

FORECASTING WAGE INEQUALITY*

PREDICIENDO LA DESIGUALDAD DE SALARIOS

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Abstract

Wage inequality in Chile has remained high for decades and it is currently at the center of the political agenda. Increasing education of workers is expected to contribute to reduce wage inequality. Based on historical trends of age, education, and returns to education, this paper attempts to forecast wage inequality. Despite an increase in average earnings due to higher levels of education of workers, high levels of wage inequality within age groups and within education groups produce that forecasted wage inequality remains high for the next 10-year period. The structure of the Chilean labor market appears to imply that there is a high level of underlying wage inequality. Nevertheless, the good news are that the labor market structure seems to prevent further deteriorations of wage inequality.

Key words: *wage inequality, labor market.*

Resumen

La desigualdad de salarios en Chile ha permanecido alta por décadas y está actualmente en el centro de la agenda política. Aumentar la educación de los trabajadores se espera que contribuya a la disminución de la desigualdad. Basados en tendencias históricas de edad, educación y retornos a la educación, este trabajo intenta predecir la desigualdad de ingresos. A pesar del aumento en ingresos promedios, debido a mayores niveles de educación de los trabajadores, altos niveles de desigualdad salarial en los grupos etarios y los grupos educacionales producen que la desigualdad de salarios predicha permanezca alta por los próximos 10 años. La estructura del mercado laboral chileno pareciera implicar que existe subyacentemente una alta desigualdad en los salarios. Sin embargo, las buenas noticias son que la estructura del mercado laboral parece impedir futuros deterioros en la desigualdad de salarios.

Palabras clave: *desigualdad de salarios, mercado laboral.*

JEL Classification: *D31, D15.*

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1 INTRODUCTION

Inequality in Chile has been documented to be high and persistent. The recent 20- year period of rapid economic growth that allowed to significantly reduce poverty has not been as successful in reducing inequality. There are currently both academic and political important discussions aiming to find answers to the problem of inequality. Several studies have focused in explaining the reasons of the high levels inequality in Chile, but none has actually announced what could happen with inequality in the coming years. This paper contributes with a novel exercise of inequality forecasting using microsimulations.

Cowan and De Gregorio (1996) propose that despite the historical high inequality in Chile, there have been significant improvements in social aspects. Poverty has diminished significantly (which is confirmed with the latest official figures for 2006), consumption by households are leveled when fiscal policy is considered, and life quality indicators show Chile in a privileged position among similar countries. However, Ruiz-Tagle (1999) documents that, after reaching its worth level in the 80s, inequality in Chile has improved only moderately in the 90s, exhibiting high persistence that prevents improvements in the short run. On the other hand, Bravo and Contreras (2004) documented that the apparent inequality stability between 1990 and 1996 was due to forces that compensated each other. This view is also supported by Solimano and Torche (2007), who remark that income distribution is affected by different effects that cancel each other, challenging the idea that income distribution has remain unchanged.

Inequality has many dimensions and it is difficult to disentangle the different elements that causes it. In first place, it is important to distinguish between household income inequality and wage inequality. Household income depends not only on the labor income contributed by its members, but also on other sources of income such as capital income, pensions, and transfers (subsidies), among others. Moreover, the number of members of the households determine the per capita income, and the number of working persons determine the total labor income. Household composition and labor participation decisions are key to explain total household income.

Social policy may be much more likely to be able to affect household income inequality than individual labor income inequality. Social policies are able to affect pensions, subsidies, taxes, and even labor participation rates. However, labor income can be considered closer to a “market result” since policies have limited scope. Policies can affect the supply side of labor income by affecting education in its coverage and quality, or by facilitating on-the-job training. On the demand side, policies could affect labor income by boosting some specific economic sector. In the regulation area, policies can affect minimum wages, direct taxes, and employer-employee bargaining process. This set of possible interventions are not expected to be able to affect significantly labor income inequality.

In sum, the major role of social policy is linked to subsidies (monetary and non-monetary), and it is very difficult to analyze its distributive impact¹.

The relevance of the inequality discussion depends on what is expected for the path of inequality in the coming years. Unfortunately, there is an absence of studies focused on researching the income distribution in the coming years, so that speculation has no strong support. If it is expected that the current changes in labor market will “naturally” reduce inequality, the remaining problem is related only to the timing of such events. However, if the expectations are that inequality is “naturally” increasing, policy makers should seriously think about how to reduce current inequality and how to prevent future increases.

In order to be able to state how much inequality will be present in the future it is necessary to start by defining what is better known about the determinants of inequality in future periods. In this manner, it is possible to observe that age and education composition are the trends that are more robust and more easily to predict. This suggests that a forecast that is based on this trends could be more precise. Hence, it is key to determine what are those trends and what happens in terms of inequality between and within age and educational groups.

Population in Chile is getting older as the number of young people relative to elder people is decreasing. Besides, the proportion of individuals with tertiary education is increasing significantly and is expected to continue to do so. What can we expect about wage inequality in the coming years as a result of those trends?

Some economists hope inequality will reduce as increasing education takes effect. This view is based in one fact and one assumption: The fact is that increasing education will necessarily increase wages through higher productivity of workers and the corresponding rewards; the assumption is that returns to education (specially tertiary education) will reduce as there is a larger share of the workers with higher education. In that framework, the distribution will compress from the bottom and from the top, reducing inequality. This view will be challenged in this article, not only because of the weakness of the assumption, but also because of the importance of two elements that are left aside: within groups inequality and population composition changes.

Predicting household composition and labor participation rates is rather difficult and less robust. While males exhibit labor participation rates that are rather stable on time, females present an increasing path of labor participation. This suggests that a forecast based on age and education could be more precise if the analysis is narrowed to males. Because of these reasons, this paper focuses on labor income inequality among men.

