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Analysis of Poverty and Inequality in Bolivia, 1999-2005: A Microsimulation Approach

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Analysis of Poverty and Inequality in Bolivia, 1999-2005: A Microsimulation Approach[1]

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Abstract:
This paper studies the changes in inequality and poverty in the period 1999-2005 in Bolivia through the analysis of the changes in the labour market. A decomposition method based on micro-simulation techniques was applied. The decomposition works with an income generation model at the household level, which is a set of equations for the individual earnings and for the labour supply and occupational choices for each member of the household. We decomposed the observed change in inequality into four components: *i)* a shift in the income distribution related to a change in employment rates and the shares of wage and non-wage labour among the employed population (*participation effect*); *ii*) a shift related to changes in the remuneration of observed characteristics of the employed population (*price effect*); *iii*) a shift related to a change in the distribution of error terms of estimated earnings functions (*error term effect*); and *iv*) a residual change in inequality not captured by the first three simulated changes in the income distribution. According to our results the increase in inequality of 3 points of the Gini coefficient, was explained by approximately 1 point for the participation, price and error term effects and 2 points for the residual change. The increase in the unemployment rate, the shift in the participation of the non wage earners, the rise in wages and the more unequal distribution of unobserved productive talents deteriorated the income distribution in this period in Bolivia. Regarding the poverty incidence, the observed variation was a reduction by 3 points explained mainly by the residual change. The low magnitude of the simulated effects as determinants of the decline in poverty in those years can be explained by the rising participation of the non labour incomes in the total household income.

Keywords: Poverty, Inequality, Microsimulation, Bolivia.
JEL classification: O54, R20, P46.

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1. Introduction

During the period 1999 to 2005 Bolivia suffered an economic, political and social crisis which affected its development and economic growth. Between 1999 and 2003, Bolivia registered a GDP per capita growth of less than 1%. However, the years 2004 and 2005 the economy presented positive signals of recovering with GDP per capita growth rates of 1.65% and 1.84%, respectively. The social and political crisis of this period was reflected in constant uncertainty at the political level, which led to the change of five presidents in five years and at least one event of lethal political violence each year except 2000, with a climax in 2003[2] (Mosley, 2007).

The ex-president of the Central Bank of Bolivia Juan Antonio Morales stressed as one of the main causes for these conflicts, the long-term factor of inequality, and the failure of the government's short-term measures to relieve it. In his words '[…] *Bolivia's external debt and the external aid aimed at reducing poverty benefited mainly the middle class. Even if improvements were achieved in the Human Development Index and poverty fell, the distribution of income deteriorated, as it did across the whole of Latin America. The deterioration of income distribution in a poor and supremely politicised country is perhaps among the main causes of the tragedy* […]' (Juan Antonio Morales, 'Que le ha pasado a Bolivia?' Pulso: 14-20, March 2003, page7, as cited by Mosley, 2007).

The income inequality in the country has always been a problem, but the combination of the slow (or in some years inexistent) economic growth for the period 1999 – 2005 increased its relevance. The close relation between poverty and inequality is reflected in the high figures of the Gini coefficient and the poverty incidence[3] which in 1999 registered values by 0.57 and 63%, respectively. In 2005 notwithstanding the improvements in the performance of the economy the years 2004 and 2005, the Gini coefficient increased to 0.60, whereas the poverty incidence decreased to 60%.

The reduction in poverty but the increases in inequality for 1999-2005 lead us to analyze what was behind of these changes. The analysis of the evolution of the poverty and inequality during those years is the main objective of the present paper. In spite of the conflicts and the critical situation of the economy in the first years of this period, many structural changes took place in the country, particularly

[2] A confrontation between the security forces and the civil society took place in October 2003. It followed the announcement of a general strike in El Alto and La Paz by the COB (Central Obrera Boliviana-Bolivian Confederation of Trade Unions) in protest against a government plan to export natural gas. The army broke a blockade of the Senkata petroleum depot, on the south side of El Alto, by force on 13 October, and this action escalated into a more general insurrection across the whole of El Alto in which, on 13 and 14 October, at least 59 people were killed. On 14 October, the vice-president, Carlos Mesa, detached himself form the government in the light of the killings, and when, on the 17 October, President Sanchez Lozada left the country, Mesa was sworn in as interim president. His 21-month administration ended also with general strike initiated in El Alto, in June 2005.

[3] The Gini coefficient varies between 0 and 1. 0 is the ideal situation in which all the individuals or households have the same income, and 1 represents the value when incomes are concentrated on few individuals or households.
The poverty incidence measure the proportion of individuals whose income is lower than the poverty line, for further details about these and others measures of inequality and poverty see Appendix 1.

in the labour market. At the end of 2005, the unemployment rate has declined and the level of wages has increased. How have these changes affected the levels of inequality and poverty? The approach followed in the paper focuses on the analysis of the impact of changes in the labour market on the distribution of earnings and per capita income, using a micro-simulation model to decompose observed shifts in these distributions over time.

The centre of attention of the study is the labour income, taking into account that this represents the approximately 80% of the total income of the household. Furthermore, Fields (et al., 1997) mentioned that the labour income has a direct relation with the productivity. Therefore variations in labour income have implications on the aggregate productivity and in the long run capacity of economic growth.

In order to understand the changes in the distribution of individual earnings and household income registered in the period 1999-2005, we will apply a regression-based decomposition technique involving counterfactual simulations to household survey data. The decomposition works with an income generation model at the household level, which is a set of equations for the individual earnings and for the labour supply and occupational choices for each member of the household. We will decompose the observed change in inequality into four components: *i)* a shift in the income distribution related to a change in employment rates and the shares of wage and non-wage labour among the employed population (*participation effect*); *ii*) a shift related to changes in the remuneration of observed characteristics of the employed population (*price effect*); *iii*) a shift related to a change in the distribution of error terms of estimated earnings functions (*error term effect*); and *iv*) a residual change in inequality not captured by the first three simulated changes in the income distribution (Bourguignon et al, 2001). In the literature it is common to interpret the change in the distribution of error terms as the change over time in the distribution of unobserved productive talents of the individuals (see Juhn, Murphy and Pierce, 1993). The analysis of these effects will allow us to identify the main channels and mechanisms through which income distribution has been affected.

This micro-simulation process consists of the simulation of counterfactual distributions by changing one aspect at a time and holding all the other aspects constant. The methodology follows the guidelines of similar studies; Ferreira and Paes de Barros (2005), Bourguignon (et al., 2001), De Jong (2001) and Grimm (2001) among others.

The absence of panel data, made us choose a methodology based on cross section data. The analysis is based on three household surveys for the years 1999, 2002 and 2005. The micro-simulation technique was selected as the tool of analysis considering its relevance for this kind of studies, especially to identify the microeconomic factors underlying changes in income inequality.

The paper is organized as follows. The next section presents the literature review. Section 3 explains some facts about the income distribution and poverty in Bolivia during the period of study. The methodological framework is presented in section 4. In section 5 we describe the data. Section 6 presents the econometric estimation of the individual earnings and the labour supply and occupational choice models, besides the results of the decomposition of the household income distribution. Finally in section 7, summarizes and concludes.

2. Literature Review

The most common microeconomic approach found in the literature for the study of income distribution dynamics is based on decompositions of changes in inequality measures by population subgroups. The change in some scalar measure is decomposed into what is due to changes in the relative mean income of various predetermined groups of individuals or households, what is due to changes in their population weights, and residually what is due to changes in the inequality within those groups. When groups are defined by some characteristics of the household or household head, such as location, age, or schooling, the method identifies the contribution of changes in those characteristics to changes in poverty or inequality (Bourguignon et al., 2005).

Bourguignon (et al., 2005) argue that this kind of approach has limitations. First, the analysis does not include the full distribution. Second, the decomposition of changes in inequality or poverty measures often leaves an unexplained residual of a nontrivial magnitude. And third, the decompositions do not easily allow for controls[4].

Considering these limitations the literature proposes an alternative approach, which seeks to address all of these shortcomings in scalar decompositions. This methodology is the counterfactual simulation of entire distributions on the basis of the disaggregated information of the household surveys.

This approach was first applied by Almeida dos Reis and Paes de Barros (1991) for Brazil. They analyzed the relationship between education and wage inequality using a methodology which combines decomposition with simulation. They used Theil's second measure[5], as a measure for inequality considering its decomposability. They showed that there are sharp differences in wage inequality across metropolitan areas. To identify whether these large regional differences in inequality are directly associated with differences in educational levels or with differences in the steepness of the wage education profiles some simulations were conducted. The results indicated that regional differences in the distribution of education are not able to explain much of the regional differences in wage-inequality. Hence, the differences in wage-inequality were shown to be intrinsically associated with differences in the steepness of the wage-education profiles.

Juhn, Murphy, and Pierce (1993) use a technique of this kind to study the determinants of the increase in wage inequality in the United States during the 1970s and 1980s. They found that the trend toward increased wage inequality was apparent within narrowly defined education and labour market experience groups. According to them, much of the increase in wage inequality for males was due to increased returns to the components of skill other than years of schooling and years of labour market experience.

[4] For instance is not possible to identify the partial share attributable to each factor in a joint decomposition of inequality changes by education, race, and gender subgroups.

[5] The Theil-L like all decomposable measures, it can be expressed as a function of three features of the joint distribution of education and wages: (i) the distribution of education, (ii) the average wage by educational category, and (iii) the degree of wage inequality within each educational category.

DiNardo, Fortin, and Lemieux (1996) elaborated a semi-parametric version of this last approach. They analyzed the effects of institutional and labour market factors on recent changes in the U.S. The effects of these factors were estimated by applying kernel density methods to appropriately weighted samples. The procedure applied by them provides a visually clear representation of where in the density of wages these various factors exert the greatest impact. They concluded that labour market institutions are as important as supply and demand considerations in explaining changes in the U.S. distribution of wages from 1979 to 1988.

In the same direction of this last group of studies, the chosen methodology of decomposition follows the guidelines of the methodology proposed by Juhn, Murphy and Pierce (1993), which was subsequently further developed and applied particularly by Bourguignon (et al., 2001), who studied the mechanisms underlying the apparent stability of the income distribution in Taiwan. They applied a decomposition method based on micro-simulation technique. Through this decomposition they isolated the respective changes in *i)* the earning structure; *ii)* labour force participation behaviour; and *iii)* the socio-demographic structure of the population. They found that the stability of the distribution in Taiwan appears as the result of various structural forces which happened to offset each other.

Ferreira and Paes de Barros (2005) used a similar approach for the study of the increments in extreme poverty in urban Brazil in the period 1976 – 1996. They applied a micro-simulation based decomposition methodology which endogenizes labour incomes, individual occupational choices and education decisions. They proved that the distribution of incomes was being affected, on the one hand, by a decline in average returns to both education and experience, a negative 'growth' effect and immiserizing changes in the structure of occupations and labour force participation (all of which tended to increase poverty), and on the other hand by an increase in educational endowments across the distribution, and a progressive reduction in dependency ratios (both of which tended to reduce poverty).

De Jong (2001), in an application of this technique, studied the effects of changes in participation, the structure of employment and returns to education and other characteristics on income distribution and poverty in Panama. He simulated changes in income inequality if the remuneration parameters, labour supply and occupational choices, and unobserved socio-demographic characteristics would be different than those actually observed. He concluded that the observed changes in returns to education implied less inequality, but more poverty. And that the returns to experience have poverty-increasing effects.

Grimm (2001) applied the same methodology for the study of the evolution of income inequality in Cote d'Ivoire in the 1990's. He analyzed the simultaneous contributions of four types of phenomena to the evolution of the income distribution: a change in the remuneration rates of observed and unobserved earnings determinants, a change in the occupational preferences, and a change in the socio-demographic population structure. He conclude that in Abidjan changes in the employment structure, a higher activity rate and a boost in employment in the private wage sector, in connection with changes in the returns to observed earnings determinants on the labour market led to less inequality and poverty. But, these effects were offset on the one hand by more heterogeneity in unobserved earnings determinants and by changes in the population structure.

The methodology used in this paper belongs to this stream of new decomposition techniques. Indeed, it is similar to the one applied by Bourguignon (et al., 2001), Ferreira and Paes de Barros (2005), De Jong (2001) and Grimm (2001). And, as they did, we generalized the counterfactual simulation techniques from the single earnings equation model to a system of multiple nonlinear equations, which tries to represent the mechanisms of household income generation. This system comprises earnings equations and occupational-choice models that describe the occupational decisions of the individuals (Bourguignon et al., 2005).

As Bourguignon (et al., 2005) suggests the model is estimated in its reduced form, in order to avoid the difficulties associated with joint estimation of the occupational-choice models and earnings equation for each household member. "*We maintain some strong assumptions about the independence of residuals. Therefore, the estimation results are never interpreted as corresponding to a structural model and no causal inference is drawn. We interpret the parameter estimates generated by these equations only as descriptions of conditional distributions, whose functional forms we maintain hypotheses about. Yet, even in this limited capacity, these estimates help us to gain useful insights into the nature of differences across distributions and about underlying forces behind their evolution over time*" (Bourguignon et al., 2005 pp. 11).

One of the main differences between this decomposition methodology and others such as the one applied by Jimenez (et al., 2001) is the specification of the equations which determines the labour supply, occupational choices and earnings, whereas in the methodology applied by Jimenez (et al., 2001) the labour supply and the occupational decisions are estimated through a random process. One of the advantages of this last approach is that it allows for assessing the impact of changes in a whole range of labour market parameters in isolated form or sequentially (Vos and De Jong, 2003).

However, is important to mention that albeit both methodologies the one applied by Bourguignon (et al., 2001) and the one applied by Jimenez (et al., 2001) allow us to analyze changes in income inequality vis-à-vis to changes in the labour market, the approach proposed by Bourguignon (et al., 2001) does explicitly take into account labour market behaviour (Vos and De Jong, 2003). In this paper we will apply the approach proposed by Bourguignon (et al., 2001).

3. Basic facts about income distribution and poverty in Bolivia from 1999 to 2005: A brief review of the literature and the data[6]

During the period 1999 to 2005 the population in Bolivia grew by 2.3% on average each year. In 2005 the population was more educated with an average of 8 years of schooling. The percentage of the men and women who belongs to the occupied population registered a small reduction. The average labour income has increased, in 2002 and 2005 for both men and women, however the increments were higher for the men than for the women.

Table 1
Bolivia: General Economic Indicators

Years	1999	2002	2005	1999-2002	2002-2005	1999-2005
Population*	8,233,029	8,823,743	9,427,219	2.3%	2.2%	2.3%
GDP (in constant 1990 Bolivianos-millions)*	21,809	23,298	25,936	2.2%	3.6%	5.9%
GDP per capita (in constant 1990 Bolivianos)*	2,649	2,640	2,751	-0.1%	1.4%	0.6%
Years of schooling**	7.6	7.5	8.1	-0.1	0.6	0.5
Average years of education by age groups						
15-30	9.3	8.9	9.8	-0.4	0.9	0.5
30-50	7.3	7.4	8.0	0.1	0.6	0.7
50-65	4.7	5.0	5.7	0.3	0.7	1.0
Employment rate as % of working age population						
% Occupied Population***	41.1	40.3	40.6	-0.8	0.3	-0.5
Men	52.8	51.8	52.0	-1.0	0.3	-0.7
Women	30.7	29.1	29.9	-1.6	0.8	-0.9
Average Real Income****						
All Individuals	970.6	1,045.7	1,141.9	7.7%	9.2%	17.7%
Men	1,079.6	1,164.7	1,274.3	7.9%	9.4%	18.0%
Women	792.8	839.6	924.2	5.9%	10.1%	16.6%

Note: *Source: INE-average of the annual growth rates.
** Corresponds to the population who is older than 15 years old.
*** We consider as an occupied at all individuals who receive a positive income (wage earners and non wage earners)
**** Corresponds to the labour income of the principal activity. The average incomes are in 2005 Bolivianos.

The first years of the period under study are characterized as years of low performance of the economy and especially as years of social conflicts and political instability. The economic situation was the result of external and internal factors. In 1999, Brazil's economic crisis affected the Bolivian economy, the international prices of raw materials have also decreased, and the contraction in the economy led to higher levels of inequality and poverty. Nevertheless, in 2005 the economy showed signs of recovery (see Table 1).

[6] For the analysis of this period we will consider as well a subdivision i.e. we will study the changes between the periods 1999-2002, 2002-2005 and the changes in the in the two extremes years of the period 1999 and 2005. This subdivision was introduced considering the downward trend of the economy in the first years of the sample 1999-2002 and the signals of recovering in the economic performance in the period 2002-2005 (actually it would be better to work with the year 2003, taking into account that this year was also a year of crisis but the household survey available for this year is not comparable with the others).

