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**THE EVOLUTION OF
OPPORTUNITIES FOR CHILDREN IN
CHILE 1990-2006**

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The Evolution of Opportunities for Children in Chile 1990-2006

by

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Abstract

In this article we apply some recently developed methodologies (Paes de Barros et al, 2008) to measure the evolution of the inequality of opportunity in Chile in the 1990-2006 period. The opportunities are measured as intermediate outcomes for children such as access to preschool, access to sanitary infrastructure, nutritional status and timely completion of secondary education. The distribution of these varies with coverage rates and how they distribute according to population subgroups, grouped by circumstances. These circumstances are exogenous (to the children) factors that contribute to determining socioeconomic outcomes. The more unequal the distribution of outcomes due to differences in circumstances, the more unequal the distribution of opportunity in the country. The results show a reduction in the inequality of opportunity in the period analyzed. The gains are of two classes. First, there have been substantial increases in social service coverage leading to a general improvement in opportunities. Second, the gap in access probabilities among population subgroups have been reduced, making the playing field more balanced.

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I. Introduction

Since the mid 1980s Chile has exhibited sustained economic growth, reaching an average annual rate of 5% in the 1987-2008 period. Poverty reduction has benefited from the expansion of the economy; the percentage of the population in poverty in 2006 is only one-third of the percentage in 1990. The cost of the optimal transfer to “eliminate” poverty was 4.6% of GDP in 1990, while the corresponding amount in 2006 was only 0.9% (Larrañaga, 2009). These results represent a dramatic decline in poverty in a relatively short period of time.

On the other hand, Chile still shows a high level of income inequality compared to developed countries. There is a difference of approximately 25 points in the Gini coefficient with respect to the average for developed countries, according to the data reported in the De Ferranti et al (2003) study. Notwithstanding, all indicators show that income inequality has fallen in Chile since 2000. The decline in inequality is related to a reduction in the wage premium following a large expansion in tertiary education (Eberhard and Engel, 2008, Larrañaga and Herrera, 2008). There is also evidence that income inequality has declined in other Latin American countries in the previous years, which can be related to increases in export prices rising domestic wages (Cedlas, 2009).

Another important dimension of the distribution of welfare is the inequality of opportunity, a dimension that has traditionally been neglected because of the lack of empirical measures to assess and monitor it. The distinction of inequality of outcomes and inequality of opportunity, as pointed out by Ferreira and Gignoux (2008), is of interest because of the widespread normative view that the inequality of opportunity is important in the design of public policy. Disadvantaged groups should be compensated by public policies to balance the playing field and ensure that the distribution of outcomes is not dependent on exogenous circumstances.

In this paper we apply some recently developed methodologies to measure the evolution of the inequality of opportunity (Paes de Barros et al, 2008). These measures assess how unequal the distribution of socioeconomic outcomes among subgroups is, grouped by circumstances. These circumstances are exogenous factors that contribute to determining

socioeconomic outcomes. The more unequal the distribution of outcomes due to differences in circumstances is, the more unequal is the distribution of opportunity in the country.

The focus of the analysis is the population under 18 years of age. This is the period of the life cycle where most cognitive and non-cognitive skills are determined, which have a strong influence on adult socioeconomic outcomes such as labor market productivity, social behavior, political participation, health status and others.

The paper assesses the impact of circumstances on the following intermediate outcomes: access to preschool, access to sanitary infrastructure, nutritional status and timely completion of secondary education. Circumstance variables include gender, schooling of the mother, schooling of the father, location of the household, per capita household income and family structure.

The results show a reduction in the inequality of opportunity in the 1990-2006 period. The gains are of two classes. First, there have been substantial increases in social service coverage leading to a general improvement in opportunities. Second, the gap in access probabilities among population subgroups have been reduced, making the playing field more balanced.

These results should be interpreted as partial evidence for the evolution of opportunities in Chile. There are other important socioeconomic outcomes for which we lack data to assess the evolution of opportunities, such as health related variables and school quality.

On the other hand, there is a significant gap in the index of opportunities across Chile, which reflects differences in both the coverage rates and in the distribution of opportunities within regions. During the 1990-2006 period, there has been some convergence as regions that lagged the most in the beginning are the ones that show the largest gains in the index of opportunities. But there are still large regional differences that add to the inequality of opportunity in the country.

The paper is organized as follows: in section II we discuss the relationship between achievements, resources and opportunities; section III presents the methodology to

compute an index of opportunities for children; section IV describes the data set and estimates; section V presents the main results; section VI decomposes changes in the index in terms of changes in coverage and changes in the dissimilarity index; and section VII concludes.

II. Outcomes, resources and opportunities

Human welfare has different dimensions, such as income, health and education, among others. Monetary income represents purchasing power over goods and services that provide for human needs; good health is a state of physical and mental well being that allows people to live long and satisfactory lives; and education is knowledge and learning capacities. These outcomes are intertwined by complex cause-effect links, so that some positive influence others and vice versa.

Socioeconomic outcomes are determined by resources. Examples of resources are parents' education and income, school inputs, nutrition intakes, characteristics of dwellings and neighborhoods, among others. The distinction between resources and outcomes is somewhat arbitrary. Some resources represent intermediate outcomes, which are determined by other more basic resources. For example, graduation from high school is a resource for future income generation, but is also an educational outcome determined by school and household inputs.

Resources can be classified as exogenous or endogenous to the individual. An exogenous resource is called a circumstance, as is the case of parental household endowments. A child does not choose the time and location of his birth, the schooling of his/her parents, household income, number of siblings, etc. However, these variables shape the formation of skills in the early stages of the life cycle. Meanwhile, endogenous resources are those that are chosen by the individual, such as the effort exerted in schools and jobs, allocation of time among competing ends, allocation of income between consumption and savings.

