Rural income dynamics: Understanding poverty and inequality changes in rural Peru

Insa Flachsbarth[1], Jann Lay[2], Alberto Garrido[3]

[1] University of Göttingen, RTG GlobalFood, Insa.Flachsbarth@agr.uni-goettingen.de

[2] German Institute of Global and Area Studies, University of Göttingen, Jann.Lay@giga-hamburg.de

[3] Universidad Politécnica de Madrid, alberto.garrido@upm.es

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Abstract

Rural Peru has shown poverty and inequality reductions, but some regions lag behind. We analyse the driving forces behind these trends by using microsimulation-based decompositions. We find that poverty and inequality reductions are mainly attributable to positive price effect in Peru's agricultural sector, in part due to international market forces. Favourable developments have increased incomes also in non-agricultural sectors, and created new jobs, but were less pro-poor than is ideal. Further, shrinking farm sizes have hampered poverty reduction. Policies should target the participation in cash cropping and non-agricultural activities, especially if positive commodity price developments are only transitory.

Keywords: **income distribution, microsimulation-based decomposition, Peru, rural poverty, rural labour markets**

1 Introduction

Peru's economy grew at an average rate of 6.8 per cent between 2004 and 2012 which translated into decreasing poverty and income inequality rates (WDI, 2015). And yet, poverty is still widespread and inequality still remains high in Peru's rural areas. Based on household survey data, we calculated that in 2012, about one-quarter of the population lived in rural areas, where people remain vulnerable with poverty rates above 50 per cent. The rural GINI index worsened from 40.5 per cent in 2004 to 42.2 per cent in 2012. However absolute rural poverty declined by more than one third from 87 per cent in 2004 to 56 per cent in 2012, and extreme poverty declined even faster from 45 per cent to 21 per cent in the same years. Yet, there are large disparities among regions.

These poverty and inequality trends remain poorly understood, as neither the underlying determinants of income nor the poverty dynamics in rural areas in Peru have been thoroughly investigated as yet. This study's overarching objective is thus to identify the drivers of rural poverty and income inequality changes in Peru between 2004 and 2012, putting the focus on the labour market as well as on agricultural and non-agricultural income dynamics. Alongside ongoing long-term structural changes, such as occupational shifts into non-agricultural sectors or production shifts towards higher-value crops, the period of investigation falls into a phase characterized by increasing global market integration. This era between 2004 and 2012 starts off with relatively low (agricultural) commodity prices, then reaching high ones in 2012 (OECD/FAO, 2015) – making this chosen timeframe exceptionally interesting for studying rural areas. Understanding rural income changes is of crucial importance also beyond the case study of Peru, because the mentioned trends are a rather global phenomenon and poverty is still a predominantly rural phenomenon in many world regions (Dercon, 2009; Losch, Fréguin-Gresh and White, 2012).

The literature identifies several potentially important determinants of rural income dynamics. Some authors suggest that engaging in high-productivity, non-agricultural activities can be very conducive to income growth and poverty reduction (Escobal, 2001; Lanjouw, 2001) But, as is typical for developing countries, the largest section of the rural Peruvian work force is still employed in agriculture. Income growth in this sector, and thus changes in rural inequality and poverty, can result from various factors: First, real agricultural price increases can explain growing agricultural profits. Second, as a reaction to more open markets, Peru has shifted agricultural production towards some high value export products, like asparagus, mangos or coffee for which it has comparative advantages (Niemeyer and Garrido, 2011; Velazco and Velazco, 2012). Entering high-value export chains can generate higher profits for farmers and new employment opportunities for agricultural wage-labourers (Weinberger and Lumpkin, 2007; Maertens, Minten and Swinnen, 2012). Lastly, higher agricultural productivity has been shown to raise the income level of the poorest rural households (Datt and Ravallion, 1998; Fan, Zhang and Zhang, 2004; Klasen, Priebe and Rudolf, 2013).

Based on a microsimulation that models the rural income generation process, we decompose poverty and distributional change into the mentioned underlying causes of rural income change in Peru. The

methodology was developed by Bourguignon and Ferreira (2005), and builds on the earlier work of Almeida dos Reis and Paes de Barros (1991) and of Juhn, Murphy and Pierce (1993). The advantage is that it decomposes changes in the entire income distribution into their various driving forces, for example changes in the distribution of rural assets and personal characteristics in the population; changes in the returns on those assets and characteristics; and changes in people's occupational choices.