In order to analyze the changes in the levels of poverty and inequality during the period 1999 to 2005 some indices were calculated. For inequality we have chosen the well know Gini coefficient, the Theil Coefficient (E (1)), and the transformed coefficient of variation (E (2)). These indices provide a useful range of sensitivities to different parts of the distribution. E(1) is more sensitive to higher incomes, E(2) is neutral and the Gini places greater weight around the mean (Ferreira and Paes de Barros, 2005).

For poverty, the indices suggested by Foster, Greer and Thorbecke were estimated. P (0) that is the headcount index, which measures poverty incidence, P (1) which is the poverty gap and P (2) that stands for the poverty severity index[7].

In Table 2 we can observe the evolution of the mentioned indices for the period under study. The poverty and the inequality levels in the country have intensified between the years 1999 and 2002. Even though there was a very small decrease in P (1) and P (2), in general the crisis in the country during these years affected the income levels of the population rising the poverty and the income inequality.

Table 2
Bolivia: Poverty and Inequality Indices

Indices	1999	2002	2005	1999-2002	2002-2005	1999-2005
Gini Coeffcient	0.57	0.60	0.60	4.49%	0.03%	4.51%
Theil Coeffcient (E(1))	0.61	0.71	0.72	16.13%	0.28%	16.46%
Transformed coefficient of variation (E(2))	1.29	1.52	1.70	17.95%	11.84%	31.92%
Poverty incidence (P(0))	0.63	0.64	0.60	2.21%	-6.80%	-4.74%
Poverty Gap (P(1))	0.35	0.35	0.33	-0.65%	-5.41%	-6.03%
Poverty Severity (P(2))	0.25	0.24	0.23	-2.69%	-5.76%	-8.29%

Source: Author's elaboration based on household surveys.

Analyzing the period 1999 to 2002, the inequality and the poverty levels have increased due the economic and social crisis. According to UDAPE (2003), the low growth rates and the external shocks that the economy was suffering since 1999 deteriorated the social indicators. In 2002, the weakness of the economic activity together with low occupation rates and low levels of labour income generated higher levels of poverty, which contributed to the worsening of the income distribution.

The period 2002 and 2005, when the economy and the social situation turned to be more stable, the inequality levels remained almost constant, but the poverty decreased probably as a result of the positive per capita GDP growth. Between 1999 and 2005, the Gini coefficient increased 3 percentage points, whereas the poverty incidence decreased by 3 percentage points.

Our analysis will focus on the mentioned changes in inequality and poverty during the periods 1999-2002, 2002-2005 and 1999-2005, and the possible explanations for these changes. Even though the statistically significance level of the observed shifts in the poverty and inequality indices in some of these periods may be low.

[7] For a further explanation of the inequality and poverty indices used in the paper, see Appendix 1.

The high levels of inequality and poverty in Bolivia have been topics of many studies. Hernani (2002) studied the labour market, poverty and inequality in Bolivia for the period 1997 to 2001. According to him the unequal distribution of human capital is one of the main determinants of the poverty and income inequality in Bolivia. Furthermore, he stands that the main source of poverty is the low labour productivity, which is caused by low levels of education in the rural areas, low quality of education in the national level and the low quality of the jobs offered by the labour market.

Jimenez (et al., 2001) analyzed the effects of the liberalization over growth, employment, distribution and poverty. They decomposed the changes registered in the income distribution and the poverty levels in the period before and after the liberalization. The results of their simulations showed that without liberalization, the poverty incidence was almost the same, whereas the extreme poverty would have been 1 point higher, the same happened with the poverty gap. Regarding the levels of income labour inequality these would have been lower by 3 or 6 points without the process of liberalization. The household income inequality also would have been lower in around 2 or 7 points.

Fields (et al., 1997) applied a methodology of decomposition based on regressions which their coefficients had been used in order to calculate the relative contributions to the factorial inequality. The regressions are common income generation functions consistent with the theory of human capital. With the estimators, they used the result obtained by Shorrocks (1980) to calculate the variance in both sides of the equation and to decompose the variation in their components, where each component corresponds to the contribution of each factor in the observed inequality. According to their results the years of schooling determines between 70% and 80% of the income inequality. One year of increase in education is associated with and increases in the income of around 10%.

On of the main differences between the methodology applied by Fields (et al., 1997) and the methodology proposed in the present paper, is that instead of calculating the contributions of the explanatory variables in the income generation function, we decompose the changes in inequality in different effects that are related to changes in the occupational choices of the individuals, changes in their wages and changes in their unobserved productive talents, besides of a residual change.

Landa (2002) analyzed the labour income inequality in the country through an application of the model used by Juhn, Murphy and Pierce (1993). He estimated the labour incomes for the years 1989 and 1999, then he simulated the income distribution which would have been observed in 1989 (1999) and compared if the outcomes had been the same as 1999 (1989). Finally, he calculated the contribution of the changes in the returns, endowments and in the error term of the observed changes in the income distribution. Landa concluded that inequality mainly increased because of the market returns of the education endowments and the labour experience of the individuals.

However, the methodology that Landa (2002) applied in his paper is based on the changes related to the distribution of individual earnings. The approach used in this paper follows the recent techniques for the study of the income distribution dynamics, which rather than limiting the analysis to the individual earnings uses the distribution of welfare, proxied by the distribution of per capita household income.

According to Bourguignon (et al., 2005) the underlying determinants of the income household distribution are complex, because in addition to the quantities and prices of individual characteristics that determine earnings rates, household incomes depend also on participation and occupational choices, on demographic trends, and non labour incomes. To work with the distribution of the household income rather than only with the distribution of earnings is one of the advantages of this methodology. In this way, we can decompose any change in the household income into its principal sources.

4. Methodology

The specification of the model is similar to the one applied by Ferreira and Paes de Barros (2005) who studied inequality dynamics in Brazil during the years 1976-1996 but takes into account the adjustments made by De Jong (2001), who studied the income distribution in Panama.

Total household income is given by:

$$(1)\quad Y_h = \sum_{i=1}^{n} w_i L_i^w + \sum_{i=1}^{n} \pi_i L_i^{se} + Y_{0h}$$

Where w_i is the total wage earnings of individual i; L^w is a dummy variable that takes the value 1 if individual i is a wage earner (and 0 otherwise); π_i is the self-employment profit of individual i; L^{se} is a dummy that takes the value 1 if individual i is self-employed (and 0 otherwise); and Y_0 is income from any other sources, such as transfer or capital incomes. Equation (1) is not estimated econometrically, because is the aggregation of the following equations. The first term of equation (1) is composed by equations (2) and (3), the second term is the aggregation of equations (2) and (4) and the last term (Y_0) is obtained directly from the household data set.

For the labour force participation model, we assume that labour supply decisions of the members of the household are independent among them. The individuals can be inactive or unemployed, or work as wage earners, or non-wage earners. The probability of belonging to one of these categories can be estimated by a multinomial logit model.

According to that specification, the probability of being in state s (= 0, w, se) where *0* means unemployed or inactive, *w* means wage earner and *se* refers to non-wage earner, in the reduced form of the multinomial logit model of occupational choice is given by equation (2):

$$(2)\quad P_i^s = \frac{e^{Z_i\gamma_s}}{e^{Z_i\gamma_s} + \sum_{j\neq s} e^{Z_i\gamma_j}} \qquad \text{where s,j=(0,w,se)}$$

Where the explanatory variables differ for household heads and other household members, by assumption, as follows.

For household heads:

$$Z_1^h = \left(X_i^P, n_{0-6}; n_{7-65}; n_{>65}\right)$$

For other members of the household:

$$Z_i^h = \left(X_i^P, n_{0-6}; n_{7-65}; n_{>65}; L_1^w w_1\right)$$

Notice that this is a reduced form model of labour supply, in which own earnings are replaced by the variables that determine them.

The vector X_i^P is composed by $X_i^P = (s, \exp, \exp^2, metro)$; where s denotes years of schooling, *exp* is the variable for work experience[8], *metro* is a dummy variable for area of residence, which takes the value of 1 for capital cities and 0 otherwise and a residual term that captures any other determinant of earnings, including any unobserved individual characteristics.,

The variable $n_{k\text{-}m}$ is the number of persons in the households whose age falls between k and m. The number of an age group is excluding the household member in the sample for which participation and occupational choice is estimated, if the member falls in that age group. The idea is that participation may be higher (or lower) if there are for instance more children younger than 7 years old in the household.

The variable $L_1w_{1,}$, for the labour supply of other members of the household, is the earnings of the head of the household.

Thereby, equation (2) is the labour supply of the individual and makes labour supply dependent on the characteristics of individual members (s, exp, exp2), those of the household (metro, $n_{0\text{-}6}$, $n_{7\text{-}65}$, and $n_{>65}$), and of a residual term which stands for the unobserved determinants of labour supply and its allocation. This equation has been calculated separately for men and women who are older than 7 years old[9].

Considering that the error terms of the labour supply equations are not observed for individuals who were inactive or unemployed and they also are not observed for occupational choices, all these stochastic terms must be generated by drawing randomly in the appropriate distribution conditionally on the estimated residual variance and the occupational choice that is observed.

Once drawn, the error terms are held in constant in the simulation of the impact of changes in the behavioural parameters. For those individuals who in the simulation become wage earners or non-wage earners also and error term is required to predict their earnings. These error terms are drawn randomly in a normal distribution with zero mean and variance of respectively the distribution of residuals of the wage and non-wage earnings equations. Observed earnings of individuals who in the simulation are no longer working as wage earners or non-wage earners are replaced by a zero (De Jong, 2001)[10].

Regarding the individual earnings function, the *wage earners* function is given by:

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[8] As we do not know the actual experience, we worked with the *potential experience* variable using the following transformation: $age_i - S_i - 6$, based on the assumption that people start their primary education at age 6.

[9] In Bolivia the working age population comprises the population who is older than 7 years old.

[10] For the detail of the methodology applied for the simulation of residuals for the multinomial logit model see Appendix 2.

(3) $\ln w_i = X_i^P \beta^w + \varepsilon_i^w$

We estimated equation (3) separately for men and women.

Analogously, the earnings function for the *non-wage earners* is given as follows, which is has also been estimated separately for women and men:

(4) $\ln \pi_i = X_i^P \beta^{se} + \varepsilon_i^{se}$

Equations (3) and (4) are estimated by Ordinary Least Square (OLS). Equation (3) is estimated for all employees, whether or not heads of household. Equation (4) is estimated for all self-employed individual, whether or not heads of households.

Taking into account that the errors terms ε are unlikely to be independent from the exogenous variables, a sample selection bias correction procedure might be used. However, Ferreira and Paes de Barros (2005) argue that the standard Heckman procedure for sample selection bias correction requires as equally strong assumptions about the orthogonality between the error terms and the independent variables (from the occupational choice multinomial logit below) as the OLS estimation.

Thus, the assumptions required to validate OLS estimation of equations (3) and (4) are not more demanding than those required to validate the results of the Heckman procedure. We assume, therefore, that all errors are independently distributed, and do not correct for sample selection bias in the earnings regressions.

4.1. Decomposition of Changes in the Income Distribution

As we mentioned before, we will apply the regression-based methodology, which decomposes changes in income inequality into various components, in order to understand the nature of income distribution dynamics. As this methodology suggests, we simulate counterfactual distributions, changing the behaviour of markets and households. Furthermore, we take into account the effect of each variation on the distribution, keeping the rest of the variables constant.

Once we estimate equations (2), (3) and (4), we have two vectors of parameters for each of the three years in our sample (t ∈ {1999, 2002, 2005}: β_t from the earnings functions for both wage earners and no wage earners (including constant terms α_t), and γ_t from the equation (2), which means that represents the occupational choice. In addition, from equation (1), we have Y_{0ht} and Y_{ht}.

Let $X_{ht} = \left\{ X_i^P, Z_i^h \mid \forall i \in h \right\}$ and $\Omega_{ht} = \left\{ \varepsilon_i^w, \varepsilon_i^{se}, \xi_i^j \mid i \in h \right\}$. We can then write the total income of household h at time t as follows:

(5) $Y_{ht} = H(X_{ht}, Y_{0ht}, \Omega_{ht}; \beta_t, \gamma_t)$ h=1,…..m

Based on this representation, the distribution of household incomes:

(6) $D_t = \left\{ Y_{1t}, Y_{2t}, ..., Y_{mt} \right\}$

Can be rewritten as:

$$(7) \quad D_t = D\left[\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t\right]$$

Where {.} refers to the joint distribution of the corresponding variables over the whole population. In order to study the dynamics of the income distribution, we are interested in understanding the evolution of D_t over time.

The proposed decomposition methodology consists of estimating the effects of changing one or more of the arguments of D[.] on D_t. The decomposition applies to those arguments which are exogenous to the household, β, γ and the variance of the various residual terms.

Changing the occupational situation (γ) we have the *participation effect*:

$$(8) \quad L_{tt*} = D[\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_{t*}) - D(\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t)]$$

This expression measures the contribution to the overall change in the distribution $D_{t*} - D_t$ of a change in γ between t and t*, holding all else constant. This effect is obtained by comparing the initial distribution at time t with the hypothetical distribution obtained by simulating on the population observed at date t the occupational preferences observed at date t*.

De Jong (2001) says "[…] that the participation effect is an overall participation effect, which includes any effect of changes in wages and an autonomous effect. This is because a reduced-form equation of labour supply and occupational choice is estimated, and not a structural model in which labour supply is a function of among others the wage rate".

Changing the remuneration rates (β) we have the *price effect*, which can be expressed as:

$$(9) \quad B_{tt*} = D[\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_{t*}, \gamma_t] - D[\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t]$$

This expression measures the contribution to the overall change in the distribution $D_{t*} - D_t$ of a change in β between t and t*, holding all else constant. The price effect is obtained by comparing the initial distribution at time *t* and the hypothetical distribution obtained by simulating on the population observed at date *t* the remuneration structure observed at date *t**.

Following the paper elaborated by De Jong (2001), we can evaluate the price effect after the occupational preferences have been modified, thus as to yield a combined participation and price effect:

$$(10) \quad LB_{tt*} = D(\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_{t*}, \gamma_{t*}) - D(\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t)$$

Changing the error terms of the earnings functions (Ω) we have the *error term effect,* which is the effect of a change in the unobserved characteristics in the earnings equations:

(11) $E_{tt*} = D[\{X_{ht}, Y_{0ht}, \Omega_{ht*}\}, \beta_t, \gamma_t] - D[\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t]$

According to Juhn, Murphy and Pierce (1993) this effect is interpreted as the dispersion of the remuneration of unobserved productive talents (Bourguignon et al., 2001).

Assuming that unobservable factors are orthogonal to observable factors, it is possible to simulate the change in their distribution through rank-preserving transformations:

$$\hat{\varepsilon}_{it} = F_{t*}^{-1} \circ F_t(\varepsilon_{it})$$

Where F () is the cumulative function of the distribution. When this distribution is assumed to be normal with zero mean, the preceding transformation becomes:

$$\hat{\varepsilon}_{it} = \frac{\sigma_{t*}}{\sigma_t} \varepsilon_{it}$$

Where σ_t is the standard deviation of the distribution at time t (Bourguignon et al., 2005).

The combined participation, price and error term effect is then written as:

(12) $LBE_{tt*} = D(\{X_{ht}, Y_{0ht}, \Omega_{ht*}\}, \beta_{t*}, \gamma_{t*}) - D(\{X_{ht}, Y_{0ht}, \Omega_{ht}\}, \beta_t, \gamma_t)$

Finally, the *residual change*, which is the variation do not captured by the three previous effects will be estimated by:

(13) $R_{tt*} = D_{t*} - D_t - L_{tt*} - B_{tt*} - E_{tt*}$

A common problem with this methodology is the path dependency[11]. The price effect and the participation effect are likely to depend on the reference population that is used to evaluate them, unless population, price structure, and behavioural parameters are close to each other, which in most of the cases is unlikely due the changes in the economy (Bourguignon et al., 2001). One way to asses the robustness of the results for each effect, as Bourguignon (et al., 2001) and Grimm (2001) suggest is to perform the simulation with different combinations of base years. We will perform six combinations with the three years of our sample 1999, 2002 and 2005.

In this paper we will present the components represented by equations (8), (9), (10), (11), (12) and (13).

[11] In the present framework, this property means that changing the conditional income distribution from the one observed in *t* to that observed in *t'* does not have the same effect on the distribution when this is done with the distribution of characteristics X observed in *t,* as when X is observed in *t'* (Bourguignon et al., 2005).