The classification of resources into endogenous or exogenous categories is contingent to

the age of the individual. While most, if not all, family resources are exogenous to children, adults have the greatest command over their living conditions. The scope of endogenous choices is also dependent on socioeconomic status, as acknowledged by Sen who defines poverty as the lack of freedom to choose the type of life in which an individual would have reasons to live (Sen, 1999).

Notice also that the line between exogenous or endogenous resources is not well defined. The debate about penal responsibilities of young offenders or the mentally insane illustrates some of the complexities that arise when trying to ascertain how responsible people are for their acts. In our discussion a dimension of endogeneity, which is particularly relevant for public policy, is family choices that affect children expectations. Variables such as family structure, location of residence, and preschool attendance are, within a certain range, chosen by families. These factors are exogenous to the child but endogenous to their families. This leads to the question of how responsible public policies are for compensating for family choices that are bad for children.

The issue is related to the discussion of familiarism versus de-familiarism in public policies (Esping-Andersen, 1999). The former view establishes that families are responsible for the welfare of their members and public policies should intervene only when families do not have the needed resources or capacities to take care of their own. On the other hand, de-familiarism prioritizes individual rights and establishes that the state has obligations to individuals, regardless of their family resources or choices.

The relationship between outcomes, resources and opportunities is also time and place contingent. This introduces an important caveat in empirical assessments of the distribution of opportunities. Consider for example life expectancy, which represents a main health outcome. A person who dies in Chile in 2009 at 65 years old would have had an exceedingly shorter life-span than the average individual, but in 1960 would have already lived seven years more than the average. Likewise, being literate represented a sufficient achievement in education decades ago, but to perform adequately in society today, people need to be functionally literate.

As for resources, access to a good nutrition, vaccines, mother-child health services, drinkable water and other sanitary infrastructure represented key resources for health outcomes that only a fraction of the population had access to decades ago. Nowadays its coverage is almost universal and the quality of life depends on access to health care services that deal with old age health risks, such as physical and mental disabilities, coronary disease and others.

On a related example, granting universal access to primary education and ensuring that most children complete six or eight years of schooling is a reasonable policy goal in very low-income countries. But for a middle-income country, achieving social and economic inclusion requires no less than completing a secondary education.

The relative nature of outcomes and resources is also an issue for other dimensions of the distribution of welfare. A leading example is the poverty line, or income threshold, that defines poverty status. Developed countries use higher poverty lines than poor countries, because the amount of income that is needed to achieve a decent standard of living depends on consumption patterns that are socially determined. Many years ago Adam Smith noticed this when saying that a woman in Ireland could walk the streets barefoot without feeling ashamed, but that was not the case for a English woman because of the higher standard of living in that country at the time.

III. Methodology⁵

Consider m circumstance groups denoting the unconditional probability of access to a particular outcome by \bar{p} . Paes de Barro *et al.* (2008) consider the minimum proportion of all available opportunities that one must reallocate to ensure equal access to all circumstance groups, i.e., a situation in which $p(x_j) = p_j$ would be equal to \bar{p} where x_j

⁵ This section follows closely Paes de Barro *et al.* (2008).

represents a circumstance group $j = 1, \dots, m$.

Thus, Paes de Barro *et al.* (2008) propose the following index based on the dissimilarity index:

$$D = \frac{1}{2\bar{p}} \sum_{j=1}^m \alpha_j |p_j - \bar{p}|$$

Where $\alpha_j = \frac{N_j}{N}$ corresponds to the proportion of individuals in circumstance group j . As this expression indicates, the index is proportional to the mean absolute distance between group-specific access probabilities and the overall access probabilities. In this sense, it is a measure of the inequality of opportunity.

The sample analog is:

$$D = \frac{E|P(I = 1|x) - P(I = 1)|}{2P(I = 1)}$$

Where I is an indicator function, which is equal to one if an individual had access to a given opportunity and equal to zero otherwise.

The computation of the inequality of opportunity index is similar to the parametric approach for computing the dissimilarity index. First, assume that we have a random sample from the population with information on whether person i had or had not had access to a given opportunity ($I_i = 1$ if that person had access and $I_i = 0$ otherwise) and a vector of variables indicating his/her circumstances, $x_i = (x_{1i}, \dots, x_{mi})$. Then we can rewrite the index as follow

$$D = \frac{E|P(I = 1|x) - P(I = 1)|}{2P(I = 1)} = \frac{E|P(I = 1|x) - E(P(I = 1|x))|}{2E(P(I = 1|x))}$$

Where the second equality comes from $P(I = 1) = E(I) = E(E(I|x))$ by the law of iterated expectations. This expression also indicates the central role of group specific coverage

rates, $P(I = 1|x)$, in estimating D . Given this information, one needs to follow three steps to estimate the inequality of opportunity index.

The first step consists of estimating the conditional probabilities. The simplest way of estimating conditional probabilities is to assume a separable logistic regression

$$\text{Ln}\left(\frac{P(I = 1|x_1, \dots, x_m)}{1 - P(I = 1|x_1, \dots, x_m)}\right) = \sum_{k=1}^m h_k(x_k)$$

Where x_k denotes a k-dimension vector of circumstances.