The remainder of this article is organized as follows. Section 2 outlines the methodology used for the empirical analysis and outlines the data used. Section 3 presents selected results from the multivariate analyses, which is followed by a discussion in Section 4 highlighting the most relevant opportunities and challenges for rural poverty and income inequality reduction. The article ends by summarizing the main findings and drawing key conclusions.

2 Methodology and data

2.1 Methodology

To disentangle the underlying causes of poverty and inequality changes, we use a microsimulation-based decomposition technique following Bourguignon and Ferreira (2005) and Lay (2010). The relevant drivers of change – for example in occupations, but also in socio-demographic population characteristics – are derived from survey data. By using two cross-sectional household datasets we are thus in a position to simulate, ex-post, counterfactual household income and, thereby, decompose distributional change into different drivers. More specifically, the decomposition exercise consists of estimating the effects on the joint distribution of income by changing one (or more) of the following aspects between two points in time: (a) changing the socio-demographic structure of the population, as characterized by area of residence, level of education, years of experience or ownership of physical assets (collectively referred to as the 'endowment effect'); (b) changing returns on factors of production, including land and labour and the various components of human capital, such as education and experience ('price effect'); (c) changing the occupational structure of the population, in terms of agricultural versus non-agricultural wage employment, agricultural versus non-agricultural self-employment, non-remunerated work and unemployment or inactivity ('occupational choice effect'); (d) changing unobservables ('residual effect'); and, (e) changing non-labour income sources ('effect of non-labour income sources'). This decomposition can be done for all returns, endowments and occupational choices simultaneously or only for certain selected parameters at a time. For the Peruvian data, the methodology applied is superior to other methods that study poverty and inequality, because it can identify drivers of change despite the absence of panel data and it provides a holistic picture of the effects of structural changes in rural labor markets. For details on the decomposition technique being applied, see Bourguignon and Ferreira (2005).

To separate the observed changes in the distribution of income into the three key forces just described, we first need to model the household income generation process. We use individual-level employment information to empirically model occupational choices and corresponding wages or profits. Equation 1 describes a household's earnings (all variables refer to a particular year, but are not time-indexed to facilitate the presentation).

$$Y_{hh} = \frac{1}{n}\left[\sum_{i=1}^{n}\sum_{s}\omega_i^s W_i^s + \sum_{i=1}^{n}\pi_i^{nonag}P_i^{nonag} + \sum_{i=1}^{n}\sum_{sag}\pi_i^{sag}P_i^{sag} + \bar{y}_{hh}\right] \quad (1)$$

A rural Peruvian household's income Y_{hh} is earned by n members, who are active in different sectors. Individual i's wage income ω_i^s is either earned in the agricultural or the non-agricultural sector $s = \{$ag,

nonag}. π_i^{nonag} and π_i^{sag} refer to profits in self-employment. In the case of agricultural self-employment there are sub-sectors *sag* = {maize farmer, potato farmer, coffee farmer, 'other' farmer}. W_i^s and P_i^{nonag} or P_i^{sag} are dummy variables indicating whether individual i is wage or self-employed in one of the sectors (or subsectors). Wages and profits include monetary income as well as payments in kind or production for self-consumption. We only consider income from the first employment activity, but add incomes from any secondary activities. Additionally, the household receives non-labour incomes $\bar{y}_{hh}$, such as non-monetary benefits, rents from property, remittances and transfers from social programmes. Likely, non-labour income sources are not independent from other household's income sources, but for simplification and because our focus lies on the labour market, we assume them to be exogenous. All these components are real values, and expressed in 2009 Peruvian nuevo sol (PEN). Per capita income is obtained by dividing total household income by household size. Eq. 1 is not estimated econometrically, it aggregates information from the labour income estimates (ω_i^s, π_i^{nonag}, π_i^{sag}) and the occupational choice model (W_i^s, P_i^{nonag}, P_i^{sag}), described below, as well as exogenous non-labour income ($\bar{y}_{hh}$) .