¹ Bravo, Contreras and Millán (2001), imputed non monetary subsidies according to households usage of free services (such as education and health services) in order to show that inequality in terms of purchasing power can be significantly reduced.

The strategy is to predict earnings based on the well-known wage-equations (or Mincer equations), using a reduced set of dependent variables that are forecasted in their trends. Hence, returns to education and returns to potential experience will play a determinat role. Wage-equations account only for a limited part of the variation in wages, so imputing error terms constitute a major task to be able to replicate wage inequality. It is worth to mention that Behrman (2006) and McKee and Todd (2007) carried out similar simulation exercises for policy interventions focused on alleviating poverty and inequality in Chile and Mexico respectively, but without taking into account the dynamic aspects of demographics.

The structure of the paper is as follows. A review of 50 years of income inequality using the Encuesta de Ocupacion y Desocupacion (EOD) of the University of Chile, the most consistent household survey for this purpose, is presented in section 2. This section focuses on wage inequality, returns to education and trends in age and education composition of the population. The methodology that allow to forecast wage inequality by using microsimulations is presented in section 3. This section also present 10-years simulations for males wage inequality. Finally, section 4 summarises the main conclusions and the next steps that could be followed in order to increase the knowledge of inequality in the coming years.

2. STYLISED FACTS OF WAGE INEQUALITY IN CHILE

This section presents some stylised facts about wage inequality in Chile in the last 50 years using the EOD survey². Wage inequality will be revised in its trends by age and education composition, and then workers composition will be analysed in order to find some explanations for changes in inequality. Later on, returns to education will be revised in detail in order to assess the wage generation process.

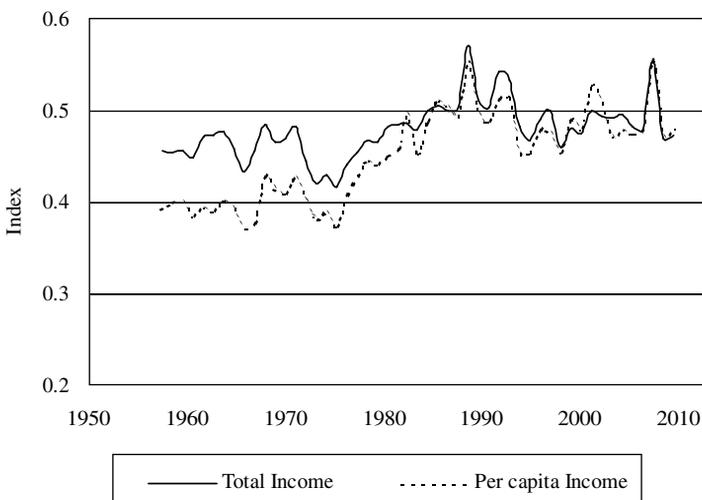
2.1. Evolution of Wage Distribution

As stated above, total household income inequality is mainly driven by wage distribution. Bravo and Marinovic (1997), in the first systematic analysis of wage inequality using the EOD, report that long-run changes in relative wages can be explained by observable variables. In parallel, Contreras and Ruiz-Tagle (1997) observe that the noticeable heterogeneity among regions' inequality could follow differences in demand for skilled and unskilled labor between regions.

² The EOD survey has a significant amount of missing values in the wage variable, particularly in geographical areas with higher income. Hence a hotdeck imputation was carried out in order to preserve the properties of the distribution. The variables used for imputation were: estrato, comuna, gender and education group (primary, secondary and tertiary education). The first two variables determine the stratification of the survey.

Total household income inequality and wage inequality are depicted in Figure 1 and Figure 2 respectively. It can be observed the patterns are rather similar, revealing that wage inequality is major responsible for overall inequality beyond household composition and labor participation patterns considerations³. However, it can be noticed that wage distribution is somehow flatter than total household income inequality. The differences may be due to differences in labor participation rates and particularly because of employment rates. As a matter of fact, the high levels of unemployment experienced during the early 80s explain the peak of total household income inequality. Although wage inequality is consistently lower for females compared to males since the 80s, the differences in the Gini coefficient are not particularly important: Wage inequality is rather high for both males and females.

FIGURE 1
HOUSEHOLD INCOME INEQUALITY

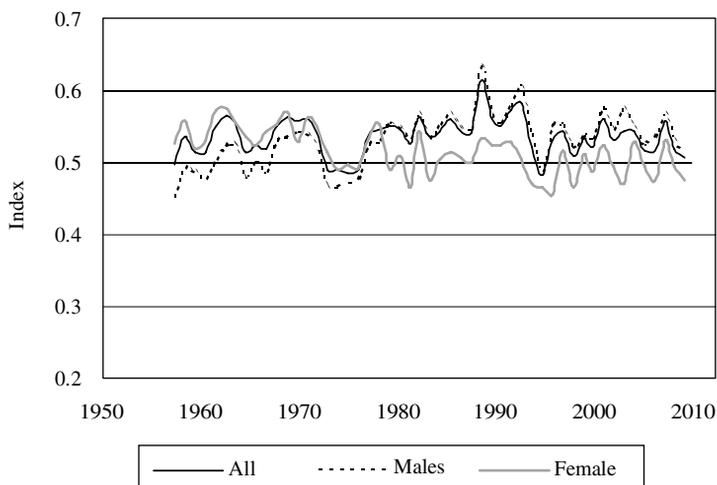


Henceforth, the focus will be shift to males because they exhibit higher rates of labor participation and tend to work full time, so that wages are less affected by those effects. In particular, the sample is restricted to those aged 15 to 65 years old. Also, from here onwards, wages will refer to hourly wages. Figure 3 shows wage inequality by five age groups. Three facts emerge clearly. First, there are significant differences between age groups. Second, older workers present

³ It is worth to remark that the limitations of the EOD in capturing total household income (compared to other household surveys such as the National Survey for Socio Economic Characterisation (CASEN), may increase the similarities of total household income inequality and wage inequality. However, in the CASEN surveys approximately 80% of total household income comes from labor income (see Bravo and Contreras, 2004).

consistently higher inequality than younger workers. Third, differences in wage inequality between age groups tend to increase since the middle 80s until the middle 2000s, when the youngest group increases its wage inequality to a level similar to the older groups. These characteristics of the wage distribution were already reported by Martínez (1999), who decomposed inequality between age cohorts to conclude that ageing would ‘naturally’ increase in-equality⁴.

