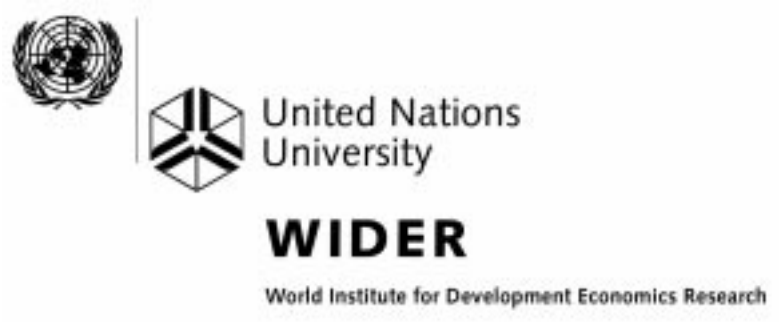

Discussion Paper No. 2001/91

A Decomposition of Inequality and Poverty Changes in the Context of Macroeconomic Adjustment

A Microsimulation Study for Côte d'Ivoire

Michael Grimm*

September 2001

Abstract

This paper proposes a microeconomic decomposition of the evolution of income inequality in Côte d'Ivoire in the 1990s, allowing the in-depth analysis of simultaneous contributions of four types of phenomena to the evolution of the distribution of income: a change in the remuneration rates of observed and unobserved earnings determinants, a change in occupational preferences, and a change in the sociodemographic population structure. I show, for instance, that the increase in income inequality in Abidjan was the result of changes in the sociodemographic population structure and of changes in unobserved earnings determinants, even though higher activity, inflows in wage labour, a drop in returns to schooling, and the Ivorian/non-Ivorian wage differential worked toward a more equal distribution. Concerning the link between growth and inequality, it is interesting to note that both negative income growth in Abidjan as well as positive income growth in rural Côte d'Ivoire, were connected with rising inequality.

Keywords: decomposition, income distribution, microsimulation, poverty, Côte d'Ivoire

JEL classification: C15, D31, J22, J31, O12

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Introduction

After strong and sustained growth during the 1960s and 1970s in an environment of rising international commodity prices,[1] Côte d'Ivoire saw its average annual GDP per capita growth rate between 1978 to 1993 fall to -3.7 percent. This period was marked by a significant loss of competitiveness, sharp deterioration in the terms of trade as well as a strong increase in the external debt. Measures to stabilize the economy and structural reforms pursued by the Ivorian authorities since 1981 have not been sufficient to restore competitiveness or external viability (Bourguignon and Berthélemy 1996; Cogneau and Mesplé-Somps 2001; IMF 1998, 2000).

The failure of the internal adjustment strategy in Côte d'Ivoire–one of the most significant economies of the 14 member countries of the CFA[2] Franc zone–led to a 50 percent devaluation of CFA Franc parity in relation to the French Franc in January 1994. Numerous structural measures followed the devaluation in the framework of a fund-supported program by the World Bank and the IMF.

The growth rate of real GDP per capita was -1.7 percent in 1994, but attained over 3 percent in the three years following. After the initial passage of higher import prices following devaluation, inflation has stabilized at under 6 percent, on average annually since 1996. Growth recovery was mainly due to a strong increase in the production of export crops (cocoa +62 percent, coffee +107 percent in volume) and cotton (+9 percent), favoured by the devaluation and high world market prices,[3] and due to a good performance in the manufacturing sector, agro-industry, and energy sector.

From a political point of view, it is important to study how these profound economic changes as well as the accompanying high population growth (including immigration) affected the distribution of income and social welfare. Existing papers studying the evolution of inequality and poverty in the 1990s in Côte d'Ivoire (see e.g. Jones and Ye 1997; World Bank 1997) remain very limited regarding two aspects. First, using household surveys from 1993 and 1995 the timeframe is too short to say anything of value on the medium term effects of the changes that occurred in the early 1990s, and second, because of their very descriptive character and their focus on consumption, they can tell us very little about the mechanisms through which poverty ratios and the distribution of income may have been affected.

Other studies, of a more analytical approach, used computable general equilibrium models to compare the distributional effects of different adjustment strategies open to Côte d'Ivoire (Bourguignon, de Melo and Suwa-Eisenmann 1995; Calipel and Guillaumont Jeanneney 1996; Cogneau and Collange 1998). The advantage of these analyses is their macro-economic closure, but by relying on the representative agent hypothesis

[1] Côte d'Ivoire is the world's largest producer of cocoa, before Ghana and Indonesia.

[2] *Communauté financière d'Afrique.*

[3] The nominal producer prices of cocoa increased in the five years following the devaluation 1994-1998 by 0%, 57.5%, 1.6%, 0% and 42.2%. The corresponding increases of the coffee prices were 21.4%, 282%, 7.7%, -38.6% and 4% (IMF 1998).

they cannot tell us about individual responses to macro-economic changes, and their implications for developments in overall income inequality.

In the present paper, I use microsimulation techniques, developed by Bourguignon, Fournier and Gurgand (2001), to distinguish the respective contribution of four types of phenomena to the evolution of household income distribution in Côte d'Ivoire during the 1990s: (i) a change in the remuneration rates of observed earnings determinants, (ii) a change in the remuneration rates of unobserved earnings determinants, (iii) a change in occupational choice behaviour, and (iv) changes in the socio-demographic population structure. Thus, this methodology allows the identification of the main channels and mechanisms through which income distribution has been affected. The analysis is based on two household surveys carried out in 1992/93 and 1998, which constitute the most recent available micro-data for Côte d'Ivoire. This study is, to my knowledge, the first application of this methodology to an African country, and to an economy characterized by a large agricultural sector. Furthermore, it offers an original modelling of intra-household labour allocation.

This study hopes also to contribute to the general debate about the link between growth, inequality and poverty alleviation. It seems that there is a rising consensus that results from cross-country studies (e.g. Dollar and Kraay 2000) are only seriously generalisable and that data remain a principal problem. Therefore more and more economists (e.g. Bourguignon 2000; Banerjee and Duflo 2001; Ravallion 2001) today argue that we can learn more from country specific case studies. This analyses offers such an approach.

The next section gives a brief description of the evolution of income distribution, poverty and some related economic and socio-demographic characteristics in Côte d'Ivoire. Section 3 explains the methodology. Section 4 presents the econometric estimation of the occupational choice, wage and profit functions. Section 5 presents various microsimulations and derives from them a decomposition of the change of income distribution and poverty ratios.

1 The evolution of income distribution between 1992/93–1998: basic facts and sources of change

The following description, like the rest of the paper, is based on two national representative household surveys that were jointly undertaken by the *Institut National de la Statistique* of Côte d'Ivoire (INS) and the World Bank. First, the *Enquête Prioritaire* (EP) which was started in 1992 (Abidjan), and finished in 1993 (other cities and rural areas). Second, the *Enquête de Niveau de Vie* (ENV) which was carried out in 1998. A two stage stratified design was used to sample a total of 9 600 (57 433) and 4 200 households (24 211 individuals) respectively, spread over five regions and 200 districts.

Evolution of mean household income and its components

Table 1
Evolution of mean household income 1992/93–1998

weighted obs., in 1000		Abidjan			other urban	
1998 CFAF, adjusted to Abidjan[a]	1992	1998	$g_{p.a.}$	1993	1998	$g_{p.a.}$
Mean household income	2 488	2 264	-1.6%	1 561	1 536	-0.3%
Wage income[b]	1 370	1 444	0.9%	636	766	3.8%
Non-farm self-employ. income[b]	612	509	-3.0%	526	439	-3.6%
Farm income[b] [c]	10	17	9.6%	106	116	1.8%
export crops (cotton, coffee, cocoa)	4	11	20.1%	20	56	22.7%
food crops	3	12	27.9%	25	25	-0.2%
cost of labour	7	9	5.0%	13	12	-2.7%
self-consumption[d]	2	7	20.6%	72	60	-3.6%
livest., fish, a. hunting[e]	7	22	21.7%	6	6	-0.7%
Other income sources	237	123	-10.4%	172	81	-14.0%
Received transfers[f]	260	172	-6.6%	121	135	2.2%
Mean hh. inc. by active hh. member	1 686	1 418	-2.9%	1 016	1 049	0.6%
Mean hh. expenditures[g]	2 797	2 576	-1.4%	1 588	1 606	0.2%
		rural			national	
	1993	1998	$g_{p.a.}$	1993	1998	$g_{p.a.}$
Mean household income	950	1 341	7.1%	1 383	1 586	2.8%
Wage income[b]	92	251	22.2%	460	632	6.6%
Non-farm self-employ. income[b]	96	107	2.1%	291	274	-1.2%
Farm income[b] [c]	675	888	5.6%	420	513	4.1%
export crops (cotton, coffee, cocoa)	138	371	21.8%	86	216	20.3%
food crops	123	110	-2.2%	77	68	-2.7%
cost of labour	43	51	3.5%	29	32	2.0%
self-consumption[d]	433	439	0.3%	268	252	-1.2%
livest., fish, a. hunting[e]	17	36	16.9%	12	26	15.8%
Other income sources	34	24	-6.6%	104	59	-10.7%
Received transfers[f]	53	70	6.0%	108	108	0.1%
Mean hh. inc. by active hh. member	421	614	7.8%	788	886	2.4%
Mean hh. expenditures[g]	1 094	1 415	5.3%	1 532	1 710	2.2%

Notes:
[a] The price deflator series 1992-1998 published by the *Institut National de la Statistique* (INS) of Côte d'Ivoire and the World Bank (2000) is used. To adjust incomes to the level of Abidjan, regional deflators constructed by Grootaert and Kanbur (1994) and revised by the INS (see Jones and Ye 1997) are used.
[b] In the EP 1992/93 individual earnings from dependent labour and non-farm self-employment were only collected from the first and second decision maker in the household. Wages and profits for the other household members supplying labour in these activities are imputed to make the data of the two surveys comparable. The method used is described in section 4.2.
[c] The four income sources minus the cost of labour do not exactly add up to the total farm income, because extreme values were omitted here and not replaced by imputed values.
[d] Self-consumption in the EP 1992/93 was corrected as proposed by Jones and Ye (1997).
[e] In the EP 1992/93 income from hunting was included in "other income sources".
[f] Including subsidies for education and transport, monetary aid, food aid and non-food aid received from individuals outside the household as well as pensions and insurance premiums.
[g] Including expenditure for durable and non-durable consumption items , self-consumption and transfers made to other households, but without taxes on wages and income. For house owners no rent was imputed here.
Source: EP 1992/93 and ENV 1998; computations by the author.