In the second step, we predict, for each individual in the sample, his/her probability of access to the opportunity in consideration, using the estimated coefficients in step one:

$$\hat{p}_i = \frac{\text{Exp}\left(\hat{\beta}_o + \sum_{k=1}^m x_{ki} \hat{\beta}_k\right)}{1 + \text{Exp}\left(\hat{\beta}_o + \sum_{k=1}^m x_{ki} \hat{\beta}_k\right)}$$

In the final step we compute

$$\bar{p} = \sum_{i=1}^n w_i \hat{p}_i$$

and

$$\hat{D} = \frac{1}{2\bar{p}} \sum_{i=1}^n w_i |\hat{p}_i - \bar{p}|$$

where $w_i = \frac{1}{n}$ or some sampling weights.

Since, almost surely, $\text{Lim}_{n \rightarrow \infty}(\bar{p}) = P(I = 1)$ under the assumptions that: (i) the regression has been correctly specified and (ii) its coefficients are consistently estimated. Paes de Barro et al. (2008) discuss the properties of the estimator such as consistency and asymptotic

variance.

Since $\bar{p} = \frac{M}{N}$ where M is the number of opportunities available and N is the number of opportunities needed to ensure access for all, we can reinterpret \bar{p} as the percentage of the total number of opportunities required for universal access that are actually available. This interpretation indicates that \bar{p} is a measure of the stock of available opportunities, but it is insensitive to how these opportunities are allocated.

Thus, the natural way of proceeding is to relate D and \bar{p} . Since the inequality of opportunity index, D , is the proportion of opportunities that must be reallocated for equality of opportunity to prevail, then $1-D$ is the proportion properly allocated and $M(1-D)$ the total number of opportunities allocated accordingly the principle of equal opportunity for all. Hence, Paes de Barro *et al.* (2008) define $O = M(1-D)$ as the available opportunities allocated according to the principle of equal opportunity. Finally, the overall measure of opportunity is given by

$$r = \frac{O}{N} = \frac{M}{N}(1-D) = \bar{p}(1-D)$$

With a clear interpretation, the percentage of available opportunities allocated according to the equality of opportunity principle. This index of children's opportunities is estimated in the following sections.

IV Data and estimation

The estimates are based on data from the 1990, 1996 and 2006 CASEN surveys. CASEN is a multi-topic household survey with a large sample size (75,000 households in 2006), which has been conducted every two or three years since 1987 and is the traditional source for statistics on income distribution, poverty and the impact of social spending in Chile. The data is collected by the Micro Data Center of the Universidad de Chile by mandate of the Ministry of Planning (Mideplan).

We analyze the distribution of opportunity in four key dimensions for the formation of human capital: access to preschool, access to sanitary infrastructure, completing secondary education on time and nutritional status.

The importance of schooling to explain most adult socioeconomic outcomes has been extensively documented in the literature (See the review in Cunha et al., 2004). Access to preschool and graduation from high school represents primary outcomes in current education. Preschool attendance contributes to the formation of basic cognitive and non-cognitive skills that are needed in later stages of the educational cycle; while graduation from high school is currently the minimum level of education required for accessing most non-professional jobs. In 1990 only 16% of the child population (under 6) attended preschools and only 46% of the population of 18 year olds had already completed secondary education. Moreover, preschool attendance and graduation from high-school rates were highly differentiated by household per capita income.

Access to sanitary infrastructure is defined as a categorical variable equal to one when children live in dwellings with access to drinkable water and sewage treatments and equal to zero otherwise. Sanitary infrastructure represents a basic input to health status and has been a factor behind the reduction in child mortality and morbidity. Healthier children become healthier adults, live longer and better lives, exhibit better education results and are more competitive in the labor market (Case, Fertig and Paxson, 2003; Case, Lubostky and Paxson, 2002). In 1990 71% of children under 16 years old had access to sanitary infrastructure. Access was strongly determined by location; children living in rural areas were particularly disadvantaged with coverage reaching only to 41%.

Nutritional status is measured as a dichotomous variable that takes the value one when the child's weight is normal and zero otherwise. The latter category includes both over and underweight children. Underweight children are likely to lack essential nutrients, which hinder their physical and intellectual development with negative long run effects on socioeconomic outcomes. On the other hand, being overweight is considered a major risk to future health conditions and can also hinder the emotional development of children. In 1990, 85% of children classified as having good nutritional status, 9% were

underweight and 5% overweight. Being in good nutritional status for children was dependent on the socioeconomic status of the parental household. The proportion of children in good nutritional status reached 93% in the highest income per capita quintile and 81% in the lowest quintile.

Table 1: Indicators analyzed as inequality of opportunity

<i>Number</i>	<i>Type of Service</i>	<i>Access or direct benefit</i>	<i>Indicator</i>	<i>Universe (Children age)</i>
1	Education	Direct Benefit	Probability of completing secondary education (12 th grade) on time	18
2	Education	Access	Access to preschool	0-5
3	Health	Access	Access to a good nutrition	0-5
4	Housing	Access	Access to water and sanitation	0-16

The estimation of the opportunity index requires classifying the population into subgroups according to types. The set of circumstance variables $x = (x_1, \dots, x_m)$ include parents' education, family per capita income, gender, number of siblings, family structure (number of siblings, single-parent household), and area of residence (urban versus rural).⁶ The functions $\{h_k\}$ that relate each circumstance with outcomes are specific to each dimension: quadratic on education, logarithmic on income, nonparametric (dummies) on age and other dimensions. All functions end up being linear in the parameters, so that, $h_k(x_k) = x_k \beta_k$. From the estimation of this logistic regression, one obtains estimates of the parameters $\{\beta_k\}$ that will be denoted by $\{\hat{\beta}_k\}$. A complete specification of this logistic

⁶ In the case of education, age was also a variable used to predict the probability of completing each grade.

regression is presented in Table 2.⁷

Table 2: Specification of separable logistic regression function

Dimensions of circumstances	Specification
Gender	Free (Dummy)
Parents Education	Quadratic
Per Capita Income	Logarithmic
Number of Siblings	Linear
Presence of Parents	Free (Dummy)
Area of Residence (Urban/Rural)	Free (Dummy)

IV. Results

Tables 3 to 6 show the results for the dimensions under evaluation: access to preschool, timely completion of secondary school, access to sanitary infrastructure and good nutritional status, respectively. Each table shows the opportunity index in years 1990, 1996 and 2006, providing an overview of the evolution of opportunities during the period.

