Optimal fiscal policy according to equality of opportunity. A case study applied to Ivory Coast

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Abstract – To what extent the political crisis of Ivory Coast that has lead to the partition of the country since 2002 is correlated to inequality of opportunity? Can direct tax regime be modified to reduce inequality of opportunity for income? The aim of the paper is to analyze inequality of opportunity for income in Ivory Coast from 1985-88 to 1998, and direct tax regime incidence on inequality of opportunity. The paper is in keeping with the theory of equality of opportunity of Roemer, and addresses, for the first time, the feasibility of direct fiscal reforms according to equality of opportunity principle in less developed country like Ivory Coast. First, we show that, from 1985-88 to 1998, individuals born in the North of the country and in rural areas are the most disadvantaged category of the population, their expected income conditional to their origins being the lowest. This fact could explain partly the Ivorian political crisis. Second, we confirm that inequality of opportunity for income seems to correlate with overall income inequality more than with mean average income. Third, it is shown that direct tax-regime has no incidence on inequality of opportunity. Fourth, implementing tax-and-transfer reform to reduce inequality of opportunity for income requires granting the most disadvantage type of the population and, at least, double the mean tax rate of the advantage type of the population. But, this reform does not generate systematically an efficiency cost.

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JEL Codes: D31, D63, H2, O15, O55

0- Introduction

Since few years, there has been new empirical research in development economics that assert three important facts: (i) inequality and equity matters for development, high level of inequality and low level of equity could be a cause of low growth performances of some developing countries (World Bank, 2005; Bourguignon, Ferreira, Walton, 2007); (ii) income inequality is more often associated with low equity; (iii) inequalities in Africa are among the highest in the World.

The aim of the paper is to analyze inequality of opportunity in Ivory Coast and to see to what extent direct fiscal regime contributes to inequality of opportunity and can be reformed to reduce this inequity. Empirical works on inequality of opportunity are still relatively rare and most of them are applied to developed countries (Checchi, Peragine, 2005; Dardanoni et al., 2006, Lefranc et al. 2006) or Latin American countries (Bourguignon Ferreira, Menendez, 2007; Cogneau and Gignoux, 2008; Ferreira, Gignoux, 2008). The study of equality of opportunity in Africa is only at its beginning. Cogneau and Mesplé-Somps (2008) sets out a detailed analysis of inequality of opportunity for income in five African countries (Ivory Coast, Ghana, Guinea, Madagascar and Uganda). Among other results, they show that inequality of opportunity for income seems to correlate with overall income inequality more than with national average income and that inequality of opportunity is quite high in Ivory Coast comparing with Ghana in the 80's, but less than in Madagascar. As far as we know, there are only three papers, and all of them applied to developed countries, that ask what fiscal policy could be implemented to equalize opportunities across individuals. Pages and Roemer (2001), and Roemer *et al.* (2003) investigate the extend to which fiscal system could be seen as an opportunity equalizing device in the United States and ten other developed countries. Betts and Roemer (2007) analyze the allocation of educational expenditures in the United States focusing in race and parental education as determinant of opportunities.

The paper is in keeping with the theory of equality of opportunity developed by Roemer (1996, 1998). For a given outcome variable, Roemer distinguishes between what is due to *circumstances* that is to say individual's characteristics that impact on his/her outcome (for instance the expected income) but over which he/she has no control and what is due to *effort* for which the individual is held responsible or more generally to all other background traits of individuals that might affect his or her success but considered irrelevant to the establishment of illegitimate inequality. Inequality of opportunity measures inequality linked to unfair disadvantages. Disadvantages are linked to circumstances for which society believes they should not be held accountable: socio-economic status of their parents, place of birth, sex, race… Equality of opportunity is then a weaker criterion of equality than equality of outcome. The aim of public intervention is to compensate for disadvantages that individuals can not be responsible for.

The paper shows that, from 1985-88 to 1998, individuals born in the North of the country and in rural areas are the most disadvantaged category of the population, their expected income conditional to their origins being the lowest. This fact could explain partly the political crisis that has lead to the partition of the country since 2002. However, economic crisis has reduced the expected income for all individuals whatever their place of birth. We confirm that inequality of opportunity for income seems to correlate with overall income inequality more than with mean average income. The Ivorian direct tax-regime has no incidence on inequality of opportunity. An equalizing opportunity tax regime would require granting the most disadvantage type of the population and, at least, double the mean tax rate of the advantage type of the population. Nevertheless, we show that it could induce an efficiency gain if the whole rural born population is the targeted type by the EOp policy.

The remainder of the paper is structured as follows. Section 1 introduces the main inequality of opportunity concepts and indexes and the Equality of opportunity policy (EOp)

principle. Section 2 describes the data, as well as Ivory Coast basis social-economic features. Section 3 reports the results. We discuss how the partition of the population into homogenous groups of circumstance influences inequality of opportunity indexes and try to see the evolution of inequality of opportunity in Ivory Coast between the end of the eighties and ten years later, period during which big macro-economic shocks and structural reforms occurred. The incidence of the direct tax regime is then analyzed and *ex-post* direct tax and transfer regimes that equalize opportunity for income are simulated. Finally, section 4 concludes.