FIGURE 2
WAGE INEQUALITY



On the other hand, the wage inequality by education exhibits interesting features. Three patterns can be highlighted. First, there are significant differences in wage inequality between education groups. Second, the differences in inequality between primary educated and tertiary educated groups increases since the early 80s. Third, before 1990 the inequality of secondary and tertiary education groups is much larger than the inequality of the primary education group, except for the early 70s. Then, from the early 90s, inequality of secondary education group falls to a level similar of that of primary education.

These patterns were reported by Chumacero and Paredes (2005) analysing household heads. They suggest that segmentation and exclusion may be behind the determinants of wage inequality in Chile. These findings are important because they imply that policies oriented to increase levels of education may not have significant effects in reducing inequality (if they have at all).

⁴ Martínez also suggests that as a society develops, an ageing process occurs, which may induce increasing inequality in a first stage of development like the Kuznets prediction.

FIGURE 3
INEQUALITY BY AGE

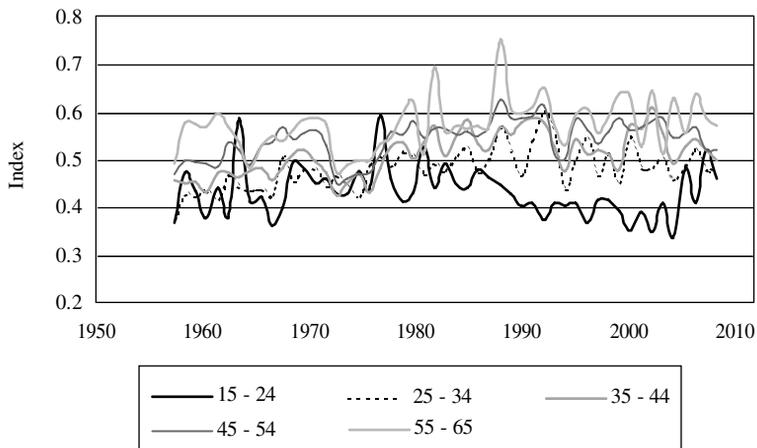
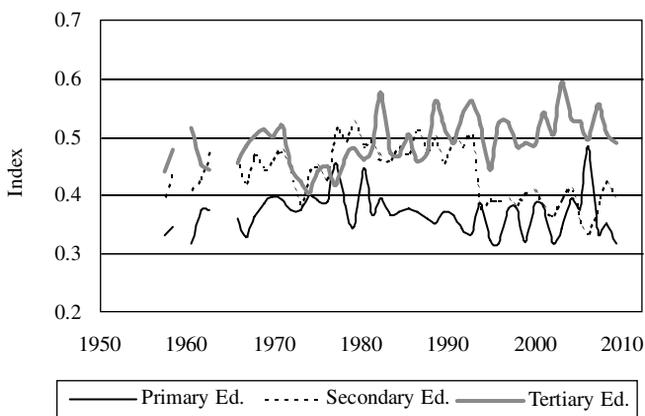


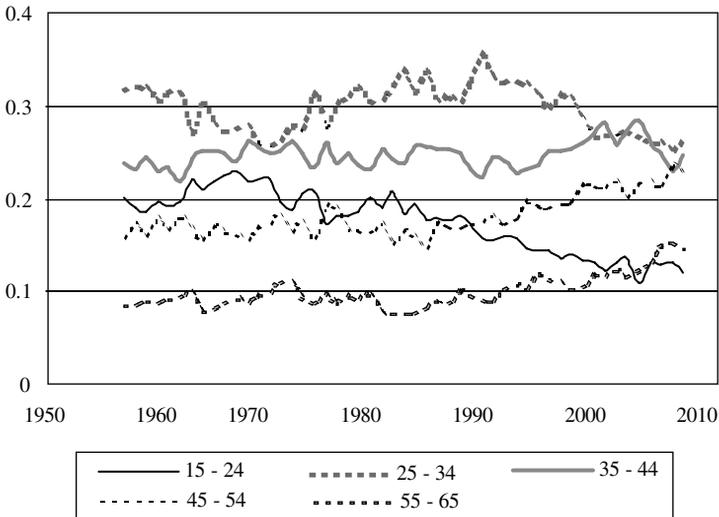
FIGURE 4
INEQUALITY BY EDUCATION



2.2. Evolution of Workers' Composition

Workers' age composition has been changing significantly over the last decades. In Figure 5 it can be observed that the only groups that reduce their share are the youngest ones: those aged 15 to 24 years old and those aged 25 to 34 years old. This is the result of three facts. First, population is ageing. Second, the oldest group has been increasing their labor participation rates. Third, young groups are increasing their years of education so that they reduce their labor participation (see also Figures A1, A2 and A3).