Recall that the opportunity index is the product of the average rate of coverage times (one minus) the dissimilarity index, $O = p(1-D)$. Thus, the index shows the percentage of available opportunities allocated according to the equality of opportunity principle. The average coverage and the dissimilarity index for each dimension and year are shown in the Annex.

Table 3 shows that the opportunity index of access to preschool increased from 13.3% in 1990 to 34.2% in 2006. This represents a significant improvement in the allocation of

⁷ An additional circumstance that may be of interest is the ethnicity or race of the head of the household. Unfortunately, this information is only available for the 2006 wave of the CASEN survey. Hence, in the empirical application we will focus the analysis without this circumstance unless it is explicitly mentioned.

preschool attendance according to the principle of equality of opportunity, although the 2006 rate is still low in absolute terms.

Table 3: Evolution of the opportunity index of access to preschool

Region/National	Years			
	1990	2000	2006	Total Increase 1990-2006
I Tarapacá	23.5%	28.2%	43.4%	0.20
II Antofagasta	12.2%	27.6%	33.6%	0.21
III Atacama	16.6%	29.3%	35.1%	0.18
IV Coquimbo	12.0%	28.7%	37.9%	0.26
V Valparaíso	13.5%	26.3%	35.5%	0.22
VI Libertador General B. O'Higgins	10.6%	20.8%	30.9%	0.20
VII Maule	8.6%	21.0%	34.6%	0.26
VIII Biobío	10.6%	20.4%	30.7%	0.20
IX La Araucanía	7.9%	19.7%	29.9%	0.22
X Los Lagos	7.5%	15.2%	29.0%	0.21
XI Aisén del General Carlos I. del Campo	10.4%	29.0%	44.0%	0.34
XII Magallanes y A. Chilena	16.5%	26.0%	44.4%	0.28
XIII Región M. de Santiago	18.0%	25.6%	35.9%	0.18
National	13.3%	23.6%	34.2%	0.21

The opportunity index of access to preschool varies considerably across regions, although that variance reduces during the period. The region with the best results had triple the rate of the least advanced region in 1990. However, all regions show significant improvement during the period. While in 1990 six out of thirteen regions showed an opportunity index below 10%, in 2006 all regions but one have a value above 30% in the index. Those regions that lagged behind in 1990 exhibit the largest gains in the period. As a result, there has been a reduction in the variance of the opportunity index among regions, although differences are still large; the gap between the highest and lowest rates is approximately 50% in 2006.

The opportunity index of timely completion of secondary education shows a similar trend as can be observed in Table 4. Between 1990 and 2006 this opportunity index increased from 38% to 58%. Thus, in 2006, three out of every five 18 years olds was graduating from high-school.

Table 4: Evolution of the opportunity index of completing 12th grade on time

Region/National	Years			
	1990	2000	2006	Total Increase 1990-2006
I Tarapacá	53.9%	60.0%	63.3%	0.09
II Antofagasta	44.0%	38.8%	51.7%	0.08
III Atacama	32.0%	31.9%	64.6%	0.33
IV Coquimbo	36.1%	53.7%	59.9%	0.24
V Valparaíso	37.1%	43.9%	56.5%	0.19
VI Libertador General B. O'Higgins	29.6%	50.5%	57.3%	0.28
VII Maule	21.1%	46.7%	53.1%	0.32
VIII Biobío	38.8%	39.9%	61.5%	0.23
IX La Araucanía	28.3%	41.4%	53.1%	0.25
X Los Lagos	19.1%	42.0%	51.3%	0.32
XI Aisén del General Carlos I. del Campo	16.7%	34.9%	40.1%	0.23
XII Magallanes y A. Chilena	46.3%	65.6%	72.3%	0.26
XIII Región M. de Santiago	46.9%	55.1%	61.8%	0.15
National	37.9%	48.0%	58.4%	0.21

Also, the 1990 index exhibited large regional differences that were significantly reduced by 2006. The gap between the highest and lowest regional indices decreased from a factor of three in 1990 to a factor of two in 2006.

Not surprisingly, regions that show the best results in the opportunity index of high school graduation also have the highest positions in the opportunity index of access to preschool. Conversely, those with the worst results in graduation from secondary school also have the lowest positions in the access to preschool index.

Table 5 shows the evolution of the opportunity index of access to water and sanitation. This is another dimension where opportunities improve significantly over time as the index increased from 60% in 1990 to 83% in 2006. Once again, the regions that lagged behind in 1990 are the ones with the highest gains in the period. In that year the most advanced regions had opportunity-adjusted-coverage rates of around 80% and higher, while regions that lagged behind were those with that were relatively rural, with index values below 40%. The only way to improve the national index in this context is with substantial increases in the least advanced regions, which was precisely what happened

during the period.