5. Description of the data

5.1. The Survey[12]

The data were obtained from the household surveys of the years 1999, 2002 and 2005 which were elaborated by the MECOVI Program (*"Programa de Mejoramiento de las Encuestas y Medición sobre las Condiciones de Vida")*. The purpose of this program is gathering information about the living conditions of the Bolivian society in order to generate poverty indicators and to formulate policies and programs which contribute to the improvement of the household welfare conditions.

As a part of this program each year, since the year 1999, household surveys are carried out. The survey includes information about the socio demographic characteristics of the household, migration, wealth, education, employment, non-wage incomes, current expenses, housing and loans. The surveys used in the present paper were conducted in the last months of the years 1999, 2002 and 2005 by the National Statistics Institute of Bolivia (INE).

Before starting with the description of the data, let us mention some aspects which were taken into account for the following analysis. First, we consider just three possible occupational categories; wage earners, non-wage earners and inactive or unemployed; the analysis of the data will include this division. Second, in addition to the classification by occupational category we will take into account the differences between men and women. Third, we will only consider as an employee (wage earner or non-wage earner) all individuals who registered a positive income. Fourth, the labour income is defined as the income of the principal activity. And finally, the non labour income includes income from the secondary activity and other incomes such as transfers or rents.

Having in mind the decomposition method described in section 4, in the following section we will describe the data used for its estimation.

5.2. Changes in the socio-demographic characteristics

Years of schooling

Between the years 1999 and 2002, the average years of schooling for the wage earners and the inactive or unemployed population has reduced. According to UDAPE (2003) in 2002 the average labour income was lower than one year before, especially among the poorest households. The lower income affected the human capital decreasing the rate of school attendance. Thus, the school attendance rate in 2002 declined probably because of the lank of economic resources and the necessity to generate income through child labour. Moreover, the basic social services in this specific year were affected by fiscal restrictions.

In contrast, the non-wage earners registered more years of education in 2002 than in 1999, despite the negative context. This could be explained by the fact that the

[12] The information related to the survey was obtained from the "Documento Metodológico de la Encuesta a Hogares"-Programa MECOVI- Instituto Nacional de Estadística- Bolivia and is explained in more detail in Appendix 3.

non-wage earner activities usually do not imply fixed timetables; hence for the non-wage earner population is common to work and to study at the same time. However, in absolute terms they still present less years of schooling than the wage earners.

Between the years 2002 and 2005, the average level of education has improved for all the occupational categories, but particularly for the women wage earners. The positive recovering of the economy contributed to improvements in the school attendance rate for this period, compensating the fall in the average years of schooling of the period 1999-2002.

Table 3
Bolivia: Average years of schooling (population of 7 and above)

Years	1999	2002	2005	1999-2002	2002-2005	1999-2005
Total	6.6	6.6	7.1	0.0	0.6	0.5
Wage earners						
All	10.4	9.9	10.6	-0.5	0.7	0.2
Men	10.2	9.8	10.4	-0.4	0.6	0.2
Women	10.8	10.1	11.0	-0.7	0.9	0.2
Non wage earners						
All	5.7	6.1	6.5	0.4	0.4	0.8
Men	6.0	6.3	6.8	0.3	0.5	0.8
Women	5.2	5.8	6.0	0.7	0.1	0.8
Inactive/Unemployed						
All	5.9	5.8	6.3	-0.1	0.5	0.5
Men	6.3	6.2	6.7	-0.1	0.5	0.4
Women	5.5	5.5	6.1	0.0	0.5	0.5

Source: Author's calculations based on household surveys.

Comparing the average levels of education of the year 1999 and 2005, all occupational categories registered an upward trend. Nevertheless, the average years of schooling for the wage earners category grew less than the others. The sharpest change in years of schooling was registered by the men and women non-wage earner.

Finally, it is interesting to note positive trend in the level of education of the female population, particularly for the women wage earners who in the sample seems to be more educated than the men.

Experience

As we mentioned before we are working with the potential experience, which is an approximation of the real experience and is calculated as experience= age – years of schooling – 6, where we assume that the individual starts his/her education at 6 years old.

Between the years 1999 and 2005, the variation in experience was in general positive for all the occupational categories. Overall we observe that the non-wage earner population registered higher levels of experience than the wage earner population. This aspect is consistent with the age structure of the population. The individuals who work as wage earners are younger than the non-wage earners. The average age of the non-wage earners and wage earners is around 43 years and 33 years old, respectively.

Table 4
Bolivia: Potential Experience (in years) (Working age population)

Years	1999	2002	2005	1999-2002	2002-2005	1999-2005
Total	17.1	16.7	17.4	-0.4	0.7	0.4
Wage earners						
All	16.9	17.0	17.3	0.1	0.3	0.4
Men	17.9	17.9	18.2	0.0	0.3	0.3
Women	14.9	15.3	15.6	0.4	0.3	0.7
Non wage earners						
All	31.3	30.5	32.1	-0.8	1.6	0.8
Men	31.9	31.1	32.0	-0.7	0.9	0.1
Women	30.6	29.5	32.3	-1.1	2.8	1.7
Inactive/Unemployed						
All	11.4	11.4	12.0	0.0	0.6	0.6
Men	5.9	5.1	6.8	-0.8	1.7	0.9
Women	15.1	15.1	15.4	0.0	0.3	0.3

Source: Author's calculations based on household surveys.

Area of Residence

The variable *metro* that is used in the regressions as a proxy for the area of residence of the individuals is a dummy variable which takes the value 1 if the individual resides in capital cities, such as La Paz, Cochabamba, Oruro, Potosi, Sucre, Tarija, Pando, Beni, Santa Cruz and El Alto, and takes the value 0 if the individual resides elsewhere.

According to our data between 1999 and 2005 the labour force in the capital cities has declined whereas the labour force in the rest of the country has increased. In

2005, 62% of the wage earners were working in the capital cities and 38% in the rest of the country, regarding the non-wage earners 38% were working in the capital cities and 61% in the rest of the country. Such variation could be explained due to problems with the sample, such as changes in the design of the household surveys.

Table 5
Bolivia: Area of residence (in percentage)

Years	1999		2002		2005	
	Capital cities	Rest of the country	Capital cities	Rest of the country	Capital cities	Rest of the country
Total	52.56	47.44	49.09	50.91	44.79	55.21
Wage earners						
All	72.99	27.01	67.21	32.79	61.79	38.21
Men	71.88	28.12	64.84	35.16	60.34	39.66
Women	75.18	24.82	71.69	28.31	64.55	35.45
Non wage earners						
All	44.95	55.05	43.53	56.47	38.55	61.45
Men	35.61	64.39	32.63	67.37	31.02	68.98
Women	58.17	41.83	61.23	38.77	49.53	50.47
Inactive/unemployed						
All	49.49	50.51	45.81	54.19	41.75	58.25
Men	53.19	46.81	48.96	51.04	43.25	56.75
Women	47.01	52.99	43.73	56.27	40.78	59.22

Source: Author's calculations based on household surveys.

5.3. Changes in the participation and occupational choices

Between the years 1999 and 2002 there was a fall in the occupied population who was working as wage earners and non-wage earners, except for the female wage earners who improved their participation in 4.6%. Apparently, the participation of the female non-wage earners in the labour force was the most affected, decreasing in around 11%.

With respect to the variation of the years 2002 and 2005, signals of improving in the wage earners participation were registered. Nevertheless, the non-wage earner participation was still decreasing excluding the female non-wage earner participation which was recovering from the sharp fall of the period 1999-2002. The inactive and unemployment rate has declined in this period. According to UDAPE (2006) the improvements in the performance of labour intensive activities contributed to stop the rise in the open unemployment rate. The estimations made it by UDAPE showed that the unemployment rate of the year 2005 was lower than the registered rates in the previous years.

Taking into account the variations presented between 1999 and 2005, we observe that the participation of the wage earners in the total employed population rose, especially among women. The opposite situation is observed with the non-wage earners who diminished their participation, for the men in 7.2% and for the women in 9.4%. The shift to wage employment instead of the non-wage employment in the period 1999-2005 may be explained by the recovering of the labour intensive activities, which are in general wage earner activities.

The inactive and unemployed category in Bolivia is principally composes by women. In 2005, 70% of the women who belongs to the working age population declared to be inactive or unemployed.

Table 6
Bolivia: Occupational category (in percentage)

Years	1999	2002	2005	1999-2002	2002-2005	1999-2005
Wage earners						
All	17.6	17.7	18.7	0.6%	5.5%	6.1%
Men	23.9	23.5	25.2	-1.7%	7.5%	5.6%
Women	11.6	12.1	12.5	4.6%	3.3%	8.0%
Non wage earners						
All	23.5	22.6	21.9	-4.0%	-2.8%	-6.7%
Men	28.9	28.3	26.8	-2.0%	-5.3%	-7.2%
Women	19.1	17.0	17.3	-11.2%	2.1%	-9.4%
Inactive/Unemployed						
All	58.9	59.7	59.4	1.4%	-0.6%	0.9%
Men	48.1	48.2	48.0	0.4%	-0.5%	-0.2%
Women	69.3	70.9	70.1	2.3%	-1.1%	1.2%

Source: Author's calculations based on household surveys.

5.4. Changes in the income levels

Between 1999 and 2002, the levels of labour income improved for both categories, with exception of the women wage earners whose wage decreased by 3.4%. Nonetheless, the improvement in the labour income was higher for the wage earners than for the non-wage earners, particularly if we compare the 5.4% increase of the men wage earners with the 1% increase of the men non-wage earners.

In 2005, the growth in the labour income of the non-wage earners in relation to the year 2002 is significant, for both men and women, 30.6% and 18.3%, respectively. While for the wage earners there was a reduction in the wages for the male wage earner population, and an increase for the female wage earner population.

If we compare the level of wages between 1999 and 2005, we can observe an almost zero growth rate in the labour income of the wage earners, because the increase in wages between 1999 and 2002 was offset by the reduction in wages between 2002 and 2005. In contrast, the non-wage earners presented positive growth rate of wages, especially between 2002 and 2005. Some possible explanations which can make clear the large increment in the labour income of the non-wage earners could be the growth rates in average years of schooling, the increased in their potential experience, and the reduction on the supply of non-wage earners. However, this large rise can also be explained by measurement problems in the household surveys.

Table 7
Bolivia: Average Labour Income (in 2005 Bolivianos)

Years	1999	2002	2005	1999-2002	2002-2005	1999-2005
Total Labor Income (ypi)	1,009	1,042	1,142	3.2%	9.6%	13.2%
Wage earners						
All	1,375	1,420	1,373	3.2%	-3.3%	-0.1%
Men	1,499	1,581	1,499	5.4%	-5.2%	0.0%
Women	1,128	1,090	1,139	-3.4%	4.5%	0.9%
Non wage earners						
All	735	752	945	2.4%	25.6%	28.6%
Men	807	815	1,065	1.0%	30.6%	31.9%
Women	632	650	769	2.9%	18.3%	21.7%

Source: Author's calculations based on household surveys.
Note: The values of the labour income are adjusted in 2005 Bolivianos and are calculated in per capita base.

Other aspect that is interesting to note, is the differences in wages between men and women, which still persist in 2005, in spite of the increase in women's wages in the last years and in the high levels of education registered for them in this period. In 2005, the labour income of the women wage earner represents the 76% of the men's income whereas for the women non-wage earners this percentage is around 72%. Nevertheless, in this estimation we are not taking into account the hours of work, therefore the results might be biased.

In Table 8 we present the composition of the household per capita income. We can see that the largest part of the total income is formed by the labour income in the three years of the sample. Thus, the labour income is the main source of income for the households. However, it presents a downward trend, whereas the other incomes are increasing in the time. It seems that, the explanation for this reduction in the participation of the labour income and the raise in the participation of the other incomes in the total income is due the new sources of income that the households found in order to overcome the deterioration in the labour market the years of the economic crisis. This new sources are probably remittances from abroad and other kind of transfers.

Table 8 Bolivia: Composition of the household income (in percentage)

Years	1999	2002	2005
Total per capita income	100.0%	100.0%	100.0%
Labor income	82.9%	79.2%	78.4%
Other incomes	17.1%	20.8%	21.6%

Note: The labour income is the income generated by the principal activity of the individual, includes wage earners and non-wage earners. Other incomes include the income of the secondary activity and other incomes such as transfers, rents, subsidies and so on.
Source: Author's calculations based on household surveys.

6. The Results

This section is divided in two subsections. In the first one we will describe the results of the estimation of the individual earnings functions and the labour supply and occupational choice model. In the second subsection, we present the results of the simulations for the decomposition technique explained in section 4.

6.1. Estimation of the Equations

6.1.1. Individual Earnings Functions

In order to estimate equations (3) and (4) we applied OLS, and the coefficients of the regressions are presented in Table 9, the detail of the results is in Appendix 4. All the variables have the expected signs; the variables *years of schooling, experience* and *metro* are positive in all the cases and the variable *experience squared* is negative[13].

Studying the dynamics of the returns of education, we can observe than this coefficient have been increasing for the male population, and it was in general higher for the non-wage earners than for the wage earners. However, in 2005, the returns of schooling of the non wage earners population declined and have became lower than those of the wage earners. This change may be explained by the boost in the labour intensive activities which are in general carried out by the wage earners.

Table 9
Coefficients of the equations (3) and (4) individual earnings functions

	Men			Women		
Years	1999	2002	2005	1999	2002	2005
Wage earner						
s	0.0788	0.0804	0.0980	0.1079	0.0927	0.1087
ex	0.0583	0.0604	0.0524	0.0267	0.0430	0.0307
ex2	-0.0008	-0.0009	-0.0007	-0.0002	-0.0006	-0.0002
metro	0.0867	0.1543	0.0928	0.4087	0.2819	0.2224
_cons	5.4567	5.3961	5.2215	4.7746	5.0527	4.9355
Sample size	1179	2276	1603	610	1162	820
R-squared	0.2935	0.2742	0.3514	0.3758	0.3315	0.4045
Non wage earners						
s	0.0829	0.0995	0.0936	0.1206	0.0784	0.1034
ex	0.0416	0.0346	0.0378	0.0600	0.0505	0.0611
ex2	-0.0006	-0.0005	-0.0006	-0.0008	-0.0006	-0.0008
metro	0.9283	0.7748	0.6159	0.3930	0.4640	0.3413
_cons	4.5757	4.4305	4.9207	3.9014	4.2530	4.0715
Sample size	1553	2915	1927	958	1687	1178
R-squared	0.3164	0.2199	0.2654	0.2152	0.1317	0.1988

Source: Author's calculations based on household surveys

[13] Furthermore, all the variables are statistically significant at the 1% level in almost all regressions. With the exception of the variable *metro* that in the regressions of men wage earners for 1999 is not statistically significant and in the regression for 2005 has a significance level of 10%. The variable *experience squared* for women wage earners regressions is not statistically significant for the year 1999 and has a significance level of 10% in the regression for 2005.

Other interesting aspect, of the results of the regressions, is the returns of schooling of the women, which are higher than the men (except for the non wage earners in 2002), albeit the mean monthly earnings for men are higher than for women. Dougherty (2003) suggests that the better educated is a woman, the more able and willing she is to look for better jobs. Besides, in general women choose to work in sectors where education is relatively highly valued[14].

The coefficient of the variable *metro,* which takes the value 1 if the individual lives in the capital cities and 0 otherwise, registers the most significant changes in terms of magnitude in the years of the sample. In 1999 to live in one of the capital cities implied a high probability to have better wages, in 2005 this probability has decreased, especially for the non-wage earner population.

6.1.2. Labour Supply and Occupational Choice Models

In order to obtain the results of the labour supply and occupational choice models, we estimated equation (2) through a multinomial logit model, which was calculated separately for men and women *household heads* or *other members of the household*. The results of the marginal effects are presented in Table 10 and they were calculated as the effects of other choices versus of being inactive or unemployed[15].