We estimate seven earnings functions (one for each sector) for two time periods separately (2004 and 2012), taking the log of real individual monthly wages or profits as dependent variables, using Ordinary Least Squares (OLS). We attempt to avoid selection biases related to self-selection into alternative occupational choices by performing a correction method based on a multinomial logit model. This is described in Bourguignon, Fournier and Gurgand (2007), and is based on the methodology first introduced by Dubin and McFadden (1984). However, the bias correction terms of the seven labour market equations turn out to be insignificant. One exception is a slight upward bias of the OLS estimate of the non-agricultural wage equation due to self-selection into this occupational category of individuals that hold superior endowments. However we ignore this bias, because the deviations from OLS coefficients are only very small. Other endogeneity problems could be avoided by using IV regression techniques, however we refrain from these modeling techniques due to missing valid instruments.

All earnings equations are Mincer-type equations, including as independent variables two skill dummies, one for medium skills (1 if primary education has been completed), and a second dummy for higher education (1 if secondary or higher education has been completed). Further, experience is included – defined as age minus years of education. Other covariates include gender, working hours and geographical location. The equations for profits of self-employment in the distinct sectors also consider physical capital and for farmers also land. The non-agricultural wage and profit equations further control for different industries.

We now turn to the occupational choice model to obtain the number of non-remunerated, wage and self-employed individuals in each activity per household. The parameters that describe the utilities associated with the respective occupational choices are estimated from a multinomial logit model that allows individuals to choose from being non-remunerated or employment in one of the seven sectors. Household heads, spouses and other household members are treated differently, meaning that we assume a sequential choice with the household head deciding first. The utility of being unemployed or not-economically active is arbitrarily set to zero, whereas the utilities of the other employment options (non-remunerated work, wage employment in agriculture or non-agriculture, self-employment in non-agriculture or in one of the agricultural subsectors) for household heads depend on education, age, gender, the number of household members in different age groups and location. For spouses and other household members, occupational choices depend on education, age, gender, number of children under 14 living in the household, the number of household members in different age groups, geographical location and an employment choice dummy of the household head. Individuals will choose the activity that leads to the highest

utility.[1]

2.2 Data

We use data from the nationally and regionally representative Peruvian household survey 'Encuesta Nacional de Hogares' (ENAHO for short in Spanish) collected by the National Institute of Statistics and Informatics (INEI) between 2004 and 2012. The ENAHO data is collected annually from a sample of about 35,000 persons corresponding to 8,000 households in rural areas, defined as those towns and villages with a population of less than 2,000 inhabitants. The regions are divided into three macro-regions, namely 'Costa', 'Sierra' and 'Selva', to study regional differences. The survey provides detailed information on the demographics, employment, education, housing, income and consumption of households and their individual members. Furthermore, the survey gives information on production quantities and values as well as total amount of land used, labour employed and irrigation technologies called upon for those households in which at least one member was active in agricultural self-employment. Unfortunately information on land allocation to different crops is missing, which blurs the evidence on productivity. We categorize farmers either as maize, potato or coffee farmers depending on which product makes up the highest share of total production value per farm. Maize and potatoes are chosen due to the fact that more than 70 per cent of all Peruvian farmers these two crops made up the most important source of income in 2004 and 2012. Coffee is chosen because it was the most important cash crop for export with a share of 31% in total agricultural export value in 2012. Between 11 per cent and 14 per cent of farmers fall into this category. 'Other' farmers make up the rest, and comprise those producing both low-value and high-value products. Although non-traditional export products – such as fruits and vegetables – have been gaining in importance in Peru, singling out these farmers is not useful because of the limited distributional relevance of doing this.

We use the Peruvian official national poverty lines constructed by INEI to measure absolute poverty. There are different poverty lines based on consumption baskets for different geographic domains and on median prices in major cities in the country. The value of each moderate poverty line is equal to the household's per capita cost of a basic basket of food and of non-food consumption. The value of each extreme poverty line represents the expenditure necessary to purchase a basic basket of food items only.[2] Consumption-based poverty measures have proven to be the better long-term welfare measure as compared to income, because households tend to smooth their consumption over time while income shows more volatility. However our analysis is based on the income generation process, so we need to construct income-based poverty lines. We scale up the consumption-based poverty lines in such a way that they reflect the difference between each household's total expenditure and total income.