Table 5: Evolution to the opportunity index of access to water and sanitation

Region/National	Years			Total Increase 1990-2006
	1990	2000	2006	
I Tarapacá	91.3%	85.0%	91.9%	0.01
II Antofagasta	75.5%	97.9%	98.6%	0.23
III Atacama	73.1%	88.5%	91.7%	0.19
IV Coquimbo	40.0%	68.8%	83.3%	0.43
V Valparaíso	65.2%	82.6%	88.3%	0.23
VI Libertador General B. O'Higgins	43.3%	61.7%	77.6%	0.34
VII Maule	37.0%	54.1%	68.3%	0.31
VIII Biobío	41.8%	60.6%	72.9%	0.31
IX La Araucanía	25.6%	45.8%	54.0%	0.28
X Los Lagos	26.6%	47.4%	62.2%	0.36
XI Aisén del General Carlos I. del Campo	52.8%	70.1%	89.8%	0.37
XII Magallanes y A. Chilena	85.7%	96.3%	97.0%	0.11
XIII Región M. de Santiago	86.5%	90.1%	94.0%	0.07
National	58.5%	74.2%	82.7%	0.24

Finally, Table 6 presents the evolution of the opportunity index for the nutritional dimension. This time the opportunity index shows little progress during the 1990-2006 period, going from 83% to 87%. One obvious explanation for this is that the already high value of the index in the initial year offers little room for further improvement. This also explains the homogeneity in the distribution of opportunities across regions.

However, there is some hidden action in this indicator. Recall that the poor nutritional status includes both underweight and overweight children. In 1990 the relationship between these two categories was 2:1 in favor of the underweight whereas in 2006 the relation was 2.5:1 in favor of the overweight. Thus, the stability in the opportunity index over time is also the result of compensating trends in the poor nutritional category.

Table 6: Evolution of the opportunity index of access to good nutrition

Region/National	Years			Total Increase 1990-2006
	1990	2000	2006	
I Tarapacá	85.1%	88.1%	88.1%	0.03
II Antofagasta	86.6%	86.0%	86.0%	-0.01
III Atacama	86.0%	85.3%	85.3%	-0.01
IV Coquimbo	81.6%	84.7%	84.7%	0.03
V Valparaíso	76.8%	87.3%	87.3%	0.11
VI Libertador General B. O'Higgins	82.5%	84.9%	84.9%	0.02
VII Maule	79.5%	85.9%	85.9%	0.06
VIII Biobío	83.4%	84.4%	84.4%	0.01
IX La Araucanía	82.3%	84.2%	84.2%	0.02
X Los Lagos	86.0%	86.1%	86.1%	0.00
XI Aisén del General Carlos I. del Campo	84.9%	78.7%	78.7%	-0.06
XII Magallanes y A. Chilena	85.2%	88.0%	88.0%	0.03
XIII Región M. de Santiago	83.8%	86.1%	86.1%	0.02
National	82.6%	85.7%	85.7%	0.03

VI. Decomposing the change in the Opportunity Index

Paes de Barro *et al.* (2008) propose a simple decomposition of the opportunity index between situations A and B. These can correspond to two points in time in a country or two countries at the same point in time. Thus, any change in the O index can be decomposed in a scale effect $\Delta \bar{P}$ and a distributional effect, Δ_D

$$\Delta = O^B - O^A = \bar{p}^B(1 - D^B) - \bar{p}^A(1 - D^A) = \Delta_{\bar{p}} + \Delta_D$$

where

$$\Delta_{\bar{p}} = \bar{p}^B(1 - D^A) - \bar{p}^A(1 - D^A) = (\bar{p}^B - \bar{p}^A)(1 - D^A)$$

and

$$\Delta_D = \bar{p}^B(1 - D^B) - \bar{p}^B(1 - D^A) = \bar{p}^B(D^A - D^B)$$

As can be easily checked, the sum $\Delta \bar{P} + \Delta_D = \Delta$.

We go beyond this decomposition and implement an Oaxaca decomposition to Δ_D , so we can explain the distributional change by changes in the circumstances (quantities) or changes in the parameters (prices). Hence,

$$D^B - D^A = D(X^B \beta^B) - D(X^A \beta^A) = \Delta_\beta + \Delta_X$$

where

$$\Delta_\beta = D(X^B \beta^B) - D(X^B \beta^A)$$

and

$$\Delta_X = D(X^B \beta^A) - D(X^A \beta^A)$$

Then, the total decomposition can be written as follows:

$$\Delta = \Delta_{\bar{p}} + \Delta_{\bar{D}} = \Delta_{\bar{p}} + \bar{p}^B \Delta_\beta + \bar{p}^B \Delta_X$$

The first term corresponds to changes in the coverage of the opportunity (the scale effect), the second term is the change in the distribution of opportunities due to changes in the coefficients that relate circumstances and outcomes (“price” distribution effect), and the third term is the change in the distribution of opportunities that are due to changes in circumstances faced by children (“endowment” distribution effect).

Decomposition results

Table 7 presents the decomposition of the 1990-2006 changes in the opportunity index of access to preschool in term of the scale effect and the distribution effect. The scale effect explains 17 of the 21 percentage point increase in this opportunity index. Thus, during this period there is a large and across-the-board expansion in preschool that benefits all subgroups, regardless of type or circumstance. This can be also seen at the regional level, because the scale effect explains most of the increase in the opportunity index in every region.

On the other hand, changes in the dissimilarity index explain the remaining 4 percentage point increase in the opportunity index. This effect originates in a more balanced distribution of opportunity among types of children, reducing the gap in the access to preschool between the most and least advantaged groups.

