
	03-08	2.49	4.66	1.73	5.25	-1.15	-3.11	-2.89	-0.99	3.51	2.45
	09-10	-2.04	5.42	-4.31	1.46	-1.17	-3.10	5.17	-8.65	-4.56	1.73
	2011	13.47	16.19	10.33	7.61	36.11	-7.64	-3.48	6.89	3.98	0.53
Ratio Informal/Formal Labor Productivity (%)	03-11	5.39	3.09	3.34	2.95	9.89	4.62	9.89	2.48	4.56	4.01
	03-08	3.66	2.46	2.56	2.25	8.04	3.48	8.18	1.73	4.11	3.41
	09-10	9.04	4.67	4.98	4.42	14.60	6.47	13.17	4.04	5.56	5.08
	2011	8.50	3.65	4.77	4.19	11.55	7.71	13.61	3.89	5.29	5.42

Table 3: Labor Productivity of Formal and Informal Jobs by Regions of Peru

Indicator	Period	Middle Inc. Regions	Moque gua	Arequipa	Lima	Tacna	Madre De Dios	Tumbes	Ica	Rich R.	Peru
Average Total Labor Productivity (1994 US\$)	03-11	3680	11822	6958	8022	6355	4694	2948	5946	6678	5079
	03-08	3506	11806	6470	7549	6134	4539	2760	5356	6373	4761
	09-10	3945	11954	7832	8700	6695	4761	3220	7001	7166	5557
	2011	4189	11653	8140	9508	7005	5490	3526	7372	7528	6026
Growth Rate Total Labor Productivity	03-11	2.64	1.24	4.32	3.62	2.00	2.45	3.14	5.70	3.21	3.70
	03-08	2.78	2.91	5.60	3.61	1.52	1.15	2.26	7.01	3.44	3.80
	09-10	1.39	-1.88	1.79	2.44	3.30	1.49	4.53	3.44	2.16	2.59
	2011	4.29	-2.54	1.70	5.97	2.30	12.12	5.69	2.33	3.94	5.33
Growth Rate Informal Labor Productivity	03-11	11.61	4.52	11.99	14.52	18.63	21.21	17.58	12.29	14.39	11.74
	03-08	14.93	6.46	15.93	23.18	26.17	29.56	23.83	16.58	20.24	16.63
	09-10	5.24	-4.09	4.91	-2.90	8.31	3.61	5.88	8.96	3.53	3.38
	2011	4.42	10.09	2.50	-2.59	-5.93	6.28	3.43	-6.77	1.00	-0.89
Growth Rate in Formal Labor Productivity	03-11	0.70	1.27	1.94	3.07	2.64	0.98	-0.63	5.25	2.07	1.96
	03-08	0.44	1.86	2.21	3.06	1.91	-1.18	-1.88	7.25	1.89	2.10
	09-10	-1.30	-5.22	-0.51	5.69	-6.73	1.26	-3.30	-1.19	-1.43	1.41
	2011	6.29	10.71	5.26	-2.13	25.73	13.39	12.21	6.15	10.19	2.20
Ratio Informal/Formal Labor Productivity (%)	03-11	5.49	2.22	5.44	6.23	5.00	8.56	12.80	4.96	6.46	4.34
	03-08	4.46	1.83	4.22	5.42	3.61	6.48	9.89	4.00	5.07	3.58
	09-10	7.62	2.97	7.76	8.04	8.12	13.09	19.18	7.26	9.49	5.92
	2011	7.38	3.09	8.13	7.52	7.08	11.94	17.48	6.09	8.76	5.73

Source: INEI-ENAH0 (2002-2011). Author's own work

Structural change indicators

Development literature offers a diverse set of indicators of structural change. The most used are the sectoral outputs shares (e.g., Clark, 1940; Fischer, 1939; Cook, 2006), the ratio between consumer final goods (e.g., food) and producers (intermediate) goods (e.g. Syrquin 1988); product and export diversification (e.g., Imbs and Wacziarg, 2003; and Hausmann, Hwang, and Rodrik, 2007) and reallocation of labor (e.g., Chenery, Robinson, and Syrquin, 1986; Timmer and de Vries, 2008; and Rodrik and McMillan, 2011). This paper uses this latter indicator. The basic labor productivity (P_{rt}) decomposition for region 'r' at period is given by the following equation:

$$\Delta P_{rt}/P_{r(t-1)} = \sum_u \omega_{ru0} \cdot \Delta P_{rut}/P_{r(t-1)} + \sum_u \Delta \omega_{rut} \cdot P_{ru0}/P_{r(t-1)}; r=1, \dots, 24; t=2003, \dots, 2011; u=S, A, SA \quad (1)$$

Where P_{rt} is measure by the regional real gross value added per worker; ω_{rut} is the labor share out of the regional labor force of the productive unit, u at period 't', ω_{ru0} and P_{ru0} are the simple averages of the labor share and productivity respectively of period 't' and 't-1' and Δ is the differential operator. Three units of decomposition of the labor productivity are used: i) sectors, S (i.e., nine sectors)⁷, ii) activities, A (formal and informal) and iii) sector-activity, SA. The first component of the right hand side of equation (1) is the within effect component (WE). It measures the contribution to the labor productivity of the region within each productive unit (sector, activity or sector-activity). The second component of the right hand side of equation is the reallocation or between effect component (BE). It measures the contribution to the labor productivity of the reallocation of labor across productive units. Since the agriculture, hunting and forestry sector (i.e., s=1) and informal activities are the productive units having the lowest level of labor productivity⁸ then the RE effect for the respective unit 'u' can be decomposed in the following equations⁹:

$$RE_S = \sum_s \Delta \omega_{rst} \cdot (P_{rs0} - P_{r10})/P_{r(t-1)}; s=1, 9 \text{ (sectors)} \quad (2)$$

$$RE_A = \Delta \omega_{rinf t} \cdot (P_{rinf0} - P_{rf0})/P_{r(t-1)}; f, inf = \text{formal and informal activities} \quad (3)$$