Table 10
Marginal effects of the multinomial logit estimations of participation and occupational choice models

	Head						Spouse/Other members					
	Men			Women			Men			Women		
Years	1999	2002	2005	1999	2002	2005	1999	2002	2005	1999	2002	2005
Wage earner												
s	0.0236	0.0136	0.0156	0.0068	0.0084	0.0161	0.0131	0.0163	0.0154	0.0121	0.0113	0.0128
ex	-0.0015	-0.0066	0.0046	-0.0043	0.0071	0.0026	0.0227	0.0212	0.0235	0.0059	0.0068	0.0057
ex2	-0.0001	0.0000	-0.0002	0.0000	-0.0002	-0.0001	-0.0004	-0.0004	-0.0005	-0.0001	-0.0001	-0.0001
metro	0.1532	0.1861	0.1623	-0.0224	-0.0320	0.0375	0.0864	0.0388	0.0442	0.0116	0.0236	0.0105
n_0106	0.0167	0.0057	0.0102	-0.0394	-0.0103	0.0029	0.0177	0.0092	0.0147	-0.0043	-0.0033	-0.0021
n_0764	0.0219	-0.0010	0.0007	-0.0032	-0.0051	0.0031	0.0033	-0.0018	0.0034	0.0011	0.0001	0.0019
n_6598	-0.0386	-0.0729	-0.0578	0.0661	-0.0507	-0.0382	-0.0153	-0.0167	-0.0174	0.0068	-0.0012	-0.0042
y_hh							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
_cons	-0.2532	-0.0420	-0.1591	0.0653	-0.0639	-0.1777	-0.3725	-0.3469	-0.3634	-0.2157	-0.2374	-0.2514
Non wage earners												
s	-0.0293	-0.0188	-0.0242	-0.0287	-0.0298	-0.0265	0.0043	0.0052	0.0034	0.0031	0.0051	0.0048
ex	0.0047	0.0106	0.0020	0.0171	0.0109	0.0167	0.0081	0.0086	0.0063	0.0159	0.0142	0.0127
ex2	0.0000	-0.0001	0.0001	-0.0003	-0.0002	-0.0002	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002
metro	-0.2471	-0.2707	-0.2325	-0.1749	-0.0428	-0.1850	0.0114	0.0048	-0.0002	0.0877	0.0714	0.0454
n_0106	0.0079	0.0024	0.0084	0.0078	-0.0210	-0.0214	0.0058	0.0044	0.0033	0.0044	0.0024	0.0069
n_0764	-0.0179	0.0008	-0.0056	-0.0185	0.0014	-0.0264	-0.0006	-0.0014	-0.0021	-0.0055	-0.0065	-0.0042
n_6598	0.0303	0.0723	0.0611	0.0993	0.1512	-0.0426	-0.0017	-0.0005	-0.0046	-0.0069	-0.0080	-0.0244
y_hh							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
_cons	0.4508	0.2295	0.3696	0.3456	0.2511	0.2810	-0.1332	-0.1549	-0.0926	-0.3514	-0.3141	-0.2956

Source: Author's calculations based on household surveys

As De Jong (2001) comments "[…] the interpretation of the estimated coefficients of the multinomial logit model is not as straightforward as in the case of the earnings equations. This is because the magnitude (and sign) of a coefficient indicate

[14] The study elaborated by Dougherty (2003) was based on household surveys of USA; it would be interesting to test if the same hypothesis can apply for the Bolivian context in further studies.

[15] The results of the multinomial logit model and also the detail of the results of the marginal effects can be found in Appendix 5.

how the relative probabilities change as a result of a unit change in a variable. The marginal effect of a change in a variable on the probability that a particular alternative is selected not only depends on the value of the coefficient for that variable, but also on that probability itself and the weighted mean value of the coefficient for each possible alternative. The weights are the predicted probabilities of selecting one of the possible alternatives. Since the probabilities are a function of the values of all coefficients, the marginal effect thus also depends in this way on the value of the coefficient in question. The sign of a marginal effect can be different from that of the coefficient".

Interpreting the results of the marginal effects we observe that in general an additional year of schooling increases the probability to be employed except for the *head of the household* non-wage earner (men and women).

The additional years of potential experience seems to have a positive effect over the probability to work in almost all of the regressions (except for the year 1999 for men and women *head of the household* and the year 2002 for men *head of the household*, where the effect was negative). In this sense, the more potential experience a person has, the more likely it is that the person is employed. Even though the marginal increase in this probability is less with every additional year of experience aspect that is reflected in the negative sign of experience squared.

For the non-wage earners *head of the household* living in capital cities decline the probability to work, whereas for *other members of the household* wage earners and non-wage earners to live in one of the capital cities increases the probability to work.

The probability to work, for men *head of the household* or men who are *other members of the household* increases if there are relatively more other members in the household between 1 and 6 years old. With respect to women *other member of the household*, the number of members between 1 and 6 years old implied less probability to work for the women wage earners. The effect is opposite for women non-wage earners. Finally, the wage of the *head of the household* (y_hh) has none effect over the probability to work for *other members of the household*.

6.2. Simulation

Once we have already estimated the earnings equations for wage earners (equation 3) and non-wage earners (equation 4) and the participations and occupational choice models for household heads and other members of the household (equation 2) we can carry out the decomposition procedure described in equation 8, 9, 10, 11, 12 and 13[16].

These simulations, as discussed above, are carried out for the entire distribution (as in equations 6 and 7). However, the results are summarized below in Tables 11 and 12. Table 11 shows the decomposition of the change in the income distribution of individual earnings in terms of the Gini coefficient. Table 12, summarizes the results for the decomposition of the evolution of the income distribution and poverty of household income and reports the results in terms of the Gini Coefficient and of

[16] The STATA program needed to calculate the decomposition methodology explained in section 4 was generously provided by Niek de Jong, supervisor of this paper.

the poverty incidence. The detail of the results obtained with the simulation can be found in the Appendix 6.

The estimated model, as we mentioned before, was calculated in reduced form, in order to avoid the difficulties associated with joint estimation of the participation and earnings equations for each household member. We also maintain strong assumptions about the independence of residuals. Hence, our results can not be interpreted as corresponding to a structural model.

The interpretation of the results is a description of the conditional distributions, whose functional forms are resulted of the assumptions explained in section 4. However, the estimates that we obtained help us to understand the underlying forces behind the income distribution and the poverty dynamics.

6.2.1. Decomposition of the Change in the Income Distribution of Individual Earnings

For the decomposition of the observed difference in the income distribution of individual earnings, we estimated different simulations with different base years for the periods 1999-2002, 2002-2005 and 1999-2005, in order to compare the results and to reduce the issue of path dependency, mentioned in section 4. The summary of the results obtained are described in the following table[17].

Table 11
Decomposition of the evolution of the inequality of individual earnings (in terms of the Gini Coefficient)

	Period 1999-2002		Period 2002-2005		Period 1999-2005	
	base year 1999	base year 2002	base year 2002	base year 2005	base year 1999	base year 2005
Observed values:	0.5628	0.5739	0.5713	0.5716	0.5604	0.5716
Observed difference:	0.0111	-0.0111	0.0002	-0.0002	0.0111	-0.0111
Simulated differences:						
Participation effect	0.0015	0.0062	0.0048	0.0037	0.0071	0.0067
Price effect	0.0000	0.0055	0.0048	-0.0068	-0.0011	-0.0001
Error term effect	0.0169	-0.0147	-0.0226	0.0288	-0.0057	0.0045
Participation effect and price effect	0.0015	0.0120	0.0101	-0.0024	0.0052	0.0073
Participation, price and error term effect	0.0167	-0.0042	-0.0163	0.0242	0.0011	0.0119
Residual Change	-0.0056	-0.0069	0.0166	-0.0244	0.0100	-0.0231

Source: Author's calculations based on household surveys

The income inequality rose between 1999 and 2002 in 1 point in terms of the Gini coefficient. According to our results this increment was the result of the changes in the labour occupational choices and in improvements in the distribution of the unobserved productive talents. The three effects together explained the deterioration

[17] We also estimated the decomposition of the change in the distribution of wage earners and non-wage earners separately, the results can be found in Appendix 6.

in inequality by around 2 points in the Gini coefficient, which was compensated by approximately 1 point in the residual change. In the simulation using 2002 as a base year, we obtained different results in terms of magnitude of the effects. However the direction of the effects is almost the same in all of the cases (except for the participation effect), for instance the *participation, price and error term effect* takings as a base 1999 implied a increase of inequality by around 2 points whereas taking as a base year 2002 we obtained a increase in inequality of less than 1 point.

For the period 2002-2005 the inequality of the individual earnings remained almost unchanged, the direction of the participation effect is still unclear also in this period (taking as a base year 2002 inequality increases but taking as a base year 2005 inequality decreases). The size of the error term effect is also relevant; it seems that between those years there was more equal distribution of the unobserved productive talents.

Finally, considering the whole period the observed difference was 1 point of increase in inequality in terms of the Gini coefficient. Apparently the reduction in the unemployment rate, the shift of the participation of the non-wage earners, the improvements in wages and the better distribution of unobserved talents tended to offset each other. The participation, price and error term effect are explaining just a marginal part of the change in the individual earnings distribution, whereas the residual change explained the increase in inequality by 1 point.

6.2.2. Decomposition of the Evolution of the Income Distribution and Poverty of the Household Income

In table 12 we present the results of the decomposition of evolution of the income distribution and poverty in terms of the Gini coefficient and poverty incidence, the results for the rest of the indices considered in the paper are in Appendix 6. We also performed different combinations for this decomposition, however in the table 12 we only present the results of the simulations for the period 1999-2002, 2002-2005 and 1999-2005 taking as base years 1999, 2002 and 1999, respectively

Table 12
Decomposition of the evolution of the inequality and poverty of household income

	Period 1999-2002			Period 2002-2005			Period 1999-2005		
	Year	Gini	Poverty Incidence	Year	Gini	Poverty Incidence	Year	Gini	Poverty Incidence
Observed values:	1999	0.5696	0.6295	1999	0.5912	0.6434	1999	0.5669	0.6295
	2002	0.5952	0.6434	2002	0.5953	0.5997	2002	0.5953	0.5997
Observed difference:		0.0256	0.0139		0.0041	-0.0437		0.0285	-0.0298
Simulated differences:									
Participation effect		0.0071	0.0068		-0.0066	0.0009		0.0113	0.0082
Price effect		0.0033	-0.0041		-0.0052	-0.0215		-0.0020	-0.0111
Error term effect		0.0076	-0.0085		-0.0107	0.0122		-0.0052	-0.0027
Participation effect and price effect		0.0098	0.0037		-0.0076	-0.0153		0.0092	0.0001
Participation, price and error term effect		0.0162	-0.0076		-0.0213	-0.0018		0.0055	-0.0008
Residual Change		0.0093	0.0215		0.0254	-0.0420		0.0229	-0.0290

Source: Author's calculations based on household surveys

Participation effect

1999-2002: The participation effect explained around 1 point of increase in poverty and inequality. Therefore, the increase in the unemployment rate in this period worsened the income distribution.

2002-2005: This effect had a small impact over the inequality and poverty indices and had also opposite directions. In some way contributed to the reduction of inequality but affected poverty. During this period the unemployment rate was recovering but apparently it was not enough to generate a significant change in the income distribution and in the welfare of the households.

1999-2005: For the whole period the participation effect is explaining around 1 point of the increase in inequality and poverty. Apparently, the unemployment rate was a factor which affected the poverty and the income distribution in the country.

Price effect

1999-2002: In this period the total labour income registered a small increase. Over inequality and poverty this change had different effects of low magnitude. Indeed, the price effect was contributing to higher levels of inequality but lower levels of poverty.

2002-2005: The labour income in this period has improved considerably in relation to the previous period but mainly for the non wage earners. The price effect is explaining the improvement of less than 1 point of the income distribution and the reduction in poverty in around 2 points. The changes in wages registered in this period contributed to reduce poverty but not income inequality, which stayed almost unaffected.

1999-2005: The improvement in wages for the non wage earners who represent the largest part of the labour force helped to reduce inequality and poverty. The price effect contributed for a better income distribution, but the magnitude of this effect was rather small. For the poverty instead this effect helped the poverty reduction in 1 point.

Error Term Effect

1999-2002: The changes in the distribution of unobserved productive talents in this period implied an increase in inequality by around 1 point and a reduction in poverty in as well approximately 1 point.

2002-2005: The error effect diminished inequality by 1 point and increased poverty by 1 point.

1999-2005: Considering the direction of this effect in both previous periods, we would expect zero impact for the whole period. However, the magnitude of the effects estimated separately for the subdivisions of the period 1999-2005, differ in a small quantity to the value that we obtained in the simulation for the whole period. Therefore, the error term explained in a very small magnitude the reduction in poverty and inequality.

Participation Effect and Price Effect

1999-2002: Simulating both effects together the impact over inequality is 1 point more, here the price effect strengthened the participation effect for more income inequality. Regarding poverty, the price effect offset the participation effect, thus the increase in poverty because of both effects is smaller than just taking the participation effect alone.

2002-2005: In this period the improvements in the unemployed rate and in the level of wages, contributed to less inequality and less poverty. The impact of these two effects together is around 1 point for the reduction in inequality and poverty.

1999-2005: The participation and price effect increased income inequality by around 1 point (the impact would have been higher if in the period 2002-2005 both effect would not being reducing inequality). With respect to poverty, both effects have an impact close to zero.

Participation, Price and Error Term Effect

1999-2002: In this period all the effects together are explaining around 2 points of the increase in income inequality, the higher unemployment rates and the unequal distribution of unobserved productive talents deteriorated the income distribution in Bolivia for this period. The contrary happened with poverty, where the price effect and the error effect were pressing on for a reduction in poverty.

2002-2005: It should be note that the levels of income inequality for this period remained almost unchanged, even though the three estimated effects were pushing for a decrease in terms of inequality in at least 2 points. The observed difference registered a reduction in poverty incidence in 4 points in this period, from which not even 1 is explained by the simulation of the three effects together. According to our results the three estimated effects were trying to reduce poverty in a very small magnitude.

1999-2005: For the whole period the three effects explained around 1 point of increase in inequality and a little magnitude of the reduction in poverty.

Residual Change

1999-2002: The observed variation in terms of inequality in this period was around 3 points of increase in the Gini coefficient. 2 explained by the simulated effects and 1 by the residual change. For poverty the observed difference was an increment of 1 point in the poverty incidence, which was explained by the residual change.

2002-2005: The income inequality remained constant between 2002 and 2005. The simulated effects pushed for a reduction in 2 points, but the residual change explained an increase in inequality for the same 2 points. The poverty incidence has reduced 4 points in this period, explained mainly for the residual change because the three estimated effects tended to offset each other.

1999-2005: The observed difference in terms of the Gini coefficient was an increase of around 3 points, one of them explained by the three simulated effects and 2 by the residual change. For poverty incidence, the reduction in 3 points, observed in this period, is mainly explained by the residual change.

6.2.3. About the results of the simulations

Considering that the residual change, which is the variation in inequality and poverty not captured by the three simulated effects, was rather large in the individual earnings decomposition and in the decomposition for household income, we tested the degree of "explanation" of the applied model for the observed variations in poverty and inequality in the period 1999-2005.

Taking into account the problem of path dependency, have already mentioned in section 4, we analyzed this issue in our model through different exercises. We estimated different combinations of the base years; we have simulated changes between the periods 1999-2002, taking as a base year 1999 and then using 2002 as a base year; for the periods 2002-2005 and 1999-2005 the procedure was similar[18]. We present in Table 13 just the results for the period 1999-2005 for the decomposition of household income.

Table 13
Decomposition of the changes in inequality and poverty-
Different specification of the model

Different especifications:	First specification (ex and ex2)				Second specification (age and eage2)			
	Base year 1999		Base year 2005		Base year 1999		Base year 2005	
Indices	Gini	Poverty Incidence	Gini	Poverty Incidence	Gini	Poverty Incidence	Gini	Poverty Incidence
Observed difference:	0.0285	-0.0298	-0.0285	0.0298	0.0285	-0.0298	-0.0285	0.0298
Simulated differences:								
Participation effect	0.0113	0.0082	-0.0082	-0.0088	0.0182	0.0052	-0.0131	-0.0130
Price effect	-0.0020	-0.0111	0.0013	0.0128	-0.0004	-0.0098	-0.0010	0.0109
Error term effect	-0.0052	-0.0027	0.0038	0.0011	-0.0049	-0.0036	0.0035	0.0012
Participation effect and price effect	0.0092	0.0001	-0.0065	0.0046	0.0194	-0.0003	-0.0140	0.0049
Participation, price and error term effect	0.0055	-0.0008	-0.0028	0.0083	0.0168	-0.0023	-0.0101	0.0077
Residual Change	0.0229	-0.0290	-0.0257	0.0215	0.0116	-0.0275	-0.0183	0.0221

As a result of these estimations we observed that many estimates were different according to the year that was chosen as a base year. This means that in our estimation the base year in which we calculated the effects matter for the results. This is a very common issue with this kind of decomposition.

[18] The results for this exercise are presented in the Appendix 6.

However, the difference in the results was relatively small in terms of magnitude, and the direction of the effects was the same for poverty and inequality in most of the cases, in the results of the Table 13, just the participation effect and price effect (estimated in a joint manner) for poverty incidence presents different direction.