It can be seen in Table 1 that in the 1990s, real average household income declined in Abidjan (-1.6 percent p.a.), the economic capital of Côte d'Ivoire, more or less stagnated in other cities (-0.3), and strongly increased in rural areas (+7.1).[4] The

[4]Unfortunately no reliable regional price index exits for the 1990s. The adjustment to Abidjan prices was thus undertaken before and after the devaluation of the CFA Franc by the same regional deflators (see notes of Table 1). However, it is likely that the devaluation affected regional price

same can be stated for the mean household income per active household member. For all three strata, the evolution of average household income between 1992/93 and 1998 complies with the observed evolution of average household expenditures. However, the various income sources altered very differently. In Abidjan income from farm activities increased, whereas income from non-farm self-employment, transfer income and income from other sources decreased. Wage income stagnated. The intensification of agricultural activity in Abidjan could indicate that households tried to cope with the downturn of market income by higher home-production. In contrast, in rural areas the income from the three main sources as well as from transfers increased. The expansion was particularly marked for income from export crops and wages. This evolution confirms that the sales of cocoa, coffee, and cotton have benefitted from the devaluation of the CFA Franc and by the significant rise in world market prices, but also by an exceptional increase in cocoa production by historical standards, independent of the former evolutions.[5]

Below it can be noted that the distinct evolution of the various income items resulted in significant changes in the the overall distribution of household income and poverty. One aim of this paper is thus to analyse why the different income shares altered so disparately, i.e. due to changes in price, in occupational choice, in population structure, or in all these factors together.

Changes in income inequality and poverty
Table 2 summarizes some basic indicators of the distribution of household income per adult equivalent (Oxford Scale[6]) and some measures of poverty. For Abidjan, the data show an increase of 3.2 points in the Gini coefficient of the distribution of household income. The poorest inhabitants of the Ivorian economic capital seem to have lost during and after the devaluation, whereas the richest sections of the population seem to have gained during this period. However, the share of households living in extreme poverty and "normal" poverty, defined as having a household income per day and capita below US$1 and US$2 respectively, remained more or less stable.

While in the other cities the distribution of household income did not alter significantly between 1993 and 1998, absolute poverty decreased by 10% when retaining the US$2 poverty line. In this context, it is important to note that the stratum "other cities" is a very heterogenous one, comprising more than 65 cities, ranging from 5 000 to 550 000 habitants. In addition, the continuing urbanization process during the period under study may have led to a continuous expansion of this stratum. Problems may arise concerning the relative representiveness of the two samples.

In contrast, in rural Côte d'Ivoire, income dispersion increased strongly and in 1998 reached a level comparable to that in urban areas. The Gini coefficient for 1998 was

differences and especially the urban/rural price differential.

[5]The increase in income stemming from the production of export crops would have been even bigger if the CAISTAB had not taxed away a part of the surplus.

[6]The robustness of the results has been tested using alternative equivalence scales. The distribution did not change significantly.

Table 2
Evolution of the distribution of household income per adult equivalent 1992/93–1998

weighted obs.	Abidjan		other urb.		rural		nat.	
1998 CFAF, adj. to Abidj.	1992	1998	1993	1998	1993	1998	1993	1998
HOUSEHOLD INCOME PER ADULT EQUIVALENT[a] (Oxford scale)								
Shares of								
Poorest 10 %	0.011	0.009	0.013	0.011	0.017	0.014	0.014	0.012
Poorest 20 %	0.038	0.034	0.040	0.038	0.054	0.043	0.044	0.037
Poorest 40 %	0.121	0.111	0.133	0.117	0.161	0.132	0.139	0.117
Richest 20 %	0.538	0.575	0.523	0.536	0.470	0.533	0.517	0.559
Richest 10 %	0.380	0.422	0.360	0.370	0.308	0.376	0.362	0.402
Richest 5 %	0.265	0.303	0.249	0.251	0.197	0.269	0.253	0.292
Summary inequality measures								
Gini coefficient[b]	0.497	0.529	0.489	0.487	0.417	0.480	0.494	0.508
Theil index	0.486	0.565	0.456	0.450	0.317	0.491	0.486	0.534
Mean logarithmic deviation	0.505	0.692	0.511	0.539	0.393	0.472	0.512	0.563
Atkinson (e=0.5)	0.208	0.239	0.202	0.201	0.149	0.204	0.207	0.223
Atkinson (e=1)	0.395	0.497	0.399	0.415	0.325	0.381	0.400	0.431
HOUSEHOLD INCOME PER CAPITA								
P0 (poverty line: US$1 [c])	0.121	0.145	0.263	0.233	0.363	0.271	0.294	0.235
P0 (poverty line: US$2 [c])	0.342	0.352	0.557	0.502	0.711	0.583	0.604	0.514
HOUSEHOLD EXPENDITURES PER ADULT EQUIVALENT (Oxford scale)								
Gini coefficient	0.396	0.424	0.392	0.387	0.349	0.371	0.417	0.412

Notes (see also notes of Table 1):
[a] Negative and zero incomes have been set to one.
[b] *Lorenz dominance*, that is the Lorenz curve of t is everywhere above that of t':
Abidjan: 1992 dominates 1998; other urban: Lorenz curves are crossing; rural: 1993 dominates 1998; national: Lorenz curves are crossing.
First order stochastic dominance, that is the cumulative distribution function of (real) income of t is everywhere above that of t':
Abidjan: 1992 first-order dominates 1998; other urban: cumulative distribution functions are crossing; rural: 1998 first-order dominates 1993; national: 1998 first-order dominates 1993.
[c] US$1 PPP1985: 110 700 CFAF 1998; US$2 PPP1985: 221 400 CFAF 1998 (for details concerning the computation of the poverty lines, see DIAL 2000).
Source: EP 1992/93 and ENV 1998; computations by the author.

6.3 points above the Gini coefficient for 1993. The Theil index and the evolution of income shares of the different income quantiles show that dispersion rose mainly at the top of the distribution. However, the rise in inequality was accompanied by a strong increase in average household income per capita, which was reflected by a remarkable reduction in absolute poverty. Whereas in 1993 36 percent of all households lived with less than US$1 per day per capita, this ratio fell to 27 percent in 1998.

Across all regions, the Gini coefficient increased slightly (+1.4 points).[7] The high level of income inequality in Côte d'Ivoire, particularly in urban areas with a Gini coefficient ranging from 0.48 to 0.53 is in line with estimates for the 1980s. Kozel

[7]The inequality measures for distribution of expenditure per capita indicate a lower level of inequality than the measures for the distribution of income per capita; this is a usual observation and stems generally from higher measurement error in the income variable, particularly for low-income groups, an underestimation of non-market income (e.g. transfers), and significant savings of high-income groups not taken into account by the expenditure variable. Likewise absolute poverty measured in terms of expenditure using the same data set is lower than in terms of income (see Grimm, Guénard, and Mesplé-Somps 2001). However, the evolution of distribution of expenditures per adult equivalent between 1992/93 and 1998 complies completely with the evolution observed for the income variable.

(1990), for instance, estimated a Gini coefficient for income distribution of 0.54.

Demographic change and variations in occupational structure
In what follows I focus on the population at working age, which here is defined as individuals above eleven years of age. At age twelve, school enrolment begins to decline, the share of working children reaches 20 percent, and it can be assumed that twelve-year-old children are able to contribute significantly to household production.

Table 3
Evolution of the socio-economic population structure, 1992/93–1998,
(population 12 years and older)

weighted obs.	Abidjan		other urb.		rural		national	
proportions in percent	1992	1998	1993	1998	1993	1998	1993	1998
MEN								
Age structure								
12 to 14	11.5	9.8	15.5	15.0	14.4	13.5	14.0	13.0
15 to 24	30.5	35.2	33.5	35.6	27.8	30.3	29.7	32.8
25 to 44	43.9	40.3	32.0	32.4	29.6	33.0	33.2	34.5
45 to 64	12.7	13.2	15.0	13.4	20.3	16.4	17.5	14.9
65 and older	1.4	1.5	4.0	3.7	7.9	6.8	5.6	4.8
Non-Ivorian	27.6	26.7	25.0	20.1	18.6	16.1	22.0	19.6
Married	41.6	34.6	40.2	38.3	48.1	48.3	44.9	42.7
Distrib. by school. levels								
No education	25.6	23.0	40.0	33.3	59.0	54.1	47.6	41.8
Prim. school but no dipl. achiev.	23.0	21.3	18.9	21.9	20.1	25.6	20.4	23.7
Primary school	28.8	27.0	25.6	28.0	16.5	15.4	21.2	21.2
Lower secondary	16.3	17.5	12.6	12.0	3.7	3.8	8.4	9.0
Higher secondary	3.0	6.7	1.5	2.2	0.6	0.6	1.3	2.4
Post-secondary	3.4	4.5	1.4	2.5	0.2	0.5	1.1	2.0
Occupation (main activity)[a]								
Inactive (excl. enrolled/trainees)	22.5	21.7	15.8	15.1	7.7	7.5	12.7	12.7
Enrolled or in training	30.8	29.2	33.6	35.9	13.0	13.8	21.6	22.8
Wage labour	32.0	36.0	20.4	25.9	5.7	12.2	14.6	21.1
Non-farm self-empl.	12.5	11.3	14.2	12.2	2.7	2.9	7.5	7.1
Unpaid family work (non-farm)	1.3	0.9	1.9	2.6	0.4	4.3	0.9	3.1
Self-empl. in agricul.	0.8	0.8	8.9	6.0	43.0	35.5	26.1	20.1
Food crop farmer			6,7	3,4	21,4	15,0	13,6	8,8
Export crop farmer[b]			2,1	2,6	21,6	20,5	12,5	11,4
Unpaid family work (farm)	0.1	0.1	5.2	2.3	27.6	23.9	16.6	13.0
Multi-activity (among actives)	4.0	5.9	12.8	10.1	9.9	13.5	9.6	11.5

Table 3 shows some basic socio-demographic statistics for the population at working age. It would take too much space to comment on all structural changes occurring in the 1990s, thus I will only shed light on the variations in occupational choices, which are particularly important for the understanding of the rest of the paper.