$$RE_{SA} = [\sum_s \Delta \omega_{rfs t} \cdot (P_{rfs0} - P_{rinf s0}) + \sum_{s'} \Delta \omega_{rs' t} \cdot (P_{rinf s'0} - P_{rinf10})]/P_{r(t-1)}, s'=2, 9 \quad (4)$$

$$= RE_{SA1} + RE_{SA2}$$

These equations indicate that if the reallocation effect is positive then labor is moving from productive units of the lowest level labor productivity (i.e., sector 1 or informal activity) to units of high level of labor productivity (i.e., the rest of sectors or formal activities). The reverse occurs when the sign of the reallocation effect is negative. The sectoral reallocation effect (RE_S), however, does not capture the labor shifts across formal-informal activities of the same sector and therefore may over or underestimate the reallocation effect. On the other hand, the activity reallocation effect (RE_A) does not capture the labor shifts across sectors of the same activity (either formal or informal) over or underestimating also the contribution of the reallocation effects. The sectoral-activity reallocation effect (RE_{SA}) captures both components: the labor shifts across activities of the same sector (i.e., component RE_{SA1} , the first component of the right hand side of equation 4) and the labor shifts across sectors of the same activity-specifically of the informal ones¹⁰ (i.e., RE_{SA2} , the second component of the right hand side of equation 4).

The signs of these reallocation effects provide three different kinds of information about the productive structure of the regions of Peru. The sign of RE_S represents the direction of the change of the labor share of non-agriculture productive sectors. The sign of RE_A represents the direction of the change of labor share of informal activities in the regions. The sign of RE_{SA} represents the direction of change of labor share of formal activities

within each of the non-agriculture sectors as well as the change of the labor share of non-agriculture sectors. It should be noted from in equations (2) and (4) that the weights of the labor share of the non-agriculture sectors in equation (2) are much higher than their respective weights of equation (4). Due to these very low weights the value of RE_{SA2} is in general very low. As it is shown in Table 1, the labor mobility within informal activities and across non-agriculture sectors did not contribute in a significant way to the labor productivity growth of the regions of Peru. Estimations of the value added and labor force in all these equations are based upon the National Households Survey (ENAHO) implemented by INEI (2002-2012) and the factor of expansion of 2007.¹¹ Table 4, in the Annex, show the estimations of the three measures of structural change and within effects by group of regions and Peru for period 2003-2011. Column 'Fr' in this table shows the percentage of observations (regions-years) of the reallocation effects that had the same sign that the respective average reallocation effect for each period in the table. The figures indicate: The low contribution of the sectoral-activity reallocation effect of the growth of the regional labor productivity (i.e., less than 4.3%) for the average of the 24 regions of Peru has meant that the structure of formal and informal activities within each sector has not changed in a significant way 2003-2011 period, despite of the fact that the share of labor employed in informal activities decreased and that of non-agriculture sectors increased. However, these latter two changes were not significative for Peruvian economy as whole: an annual average rate of -0.55% for the share of labor in informal activities and 0.56% for non-agriculture sectors. The relative higher contribution of the sectoral and activity reallocation effects (RE_S y RE_A) to the regional labor productivity growth for most of regions is explained mainly for the high differences of labor productivity between agriculture and non-agriculture sectors¹² and formal and informal activities (Table 2) weights of the changes of the labor shares of such effects: i) In general throughout 2003-2011, in close of a half of the observations the three measures of reallocation effects were negative. That is, labor moved from sectors and/or formal activities of high labor productivity to sectors and/or informal activities of low labor productivity; ii) In a period of slight decrease of the rate of growth of GDP of Peru (i.e., 2009-2010), the relative high contribution of the RE_A y RE_{SA} y to less extent the RE_S to the regional labor productivity growth suggest that labor moved from declining (e.g., fishing and mining) to rising (construction and manufactures) to sectors within formal activities in most of regions of Peru. Nonetheless, from 40% to 50% of the observations in this period such effects were negative. That is, for some years and regions labor moved to informal activities across sectors. In 2011, year of 'recovery', the reverse occurs and the within effects of the change of the labor productivity for the non-rich regions of Peru explain most of the labor productivity group of the regions. The reallocation effects were negative in about 60% of the regions and the share of the worker in informal jobs grew. Summing up, for the relative long period 2003-2011 the RE_{SA} indicates that productive structure in the regions of Peru has not changed in a significant way and base sectors are the ones shown in Table 1. Further, data of the central bank of Peru (BCRP, 2013) points out such structure is similar to the nineties and eighties. On the other hand, in short periods, there exists a mobility of labor across sectors and activities being jobs in informal activities real alternative to formal ones in both recession and recovery periods of Peruvian GDP. The effects of this labor mobility on the level and the rate of change of poverty and its severity rate are analyzed in fourth section.

Poverty, growth and structural change: a brief literature review and an empirical framework

Most of the vast literature on the relationship between poverty and growth has been empirical in nature (e.g., Guiga & Rejeb, 2012; Cagé, 2009; Maloney, Perry, Arias, López and Servén, 2006; Dollar and Kraay, 2002; Gallup, Radelet, and Warner, 1998; Romer and Gugerty, 1997, among others). Although in general the evidence is mixed, there is a general presumption that economic growth will increase the income of poor and therefore reduce poverty. The channels by which growth reduce poverty are diverse. Among others: i) through the so called ‘trickle down effects’ (such as increasing the demand for goods produced by the poor, increasing the saving-credit and financial access to poor people; and creation of linkages, e.g., Dollar and Kraay, 2002 and Cagé, 2009); ii) through higher level of tax revenues collection and consequently increasing the budget allocated to poverty reduction programs (or social inclusion programs, e.g., Maloney *et al* 2006); iii) through the main drivers of growth (such as exports, capital accumulation, strengthens the institution and regulation framework, securing property rights, improving the accountability of elected officials, education, social and infrastructure investment, e.g., Dercon, Hoddinott, and Woldehanna, 2012).

