Defining Circumstances: Francs or Ranks, Does it Matter?

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Abstract

We analyze equality of opportunity for earnings acquisition in France between 1973 and 1993. Individual circumstances are defined by parental earnings, which can be measured by either father's earnings level or father's rank in the earnings distribution. First, using stochastic dominance tools, we find that inequality of opportunity has remained stable when conditioning on the earnings level of the father, while it has diminished when conditioning on his rank in the earnings distribution. Then, we decompose the evolution of inequality of opportunity using the mean logarithmic deviation and the results of regressions of descendants'earnings on their parents earnings. The former result is explained by the stable intergenerational earnings elasticity. The latter by the decreasing wage inequality in the previous generation.

JEL Codes: D1, D3, J3

Key words : Inequality of opportunity, stochastic dominance, circumstances, decomposition, mean logarithmic deviation.

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1 Introduction

Empirical analysis of inequality have recently been challenged by several philosophers, among which Dworkin (1981), Arneson (1989), Cohen (1989), Barry (1991) or Roemer (1998) for not taking into account the role of personal responsibility in shaping individual outcomes. According to these authors, individual income acquisition implies many determinants: on the one hand, preferences and individual effort contribute to creating income inequalities between individuals; on the other hand, different factors such as social background, individual endowments or luck explain at least partly income inequalities. According to the philosophy of responsibility, these factors must be distinguished, insofar as the former (generically called *effort* by Roemer) come from the exercise of individual responsibility, while the latter called *circumstances* do not. Income inequalities coming from the first set of factors are legitimated since they come from individual freedom of choice (in a broad sense). On the contrary, outcome inequalities due to differences of circumstances cannot ethically be accepted. [1].

This distinction provides ethical foundations to a public policy aimed at compensating inequalities coming from circumstances and providing equality of opportunity for income acquisition. In an intergenerational perspective, the debate mainly focuses on the influence of parental background on children outcomes. Parental background may be described both by discrete variables such as socio-economic status or level of education of the parents or by merely continuous variables such as parental income. The first ones have the advantage to be measured with little errors and to be more or less constant over the childhood. On the other hand, they typically lead to a coarse partitioning of individuals and ignores a significant amount of heterogeneity of parental background. The shortcomings of parental income are at the opposite. We generally observe parental income over a short period while it may have varied a lot during childhood or teenage years. Moreover parental income is plagued with measurement errors. In some sense, the first tools may be not enough precise to accurately describe the circumstances while parental income is somewhat too precise.

Despite its weakness, one of the appeal of parental income as a measure of circumstances

[1] For a comprehensive summary of the literature on the theory of compensation and responsibility, see Fleurbaey (2006)

is that it captures several channels of family influence. It is an indicator of the parental economic success positively correlated to their genetic abilities and so to their offspring's. At the same time, parental income can be correlated to transmission of values, gifts, and social privileges such as acquisition of believing and abilities, constitution of preferences and aspirations, and sharing of social relations. Finally, parental income is related to the amount of bequests. Thus, parental income represents an omnibus measure of parental abilities influencing the economic outcomes of their children.

The aim of this article is to determine the impact of social background measured by parental earnings on children's earnings in France and to analyze how this impact evolved. Any income difference associated to parents' income will be interpreted as sign of inequality of opportunity. This assimilation is by no means obvious. Neutralizing any children earnings differences correlated with parental income is linked to the idea that the necessity of compensation should overcome the respect of responsibility. In particular it implies correcting for the effect of a correlation between social background and effort. It means that determinants of success correlated with parental earnings are circumstances whose impact must be neutralized. Roemer and Dardanoni (2005) seem to advocate against this option arguing that few people would accept such extreme view of equality of opportunity. In our opinion, this extreme vision of equality of opportunity has a simple instrumental value and can be defended on theoretical grounds (See Lefranc, Pistolesi and Trannoy (2009)).

To characterize inequality of opportunity, we compare income distributions conditional on individual circumstances, using a non-parametric approach. To perform this comparison, we partition the population in discrete classes defined by brackets of parental earnings. This partitioning may be viewed as a response to the above remark according to which income is maybe a too more precise to define social background.

Admittedly, defining the groups entails some arbitrary, since it comes to partitioning a continuous measure of the circumstance. Keeping in mind that our aim is to quantify the change in inequality of opportunity over time, the choice of a stable partition over time is recommended. To that end, two partitions are possible: the first one is a purely ordinal partitioning, the second is a cardinal one. According to the former, two individuals will be

in the same group if their parent's earnings are in the same quintile. Implicitly, circumstances are supposed to be identical if the father's earnings rank is identical, regardless of the date. This partition presents the advantage that groups keep a constant relative size from one period to another. However, if the dispersion of the parental earnings distribution changes over time, the advantage in terms of earnings level associated to any given quintile will also change. Belonging to the first decile represents a relatively weaker disadvantage when parental earnings is low. That is why we also use a second partition. It assumes that two individuals have the same circumstances if their parental earnings relative to the mean belong to a fixed interval. By construction, this measure of circumstances is invariant to any change in the dispersion in the father's generation. On the other hand, the relative size of the groups can vary over time. If inequality falls over time, the size of the groups near the median or the mean will increase at the expense of the groups at the top or the bottom of the social scale. These two partitions capture two different dimensions of earnings. In the first one, the rank of the father in the transmission process matters. It captures status phenomena. On the other hand, the second one emphasizes the role of the monetary affluence. Using both partitions we assess inequality of opportunity with the same methodology based on stochastic dominance tests applied to the conditional earnings distribution of the descendants as in our previous papers (Lefranc, Pistolesi and Trannoy (2008; 2009)).