For men, the activity rate increased from 46.7 to 49.1 percent in Abidjan (certainly signifying to a large extend a reduction in unemployment) and stagnated at around 50 percent in other cities, and around 80 percent in rural areas. In all zones wage labour increased, which complies with the observed rise in the share of wage income in other urban cities and in rural areas. An increase in employment in the modern private sector has also been noted by Cogneau and Mesplé-Somps (2001). A part of the increase in wage labour may also be due to an important number of immigrants

Table 3
(... cont.)

weighted obs.	Abidjan		other urb.		rural		national	
proportions in percent	1992	1998	1993	1998	1993	1998	1993	1998
WOMEN								
Age structure								
12 to 14	13.8	13.2	14.5	14.1	11.6	10.3	12.7	11.9
15 to 24	36.4	36.9	33.5	38.1	26.1	29.3	30.0	33.2
25 to 44	41.1	39.2	36.4	33.5	37.7	38.4	38.1	37.4
45 to 64	7.7	9.5	13.3	12.0	20.1	16.9	15.9	14.0
65 and older	1.1	1.3	2.4	2.2	4.5	5.1	3.3	3.5
Non-Ivorian	24.3	22.5	23.2	17.3	16.6	11.7	19.8	15.6
Married	44.4	38.8	48.0	55.3	62.2	60.7	55.1	51.8
Distrib. by school. levels								
No education	45.4	39.0	58.7	53.1	79.5	76.3	67.4	62.1
Prim. school but no dipl. achiev.	25.4	23.6	17.4	21.2	13.7	17.0	17.0	19.5
Primary school	20.2	25.4	18.7	20.9	6.1	5.9	12.1	14.0
Lower secondary	7.0	8.1	4.8	3.8	0.5	0.6	2.9	3.1
Higher secondary	1.2	2.8	0.3	0.6	0.1	0.2	0.4	0.9
Post-secondary	0.9	1.2	0.1	0.5	0.0	0.1	0.2	0.4
Occupation (main activity)[a]								
Inactive (excl. enrolled/trainees)	47.3	44.3	40.5	38.2	17.1	18.8	29.0	29.4
Enrolled or in training	19.7	20.8	17.8	21.6	5.2	6.9	11.2	13.7
Wage labour	9.4	17.0	5.6	9.5	1.1	4.2	3.9	8.4
Non-farm self-empl.	20.7	16.1	23.4	20.2	7.3	5.6	14.0	11.6
Unpaid family work (non-farm)	2.6	1.6	3.5	3.6	0.9	6.8	1.9	4.9
Self-empl. in agricul.	0.0	0.1	1.9	1.6	6.0	5.8	3.8	3.5
Unpaid family work (farm)	0.3	0.1	7.3	5.3	62.4	51.9	36.3	28.5
Multi-activity (among actives)	1.1	1.9	3.8	5.3	3.2	4.1	3.1	4.0
ALL[c]								
Average household size	6.1	5.6	6.3	5.8	5.8	5.9	6.0	5.8

Notes:
[a] The shares of individuals in the different occupations are not directly comparable to those noted in the transition matrices (Table 9), because in the transition matrices the reference population excludes individuals who were enrolled in the education system or who were in professional training.
[b] According to the definition of the *Institut National de la Statistique* of Côte d'Ivoire, farmers are considered here as export crop farmers, if the sales of cocoa, coffee and cotton represent more than 50% of the total value of agricultural production (33% in the Savannah Region).
[c] Without visitors and domestics.
Source: EP 1992/93 and ENV 1998; computations by the author.

from neighbouring countries who found jobs on the large cocoa and coffee plantations in Côte d'Ivoire. Non-farm self-employment decreased in urban areas and stagnated in rural Côte d'Ivoire. The share of food crop farmers decreased, whereas the share of export crop farmers increased. However, the total proportion of farmers declined significantly. The shares of family workers in non-farm activity and in farm activity increased and decreased respectively. The proportion of men with more than one professional activity rose in Abidjan, and particularly in rural regions.

The activity rate of women aged 12 years and over increased in Abidjan (from 33 to 35 percent), as did that for men, but decreased in other cities (from 41.7 to 40.2 percent), and in rural areas (from 78.4 to 74.3 percent). The proportion of female wage earners and non-farm self-employed increased and decreased respectively. The relative number of women who carried out at least two market activities increased.

The fact that between 1992/93 and 1998 the proportion of self-employed farmers and agricultural family workers declined and the proportion of wage workers increased implies that the rise in agricultural income was partly generated by the additional employment of non-family members.

The micro-simulations which follow show that changes in the population structure as well as in occupational choices were important determinants of the changes in inequality and poverty during the 1990s.

2 Methodological framework: a decomposition by microsimulation

The chosen methodology was first proposed by Juhn, Murphy and Pierce (1993), and was subsequently further developed and applied particularly by Bourguignon and Martinez (1996), Bourguigon, Fournier and Gurgand (1999, 2001), and Fournier (1999). Therefore, this section is quite short and orientated to the presentations given in the studies quoted.

Consider a simple household income function Y, where the income y_{it} of household i observed at time t is assumed to depend on four sets of arguments: its observable socio-demographic characteristics, or those of its members (x_{it}), unobservable characteristics (ϵ_{it}), a vector of remuneration rates of the observed (β_t) and unobserved earnings determinants (σ_t), and, finally, a set of parameters defining the participation and occupational choice behaviour of its members (λ_t):

$$y_{it} = Y(x_{it}, \epsilon_{it}, \beta_t, \sigma_t, \lambda_t). \tag{1}$$

The overall distribution of household income at time t, is then obtained by summarizing all y_{it} and some demographic characteristics possibly included in x_{it}, e.g. the size or composition of the household at t, in one vector D_t. Accordingly, D_t can be written as a function H of the former parameters and the distribution of the observable and unobservable household characteristics at date t:

$$D_t = H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_t), \tag{2}$$

where { } refers to the distribution of the corresponding variables in the population.

Using this type of household income function, the difference between two distributions D_t and $D_{t'}$ observed over two distinct cross sections can be decomposed as resulting from four different causes: (i) a change in the remuneration rates of the observed earnings determinants, (ii) a change in the remuneration rates of the unobserved earnings determinants, (iii) a change in the occupational choice behaviour, and (iv) changes in the distribution of observed and unobserved earnings determinants. This

decomposition can formally be written as:

$$\left.\begin{array}{rl} \text{(i)}: & B_{tt'} = H(\{x_{it}, \epsilon_{it}\}, \beta_{t'}, \sigma_t, \lambda_t) - H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_t), \\ \text{(ii)}: & S_{tt'} = H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_{t'}, \lambda_t) - H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_t), \\ \text{(iii)}: & L_{tt'} = H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_{t'}) - H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_t), \\ \text{(iv)}: & P_{tt'} = H(\{x_{it'}, \epsilon_{it'}\}, \beta_t, \sigma_t, \lambda_t) - H(\{x_{it}, \epsilon_{it}\}, \beta_t, \sigma_t, \lambda_t). \end{array}\right\} \tag{3}$$

Explained in words, this methodology assumes that the impact of a change in the remuneration rates of the observed earnings determinants can be quantified by comparing the observed distribution at date t with the hypothetical distribution obtained by simulating on the population observed at date t, the remuneration structure of the observed earnings determinants at date t'. In the same way we can also evaluate variations in the other sets of parameters, or even in one single parameter (e.g. return to education). The change in the remuneration rates of the unobservable earnings determinants is measured by the change in the residual variance in earnings functions.[8] The effect of changes in the distribution of observed and unobserved earnings determinants can be estimated either, if panel data is available, by running the same type of simulation as for the different parameter sets, or by computing it as a residual of the three other effects. This can be seen by the following identity:

$$C_{tt'} = B_{tt'} + S_{tt'} + L_{tt'} + P_{tt'} \tag{4}$$

where $C_{tt'}$ is the overall change in the distribution between t and t'. Here, and accordingly for the three other effects, it is important to note that the choice of the initial and the terminal date matters. Thus, the decomposition methodology implies path dependance. For example, a change in the return to education will have a different effect on the distribution of income whether it is applied to a highly-educated or a weakly-educated population. This means, that generally $P_{tt'} \neq P_{t't}$, and likewise for B, S, and L. To assess the robustness of the results for each effect, the simulation will be performed in both directions.

The assumed household income generating model can be summarized by the following set of equations (where h stands now for the household and i for the individual):

$$\begin{aligned} L_{hi}^{jt} = \quad & (x_{hi,j=1}^t, \ldots, x_{hi,j=J}^t, z_{hi,j=1}^t, \ldots, z_{hi,j=J}^t, \upsilon_{hi,j=1}^t, \ldots, \upsilon_{hi,j=J}^t, \\ & \lambda_{x,j=1}^t, \ldots, \lambda_{x,j=J}^t, \lambda_{z,j=1}^t, \ldots, \lambda_{z,j=J}^t), \\ & i = 1 \text{ to } k_h \ \forall h \qquad \text{and} \qquad j = W, F, NF, H, I \ \forall i. \end{aligned} \tag{5}$$

$$w_{hi}^{t,j=W} = w(x_{hi}^t, u_{hi}^t, \beta^t), \qquad i = 1 \text{ to } k_h \ \forall h. \tag{6}$$

$$\Pi_{hi}^{j=NF,F} = \Pi(x_{hi}^t, z_{hi}^t, s_{hi}^t, \beta_x^t, \beta_z^t), \qquad i = 1 \text{ to } k_h \ \forall h. \tag{7}$$

$$y_h^t = \sum_{i=1}^{k_h} L_{hi}^t w_{hi}^{t,j=W} + \sum_{i=1}^{k_h} L_{hi}^t \Pi_{hi}^{t,j=NF} + \sum_{i=1}^{k_h} L_{hi}^t \Pi_{hi}^{t,j=F} + y_{0h}^t, \tag{8}$$

[8] I.e. the residual u_{it} of each individual i is expanded by the ratio $\sigma_{t'}/\sigma_t \rightarrow \tilde{u}_i^{tt'} = \frac{\sigma_{t'}}{\sigma_t} u_{it}$.