Nonetheless, there are also arguments by which this general presumption may not well occur. Thus, Romer & Gugerty (1997) point out that if the Kuznets curve hypothesis (Kuznets, 1955) holds (i.e., as incomes grow in the early stages of development, income distribution would at first worsen and then improve as a wider segment of the population participate in the rising national income) then if income distribution became dramatically less equal with growth, poverty might not be declining.¹³ On the other hand, the obvious depth and persistence of poverty in some countries has created doubts about the ability of economic growth to reduce poverty. These doubts are especially prevalent among development professionals working directly with the poor in developing countries. In this regard, stabilization and structural adjustment measures that are prescribed to promote growth are widely perceived to deepen poverty, particularly in the short run, casting further doubt on the wisdom of attacking poverty through faster growth.

On the same line of negative arguments against the growth-poverty relationship, Norton (2002) indicates that some scholars assert that economic growth does not eliminate poverty and may exacerbate the problems of the poor (United Nations 1997). For example, Dreze & Sen (1990) and Sen (1997) claim that economic growth does not generate benefits in terms of numerous non pecuniary measures of well-being. Calls for increased government spending or other redistributions of wealth (Todaro, 1997) are the logical extension of the argument that growth does not ensure the elimination of poverty. In fact, some development economists contend that the “growth processes” typically “trickle-up” to the middle classes and “especially the very rich” (Todaro 1997). Finally, there are some empirical evidences suggesting that growth-poverty reduction do not necessarily applies for all sample of developing countries (e.g., Ravallion, 2001 and Foster and Svekely, 2008).

The relationship between structural change and poverty has been also addressed in the development literature since the work of Lewis (1954). Recent empirical studies with a predominant focus on Asian Countries can be found in Lavopa and Szirmai (2012), Aggarwal and Kumar (2012), UNU (2012), UNRISD (2010) among others. On this regard, Rosenweigh and Foster (2007) indicate that among the most pervasive features of the process of economic development is the shift of labor out of the agricultural sector

into other such sectors as manufacturing and services. This pattern is thought to be a necessary component of the process of sustained 'macroeconomic' growth and consequently reduced inequality or poverty. However, these authors postulate that the microeconomic foundations of the transition from an agriculture-based economy to a diversified industrial economy are poorly understood.

On the other hand, Syrquin (1988) argues that there are many uses of the concepts of structure and structural change in economics and that the most common use of structure in development and in economic history refers to the importance of sectors in the economy in terms of production and factor use and on the reallocation of resources across sectors. Lavopa and Szirmai (2012) summarize the studies which emphasize the former concept and conclude that output growth of primary and secondary activities have reduced poverty in developing countries and the respective effect of output growth of tertiary activities was not significant.

The second concept of structural change has been most used in the development literature focusing initially on the allocation of employment (Fisher, 1939; Clark, 1940) and later on production and factor use in general (Kuznets, 1973; Chenery, 1975). Thus, from the supply side Chenery *et al* (1986) and Syrquin (1988) points out that the rate of growth of TFP or alternatively labor productivity can be decomposed in two effects: the 'within effect (WE)' which measure the changes of productivity in each sector and the 'between or reallocation effect, RE' that measures the change of productivity due to the reallocation of resources among sectors or activities of different productivity. The reallocation effect (RE), when positive, shows the increase in efficiency that results when resources (labor, capital, firms) move from sectors with lower to higher marginal productivity, reducing the extent of disequilibrium. Moreover, when significant differences in factor returns (labor or total factor) or productivity across sectors (or activities) exist, structural change becomes an essential element in accounting for the rate and pattern of growth. Regardless of the measure, there are at least three mechanisms by which structural change may affect poverty in a developing economy: i) through the reallocation of labor from low to higher labor productivities activities and/or sectors¹⁴); ii) through its contribution to the labor productivity and income growth of the region wherein the poor reside; iii) through its impact on labor productivity and income growth of the activity or sector of the workers that remains in the region wherein they live.

The structural change-poverty literature using this second concept is scanty and most of the studies use the sectoral output share of the GDP as the measure of structural change and are descriptive in their analysis of the economies. Thus, Cook (2006) postulates that while some level of growth is obviously a necessary condition for poverty reduction and strong average growth has been accompanied by sharp reductions in poverty, the evidence is clear that it is not a sufficient condition, with variation both between and within countries in the way in which growth translates into improvements in human well-being, particularly for the poor. The two variables are generally positively correlated, but there are deviations – countries that have experienced higher levels of poverty reduction and human development despite slow growth (e.g., Bangladesh), and those where growth has not yet translated into significant improvements in human development (e.g., Pakistan). The challenges of creating and sustaining growth and promoting human development are shaped among other thing by transformations in the type and location of economic activity from predominantly rural and agricultural to urban-based industrial –

and increasingly service- and knowledge-based-economies: Asian countries which agriculture output share declined and manufacturing output share increased had important reductions in poverty.

UNU (2012) study on Brazil, Russia, India, China and South Africa (BRICS) finds that these economies have been successful to varying degrees in fostering economic growth and development through structural change in the past three decades. In China and India, structural change has resulted in the rise of the share of manufacturing and services, respectively, and the decline in the share of agriculture in GDP. In contrast, the manufacturing sector's share of value added shrank in the Russian Federation (1995-2008) and in South Africa. Service sector share, in contrast, increased in these two economies. This sector is the leading sector in South Africa, the Russian Federation and Brazil. China, however, is the only country where services do not account for over 50 per cent of GDP. These output shares changes had very different impacts on poverty reduction in the BRICS. Only in China did manufacturing growth directly and significantly contribute to poverty reduction. One major reason for this was that poor rural inhabitants migrating to urban areas found work in the manufacturing sector – the largest single sector of employment for migrant workers in China. It should be noted, however, that the decline in China's poverty is also attributable to policies that supported rural development and the position of small farmers. For Brazil, the Russian Federation and India, the rise of the services sector was accompanied by declining poverty rates.¹⁵

Studies related to the formal/informal labor flows postulate opposite views of its effects on poverty. In this regard, Bacheta *et al* (2009) argue that large informal economies may narrow the degree of export diversification, limit firm size (and hence productivity growth) and may act as a poverty trap preventing successful reallocation of jobs within the formal economy. On the other hand, based upon the experience of Kenya and Brazil, the study of UNRID (2010) find that working poor poverty rates tend to be higher in agricultural versus non-agricultural employment, and in informal versus formal employment. Poverty rates for self-employed workers in the formal sector and outside of agriculture are lowest, on average. In Brazil, self-employment in the informal sector has a lower poverty risk than informal wage employment. In Kenya, this same pattern holds true for men, but not for women. Overall, the highest risk of poverty is associated with agricultural employment. In Brazil, agricultural self-employment has lower poverty rates on average than agricultural wage employment. In Kenya, this pattern holds true only for women. Informal employment has much higher poverty rates than formal employment and agricultural employment exhibits the highest poverty risk.