We obtain very different results depending on the partition we use. With the franc partition, the inequality of opportunity seems to be stable while it decreases with the rank partition. The contribution of the paper is to offer an innovative way of combining a discrete and a continuous approach to explain this divergence. The continuous statistical approach builds upon an estimate of the intergenerational earnings elasticity, which measures the percentage increase in descendant earnings when parental earnings increases by one percent. At this point, we borrow a methodology introduced in Lefranc, Pistolesi and Trannoy (2010) where we mix the use of the estimate of the intergenerational earnings elasticity and the mean logarithmic deviation (MLD) as a cardinal measure of inequality of incomes both in parents and descendants generations to generate an new index of inequality of opportunity. This index is defined as the product of the intergenerational

earnings elasticity and the inequality of parents' income. One of the advantages of this choice is to easily decompose the evolution of inequality of opportunity into two factors: the change in the income inequality in the parents' generation and the change in the inter-generational earnings elasticity. This decomposition sheds light on the fact that, contrary to the philosophical premises, inequality of outcomes and inequality of opportunities are not independent concepts and are closely related. In general, a reduction of inequality of outcomes leads to a reduction of inequality of opportunities at the next generation. This allow us to decompose the EOP inequality with the ordinal partition into two components: inequality of opportunity between income classes and inequality of opportunity within income classes. This decomposition helps us provide an explanation of the difference of results between the cardinal and ordinal partition.

One should emphasize that the two approaches, the discrete and the continuous ones, are quite complementary since they capture different aspects of inequality of opportunity. By relying on a discrete analysis, we underestimate the inequality of circumstances because we ignore the within-group inequality of circumstances, whereas a regression analysis shows that a tiny income difference has a statistically significant impact on descendant income. On the opposite, performing a discrete partitioning allows to extend the analysis beyond the study of the only conditional expectation. That is why discrete and continuous approaches of equality of opportunity are implemented simultaneously in this paper. The two approaches may lead to different conclusions. In Lefranc, Pistolesi, Trannoy (2009) we concluded to a decreasing inequality of opportunity when comparing descendants income distributions by occupational group of the father. While in Lefranc and Trannoy (2005) we concluded to a constant inequality of opportunity from a regression analysis. One of the goals of this paper is to know whether differences of results are due to differences of approaches or differences in the conditioning variables defining individual circumstances.

The rest of the paper is organized as follows. Section 2 presents the data. In section 3 we implement the discrete approach. Section 4 uses a regression and decomposition analysis to measure inequality of opportunity in the continuous setting and show why the results diverge in the discrete approach according to the partition. Section 5 concludes and offers some avenue for further research.

2 Data

To measure inequality of opportunity conditional on social background, individual incomes over two generations are necessary. Such data are not available for France. This limit is overcome by using data providing information on individual income and some parental demographic characteristics correlated with their income such as education or occupational group. Parental income can be predicted from these characteristics. Firstly, we use an auxiliary sample representative of the population of the parents with these observable characteristics and their income. Then we estimate an income equation regressing income on demographic characteristics. For each individual we predict his parental income from his parental characteristics. We concentrate only on the income of the father.

2.1 Data base: survey Formation-Qualification-Profession (FQP)

Data come from the French survey FQP carried out by the French statistical office INSEE. We use waves 1964, 1977, and 1993. The first two waves represent a stratified sample of the French population of working age, and sampling rates vary from one stratum to another. Results presented here are weighted by sampling frequency[2].

Respondents provide information on their schooling career, qualification, job, sector of activity and on annual wage in the previous year[3]. For 1977 and 1993 respondents provide the number of worked months, and whether it is part or full time. On the other hand, activity income is known only for wage earners. Data include family composition (marital status and number of children). Waves 1977 and 1993, provide detail information on social background with the father schooling, his occupation (2-digits), if he was civil servant, and the living region of his parents[4].

In any wave, education level is included with a ten-level scale distinguishing general and technical institutions. Across the three waves of data several nomenclatures have been used, and we have computed a uniform nomenclature[5].

[2]Weighting is necessary in our case since we estimate the wage distribution.

[3]In 1964, the exact wage is not known. Nine bracket answers are provided. Estimations for that year use interval regressions.

[4]These pieces of information are declared by the interviewed and refer to the date when she finished studying.

[5]Occupation has been recoded using Erikson and Goldthorpe (1992) social scale. Education level has

2.2 Samples selection

Our analysis uses two sample sets: main samples (or adult-children samples) from which we measure inequality of opportunity, and auxiliary samples to predict parental income of individuals in the main samples. Adult-children samples come from 1977 and 1993 FQP data waves. In each wave we restrict to 30 to 40 years old individuals at the time of the survey and declaring being head of the household or spouse of the head. We exclude individuals of birth rank superior to three, in order to limit the age interval of the fathers of the individuals in our samples (see below). Insofar as we observe only wage-earners, we exclude self-employed and children of self-employed. Lastly, individuals with wages below half the minimum wage are excluded from our sample.

Auxiliary samples come from wave 1964 and 1977. Wave 1964 (respectively 1977) is used to predict parental income of the wave 1977 (resp. 1993). We restrict to males, head of households, wage-earners and fathers of at least one child at the time of the survey. Moreover we keep only individuals aged 25-30 at the birth of individuals in the main samples[6].

2.3 Main variables

We focus on two income variables: the outcome variable, measured by individual equivalent full-time earnings, and the circumstance variable defined by his father predicted earnings. Equivalent full-time earnings is defined from annual declared earnings taking into account the number of months worked full time and part time. It represents more a measure of individual labor market ability than his effective earnings. In addition, age effects are removed from adult-children earnings. In the following analysis earnings are normalized by the mean.

Father's earnings is predicted from four observable characteristics. These characteristics are declared in the main samples: level of education, social group, private or public

been recoded using a eight-level scale.