FIGURE 5
COMPOSITION BY AGE



The composition of workers by education presents interesting patterns. The steep fall of primary educated workers reflects the success of education policies targeted to boost education coverage. In spite of the increase of the share of the tertiary educated group, it is still far below that of secondary education and it does not seem to be catching it up. Since inequality within tertiary educated workers is larger than the other groups, these trends may not necessarily be good news for wage inequality. As it will be seen later, this constitutes one of the principal components of this paper.

2.3. Evolution of Returns to Education

The differences in returns to education are key to determine the wage inequality. Figure 7 shows returns to an additional year of education separated by education group (primary, secondary and tertiary education), accounting for the non linearities of returns to education. There are four main facts. First, there are significant differences in returns to education between different education groups during the last 50 years.

Second, returns to tertiary education are much higher than returns to secondary education, which are also larger than returns to primary education. Third, since the middle 80s returns to secondary education drop to the level of primary education. Fourth, despite the increase of the share of tertiary educated workers, there is no evidence of a fall in the returns to tertiary education since the 90s⁵. This latter observation will be critical to produce a forecast of wage inequality.

⁵ It is worth to recall that Contreras, Melo and Ojeda (2005) report that estimations of the returns to education without a rich panel data information (as the EOD) are biased, so that

FIGURE 6
COMPOSITION BY EDUCATION

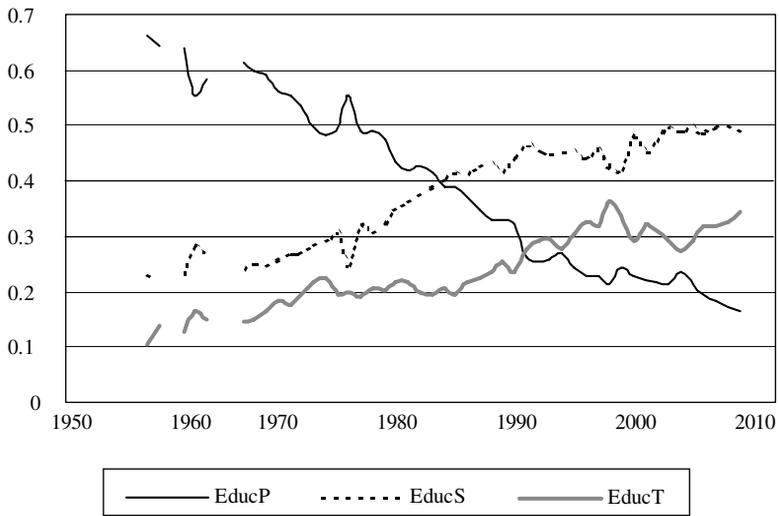
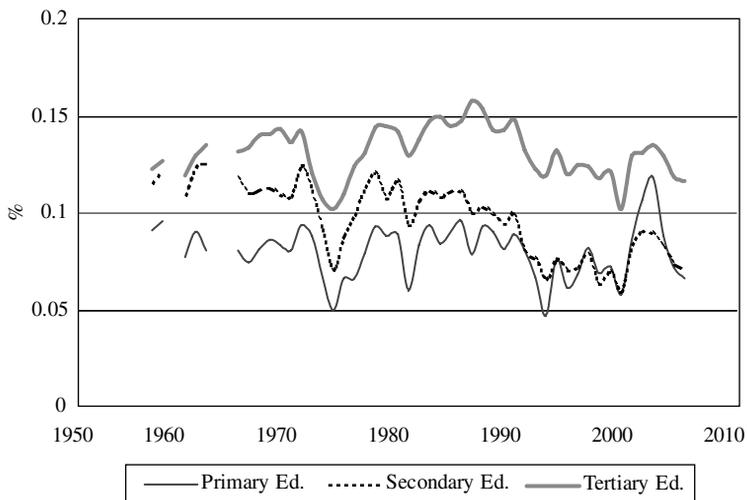


FIGURE 7
RETURNS TO EDUCATION



returns to education, for all levels of education, are overestimated by approximately 5%. In parallel, Sapelli (2007), in a cohort analysis, concludes that the flattening process of income-age profile produces a fall in the returns to experience, which also affects returns to education.

3. THE FORECAST

This section develops a scheme to forecast wage inequality based on trends of age and educational composition, and returns to education and experience. As revised in section 2, population in Chile is getting older as the number of young people relative to elder people is decreasing. Besides, the proportion of individuals with tertiary education is increasing significantly and is expected to continue to do so. What can be expected about wage inequality in the coming years as a result of those trends?

As population gets older, a relatively larger part of the population will fall in older age groups. This fact can have two effects. In first place, since returns to potential experience (given by age) is positive, it is expected that a larger proportion of the population will exhibit a higher reward for that experience. Then, as population gets older this fact should tend to reduce overall wage inequality. In second place, as observed in section 2, inequality within older groups tends to be consistently much larger than for younger groups. So, as population gets older inequality should tend to increase as there is a larger proportion of the population in age groups where inherent inequality is larger. The outcome is that there are two effects that drive inequality in opposite directions, so that the net outcome is ambiguous.

On the other hand, as population becomes more educated there are also two effects. First, on average there will be a larger proportion of the population with higher wages as a reward of their larger human capital. This fact should tend to decrease inequality. This effect could also be boosted if there was a drop in returns to education. However, the effect of more educated individuals has no obvious empirical impacts on returns to education. As seen in section 2, the significant increase of tertiary educated individuals has not implied a fall in returns to tertiary education. Second, as population becomes more educated, there will be a larger share of the population in a group (with tertiary education) which has a larger inherent inequality. This could tend to increase overall wage inequality. Again, the net outcome is ambiguous.