Moreover, we changed the specification of the model, substituting the variables experience and experience squared by the variables age and age squared as Ferreira and George Leitte (2002) did for the study about educational expansion and income distribution in Ceará. The results that we obtained are presented in Appendix 7. Nevertheless we also include in Table 13, the results for the period 1999-2005 for the Gini coefficient and poverty incidence.

Even though the magnitude of the effects is different in most of the cases with this new specification, the direction of the effects is the same in a large part of the results. For instance, taking as a base year 1999 for the two specifications, the participation, price and error term effect together are explaining less than 1 point of the observed variation in inequality with the first specification, but with the second specification the explained change for these effects is less than 2 points in inequality. For poverty incidence in both specification the residual change is explaining around 3 points of the variation.

Furthermore, we calculated the relative changes in terms of the observed difference between the two years of each period under analysis. These results can be found in Appendix 8. We observed that the simulate effects are relatively important for the explanation of the observed difference in inequality and poverty for some indicators and for some periods, however the residual change it seems to be as important as these effects are (an in some cases even more) for explaining these changes.

One possible justification for the large magnitude of the residual change in our results is the changes in the non labour income. Although the labour income is still the main source of income for the household, its participation in the total household income has been diminishing through the last years; this could be attributed to the fact that other incomes such as remittances from the individuals who are working abroad are becoming more relevant with the phenomenon of migration.

7. Conclusions

For the conclusions we will focus on the changes registered in the whole period under analysis 1999-2005. In the section of description of the data we observed that the labour market in this period presented important changes. The working age population registered in average more years of schooling, has more years of potential experience, and the level of wages has increased, among other changes.

In the estimation of the individual earnings function draw our attention the higher returns of education for women, despite the fact that they tend to earn less than men. It seems that the more educated women look for better jobs and choose to work in places where their education is valued.

Through the estimation of the labour supply and occupational choice models, we observe that additional years of schooling increases the probability to be employed, except for the *head of the household* non-wage earner, whose probability to be employed decreases with extra years of education.

In the decomposition of the individual earnings, we found through our results that the increase in 1 point in inequality was mainly explained by the residual change. However, the price effect and the error term effect were pushing for a better distribution; the participation effects offset this change and deteriorated the income distribution.

About the decomposition of the household income, according to the results of the simulations, the 3 points of increase in the Gini coefficient in the period 1999-2005 were explaining by approximately 1 point for the simulated effects and 2 points for the residual change. The increase in the unemployment rate, the shift in the participation of the non wage earners, the rise in wages and the more unequal distribution of unobserved productive talents deteriorated the income distribution in this period in Bolivia.

Regarding the poverty incidence, the observed variation was 3 points explained mainly by the residual change. The low magnitude of the simulated effects as determinants of the decline in poverty in those years can be explained by the rising participation of the non labour incomes in the total household income. In 1999 the non labour income was approximately 17% of the total income whereas at the year 2005, this represented the 22% of the total income.

The large values of the residual change in our results led us to evaluate the degree of explanation of the model for the changes in inequality and poverty in the period under study. We found that our results are path dependent, and change if we choose different base years for the estimation of the effects. However, this difference was small in most of the cases.

Moreover, we also simulated a different specification of the model; changing the variables experience and experience squared by the variables age and age squared in order to compare the results and observe how close are one from the other. We found that the results differed in magnitude in almost all the simulated effects, but this difference is relatively small and the signs of each effect are, in almost all the cases, the same as the signs of the effects calculated with the previous specification.

Finally, adding up the simulated effects form the period 1999-2002 and the period 2002-2005, we would expect to obtain the same results of the period 1999-2005. However, the results are different in terms of magnitude but the difference, as in the previous exercises, was small. Therefore we can conclude that the estimated effects are relevant as determinants of the changes in inequality and poverty for the period 1999-2005, even though these simulated effects in most of the cases were not the main source of the observed variation.

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Appendix 1: Inequality and Poverty Indices

A1.1. Inequality Indices

Gini Coefficient

The Gini coefficient is defined by:

$$G = \frac{1}{2\mu(y)}\left[\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}|y_i - y_j|}{n(n-1)}\right]$$

This coefficient varies between zero and one. Zero is the ideal situation in which all the individuals or households have the same income, and one represents the value when incomes are concentrated on a few households. The Gini coefficient is a value derived of the equitable norm, normalized with regard to the population's size. It shows us the degree of inequality that exits in the distribution of income (Mercado and Aguilar, 2006).

Theil Coefficient (E1)

The formula of the Theil Index is:

$$T = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{x_i}{\bar{x}}.\ln\frac{x_i}{\bar{x}}\right)$$

Where x_i is the income of the ith person, $\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$ is the mean income, and N is the number of people. The first term inside the sum can be considered the individual's chare of aggregate income, and the second term is that person's income relative to the mean. If everyone has the same (i.e., mean) income, then the index is 0. If one person has all the income, then the index is ln N.

Coefficient of Variation (E2)

The coefficient of variation (C) is just the standard deviation divided by the mean, so that the only relative income matter. Thus,

$$C = \frac{1}{\mu}\sqrt{\sum_{j=1}^{m}\frac{n_j}{n}(y_j - \mu)^2}$$

The transformed coefficient of variation used in the paper is half of the squared of the coefficient of variation.

A1.2. Poverty Indices

We calculated the three poverty indices deigned by Foster, Greer and Thorbecke (FGT) from the following equation:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{m}\left(\frac{Z - y_i}{Z}\right)^\alpha \quad \text{where } \alpha \geq 0$$

Where

- y_i is the average real spending of the household member i.
- Z is the poverty line.
- N is the number of people in the sample population.
- M is the number of people whose income is lower than the poverty line.
- α can be interpreted as a measure of inequality aversion.

Poverty Incidence (P0)

When α=0, the above equation reduces to P_α=M/N, the number of poor people in the population divided by the number of people in the sample population. This measure is also called headcount ratio or when turned into a percentage headcount index (proportion of individuals whose income is lower than the poverty line).

Poverty Gap (P1)

When α=1,

$$P_1 = \frac{1}{N}\cdot\sum_{i=1}^{m}\frac{Z - y}{Z} = \frac{M}{N}\cdot\frac{Z - \bar{y}}{Z},$$

The reason for dividing by the average for society as a whole is that it gives us an idea of how large the gap is relative to resources that potentially may be used to close the gap. In this sense, the poverty gap ratio is not really a measure of poverty itself, but a measure of resources required to eradicate it (Ray, 2004).

Poverty Severity (P2)

When α=2,

$$P_2 = \frac{1}{N}\cdot\sum_{i=1}^{m}\left(\frac{Z - y_i}{Z}\right)^2 = \frac{M}{N}\cdot\left(\frac{Z - \bar{y}}{Z}\right)^2,$$

This is the poverty severity index which is sensitive to the distribution of living standards among the poor. This index takes into account the variations in distribution of welfare among the poor.

Appendix 2: Simulation of residuals for the multinomial logit model

For the generation of the residuals we applied the methodology used by Grimm (2001). According to him, it is possible to generate residuals for the multinomial logit model that are compatible with the observed occupational choices and the hypothesis about the distribution of the disturbance term of the multinomial logit model.

The individual utility derived by the occupation of labour market choice *j* can be written as:

(1) $U_j = \lambda_j^* x_j + v_j$

Where *xj* is a vector of individual and household characteristics and *υj* are residuals, which are independent and identically distributed with Weibull distribution.

The observed occupational choice for the individual under study is denoted *j*◦. Thus, it is obvious, that a conditional distribution has to be determined such that:

(2) $F(v_j / \hat{\lambda}_j' x_{jo} + v_{jo} > \max_{j \neq jo}(\hat{\lambda}_j' x_j + v_j))$

If the conditional densities, independent of the error term of the labour supply functions, are denoted as *f*(*υj*), and $\hat{\lambda}_j' x_j$ as *gj* , the conditional density for the individuals observed in activity *j*◦ reads:

(3)

$$f(v_{jo} / act = j^o) = \frac{f(v_{jo})}{\Pr(act = j^o)} \int_{.....}^{.....} \int_{(v_{jo} > \max_{j \neq jo}(g_j + v_j) - g_{jo})}^{j \neq jo} f(v_j) dv_j$$

$$f(v_{jo} / act = j^o) = \frac{f(v_{jo})}{\Pr(act = j^o)} \int_{.....}^{....} \int_{(v_{jo} > g_j + v_j - g_{jo})}^{j \neq jo} f(v_j) dv_j$$

$$f(v_{jo} / act = j^o) = \frac{f(v_{jo})}{\Pr(act = j^o)} \prod_{j \neq jo} F(v_{jo} + g_{jo} - g_j)$$

Through integration by parts and the specification of the multinomial logit model, one obtains:

(4) $F(v_{jo} / act = j^o) = \exp\left(- \frac{\sum_j \exp(g_j)}{\exp(g_{j^o})} \exp(-v_{j^o}) \right)$

Likewise, once simulated the residual of the observed occupation ($\bar{v}_{j^o}$), the residuals associated to the remaining occupations can be obtained by:

(5) $F(v_j / v_j < g_{j^o} + \bar{v}_{j^o} - g_j) = \dfrac{F(v_j)}{F(g_{j^o} + \bar{v}_{j^o} - g_j)}, \forall j \neq j^o$

which yields under the specification of the multinomial logit model:

(6) $F(v_{j^o} / act = j^o) = \dfrac{\exp(-\exp(-v_j))}{\exp(-\exp(g_j - g_{j^o} - \bar{v}_{j^o}))}$

The conditional distributions defined in (16) and (17) can be easily inverted, and residuals can be calculated by drawing *Fj* 's and *Fj*◦ 's from a uniform distribution on the interval [0, 1].

Appendix 3: The Survey

A3.1. Universe of study

The survey was oriented to the households established in private dwellings in the capital cities, and the rest of the urban and rural areas of Bolivia in the years 1999, 2002, 2005. The survey excludes the households in collective dwellings.

A3.2. Sampling, Observation and Analysis Units

The sampling unit in the final stage is the occupied private dwelling. This one has fixed permanence in time and space aspect which allows to use the dwelling as a unit of selection in the sampling design.

The observation unit is the household with all and each of the members who belongs to it.

The analysis units for the generation of information are:

- Household as a collective consumption unit where the transaction of income and expenditure are done.
- Members of the household with socio-demographic, occupational and earnings characteristics.
- Dwelling and its characteristics such as size, physical conditions and services.

A3.3. Sampling Framework

The sampling framework of the household survey has been built over the base of the information of the Census 2001 and is formed by a list of dwellings (private: occupied and unoccupied) of the urban and rural area, classified through census identificators and maps.

A3.4. Sampling type

The sampling applied for the surveys combined stratification by population agglomeration and multi-stages sampling:

The stratums used in the surveys were the following:

- Capital cities and the city of El Alto
- Populations of 10.000 and more which are not capital cities neither El Alto.
- Populations of 2.000 to 10.000.
- Populations of 250 to 2.000.
- Population of less than 250.

The stages of the sampling were:

- Two in the area *amanzanada* (Primary Sampling Unit (PSU) and occupied private dwelling).
- Three in the dispersed area (PSU, census segment – Secondary Sampling Unit, SSU – and occupied private dwelling).

A3.5. Sample size

The required sample size for each year was calculated according to the poverty incidence indicators, average expenditures in consumption and adjustments from the previous surveys, on the basis of a 95% level of confidence.

A4.6. Selection of the Sampling Units

First, for the selection of the PSU, the method PPS (probability proportional to the dwelling's size) was applied for each department and stratum. Second, the same methodology was applied for the PSU in the disperse area. And finally, the same procedure is applied to the selection of occupied private dwellings in the selected PSU.

A4.7. Probability of selection

The probability of selection in the *area amanzanada* is:

$$P(Viv_{ijh}) = \left(\frac{A_h N_{jh}}{N_h}\right) * \left(\frac{VE_{jh}}{VL_{jh}}\right)$$

For the disperse area is:

$$P(Viv_{ikjh}) = \left(\frac{A_h N_{jh}}{N_h}\right) * \left(\frac{B_{jh} N_{kjh}}{N_{jh}}\right) * \left(\frac{VE_{kjh}}{VL_{kjh}}\right)$$

Where:

$P(Viv_{ijh})$: Probability to select dwelling *i* from UPMPSU *j* from *h* stratum

$P(Viv_{ikjh})$: Probability to select dwelling *i* from SSU *k* from PSU *j* from *h* stratum

A_h: number of PSUs from stratum *h*
N_h: number of dwellings from stratum *h*
N_{jh}: number of dwellings from PSU *j* from stratum *h*
VE_{jh}: number of surveyed dwellings from PSU *j* from stratum *h*
VL_{jh}: number of listing dwellings from PSU *j* from stratum *h*
B_{jh}: number of selected SSUs from PSU *j* from stratum *h*
N_{kjh}: number of dwellings from SSU *k* from PSU *j* from stratum *h*
N_{jh}: number of listing dwellings from PSU *j* from stratum *h*
VE_{kjh}: number of surveyed dwellings from SSU *k* from PSU *j* from stratum *h*
VL_{jh}: number of listing dwellings from SSU *k* from PSU *j* from stratum *h*

Appendix 4: Estimation of the Individual Earnings Functions

Table A1: Equations (3) and (4) Individual earnings regressions for wage earners and non wage earners

	1999						2002						2005					
	Men			Women			Men			Women			Men			Women		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Wage earner																		
s	0.0788	0.0054	0.0000	0.1079	0.0096	0.0000	0.0804	0.0065	0.0000	0.0927	0.0064	0.0000	0.0980	0.0076	0.0000	0.1087	0.0060	0.0000
ex	0.0583	0.0059	0.0000	0.0267	0.0080	0.0010	0.0604	0.0043	0.0000	0.0430	0.0076	0.0000	0.0524	0.0078	0.0000	0.0307	0.0069	0.0000
ex2	-0.0008	0.0001	0.0000	-0.0002	0.0002	0.2000	-0.0009	0.0001	0.0000	-0.0006	0.0001	0.0000	-0.0007	0.0001	0.0000	-0.0002	0.0001	0.1060
metro	0.0867	0.0571	0.1300	0.4087	0.0974	0.0000	0.1543	0.0409	0.0000	0.2819	0.0809	0.0010	0.0928	0.0538	0.0860	0.2224	0.0733	0.0030
_cons	5.4567	0.0914	0.0000	4.7746	0.1491	0.0000	5.3961	0.0821	0.0000	5.0527	0.1686	0.0000	5.2215	0.1103	0.0000	4.9355	0.0930	0.0000
Sample size			1179			610			2276			1162			1603			820
R-squared			0.2935			0.3758			0.2742			0.3315			0.3514			0.4045
Non wage earners																		
s	0.0829	0.0127	0.0000	0.1206	0.0142	0.0000	0.0995	0.0109	0.0000	0.0784	0.0126	0.0000	0.0936	0.0126	0.0000	0.1034	0.0150	0.0000
ex	0.0416	0.0079	0.0000	0.0600	0.0079	0.0000	0.0346	0.0060	0.0000	0.0505	0.0079	0.0000	0.0378	0.0070	0.0000	0.0611	0.0093	0.0000
ex2	-0.0006	0.0001	0.0000	-0.0008	0.0001	0.0000	-0.0005	0.0001	0.0000	-0.0006	0.0001	0.0000	-0.0006	0.0001	0.0000	-0.0008	0.0001	0.0000
metro	0.9283	0.1232	0.0000	0.3930	0.1357	0.0040	0.7748	0.0903	0.0000	0.4640	0.0867	0.0000	0.6159	0.1036	0.0000	0.3413	0.1016	0.0010
_cons	4.5757	0.1785	0.0000	3.9014	0.2028	0.0000	4.4305	0.1708	0.0000	4.2530	0.1837	0.0000	4.9207	0.2003	0.0000	4.0715	0.2435	0.0000
Sample size			1553			958			2915			1687			1927			1178
R-squared			0.3164			0.2152			0.2199			0.1317			0.2654			0.1988

Source: Author's calculations based on household surveys.
Note: In the estimation the intra-cluster correlation was corrected but the effect of stratification in the sampling errors was not considered.