In contrast with this literature, an ad-hoc relationship between poverty and its severity, growth and the three reallocation measures of structural change is analyzed for period 2003-2011. The two equations to be estimated are the following:

$$\ln y_{it} = \delta_{0it} + \delta_{1it} \cdot RE_{rit} + \delta_{2it} \cdot \ln GVA_{rit} + \sum_j \delta_{jit} \cdot \ln X_{jit} + \varepsilon_{it}; \quad (8)$$

$$\Delta \ln y_{it} = \beta_{0it} + \beta_{1it} \cdot RE_{rit} + \beta_{2it} \cdot \Delta \ln GVA_{rit} + \sum_j \beta_{jit} \cdot \Delta \ln X_{jit} + \varepsilon'_{it}; \quad (9)$$

r=1, 24; u=S, A, SA; t=2003-2011

y refers to per capita gross value added in US dollars of 1994.

Wherein 'ln' is the natural logarithm operator; 'Δ' is the one lag operator; y_{it} are the regional poverty headcount (POV)¹⁶ and severity (POV_{SEV})¹⁷ rates: RE is the structural change variable measure by the three reallocation indicators described in the Section III; GVA represent the three real gross value added (in US dollars of 1994) used: GVA,

GVA_F ; GVA_{INF} the regional, formal and informal respectively¹⁸; and X_{jrt} is the set of control variables. Since the work of Kuznetz (1955 and 1966) ad hoc empirical specifications as those equations are abundant in the literature. These have been used to relate inequality and growth (e.g., Benarjee & Duflo, 2003; Deininger & Squire, 1998; Bènavou, 1997), poverty, inequality and growth (e.g., Guiga & Rejeb, 2012, Fosu, 2010; Maloney *et al*, 2006, Norton, 2002; Ravallion, 2001 and 1995) and poverty, structural change and growth (e.g., Lavopa and Szirmai, 2012; Verme, 2010; and Chaterjee, 1995). From this literature, a series of control variables are used. In this paper, such variables are related to government social and infrastructure programs and projects to alleviate poverty directly. The effectiveness of social programs to reduce poverty has been analyzed using different methods such as program evaluation (e.g., Galasso, 2011) and ad-hoc empirical specifications (e.g., Caminada and Goudswaard, 2009 and Barrientos, 2011). Four types of social programs are included as control variables in the above specifications: i) social protection expenditures (G_{SP}), which includes programs to support determined population (e.g., communities, adolescents; old people, etc.); ii) health expenditures (G_{He}) which includes health programs addressed to prevent diseases, epidemic, malnutrition etc., iii) housing expenditures (G_{Ho}) which include programs to provide housing and sanitary services to lower income families, and iv) educational expenditures of primary level per student ($G_{EDUPrim}$). A fifth control variable is the share of public infrastructure¹⁹ out of the GVA of each region (called $SINV_{INFRA}$). Ali and Pernia (2003) list a series of channels by which public infrastructure affect poverty: i) through changes in the productivity of the productive activities of the poor and their effects on economic growth; ii) through changes of wages and level of employment of the poor; iii) through the change of the relative prices of the goods and services produced and consumed by the poor; and iv) through the effects of these channels on income and consumption of the poor.²⁰ This set of variables is obtained from MEF (2013) and INEI (2013b). The last control variable is the size of the labor force (EEAP) in a region. This could affect in both directions the level of poverty and its severity. Increases in the labor force may increase poverty and its severity if the ‘new labor force’ undertakes informal low productivity activities otherwise such an increase in labor force will reduce poverty and its severity.

Poverty, growth, social programs and structural change in the regions of Peru: an exploratory analysis and results

The method to estimate specifications (8) and (9) is the standard ‘one-way’ least square fixed and GLS random effects models²¹ with robust standard errors²². This method assumes that the stochastic term are decomposed in two components, regional and stochastic which satisfy traditional assumptions of zero expected value and zero covariance between different regions and time. For robustness purposes, for each equation and dependent variable 27 regressions with robust matrix of variance and covariance were implemented for each method. These 27 regressions come from using the set of control variables, each of the 3 real valued added (regional, formal and informal) with each of the reallocation effects measures (i.e., activity and sectoral-activity and their respective formal and informal components, the sectoral, and the two components of the sectoral activity of equation 7²³). For size limitations only the weighted least squares fixed effects were applied for the medium-income and rich regions. For all the regions and the poor regional group fixed and random effects methods were applied. Table 5, in the Annex, shows the set of descriptive statistics of the relevant variables considered in both equations. The figures indicate that poverty and its severity

average rates have declined during the period for all the regions. Nonetheless, poor regions still have very high levels of poverty (see Table 1). On the other hand, average regional shares of government expenditure in social programs and primary education per student were relatively low, although it grew during the 2003-2011 period. Note, also that the average regional rate of growth of the informal value added was much greater than the respective rate of the formal sector. Variability were higher for real value added variables and the labor productivity reallocation measures. Tables 7 and 8, In the Annex, report the summary of the regressions coefficients of the regressions implemented for each table. For each regional group, there are three columns. The first column shows the average of the coefficients statistically significant with the sign defined for the second column. This shows the share of the number of coefficients statistically significant with its respective sign out (between parentheses) of the total number of regressions implemented for each independent variable. The third column shows the share of number of coefficients not statistically significant and its respective dominant sign. The question mark in these two last columns means that half of the number of coefficients had positive sign and the other half negative sign. Although not reported unit roots panel tests for the set of independent and variables in levels rejected the null hypotheses of unit roots, due to small size of the sample this result need to be taken with cautions²⁴. In any case, variables in difference are more likely to be stationary than variables in natural logarithms. In fact, the results are more consistent for such variables (Tables 7 and 8). R^2 represent the averages of the regressions implemented. F and χ^2 are the respective averages for the fixed and random effects regressions implemented for poor regions and all the regions of Peru.