Table 1 reinforces the doubts concerning the net outcomes of inequality of aging and increasing education. In a decomposition of hourly wage inequality for males by groups using the Theil Index⁶ it can be seen that most of the inequality comes from within the groups. In fact, the decomposition by educational groups (primary, secondary and tertiary) indicates that almost 2/3 of the overall inequality is due to inequality within each of these groups. Only 1/3 can be accounted by inequality between the educational groups.

The decomposition by age groups⁷ shows that 98% of overall inequality is due to inequality within each age group. A combined decomposition by education and age⁸ reveals that more than 60% of total inequality can be accounted by

⁶ The Theil Index is an inequality index that is more sensitive to the changes in the lower part of the distribution, while the Gini coefficient is more sensitive to changes in middle part of the distribution. The Gini coefficient is not decomposable as the Theil Index.

⁷ The age groups are: 15-24, 25-34, 35-44, 45-54, and 55-65.

⁸ This implies 15 groups (3 educational groups x 5 age groups).

TABLE 1
DECOMPOSITION OF INEQUALITY IN 2007

	Within	Between	Theil Index	% Within
Groups by Education	0.385	0.208	0.591	65%
Groups by Age	0.575	0.016	0.591	97%
Groups by Education and Age	0.366	0.225	0.591	62%

inequality within each of the groups. These results indicate that most of the inequality is due to unobserved components, such as personal skills.

Following these ideas, the strategy for attempting a forecast of wage inequality takes into account 4 elements: (i) the population age composition; (ii) the population educational composition; (iii) the returns to education; and (iv) the returns to potential experience.

Predicted hourly wage will be computed by simulations as a result of a wage equation⁹ such as:

$$\hat{w}_{ite} = \hat{\beta}_{0e} + \hat{\beta}_{1e} \times educ_{ite} + \hat{\beta}_{2e} \times exp_{ite} + \hat{\beta}_{3e} \times exp_{ite}^2 + \varepsilon_{ite},$$

where \hat{w}_{ite} is the predicted hourly wage for individual i in period t in educational group e . Parameters $\hat{\beta}_{0e}$, $\hat{\beta}_{1e}$, $\hat{\beta}_{2e}$ and $\hat{\beta}_{3e}$ are the parameters estimated from a wage equation for educational group e in 2007 (kept constant over the simulation periods). $educ_{ite}$ is years of education of individual i in period t in educational group e . exp_{ite} is potential experience¹⁰ of individual i in period t in educational group e , and exp_{ite}^2 is potential experience squared, accounting for the non-linearities of the contribution of experience to wages. Finally, ε_{ite} is an error term computed stochastically for individual i in period t in educational group e , which follows a normal distribution with mean 0 and variance $\hat{\sigma}_e^2$. The variances are estimated from the 2007 estimations for each educational group and kept constant over time. This scheme allows non-linearities in returns to education to emerge from the data and to be introduced in the simulations.

3.1. Simulations Assumptions

According to the previous scheme, making the simulations requires three types of assumptions: Assumptions on the composition of the population by age and education, assumptions on the occupation rates, and assumptions on the parameters of the wage equation. It is worth to remark at this point that only those with larger than zero wages are actually taken into account for the inequality measures, as the focus of the paper is on wages, not overall income.

⁹ This is actually a semilog wage-equation as hourly wages appear in logarithms.

¹⁰ Potential experience is computed as age – years of education – 6.

Following the stylised facts revised in section 2, the simulations are based on the EOD survey, which accounts for the population of Great Santiago. We also restrict our analysis to males aged 15 to 65 years old. Statistics about age composition are prepared for the whole population of the country by the Instituto Nacional de Estadísticas (INE - National Institute for Statistics). However, there are no statistics for Great Santiago. This implies that it is required to assume a change in the age structure for Great Santiago similar to that of the total country population.

The age of the population is based on the age structure of the EOD in 2007. For every next year, each individual becomes one year older ($a_{i,t+1} = a_{i,t} + 1$, where $a_{i,t}$ is age of individual i in period t) and 66 years old individuals drop out of the sample and are replaced by individuals aged 15 years old. Hence the only statistic required to forecast population age structure is the ratio of males 15 years old to males aged 66 years old for each of the forecast years. Table 2 presents the assumptions for that ratio based on INE statistics. It can be observed that as population gets older, the ratio of individuals aged 15 years old to that aged 66 years old decreases from 3.2 in 2007 to 1.9 in 2017, revealing the ageing process that underlies Chilean demographics.

TABLE 2
POPULATION AGE RATIOS
Males (15 years old to 66 years old)

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
3.0587	2.9012	2.7569	2.6076	2.4677	2.3364	2.2128	2.0964	1.9957	1.9030

The composition by education is somehow more complicated. Again, the forecast is based on the EOD. In this case, average changes from 2002 to 2007 are used as the trend to follow. The procedure is as follows: The proportion of individuals aged a with e years of education in period $t+1$ ($P_{a,t+1,e}$) corresponds to $P_{a,t,e}$ plus the change $P_{a,t,e} - P_{a,t-1,e}$.¹¹ Since young individuals keep on accumulating years of education, the forecasted composition by age and education is applied to those individuals between 15 and 30 years old. From 31 years old onwards, individuals are assumed to keep the same years of education. The aggregate outcome of the composition by education is presented in Figure 8. The proportion of individuals between 15 and 30 years old with primary education only reduces from 8% in 2007 to 5% in 2017. The proportion of those with secondary education reduces from 58% in 2007 to 47% in 2017, while the proportion of those with tertiary education increases from 34% in 2007 to 48% in 2017.

Once the population by age and education is obtained it is required to determine which individuals are going to be considered working. For this purpose the observed occupation rates in 2007 are taken as the benchmark. Since in

¹¹ The proportions must be bounded to zero when corresponds.