The number of persons of working age (12 years and over) in household h is k_h.

Equation (5) describes the labour supply of each household member i, where the index j stands respectively for the labour supplied as wage worker outside the family business (W), the labour supplied as manager of the family farm (F), the labour supplied as manager of a family non-farm business (NF), and the labour supplied as family help (H) in either the family farm or the family non farm business. I stands for inactivity. These functions express the labour supply of member i in household h as a function of his/her personal characteristics x_{hi}, and some characteristics of the household and its environment z_{hi}. In addition, they generally include the productive assets available in the household, as cultivable land, and for other household members than the household head, some characteristics of the household head, such as his/her labour supply choice. The two surveys used in this study do not contain sufficient information about the allocation of time between different occupations, and as a result, it is only considered whether individual i supplies labour or not in the corresponding activity j.

Equation (6) is a wage function whose arguments are typical human capital proxies and some other personal characteristics. Equation (7) is a profit function containing as arguments personal characteristics of the household member who runs the business, x_{hi}, and some household characteristics, z_{hi}, as available productive assets and the uncompensated labour input supplied by other household members in the corresponding business.

The variables v_{hi}, u_{hi}, and s_{hi} are the usual residual terms of the corresponding econometric models. They can be interpreted as 'fixed' individual effects representing the influence on wages, profits and occupational choice behaviour of unobserved variables. Naturally these terms can only be estimated for the individuals who are engaged in the corresponding activity. Moreover they are not observed for the discrete labour choice. As a result, for all non-participants these terms will be drawn randomly conditionally on the estimated residual variance and the occupational choice that is observed.

Equation (8) aggregates the different income sources over the household members. The term y^t_{0m} summarizes income from other sources, including transfers, and income from wealth. It is supposed as exogenous in the model. Income from wage work and non-farm self-employment is observed at the individual level, whereas income from farming is observed at the household level. As head of a farm, the person with the highest order number among all household members having declared to manage a farm is selected. The other involved family members are coded as family workers in that farm.[9]

[9] In most cases only one household member declared himself to manage a farm, whereas the other family members involved in agricultural activity declared themselves as family help.

3 Occupational choice, wage and profit functions

3.1 Estimation of the occupational choice functions

Table 4a
Occupational choice – household heads, multinomial logit model,
marginal effects evaluated at sample means

	wage labour		self-empl. non-agric.		self-empl. agricult.	
Expl. variable	1993	1998	1993	1998	1993	1998
Schooling	0.021	0.016	-0.014 *	-0.012 *	-0.021 *	-0.009 *
Pot. experience	0.011 *	0.009 *	-0.001 *	0.000 *	0.001 *	-0.001 *
Pot. experience^2/100	-0.022 *	-0.023 *	-0.003 *	-0.002 *	0.002 *	0.004 *
Woman	-0.201 *	-0.266 *	0.234	0.239 *	-0.051 *	-0.020 *
Non-Ivorian	-0.028 *	0.052 *	0.169 *	0.107 *	-0.070	-0.073
No land (Ref.)						
Land: from 0 to 1 ha	-0.412 *	-0.157	-0.316 *	-0.275	0.823 *	0.517 *
Land: from 1 to 2 ha	-0.467 *	-0.325	-0.447	-0.237	0.991 *	0.574 *
Land: from 2 to 5 ha	-0.498 *	-0.512	-0.450	-0.176	1.104 *	0.657 *
Land: from 5 to 10 ha	-0.465 *	-0.550	-0.658 *	-0.218	1.194 *	0.712 *
Land: more than 10 ha	-0.545 *	-0.480	-0.623	-0.246	1.232 *	0.684 *
Abidjan (Ref.)						
Other urban	-0.077 *	-0.127	0.007 *	0.009	0.185 *	0.109 *
East Forest	-0.023	-0.131	-0.238	-0.092	0.319 *	0.265 *
West Forest	-0.123	-0.041	-0.192	-0.132	0.377 *	0.224 *
Savannah	-0.242	-0.106	-0.020 *	-0.141	0.424 *	0.232 *
	wage labour and s.-empl. agr.		(Ref.) inactivity			
Expl. variable	1993	1998	1993	1998		
Schooling	0.001	0.001	0.013	0.005		
Pot. experience	0.002 *	0.001 *	-0.013	-0.009		
Pot. experience^2/100	-0.005 *	-0.002 *	0.028	0.023		
Woman	-0.075 *	-0.039 *	0.092	0.085		
Non-Ivorian	0.017 *	-0.009	-0.088	-0.078		
No land (Ref.)						
Land: from 0 to 1 ha	0.144 *	0.140 *	-0.239	-0.226		
Land: from 1 to 2 ha	0.140 *	0.158 *	-0.218	-0.170		
Land: from 2 to 5 ha	0.138 *	0.154 *	-0.293	-0.122		
Land: from 5 to 10 ha	0.128 *	0.157 *	-0.198	-0.100		
Land: more than 10 ha	0.134 *	0.150 *	-0.197	-0.108		
Abidjan (Ref.)						
Other urban	0.010 *	0.034 *	-0.124	-0.025		
East Forest	0.006	0.063 *	-0.063	-0.105		
West Forest	0.016 *	0.028 *	-0.078	-0.080		
Savannah	0.019 *	0.051 *	-0.181	-0.036		
No. of observations	9 598	4 191				
Pseudo R^2	0.477	0.422				

Notes: * = coefficient significative at the 5% level, where inactivity is the reference category. Besides the variables noted in the table, the model includes the following explicative variables: born in urban area, religion, square root of household (hh.) size, dummy if inactive adults in hh. (without accounting for the individual itself), and mean age of other hh. members.
Source: EP 1992/93 and ENV 1998; estimations by the author.

Assuming that the Ivorian labour market is imperfectly competitive, the five occupational choices mentioned above are distinguished, plus a sixth one which is self-employed farmer *and* wage worker (multi-activity). I consider the population 12 years old and over, outside the educational system and professional training. Educational investment is thus taken as exogenous in the model. If agent i makes choice j, it is

Table 4b
Occupational choice – spouses of household head, multinomial logit model,
marginal effects evaluated at sample means

	family help		wage labour		self-empl. non-agric.	
Expl. variable	1993	1998	1993	1998	1993	1998
Schooling	-0.002	-0.014	0.011 *	0.014	0.003 *	0.005 *
Pot. experience	-0.003 *	-0.005 *	0.004 *	0.009 *	0.028 *	0.026 *
Pot. experience^2/100	-0.001 *	0.002	-0.006 *	-0.011	-0.037 *	-0.036 *
Non-Ivorian	-0.045 *	0.063	0.000	-0.008	-0.058 *	-0.033 *
Prob. head wage labour	-0.585 *	-0.417 *	0.030	-0.003	0.023 *	0.079
Prob. head self-empl. non-agric.	-0.046	-0.649 *	0.024	-0.066 *	-0.005	-0.011 *
Prob. head self-empl. agric.	0.631 *	0.873 *	-0.001	-0.180	-0.361	-0.344
HH. holds land (dummy)	–	–	–	–	–	–
Abidjan (Ref.)						
Other urban	0.004	0.366 *	-0.005	-0.121 *	0.018	-0.056
East Forest	0.173 *	0.545 *	-0.005	-0.148 *	-0.202 *	-0.224 *
West Forest	0.200 *	0.330	-0.016	-0.091	-0.124	-0.132
Savannah	0.155 *	0.521 *	-0.026	-0.102	-0.143 *	-0.187

	self-empl. agricult.		(Ref.) inactivity	
Expl. variable	1993	1998	1993	1998
Schooling	–	–	-0.012	-0.005
Pot. experience	0.000 *	0.001	-0.029	-0.030
Pot. experience^2/100	0.000 *	-0.001	0.043	0.046
Non-Ivorian	0.000	0.006	0.103	-0.029
Prob. head wage labour	0.000	0.003	0.533	0.338
Prob. head self-empl. non-agric.	0.000 *	-0.083 *	0.028	0.809
Prob. head self-empl. agric.	–	–	-0.269	-0.339
HH. holds land (dummy)	0.000 *	0.021	0.000	0.008
Abidjan (Ref.)				
Other urban	–	–	-0.017	-0.183
East Forest	–	–	0.034	-0.168
West Forest	–	–	-0.060	-0.104
Savannah	–	–	0.014	-0.226
No. of observations	8 583	3 514		
Pseudo R^2	0.372	0.357		

Notes: * = coefficient significative at the 5% level, where inactivity is the reference category. If no marginal effect is noted, the corresponding coefficient was restricted to 0. Besides the variables noted in the table, the model includes the following explicative variables: born in urban area, religion, square root of household (hh.) size, number of women in hh., dummy if inactive adults in hh. (without accounting for the individual itself), and mean age of other hh. members.
Source: EP 1992/93 and ENV 1998; estimations by the author.

assumed that U_{ij} is the maximum among the J utilities, $U_{ij} > U_{ik}\ \forall\ k \neq j$. The J disturbances υ_{ij} are supposed to be independent and identically distributed with Weibull distribution. Thus, the model can be estimated by a multinomial logit model (McFadden 1973, 1984). Theoretically, it would be more correct to estimate the discrete labour supply functions simultaneously using a multinomial probit model, allowing the random terms υ_{ij} to be correlated with each other. For the sake of simplicity, the multinomial logit model is used.[10] Another issue, which is not addressed, concerns the connection between labour supply choices and migration. Vijverberg (1993) has shown that these two decisions may be intertwined for the Ivorian labour

[10]The assumption of the independence of irrelevant alternatives (IIA) was rejected by the usual Hausman test for the following outcomes, type of individuals and years: family help, wage work, and non-farm self-employment of spouses 1992/93; wage work of spouses 1998.