Table 7: Decomposing the change in the opportunity index of access to preschool

Region/National	Decomposition: Increase HOI 1990-2006			Total Increase (1)+(2)+(3)
	Scale effect: $\Delta \bar{P}$ (1)	Distribution effect: $\bar{P}^B \Delta_{\beta}$ (2)	Distribution effect: $\bar{P}^B \Delta_{\chi}$ (3)	
I Tarapacá	0.17	-0.08	0.11	0.20
II Antofagasta	0.19	-0.16	0.19	0.21
III Atacama	0.16	-0.08	0.11	0.18
IV Coquimbo	0.21	-0.19	0.23	0.26
V Valparaíso	0.19	-0.14	0.17	0.22
VI Libertador O'Higgins	0.16	-0.10	0.14	0.20
VII Maule	0.20	-0.23	0.29	0.26
VIII Biobío	0.17	-0.14	0.17	0.20
IX La Araucanía	0.17	-0.18	0.22	0.22
X Los Lagos	0.17	-0.20	0.24	0.21
XI Aisén del General Carlos I. del Campo	0.28	-0.39	0.44	0.34
XII Magallanes y A. Chilena	0.24	-0.20	0.23	0.28
XIII Región M. de Santiago	0.16	-0.07	0.09	0.18
National	0.17	-0.10	0.14	0.21

The Oaxaca decomposition of the distribution effect shows that the 4 percentage points impact results from large compensating effects in circumstances of “endowments” and “prices”. Changes in endowments cause the opportunity index to increase by 14 points. This happens when the subgroups or types with the highest probability of attending preschool are the ones who experience the largest increase in their participation in the total population. This is an expected development in the context of a growing economy, because people become more educated, migrate to fast growing regions, have fewer children, etc. On the other hand, change in circumstance “prices” cause a decrease in the opportunity index of about 10 points. This effect originates in a reduction in the

coefficients that link the disadvantaged and access to preschool, a result that has to be interpreted in the context of a large-scale effect that benefits all subgroups.

The scale effect also dominates in the decomposition of changes in the opportunity index of completing secondary education (Table 8). This effect explains 15 of the 21 percentage point increase in this index in the 1990-2006 period. Every type or population subgroup increases its probability of graduating from high school, representing an across-the-board improvement in opportunities (an “all boats rise with the tide” effect). The dominance of the scale effect also shows at the regional level since it represents over half of the increase in the opportunity index in each region.

Table 8: Decomposing the changes in the opportunity index of completing secondary education on time

Region/National	Decomposition: Increase HOI 1990-2006			Total Increase (1)+(2)+(3)
	Scale effect: $\Delta \bar{P}$ (1)	Distribution effect: $\bar{P}^B \Delta_{\beta}$ (2)	Distribution effect: $\bar{P}^B \Delta_{\chi}$ (3)	
I Tarapacá	0.07	-0.01	0.03	0.09
II Antofagasta	0.06	0.00	0.02	0.08
III Atacama	0.25	-0.05	0.12	0.33
IV Coquimbo	0.15	0.04	0.05	0.24
V Valparaíso	0.14	0.02	0.03	0.19
VI Libertador General B. O'Higgins	0.18	0.03	0.07	0.28
VII Maule	0.22	-0.02	0.12	0.32
VIII Biobío	0.17	0.02	0.03	0.23
IX La Araucanía	0.16	0.05	0.04	0.25
X Los Lagos	0.22	-0.07	0.17	0.32
XI Aisén del General Carlos I. del Campo	0.19	-0.02	0.06	0.23
XII Magallanes y A. Chilena	0.18	0.00	0.08	0.26
XIII Región M. de Santiago	0.12	0.01	0.02	0.15
National	0.15	0.03	0.03	0.21

Changes in the direction of a more balance distribution of opportunities in the dissimilarity index explain the remaining 5 percentage point increase in the opportunity index. This time changes in circumstances endowments and circumstance prices work in

the same direction, making the opportunity index increase.

Therefore all three effects are responsible for having created more and more balanced opportunities to complete secondary education over time.

Table 9 shows that the large gains in the opportunity index of accessing sanitary infrastructure results from an across-the-board increase in coverage and from changes in circumstance endowments. The former explains 14 out of the 24 percentage point increase in the opportunity index whereas the latter explains the remaining 10 percentage points.

Table 9: Decomposing the change in opportunity index of access to water and sanitation

Region/National	Decomposition: Increase HOI 1990-2006			
	Scale effect: $\Delta \bar{P}$	Distribution effect: $\bar{P}^B \Delta_{\beta}$	Distribution effect: $\bar{P}^B \Delta_{\chi}$	Total Increase
	(1)	(2)	(3)	(1)+(2)+(3)
I Tarapacá	0.00	0.00	0.01	0.01
II Antofagasta	0.16	-0.03	0.10	0.23
III Atacama	0.13	-0.02	0.07	0.19
IV Coquimbo	0.25	-0.03	0.21	0.43
V Valparaíso	0.16	-0.02	0.09	0.23
VI Libertador General B. O'Higgins	0.19	0.01	0.14	0.34
VII Maule	0.17	0.01	0.13	0.31
VIII Biobío	0.21	-0.06	0.15	0.31
IX La Araucanía	0.18	-0.04	0.15	0.28
X Los Lagos	0.21	-0.06	0.20	0.36
XI Aisén del General Carlos I. del Campo	0.24	-0.03	0.16	0.37
XII Magallanes y A. Chilena	0.08	0.00	0.04	0.11
XIII Región M. de Santiago	0.05	0.01	0.02	0.07
National	0.14	0.00	0.09	0.24

Changes in circumstance endowments are particularly important for those regions that show the largest gains in the opportunity index, which are, in turn, those that lagged behind in the initial year. In seven out of thirteen regions the opportunity index of accessing sanitary infrastructure increased over 30 percentage points in the period under

analysis; in four of these seven regions the endowment effect explains at least half of the increase in the opportunity index.