FIGURE 8
FORECAST OF COMPOSITION BY EDUCATION (MALES AGED 15 TO 30)

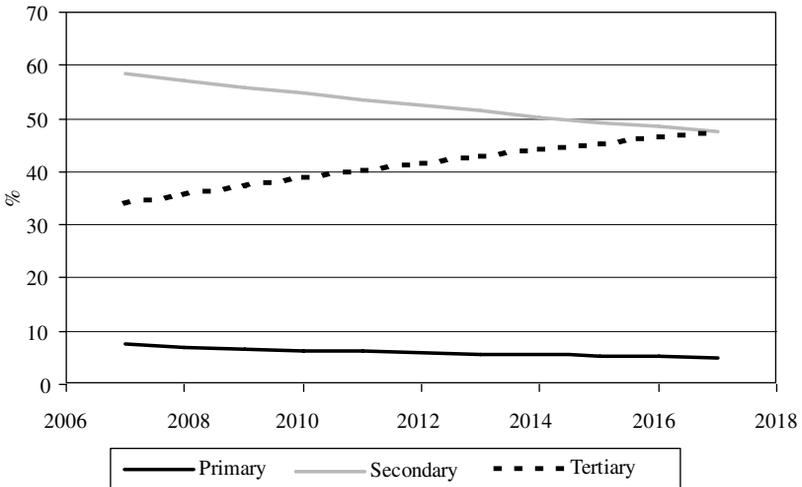
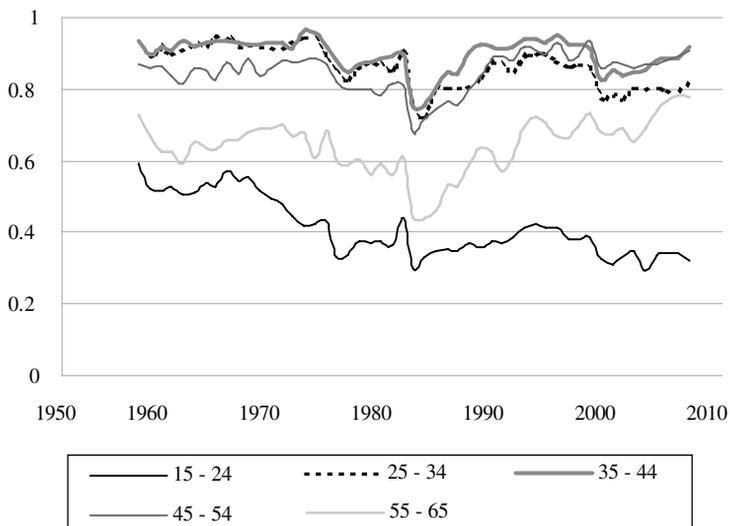


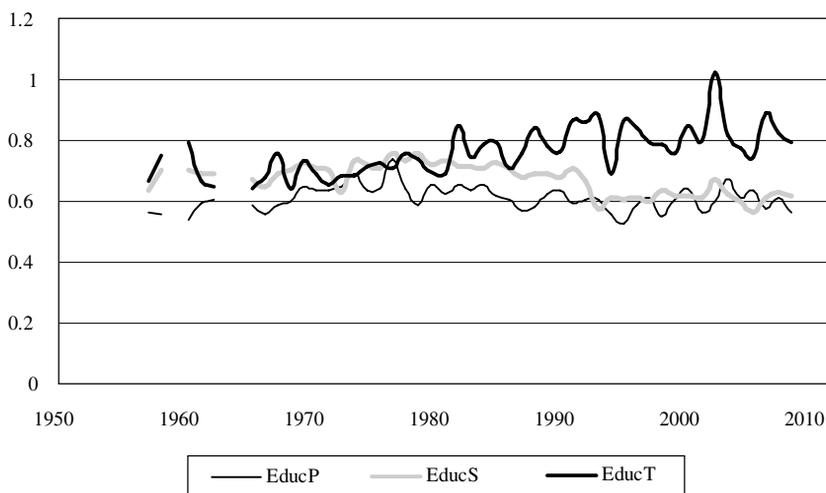
FIGURE 9
OCCUPATION RATES BY AGE



2007 unemployment rates are close to “full employment” this is considered to be a reasonable assumption. Figure 9 presents the occupation rates by age in time. The figures for 2007 are used as anchors for the simulations. The procedure implies assigning randomly individuals to be working or not within each category.

Finally, assumptions on the parameters of the wage equation must be made. The coefficients of the wage equations are taken from the 2007 regressions by education. The variance of the error terms are also taken from those regressions. Figure 10 presents the Root of the Mean Square Errors (RMSE) of the wage equations throughout the period. Following the inequality within education groups, the RMSE are much larger for the group with tertiary education. Table 3 show the estimations results for 2007 where the parameters used are taken from¹².

FIGURE 10
RMSE



One consideration can be made about this last assumption. Tertiary education in Chile has been increasing consistently in the past years. However, newcomers in tertiary education are not expected to be at the top of the distribution in terms of skills, they are more likely to be entering through the bottom of the distribution. This should increase unexplained wage variance. This has important implications for interpreting the simulation results because this assumption could be considered as a lower bound assumption.

3.2. Simulations Results

Following the procedure described above, the simulations for a 10-year period of wage inequality among males are carried out. Upper and lower bounds are computed using centiles of the simulated distribution to create 95% confidence

¹² It is worth to remark that, compared to the full model reported in Figure 7, returns to education are larger for secondary and tertiary education, and the constant term is smaller. This reflects the fact that the subgroup estimations allow to capture more heterogeneity of hourly wages through years of education than the full model.