Table 4c.
Occupational choice – other household members, multinomial logit model,
marginal effects evaluated at sample means

	family help		wage labour		self-empl. non-agric.	
Expl. variable	1993	1998	1993	1998	1993	1998
Schooling	-0.023 *	-0.001 *	0.006 *	0.013 *	0.005 *	0.006 *
Pot. experience	0.026 *	0.012 *	0.010 *	0.014 *	0.009 *	0.009 *
Pot. experience^2/100	-0.045 *	-0.026 *	-0.017 *	-0.022 *	-0.013 *	-0.014 *
Woman	-0.163 *	-0.125 *	-0.021 *	-0.041 *	0.047 *	0.035 *
Non-Ivorian	0.047 *	-0.077 *	0.011 *	0.037	0.002	0.004 *
Prob. head wage labour	-0.152 *	-0.060	-0.039 *	-0.031	-0.030 *	0.000
Prob. head self-empl. non-agric.	0.257 *	0.329 *	-0.030	-0.094	-0.002	-0.009
Prob. head self-empl. agric.	0.561 *	0.710 *	-0.054	-0.236 *	-0.033	-0.047
HH. holds land (dummy)	–	–	–	–	–	–
Abidjan (Ref.)						
Other urban	0.095 *	0.155 *	-0.019	-0.059 *	-0.003	0.008 *
East Forest	0.230 *	0.329 *	-0.051 *	-0.083	-0.023	-0.001
West Forest	0.185 *	0.141 *	-0.035	-0.062	-0.060 *	0.004
Savannah	0.335 *	0.369 *	-0.087 *	-0.067	-0.013	-0.014

	self-empl. agricult.		(Ref.) inactivity	
Expl. variable	1993	1998	1993	1998
Schooling	0.000	0.000	0.013	-0.018
Pot. experience	0.000 *	0.000 *	-0.046	-0.036
Pot. experience^2/100	0.000 *	0.000 *	0.075	0.062
Woman	-0.002 *	-0.002 *	0.138	0.133
Non-Ivorian	-0.001	-0.001	-0.059	0.037
Prob. head wage labour	0.007 *	-0.001	0.214	0.092
Prob. head self-empl. non-agric.	0.003 *	-0.007	-0.228	-0.219
Prob. head self-empl. agric.	–	–	-0.474	-0.425
HH. holds land (dummy)	0.007 *	0.007 *	-0.004	-0.004
Abidjan (Ref.)				
Other urban	0.002 *	-0.003	-0.075	-0.101
East Forest	0.002 *	-0.005 *	-0.159	-0.240
West Forest	0.001	-0.004 *	-0.091	-0.080
Savannah	0.002 *	-0.005 *	-0.238	-0.282
No. of observations	10 867	5 180		
Pseudo R^2	0.325	0.328		

Notes: * = coefficient significative at the 5% level, where inactivity is the reference category. If no marginal effect is noted, the corresponding coefficient was restricted to 0. Besides the variables noted in the table, the model includes the following explicative variables: born in urban area, religion, matrimonial status, being child of the household head, square root of household (hh.) size, number of inactive adults in hh. (without accounting for the individual itself), mean schooling of other hh. members, and mean age of other hh. members.
Source: EP 1992/93 and ENV 1998; estimations by the author.

market.

The model is estimated for both surveys (1992/93 and 1998) and separately for the household head, his/her spouse, and the other household members. Theoretically it is plausible that labour supply decisions in the household are interdependent. This is taken into account by assuming a kind of sequential decision process, where the household head chooses first, and the other household members afterwards conditional on the decision of the household head. The decision of the household head is introduced in the occupational choice functions of the other household members in the form of estimated probabilities to find the household head as wage worker,

non-farm self-employed, or farmer. In the sample used there are very few household heads working as family help, therefore this opportunity is not modelled for household heads and the individuals concerned are coded as inactive. Likewise, only a few household members other than the household head simultaneously run a farm and have employment as wage worker. For them, only the main activity is modelled.[11]

The marginal effects associated with the estimated coefficients, calculated at the sample means, are recorded in Tables 4a-c. They provide information about the sensitivity of the probability of choosing occupation j if the explicative variable x varies by one percent. To save space only the marginal effects of the most important coefficients are presented.[12]

The most striking changes in preferences occurred for those associated to years of schooling, land and regional dummies and to occupational choice of the household head.

The simulation of occupational choices under alternative preferences requires, as mentioned in section 3, to draw residuals for the multinominal logit model. The same method is used as Fournier (1999), which allows residuals to be generated which are compatible with the observed occupational choices and the hypothesis about the distribution of the disturbance term of the multinominal logit model (see Appendix A).

3.2 Estimation of the wage and profit functions

Three main income sources are distinguished: wage income from a dependent activity, profits from farming, and profits from a non-farm independent activity.

Estimation of the wage functions
For wage workers, a typical semi-logarithmic mincerian potential wage equation (Mincer 1974) is estimated, with education and professional experience as central variables. The dependent variable is the logarithm of the monthly wage w (before taxes and transfers). Whereas in the *Enquête de Niveau de Vie* 1998 all wage workers were asked their wage, in the *Enquête Prioritaire* 1992/93 only the first and second decision maker of each household were asked. This means that particularly wage income from very young household members is often unknown. It is obvious that this selection introduces a bias in the mean of the observed wages and in the estimated returns

[11] Individuals drawn from the simulation as family help are assigned to the family business as follows: If the household possesses a farm, the individual is assigned as family help to the farm. If the family possesses one or more family non-farm business the individual is assigned to the business which is conducted by the household member with the highest order number in the survey questionnaire. If the household possesses a non-farm business and a farm, a random number out of an uniform distribution is drawn and the individual is assigned with a probability 50:50 to one of the two. If two members of one household are drawn as farmers from the simulation, the one with the highest order number is assigned as farm manager and the other as family help.

[12] The used specification implicitly assumes that there is no fixed cost involved in switching from wage labour to non-farm self-employment, but there is indeed no other assumption to make in the absence of any information about capital goods relevant for non-farm self-employment.

to the different earnings determinants. This selection effect has to be corrected in addition to the selection "being a wage worker or not". To do this a tobit model (Heckman 1979) is used.[13] In the simulation model, wages were imputed in both reference years (1992/93 and 1998), for individuals working as wage workers, but for whom earnings had not been observed using the estimated wage equation, and by drawing normally distributed residuals out of $N(0, \hat{\sigma}_u^2)$, where $\hat{\sigma}_u^2$ is the estimated residual variance in the estimated wage equation. Likewise, potential wages are calculated for the individuals not observed as wage workers, but drawn as such during the simulation exercise.

Another difficulty in the 1992/93 survey stems from the fact that the individuals were not asked their exact wage, but instead to situate it in one of nine different income classes and to give the corresponding period during which this wage was earned (day, week, month, or year). To keep the analysis simple, the discrete observations are transformed into continuous ones by simulating residuals following the method described in Gourieroux *et al.* (1987) (see Appendix B), rather than carrying out maximum likelihood estimations using the discrete values of the wages directly.

Table 5a
Wage equation – men, urban, selection model (Full MLE)

Dependent variable				
log monthly wage	1992/93		1998	
Schooling	0.125	(0.007)	0.094	(0.007)
Pot. experience	0.057	(0.010)	0.048	(0.008)
Pot. experience^2/100	-0.046	(0.015)	-0.034	(0.013)
Non-Ivorian	-0.244	(0.035)	-0.091	(0.056)
Multi-activity (IV)	-0.274	(0.066)	0.114	(0.134)
Abidjan	0.211	(0.031)	0.211	(0.050)
Intercept	9.605	(0.283)	10.094	(0.177)
ρ	-0.362	(0.163)	-0.725	(0.051)
$\hat{\sigma}_u$	0.684		0.924	
No. of observations	6 873		2 510	
No. of uncensored observations	2 222		1 057	

Notes: Standard errors in parentheses. The explicative variables in the selection model are: schooling, age, square of age, matrimonial status, relationship to household (hh.) head, dummy if migrated during the last five years, number of adult men in hh., number of adult women in hh., and number of inactive adults in hh (without accounting for the individual itself). Concerning the instrumentation of "multi-activity" see section 4.2.
Source: EP 1992/93 and ENV 1998; estimations by the author.

The model is specified separately for men living in urban areas and men living in rural areas, because of the different structures of urban and rural labour markets in Côte

[13]The variables determining the position of an individual in the household are proven to be a subset of the variables determining the participation process. Furthermore, the estimated coefficients of the wage equation using two separate selection equations are almost identical to the estimated coefficients using only one selection equation. Accordingly, the specification of one common selection equation can be considered as sufficient. To be consistent with the occupational choice model (section 3.1), multiple choices should be taken into account in the selection model of the wage equation. However specifications along the lines of Lee (1983) with a selection process over multiple choices rely on strong distributional assumptions about the error terms. Thus, to keep the model simple, the usual Heckman specification is used.

Table 5b
Wage equation – men, rural, selection model (Full MLE)

Dependent variable *log monthly wage*	1993		1998	
Schooling	0.222	(0.023)	0.192	(0.017)
Pot. experience	0.102	(0.023)	0.090	(0.017)
Pot. experience^2/100	-0.118	(0.034)	-0.117	(0.027)
Non-Ivorian	0.551	(0.178)	0.414	(0.154)
Multi-activity (IV)	-0.908	(0.162)	-0.149	(0.152)
East Forest (Ref.)				
West Forest	-0.478	(0.144)	0.408	(0.123)
Savannah	0.421	(0.156)	-0.039	(0.142)
Intercept	7.022	(0.579)	7.796	(0.438)
ρ	0.014	(0.145)	0.042	(0.130)
$\hat{\sigma}_u$	1.304		1.162	
No. of observations	6 198		3 494	
No. of uncensored observations	558		521	

x

Notes: Standard errors in parentheses. The explicative variables in the selection model are: schooling, age, square of age, relationship to household (hh.) head, square root of hh. size, dummy if migrated during the last five years, number of inactive adults in hh. (without accounting for the individual itself), and dummies for ethnic affiliation. Concerning the instrumentation of "multi-activity" see section 4.2.
Source: EP 1992/93 and ENV 1998; estimations by the author.