The results from equation (8) were mixed (Tables 6 and 8). The coefficients of social programs and expenditure in primary education per student were not statistical significative for most of the regressions. The exceptions were the significative impact of expenditure in primary education and health programs on reducing the severity of poverty for middle-income and rich regions respectively. For income and labor force variables, only the coefficient of the real gross value of informal activities was statistically significative negative and robust for poverty severity for all the regions of Peru, particularly for poor regions. For this region, the impact of such income and the regional real gross value added also were statistical significant and robust in reducing the level of poverty. Similar results were obtained for structural change variables wherein only the activity (and its formal component) reallocation effect had a statistically and robust impact on reducing poverty and its severity for middle-income regions.

Much better statistical results were obtained from equation (9) (Tables 7 and 8). The impact of the rate of change of health programs was statistically significative and robust in reducing the rate of change of poverty severity for all the regions of Peru (particularly, for middle-income and rich regions). On the other hand, the rate of change of housing programs and the expenditure in primary education per student were statistically significative and robust on reducing the rate of change of poverty headcount rates (particularly from poor regions).

None of the rates of growth of income variables were statistically significative and/or robust in reducing the rate of change of poverty and its severity. In contrast, the growth of the labor force has reduced the rate of change of poverty and its severity in all regions of Peru (particularly in poor and rich regions). This result may indicate that new labor force was employed in formal, informal or sectoral jobs with non-poverty wages.

In contrast to the above variables, the results for most of the structural change variables were statistically robust and consistent across regions. Thus, labor reallocation from informal to formal activities and/or increasing labor share of the formal activities have impacted negatively on the rate of change of poverty and its severity in all regions of Peru (particularly for poor and middle-income regions). On the other hand, higher labor share of informal activities has increased the rate of change of poverty in the regions of Peru (particularly in poor and middle income regions). Similar results, although less robust statistically (particularly for poor and middle income regions), were obtained for the sectoral-activity reallocation effects indicators. The labor reallocation from agriculture, hunting and forestry to the rest of sectors was statistically significant and robust in reducing the rate of change of poverty only for rich regions. The negative impact for the rate of change of poverty severity was statistically significant and robust for middle-income and rich regions. See Annex for Descriptive statistics and regression results.

Despite of the size limitation of the estimates, the overall results are consistent with the mixture of findings of the effects of growth on poverty reported in the literature summarized in previous section. This mixture of results also applies for the effect of social programs. Thus, Gallup *et al* (1998) did not find evidence that existing health, education, or population programs specially benefit the poor, over above how they affect overall economic growth. Vakis & Perova (2009) provides some micro evidence on the welfare impact of social program called 'Juntos' (a conditional transfer program) of Peru. Their results are partially consistent with the 'macro' approach of this paper. They conclude that whereas 'Juntos' have not reduced poverty headcount neither extreme poverty; however, it has decreased poverty gap and its severity by increasing monetary income and consumption. Similar methodology and results on poverty was reached by Galasso (2011) for the social protection-and-cash transfer program 'Chile Solidario'. Positive effects in reducing poverty of social-insurance and money assistance programs were found for Taiwan (e.g., Wang and Ku, 2011). For the public investment infrastructure rate the estimations produce very weak results, although this rate affected negatively to poverty when all the regions (particularly from rich regions) are considered in the regressions. Most of the studies in the literature (e.g., Seetanah, Ramessur and Rojid, 2009; and Ali and Pernia, 2003) find that investment infrastructure, specifically access of poor people to goods and services draw upon this investment improve the income of the poorest (e.g., Webb, 2013; Pouliquen, 2000). Institutional aspects also matters for the effectiveness of investment infrastructure in reducing poverty, at least for the case of Peru (e.g., Escobal and Ponce, 2011). Neither access nor institutional aspects are captured by the variable used in this paper.

Finally, despite of the small size of the sample (particularly in the number of years), which indicates that the estimation results of equations (8) and (9) reported need to be considered as exploratory in nature and be taken with caution, the statistically robust estimations point out that the relative small structural change (particularly measure through the activity and the sectoral-activity reallocation effects) experienced in period 2003-2011 seem to have had a notable impact on the reduction of poverty and its severity in the regions of Peru. This impact seems to have outperformed the weak impact of the regional economic growth on such rates.

Conclusions and final remarks

The objective of this paper has been to provide statistical evidence of the role of economic growth, structural change, and social public programs upon the reduction of poverty and its severity at the level of 24 regions of Peru for period 2003-2011. Based upon an empirical ad-hoc specification model, the evidence indicates, on the one hand, that the reallocation of labor from informal to formal jobs and/or the increase of the labor share of formal jobs may have contributed in reducing poverty and its severity in the regions of Peru in such a period. On the other hand, the direct impacts on poverty of regional economic growth, social programs, expenditures on primary education and public infrastructure were in general mixed and statistically non-robust for some regions of Peru. Despite of these positive effects on poverty of the activity measure of structural change, the evidence also points out that the magnitude of structural change has been small which means that in the last decade the high rate of economic growth of Peru and its regions has been still accompanied by a labor force employed predominantly in informal activities (close to 75%) and by a large labor productivity gaps at the regional, sectoral and activity levels. These facts indicate that Peruvian economy has experimented economic growth without economic development. To revert this state of affairs interventions (public, private or both) may be required to foster structural change and regional economic development.