TABLE 3
PARAMETERS FOR WAGE EQUATION SIMULATIONS
 Dependent Variable Ln(wage/hrs)

	(1) Primary	(2) Secondary	(3) Tertiary
<i>Wage</i>			
Years of Primary Education	0.0120 (0.71)		
Years of Secondary Education		0.1124 (6.14)	
Years of Tertiary Education			0.1833 (9.62)
Experience	-0.0100 (-0.91)	0.0102 (1.67)	0.0034 (0.24)
Experience ²	0.0003 (1.54)	0.0000 (-0.01)	0.0002 (0.53)
Constant	6.7772 (32.19)	5.5260 (23.68)	4.9499 (12.95)
<i>Participation</i>			
Years of Primary Education	0.0888 (2.93)		
Years of Secondary Education		0.1101 (3.06)	
Years of Tertiary Education			0.2195 (6.42)
Experience	0.1031 (5.69)	0.1626 (16.44)	0.2315 (11.42)
Experience ²	-0.0016 (-5.44)	-0.0034 (-15.41)	-0.0053 (-10.19)
# of under 15 years old in household	-0.0816 (-0.93)	-0.2523 (-4.41)	0.1065 (1.06)
Spouse present	0.5960 (4.44)	0.6718 (6.02)	0.6349 (3.59)
Constant	-1.4581 (-4.44)	-1.7634 (-4.28)	-4.2915 (-7.79)
rho	-0.5744	-0.2283	-0.3083
sigma	0.5982	0.6210	0.7984
lambda	-0.3436	-0.1418	-0.2461
Number of obs	551	1784	966
Censored obs	132	538	292
Uncensored obs	419	1246	674

Robust z statistics in parentheses.

intervals¹³. Figure 11 presents the Gini coefficients obtained from the exercise. It is noticeable that over-all wage inequality for males remains fairly stable over a 10-year forecast. Also, the confidence interval is rather narrow, indicating that there are not so many possible extreme situations. This results are in line with those of Behrman (2006) and Mc- Kee and Todd (2007). Behrman finds improvements in inequality when well-targeted increases in schooling attainment of the poorest in Chile is introduced, although his exercise is static and does not take into account demographic dynamics¹⁴. On the other hand, McKee and Todd find modest reductions in inequality when human capital (measured by education and height as a proxy for health) is increased due to the Oportunidades poverty alleviation program in Mexico¹⁵.

FIGURE 11
INEQUALITY FORECAST

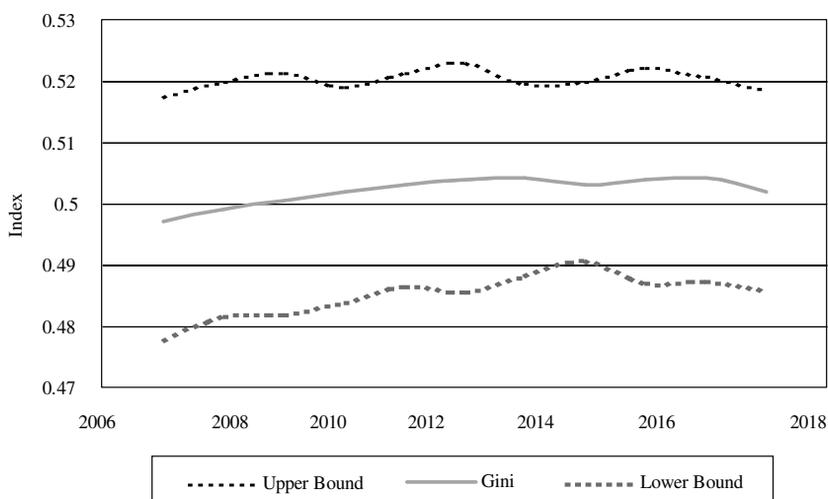


Table 4 shows some statistics of the simulations. First, as males become more educated, average years of education increase from 12.0 in 2007 to 12.5 in 2017 for the whole population (this is the result of younger individuals entering with more years of education and elderly with less education leaving the sample). What this implies is that although there is a significant increase in the proportion of young individuals with tertiary education, a 10-year horizon seems to be not enough for average years of education to increase more substantially.

¹³ Upper and lower bounds correspond to centile 97.5 and 2.5 respectively. The process run 500 simulations for each forecasted year. More replications were also attempted without significant improvements in the confidence interval.

¹⁴ Behrman uses similar simulations based on wage-equations using the Encuesta de Protección Social (Social Protection Survey) for 2004 with national coverage.

¹⁵ They use non parametric simulations, although parametric results give similar outcomes.

TABLE 4
STATISTICS IN 2017

	2007	2017	Change
Hourly wage	2257	2551	13%
Age	40.0	40.3	1%
Years of Education	12.0	12.5	4%
Years of Education (15 to 30 only)	12.5	13.4	7%

The process of ageing of the population is slow, so that the average age increases from 40.0 in 2007 only to 40.3 in 2017¹⁶. Looking at wages, as a result of increased levels of education and experience, hourly wages increase in 13% throughout the 10-year period.

Finally, comparing the within and between groups decomposition of inequality simulated in 2007 and 2017 may help to understand what is going on with overall in- equality. Table 5 shows that in 2007 inequality within educational groups explains 59% of overall inequality. This figure increases to 62% in 2017 as a result of more individuals entering tertiary education, which is the type of education which has the largest inherent within group inequality.

On the other hand, in 2007 inequality within age groups explains 95% of overall inequality. The process of ageing leads to within age inequality to explain 99% of total inequality in 2017. This is due to the fact that older groups have larger inherent within group inequality. The combined groups by education and age imply that within groups inequality accounts for 56% of inequality in 2007 and 58% in 2017. This is the result of older and more educated groups, those with larger inherent within group inequality, having a larger relative weight, making the within effect to be relatively more important.