[6]Mean age of the fathers at birth of the first child in our samples is near 27. As individuals in main samples are aged 30 to 40 at the survey date, we thus restrict to individuals aged [30+25-v+v', 40+30-v+v']. with v the survey wave used to predict income in wave v'.

company status, and place of living[7] of the father. [8] Using father predicted rather than real earnings has some advantages. First, real earnings includes transitory elements poorly linked to permanent earnings which represents individual social background. On the contrary, earnings differences linked to education differences of social group are more lasting and are a better representation of individual circumstances.

After, estimating the father earnings, we test equality of opportunity in France and its evolution between 1977 and 1993 from two complementary approaches. We implement the first in the next section, the second in section 4.

3 Discrete Approach: equality of opportunity and stochastic dominance

In social choice theory, it is common to distinguish equity criteria from social orders. The former give conditions defining equitable solutions, while the latter provide criteria in order to rank social states. We use here an equity criterion based on dominance concepts that has been motivated in length in Lefranc, Pistolesi and Trannoy (2009). In order to implement these criteria of equality of opportunity, it is necessary to build types representing the set of individuals benefiting of the same circumstances. Next section explains how we proceed. Then we present results obtained with the equity criterion applied to FQP data.

3.1 Partitioning in different circumstances

To implement our definition of equality of opportunity it is necessary to group individuals by income of the father. A first solution comes to gathering individuals by income quintile of the father. For each wave of data we get a relative ordinal partitioning of the circumstance "income of the father". It comes to considering that the relative advantage or disadvantage that individual experience depends uniquely of their father rank in the income distribution. At the opposite, circumstances can depend from the family income level. If such is the case, a changing income inequality among fathers may limit the longi-

[7] One dummy variable for Île de France, ie: Paris region, and one dummy variable for living in the country.

[8] See Lefranc, Pistolesi Trannoy (2010) for the estimations results predicting the father earnings.

Table 1: Social Background groups definition

Group of social background	centiles	ordinal definition 1977 x_{inf}	x_{moy}	x_{sup}	1993 x_{inf}	x_{moy}	x_{sup}
C1	[1,15]	.377	.499	.555	.538	.635	.687
C2	[16,35]	.556	.652	.699	.701	.734	.777
C3	[36,55]	.704	.775	.839	.781	.833	.867
C4	[56,70]	.843	.949	1.033	.869	.958	1.028
C5	[71,85]	1.034	1.223	1.443	1.031	1.153	1.367
C6	[86,100]	1.450	2.163	3.167	1.388	1.903	2.569
		cardinal definition					
		1977			1993		
	centiles	x_{inf}	x_{moy}	x_{sup}	x_{inf}	x_{moy}	x_{sup}
C1	[8, 22]	.559	.652	.699	.538	.635	.687
C2	[24,35]	.709	.751	.786	.701	.734	.777
C3	[38,43]	.803	.822	.857	.781	.833	.867
C4	[46,65]	.860	.952	1.028	.869	.958	1.028
C5	[67,84]	1.037	1.145	1.334	1.031	1.153	1.367
C6	[87,97]	1.369	1.840	2.531	1.388	1.903	2.569

Note : x_{inf}, x_{sup} et x_{moy} represent respectively, limits and mean values of the social groups expressed relative to the mean father predicted earnings.

tudinal comparison of equality of opportunity. Implementing a cardinal partitioning would take more closely into account the income level of the parents.

In the rest of the article, we use the two approaches. The values of the centiles defining the ordinal partitioning are given in table 1. In the definition of these groups, we try obtaining groups of sufficient size to implement the nonparametric tests of stochastic dominance. Between 1977 and 1993, we observe a decrease in the spread of the father predicted earnings: the interval of observed values, expressed relative to the mean goes from [.377,3.1673] to [.538,2.569].

The second partitioning is defined from the value of the father earnings relatively to the father mean earnings: a social group of origin is composed of individuals whose father perceived a predicted earnings belonging between x times and y times the mean earnings in that year. We maintain as long as possible [9] unchanged boundaries x and y whatever the data wave. To define our second partitioning of social background, we use as boundaries

[9] A perfect match between the two dates may sometimes not be possible. It is due to the discrete nature of the distributions. The slight bracket differences in table 1 exhibit this property for the cardinal definition.

Table 2: Descriptive statistics by group of social origin

	1977						1993					
	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
Male (%)	63.9	66.4	62.8	65.1	67.4	55.6	60.3	53.0	55.6	55.0	60.5	50.8
Age	34.2	34.2	34.3	34.2	33.9	34.5	35.1	34.5	35.0	34.5	34.8	34.7
Occupation of the father (%)												
H-grade Prof.	0.0	0.0	0.0	0.0	1.7	80.9	0.0	0.0	0.0	0.0	0.0	74.6
L-grade Prof.	0.0	0.0	0.0	26.6	85.0	19.1	0.0	0.0	0.0	39.9	84.2	23.7
Clerks	3.4	28.9	39.2	36.1	3.5	0.0	2.7	16.3	29.0	33.7	12.2	0.0
Workers	96.6	71.1	60.8	37.2	9.8	0.0	97.3	83.7	71.0	26.3	3.6	0.0
Obs.	547	268	211	269	333	499	199	275	273	138	152	183

the values of earnings (expressed in proportion to the mean) that serve to define the relative ordinal partitioning in 1993. For this wave the two partitions match perfectly by construction. In 1977, individuals with earnings lower that the minimum threshold[10] in 1993 are discarded as are those with a father earnings superior to the maximum of 1993. Lastly, 442 observations have been deleted in 1997, representing 11% of the initial sample, 8% in the lower part of the distribution and 3% in the top. Table 1 summarizes differences between groups with the two approaches.