Finally, Table 10 presents the decomposition of changes in the opportunity index of nutritional status. There is relatively little change in this index, so the decomposition is less informative than in the previous cases. Nonetheless, the scale effect predominates, explaining 2.3 out of 3.1 percentage point increase in this opportunity index.

Table 10: Decomposing the change in the opportunity index of good nutrition

Region/National	Decomposition: Increase HOI 1990-2006			
	Scale effect: $\Delta \bar{P}$ (1)	Distribution effect: $\bar{P}^B \Delta \beta$ (2)	Distribution effect: $\bar{P}^B \Delta \chi$ (3)	Total Increase (1)+(2)+(3)
I Tarapacá	0.022	0.004	0.004	0.031
II Antofagasta	-0.010	-0.007	0.012	-0.006
III Atacama	-0.011	-0.008	0.012	-0.007
IV Coquimbo	0.024	0.004	0.002	0.031
V Valparaíso	0.092	-0.015	0.029	0.106
VI Libertador General B. O'Higgins	0.018	0.004	0.002	0.024
VII Maule	0.056	0.000	0.008	0.064
VIII Biobío	0.006	-0.001	0.006	0.010
IX La Araucanía	0.012	0.004	0.003	0.019
X Los Lagos	-0.002	-0.004	0.008	0.001
XI Aisén del General Carlos I. del Campo	-0.061	-0.031	0.031	-0.061
XII Magallanes y A. Chilena	0.022	0.004	0.002	0.028
XIII Región M. de Santiago	0.017	0.003	0.003	0.024
National	0.023	0.006	0.002	0.031

VII. Concluding Remarks

The paper assesses the impact of circumstances on the following intermediate outcomes: access to preschool, timely completion of secondary education, access to sanitary infrastructure and good nutritional status. The circumstances include gender, schooling of the mother, schooling of the father, location of the household, per capita household income and family structure.

The results show a reduction in inequality of opportunity during the 1990-2006 period. The gains are in two classes. First, there have been substantial increases in coverage, leading to an across-the-board improvement in opportunities. Second, there has been a reduction in the access probabilities across population subgroups, thus making the playing field more balanced.

The evidence presented in the paper suggests that Chile has been successful in reducing the inequality of opportunity, in addition to large reductions in poverty and the more recent reduction in income inequality. However, the original starting point was one characterized by high inequality in opportunities and outcomes. The reduction in inequality represents good news, but Chile has still a long way to go before achieving an equitable distribution of welfare.

Also, the results in this paper must be interpreted simply as an example of the evolution of opportunities in the country, because they are based on the specific set of intermediate outcomes that have been evaluated. There are other important determinants of human capital that should be evaluated in the future to assess the evolution of opportunities, such as the case of health related variables and quality of schooling.

There is a significant gap in the index of opportunities across Chilean regions, which reflects differences in both the coverage rates and in the distribution of opportunities within regions. During the 1990-2006 period there has been some convergence, as regions that lagged most behind in 1990 are the ones that show the largest gains in the index of opportunities. But there are still large regional differences that add to the inequality of opportunity.

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STATISTICAL ANNEX

Table A-1: Dissimilarity Index for Completing Secondary Education on Time (D)

Region/National	Years			Reduction 1990-2006
	1990	2000	2006	
I Tarapacá	0.10	0.09	0.07	0.03
II Antofagasta	0.13	0.15	0.10	0.03
III Atacama	0.17	0.20	0.07	0.10
IV Coquimbo	0.20	0.12	0.08	0.13
V Valparaíso	0.17	0.14	0.09	0.08
VI Libertador General B. O'Higgins	0.23	0.13	0.07	0.16
VII Maule	0.28	0.15	0.10	0.18
VIII Biobío	0.17	0.17	0.08	0.08
IX La Araucanía	0.25	0.19	0.11	0.15
X Los Lagos	0.27	0.14	0.09	0.18
XI Aisén del General Carlos I. del Campo	0.23	0.14	0.15	0.09
XII Magallanes y A. Chilena	0.14	0.09	0.03	0.10
XIII Región M. de Santiago	0.13	0.12	0.09	0.04
National	0.18	0.15	0.09	0.09

Table A-2: Coverage of Completing Secondary Education on Time (p)

Region/National	Years			Increase 1990-2006
	1990	2000	2006	
I Tarapacá	0.60	0.66	0.68	0.08
II Antofagasta	0.50	0.46	0.57	0.07
III Atacama	0.39	0.40	0.69	0.31
IV Coquimbo	0.45	0.61	0.65	0.19
V Valparaíso	0.45	0.51	0.62	0.17
VI Libertador General B. O'Higgins	0.39	0.58	0.62	0.23
VII Maule	0.29	0.55	0.59	0.30
VIII Biobío	0.47	0.48	0.67	0.20
IX La Araucanía	0.38	0.51	0.59	0.21
X Los Lagos	0.26	0.49	0.57	0.30
XI Aisén del General Carlos I. del Campo	0.22	0.40	0.47	0.25
XII Magallanes y A. Chilena	0.54	0.72	0.75	0.21
XIII Región M. de Santiago	0.54	0.62	0.68	0.14
National	0.46	0.56	0.64	0.18

Table A-3: Dissimilarity Index of access to preschool

Region/National	Years			
	1990	2000	2006	Reduction 1990-2006
I Tarapacá	0.10	0.09	0.04	0.06
II Antofagasta	0.12	0.10	0.04	0.08
III Atacama	0.12	0.09	0.05	0.06
IV Coquimbo	0.18	0.13	0.06	0.12
V Valparaíso	0.13	0.10	0.06	0.07
VI Libertador General B. O'Higgins	0.21	0.15	0.09	0.12
VII Maule	0.24	0.15	0.09	0.15
VIII Biobío	0.16	0.15	0.07	0.09
IX La Araucanía	0.24	0.16	0.10	0.14
X Los Lagos	0.22	0.16	0.09	0.13
XI Aisén del General Carlos I. del Campo	0.17	0.11	0.05	0.12
XII Magallanes y A. Chilena	0.11	0.09	0.04	0.07
XIII Región M. de Santiago	0.11	0.12	0.05	0.06
National	0.17	0.13	0.07	0.10