Table 5c
Wage equation – women, selection model (Full MLE)

Dependent variable *log monthly wage*	1992/93		1998	
Schooling	0.192	(0.016)	0.134	(0.025)
Pot. experience	0.080	(0.015)	0.090	(0.014)
Pot. experience^2/100	-0.078	(0.023)	-0.126	(0.023)
Other urban (Ref.)				
Abidjan	0.237	(0.075)	-0.112	(0.099)
Rural	-0.907	(0.134)	-0.477	(0.115)
Intercept	8.528	(0.379)	9.078	(0.688)
ρ	-0.081	(0.108)	-0.266	(0.269)
$\hat{\sigma}_u$	0.771		0.991	
No. of observations	15 985		6 784	
No. of uncensored observations	477		545	

Notes: Standard errors in parentheses. The explicative variables in the selection model are: schooling, age, square of age, matrimonial status, relationship to household (hh.) head, dummy if migrated during the last five years, square root of hh. size, number of men in hh., number of women in hh., and number of inactive adults in hh. (without accounting for the individual itself).
Source: EP 1992/93 and ENV 1998; estimations by the author.

d'Ivoire. For women, this difference seems less pronounced, therefore for this segment only one model is estimated, but a dummy variable for rural location is introduced. To account for the multiple activities of some wage workers, a dummy variable is introduced in the wage equation taking the value 1 if the individual supplies labour as wage earner *and* independent farmer ($Y = wf$), and 0 otherwise ($Y \neq wf$). It is obvious that this dummy cannot be treated as exogenous and must be instrumented. As Fournier (1999) does, the difference between the predicted probabilities "to be wage earner *and* independent farmer", $\tilde{P}_{wf}$, and "to be only wage earner", $\tilde{P}_w$, from the multinomial logit model (see section 4.1) is used as instrument. The idea behind

this instrumentation is that an individual who supplies the two forms of labour gets a higher utility than by supplying only wage work, which implies $U_{wf} > U_w$.

The estimated coefficients of the wage equations show a general decrease in returns to schooling and a narrowing of the wage differential between Ivorians and Non-Ivorians over the period under study. Furthermore, a strong regional redistribution of returns in rural Côte d'Ivoire in favour of the West Forest Region can be noted. The dispersion of earnings due to unobserved wage determinants, increased for men in urban areas and for women, and declined for men in rural areas.

Estimation of the non-agricultural profit functions
For the self-employed with a non-farm business, the same type of semi-logarithmic model as for wage workers is estimated. The dependent variable is the logarithm of the declared monthly individual earnings (before taxes and transfers) of the person who declared running a non-farm business. A central argument in the non-farm profit function is the number of uncompensated family members involved (including the manager).[14] This variable has to be considered as endogenous. However, the attempt to instrument this variable has led to unstable estimates, and the usual Hausman specification test did not reject the hypothesis of a non-systematic difference between the IV estimator and the simple OLS estimator. One explanation could be that the majority of non-farm enterprises employed no additional household members, and very few employed two or more additional household members. Further firm and manager characteristics, like the region of the firms location, education, experience, and the sex of the manager are introduced in the profit functions. Unfortunately the data sets contain no usable information about potentially important productive assets in a firm.

The problem encountered in the 1992/93 survey of missing declarations of earnings for individuals not among the first and second decision makers in their household and of earnings which are only declared in classes is solved in the same way as for wage workers (see above).

The most striking feature emerging from the estimations is the decline in productivity of an additional person involved in the business between 1992/93 and 1998 (Table 6). Furthermore, the earnings differentials between regions show that the West Forest almost caught up with the earnings level in the stratum "other cities" in 1998. In contrast, earnings in the Savannah region relatively lost ground. The residual variance remained more or less constant.

Estimation of the agricultural profit functions
The dependent variable of the agricultural profit function is the logarithm of earn-

[14] Labour supplied in the enterprise by family members is not directly recorded in the enterprise module. But, in the case where several members in the household run a business, provided family work can be deducted by combining employment status and industry codes in the employment module. Hours supplied by family workers are not available in the data set, so the quantity of work has to be approximated by the number of family members involved.

Table 6
Non-agriculture profit function, selection model (Full MLE)

Dependent variable *log monthly profit*	1992/93		1998	
No. of household members involved in business	0.185	(0.032)	0.127	(0.046)
Schooling	0.076	(0.006)	0.079	(0.008)
Pot. experience	0.059	(0.006)	0.073	(0.011)
Pot. experience^2/100	-0.070	(0.008)	-0.081	(0.015)
Woman	-0.689	(0.035)	-0.729	(0.059)
Abidjan (Ref.)				
Other urban	-0.188	(0.040)	-0.126	(0.063)
East Forest	-0.480	(0.086)	-0.558	(0.122)
West Forest	-0.892	(0.103)	-0.174	(0.099)
Savannah	-0.294	(0.076)	-0.630	(0.152)
Intercept	9.526	(0.146)	9.216	(0.253)
ρ	0.127	(0.041)	0.112	(0.084)
$\hat{\sigma}_u$	1.026		0.995	
No. of observations	29 056		12 888	
No. of uncensored observations	3 849		1 347	

Notes: Standard errors in parentheses. Individual characteristics concern head of business. The explicative variables in the selection model are: schooling, experience, square of experience, sex, religion, dummy for Non-Ivorian, square root of household (hh.) size, dummy for inactive adults in hh. (without accounting for the individual itself) , mean age of other hh. members, dummy for land property, location of residence.
Source: EP 1992/93 and ENV 1998; estimations by the author.

ings derived from the sale and self-consumption of agricultural products (food crops, export crops and livestock) during the previous twelve month minus the cost of hired labour from outside the household. The profit includes the implicit wages of the family workers and the implicit cost of the cultivated land. As mentioned above, the number of family members involved in the farm has to be considered as endogenous and is therefore instrumented. This assumption is confirmed by a Hausman specification test, indicating that the OLS estimator is biased downward. Family composition variables are used as instruments. The model is estimated with 2SLS. There was no sign of a systematic self-selection into agricultural activity.

Besides the number of family members involved, the amount of available land (cultivated and left fallow[15]) is the principal argument in the agricultural profit function. Furthermore, a categorical variable is introduced whether the household owns a home or not. Even if this asset does not directly contribute to the generation of income, it may do so indirectly, both through its function of shelter and as collateral for borrowing (Grootaert 1997).

Multi-activity in the sense that a farmer works periodically also as wage earner is taken into account via a binary categorical variable in the estimation. This variable is instrumented using the same procedure as for wage earners. In both surveys, I detected some households with implausibly low or implausibly high agricultural profits. These households are excluded from the estimation and profits are imputed, likewise, using the same procedure as for wage earners.

[15]The data from 1992/93 did not allow the separation of cultivated land and that left fallow.

Table 7
Agriculture profit function, 2SLS model

Dependent variable				
log profit last 12 month	1992/93		1998	
No. of household members				
involved in farm work (IV)	0.153	(0.010)	0.148	(0.014)
Land: no land or less than 1 ha (Ref.)				
Land: from 1 to 2 ha	0.498	(0.045)	0.176	(0.215)
Land: from 2 to 5 ha	0.723	(0.047)	0.663	(0.212)
Land: from 5 to 10 ha	1.074	(0.055)	0.932	(0.214)
Land: more than 10 ha	1.117	(0.061)	1.156	(0.213)
Homeowner	0.086	(0.034)	0.296	(0.055)
Pot. experience	0.017	(0.004)	0.022	(0.006)
Pot. experience^2/100	-0.025	(0.005)	-0.034	(0.007)
Woman	-0.141	(0.040)	-0.323	(0.063)
Multi-activity (IV)	-0.071	(0.068)	-0.183	(0.115)
East Forest (Ref.)				
Urban	-0.212	(0.042)	-0.234	(0.085)
West Forest	0.094	(0.038)	0.319	(0.056)
Savannah	0.327	(0.036)	0.016	(0.053)
Intercept	11.618	(0.088)	11.570	(0.231)
$\hat{\sigma}_u$	0.848		0.888	
No. of observations	4 454		1 899	
Adj. R^2	0.359		0.298	

Notes: Standard errors in parentheses. Individual characteristics concern head of business. The instrumental variables for "number of household members (hh.) involved in farm work" are: square root of hh. size, number of adult men in hh., number of adult women in hh., number of children 0 to 5 years old in hh., number of children 6 to 14 years old in hh., number of inactive adults in hh., mean schooling of hh. members. Concerning the instrumentation of "multi-activity" see section 4.2.
Source: EP 1992/93 and ENV 1998; estimations by the author.

Despite the positive evolution of the export crop sector, the return to family members involved remained constant, and the return to land decreased, particularly for small scale farmers, i.e. mainly food crop farmers (Table 7). However, it is obvious that the number of involved family members is only a very approximative measure of the amount of labour supplied. The participating household members may have reduced on average their supplied hours of work. Analysis of the data showed that the quantity of land held by households increased significantly between 1993 and 1998. Therefore, it seems that the increase in agricultural production (which took place as well as the price boost) was mainly due to an expansion in cultivated land and hired labour. However, further data has to be checked to verify if the increase in available land, observed in the data, is real or simply a measurement error.[16]

The relative price increase of export crops is entirely reflected by the change of the coefficients associated to the regional dummies. The West Forest is the principal region for the cultivation of cocoa and coffee, so the evolution of the coefficients yields what can be expected.

[16] In harmony with this evolution, the *Enquête de Niveau de Vie* 1995 already shows an increase in the average amount of land held by households.