3 Results

Moderate poverty dropped by 31 percentage points, while extreme poverty fell by 24 percentage points. The GINI index increased by 1.7 percentage points in rural Peru. However, there are noteworthy regional differences: on the Costa, moderate poverty was substantially reduced by 36 percentage points and extreme poverty was almost eradicated, dropping from 22 per cent to 6 per cent. This drop in poverty was accompanied by an improving GINI index falling more than 6 percentage points. The Selva showed large drops in moderate (-37 percentage points) and extreme poverty (-20 percentage points), but income

[1] We omit the presentation of a detailed model description due to conciseness of the paper, but it can be found in Bourguignon and Ferreira (2005) and Lay (2010) and from the authors upon request.

[2] For details on how poverty lines were constructed, see INEI (2013).

inequality worsened (+6 percentage points GINI index). In the Sierra, moderate poverty remained very high with rates above 60 per cent in 2012, but extreme poverty dropped by 26 percentage points – this was accompanied by a more unequal distribution of income (+ 2.5 percentage points GINI index).

The microsimulations show that – on aggregate – the price effects followed by increasing non-labour income sources were pivotal in explaining decreases in extreme and moderate poverty (see upper rows of Table 1). Non-labour income sources had a poverty reducing effect due primarily to increasing non-monetary forms of income in poor households. Especially, increasing values (imputed rents) of their own property, more freely accessible medical services and free access to cultural and recreational activities, as well as an increase in food donations were all responsible for the sharp increase in non-monetary income sources. Changing occupations[3] between 2004 and 2012 also reduced extreme and moderate poverty, however the effect of this was not as pronounced. These poverty-decreasing effects were in part counterbalanced by the endowment effect. In particular, extreme poverty increased due to deteriorating population endowments between 2004 and 2012. This means that especially the rural population at the lower end of the income distribution was placed in a worse position in 2012 than in 2004, as a result of inferior endowments of important assets. If price and endowment effects are interacted (see Row f), the joint poverty-reducing effects are lower than the sum of the single endowment effect (see Row a) and the single price effect (see Row b). This means that endowments were lower in particular for those whose returns grew the strongest. We also see that poverty reduction did not always go hand in hand with a reduction in income inequality. While the aggregate occupational choice effect and effects from increasing non-labour income sources reduced income inequality, the aggregate price effect, aggregate endowment effect and residual effect actually increased income inequality.

[Table 1 about here]

These aggregate effects are summary measures, capturing a variety of different – and partly counteracting – influences. Each effect can be further decomposed into its components, either aggregated across occupations or within each of the seven labour market sectors. We only report the decomposition of the price and endowment effects aggregated across all occupations , because the differences between sectors are only marginal (see bottom rows of Table 1).[4]

Decomposing the price effect reveals that the main poverty-reducing effect can be ascribed to an increase in the sectoral base income, rather than changes in returns on particular assets. Below, we look into these effects – driven for example by higher prices and productivity – for different sectors and agricultural subsectors. Also, higher returns on working hours and to labour reduced extreme and moderate poverty, though, increasing income inequality. On the contrary, decreasing returns on education had an impoverishing effect – pushing some vulnerable households below the moderate or even extreme poverty line. Female income gaps remained high in all sectors, but without impoverishing effects during the period of investigation – this is because these income gaps already existed in 2004 and did not deepen further at the lower end of the distribution. Decomposing the endowment effect shows that the major poverty- and income inequality-increasing effects resulted from a decline in working hours – and, even more, from reduced agricultural land sizes. Increased levels of education could only slightly buffer against these impoverishing effects, and indeed even worsened income inequality.

[3]The occupational choice effect only captures income effects induced by occupational shifts between sectors, and assuming static average incomes in different sectors. This means that varying developments in average income across different sectors between 2004 and 2012 are not taken into account.

[4]Decomposed price and endowment effects disaggregated for each sector can be obtained from the authors upon request.