TABLE 5
DECOMPOSITION OF SIMULATED INEQUALITY 2007-2017

	2007- Simulated				2017- Simulated			
	Within	Between	Theil Index	% Within	Within	Between	Theil Index	% Within
Groups by Education	0.281	0.194	0.476	59%	0.317	0.193	0.510	62%
Groups by Age	0.453	0.022	0.476	95%	0.504	0.006	0.510	99%
Groups by Education and Age	0.265	0.211	0.476	56%	0.297	0.213	0.510	58%

¹⁶ The figures for the whole country by the INE are 36.6 in 2007 to 38.0 in 2017, indicating that Great Santiago may be leading the process of ageing of the country and may have passed already a significant part of ageing process.

Finally, the forecast of wage inequality is consistent with the findings of Contreras, Cooper and Neilson (2007). Their estimations show evidence that economic growth during the 90s does imply convergence in the lower part of the income distribution, but that there is no evidence of overall income convergence.

4. CONCLUSIONS

The high and persistent income inequality in Chile remains a challenge for policy makers. Wage inequality is one of the main elements that drive household income inequality. Chilean population is ageing and our findings indicate that this 'natural' process may induce increasing inequality. Besides, younger cohorts of Chilean workers are entering the labor market with higher levels of education. This paper suggests that there are no reasons to expect this to improve inequality.

Using microsimulations, this paper finds that the opposed forces that drive wage inequality tend to cancel each other. In fact, the 10-year wage inequality forecasted proposes that it is not expected that wage inequality will reduce significantly in the coming years. These findings imply a challenge for policy makers that would prefer increasing education to significantly improve income distribution in the short run. Nevertheless, the good news are that the labor market structure seems to prevent further deteriorations of wage inequality.

Future research should certainly include females. This poses the challenge of simulating female labor participation, which is expected to continue its increasing path. However, it could be anticipated that as highly educated females have already high participation rates, newcomers to employment will be mainly from low educated groups. This would create more inequality within working females, and probably also among both genders. Nevertheless, overall household income inequality should be significantly reduced as a result of increased female labor participation.

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APPENDIX A

THE EOD DATASET

The EOD dataset is a quarterly household survey focused to estimate unemployment rates that has been carried out by the Department of Economics of the University of Chile since 1957. In the second quarter of each year (July), an income module is appended to the questionnaire. The survey is composed of approximately 3,000 households representing the Metropolitan Area of Great Santiago. The EOD survey is the only survey that allows comparability of income information before the 1990s (when the CASEN survey was introduced)¹⁷.

¹⁶ The CASEN survey (National Survey for Socioeconomic Characterisation) started in 1987 and continued beyearly since 1990 until 2000, when it became every 3 years.

APPENDIX B

FIGURE B1
LABOR PARTICIPATION BY GENDER

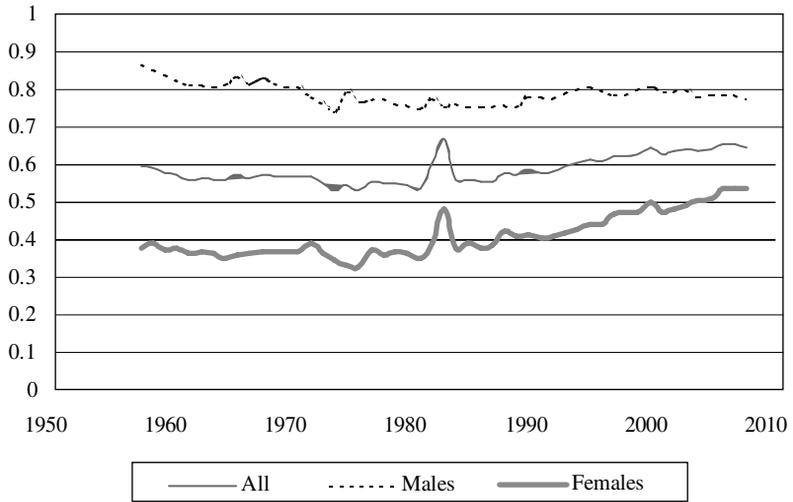


FIGURE B2
LABOR PARTICIPATION BY AGE: MALES

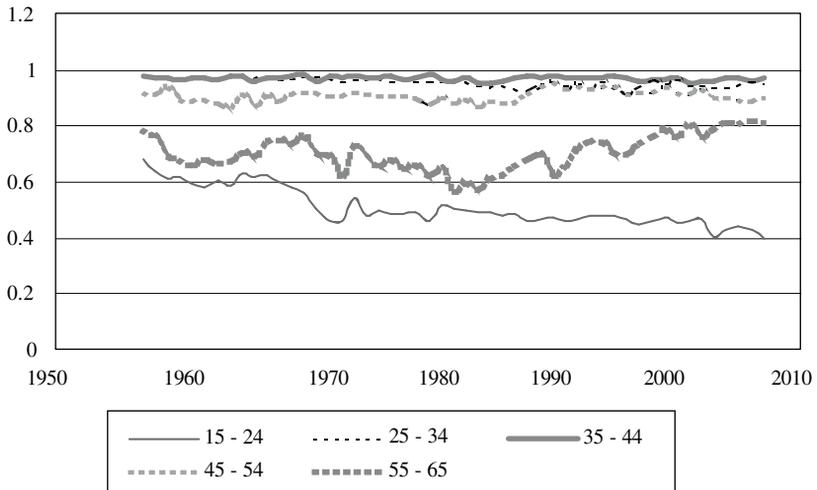


FIGURE B3
LABOR PARTICIPATION BY AGE: FEMALES