1- The measurement of inequality of opportunity for income and equality of opportunity policy (EOp) principle

1.1 The measurement of inequality of opportunity

In practice, to measure inequality of opportunity, we need to classify people in different types that is to say people according to the circumstance they suffer from. Roemer points the fact that efforts are linked to circumstances. For instance, coming from a family that lives in urban areas can give to an individual more willing to achieve tertiary level of education than belonging to rural family for which the best social norm should be achieving the primary level. People are not responsible for the "length" of the distribution of effort of the type they are belonging. Roemer proposes to construct an inter-type comparable measure of effort: the quantile of the effort distribution in his type at which an individual sits. The inequality between types are then measured by comparing individuals with the same relative level of effort; the inequality of opportunity is measured at different points of the distribution of relative levels of effort and these measurements are then aggregated into a single index. The inequality indices at each decile are calculated and are aggregated taking their average. These "Roemer" indices are written:

$$ROE = 1/10 \sum_{\pi=1,\dots10} I(v^t(\pi), p^t) \tag{1}$$

where t is an index for the different types of circumstances, $v^t(\pi)$ is the mean income at decile π for type t, p^t is the observed frequency of type t (type's weight), and I is an index of inequality. Instead of a traditional index of inequality like Gini or Theil, Roemer favors the minimum function (I = min), in keeping with a Rawlsian maximin principle.

Van de Gaer, Schokkaert and Martinez (2001) propose an alternative approach. They consider that there is equality of opportunity when the distribution of expected earnings is independent of circumstances. The extent of inequality of opportunity is then measured by an indicator of the inequality of income expectations obtained by individuals of different types. These conditional income expectations can be obtained from the distribution of average income estimated by categories of origin. In their general form, these "Van de Gaer" indexes are written:

$$VdG = I(E(v^t), p^t) \tag{2}$$

where I is an inequality index and $E(y^t)$ is the income expectation conditional on type t.

As argued by Van de Gaer *et al.* (2001), the two "Roemer" and "Van de Gaer" measurements produce the same rankings when the transition matrices between origins and income deciles are "Shorrocks monotonic" (Shorrocks, 1978), i.e. when the most underprivileged types of origin in each decile are the same. The matrices we compute come out as monotonic. In the particular case of maximin, the Roemer is even equal to the Van de Gaer index. In the Roemer or in the Van de Gaer cases, minimum indexes can be divided by the overall average income. We also compute the Van de Gaer index using Gini index as an inequality index.

1.2 Equality of opportunity policy principle

To implement a policy whose objective is to reduce inequality of opportunity, it needs to admit that outcome is a function of circumstances, effort, and policies. As said by Bett and Roemer (2007), "*the equal-opportunity policy is the value (or specification) of the instrument which makes it the case that an agent's expected value of the objective is a function only of his effort and not of his circumstance.*" Person's effort is measured by quantile at which he or she sits on the effort-distribution of his or her type. As quantile ranks people inside their type, it's a relative rather than absolute measure of effort and is a good compelling inter-type measure of effort.

Suppose that policies treat individuals belonging to the same type identically. Then, if the instrument equalizes opportunities, individuals of two types who are at the same quantile of their respective effort distributions should sit at the same quantile of outcome distribution of their type.

The formalization of the objective proposed by Roemer (1998) is not exactly to equalize objective but to maximize the minimum value of the objective for all agents of all types at effort quantile π. Suppose that the expected value of the objective for individuals in type t is a function of a policy instrument and their efforts: $v^t(x^t, e)$. Then, the average value of objective for individuals of type t at quantile π is defined as $v^t(\pi, x^t)$. The policy program for one quantile of effort is the following:

$$
\begin{aligned}
& \underset{x^1, x^2, \dots, x^T}{Max} \underset{t}{Min} \, v^t(\pi, x^t) \\
& subject \quad to(x^1, \dots x^T) \in X
\end{aligned}
\tag{3}
$$

where *X* is the feasible set of policies. The EOp is an average of these policies:

$$
x^{EOp} = \int_0^1 \underset{(x^1, \dots, x^T) \in X}{ArgMaxMin} \, v(\pi, x^t) d\pi
\tag{4}
$$

If *X* is convex, then the EOp is feasible. If income distributions by types do not cross, the policy program objective can be simplified by maximising the minimum of the average value of the most disadvantage type.

Two kinds of policy can be implemented: *ex-post* tax and transfer regimes, on the one hand, and *ex-ante* instruments like educational policy on the other hand. The tax regime policy generates a post-tax income whose the expected value by type are equal, or, at least, the gap between types is minimized, whereas the public expenditure policy re-allocates educational expenditure when individuals went to school in such a way that it contributes to reduce inequality of opportunity for income when there are adults. In this paper, only ex-post direct tax and transfer policy is investigated.

2- Data

To measure inequality of opportunity for income in Ivory Coast and to estimate the feasibility of an EOp policy, we use two household surveys covering large nationally representative samples. The first one is an "integrated" Living Standard Measurement Surveys (LSMS) designed by the World Bank that has been undertaken in Ivory Coast from 1985 to 1988. In addition to information on individual characteristics and income level, it provides information on parental background for adult respondents like education and main occupation of mother and father. The second survey used in this paper has been conducted ten years later, in 1998. The ENV98 survey (*Enquête niveau de vie des ménages*) of Côte d'Ivoire is a much more simple survey that provides information on "circumstances" only through place of birth of respondents.

We restrict the sample to men and women from 20 to 69 year-old and family backgrounds to fathers' positions and place of birth. To analyze inequality of opportunity for income in the

80's in Ivory Coast, we combine information on education and main occupation of fathers and define three social origins: farmers (whatever their level of education); non farmers with no education or primary level; and non farmers having reached a secondary or tertiary level of education. We also define another circumstance to take into account a variable of outmost importance in the political context of Ivory Coast: region of birth. We distinguish individuals born in the most peripheral and disadvantaged regions of Ivory Coast, i.e. the Northern parts of the country; we aggregate foreign born migrants born in Burkina-Faso and Mali to Northerners born, as these two populations may be confronted to the same restrictions in their income opportunity set (Figure 1). On the other hand, we distinguish individuals born in the most advantaged region: the capital town district (Abidjan).[1] In 1998, we could distinguish people only by their place of birth. As for the first survey, we differentiate individuals born in the North of the country from those born in Abidjan district. There is no information on the country of origin of foreign born in the ENV 1998 survey. We aggregate all of them to Northerners born, knowing that in 1988 more than three quarters of foreigners living in Ivory Coast were born in Mali or Burkina Faso. We also divide population between two other types of origins: being born in rural areas and being born in urban areas.