Although some of the rural population shifted into occupations with better pay[5], the upper rows of Table 2 below shows that the distributional effects of these changes were actually quite small. The 'occupational change only' scenarios assumes that incomes in the destination sectors are constant. So, if initial income differences between the sectors are small then the associated distributional effects will also be small. This holds true particularly for shifts into the coffee sector which triggered some poverty reductions in the Selva. If the dynamic coffee price developments – and hence, increase in farmers' income – had been taken into account, this effect would have been higher. Furthermore, rising wage employment in the agricultural sector reduced poverty and income inequality foremost on the Costa followed second by in the Selva – both being regions that increased fruits and vegetable production for the export market. Again, our results should be understood as lower boundaries, because agricultural wages, on average, increased faster than those in most other sectors. Our decomposition results also confirm that occupational shifts towards non-agricultural wage employment reduced extreme poverty and moderate poverty by about 1.5 percentage points. About half of this effect was driven by movements out of non-remunerated work.

[Table 2 about here]

The lower rows of Table 2 below reports the disaggregated price effects at the sectoral level, interacted with the aggregate endowment and occupational choice effects. The bulk of extreme and, to a lesser extent, also moderate poverty reduction occurred due to changing returns in maize and potato farming in the Sierra and Selva regions. Especially in the Sierra, extreme poverty declined due to the improving incomes of staple crop producers. The same could be observed in the Selva as well, but here the impoverishing endowment effect (see Row a) could still not be fully compensated for by price effects in staple crop farming. Also, income inequality declined in these areas due to higher returns on staple crop production. These positive price effects in maize and potato farming, which reduced poverty considerably in Peru's poorest regions, resulted from increasing producer prices on the one hand and increasing yields on the other.

Positive price effects in coffee production mainly benefited farmers in the Selva which is the main production region. Since coffee farmers are not among the poorest, especially moderate poverty was reduced by this effect – but at the same time it had a negative effect on income inequality. In the coffee sector, price increases – occurring due to increasing domestic and international demand – were most likely the responsible factor for this, as yields did not improve significantly over time.

The Costa benefited most from increasing returns in agricultural wage employment, substantially reducing extreme and moderate poverty as well as income inequality. Furthermore, higher wages in non-agricultural wage employment led to the reduction of extreme and moderate poverty across all regions – with the largest effect on extreme poverty in the Sierra and on moderate poverty on the Costa. However, the rich benefited more than the poor and income inequality worsened accordingly. Changing returns in non-agricultural self-employment had smaller effects on poverty reduction, and increased income inequality in all regions.

In sum, we can state that increasing prices, yields or labour productivity helped to lift people out of poverty, but on average worsened income inequality. Both the poverty reduction effects and the distributional implications varied by occupation and sector and had an important regional dimension to them.

[5] Descriptives and occupational simulations on these movements are omitted to be concise, but can be obtained from author upon request.

4 Discussion

We now place the results in the context of the broader literature on the drivers of rural poverty dynamics and distributional change and link the above 'proxy' drivers ('price', 'endowment' and 'occupational choice' effects) to more general observations on rural development in Peru.

In line with other authors (Dixon, Gibbon and Gulliver, 2001; Christiaensen, Demery and Kuhl, 2011), our results provide evidence that the patterns of growth in agriculture are crucial for poverty reduction. Increased market integration of smallholders and the emergence and expansion of non-traditional export crops can be attributed to the liberalization of Peru's agricultural markets (FAO, 2010). Farmers substituted maize, and to some extent potato, with coffee and 'other' farming crops. Some authors stress the relevance of cash crop production for poverty reduction in developing countries, on the premise that small and poor farmers are not excluded from the opportunities in these market sectors (Lipton, 2005; Weinberger and Lumpkin, 2007). However our results show that the static distributional impacts of crop production shifts towards cash crops (holding incomes in the cash crop sectors constant over time) were actually rather small. This indicates that poor farmers faced constraints to switch to more commercial forms of agriculture. In part, the limited ability to move from staple to cash crop production is because of simple locational reasons. In particular, the southern Sierra has only limited agricultural development potential due to its harsh climate while coffee can only be produced at certain altitudes (Escobal and Ponce, 2008). Yet, many poor farmers, located in areas where cash crop production is, in principle, possible, struggled to enter into coffee and non-traditional export crop production. Our analysis does not allow for concrete conclusions about the reasons behind these entry barriers. The literature meanwhile has identified high compliance costs related to international food quality standards as being responsible for the crowding out of smallholders (Schuster and Maertens, 2013).