Appendix 5: Results of multinomial logit regressions of labour participation and occupational choice

Table A2: Multinomial logit regressions

	1999												2002												2005					
	Head						Spouse/Other members						Head						Spouse/Other members						Head				Spouse/Other members			
	Men			Women			Men			Women			Men			Women			Men			Women			Men			Women	Men			Women		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Wage earner																																
s	-0.0123	0.0262	0.6390	-0.0315	0.0449	0.4820	0.1913	0.0255	0.0000	0.2718	0.0221	0.0000	-0.0314	0.0173	0.0700	-0.0017	0.0266	0.9490	0.2271	0.0186	0.0000	0.2241	0.0143	0.0000	-0.0641	0.0233	0.0060	0.0564	0.0327	0.0850	0.2255	0.0216	0.0000	0.2457	0.0181	0.0000
ex	0.0424	0.0273	0.1210	0.0166	0.0587	0.7770	0.3337	0.0311	0.0000	0.1502	0.0167	0.0000	0.0370	0.0200	0.0650	0.1045	0.0304	0.0010	0.2962	0.0179	0.0000	0.1475	0.0117	0.0000	0.0983	0.0273	0.0000	0.0837	0.0281	0.0030	0.3443	0.0310	0.0000	0.1218	0.0158	0.0000
ex2	-0.0016	0.0004	0.0000	-0.0013	0.0010	0.1630	-0.0061	0.0008	0.0000	-0.0029	0.0005	0.0000	-0.0014	0.0003	0.0000	-0.0025	0.0006	0.0000	-0.0051	0.0006	0.0000	-0.0027	0.0003	0.0000	-0.0025	0.0003	0.0000	-0.0017	0.0005	0.0000	-0.0072	0.0010	0.0000	-0.0022	0.0004	0.0000
metro	-0.9354	0.3588	0.0090	-0.9620	0.4252	0.0240	1.2466	0.2783	0.0000	0.3619	0.1860	0.0520	-0.6181	0.1840	0.0010	-0.4506	0.2184	0.0390	0.5301	0.1811	0.0030	0.5391	0.1316	0.0000	-0.4188	0.2178	0.0540	-0.3065	0.2730	0.2620	0.6348	0.1756	0.0000	0.2494	0.1472	0.0900
n_0106	0.4198	0.1758	0.0170	-0.4434	0.2135	0.0380	0.2589	0.0978	0.0080	-0.0903	0.0809	0.2650	0.1318	0.0918	0.1510	-0.1667	0.1658	0.3150	0.1296	0.0594	0.0290	-0.0603	0.0533	0.2580	0.2695	0.1423	0.0580	-0.0489	0.1895	0.7970	0.2146	0.0758	0.0050	-0.0308	0.0612	0.6150
n_0764	0.1262	0.0635	0.0470	-0.1114	0.1188	0.3480	0.0460	0.0469	0.3280	0.0169	0.0339	0.6170	-0.0055	0.0324	0.8650	-0.0479	0.0708	0.4990	-0.0257	0.0252	0.3090	-0.0047	0.0182	0.7950	-0.0608	0.0456	0.1820	-0.0648	0.0872	0.4570	0.0472	0.0488	0.3330	0.0311	0.0366	0.3950
n_6598	-0.2405	0.3489	0.4910	1.1886	0.8411	0.1580	-0.2199	0.2128	0.3020	0.1430	0.1857	0.4420	-0.2301	0.1769	0.1930	-0.0719	0.3814	0.8510	-0.2268	0.1396	0.1040	-0.0316	0.1028	0.7580	-0.1292	0.2441	0.5970	-0.5078	0.3967	0.2000	-0.2556	0.1900	0.1790	-0.1068	0.1299	0.4110
y_hh							-0.0001	0.0001	0.2100	-0.0002	0.0000	0.0000							0.0000	0.0000	0.6050	-0.0001	0.0000	0.0130	2.2296	0.7940	0.0050	-0.6622	0.5660	0.2420	0.0000	0.0001	0.9720	-0.0001	0.0000	0.1210
_cons	2.1802	0.7378	0.0030	2.1546	0.9226	0.0200	-5.4657	0.3833	0.0000	-5.2062	0.3095	0.0000	2.4976	0.4459	0.0000	0.0869	0.5488	0.8740	-4.8687	0.2269	0.0000	-4.9559	0.2099	0.0000							-5.3215	0.3067	0.0000	-5.0563	0.2526	0.0000
Non wage earners																																
s	-0.1328	0.0268	0.0000	-0.1326	0.0348	0.0000	0.1927	0.0330	0.0000	0.0476	0.0123	0.0000	-0.1041	0.0199	0.0000	-0.1197	0.0252	0.0000	0.1890	0.0232	0.0000	0.0790	0.0119	0.0000	-0.1515	0.0217	0.0000	-0.0857	0.0350	0.0140	0.2180	0.0278	0.0000	0.0844	0.0156	0.0000
ex	0.0548	0.0255	0.0320	0.0784	0.0309	0.0110	0.3591	0.0371	0.0000	0.1793	0.0110	0.0000	0.0747	0.0184	0.0000	0.0737	0.0204	0.0000	0.3033	0.0271	0.0000	0.1891	0.0085	0.0000	0.0882	0.0258	0.0010	0.0990	0.0215	0.0000	0.3926	0.0417	0.0000	0.1920	0.0109	0.0000
ex2	-0.0013	0.0003	0.0000	-0.0015	0.0004	0.0000	-0.0055	0.0009	0.0000	-0.0024	0.0002	0.0000	-0.0015	0.0002	0.0000	-0.0014	0.0002	0.0000	-0.0045	0.0007	0.0000	-0.0026	0.0002	0.0000	-0.0018	0.0003	0.0000	-0.0015	0.0002	0.0000	-0.0077	0.0013	0.0000	-0.0025	0.0002	0.0000
metro	-1.8109	0.3354	0.0000	-1.0621	0.3270	0.0010	0.5651	0.2934	0.0540	0.9655	0.1576	0.0000	-1.6360	0.1832	0.0000	-0.3015	0.1947	0.1210	0.1995	0.2288	0.3830	0.9401	0.1132	0.0000	-1.2974	0.2210	0.0000	-0.8630	0.2245	0.0000	0.0396	0.2359	0.8670	0.6752	0.1279	0.0000
n_0106	0.3820	0.1777	0.0320	-0.1131	0.1355	0.4040	0.2566	0.1152	0.0260	0.0431	0.0692	0.5340	0.1184	0.0851	0.1640	-0.1322	0.1124	0.2390	0.1545	0.0733	0.0350	0.0270	0.0354	0.4450	0.2535	0.1409	0.0720	-0.1050	0.1495	0.4830	0.2076	0.1120	0.0640	0.0984	0.0671	0.1430
n_0764	0.0300	0.0625	0.6310	-0.1154	0.0757	0.1270	-0.0203	0.0709	0.7740	-0.0587	0.0334	0.0790	-0.0011	0.0300	0.9710	-0.0080	0.0422	0.8490	-0.0474	0.0264	0.0720	-0.0832	0.0205	0.0000	-0.0724	0.0448	0.1060	-0.1310	0.0628	0.0370	-0.1178	0.0548	0.0320	-0.0598	0.0271	0.0270
n_6598	-0.0729	0.2673	0.7850	0.8149	0.7601	0.2840	-0.0851	0.1984	0.6680	-0.0674	0.1491	0.6510	0.1123	0.1531	0.4630	0.5851	0.2230	0.0090	-0.0344	0.1432	0.8100	-0.1041	0.1017	0.3060	0.1467	0.2101	0.4850	-0.3647	0.4049	0.3680	-0.2894	0.1862	0.1200	-0.3616	0.1583	0.0220
y_hh							-0.0003	0.0001	0.0050	0.0000	0.0000	0.2420							0.0000	0.0001	0.9460	0.0000	0.0000	0.1770	3.3330	0.7912	0.0000	0.8817	0.6048	0.1450	-0.0001	0.0001	0.3470	0.0000	0.0000	0.7300
_cons	3.6971	0.7384	0.0000	2.1825	0.7724	0.0050	-5.8867	0.4906	0.0000	-4.0692	0.2437	0.0000	3.0078	0.4612	0.0000	1.0313	0.5243	0.0490	-5.4249	0.2943	0.0000	-4.2927	0.1737	0.0000							-5.8308	0.4193	0.0000	-4.6045	0.2359	0.0000
sample size			2430			573			2764			4718			4580			1127			5314			8977			3164			880			3627			6203
pseudo-rsquared			0.192			0.1835			0.2889			0.2274			0.1611			0.1474			0.2598			0.2095			0.1667			0.1418			0.3048			0.213

Source: Author's calculations based on household surveys.

Notes: Category "unemployed or inactive" is the comparison group.

Estimates are based on weighted data. Standard errors are adjusted for clustering.

Table A3: Marginal effects of the multinomial logit estimations of participation and occupational choice

	1999												2002												2005											
	Head						Spouse/Other members						Head						Spouse/Other members						Head						Spouse/Other members					
	Men			Women			Men			Women			Men			Women			Men			Women			Men			Women			Men			Women		
	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z	Coef.	Std. Err.	P>z
Wage earner																																				
s	0.0236	0.0036	0.0000	0.0068	0.0041	0.0940	0.0131	0.0018	0.0000	0.0121	0.0014	0.0000	0.0136	0.0026	0.0000	0.0084	0.0029	0.0040	0.0163	0.0015	0.0000	0.0113	0.0009	0.0000	0.0156	0.0030	0.0000	0.0161	0.0039	0.0000	0.0154	0.0020	0.0000	0.0128	0.0012	0.0000
ex	-0.0015	0.0035	0.6620	-0.0043	0.0064	0.5050	0.0227	0.0028	0.0000	0.0059	0.0006	0.0000	-0.0066	0.0026	0.0110	0.0071	0.0027	0.0080	0.0212	0.0018	0.0000	0.0068	0.0005	0.0000	0.0046	0.0030	0.1240	0.0026	0.0032	0.4170	0.0235	0.0020	0.0000	0.0057	0.0008	0.0000
ex2	-0.0001	0.0001	0.1160	0.0000	0.0001	0.7600	-0.0004	0.0001	0.0000	-0.0001	0.0000	0.0000	0.0000	0.0000	0.5750	-0.0002	0.0000	0.0000	-0.0004	0.0000	0.0000	-0.0001	0.0000	0.0000	-0.0002	0.0000	0.0000	-0.0001	0.0001	0.0620	-0.0005	0.0001	0.0000	-0.0001	0.0000	0.0000
metro	0.1532	0.0333	0.0000	-0.0224	0.0391	0.5680	0.0864	0.0208	0.0000	0.0116	0.0089	0.1910	0.1861	0.0259	0.0000	-0.0320	0.0228	0.1600	0.0388	0.0138	0.0050	0.0236	0.0068	0.0010	0.1623	0.0276	0.0000	0.0375	0.0344	0.2740	0.0442	0.0109	0.0000	0.0105	0.0080	0.1860
n_0106	0.0167	0.0128	0.1920	-0.0394	0.0221	0.0750	0.0177	0.0069	0.0100	-0.0043	0.0036	0.2350	0.0057	0.0089	0.5190	-0.0103	0.0163	0.5250	0.0092	0.0043	0.0320	-0.0033	0.0027	0.2270	0.0102	0.0124	0.4090	0.0029	0.0227	0.8980	0.0147	0.0055	0.0070	-0.0021	0.0033	0.5280
n_0764	0.0219	0.0072	0.0020	-0.0032	0.0123	0.7970	0.0033	0.0033	0.3240	0.0011	0.0015	0.4850	-0.0010	0.0043	0.8180	-0.0051	0.0072	0.4790	-0.0018	0.0018	0.3310	0.0001	0.0009	0.8750	0.0007	0.0062	0.9100	0.0031	0.0114	0.7870	0.0034	0.0034	0.3110	0.0019	0.0020	0.3250
n_6598	-0.0386	0.0527	0.4650	0.0661	0.0714	0.3550	-0.0153	0.0148	0.3030	0.0068	0.0082	0.4040	-0.0729	0.0245	0.0030	-0.0507	0.0414	0.2210	-0.0167	0.0104	0.1070	-0.0012	0.0053	0.8290	-0.0578	0.0379	0.1270	-0.0382	0.0522	0.4650	-0.0174	0.0128	0.1740	-0.0042	0.0067	0.5300
y_hh							0.0000	0.0000	0.2660	0.0000	0.0000	0.0010							0.0000	0.0000	0.6080	0.0000	0.0000	0.0190							0.0000	0.0000	0.9890	0.0000	0.0000	0.1170
_cons	-0.2532	0.0632	0.0000	0.0653	0.0888	0.4620	-0.3725	0.0323	0.0000	-0.2157	0.0245	0.0000	-0.0420	0.0502	0.4040	-0.0639	0.0468	0.1720	-0.3469	0.0240	0.0000	-0.2374	0.0152	0.0000	-0.1591	0.0567	0.0050	-0.1777	0.0605	0.0030	-0.3634	0.0308	0.0000	-0.2514	0.0212	0.0000
Non wage earners																																				
s	-0.0293	0.0040	0.0000	-0.0287	0.0070	0.0000	0.0043	0.0008	0.0000	0.0031	0.0012	0.0080	-0.0188	0.0030	0.0000	-0.0298	0.0055	0.0000	0.0052	0.0007	0.0000	0.0051	0.0009	0.0000	-0.0242	0.0032	0.0000	-0.0265	0.0073	0.0000	0.0034	0.0006	0.0000	0.0048	0.0011	0.0000
ex	0.0047	0.0036	0.1910	0.0171	0.0070	0.0150	0.0081	0.0012	0.0000	0.0159	0.0010	0.0000	0.0106	0.0026	0.0000	0.0109	0.0044	0.0140	0.0086	0.0010	0.0000	0.0142	0.0007	0.0000	0.0020	0.0032	0.5220	0.0167	0.0044	0.0000	0.0063	0.0008	0.0000	0.0127	0.0007	0.0000
ex2	0.0000	0.0001	0.9790	-0.0003	0.0001	0.0050	-0.0001	0.0000	0.0000	-0.0002	0.0000	0.0000	-0.0001	0.0000	0.0440	-0.0002	0.0001	0.0040	-0.0001	0.0000	0.0000	-0.0002	0.0000	0.0000	0.0001	0.0000	0.2460	-0.0002	0.0001	0.0000	-0.0001	0.0000	0.0000	-0.0002	0.0000	0.0000
metro	-0.2471	0.0337	0.0000	-0.1749	0.0660	0.0080	0.0114	0.0071	0.1080	0.0877	0.0157	0.0000	-0.2707	0.0271	0.0000	-0.0428	0.0430	0.3200	0.0048	0.0071	0.4990	0.0714	0.0093	0.0000	-0.2325	0.0302	0.0000	-0.1850	0.0474	0.0000	-0.0002	0.0040	0.9690	0.0454	0.0088	0.0000
n_0106	0.0079	0.0149	0.5930	0.0078	0.0296	0.7930	0.0058	0.0030	0.0550	0.0044	0.0063	0.4820	0.0024	0.0088	0.7810	-0.0210	0.0229	0.3580	0.0044	0.0022	0.0420	0.0024	0.0027	0.3790	0.0084	0.0139	0.5450	-0.0214	0.0311	0.4910	0.0033	0.0019	0.0890	0.0069	0.0047	0.1400
n_0764	-0.0179	0.0076	0.0190	-0.0185	0.0170	0.2780	-0.0006	0.0017	0.7340	-0.0055	0.0030	0.0670	0.0008	0.0044	0.8520	0.0014	0.0090	0.8730	-0.0014	0.0008	0.0830	-0.0065	0.0016	0.0000	-0.0056	0.0066	0.3980	-0.0264	0.0142	0.0640	-0.0021	0.0009	0.0280	-0.0042	0.0019	0.0220
n_6598	0.0303	0.0492	0.5370	0.0993	0.1440	0.4900	-0.0017	0.0047	0.7240	-0.0069	0.0137	0.6120	0.0723	0.0239	0.0020	0.1512	0.0489	0.0020	-0.0005	0.0043	0.9110	-0.0080	0.0079	0.3100	0.0611	0.0374	0.1020	-0.0426	0.0897	0.6350	-0.0046	0.0031	0.1390	-0.0244	0.0106	0.0210
y_hh							0.0000	0.0000	0.0140	0.0000	0.0000	0.3580							0.0000	0.0000	0.9660	0.0000	0.0000	0.2180							0.0000	0.0000	0.3500	0.0000	0.0000	0.7840
_cons	0.4508	0.0729	0.0000	0.3456	0.1476	0.0190	-0.1332	0.0165	0.0000	-0.3514	0.0218	0.0000	0.2295	0.0556	0.0000	0.2511	0.1089	0.0210	-0.1549	0.0159	0.0000	-0.3141	0.0162	0.0000	0.3696	0.0624	0.0000	0.2810	0.1224	0.0220	-0.0926	0.0130	0.0000	-0.2956	0.0183	0.0000

Source: Author's calculations based on household surveys.

Notes: Category "unemployed or inactive" is the comparison group.

Estimates are based on weighted data. Standard errors are adjusted for clustering.