Table 1 shows some descriptive statistics of the two samples. Samples are quite large, around 10,000 observations. In the eighties, the fathers of most 20-69 year old individuals are farmers (86.7%). This high proportion of farmer social origin is quite close to what can be observed in other African countries. On the contrary, the proportion of individuals belonging to family with a non farmer and high educated father is lower in Ivory Coast (4%) than in other African countries like Ghana (12%), Madagascar (7%) or Uganda (8%) (Cogneau,

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[1] We do not adopt the approach proposed by Ferreira and Gignoux (2008) based on partitioning the population into the maximum possible combinations of circumstances, because it induces defining categories with too little observations.

Mesplé-Somps, 2008). This is due to the fact that in former French colonies before independence primary education was reserved to a small minority. Less than 30% of the population are born in the North part of the country or in Mali and Burkina Faso, and less then 10% in Abidjan district. Ten years later, the proportion of Northerners increases by 7 points of percentage, suggesting first that there is difference of natural growth rate of the population between regions inside the country and, second, an increase of immigration rate due to the need of labor force for cocoa and coffee extensive productions. On the other hand, the percentage of people born in rural areas is less than the percentage of individuals with father farmer position 10 years ago due to an increase of the urbanization rate. Nevertheless, at the end of the nineteen's, two-third of the population come from the countryside of the country.

[Insert Table 1 about here]

The outcome variable is both consumption and income per head for the household in which the individual lives. In low-income countries, it is more reliable to measure consumption (including home-produced consumption) than income (Deaton, 1997) but we need income information to analyze the feasibility of an income taxes policy for implementing an Eop policy. For each sample, consumption and income components have been meticulously reconstructed from raw survey data using a uniform methodology for comparison purposes.[2] Welfare aggregates are measured at 1988 prices and translated in 1988

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[2] Details are available from the authors. The consumption variable includes all food and non-food current expenditures, home-produced food consumption, an imputed rent for house owners. It excludes too infrequent expenditures such as durable goods and health, as well as net transfers.. The income variable includes wages, agricultural net income (except income from livestock sale), home-produced food consumption, incomes from non-agricultural independent activities, net public and private transfers, an imputed rent for house owners. Consumption and income aggregates are adjusted for infra-annual inflation.

international dollars using the PPP exchange rate of Pen World Tables (Heston, Summers and Aten, 2002).

Table 2 first shows that Ivory Coast exhibits low mean levels of income and consumption coupled with very high levels of inequality. These levels of inequality are comparable with Africa and Latin American standards. As it is the case most often, income inequality is higher than consumption inequality, due to transient components and measurement errors.

Secondly, Table 2 reveals that consumption and income per capita in 1998 were lower than those of 1988. This result is consistent with other diagnostics (Cogneau, Mesplé-Somps, 2003). Since 1978, Ivory Coast has suffered from a huge economic crisis linked to a Dutch Disease phenomenon and a public finance crisis: GDP per capita decreased by 3.7% per year between 1978 and 1993 (Berthélemy, Bourguignon, 1996); the recovery started in 1994 was not enough to improve household living standard. During this period of macroeconomic shocks, stabilization reforms and adjustment programs, the evolution of inequality pointed out in Table 2 is less obvious, inequality of income per capita seems not to change significantly whereas inequality of consumption increases. Grimm (2004), observing the trend of income distribution in Ivory Coast between 1991/92 and 1998, finds that across all regions the Gini coefficient increased slightly (1.4 points). But it hides more contrasted evolution of income distribution within regions. In Abidjan and in rural areas, the Gini coefficient of the income distribution per adult equivalent increased by 3.2 and 6.3 points, whereas no change of the income distribution was observed in other cities. Nevertheless, the high level of inequality he observed is in line with ours results.

[Insert Table 2 about here]

3- Results

3.1 Inequality of opportunity for income in Ivory Coast, 1985-88 – 1998

Table 3 shows the main indicator of inequality of opportunity for income, *i.e.* the maximin index for which both Roemer's and Van de Gaer's give the same results, given the monotonicity of the transition matrix linking types and income, with income per capita of the household of each individual as outcome. The index is presented in both its social welfare version ($ PPP levels) and its inequality (normalized by the mean) version. Table 4 shows conditional mean differences of income between types. Table A1 in appendix gives the Van de Gaer formula (2) with Gini index as Inequality index I. In Appendix, tables A2 and A3 present the same indicators of tables 3 and 4 with consumption aggregate as outcome.

[Insert Table 3 and Table 4 about here]

First, let's have a look to the first columns of Tables 3 and 4 that show inequality of opportunity for income during the period of 1985-88. Having a farmer father is the most disadvantaged social origin whatever the within-type income decile. The opportunity earning scale goes from 100 for farmer's son through 181 (father non farmer low educated) to 287 (father non farmer high educated). Concerning the place of birth, being born in the North restricts income opportunity. This lack of opportunity of Northerners may be one element of explanation for the political crisis that has lead to the partition of the country since 2002. This circumstance is quite as unfavorable as having a farmer father (except that Gini index by place of birth in appendix is less important than the Gini index by social origin). When these both circumstances are interacted, individuals born in the North and whose father was a farmer are the most disadvantaged people of the Ivorian society in the eighties.