Despite these important entry barriers, our results suggest that coffee sector growth, driven by both increasing prices and productivity improvements, in particular increased farmers' income – including that of the poor who were already in the market. In the Selva, coffee farming contributed by more than 40 per cent to total poverty reduction between 2004 and 2012. These positive 'price' effects were in part offset by declining farm sizes. Our findings support Fort (2008) and Meade, Baldwin and Calvin (2010), who state that there was an increased concentration of landholdings by just a handful of farmers that produce crops predominantly for the export market. Complicated rules of land tenure limited smallholders' access to land which pushed some coffee and 'other' farmers in the Selva and on the Costa below the poverty line.

Despite the undeniable relevance of the cash crop sector to rural development, the majority of poorer farmers remained in maize and potato farming. Income growth in these staple crops strongly operated in favour of the poor. Although the decomposition method cannot identify the reasons behind increasing maize and potato base incomes, one plausible hypothesis is that improvements in the road network reduced transaction costs and allowed for greater returns due to better market access (Inchauste, Olivieri, Saavedra and Winkler, 2012). The above decomposition cannot distinguish between productivity and price effects, but the descriptive analysis (not presented here due to paper length restrictions) of yields and domestic prices has shown that both drive the income increases of farmers who are engaged in these crops. However, some vulnerable farmers were pushed into poverty due to decreasing farm sizes over time – especially maize farmers located in the Sierra.

Another, structural change affecting rural markets was the rise in agricultural wage employment. Yet, while the creation of new jobs was less important, wage increases in this sector strongly contributed to poverty and income inequality reduction. Generally the landless low-skilled and poorest rural population engages in agricultural wage employment (Lanjouw, 2001). The new demand for agricultural labour and

increasing wages were very likely driven by an increasing engagement in global agricultural trade flows by Peru's horticulture sector. While coffee remains Peru's single-most important agricultural export crop, more than 60 per cent of all Peruvian agricultural exports are now fruits and vegetables. The opportunities arising from this industry may be extended to other regions of the country, as recent private and foreign investments in infrastructure projects connect remote areas to the coast (The Economist, 2013). Our results indicate that the Selva may already have benefited from these investments. Here, the mango industry developed rapidly, becoming another export star of the Peruvian agricultural sector. Our results show that also in the Selva, poverty declined due to new employment opportunities and rising wages in agriculture. Unfortunately, in many regions of the Sierra, the potential for growing these cash crops and progress in agricultural productivity is somewhat limited due to less favourable growing conditions (Gallardo and Saavedra, 2009).

Non-agricultural income plays an increasingly important role for rural livelihoods (see e.g. de Janvry and Sadoulet, 2001; Reardon, Berdegué and Escobar, 2001; Jonasson, 2008), and offer a potential pathway out of rural poverty. Wages and profits increased in non-agricultural employment, and not only on the Costa – where off-farm employment abounded and wages and profits were highest. High urbanization rates and proximity to markets facilitated the development of non-agricultural businesses and the corresponding profit and wage increases here, especially in food processing and the tourist industry (Jonasson, 2008). Also for the poorer regions there was potential to catch up. Foreign investments, flowing for example into mining in the Selva and Sierra (Ticci and Escobal, 2013), increased profits and wages with poverty-reducing effects. However, because these activities benefit the richer rural households more than the do the poorer ones, we find growing income inequality.

5 Conlusions

In conclusion, we find that observed rural poverty reduction in Peru between 2004 and 2012 can be mainly attributed to positive 'price' effects in all sectors – most importantly, among staple crop producers. Increasing yields and positive price developments in both of Peru's main staple crops, maize and potatoes, were not only responsible for more than half of total extreme poverty reduction, but also led to a decline in income inequality – as many of the poorest farmers can be found operating in these sectors. Income gains in cash crop farming also contributed to poverty reduction, but the richer rural farmers benefited more than the poorer ones did. Income gains in agriculture thus exhibit clear distributional patterns, while the rural poor have benefited from price increases that went beyond the realm of export crops. One of the reasons for this is that domestic demand has also been high as part of a growing domestic economy, driven, in turn, by international developments – in particular the high demand for commodities and high commodity prices. The favourable evolution of Peruvian economy increased wages and profits, and created new jobs both inside and outside of agriculture. However, our analysis shows that these labour market effects were less pro-poor than one would ideally hope for, as the poverty-reducing effects resulting from occupational shifts were only moderate. The take-up of new and better remunerated jobs has been largely confined to better educated (and typically less poor) individuals. Further, shrinking farm sizes and working lesser hours in rural areas hampered poverty reduction and were the main drivers of worsening income inequality in rural Peru.