Table 2 provides descriptive statistics on the sample for each group of social origin. Most analysis of equality of opportunity divide the population from social group or education level of the parents. It exhibits a comparison with the one generally used in the literature[11]. Groups of origin defined by the father income are very close to those build from the single information of the father social group, and in particular, the groups in Lefranc, Pistolesi and Trannoy (2009). Individuals in the first two groups are barely all children of workers. Those of groups (C3) and (C4) are one third children of lower-grade professionals or clerks. Lastly, groups (C5) (respectively (C6)) are mainly children of lower-grade professionals (respectively higher-grade professionals). Besides, during the period the groups compositions change only very slightly. It excludes any explanation for the observed evolutions from a change of composition in the social groups of origin.

[10] relative to the mean.

[11] The table is established for the cardinal partitioning. Ordinal partitioning changes only slightly the results.

Next section applies our definition of equality of opportunity to the ordinal conditioning. Section 3.3 turns to cardinal partition.

3.2 Ordinal approach : less inequality of opportunity?

Table 3: Stochastic dominance tests - Ordinal Approach

	1977						**1993**					
	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
C1	-	=	$<_1$	$<_1$	$<_1$	$<_1$	-	=	?	$<_1$	$<_1$	$<_1$
C2	-	-	$<_1$	$<_1$	$<_1$	$<_1$	-	-	=	$<_1$	$<_1$	$<_1$
C3	-	-	-	$<_1$	$<_1$	$<_1$	-	-	-	$<_1$	$<_1$	$<_1$
C4	-	-	-	-	?	$<_1$	-	-	-	-	=	$<_1$
C5	-	-	-	-	-	$<_1$	-	-	-	-	-	?

Equivalent full-time earnings. =: the row and the column are equal at 5%. $>_1$: the row dominates the column at 5% at the first order.

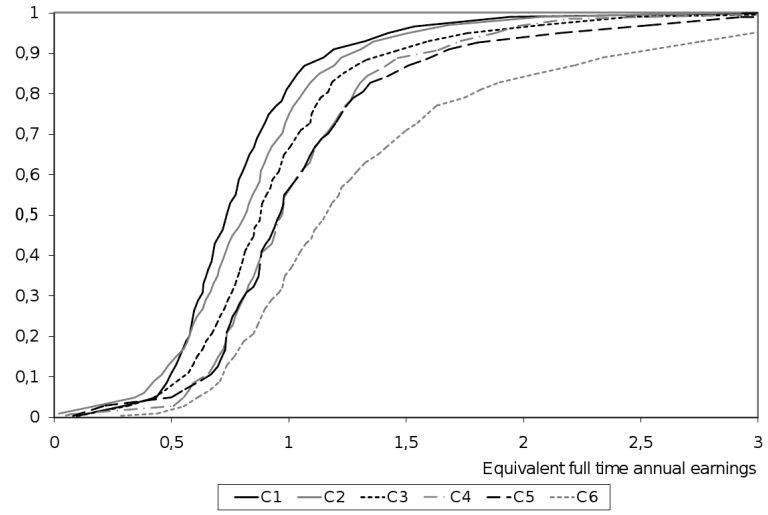
Graphics A and B in figure 1 represent adult-children distributions conditional on social background with the ordinal partition of the father income values. In 1977, the groups ranking corresponds to the earnings hierarchy. Indeed, distributions are clearly ranked from (C1) to (C6). It is nearly always preferable to come from a more privileged background. Only two comparisons cannot rank the distributions. The more disadvantaged distribution (C1) cuts clearly the distribution of the second group. Moreover, the distribution of group (C4) is very close to the group (C5) except in the tail of the distributions in which the very high and very low earnings are different. Results of the tests (table 3) confirm these observations. A strong order between the groups is observable except for groups (C1) and (C2) which are statistically equal at 5% and for the groups (C4) and (C5) which are non comparable. In 1977, the more privileged descendants distinguish clearly from the rest of the population.

In 1993, figure 1 provides a more ambiguous ranking. On the one hand, social backgrounds (C1), (C2) an (C3) are much closer. On the other hand, the distance between social backgrounds (C4), (C5) and (C6) seems weaker. Statistical tests in table 3 confirm these remarks since the first three backgrounds are either non-comparable or equal. Moreover, the tests conclude to equality in the comparison (C4) and (C5) and to non-dominance

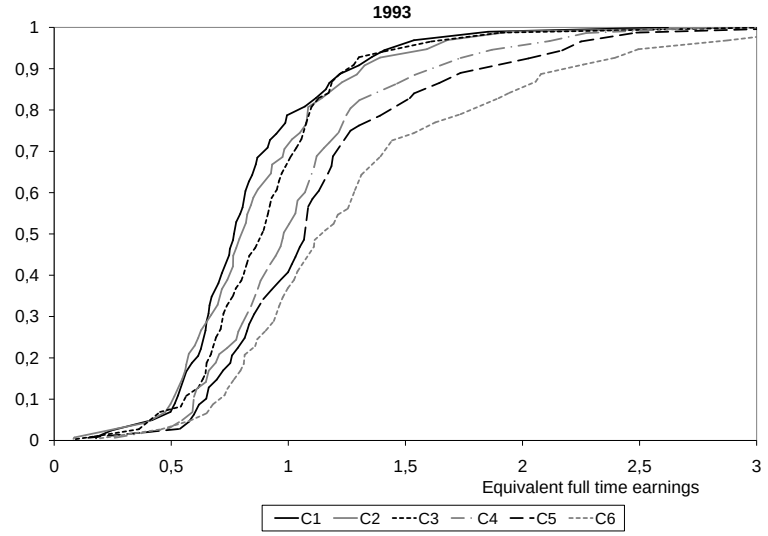
between (C5) and (C6). The narrowing reflect the results already obtained on the data *Budget des Familles* over the same period with a different conditioning with the father occupational group in Lefranc, Pistolesi and Trannoy (2009). Lastly, if the tests conclude most of the time to inequality of opportunity over the two waves (86% of the cases in 1977 and 66% of the cases in 1993), this figure is decreasing over the period. In 20% of the cases we have strong equality of opportunity and in 13% of the cases (2 comparisons out of 15) a non-comparability of the conditional distributions.