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FINAL NOTES

1. It is worth mentioning that in the new methodology to measure poverty (INEI, 2012, 2013a) used since 2011 the average rate of change of the per capita baseline expenditure in current US dollars for period 2007-2012 grew 7.3%, whereas the respective per capita GDP grew in 12.2%.
2. Any individual between of 14 or more years of age belongs to the labor force when: i) it had an temporal or fixed employment (which is not a household job) wherein it worked at least one hour during the week previous to the survey week; or ii) it did not have a job the previous week to the survey week although it had a fixed employment or business working at least an hour and that in the near future this individual will work again; or iii) it did a work activity at least one hour to obtain monetary or non-monetary income. It includes individual helping relatives without a salary working 15 or more hours per week.
3. In this paper, the definition of informal activities follows that of the 1993-15th International Conference of Labor Statisticians of the International Labor office. That is, an individual, independent worker, a family worker without pay, or firm is 'informal' if engaged in productive activities within an establishment that is not legally registered or that does not keep a complete set of accounts". The 'informal activities' do not include government or army activities. For the case of Peru, the informal labor force is estimated using the Households National Survey, ENAHO (INEI-ENAHO, 2002-2012) and the factor of expansion of 2007.
4. In 2012, a poor is an individual that earned less than 3.6 US dollars a day.
4. Let s_{it} be the output share (out of the total real gross value) of sector 'i' of region 'r' at period 't' and s_{it} is the respective share for the Peruvian economy. The average ratios of these shares, $R_{it} = s_{it}/s_{it}$, greater than one for period 2001-2011 are identified as regional base sectors.
5. The literature has a variety of measures of 'informality'. Perry, Maloney, Arias, Fajnzylber, Mason, and Saavedra-Chanduvi (2007) summarize the main measures used in the literature of informality. Among others: i) informality is measure by the percentage of sales that businesses do not report for tax purposes; ii) "a salaried worker is informal if s(he) does not have the right to a pension linked to employment when retired" (e.g., Gasparini and Tornarolli, 2006); iii) "an individual is considered an informal worker if (s)he

belongs to any of the following categories: unskilled self-employed, salaried worker in a small private firm, zero-income worker” (Gasparini and Tornarolli, 2006); iv) a self-employed (i.e. Loayza and Rigolini 2006); v) informal activity as the shadow economy which includes all market-based legal production of goods and services that are deliberately concealed from public authorities for the following reasons: (a) to avoid payment of income, value added or other taxes, (b) to avoid payment of social security contributions, (c) to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and (d) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms” (Schneider 2005, and Schneider, Buehn & Montenegro, 2010). In the paper, I use the ICSL-ILO (1993) definition of informal activities.

6. These are: Agriculture, hunting and forestry; Mining and Electricity; Manufacture; Construction; Trade; Transport and Communications; Restaurants and Hotels; Government Services; and Other Services.

7. The average ratio between the labor productivity in any non-agriculture sector and the respective productivity of the agriculture sector in period 2002-2011 varies between 2.3 (for restaurants and hotels) and 22.5 (for mining). Table 3 shows the figures of the ratios of labor productivities between informal and formal activities.

8. Note that $\sum_u \omega_{uit} = 0$; for any $u = S, A, SA$.

9. Note that the average ratio between the labor productivity of any non-agriculture sector and the respective of the agriculture sector in informal activities in period 2002-2011 varies between 1.18 (for restaurants and hotels) and 1.9 (for transport and communications).

10. Informal gross value added of informal activities (GAV_{INF}) is estimated using data of informal microenterprises obtained from INEI-ENAH0 (2002-2012). Informal gross value added includes sales in production, trade and services minus input production expenditures (without discounting taxes) plus wages and auto-consumption value. GVA of formal activities is estimated by the difference between the regional GVA and GAV_{INF} . Labor force employed in informal activities is estimated from the sample of the ‘Independent worker’ component of INEI-ENAH0 (2002-2012) and the factor expansion of 2007 correspondent to each worker.

11. See footnote 8.

12. Against this argument, the evidence indicates that income distribution does not change dramatically in most countries.

13. It should be noted that poverty will decline only if non-agriculture sectors and/or formal activities can absorb the semi-skilled and unskilled labor released from the agriculture sector and/or informal activities (Aggarwal and Kumar, 2012).

14. Aggarwal and Kumar (2012) and Mallick (2013) present evidence on India suggesting that increases in non-agricultural GDP have contributed to reduction of poverty in rural areas.

15. This rate measures the percentage of the population living below the national poverty line (i.e., a fixed cost of a bundle of goods). This cost varies per year and region. For example, in 2012, this cost at national level was 3.6 US dollars per day.

16. Thus, let ‘z’ and ‘g’ be the poverty line and the per capita expenditure on goods of services of a poor households ‘i’ respectively and ‘n’ the number of poor households then: $POV_{SEV} = \sum_i [(z-g_i)/z]^2/n$. Note that in the data z varies per region.

17. See footnote 11.

18. It includes: roads, irrigation, electricity and so on.

19. For example, Seetanah, Ramessur and Rojid (2009) and Poulighen (2000).

20. Heterogeneous and dynamic non-stationary panels techniques (e.g. Baltagi, Fomby and Carter, 2000; Frank and Blackburne III, 2007) are not applied due to the small size of the sample.

21. For fixed effects cross section heteroskedasticity weights for the parameters and White cross-section weights for the variance of these parameters were used. For random effects, the Swamy-Arora variance for the components and the White cross-section were used for most of the regressions. The exceptions were 29 random effects regressions (i.e., 15 for regressions $\ln POVS$ of Peru, 12 for $\ln POVS_{SEV}$ and 2 $\ln POVS$ for poor regions) wherein the Wallace-Hussain variance for the components was used.

22. Note that $RE_A = P_{rinf0} \cdot \Delta \omega_{rinf} + P_{rf0} \cdot \Delta \omega_{rf}$. The first component, RE_{AF} , is the formal component and the second the informal component, RE_{AINF} . Also $RE_{SA} = \sum_s \Delta \omega_{rfst} \cdot P_{rfs0} + \sum_s \Delta \omega_{rinfst} \cdot P_{rinf0}$. The first component RE_{SAF} is the formal component and the second RE_{SAINF} is the informal component.

According to Levin, Lin and Chu (2002), panel data unit roots tests are more powerful than individual data variables for moderate size of the sample with a minimum of 10 cross-sections individual and 25 years.