Since some of the internal and external factors explaining Peru's poverty reduction were only temporary, it is likely that future rural development pathways in Peru will look less pro-poor unless significant crop yield increases can be achieved also by the poor themselves. This is because the key future trends

that are likely to continue – the shift into high-value crops, the increase in wage employment and a more prominent role for non-agricultural activities – tend to be inequality-increasing. Reversing this unfavourable outcome requires that transportation infrastructure and marketing systems be improved, so as to open up opportunities for farmers in the Sierra and Selva as well. That land policies appear to work against the poor implies that these policies may need reconsideration, in particular if land expansion (or consolidation) facilitates entry into higher-value agricultural products. Opportunities in non-agricultural wage employment, especially in areas with limited agricultural development potential, can only be harnessed by the poor if they are enabled with the means to take them, by way of better public educational institutions or skills trainings.

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Tables

Table 1: Poverty and distributional effects of all aggregate effects (upper rows) and disaggregated price and endowment effects (bottom rows) across all sectors in rural Peru between 2004 and 2012 (in percentage points)

Scenario	**GINI**	**P(0) extreme poverty**	**P(0) moderate poverty**
Observed 2004	40.5	44.7	86.7
Observed 2012	42.2	20.9	55.6
Observed change 2004 - 2012	**+1.7**	**-23.8**	**-31.1**
Total effects without interaction			
a) Total endowment effects	+2.3	+8.2	+1.4
b) Total price effects	+1.3	-26.8	-26.2
c) Total occupational choice effects	-0.7	-2.7	-2.2
d) Residual effect	+1.1	-0.5	-0.8
e) Effect of non-labour income sources	-1.2	-7.2	-5.2
Total effects with interaction			
f) (a) + (b)	+2.4	-13.8	-22.8
g) (f) + (c)	+1.8	-16.1	-25.1
h) (g) + (d)	+2.8	-16.6	-26.0
i) (h) + (e)	+1.7	-23.8	-31.2
Disaggregated price effect across all sectors			
Education	-0.4	+0.9	+1.2
Experience	-0.5	-0.5	+0.4
Female income gap	n.e.	+0.2	+0.2
Working hours	+1.6	-7.7	-8.4
Regional income gap	-0.5	-0.4	-0.2
Sectoral income gap	-0.2	-0.1	+0.1
Paid labour	+0.4	-1.7	-1.3
Non-remunerated labour	+0.1	n.e.	n.e.
Land	+0.1	+0.1	-0.1
Baseline income	+0.9	-19.0	-18.0
Remainder	-0.3	+1.3	-0.1
Disaggregated endowment effect across all sectors			
Education	+0.6	-1.0	-1.3
Experience	n.e.	-0.1	n.e.
Female labour force participation	+0.1	-0.6	-0.6
Working hours	+0.9	+3.3	+0.6
Sector mobility	-0.1	-0.1	-0.1
Paid labour	-0.7	-0.2	-0.1
Non-remunerated labour	n.e.	+0.1	n.e.
Land	+1.3	+5.7	+2.5
Remainder	+0.1	+1.2	+0.3

Note: P(0) = poverty headcount index; GINI = GINI coefficient as an indicator for income inequality; n.e. = no effect.
The upper rows of the table report observed levels of poverty and income inequality in 2004 and 2012 (in per cent) and the respective changes over time (in percentage points). The bottom rows of the table report the changes in poverty and income inequality (in percentage points) based on each counterfactual scenario.
Source: Own elaboration based on regression results and ENAHO data.