Table A-4: Coverage of access to preschool

Region/National	Years			
	1990	2000	2006	Increase 1990-2006
I Tarapacá	0.26	0.31	0.45	0.19
II Antofagasta	0.14	0.31	0.35	0.21
III Atacama	0.19	0.32	0.37	0.18
IV Coquimbo	0.15	0.33	0.41	0.26
V Valparaíso	0.15	0.29	0.38	0.22
VI Libertador General B. O'Higgins	0.13	0.24	0.34	0.20
VII Maule	0.11	0.25	0.38	0.27
VIII Biobío	0.13	0.24	0.33	0.21
IX La Araucanía	0.10	0.23	0.33	0.23
X Los Lagos	0.10	0.18	0.32	0.22
XI Aisén del General Carlos I. del Campo	0.12	0.33	0.46	0.34
XII Magallanes y A. Chilena	0.19	0.29	0.46	0.28
XIII Región M. de Santiago	0.20	0.29	0.38	0.18
National	0.16	0.27	0.37	0.21

Table A-5: Dissimilarity Index of Access to Water and Sanitation

Region/National	Years			
	1990	2000	2006	Reduction 1990-2006
I Tarapacá	0.03	0.05	0.03	0.00
II Antofagasta	0.07	0.01	0.00	0.07
III Atacama	0.09	0.04	0.03	0.06
IV Coquimbo	0.27	0.15	0.07	0.20
V Valparaíso	0.12	0.07	0.04	0.08
VI Libertador General B. O'Higgins	0.27	0.19	0.10	0.18
VII Maule	0.32	0.23	0.14	0.18
VIII Biobío	0.23	0.17	0.11	0.12
IX La Araucanía	0.37	0.27	0.22	0.16
X Los Lagos	0.36	0.25	0.17	0.19
XI Aisén del General Carlos I. del Campo	0.18	0.13	0.04	0.14
XII Magallanes y A. Chilena	0.05	0.01	0.01	0.04
XIII Región M. de Santiago	0.04	0.03	0.02	0.02
National	0.18	0.11	0.07	0.11

Table A-6: Coverage of Access to Water and Sanitation

Region/National	Years			
	1990	2000	2006	Increase 1990-2006
I Tarapacá	0.94	0.89	0.94	0.00
II Antofagasta	0.81	0.99	0.99	0.18
III Atacama	0.80	0.93	0.94	0.14
IV Coquimbo	0.55	0.81	0.90	0.35
V Valparaíso	0.74	0.89	0.92	0.18
VI Libertador General B. O'Higgins	0.60	0.76	0.86	0.26
VII Maule	0.55	0.70	0.80	0.25
VIII Biobío	0.54	0.73	0.82	0.28
IX La Araucanía	0.41	0.63	0.69	0.28
X Los Lagos	0.41	0.64	0.75	0.33
XI Aisén del General Carlos I. del Campo	0.65	0.80	0.94	0.29
XII Magallanes y A. Chilena	0.90	0.97	0.98	0.08
XIII Región M. de Santiago	0.90	0.93	0.96	0.05
National	0.71	0.83	0.89	0.18

Table A-7: Dissimilarity Index of Good Nutritional Status

Region/National	Years			
	1990	2000	2006	Reduction 1990-2006
I Tarapacá	0.02	0.02	0.01	0.01
II Antofagasta	0.02	0.02	0.01	0.01
III Atacama	0.01	0.02	0.01	0.01
IV Coquimbo	0.02	0.02	0.01	0.01
V Valparaíso	0.03	0.01	0.01	0.02
VI Libertador General B. O'Higgins	0.02	0.02	0.01	0.01
VII Maule	0.02	0.02	0.01	0.01
VIII Biobío	0.02	0.02	0.01	0.01
IX La Araucanía	0.02	0.02	0.01	0.01
X Los Lagos	0.01	0.02	0.01	0.00
XI Aisén del General Carlos I. del Campo	0.02	0.03	0.02	0.00
XII Magallanes y A. Chilena	0.02	0.02	0.01	0.01
XIII Región M. de Santiago	0.02	0.02	0.01	0.01
National	0.02	0.02	0.01	0.01

Table A-8: Coverage of Good Nutritional Status

Region/National	Years			
	1990	2000	2006	Increase 1990-2006
I Tarapacá	0.87	0.83	0.90	0.03
II Antofagasta	0.88	0.87	0.87	-0.01
III Atacama	0.87	0.86	0.88	0.01
IV Coquimbo	0.83	0.85	0.87	0.04
V Valparaíso	0.79	0.89	0.89	0.10
VI Libertador General B. O'Higgins	0.84	0.85	0.88	0.04
VII Maule	0.81	0.83	0.89	0.07
VIII Biobío	0.85	0.84	0.87	0.02
IX La Araucanía	0.84	0.85	0.86	0.02
X Los Lagos	0.87	0.87	0.89	0.02
XI Aisén del General Carlos I. del Campo	0.86	0.80	0.82	-0.04
XII Magallanes y A. Chilena	0.87	0.85	0.92	0.06
XIII Región M. de Santiago	0.85	0.86	0.88	0.02
National	0.84	0.86	0.88	0.03