4 Decomposition by microsimulation of the evolution of income distribution

Abidjan

The simulation model suggests that the increase in inequality by 3.1 points in the Gini coefficient observed for Abidjan between 1992 and 1998 resulted from various forces which partly offset each other (Table 8). [17]

Table 8
Decomposition by microsimulation of the change in the distribution of household income per adult equivalent (Oxford scale)

	Initial population 1992/93				Initial population 1998			
	Gini	dGini	E(0)	dE(0)	Gini	dGini	E(0)	dE(0)
ABIDJAN								
Initial values	0.497		0.505		0.529		0.692	
Observed change		0.031		0.187		0.031		0.187
Price observables	0.472	-0.025	0.461	-0.044	0.570	-0.042	0.780	-0.089
Returns to school.	0.475	-0.022	0.463	-0.042	0.578	-0.049	0.804	-0.113
Returns to exp.	0.501	0.003	0.510	0.005	0.533	-0.005	0.706	-0.015
Ivoir./Non-I. wage diff.	0.495	-0.002	0.501	-0.004	0.530	-0.002	0.695	-0.003
Price unobservables	0.520	0.022	0.553	0.048	0.491	0.038	0.621	0.071
Total price		-0.003		0.004		-0.004		-0.018
Occupational choice	0.476	-0.021	0.439	-0.066	0.529	-0.001	0.649	0.042
Price and occup. choice		-0.024		-0.062		-0.005		0.024
Population structure effect		0.055		0.249		0.036		0.162
OTHER URBAN								
Initial values	0.489		0.511		0.487		0.539	
Observed change		-0.002		0.028		-0.002		0.028
Price observables	0.476	-0.013	0.492	-0.019	0.503	-0.016	0.567	-0.028
Returns to school.	0.473	-0.015	0.481	-0.030	0.515	-0.029	0.596	-0.057
Returns to exp.	0.485	-0.004	0.503	-0.008	0.493	-0.006	0.554	-0.015
Ivoir./Non-I. wage diff.	0.488	0.000	0.510	0.000	0.488	-0.001	0.541	-0.002
Returns to land	0.488	-0.001	0.511	0.000	0.484	0.003	0.533	0.006
Price unobservables	0.500	0.011	0.535	0.024	0.467	0.020	0.505	0.034
Total price		-0.002		0.005		0.004		0.006
Occupational choice	0.489	0.000	0.501	-0.010	0.513	-0.026	0.555	-0.016
Price and occup. choice		-0.001		-0.005		-0.022		-0.010
Population structure effect		-0.001		0.034		0.020		0.038

The simulation of income distribution for 1992 (1998) by applying the occupational preferences of 1998 (1992) indicates that modifications on the labour market contributed to a reduction in inequality. The transition matrix (Table 9) shows that the activity rate (population 12 years old and over outside schooling and training) rises from 52.8 percent to 59.1 percent between 1992 and 1998, if one uses the 1988's preferences for 1992. The inflow into dependent wage work (+7 points) out of inactivity and non-farm self-employment is remarkable. The simulated transitions on the labour market are completely in line with the observed changes in the occupational structure between 1992 and 1998. These occupational changes suggest two things. Firstly, a part of the involuntary unemployed individuals found jobs after 1994. Second, households tried to overcome declines in real income by an increase in labour

[17] In what follows mainly the Gini coefficient is maintained as inequality measure, but the decomposition can be made likewise with all other standard inequality measures.

Table 8
(...cont.)

	Initial population 1992/93				Initial population 1998			
	Gini	dGini	E(0)	dE(0)	Gini	dGini	E(0)	dE(0)
RURAL AREAS								
Initial values	0.417		0.393		0.480		0.472	
Observed change		0.063		0.079		0.063		0.079
Price observables	0.439	0.022	0.425	0.033	0.483	-0.003	0.485	-0.013
Returns to school.	0.411	-0.006	0.385	-0.008	0.497	-0.017	0.501	-0.030
Returns to exp.	0.412	-0.005	0.392	0.000	0.485	-0.006	0.481	-0.009
Ivoir./Non-I. wage diff.	0.417	0.000	0.393	0.001	0.481	-0.001	0.474	-0.002
Returns to land	0.419	0.002	0.398	0.006	0.474	0.006	0.463	0.009
Price unobservables	0.431	0.014	0.420	0.028	0.458	0.021	0.435	0.037
Total price		0.036		0.060		0.018		0.023
Occupational choice	0.421	0.004	0.387	-0.006	0.482	-0.003	0.472	0.000
Price and occup. choice		0.040		0.055		0.016		0.024
Population structure effect		0.023		0.025		0.047		0.056
NATIONAL								
Initial values	0.494		0.512		0.508		0.563	
Within-group inequality			0.441				0.537	
Between-group inequality			0.071				0.026	
Observed change		0.014		0.050		0.014		0.050
Price observables	0.483	-0.011	0.497	-0.015	0.540	-0.032	0.630	-0.067
Returns to school.	0.471	-0.023	0.473	-0.039	0.547	-0.039	0.640	-0.078
Returns to exp.	0.476	-0.017	0.486	-0.026	0.512	-0.004	0.573	-0.010
Ivoir./Non-I. wage diff.	0.495	0.001	0.515	0.003	0.508	0.000	0.562	0.001
Regional differential	0.484	-0.010	0.496	-0.016	0.511	-0.003	0.574	-0.011
Returns to land	0.489	-0.005	0.506	-0.006	0.500	0.008	0.550	0.013
Price unobservables	0.498	0.004	0.525	0.013	0.482	0.026	0.515	0.048
Total price		-0.007		-0.002		-0.006		-0.019
Occupational choice	0.496	0.003	0.505	-0.007	0.515	-0.007	0.557	0.006
Price and occup. choice		-0.005		-0.010		-0.014		-0.013
Population structure effect		0.019		0.060		0.028		0.064

Notes: E(0) is the mean logarithmic deviation. Positive change=disequalizing effect from 1992/93 to 1998. Negative change=equalizing effect from 1992/93 to 1998.
Source: EP 1992/93 and ENV 1998; simulations by the author.

market activity of former voluntary unemployed family members. The necessary supplement jobs were provided thanks to the recovery of private investment after the devaluation.

In the same way as the occupational choice effect, the price effect also tended towards a more equal distribution (-3.4 points in Gini on average over both simulations), mainly via a drop in the return to schooling and a decline in the wage differential between Ivorians and Non-Ivorians. The major factor behind these two effects may be the freezing of wages in the public sector.

In contrast, inequality increased due to changes in the returns to unobserved earnings determinants, possibly reflecting more heterogeneity in working time among individuals. One can also assume that the major macroeconomic events (devaluation, boom of cocoa and coffee world market prices, adjustment policy) affected in a very distinct way the different sectors of the economy and thus led to a higher residual variance.

Likewise, changes in the socio-economic population structure had a non-equalizing

Table 9
Simulated changes in occupational choices (in percent)

	Simulated with 1998 occupational choice behaviour						
observed 1992/93	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1992
ABIDJAN							
inactive	81.3	11.6	4.6	0.8	1.8	0	47.2
pure wage labour	1.9	94.3	3.1	0.1	0.7	0	26.9
self-empl. non-a.	6.6	13.1	79.3	0.5	0.4	0	22.3
self-empl. agric.	0	23.9	9.8	66.3	0	0	0.5
family help	17.5	14.9	2.1	6.2	59.3	0	2.9
wage labour/s-empl. agric.	13.3	52.6	6.3	0	0	27.8	0.3
Total 1998′	40.9	34.5	20.8	1.0	2.8	0.1	100
OTHER URBAN							
inactive	85.3	5.4	3.4	0.5	5.4	0	38.4
pure wage labour	3.4	91.3	3.4	0.1	1.7	0.1	15.7
self-empl. non-a.	10.3	8.7	75.5	0.4	5.0	0.1	25.3
self-empl. agric.	10.0	13.2	6.1	62.7	1.4	6.7	6.7
family help	16.1	6.9	4.3	3.7	69.0	0	12.0
wage labour/s-empl. agric.	3.4	20.2	1.4	2.7	0.0	72.3	1.8
Total 1998′	38.6	20.6	21.9	5.0	12.0	1.8	100
RURAL AREAS							
inactive	72.3	3.6	1.9	1.5	20.1	0.6	13.7
pure wage labour	0.5	90.8	0.5	0.6	6.5	1.2	2.8
self-empl. non-a.	6.0	10.6	58.0	1.7	22.5	1.2	5.5
self-empl. agric.	2.5	5.4	0.9	83.6	0.8	6.7	24.8
family help	7.5	4.9	2.7	1.3	83.7	0	50.6
wage labour/s-empl. agric.	0	14.8	0.3	6.3	0.0	78.6	2.6
Total 1998′	14.6	7.8	5.1	21.8	46.7	3.9	100
NATIONAL							
inactive	79.6	7.0	3.3	0.9	8.9	0.2	25.2
pure wage labour	2.1	92.7	2.8	0.2	2.0	0.2	10.0
self-empl. non-a.	8.0	10.6	72.2	0.8	8.0	0.4	12.9
self-empl. agric.	3.1	6.2	1.4	81.7	0.9	6.7	16.4
family help	8.3	5.2	2.8	1.5	82.2	0	33.5
wage labour/s-empl. agric.	1.0	16.9	0.7	5.4	0.0	76.0	2.0
Total 1998′	24.6	15.5	11.6	14.4	31.2	2.7	100

Notes: In this table, but not in the simulation model, family workers in a non-agricultural business and family helpers in a farm are aggregated.
Source: EP 1992/93 and ENV 1998; simulations by the author.