Appendix 6: Simulation Results

Table A4: Values of inequality and poverty indices and observed and simulated changes 1999-2002

	Wage earnings			Non wage earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
1999	0.47	0.44	0.88	0.61	0.70	1.13	0.56	0.60	1.09	0.57	0.61	1.29	0.63	0.35	0.25
2002	0.49	0.50	1.02	0.62	0.79	1.94	0.57	0.67	1.44	0.60	0.71	1.52	0.64	0.35	0.24
Base year: 1999															
Observed difference in 2002	**0.02**	**0.06**	**0.15**	**0.00**	**0.09**	**0.81**	**0.01**	**0.07**	**0.35**	**0.03**	**0.10**	**0.23**	**0.01**	**0.00**	**-0.01**
Simulated differences:															
Participation effect	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.01	0.02	0.01	0.01	0.00
Price effect	0.00	0.00	0.01	-0.01	-0.02	-0.03	0.00	0.00	0.04	0.00	0.01	0.07	0.00	0.00	0.00
Error effect	0.01	0.03	0.11	0.03	0.09	0.31	0.02	0.05	0.16	0.01	0.02	0.14	-0.01	0.00	0.00
Participation and price effect	0.00	0.01	0.02	-0.01	-0.02	-0.03	0.00	0.01	0.04	0.01	0.02	0.09	0.00	0.01	0.01
Participation, price and error term effect	0.01	0.03	0.14	0.02	0.07	0.27	0.02	0.05	0.19	0.02	0.04	0.22	-0.01	0.00	0.01
Residual Change	0.01	0.03	0.01	-0.01	0.02	0.54	-0.01	0.02	0.16	0.01	0.06	0.01	0.02	-0.01	-0.01
Base year: 2002															
Observed difference in 1999	**-0.02**	**-0.06**	**-0.15**	**0.00**	**-0.09**	**-0.81**	**-0.01**	**-0.07**	**-0.35**	**-0.03**	**-0.10**	**-0.23**	**-0.01**	**0.00**	**0.01**
Simulated differences:															
Participation effect	0.00	0.00	-0.01	0.00	0.01	-0.03	0.01	0.01	-0.01	-0.01	-0.03	-0.07	-0.01	-0.02	-0.02
Price effect	0.00	0.00	0.00	0.02	0.04	0.15	0.01	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Error effect	-0.01	-0.04	-0.13	-0.03	-0.09	-0.49	-0.01	-0.05	-0.23	0.00	-0.02	-0.08	0.01	0.01	0.00
Participation and price effect	0.00	0.00	-0.03	0.02	0.06	0.23	0.01	0.02	0.06	-0.01	-0.03	-0.05	-0.01	-0.02	-0.02
Participation, price and error term effect	-0.01	-0.03	-0.15	0.00	-0.02	-0.25	0.00	-0.03	-0.19	-0.02	-0.05	-0.12	0.01	-0.01	-0.02
Residual Change	-0.01	-0.03	0.01	0.00	-0.07	-0.56	-0.01	-0.04	-0.15	0.00	-0.05	-0.11	-0.02	0.02	0.02

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Table A5: Simulation 1999-2002: Observed and simulated mean monthly incomes (2002 Bolivianos)

	Base year: 1999				Base year: 2002			
	Wage earnings	Self-employment earnings	Total earnings	Per capita income	Wage earnings	Self-employment earnings	Total earnings	Per capita income
Observed values								
1999	1226	648	895	365	1226	648	895	365
2002	1256	664	925	382	1256	664	925	382
Simulated values in case of:								
Participation effect	1223	685	912	368	1282	657	927	383
Price effect	1289	603	897	366	1195	731	935	385
Error effect	1248	715	944	382	1230	604	879	367
Participation and price effect	1287	635	910	367	1225	724	940	387
Participation, price and error term effect	1311	700	958	383	1197	659	891	371

Source: Author's calculations based on household surveys.

Table A6: Values of inequality and poverty indices and observed and simulated changes 2002-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
2002	0.4928	0.5012	1.0126	0.6160	0.7764	1.8911	0.5713	0.6613	1.4179	0.5912	0.7039	1.4969	0.6434	0.3511	0.2427
2005	0.4794	0.4640	0.8860	0.6430	0.8451	1.9930	0.5716	0.6517	1.3436	0.5953	0.7151	1.6998	0.5997	0.3321	0.2287
Base year: 2002															
Observed difference in 2005	**-0.0134**	**-0.0372**	**-0.1266**	**0.0271**	**0.0687**	**0.1019**	**0.0002**	**-0.0096**	**-0.0744**	**0.0041**	**0.0112**	**0.2028**	**-0.0437**	**-0.0190**	**-0.0140**
Simulated differences:															
Participation effect	0.0018	-0.0033	-0.0249	0.0127	0.0500	0.2494	0.0048	0.0116	0.0325	-0.0066	-0.0115	-0.0010	0.0009	-0.0075	-0.0099
Price effect	0.0132	0.0267	0.0684	0.0114	0.0249	0.0549	0.0048	0.0114	0.0563	-0.0052	-0.0115	-0.0319	-0.0215	-0.0215	-0.0199
Error effect	-0.0307	-0.0723	-0.2191	-0.0191	-0.0697	-0.3869	-0.0226	-0.0704	-0.2880	-0.0107	-0.0359	-0.1357	0.0122	0.0050	0.0023
Participation and price effect	0.0146	0.0235	0.0437	0.0240	0.0795	0.3597	0.0101	0.0296	0.1423	-0.0076	-0.0096	0.0231	-0.0153	-0.0251	-0.0256
Participation, price and error term effect	-0.0156	-0.0498	-0.1795	-0.0004	-0.0135	-0.1389	-0.0163	-0.0524	-0.1964	-0.0213	-0.0530	-0.1436	-0.0018	-0.0209	-0.0249
Residual Change	0.0022	0.0126	0.0529	0.0275	0.0822	0.2409	0.0166	0.0428	0.1220	0.0254	0.0642	0.3464	-0.0420	0.0019	0.0109
Base year: 2005															
Observed difference in 2002	**0.0134**	**0.0372**	**0.1266**	**-0.0271**	**-0.0687**	**-0.1019**	**-0.0002**	**0.0096**	**0.0744**	**-0.0041**	**-0.0112**	**-0.2028**	**0.0437**	**0.0190**	**0.0140**
Simulated differences:															
Participation effect	0.0034	0.0007	-0.0170	-0.0039	-0.0187	-0.1362	0.0037	0.0027	-0.0285	-0.0043	-0.0271	-0.2488	-0.0079	-0.0057	-0.0038
Price effect	-0.0135	-0.0272	-0.0659	-0.0124	-0.0399	-0.1529	-0.0068	-0.0249	-0.1160	0.0004	-0.0009	-0.0239	0.0130	0.0152	0.0172
Error effect	0.0310	0.0791	0.2573	0.0277	0.1069	0.5315	0.0288	0.0920	0.3771	0.0159	0.0472	0.1333	-0.0056	-0.0015	0.0011
Participation and price effect	-0.0100	-0.0265	-0.0828	-0.0145	-0.0526	-0.2731	-0.0024	-0.0207	-0.1384	-0.0032	-0.0256	-0.2512	0.0055	0.0125	0.0158
Participation, price and error term effect	0.0218	0.0499	0.1508	0.0110	0.0447	0.1858	0.0242	0.0632	0.1856	0.0101	0.0166	-0.0951	-0.0024	0.0099	0.0153
Residual Change	-0.0084	-0.0127	-0.0242	-0.0380	-0.1134	-0.2877	-0.0244	-0.0536	-0.1112	-0.0143	-0.0278	-0.1077	0.0462	0.0091	-0.0014

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Table A7: Simulation 2002-2005: Observed and simulated mean monthly incomes (in 2005 Bolivianos)

	Base year: 2002				Base year: 2005			
	Wage earnings	Self-employment earnings	Total earnings	Per capita income	Wage earnings	Self-employment earnings	Total earnings	Per capita income
Observed values								
2002	1411	752	1042	430	1411	752	1042	430
2005	1373	945	1142	494	1373	945	1142	494
Simulated values in case of:								
Participation effect	1432	772	1074	431	1375	971	1145	498
Price effect	1347	939	1119	456	1414	757	1059	466
Error effect	1331	702	979	410	1460	1039	1233	525
Participation and price effect	1369	963	1148	455	1414	781	1054	467
Participation, price and error term effect	1292	886	1071	430	1503	851	1132	493

Source: Author's calculations based on household surveys.

Table A8: Values of inequality and poverty indices and observed and simulated changes 1999-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
1999	0.4698	0.4416	0.8780	0.6118	0.6926	1.1292	0.5604	0.5947	1.0901	0.5669	0.6091	1.2871	0.6295	0.3534	0.2494
2005	0.4794	0.4640	0.8860	0.6430	0.8451	1.9930	0.5716	0.6517	1.3436	0.5953	0.7151	1.6998	0.5997	0.3321	0.2287
Base year: 1999															
Observed difference in 2005	**0.0096**	**0.0224**	**0.0080**	**0.0313**	**0.1525**	**0.8639**	**0.0111**	**0.0569**	**0.2535**	**0.0285**	**0.1060**	**0.4126**	**-0.0298**	**-0.0213**	**-0.0207**
Simulated differences:															
Participation effect	0.0009	-0.0014	-0.0110	0.0195	0.1026	0.8161	0.0071	0.0330	0.2229	0.0113	0.0426	0.2720	0.0082	0.0053	0.0031
Price effect	0.0110	0.0227	0.0698	-0.0037	-0.0065	0.0103	-0.0011	0.0006	0.0190	-0.0020	-0.0031	0.0119	-0.0111	-0.0136	-0.0144
Error effect	-0.0178	-0.0408	-0.1272	0.0071	0.0209	0.0585	-0.0057	-0.0193	-0.0963	-0.0052	-0.0195	-0.1237	-0.0027	-0.0015	-0.0011
Participation and price effect	0.0126	0.0229	0.0635	0.0121	0.0708	0.5437	0.0052	0.0283	0.1853	0.0092	0.0356	0.2240	0.0001	-0.0062	-0.0097
Participation, price and error term effect	-0.0063	-0.0209	-0.0742	0.0208	0.1028	0.7258	0.0011	0.0175	0.1644	0.0055	0.0230	0.1676	-0.0008	-0.0076	-0.0106
Residual Change	0.0159	0.0432	0.0823	0.0105	0.0496	0.1381	0.0100	0.0394	0.0891	0.0229	0.0830	0.2450	-0.0290	-0.0137	-0.0101
Base year: 2005															
Observed difference in 1999	**-0.0096**	**-0.0224**	**-0.0080**	**-0.0313**	**-0.1525**	**-0.8639**	**-0.0111**	**-0.0569**	**-0.2535**	**-0.0285**	**-0.1060**	**-0.4126**	**0.0298**	**0.0213**	**0.0207**
Simulated differences:															
Participation effect	-0.0029	-0.0031	0.0029	0.0038	0.0152	0.0633	0.0067	0.0180	0.0600	-0.0082	-0.0351	-0.2451	-0.0088	-0.0074	-0.0058
Price effect	-0.0098	-0.0230	-0.0666	0.0045	0.0219	0.1622	-0.0001	-0.0028	-0.0128	0.0013	0.0083	0.0967	0.0128	0.0131	0.0147
Error effect	0.0190	0.0427	0.1125	-0.0089	-0.0314	-0.1332	0.0045	0.0114	0.0228	0.0038	0.0165	0.0984	0.0011	0.0011	0.0006
Participation and price effect	-0.0119	-0.0239	-0.0592	0.0078	0.0329	0.1818	0.0073	0.0156	0.0388	-0.0065	-0.0280	-0.2093	0.0046	0.0069	0.0101
Participation, price and error term effect	0.0074	0.0188	0.0552	-0.0007	0.0015	0.0401	0.0119	0.0281	0.0693	-0.0028	-0.0127	-0.1106	0.0083	0.0082	0.0109
Residual Change	-0.0170	-0.0412	-0.0632	-0.0306	-0.1540	-0.9040	-0.0231	-0.0851	-0.3228	-0.0257	-0.0933	-0.3020	0.0215	0.0131	0.0098

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Table A9: Simulation 1999-2005: Observed and simulated mean monthly incomes (in 2005 Bolivianos)

	Base year: 1999				Base year: 2005			
	Wage earnings	Self-employment earnings	Total earnings	Per capita income	Wage earnings	Self-employment earnings	Total earnings	Per capita income
Observed values								
1999	1375	735	1009	412	1375	735	1009	412
2005	1373	945	1142	494	1373	945	1142	494
Simulated values in case of:								
Participation effect	1388	792	1056	417	1385	941	1131	496
Price effect	1380	829	1065	431	1356	831	1073	471
Error effect	1328	754	1000	409	1428	915	1151	498
Participation and price effect	1389	884	1107	434	1366	826	1057	470
Participation, price and error term effect	1339	912	1101	432	1416	801	1064	473

Source: Author's calculations based on household surveys.

Appendix 7: Different Specification-Using Age and Age Squared

Table A10: Values of inequality and poverty indices and observed and simulated changes 1999-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
1999	0.4708	0.4426	0.8754	0.6149	0.6992	1.1334	0.5628	0.5990	1.0929	0.5696	0.6141	1.2885	0.6295	0.3534	0.2494
2002	0.4937	0.5030	1.0222	0.6196	0.7880	1.9404	0.5739	0.6678	1.4414	0.5952	0.7131	1.5199	0.6434	0.3511	0.2427
Base year: 1999															
Observed difference in 2002	**0.0229**	**0.0604**	**0.1468**	**0.0047**	**0.0888**	**0.8070**	**0.0111**	**0.0688**	**0.3485**	**0.0256**	**0.0990**	**0.2313**	**0.0139**	**-0.0023**	**-0.0067**
Simulated differences:															
Participation effect	0.0025	0.0021	0.0018	0.0118	0.0643	0.5271	0.0068	0.0258	0.1569	0.0109	0.0283	0.0759	0.0063	0.0057	0.0037
Price effect	-0.0037	-0.0053	-0.0059	-0.0085	-0.0187	-0.0245	-0.0012	0.0003	0.0269	0.0020	0.0067	0.0465	-0.0035	0.0020	0.0030
Error effect	0.0122	0.0302	0.1235	0.0261	0.0864	0.2957	0.0170	0.0483	0.1664	0.0078	0.0221	0.1482	-0.0074	-0.0040	-0.0017
Participation and price effect	-0.0007	-0.0021	-0.0024	0.0048	0.0506	0.5931	0.0059	0.0259	0.1889	0.0124	0.0332	0.1187	0.0077	0.0081	0.0069
Participation, price and error term effect	0.0103	0.0261	0.1190	0.0346	0.1799	1.9380	0.0237	0.0908	0.7049	0.0214	0.0671	0.3835	-0.0033	0.0032	0.0044
Residual Change	0.0125	0.0343	0.0277	-0.0299	-0.0911	-1.1310	-0.0126	-0.0220	-0.3564	0.0042	0.0319	-0.1522	0.0172	-0.0055	-0.0111
Base year: 2002															
Observed difference in 1999	**-0.0229**	**-0.0604**	**-0.1468**	**-0.0047**	**-0.0888**	**-0.8070**	**-0.0111**	**-0.0688**	**-0.3485**	**-0.0256**	**-0.0990**	**-0.2313**	**-0.0139**	**0.0023**	**0.0067**
Simulated differences:															
Participation effect	0.0060	0.0043	-0.0105	0.0124	0.0545	0.3631	0.0106	0.0278	0.1095	-0.0085	-0.0133	0.0525	-0.0006	-0.0115	-0.0132
Price effect	0.0059	0.0085	0.0109	0.0154	0.0396	0.1270	0.0065	0.0130	0.0385	-0.0004	0.0007	0.0034	-0.0018	-0.0035	-0.0036
Error term effect	-0.0139	-0.0393	-0.1482	-0.0241	-0.0873	-0.4688	-0.0151	-0.0519	-0.2403	-0.0054	-0.0207	-0.0840	0.0148	0.0072	0.0038
Participation and price effect	0.0094	0.0087	-0.0089	0.0315	0.1190	0.7388	0.0184	0.0515	0.2474	-0.0066	-0.0015	0.1589	-0.0025	-0.0147	-0.0162
Participation, price and error term effect	-0.0046	-0.0305	-0.1531	0.0050	0.0060	-0.0410	0.0001	-0.0166	-0.1280	-0.0150	-0.0359	-0.0632	0.0147	-0.0078	-0.0133
Residual Change	-0.0182	-0.0299	0.0063	-0.0097	-0.0948	-0.7659	-0.0113	-0.0522	-0.2205	-0.0106	-0.0631	-0.1681	-0.0287	0.0101	0.0200