Annex on line at the journal Website: <http://www.usc.es/economet/eaat.htm>

Annex

Table 5: Descriptive Statistics of the Relevant Variables of Equation 8 and 9, 2003-2011 (%)

Variable	Poor Regions			Middle Income Regions			Rich Regions			Peru		
	Averg.	VCcoef	%g	Averg.	VCcoef	%g	Averg.	VCcoef	%g	Averg.	VCcoef.	%g
POV										45.5		
									-13.			
POV _{SEV}	64.1	17.9	-4.6	42.765	26.6	-8.7	21.8	35.1	0	44.6	-8.3	
			-11.			-17.			-19.	7.2	-	
	12.0	49.0	3	5.721	49.8	0	1.8	62.4	2	94.2	15.	3
1.Public Social Programs and Infrastructure												
SG _{SP}	2.1	75.3	7.8	0.8	69.4	7.0	0.6	107.5	-0.4	1.3	102.7	5.2
SG _{Ho}			33.			43.			29.			35.
	1.3	112.3	4	0.09	150.6	2	0.1	114.9	0	0.12	122.2	0
SG _{He}	2.5	62.1	6.0	1.3	35.9	4.4	1.3	50.5	4.9	1.8	69.0	5.2
¹ G _{EDU_Prim}			10.						10.	268.3		
	258.0	33.9	0	228.5	31.0	9.5	322.8	33.5	0		36.1	9.7
SINV _{INFR}			15.						14.	3.5		13.
_A	4.4	93.0	6	2.4	83.5	9.9	3.2	190.0	0		127.8	5
2.Labors and Income Variables												
EEAP ²	414.9	55.2	2.0	563.8	35.3	3.0	853.0	184.0	3.0	586.1	150.4	2.6
GVA ³	1,067.			2,143.			6,607.			2,997.		
	0	59.0	5.1	2	46.9	5.5	8	197.4	6.0	0	247.7	5.5
VA _F ³				1,778.			5,936.			2,604.		
	851.4	60.2	4.4	1	51.4	4.6	0	198.2	5.3	6	257.6	4.7
VA _{INF} ³									10.			
	215.6	67.5	7.8	365.1	45.1	8.6	671.9	198.4	0	392.2	191.7	8.6
3.Structural Change Indicators												
RE _S	2.48	658.2		0.84	1218.8		0.85	813.6		1.53	815.3	
RE _A	1.71	589.8		1.61	593.0		0.74	1293.4		1.40	697.3	
RE _{SA}											25144.	
	-0.75	5692.8		2.13	986.2		-0.60	4731.3		0.13	6	
RE _{SA1}											32849.	
	-0.80	5310.6		2.10	999.6		-0.61	4638.5		0.10	1	
RE _{SA2}	0.05	1125.5		0.03	1972.2		0.01	5283.3		0.03	1738.8	

Source: INEI-ENAH0 (2002-2012). Author's work. ¹ US dollars of 1994. ² Thousand of people. ³ In millions of US dollars of 1994.

Table6: Regression Estimates of Equation (8) for Regional Groups of Peru, 2003-2011

Variables	Poor Regions						Middle Income Regions						Rich Regions					
	lnPOV			lnSEVPOV			lnPOV			lnSEVPOV			lnPOV			lnSEVPOV		
	Coef	%S	NS	Coef	%S	NS	Coef	%S	NS	Coef	%S	NS	Coef	%S	NS	Coef	%S	NS
1.Public Social Programs and Infrastructure																		
lnSG _{SP}	-	0.07***	63(-)	31(-)	-0.1***	31(-)	69(-)	-0.02	100(-)	-0.04	100(-)	-0.02	100(-)	0.03	100(+)			
lnSG _{H0}	-	0.008**			0.009**				100(-)	-0.005	100(-)	-0.003	100(-)	0.007	100(+)			
lnSG _{He}	-	-0.2**	61(-)	33(?)	-0.2***	43(-)	57(-)	-0.2	100(-)	-0.3*	30(-)	70(-)	0.2	100(+)	-0.2	100(-)		
lnG _{EDU}	-	-0.2**	33(-)	67(+)	-0.6***	43(-)	57(-)	-0.7**	48(-)	52(-)	-1.3**	100(-)	-0.4*	56(-)	44(-)	-0.5*	4(-)	96(-)
lnSIN	-	0.010		100(+)	0.03		100(+)	0.1		100(+)	0.1		100(+)	-0.02		-0.04		100(-)
V _{INFRA}	-																	
2.Demand, Income, Export Variables																		
lnEEA	-	-1.1**	50(-)	43(+)	-1.8**	33(-)	67(-)	-1.8**	100(-)	-3.1**	63(-)	37(-)	3.0***	100(-)	0(?)	-3.6**	100(-)	0(?)
P	-																	
lnGVA	-	-0.4**	100(-)		-0.3***	6(-)	94(-)	0.2	100(+)	0.8		100(+)	-0.07		-0.4			100
lnGVA _F	-	-0.2		100(-)	0.2		100(+)	0.7**	100(+)	1.3*		100(+)	-0.4		-0.6			100
lnGVA _{INF}	-	-0.2***	100(-)		-0.4***	100(-)		-0.07	100(-)	-0.1		100(-)	0.06		-0.05			100
3.Structural Change Indicators																		
RE _S	-	0.0008					100(+)	0.001	100(-)	-0.003	0(?)	100(-)	-		0.01*			100
RE _A	-	-0.0002		100(-)	0.0005		100(+)	0.003	100(-)	0.006		100(-)	-		100(-)	-0.003		100
RE _{AF}	-	-0.0002		100(-)	0.0006		100(+)	0.002	100(-)	0.006		100(-)	-		100(-)	-0.003		100
RE _{AI}	-	0.006		100(+)	0.01		100(+)	0.03	100(+)	0.05		100(+)	-0.01		100(-)	-0.02		100
RE _{SA}	-	0.00005		100(-)	-0.0002		100(-)	0.000	100(-)	-0.001		100(-)	-		100(-)	0.001		100
RE _{SAF}	-	0.00005		100(-)	-0.0002		100(-)	0.000	100(-)	-0.001		100(-)	-		100(-)	0.001		100
RE _{SAIN}	-	0.007		100(+)	0.01		100(+)	0.03*	67	33	0.04		100(+)	0.0007		100(+)	0.02	100
RE _{SA1}	-	0.00005		100(-)	-0.0002		100(-)	0.000	100(-)	-0.001		100(-)	-		100(-)	0.001		100
RE _{SA2}	-	-0.004		100(?)	-0.003		100(?)	0.02	100(+)	-0.005		100(-)	0.006		100(+)	0.07		100
Constant	-	15.0**	100		16.5*	93	7(+)	24.7	100	33.7	22	78	46.5	100		53.1	100	
R ²	-	0.247			0.216			0.03		0.09			0.00			0.00		
χ ²	-	455.8	100(+)		229.4	100		60		86			38			01		