The preceding analysis supposes that a same ranking in the earnings distribution of the father leads to the same inequality of opportunity in 1977 and 1993. However, this hypothesis is questionable. Indeed, the fathers' earnings distribution evolution over the period bears consequences on the inequality of opportunity appraisal. The decreasing earnings inequality over the eighties means that a unchanged ranking in the distribution translates in a less important earnings gap to the mean. Precisely, next sub-section focuses on the gaps to the mean through the cardinal partition.

A- 1977 - ordinal partition



B- 1993



C- 1977 - cardinal partition

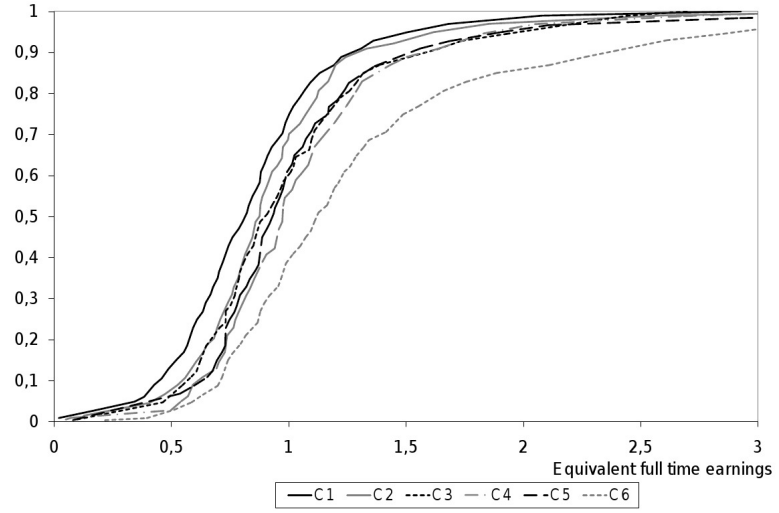


Figure 1: Conditional income distributions - relative measure of inequality of opportunity

Table 4: Stochastic dominance tests - Cardinal approach

	1977						**1993**					
	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
C1	-	=	$<_1$	$<_1$	$<_1$	$<_1$	-	=	?	$<_1$	$<_1$	$<_1$
C2	-	-	=	$<_1$	=	$<_1$	-	-	=	$<_1$	$<_1$	$<_1$
C3	-	-	-	=	=	$<_1$	-	-	-	$<_1$	$<_1$	$<_1$
C4	-	-	-	-	=	$<_1$	-	-	-	-	=	$<_1$
C5	-	-	-	-	-	$<_1$	-	-	-	-	-	?

Equivalent full-time earnings. =: Row and column distributions are equal at 5%. $>_1$: Distribution in row dominates column distribution at 5% at the first order.

3.3 Cardinal approach : A constant inequality over the period

Graphics B and C on figure 1 represent income distribution of adult-children, conditional on social background defined by the cardinal partitioning of the father earnings. Results of the dominance tests are displayed in table 4. For 1977, a narrowing of the distributions can be observed compared to the ordinal approach. While in the ordinal approach the hierarchy of groups is quite clear, with the cardinal approach the distributions of social background are very close except for (C1) and (C6) displaying a gap with the rest of the sample. The visual differences are confirmed by the tests, since one can conclude six times out of fifteen to equality with the cardinal approach instead of once with the cardinal approach in 1977.

By definition, in 1993, cardinal and ordinal approaches match perfectly and results have already been discussed. We conclude to strong inequality except in the first three groups on the one hand, and the last two groups on the other. With the cardinal approach the number of times we conclude to equality of opportunity goes from 40% to 20% in these comparisons between 1977 and 1993. That is why, instead of concluding to a narrowing of the distributions, this time we conclude to a certain stability or increase in inequality of opportunity. Finally, cardinal and ordinal approaches send a contradictory message. Section 4 explains this contradiction.

Table 5: Lorenz dominance tests

	1977						1993					
	C1	C2	C3	C4	C5	C6	C1	C2	C3	C4	C5	C6
C1	-	=	=	=	?	?	-	=	=	=	=	?
C2	-	-	=	<	?	?	-	-	?	=	=	?
C3	-	-	-	=	=	?	-	-	-	=	?	?
C4	-	-	-	-	=	=	-	-	-	-	=	=
C5	-	-	-	-	-	=	-	-	-	-	-	=
C6	-	-	-	-	-	-	-	-	-	-	-	-

Equivalent full-time earnings =: Lorenz curves in row and in columns are identical at 5%. >: Lorenz curve in row dominates Lorenz curve in column at 5%.

3.4 Risk and return of the distributions

Risk is measured by centering distributions around their mean, which is also the Lorenz curve. Mean inequalities between groups are erased. Lorenz dominance tests follow a identical methodology as stochastic dominance tests. Table 5 presents results for the ordinal approach [12]. On the two waves, only one comparison produces a relation of dominance. The rest of the tests conclude to equality in two cases out of three. Differences of risk are weak. It confirms results in Lefranc, Pistolesi and Trannoy (2009) with other French data.