Unfortunately, social origins are not available for the 1998 sample preventing from computing exactly the same indicators, except the measure of inequality of opportunity linked to regions of birth. Being born in the North is still the most disadvantaged type. We observe

that in 1998, this inequality of opportunity index increases in absolute terms, whereas the evolution of maximin index normalized by mean (as Gini index one) is not very clear, depending on the chosen outcome: inequality of opportunity for income (consumption) increases (resp. decreases). As for the overall inequality indicators, the diagnostic on inequality of opportunity evolution between 1985-88 and 1998 is unfortunately influenced by the choice of the outcome. Nevertheless, 1998 data confirm that coming from rural family restricts opportunity for income and that Northern individuals born in rural areas are the most disadvantage people. The partition of the Ivorian population in 5 groups induces the worst maximin index and normalized maximin index: being born in rural area of the Northern part of the country is the most disadvantaged circumstance.[3] This result is quite close to the result found in 1985-88 showing that individuals born in the North and whose father was a farmer were the most underprivileged type.

From 1985-88 to 1998, the most underprivileged type of the population did not changed whereas the economic crisis has reduced the expected income for all types of individuals. Unfortunately, it is not obvious if the gap between types increased or decreased the normalized maximin and Gini indexes evolution depending on the chosen outcome. This result confirms the fact that inequality of opportunity for income seems to correlate with overall income inequality more than with mean average income.

3.2 Implementation of the tax-and-transfer EOp policy

We analyze the incidence of the direct tax regime and simulate tax-and-transfer EOp policy only for 1998, because information on direct tax collection is available only for this year.

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[3] However, when outcome is consumption, there is no significant difference between people born in rural area in the Northern part of country and those born in rural area of the Southern part of the country (Table A3 in appendix).

Income tax policy in Ivory Coast

In Ivory Coast like in most African countries, there are two main direct income taxes: (i) income tax that is levied on formal wages and profits before people are paid and that is collected by formal non-agricultural companies; (ii) in addition to export taxes, a quasi tax is levied on coffee and cocoa exports by a Price Stabilization Fund (CSSPPA, *Caisse de Stabilisation et de Soutien des Prix Agricoles*) through the authoritarian price that it sets for domestic producers. The CSSPPA collects the difference between actual world prices, net of exporters' margins, and the domestic prices that it sets for export crops (Bates, 1984; Bourguignon and Berthélemy, 1996). It has been an important source of revenues: between 1976 and 1979, this quasi tax was around 16% of GDP; in 1998, it was equal to 4.2% of GDP whereas income tax collection represented 1.3% of GDP (total tax collection was equal to 17% of GDP).

Even if the Ivorian direct income tax regime is progressive, as Roemer *et al.* (2003), we estimate an affine income tax rate, as follow:

$$
\begin{aligned}
Taxes_{Wages} &= \sum_i a_i y_{i-wage} \\
&= \sum_i a_i w_{i\_wage}(1+a_i) \\
&\cong a(1+a)\sum w_{i-wage}
\end{aligned}
$$

with $Taxes_{Wages}$ total direct taxes collected on wages and individual formal profits, y_{i-wage} pre-fisc wages and individual profits for household *i* (*i.e.* formal income before tax deduction that is not observed by household survey), and $w_{i-wages}$ formal income per household *i* after tax deduction. Supposing that $a^2 \cong 0$ and knowing the value of $Taxes_{Wages}$ in 1998 then the mean income tax rate *a* can be estimated as equal to:

$$
a = Taxes_{wages} \Big/ \sum_i w_{i-wages} = 0.14 \tag{5}
$$

Concerning taxes levied on cocoa and coffee production, as information on public funding collected by this tax, $Taxes_{Cocoa-coffee}$, producer price, $P_{Producer}$, and international price, P_{Inter}, are available, pre-fisc income, $y_{i-Cocoa-Coffee}$, can be estimated as:

$y_{i-Cocoa-Coffee} = P_{Inter} * Q_{i-Cocoa-Coffee}$ with $Q_{i-Cocoa-Coffee} = w_{i-Cocoa-Coffee} / P_{Producer}$ and $w_{i-Cocoa-Coffee}$ post-fisc income from cocoa and coffee production.

Then, we calculate the mean tax rate on cocoa and coffee production, b, as:

$$b = Taxes_{Cocoa-coffee} \Big/ \sum_i y_{i-Cocoa-Coffee} = 0.30 \tag{6}$$

with $\sum_i y_{i-Cocoa-Coffee} = \sum_i (P_{Inter} * Q_{i-Cocoa-Coffee})$

Finally, we calculate for each individual a tax rate equal to r_i:

$$r_i = \frac{(y_i - w_i)}{y_i} \tag{7}$$

with $w_i = w_{i-Wage} + w_{i-Cocoa-Coffee} + w_{i-Other}$ and $y_i = (1+a)w_{i-Wage} + (1+b)w_{i-Cocoa-Coffee} + y_{i-Other}$.

We suppose that informal income, net transfer and agricultural income other than coffee and cocoa revenues are not taxed, then $w_{i-Other} = y_{i-Other}$.

Table 5 gives the average tax rate at the national level, by decile of pre-fisc income and by place of birth whereas Table 6 shows its incidence. It can be observed that income tax rate is progressive but that it does not really correlate with circumstances, notably with being born in rural areas or urban areas. It is why the comparison of several indicators of inequality of opportunity for income with and without tax deduction shows that direct tax regime does not have any impact on equality of opportunity (Table 6).