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Table A11: Values of inequality and poverty indices and observed and simulated changes 2002-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
2002	0.4928	0.5012	1.0126	0.6160	0.7764	1.8911	0.5713	0.6613	1.4179	0.5912	0.7039	1.4969	0.6434	0.3511	0.2427
2005	0.4794	0.4640	0.8860	0.6430	0.8451	1.9930	0.5716	0.6517	1.3436	0.5953	0.7151	1.6998	0.5997	0.3321	0.2287
Base year: 2002															
Observed difference in 2005	**-0.0134**	**-0.0372**	**-0.1266**	**0.0271**	**0.0687**	**0.1019**	**0.0002**	**-0.0096**	**-0.0744**	**0.0041**	**0.0112**	**0.2028**	**-0.0437**	**-0.0190**	**-0.0140**
Simulated differences:															
Participation effect	0.0035	0.0011	-0.0183	0.0066	0.0146	-0.0031	0.0034	0.0028	-0.0288	-0.0076	-0.0169	-0.0361	-0.0002	-0.0087	-0.0103
Price effect	0.0208	0.0456	0.1384	0.0115	0.0256	0.0569	0.0084	0.0223	0.1014	-0.0017	-0.0010	0.0073	-0.0177	-0.0188	-0.0178
error term effect	-0.0317	-0.0749	-0.2283	-0.0175	-0.0651	-0.3704	-0.0226	-0.0706	-0.2917	-0.0109	-0.0367	-0.1409	0.0102	0.0047	0.0021
Participation and price effect	0.0230	0.0431	0.1053	0.0171	0.0376	0.0423	0.0107	0.0224	0.0596	-0.0068	-0.0114	-0.0108	-0.0153	-0.0243	-0.0244
Participation, price and error term effect	-0.0082	-0.0345	-0.1404	-0.0049	-0.0432	-0.3806	-0.0149	-0.0561	-0.2597	-0.0199	-0.0525	-0.1650	-0.0005	-0.0202	-0.0238
Residual Change	-0.0053	-0.0027	0.0137	0.0319	0.1119	0.4825	0.0151	0.0465	0.1853	0.0240	0.0637	0.3679	-0.0432	0.0012	0.0098
Base year: 2005															
Observed difference in 2002	**0.0134**	**0.0372**	**0.1266**	**-0.0271**	**-0.0687**	**-0.1019**	**-0.0002**	**0.0096**	**0.0744**	**-0.0041**	**-0.0112**	**-0.2028**	**0.0437**	**0.0190**	**0.0140**
Simulated differences:															
Participation effect	0.0017	0.0018	0.0000	-0.0032	-0.0175	-0.1216	0.0036	0.0043	-0.0099	-0.0048	-0.0301	-0.2602	-0.0013	-0.0007	-0.0002
Price effect	-0.0215	-0.0402	-0.0879	-0.0112	-0.0363	-0.1422	-0.0103	-0.0326	-0.1314	-0.0022	-0.0061	-0.0159	0.0120	0.0136	0.0159
error term effect	0.0317	0.0804	0.2583	0.0263	0.1010	0.4995	0.0283	0.0899	0.3635	0.0156	0.0457	0.1194	-0.0044	-0.0013	0.0012
Participation and price effect	-0.0197	-0.0386	-0.0874	-0.0116	-0.0439	-0.2215	-0.0054	-0.0247	-0.1252	-0.0058	-0.0317	-0.2500	0.0141	0.0156	0.0175
Participation, price and error term effect	0.0132	0.0401	0.1586	0.0102	0.0381	0.1860	0.0199	0.0547	0.1928	0.0068	0.0084	-0.0827	0.0054	0.0135	0.0174
Residual Change	0.0002	-0.0029	-0.0320	-0.0373	-0.1068	-0.2879	-0.0201	-0.0451	-0.1184	-0.0109	-0.0196	-0.1201	0.0383	0.0055	-0.0034

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Table A12: Values of inequality and poverty indices and observed and simulated changes 1999-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Observed values															
1999	0.4698	0.4416	0.8780	0.6118	0.6926	1.1292	0.5604	0.5947	1.0901	0.5669	0.6091	1.2871	0.6295	0.3534	0.2494
2005	0.4794	0.4640	0.8860	0.6430	0.8451	1.9930	0.5716	0.6517	1.3436	0.5953	0.7151	1.6998	0.5997	0.3321	0.2287
Base year: 1999															
Observed difference in 2005	**0.0096**	**0.0224**	**0.0080**	**0.0313**	**0.1525**	**0.8639**	**0.0111**	**0.0569**	**0.2535**	**0.0285**	**0.1060**	**0.4126**	**-0.0298**	**-0.0213**	**-0.0207**
Simulated differences:															
Participation effect	-0.0025	-0.0084	-0.0278	0.0333	0.2181	3.3973	0.0126	0.0765	1.0546	0.0182	0.0873	0.8763	0.0052	0.0043	0.0032
Price effect	0.0146	0.0286	0.0750	-0.0029	-0.0045	0.0125	0.0009	0.0049	0.0241	-0.0004	0.0004	0.0150	-0.0098	-0.0125	-0.0135
Error term effect	-0.0171	-0.0389	-0.1200	0.0071	0.0208	0.0583	-0.0053	-0.0182	-0.0907	-0.0049	-0.0187	-0.1159	-0.0036	-0.0015	-0.0011
Participation and price effect	0.0128	0.0215	0.0503	0.0296	0.2096	3.3685	0.0147	0.0892	1.2256	0.0194	0.0965	1.0194	-0.0003	-0.0063	-0.0089
Participation, price and error term effe	-0.0049	-0.0194	-0.0762	0.0390	0.2547	4.1067	0.0120	0.0900	1.5261	0.0168	0.0932	1.1907	-0.0023	-0.0077	-0.0098
Residual Change	0.0145	0.0418	0.0843	-0.0078	-0.1022	-3.2428	-0.0009	-0.0331	-1.2726	0.0116	0.0128	-0.7780	-0.0275	-0.0136	-0.0109
Base year: 2005															
Observed difference in 1999	**-0.0096**	**-0.0224**	**-0.0080**	**-0.0313**	**-0.1525**	**-0.8639**	**-0.0111**	**-0.0569**	**-0.2535**	**-0.0285**	**-0.1060**	**-0.4126**	**0.0298**	**0.0213**	**0.0207**
Simulated differences:															
Participation effect	0.0003	0.0019	0.0127	-0.0046	-0.0262	-0.1991	0.0028	0.0002	-0.0415	-0.0131	-0.0504	-0.3054	-0.0130	-0.0072	-0.0048
Price effect	-0.0143	-0.0312	-0.0807	0.0022	0.0106	0.0877	-0.0032	-0.0122	-0.0480	-0.0010	0.0017	0.0669	0.0109	0.0123	0.0142
Error term effect	0.0183	0.0404	0.1037	-0.0090	-0.0319	-0.1375	0.0041	0.0098	0.0151	0.0035	0.0152	0.0879	0.0012	0.0011	0.0005
Participation and price effect	-0.0137	-0.0272	-0.0607	-0.0046	-0.0298	-0.2279	-0.0007	-0.0142	-0.1080	-0.0140	-0.0504	-0.2856	0.0049	0.0070	0.0106
Participation, price and error term effe	0.0049	0.0130	0.0456	-0.0130	-0.0583	-0.3385	0.0043	-0.0001	-0.0590	-0.0101	-0.0340	-0.1737	0.0077	0.0083	0.0114
Residual Change	-0.0144	-0.0354	-0.0536	-0.0183	-0.0942	-0.5253	-0.0154	-0.0568	-0.1945	-0.0183	-0.0720	-0.2389	0.0221	0.0130	0.0093

Notes: 1 Values indicate the amount to which observed or simulated values were higher or lower than in base year
2 E1 and E2 are the Theil coefficient and the transformed coefficient of variation; P1, P2 and P3 are the FGT poverty indices

Source: Author's calculations based on household surveys.

Appendix 8: Observed and simulated relative changes

Table A13: Simulation 1999-2002

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Base year: 1999															
Observed difference in 1999-2002	**4.9**	**13.6**	**16.8**	**0.8**	**12.7**	**71.2**	**2.0**	**11.5**	**31.9**	**4.5**	**16.1**	**18.0**	**2.2**	**-0.7**	**-2.7**
Simulated differences:															
Participation effect	0.9	1.2	1.6	0.3	0.5	0.0	0.3	0.2	-0.6	1.2	2.3	1.9	1.1	1.7	1.8
Price effect	-0.3	-0.2	0.6	-1.7	-3.3	-3.0	0.0	0.6	3.9	0.6	1.7	5.2	-0.7	0.9	1.6
Error effect	2.3	6.1	12.9	4.4	12.9	27.1	3.0	7.9	14.6	1.3	3.4	10.5	-1.4	-1.2	-0.8
Participation and price effect	0.6	1.1	2.4	-1.2	-2.4	-2.5	0.3	0.8	3.4	1.7	3.9	7.4	0.6	2.7	3.4
Participation, price and error term effect	2.7	7.0	15.5	3.2	10.1	23.9	3.0	8.1	17.3	2.8	6.8	17.4	-1.2	1.3	2.4
Residual Change	2.1	6.6	1.3	-2.4	2.6	47.3	-1.0	3.4	14.6	1.6	9.3	0.5	3.4	-1.9	-5.1
Base year: 2002															
Observed difference 1999-2002	**-4.9**	**-13.6**	**-16.8**	**-0.8**	**-12.7**	**-71.2**	**-2.0**	**-11.5**	**-31.9**	**-4.5**	**-16.1**	**-18.0**	**-2.2**	**0.7**	**2.7**
Simulated differences:															
Participation effect	0.8	0.5	-1.3	0.7	0.9	-2.8	1.1	1.5	-0.5	-2.4	-5.1	-5.1	-0.9	-4.5	-6.5
Price effect	0.6	0.6	-0.4	2.7	6.3	13.4	1.0	1.8	3.3	-0.3	-0.4	-0.4	-0.6	-1.3	-1.9
Error effect	-2.6	-7.9	-15.2	-4.2	-13.1	-42.8	-2.6	-8.4	-21.0	-0.9	-3.1	-5.8	2.4	2.1	1.6
Participation and price effect	0.9	0.1	-3.0	3.9	9.3	20.6	2.1	3.8	5.1	-2.5	-4.7	-3.9	-1.6	-5.7	-8.2
Participation, price and error term effect	-1.8	-7.8	-17.5	-0.1	-3.4	-22.1	-0.8	-5.1	-17.8	-3.6	-8.3	-9.5	1.5	-3.7	-7.0
Residual Change	-3.0	-5.8	0.7	-0.7	-9.3	-49.1	-1.2	-6.3	-14.1	-0.8	-7.9	-8.4	-3.7	4.4	9.7

Source: Author's calculations based on household surveys.

Table A14: Simulation 2002-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Base year: 2002															
Observed difference in 2002-2005	**-2.7**	**-7.4**	**-12.5**	**4.4**	**8.8**	**5.4**	**0.0**	**-1.5**	**-5.2**	**0.7**	**1.6**	**13.6**	**-6.8**	**-5.4**	**-5.8**
Simulated differences:															
Participation effect	0.4	-0.7	-2.5	2.1	6.4	13.2	0.8	1.8	2.3	-1.1	-1.6	-0.1	0.1	-2.1	-4.1
Price effect	2.7	5.3	6.8	1.9	3.2	2.9	0.8	1.7	4.0	-0.9	-1.6	-2.1	-3.3	-6.1	-8.2
Error effect	-6.2	-14.4	-21.6	-3.1	-9.0	-20.5	-4.0	-10.6	-20.3	-1.8	-5.1	-9.1	1.9	1.4	1.0
Participation and price effect	3.0	4.7	4.3	3.9	10.2	19.0	1.8	4.5	10.0	-1.3	-1.4	1.5	-2.4	-7.1	-10.5
Participation, price and error term effect	-3.2	-9.9	-17.7	-0.1	-1.7	-7.3	-2.9	-7.9	-13.9	-3.6	-7.5	-9.6	-0.3	-6.0	-10.3
Residual change	0.5	2.5	5.2	4.5	10.6	12.7	2.9	6.5	8.6	4.3	9.1	23.1	-6.5	0.5	4.5
Base year: 2005															
Observed difference 2002-2005	**2.7**	**7.4**	**12.5**	**-4.4**	**-8.8**	**-5.4**	**0.0**	**1.5**	**5.2**	**-0.7**	**-1.6**	**-13.6**	**6.8**	**5.4**	**5.8**
Simulated differences:															
Participation effect	0.7	0.1	-1.7	-0.6	-2.4	-7.2	0.7	0.4	-2.0	-0.7	-3.8	-16.6	-1.2	-1.6	-1.5
Price effect	-2.7	-5.4	-6.5	-2.0	-5.1	-8.1	-1.2	-3.8	-8.2	0.1	-0.1	-1.6	2.0	4.3	7.1
Error effect	6.3	15.8	25.4	4.5	13.8	28.1	5.0	13.9	26.6	2.7	6.7	8.9	-0.9	-0.4	0.4
Participation and price effect	-2.0	-5.3	-8.2	-2.4	-6.8	-14.4	-0.4	-3.1	-9.8	-0.5	-3.6	-16.8	0.9	3.5	6.5
Participation, price and error term effect	4.4	9.9	14.9	1.8	5.8	9.8	4.2	9.6	13.1	1.7	2.4	-6.4	-0.4	2.8	6.3
Residual change	-1.7	-2.5	-2.4	-6.2	-14.6	-15.2	-4.3	-8.1	-7.8	-2.4	-3.9	-7.2	7.2	2.6	-0.6

Source: Author's calculations based on household surveys.

Table A15: Simulation 1999-2005

	Wage earnings			Self-employment earnings			Total earnings			Per capita income					
	Gini	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**Gini**	**E1**	**E2**	**P0**	**P1**	**P2**
Base year: 1999															
Observed difference in 1999-2005	**2.0**	**5.1**	**0.9**	**5.1**	**22.0**	**76.5**	**2.0**	**9.6**	**23.3**	**5.0**	**17.4**	**32.1**	**-4.7**	**-6.0**	**-8.3**
Simulated differences:															
Participation effect	0.2	-0.3	-1.3	3.2	14.8	72.3	1.3	5.6	20.4	2.0	7.0	21.1	1.3	1.5	1.2
Price effect	2.3	5.1	7.9	-0.6	-0.9	0.9	-0.2	0.1	1.7	-0.4	-0.5	0.9	-1.8	-3.9	-5.8
Error effect	-3.8	-9.2	-14.5	1.2	3.0	5.2	-1.0	-3.2	-8.8	-0.9	-3.2	-9.6	-0.4	-0.4	-0.4
Participation and price effect	2.7	5.2	7.2	2.0	10.2	48.1	0.9	4.8	17.0	1.6	5.8	17.4	0.0	-1.7	-3.9
Participation, price and error term effect	-1.4	-4.7	-8.5	3.4	14.8	64.3	0.2	2.9	15.1	1.0	3.8	13.0	-0.1	-2.1	-4.3
Residual Change	3.4	9.8	9.4	1.7	7.2	12.2	1.8	6.6	8.2	4.0	13.6	19.0	-4.6	-3.9	-4.0
Base year: 2005															
Observed difference 1999-2005	**-2.0**	**-5.1**	**-0.9**	**-5.1**	**-22.0**	**-76.5**	**-2.0**	**-9.6**	**-23.3**	**-5.0**	**-17.4**	**-32.1**	**4.7**	**6.0**	**8.3**
Simulated differences:															
Participation effect	-0.6	-0.7	0.3	0.6	2.2	5.6	1.2	3.0	5.5	-1.4	-5.8	-19.0	-1.4	-2.1	-2.3
Price effect	-2.1	-5.2	-7.6	0.7	3.2	14.4	0.0	-0.5	-1.2	0.2	1.4	7.5	2.0	3.7	5.9
Error effect	4.0	9.7	12.8	-1.5	-4.5	-11.8	0.8	1.9	2.1	0.7	2.7	7.6	0.2	0.3	0.2
Participation and price effect	-2.5	-5.4	-6.7	1.3	4.7	16.1	1.3	2.6	3.6	-1.1	-4.6	-16.3	0.7	1.9	4.0
Participation, price and error term effect	1.6	4.3	6.3	-0.1	0.2	3.6	2.1	4.7	6.4	-0.5	-2.1	-8.6	1.3	2.3	4.4
Residual Change	-3.6	-9.3	-7.2	-5.0	-22.2	-80.1	-4.1	-14.3	-29.6	-4.5	-15.3	-23.5	3.4	3.7	3.9

Source: Author's calculations based on household surveys.