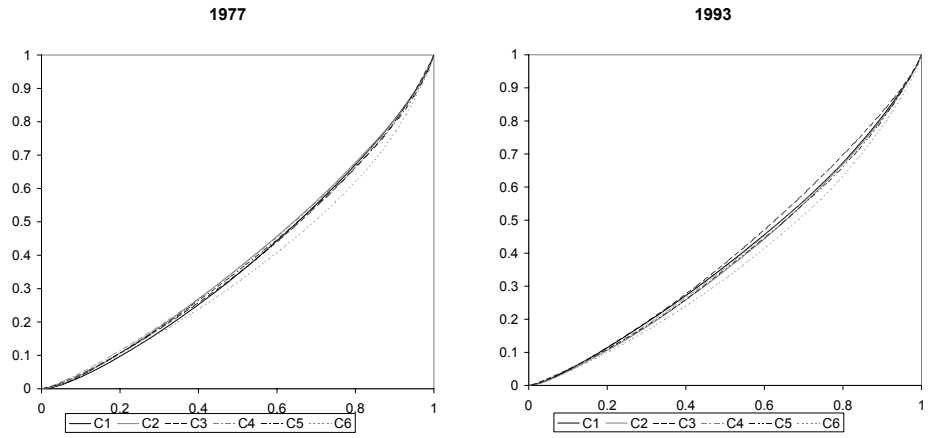


Figure 2: Conditional distribution Lorenz curves

As risks differ only slightly, it is possible to study the evolution of conditional means.

[12] We obtained similar results for cardinal approach.

Table 6: conditional mean earnings evolution

	Ordinal Approach		Cardinal approach	
(C6)/(C1)	4.33	3.00	2.82	3.00
(C6)/(C2)	3.32	2.59	2.45	2.59
(C6)/(C3)	2.79	2.28	2.24	2.28
(C6)/(C4)	2.28	1.99	1.93	1.99
(C6)/(C5)	1.77	1.65	1.61	1.65

In 1977, the mean earning of adult-children from (C6) is four times superior to the mean earnings in group (C1).

Table 6 shows that the mean earnings gap between groups has diminished over the period. With the ordinal approach, mean earnings of more privileged individuals is more than four times superior to mean earnings in 1977. The gap is only three times in 1993, expressing a decreasing from one third. This decrease confirms the results for disposable income with the data *Budget de Famille*. It is somewhat larger than what was observed between adult-children of workers and higher-grade professionals before taxes and transfers (cf Lefranc, Pistolesi and Trannoy (2009)). The decrease in mean gap is decreasing along the income distribution. On the other hand, the cardinal approach provides a different conclusion since the bracket limits are identical: mean income ratios do not change over the period. The opposition of results between the cardinal and ordinal approaches suggests an important research area: Analyzing the role of the degree of inequality of circumstances (which is equal to the outcome inequality in the previous generation) and of the process of transmission of inequality of opportunity and its evolution. Next section develops this analysis.

4 Continuous approach: explaining the differences between the ordinal and cardinal partition

We develop here an alternative approach to inequality of opportunity. We use a continuous representation of the inequality transmission process. The goal is to measure inequality of opportunity using an index, and decompose its evolution through regression methods. We rely on a method of Lefranc, Pistolesi and Trannoy (2010) that develops an index of

inequality of opportunity based on the mean logarithmic deviation. We refer the reader to this paper for a full description of the methodology.

One of the advantage of the mean logarithmic deviation is to allow within and between groups inequality decompositions. Here the groups are defined by parental earnings level or quintiles as in the ordinal partition adopted in the first part. However, the partition can lead to a loss of information. Our first aim is to assess this loss.

More specifically, descendants belong to one of the groups j from 1 to 6. Let y_{it}^c and y_{it}^f be the earnings of individual i and her father at the time $t, \overline{y_t^c}, \overline{y_t^f}$, their respective arithmetic means. We know that with logarithmic mean deviation income inequality among descendants can be obtained as a weighted sum by demographic weights of the groups of within and between groups inequalities.

$$I_t^c = \sum_{j=1}^{6} \frac{n_j}{n} I_{jt}^c + \sum_{j=1}^{6} \frac{n_j}{n} \log \frac{\overline{y_t^c}}{\overline{y_{jt}^c}} = I_{Wt}^c + I_{Bt}^c \tag{1}$$

where

$$I_{jt}^c = \frac{1}{n_j} \sum_{i=1}^{n} \log \frac{\overline{y_{jt}^c}}{y_{ijt}^c} = -\frac{1}{n_j} \sum_{i=1}^{n} \widetilde{y}_{it}^c$$

In the first part of this paper, we concentrated on between-group inequality I_{Bt}^c identifying it to inequality of opportunity, except that we focused on the full earnings distribution and not just on the conditional mean. We identified within-group inequality I_{jt}^c as the degree of earnings due to risk within group j. It is at best a rough estimate, since in reality there are some differences of circumstance within each group producing disparities within the group. The neglected within group inequality is equal to I_{Wt}^c. To summarize, the evolution of between group inequality among descendants (I_{Bt}^c) must be in agreement with what we found in the first part with the ordinal approach.

On the other hand, the additive decomposition formula can be applied to inequality among fathers.

$$I_t^f = \sum_{j=1}^{6} \frac{n_j}{n} I_{jt}^f + \sum_{j=1}^{6} \frac{n_j}{n} \log \frac{\overline{y_t^f}}{\overline{y_{jt}^f}} = I_{Wt}^f + I_{Bt}^f \tag{2}$$

Table 7: Inequality of outcome and inequality of opportunity within and between groups

t	I_t^f	I_{Bt}^f	I_{Wt}^f	I_t^c	I_{Bt}^c	I_{Wt}^c
1977	0.1233	0.1158	0.0075	0.1006	0.0162	0.0844
(%)		93.91	6.08		16.10	83.89
1993	0.0717	0.0678	0.0038	0.0860	0.0127	0.0733
(%)		94.56	5.60		14.76	85.23

Mean Logarithmic deviation computed on log earnings in 1977 and in 1993 and decomposition in within and between groups terms defined by parental earnings. I_t^f represents MLD in the father's generation and I_t^c MLD the adult-children generation.