[Insert Table 5 and Table 6 about here]

Tax-and-transfer EOp policy in practice

Let's analyze what should be a tax-and-transfer regime for an equalization of opportunity for income. We simulate three optimal fiscal regimes depending of the three partitions of Ivorian population done in the previous part of the paper. As the distribution functions of pre-fisc income, for various types, do not cross and because the tax instrument is monotonic, the post-fisc income distributions of different types will also not cross as in Roemer *et al.* (2003). The objective of the program is then to find a tax and transfer policy that maximizes the *average* post-fisc income of the most disadvantage type:

$$Max\, min_{r^t}\left[y^1(1-r^1)+b \right] \tag{8}$$

Subject to:

$$\sum_t r^t y^t = b \tag{8'}$$

and,

$$Poverty-line \leq y^1(1-r^1)+b \leq \frac{1}{T}\sum_{t=2}^{T}\left(y^t(1-r^t)+b \right) \tag{8''}$$

with 1 the least advantaged type, t the other circumstances (t = 2, 3, 4, 5), and b a transfer payment equal to mean collected taxes. Actually, equation (8') suppose that taxes are transferred in such a way that fiscal regime is revenue neutral. Constraint (8'') obliges post-fisc mean income of type 1 to reach at best the mean post-fisc income of other types, and at least the poverty line (512 PPP$ per year).

As Roemer *et al.* (2003), we take into account the elasticity of labor supply to post-fisc income. The utility function to each household is then equal to:

$$u_i(y_i, L_i) = y_i - \alpha L_i^{1+\frac{1}{\eta}} \tag{9}$$

with L, labor, η the labor elasticity to wage.[4] His optimal labor supply depends on the tax policy (r, b) and wage:

$$L_i(w_i; r, b) = \left[\frac{(1-r)w_i}{\widehat{\alpha}} \right]^{\eta} \text{ where } \widehat{\alpha} = \alpha(1 + 1/\eta)$$

Household's pre-fisc income is then $v_i(w_i, r, b) = \left[\frac{1-r^t}{\widehat{\alpha}} \right]^{\alpha} w_i^{1+\eta}$ and the objective of optimal fiscal policy is to maximize the mean income of type 1:

$$y^1(1-r^1) + b = (1-r^1)\left[\frac{1-r^1}{\widehat{\alpha}} \right]^{\alpha} w^{1+\eta} + b.$$

We define a 'benchmark' policy that would tax all incomes at an equal proportional rate, r^{bench}, let's say the average tax rate. V^{Bench} is the average pre-fisc income at this policy. The 'efficiency cost' of the EOp is the ratio, ε, between the average pre-fisc income at the EOp policy and V^{Bench}. If $\varepsilon < 1$, then the EOp policy induces some economic cost, the average pre-fisc income being lower than the 'benchmark' pre-fisc income, and, if $\varepsilon > 1$, then there is an increase in average incomes in implementing an Eop policy.

[Insert Table 7 about here]

Lines (a) of Table 7 give the results of program (8) without any constrain on income tax rate. Lines (b) suppose that positive transfers to individuals belonging to the most disadvantaged type are not possible. Finally, lines (c) point out simulations that restrict the mean income rate per quantile of the most advantaged type to be lower than 0.10. Counterfactual tax regimes are computed for three kinds of partitions of the population: firstly the Northerners are the underprivileged that are compared to the other inhabitants; secondly rural born people are compared to urban ones; thirdly, inhabitants that have been born in rural

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[4] The term wage includes wage and incomes from agricultural activities.

areas of the North part of the country are the targeted one. We compute optimal tax regimes for three assumptions of η: 0.03, 0.1 and 0.2. Higher is η, and the 'cost' of increasing income tax is high. As can be seen in Table 7, this effect is not very important. We can see that, whatever the definition of unfair circumstances, the EOp tax regime without any restriction on tax rate (lines a) requires transfers to the most disadvantaged types and a huge rise of mean income tax rate for the best ones: according to the targeted population and the elasticity of labor supply, the transfer goes from 7.9% (North born as the most disadvantaged type) to 13% (rural North born) and the mean tax rates of the rest of the population from 17.6% (North born as the most disadvantage type) to 25.7% (rural born people as the most disadvantage type). Whatever the circumstances, equality of opportunity is exactly reached. Cancelling inequality of opportunity between rural and urban born people induces, on the one hand, the higher tax rate on the 'advantaged' type of the population, but, on the other hand, an economic benefit, ε being higher than one. Optimal tax regime that equalizes opportunity of the Northerners (with or without specifying if they have born in rural areas) generates an efficiency cost.

Supposing that is not possible to subsidize individuals born in rural areas (lines b), equality of opportunity for income can not exactly be reached, but the normalized maximin indexes are improved, whatever the partition of the population. Finally, when we restrict mean income rate per quantile of the most advantaged type to be lower than 0.10, equalization of opportunity can not be obtained.

To summarize, this quite simple exercise shows that an equalizing opportunity tax regime requires granting the most disadvantage type of the population and, at least, double the mean tax rate of the advantage type of the population. Nevertheless, it could induce an efficiency gain in the case of the whole rural born population as the targeted type by the EOp policy.

4- Conclusion

This paper, firstly, measures inequality of opportunity for income in Ivory Coast and, secondly, seeks to assess to what extend tax regime has an impact to inequality of opportunity for income in Ivory Coast.