F-test 74.45 100(+)
***) 524.7 100
1*** (+)

Source: INEI-ENAH0 (2002-2011). Author's own work. The sign between parentheses means the dominant sign of the coefficients of the regressions implemented by each variable. The question mark symbol (?) means that half of the sign of the coefficients were positive and the other half negative. *, **, ***, 10%, 5%, and 1% level of statistical significance respectively.

Table 7 Regression Estimates of Equation (9) for Regional Groups of Peru, 2003-2011

Variables	Poor Regions						Middle Income Regions						Rich Regions					
	dlnPOV			dlnSEVPOV			dlnPOV			dlnSEVPOV			dlnPOV			dlnSEVPOV		
	%N		S	%N		S	%N		S	%N		S	%N		S	%N		S
	Coef	%S		Coef	%S		Coef	%S		Coef	%S		Coef	%S		Coef	%S	
1.Public Social Programs and Infrastructure																		
$\Delta \ln SG_{SP}$	-0.01		100(-)	-0.05*	48(-)	52(-)	0.02		100(+)	0.02		100(+)	-0.02		100(-)	-0.04		100(-)
$\Delta \ln SG_{Ho}$	-0.010**	100(-)		-0.02*	26(-)	74(-)	-0.006		100(-)	-0.008		100(-)	-0.02*	33(-)	67(+)	0.01		100(+)
$\Delta \ln SG_{He}$	-0.04		100(-)	-0.1*	85(-)	15(-)	-0.2**		100(-)	0(?)	-0.3*	96(-)	4(-)	-0.03		100(-)	-0.4**	100(-)
$G_{EDUPRIM}$	-0.03***	100(-)	0(?)	-0.05*	50(-)	50(-)	-0.04*	89(-)	11(-)	-0.06*	81(-)	19(-)	-0.02		100(-)	0.02		100(+)
$\Delta \ln S_{INVIN}$		100(+)			100(+)			100(+)			100(+)		100(+)					100(+)
FRA	0.03		)	0.04		)	0.03		)	0.05		)	0.02		100(+)	0.06		)
2.Demand, Income, Export Variables																		
$\Delta \ln EEA_P$	-0.8***	100(-)		-2.0***	100(-)	0(?)	-0.6		100(-)	-0.8		100(-)	-2.0**		100(-)	-4.2**		100(-)
$\Delta \ln GVA$	-0.3*	39(-)	61(-)	0.1	0(?)	)	-0.2		100(-)	-0.1		100(-)	1.0	0(?)	100(+)	3.6**		100(+)
$\Delta \ln GVA_F$	0.08		100(+)	0.3	0(?)	)	0.4*	22(+)	78(+)	0.2		100(+)	-0.2	0(?)	100(-)	0.6		100(+)
$\Delta \ln GVA_{INF}$	-0.04		100(-)	-0.06	0(?)	100(-)	-0.06	0(?)	100(-)	-0.06		100(-)	0.1*		100(+)	0.3**	11(+)	89(+)
3.Structural Change Indicators																		
RE_S	-0.01		100(-)	0.07		100(+)	-0.2	0(?)	100(-)	-0.7**	100(-)		-0.8**		100(-)	-1.9**		100(-)
RE_A	-0.2**	100(-)		-0.4**	100(-)	0(?)	-0.4**		100(-)	0(?)	-0.8***	100(-)		-0.4*		100(-)	-1.3**	33(-)
RE_{AF}	-0.2**	100(-)		-0.4**	100(-)	0(?)	-0.4**		100(-)	0(?)	-0.8***	100(-)		-0.4*	67(-)	33(-)	-1.2**	33(-)
REA_A									100(+)			100(+)						100(+)
INF	6.6*	100(+)		14.2*	83(+)	17(+)	8.8*		)	10.1*		)	2.2		100(+)	3.0		)
RE_{SA}	-0.02		100(-)	-0.04		100(-)	-0.09		100(-)	-0.3		100(-)	-0.3***		100(-)	-0.5**		100(-)
RE_{SAF}	-0.02		100(-)	-0.04		100(-)	-0.09		100(-)	-0.2		100(-)	-0.3***		100(-)	-0.5**		100(-)
RE_{SAI}						100(+)			100(+)			100(+)						100(+)
NF	3.2*	33(+)	67(+)	6.5		)	5.2**		)	4.9		)	4.7*	33(+)	67(+)	5.8		)
RE_{SA1}	-0.02		100(-)	-0.04		100(-)	-0.09		100(-)	-0.2		100(-)	-0.3***		100(-)	-0.5**		100(-)
RE_{SA2}			100(+)			100(+)												100(+)
	0.5		)	3.0		)	-2.3		100(-)	-4.8		100(-)	2.5	0(?)	100(+)	5.7		)
Const	25.2**	100(+)		31.3**	100(+)		Const	2.8		100(+)	8.6*	15(-)	85(-)		100(+)	30.6**	52(-)	48(-)
R^2	0.2606			0.2042			0.2772			0.1748			0.1395			0.2291		
χ^2	1281***	100(+)		5240***	100(+)													
F-test	1823***	100(+)		102**	100(+)													

Source: INEI-ENAH0 (2002-2011). Author's own work. The sign between parentheses means the dominant sign of the coefficients of the regressions implemented by each variable. The question mark symbol (?) means that half of the sign of the coefficients were positive and the other half negative. *, **, ***, 10%, 5%, and 1% level of statistical significance respectively.

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