Table 7 presents a decomposition of inequality along this line for both the descendant and the ascendant generation. It makes it possible to quantify the size of this *neglect* of the within term in the discrete approach. Ignoring within-group inequality in the father generation leads to rather minor differences. Composing a discrete partition of the social origins enables to grasp the bulk of inequality of circumstances: inequality between-group (it would be observed if circumstances within each group were identical) represents nearly 95% of inequality of circumstances. This part tends to increase over the period. The fall of inequality over time has translated into a sharper decrease in within-group than in between-group inequality of circumstances (a decrease of 42% against 31%). On the whole, the inequality among the father generation has decreased sharply. On the contrary, inequality of outcomes measured by I_t^c cannot be summarized only by the between-group term: The major part of inequality of outcomes comes from the within-group term.

The difference in the role of the between groups inequality component according to inequality of opportunity and inequality of outcome is by no means surprising. The partition by origin groups is defined from a continuous variable of circumstance. The partition does capture a large share of inequality of opportunity. On the opposite, the same conclusion does not hold for inequality of outcomes. It is only partly linked to circumstances, it also depends on the effort or luck components. But the main information coming from the inspection of this table is that there is a decrease in the between group term I_{Bt}^c which is in agreement with what we found in the first part with the *Ranks partition*.

Continuous and ordinal approaches do not contradict each other and confirm that adopting an ordinal partition leads to the conclusion of a decrease of inequality of oppor-

tunity.

Now, we go a step further by using the index developed in Lefranc, Pistolesi and Trannoy (2010) to understand why this decrease has taken place. They show that a very simple linear relationship relates inequality of outcome I_t^c and inequality of circumstances I_t^f when using the MLD as as measure of inequality. If β_t denotes the intergenerational earnings elasticity and α_t the intercept of the regression, then the relation

Hence

$$I_t^c = -\alpha_t + \beta_t I_t^f \tag{3}$$

follows. Income inequality among descendants measured by the mean logarithmic deviation can be written as a linear affine function of inequalities of circumstances measured by the mean logarithmic deviation among the fathers. The constant $-\alpha_t$ can be interpreted as residual inequality if there were no inequality of circumstances, namely, any parents came from the same group.

The linear regression model, joint with the mean logarithmic deviation to measure inequality, leads to a quite simple expression of inequality of opportunity, that is:

$$I_{oppt} = \beta_t I_t^f \tag{4}$$

It is the part of inequality that would remain if the only disparity factor among descendants were their father earnings. It is the product of the intergenerational earnings elasticity and inequality of circumstances. The share of inequality of opportunity in inequality of outcomes is given by $\frac{\beta_t I_t^f}{I_t^c}$.

Thanks to (3) it is possible to write that inequality among descendants is the sum of three terms: the residual term , the within-group and between-group inequality of opportunity.

$$I_t^c = -\alpha_t + \beta_t I_{Wt}^f + \beta_t I_{Bt}^f = -\alpha_t + I_{oppWt} + I_{oppBt} \tag{5}$$

There is no obvious relation between the two equations (1) and (5). If mean earnings by groups of the fathers are equalized, the third term of the RHS of (5) cancels. It does

Table 8: Inequality of outcome and inequality of opportunity within and between groups

t	I_t^c	$-\alpha_t$	I_{oppBt}	I_{oppWt}
1997	0.1006	0.0576	0.0403	0.0026
(%)		57.25	40.14	2.60
1993	0.0859	0.0568	0.0275	0.0015
(%)		66.09	32.06	1.84

not imply that between-group inequality among descendants disappears. If earnings are equalized within each groups of the fathers, the second term of (5) cancels. It does not imply that within-group inequality among the descendants disappears. Table 8 computes formula 5. It relates inequality of outcomes (I_t^c) and inequality of opportunity within and between groups defined as inequality of circumstances times the intergenerational earnings elasticity and the residual inequality $-\alpha_t$. As the table indicates the bulk of inequality of opportunity comes from the between group term it represents between 40 and 32% of the observed earnings inequality. While inequality of opportunity within groups stands for only 2%. Over time, its relative importance has remained constant, while between groups inequality of opportunity has markedly decreased explaning most of the decreasing in inequality of outcomes.

To sum up, the evolution of inequality of opportunity I_{oppt} and of its decomposition in within and between-group inequality can differ from the evolution of (I_{Bt}^c). Attention must be paid to that point in our application.

Oaxaca decomposition of inequality of opportunity

Studying the evolution of inequality of opportunity between two dates, formula (4) leads to an easy Blinder-Oaxaca decomposition. Inequality of opportunity varies according two factors, the intergenerational income elasticity and circumstances inequality, that is income inequality among fathers. There is no reason to suppose that the two forces change in the same direction. The first assesses the power of the intergenerational transmission of economic ability, while the second translates the initial conditions disparity. This leads to two parallel decompositions of the evolution of inequality of opportunity between two dates t and t',

Table 9: Oaxaca-Blinder decomposition of the evolution of inequality of opportunity between 1977 and 1993

t	$\Delta I_{opp\ t}$	$\Delta\beta_t I_t^f$	$\beta_{t'}\Delta I_t^f$	$\frac{\Delta\beta_t I_t^f}{\Delta I_{opp\ t}}$	$\frac{\beta_{t'}\Delta I_t^f}{\Delta I_{opp\ t}}$
			Total inequality of opportunity ($I_{opp\ t}$)		
1993	0.0139	-0.0041	0.0180	-0.2965	1.2965
1977	0.0139	-0.0071	0.0210	-0.5106	1.5106
			Between groups inequality of opportunity ($I_{oppB\ t}$)		
1993	0.0128	-0.0039	0.0167	-0.3043	1.3043
1977	0.0128	-0.0067	0.0195	-0.5197	1.5197
			Within groups inequality of opportunity ($I_{oppW\ t}$)		
1993	0.0011	-0.0002	0.0013	-0.2097	1.2097
1977	0.0011	-0.0004	0.0015	-0.4094	1.4094

$$\begin{aligned}\Delta I_{oppWt} &= \Delta\beta_t I_{Wt}^f + \Delta I_{Wt}^f \beta_{t'} = \Delta\beta_t I_{Wt'}^f + \Delta I_{Wt}^f \beta_t \\ \Delta I_{oppBt} &= \Delta\beta_t I_{Bt}^f + \Delta I_{Bt}^f \beta_{t'} = \Delta\beta_t I_{Bt'}^f + \Delta I_{Bt}^f \beta_t\end{aligned}$$

with $\Delta I_{oppt} = I_{oppt} - I_{oppt'}$ and $\Delta\beta_t$ and ΔI_t^f the corresponding gaps between t and t'.