Inequality of opportunity for income in Ivory Coast is high that could explain partly the political crisis in 2002. Non-egalitarian public policies have been implemented since the colonial period to nowadays: farmers are used to finance public budget that it is almost spent to finance urban facilities (much more in Abidjan than in other towns). Dualism against agriculture has been coupled with an unequal access to education. These both elements induce low intergenerational mobility that reinforces inequality of opportunity. Pre-fisc income expectations by social origin and place of birth are then quite unequal. Tax-and transfer policy that could equalize opportunity should induces a huge reform that does not generate systematically an efficiency cost. However, it calls for a real political willingness that most of African governments fail.

It would be interesting for future work to investigate the feasibility of *ex-ante* EOp policy, for instance educational policy. Actually, our exercise does not take into account the fact that the funding finances government spending that can have also an equal-opportunity effect: educational policy when individuals were children has an impact on their occupational position and expected income. Educational policy can be optimized to reduce inequality of opportunity.

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Appendix

[Insert Tables A1, A2 and A3 here]

Table 1 – Sample description

Ivory Coast	1985-88	1998
Sample size	10 981	9 345
Fathers (%)		
Farmer	86.7	na
Non Farmer Low Education[a]	9.4	na
Non Farmer High Education[b]	3.9	na
Born in the North [c]	29.7	36.1
Born in Abidjan district	8.4	11.0
Born in rural areas	na	66.2
Born in urban areas	na	33.8

Coverage: Men and women 20 to 69 year-old.

Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

a. Low Education: never been at school or has achieved at most primary level that means having obtained at most a primary degree (CEPE).

b. High Education: having achieved more than primary school level that means having middle school degree (BEPC).

c. Being born in départements of Bouna, Bondoukou, Boundiali, Dabakala, Ferkessedougou, Katiola, Korhogo, Mankono, Odienné, Séguéla, Tengrela and Touba (13.1% for 1985-88 and 19.9% for 1998) and born in Burkina-Faso or Mali in 1985-88 (10.6%) and born outside Ivory Coast for 1998 (16.1%).

Table 2 – Mean income levels and overall income inequality levels

	1985-88	1998
Mean Per capita Consumption in international $[a]	1645	1434
Gini index	0.43	0.49
	[0.42; 0.44]	[0.48; 0.50]
Theil-T index	0.35	0.48
	[0.33; 0.37]	[0.45; 0.51]
Mean Per capita Income in international $[a]	1634	1539
Gini index	0.57	0.55
	[0.56; 0.58]	[0.53; 0.56]
Theil-T index	0.69	0.65
	[0.65; 0.72]	[0.57; 0.71]

Coverage: Men and women 20 to 69 year-old. Sources: see table 1, calculations by the author.

a. Per capita consumption and income in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).

Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Table 3 - Inequality of opportunity for income

Mean Per capita Income in international $[a]	1985-88	1998
Maximin index (normalized by mean)		
Father position in 3 groups (Farmer, Non Farmer Low Education, Non Farmer High Education)	1424 (0.87)	na
Place of birth		
(1) North, South, Abidjan district	1471 (0.90)	1278 (0.83)
(2) Rural, Urban areas	na	1348 (0.88)
(3) North, South X Rural, Urban areas + Abidjan dist.	na	1168 (0.76)
Father position & Place of birth (1) [b]	1353 (0.83)	na

Coverage: Men and women 20 to 69 year-old. Sources: see table 1, calculations by the author.
a. Per capita income in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
b. Father Farmer and being born in the North; Father Farmer and being born in the capital town district; Father Farmer and being born in the South; Uneducated Non Farmer Father, Educated Non Farmer Father.
Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Table 4 – Inequality of opportunity for income: conditional means differences

Mean Per capita Income in international $[a]	85-88	98
Father position in 3 groups		
(1) Father Farmer	100	na
(2) F. non-farmer Low edu.	181*	na
(3) F. non-farmer High edu.	287*	na
Place of birth (1)		
(1) North	100	100
(2) Abidjan district	184*	173*
(3) South	107	124*
Place of birth (2)		
(4) Rural	na	100
(5) Urban	na	142*
Place of birth (3)		
(6) Rural North	na	100
(7) Urban North	na	139*
(8) Rural South	na	125*
(9) Urban South	na	159*
(10) Abidjan district	na	189*

Coverage: Men and women 20 to 69 year-old. Sources: see table 1, calculations by the author.
a. Per capita income in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
* Difference with the first line significant at 1%.
Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Table 5 – Direct tax rate, 1998

	Mean rate r
Mean national level	0.085
Minimum national level	0.0
Maximum national level	0.31
By decile of pre_fisc income	
d1	0.035
d2	0.058
d3	0.065
d4	0.079
d5	0.089
d6	0.092
d7	0.100
d8	0.105
d9	0.111
d10	0.114
By place of Birth	
(1) North	0.069
(2) Abidjan district	0.089
(3) South	0.095
(4) Rural	0.082
(5) Urban	0.089
(6) Rural North	0.067
(7) Urban North	0.073
(8) Rural South	0.094
(9) Urban South	0.096

Source: Côte d'Ivoire ENV 1998; calculations by the author.