Table 2: Occupational choice effect of different sectoral movements (upper rows) and price effects of different sectors interacted with endowment and occupational choice effect (bottom rows) in different rural areas between 2004 and 2012 (in percentage points)

	Rural average			Costa			Sierra			Selva		
Scenario	**GINI**	**P(0) extreme poverty**	**P(0) moderate poverty**	**GINI**	**P(0) extreme poverty**	**P(0) moderate poverty**	**GINI**	**P(0) extreme poverty**	**P(0) moderate poverty**	**GINI**	**P(0) extreme poverty**	**P(0) moderate poverty**
Observed 2004	40.5	44.7	86.7	44.8	22.3	73.7	38.9	50.8	89.2	36.4	35.2	84.3
Observed 2012	42.2	20.9	55.6	38.4	5.7	37.6	41.5	24.9	60.5	42.6	14.9	47.6
Observed change 2004 - 2012	**+1.7**	**-23.8**	**-31.1**	**-6.4**	**-16.6**	**-36.0**	**+2.5**	**-25.8**	**-28.7**	**+6.2**	**-20.3**	**-36.7**
Total occupational choice effect	**-0.7**	**-2.7**	**-2.2**	**-2.8**	**-1.8**	**-3.8**	**-0.3**	**-2.6**	**-1.8**	**-0.5**	**-3.4**	**-2.7**
Move to non-agricultural wage employment	n.e.	-1.5	-1.3	-0.2	-0.4	-1.1	+0.1	-1.8	-1.5	+0.1	-0.9	-0.9
Move to agricultural wage employment	-0.1	-0.5	-0.6	-0.6	-0.8	-1.4	n.e.	-0.3	-0.3	-0.2	-1.0	-1.0
Move to non-agricultural self-employment	+0.1	n.e.	-0.4	n.e.	+0.1	-0.6	+0.1	n.e.	-0.3	+0.2	-0.1	-0.6
Move to maize farming	n.e.	-0.3	n.e.	-0.2	-0.4	-0.1	n.e.	n.e.	+0.1	-0.1	-1.0	-0.1
Move to potato farming	+0.5	-0.1	-0.1	-0.1	n.e.	-0.3	+0.8	-0.1	-0.1	n.e.	n.e.	+0.1
Move to coffee farming	n.e.	-0.1	-0.2	-0.2	-0.1	-0.4	n.e.	n.e.	-0.1	n.e.	-0.3	-0.5
Move to 'other' farming	-0.1	-0.1	-0.2	-0.8	-0.1	-0.3	+0.1	n.e.	-0.1	-0.2	-0.4	-0.3
a) Endowment + occupational choice effects (all sectors)	+0.4	+9.6	+0.8	-7.0	-0.5	-4.0	+1.0	+10.3	+1.0	+3.3	+11.8	+2.2
b) (a) + price effects (all sectors)	+1.8	-16.1	-25.1	-6.6	-12.0	-28.8	+3.0	-17.5	-23.1	+5.6	-13.4	-29.9
c) (a) + staple crop* price effect	-2.4	-4.6	-10.2	-6.8	-2.4	-7.3	-1.8	-7.6	-12.2	+1.9	+3.9	-5.4
d) (c)+ cash crop** price effect	-2.1	-7.1	-13.0	-6.8	-2.4	-7.3	-1.8	-8.0	-12.7	+2.6	-6.1	-16.6
e) (d)+ price effect of 'other' farmers***	-1.7	-8.3	-14.3	-5.9	-3.3	-10.7	-1.5	-8.8	-13.2	+2.6	-8.7	-19.3
f) (e) + price effects in agricultural wage employment	-1.5	-11.0	-17.4	-7.3	-9.7	-19.8	-1.5	-11.2	-15.1	+2.9	-11.1	-23.7
g) (f) + price effects in non-agricultural wage employment	+0.2	-14.4	-22.6	-7.0	-11.1	-26.5	+0.9	-15.5	-20.5	+4.4	-12.6	-27.7
h) (g) + price effects in non-agricultural self-employment	+1.8	-16.1	-25.1	-6.7	-12.0	-28.9	+3.0	-17.5	-23.1	+5.6	-13.4	-29.9

Note: P(0) = poverty headcount index; GINI = GINI coefficient as an indicator for income inequality; n.e. = no effect.
The upper rows of the table report observed levels of poverty and income inequality in 2004 and 2012 (in per cent) and the respective changes over time (in percentage points).
The bottom rows of the table report the changes in poverty and income inequality (in percentage points) based on each counterfactual scenario.
Source: Own elaboration based on regression results and ENAHO data.