The first terms gives the impact of the change in the elasticity applied to a given constant level of inequality of circumstances, either the initial or the terminal value. The second terms indicates the impact of the change of the circumstance inequality applied to a given elasticity, either the initial value or the terminal one. In that decomposition, the term of changing inequality of circumstance is the most interesting part. It is possible to imagine situations in which inequality of circumstances decreases between groups but not within groups. The decomposition of the between-group term will allow us to understand why the inequality of opportunity has decreased with the ordinal partition over the period.

Table (9) presents the Oaxaca-Blinder decomposition using the ordinal partition of the first section for total inequality of opportunity and its between and within component. Inequalities of opportunity within and between groups evolve symmetrically under the

(opposite) influence of the same causes: Increase in the elasticity and decrease of inequality of circumstances. Here we pick the estimates of the intergenerational elasticity at two dates 1977 and 1993 from Lefranc, Pistolesi and Trannoy (2010) . It turns out that the estimated intergenerational elasticity goes from 0.3488 to 0.4064. On the other hand, table (7) documents a huge decrease of inequality of circumstances.

The previous results from the continuous model of intergenerational transmission of inequality can be linked to the results of section 3 with the discrete approach. They solve the apparent contradictory conclusions of the cardinal and ordinal partitions of social background. We have seen that, when we follow an ordinal partition, inequality of opportunity diminishes, that is not the case when one uses a cardinal partition. The Blinder-Oaxaca decomposition enables to explain this opposition. By definition, the ordinal partition is affected by the decrease in I_t^f : It brings closer the different social groups of origin. Everything else constant, one would expect the distributions to get closer with this partition. On the contrary, the cardinal partition is not really affected by the decrease in I_t^f, since the limits of the social groups are defined by the earnings in proportion to the mean. If we do not take into account the changes in the distribution within each group, a decrease in I_t^f should let unchanged the inequality between the groups defined with the cardinal partition. Everything else constant, on should not observe any narrowing of the earnings distributions with this partition. Moreover, if the transmission of inequality from one generation to the next gets larger (β increases), the cardinal partition must display a widening of the conditional distributions. It is indeed what we observe.

5 Conclusion

The difference of results obtained with the dominance approach between an ordinal (decrease in inequality of opportunity) or cardinal (relative stability) definition of circumstances are illuminated by the results of the continuous model.

A cardinal partition of the fathers earnings distribution removes any possible effect of a change in earnings inequality in that generation on the following generation. The only source of inequality of opportunity comes from the ability transmission to generate

economic success. In the continuous model, it is measured by the intergenerational earnings elasticity which at best is stable over the studied period.

On the other hand, partitioning the father earnings according to their ranking makes it possible an impact of a change in inequality of circumstances on descendants' earnings. The drop in inequality of opportunity with an ordinal partition of the circumstances comes from the decrease in income inequality among fathers observed in the continuous approach.

Those results enlighten the differences of results obtained in two previous articles. In Lefranc, Pistolesi and Trannoy (2009), we concluded that inequality of opportunity conditioning on social groups has decreased. In Lefranc and Trannoy (2005) we concluded that it is more or less constant on the premices of the stability of the value of the intergenerational earnings elasticity. The difference could have come from different conditioning. Earnings are a much richer conditioning than social class. Moreover, the social groups conditioning is not constant to the changing structure of jobs over time: for example, the proportion of higher-grade professionals keeps increasing, and farming keeps declining. Now we can advance a different explanation. The major difference in the results of these two articles came from the fact that they did not focus on the same subject: inequality of opportunity in Lefranc, Pistolesi and Trannoy (2009) and the transmission to generate earnings in Lefranc and Trannoy (2005). Usually, the literature on intergenerational mobility concentrates on the value of the elasticity: it is the value of interest in a stationary regime. However, the period between 1977 and 1993 cannot be considered as a period of constant inequality. This period has displayed a contraction of earnings spread among fathers.

These results lead to a political economic dilemma for ethics based on equality of opportunity. Decreasing inequality of outcome among descendants has two effects. On the one hand, it can be interpreted as a decrease in inequality of circumstances and it diminishes inequality of opportunity for the following generation. Ethics of responsibility advocates such a policy. On the other hand for the previous generation a policy lowering inequality of outcome would translate in a weaker return to effort. For the philosophers on responsibility, such a policy can only have ambiguous effects: negative for the present generation, and positive for the following generation. These philosophers would advocate

a policy aiming at diminishing the intergenerational earnings elasticity.

According to the advocates of equality of outcome such a policy presents a double dividend: a decrease in inequality of outcome for the present generation, and a decrease in inequality of opportunity for the following generation. Moreover, the latter would translate in a diminishing inequality of outcomes for the same generation. Such a policy of reducing inequality of outcome for a given generation may impact on the inequality of their children, but either on their grand children.

For methodological purposes, the linearity hypothesis in the intergenerational transmission of earnings must be considered as a first proxy. The elasticity can change along the income distribution, as in Corak and Heisz (1999) on Canadian data. With our data, first tests indicates that the value of the elasticity differ by groups. The non linearities[13] enable to use a Oaxaca decomposition of the within-group inequality for the descendants earnings and to bear a finer appraisal on the reasons for the evolution of inequality of opportunity.

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[13] See O'Neill *et al.* (2000) for an analysis of nonlinearities for a study on opportunity sets.

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