Table 6 – Incidence of direct tax regime in Ivory Coast, 1998

	Post-fisc income	Pre-fisc income
Mean Per capita level in international $[a]	1539	1698
Gini index	0.55	0.55
	[0.53; 0.56]	[0.54; 0.57]
Poverty rate (z=512)	0.27	0.24
Inequality of Opportunity		
(1) Being born in North/ Abidjan district/ South		
Maximin index (normalized by mean)	1278	1394
	(0.83)	(0.82)
Gini index	0.09	0.09
	[0.08; 0.09]	[0.09; 0.09]
Conditional mean difference		
(1) North	100	100
(2) Abidjan district	173*	174*
(3) Elsewhere	124*	126*
(2) Being born in rural areas / being born in urban areas		
Maximin index (normalized by mean)	1348	1485
	(0.88)	(0.87)
Gini index	0.083	0.083
	[0.08; 0.08]	[0.08; 0.08]
Conditional mean difference		
(4) Rural	100	100
(5) Urban	142*	143*
(3) Being born in North, South X Rural, Urban areas + Abidjan dist.		
Maximin index (normalized by mean)	1168	1271
	(0.76)	(0.75)
Gini index	0.14	0.12
	[0.14; 0.15]	[0.11; 0.12]
Conditional mean difference		
(6) Rural North	100	100
(7) Urban North	139*	140*
(8) Rural South	125*	128*
(9) Urban South	159*	162*
(10) Abidjan district	189*	191*

Coverage: Men and women 20 to 69 year-old. Sources: see table 1, calculations by the author.
a. Per capita income in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
* Difference with the first line significant at 1%.
Source: Côte d'Ivoire ENV 1998; calculations by the author.

Table 7 – Direct Tax Eop policy.

η	r^1	r^2	r^{Bench}	r^{1EOp}	r^{2EOp}	B^{EOp}	Maximin index (normalized by mean)	ε
North place of birth (36.1% of the population; normalized Maximin index 0.82)								
(a) EOp direct tax regime without any constrain on income tax rate.								
$\eta = 0.03$	0.069	0.094	0.085	-0.079	0.176	243	1.00	0.98
$\eta = 0.1$	0.069	0.094	0.085	-0.072	0.191	173	1.00	0.95
$\eta = 0.2$	0.069	0.094	0.085	-0.064	0.204	107	1.00	0.92
(b) EOp direct tax regime with $r^{1q} \geq 0.0$								
$\eta = 0.03$	0.069	0.094	0.085	0.000	0.145	243	0.93	0.96
$\eta = 0.1$	0.069	0.094	0.085	0.000	0.145	173	0.92	0.96
$\eta = 0.2$	0.069	0.094	0.085	0.000	0.146	107	0.90	0.96
(c) EOp direct tax regime with $r^{2q} <= 0.1$								
$\eta = 0.03$	0.069	0.094	0.085	0.060	0.100	243	0.87	0.99
$\eta = 0.1$	0.069	0.094	0.085	0.060	0.100	173	0.85	0.99
$\eta = 0.2$	0.069	0.094	0.085	0.060	0.100	107	0.82	0.99
Rural place of birth (66.2% of the population; normalized Maximin index 0.87)								
(a) EOp direct tax regime without any constrain on income tax rate.								
$\eta = 0.03$	0.082	0.089	0.085	-0.120	0.225	285	1.00	1.15
$\eta = 0.1$	0.082	0.089	0.085	-0.112	0.243	201	1.00	1.13
$\eta = 0.2$	0.082	0.089	0.085	-0.104	0.257	124	1.00	1.11
(b) EOp direct tax regime with $r^{1q} \geq 0.0$								
$\eta = 0.03$	0.082	0.089	0.085	0.000	0.144	285	0.93	1.05
$\eta = 0.1$	0.082	0.089	0.085	0.000	0.145	201	0.92	1.05
$\eta = 0.2$	0.082	0.089	0.085	0.000	0.146	124	0.90	1.05
(c) EOp direct tax regime with $r^{2q} <= 0.1$								
$\eta = 0.03$	0.082	0.089	0.085	0.066	0.100	285	0.89	1.01
$\eta = 0.1$	0.082	0.089	0.085	0.066	0.100	201	0.87	1.01
$\eta = 0.2$	0.082	0.089	0.085	0.067	0.100	124	0.85	1.01
Rural North place of birth (27.3 % of the population; normalized Maximin index 0.74)								
(a) EOp direct tax regime without any constrain on income tax rate.								
$\eta = 0.03$	0.067	0.091	0.085	-0.130	0.205	228	1.00	0.90
$\eta = 0.1$	0.067	0.091	0.085	-0.124	0.221	163	1.00	0.87
$\eta = 0.2$	0.067	0.091	0.085	-0.116	0.234	102	1.00	0.84
(b) EOp direct tax regime with $r^{1q} \geq 0.0$								
$\eta = 0.03$	0.067	0.091	0.085	0.000	0.137	228	0.87	0.95
$\eta = 0.1$	0.067	0.091	0.085	0.000	0.138	163	0.84	0.94
$\eta = 0.2$	0.067	0.091	0.085	0.000	0.139	102	0.82	0.94
(c) EOp direct tax regime with $r^{2q} <= 0.1$								
$\eta = 0.03$	0.067	0.091	0.085	0.054	0.100	228	0.81	0.98
$\eta = 0.1$	0.067	0.091	0.085	0.055	0.100	163	0.78	0.98
$\eta = 0.2$	0.067	0.091	0.085	0.055	0.100	102	0.74	0.98

Source: Côte d'Ivoire ENV 1998; calculations by the author.

Table A1 - Inequality of opportunity for income, Van de Gaer index, Gini coefficient.

Mean Per capita Income in international $[a] Gini index	1985-88	1998
Father position in 3 groups	0.12 [0.11; 0.12]	na
Place of birth		
(1) North, South , Abidjan district	0.07 [0.06; 0.07]	0.09 [0.08; 0.09]
(2) Rural, Urban areas	na	0.08 [0.08; 0.08]
(3) North, South X Rural, Urban areas + Abidjan dist.	na	0.11 [0.11; 0.11]
Father position in 3 groups & Place of birth (1) [b]	0.13 [0.13; 0.14]	na

Coverage: Men and women 20 to 69 year-old. Sources: see table 1, calculations by the author.
a. Per capita income in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
b. Father Farmer and being born in the North; Father Farmer and being born in the capital town district; Father Farmer and being born elsewhere; Uneducated Non Farmer Father, Educated Non Farmer Father.
Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Table A2 - Inequality of opportunity for income (consumption aggregate as outcome)

Mean Per capita Consumption in international $[a]	1985-88	1998
Maximin index (normalized by mean)		
Father position in 3 groups	1437 (0.87)	na
Place of birth		
(1) North, South , Abidjan district	1290 (0.78)	1294 (0.90)
(2) Rural, Urban areas	na	1158 (0.81)
(3) North, South X Rural, Urban areas + Abidjan district	na	1134 (0.79)
Father position in 3 groups & Place of birth (1) [b]	1180 (0.72)	na
Gini index		
Father position in 3 groups	0.11 [0.11; 0.12]	na
Place of birth		
(1) North, South , Abidjan district	0.10 [0.09; 0.10]	0.07 [0.07; 0.07]
(2) Rural, Urban areas	na	0.13 [0.13; 0.13]
(3) North, South X Rural, Urban areas + Abidjan district	na	0.14 [0.14; 0.15]
Father position in 3 groups & Place of birth (1) [b]	0.16 [0.15; 0.16]	na

Coverage: Men and women 20 to 69 year-old. Sources: see table 1.
a. Per capita consumption in international $ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
b. Father Farmer and being born in the North; Father Farmer and being born in the capital town district; Father Farmer and being born elsewhere; Uneducated Non Farmer Father, Educated Non Farmer Father.
Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Table A3 – Inequality of opportunity for income: conditional means differences (consumption aggregate as outcome)

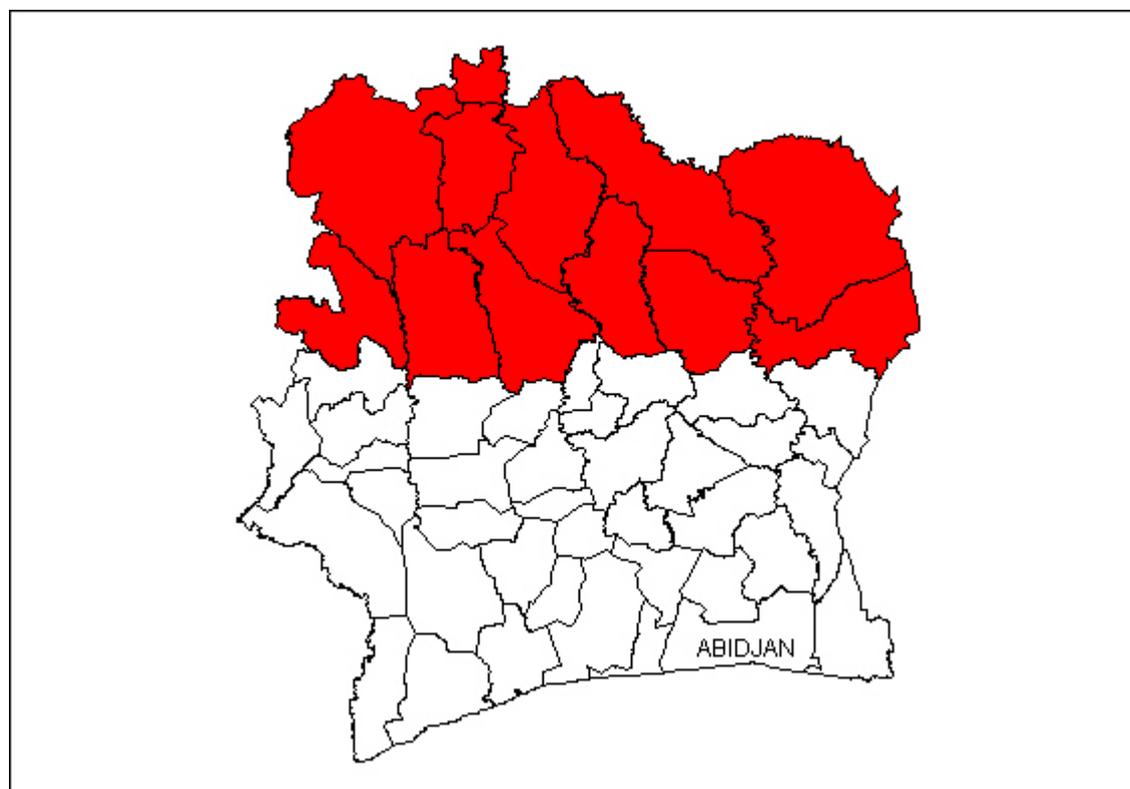| Mean Per capita Consumption in international \$[a]	85-88	98
Father position in 3 groups		
(1) Father Farmer	100	na
(2) F. non-farmer Low edu.		
	173*	na
(3) F. non-farmer High edu.		
	295*	na
Place of birth (1)		
(1) North	100	100
(2) Abidjan district	213*	176*
(3) South	130*	105
Place of birth (2)		
(4) Rural	na	100
(5) Urban	na	171*
Place of birth (3)		
(6) Rural North	na	100
(7) Urban North	na	150*
(8) Rural South	na	98
(9) Urban South	na	163*
(10) Abidjan district	na	197*

Coverage: Men and women 20 to 69 year-old. Sources: see table 1.
a. Per capita income in international \$ 1988 (source Penn World Tables 6.1, PPP level of consumption 1988).
* Difference with the first line significant at 1%.
Sources: Côte d'Ivoire LSMS 1985-1988 and ENV 1998; calculations by the author.

Figure 1 – Map of Ivory Coast

Northern *Departments* in red.