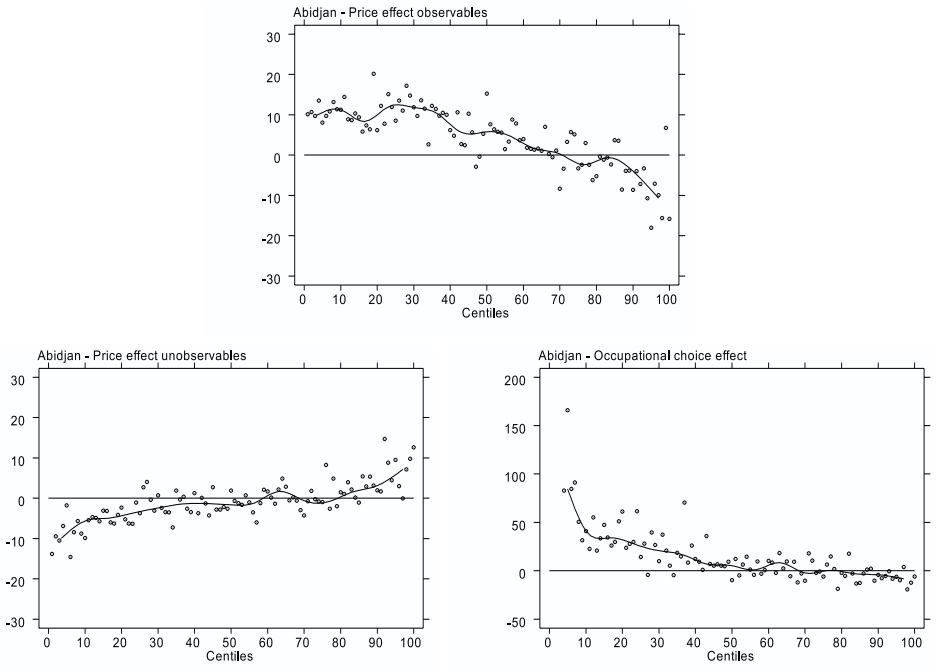
effect on income distribution. Factors behind this phenomenon may have been the rejuvenation of the population and longer school enrolment of the young. Indeed, natural population growth and immigration are still high in Côte d'Ivoire, so that each year, particularly in Abidjan, a large number of young people come onto the labour market, with no experience and hence potentially low wages. In the framework of the adjustment program, the public administration stopped recruiting school graduates, which destroyed potentially favourable posts for the young. On average younger cohorts also stay longer in school and contribute thus less or nothing to the family income.[18] Another factor, included in the population effect, could be the higher mortality of adults of working age due to AIDS.

If the decomposition is performed for the two alternative poverty indicators the picture is quite similar in the sense that factors which reduced inequality also reduced

[18]Of course, the long term effects may be very positive.

poverty (table not presented). Changes in returns to observed earnings determinants and changes in occupational preferences reduced poverty. Modifications in returns to unobserved earnings determinants and variations of the socio-demographic population structure increased poverty. However, it is interesting to see that a change in the returns to schooling had a decreasing effect on inequality, but an increasing effect on poverty. The direction and magnitude of household income changes due to modifications in occupational choices and returns to observables and unobservables can also be seen in Figure 1, which shows the relative change of mean household income for each household income centile by performing the three counterfactual simulations.

Figure 1
Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for Abidjan using as starting point 1992 (smoothing by a cubic spline)



Other urban
In the other urban centres of Côte d'Ivoire inequality remained constant. However, as the microsimulation exercise shows (Table 8), changes in the returns to different earnings determinants worked in favour of a more equal distribution. As in Abidjan, a drop in the return to education had a homogenizing effect on incomes.

In contrast, changes in the returns to unobserved earnings determinants contributed obviously to a higher dispersion of household incomes (approximately +1.5 points in Gini).

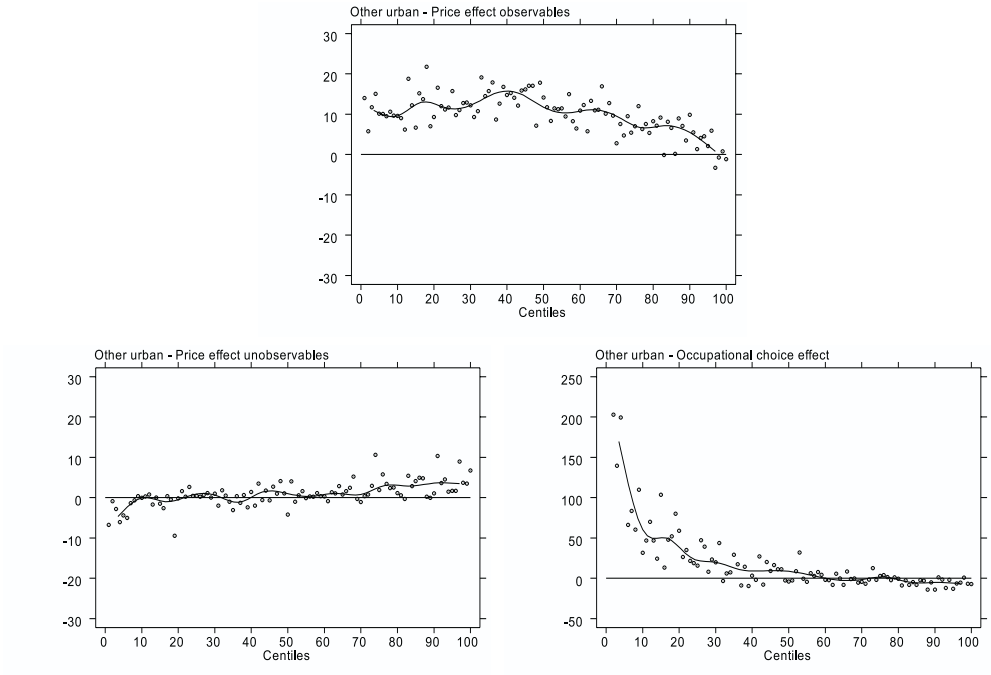
The simulation of occupational choices by taking one population as starting point

and applying the occupational preferences of the other year, produces an increase in wage labour, a decrease in non-agricultural and agricultural independent activity, and a more or less constant share working as family help (Table 9). These evolutions had an equalizing but weak effect on income distribution. Using the population of 1993 as initial population implies that even the pure occupational choice effect was close to zero.

As in Abidjan and rural areas (see below), changes in the population structure had a non-equalizing effect. Possible factors behind this phenomenon may be similar to those outlined above for Abidjan, including internal migration.

Whereas the degree of inequality remained constant between 1993 and 1998, poverty decreased by 3 points if the poverty line of US$1 and by 5.5 points if the poverty line of US$2 is retained. This reduction was reached mainly be the channel of changes in the returns to observed earnings determinants, even if partly offset by a higher dispersion of the returns to unobserved earnings determinants. This can be seen very clearly in Figure 2. The changes mentioned in occupational preferences and the socio-demographic population structure had no significant effect on poverty (table not presented).

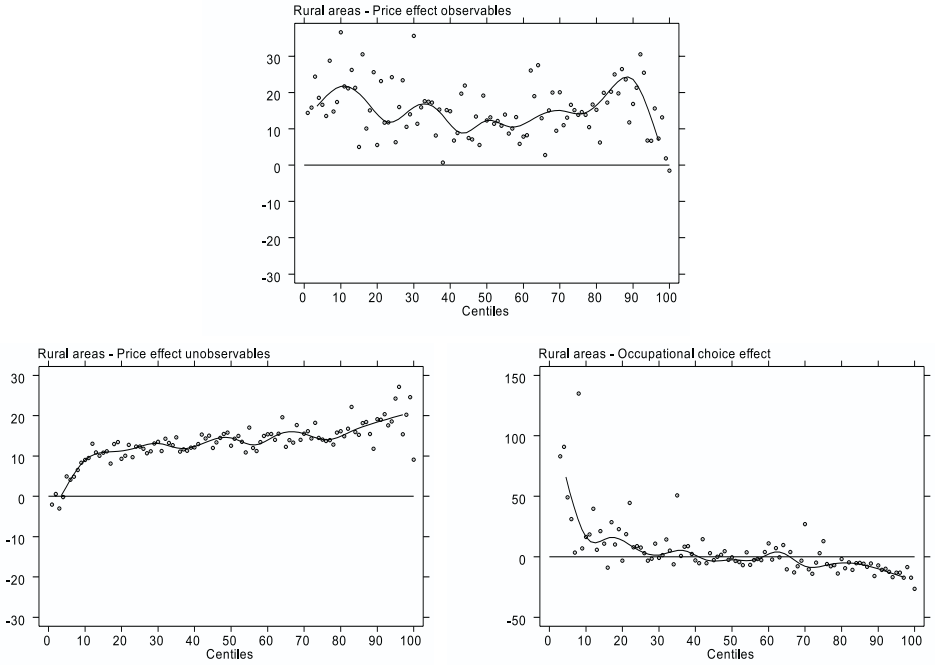
Figure 2
Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for other urban areas using as starting point 1993 (smoothing by a cubic spline)



Rural areas

Rural areas experienced a strong increase in inequality with a Gini coefficient rising from 0.42 in 1993 to 0.48 in 1998. Changes in participation behaviour led to a higher proportion of the population involved in dependent wage work and a lower proportion involved in independent non-farm, or farm activities (Table 9). However, as the descriptive statistics in Table 3 show, even if the total share of farmers decreased (-7.5 percentage points among men), the share of export crop farmers remained more or less constant. That is what we can expect in the context of a devaluation and increasing international prices for coffee and cocoa. In particular, part of the food crop farmers became, what I call "export crop farmer" simply because of pure price effects (here a farmer is considered as an export crop farmer, if sales of cocoa, coffee and cotton represent more than 50% of the total value of agricultural production (33% in the Savannah region)), or by effectively substituting food crop production by export crop production. In addition, a significant share of food crop farmers reduced their labour supply on their own farms and started working as wage workers on the larger cocoa or coffee plantations or in agro-industry (this is in line with the increase of multi-activity, +36% among men). These latter changes in occupational choices explain the overall reduction in independent farmers. The share of wage workers may have also increased as a result of immigrants from neighbouring countries who found work on the Ivorian cocoa and coffee plantations.

Figure 3
Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for rural areas using as starting point 1993 (smoothing by a cubic spline)



Concerning the effect of isolated changes in occupational preferences on income inequality, the two simulation variants might seem ambiguous. Taking the population of 1993 as initial population implies a slightly more unequal income distribution. In contrast, taking the population of 1998 as initial population implies a slightly more equal income distribution (see Table 8). This raises thus the problem of "path dependence" (see section 3).[19] However, the distributional effects, whether equalizing or non-equalizing, are so small that we should rather concentrate on the effects of changes in returns, which seem much more important.

The decrease in the returns to land, particularly for small scale farmers (thus mostly food crop farmers) as well as changes in the returns to unobserved earnings determinants had a non-equalizing effect on the income distribution. Important unobserved factors may be the use of fertilizers and market access. In contrast decreasing returns to schooling (concerns only wage workers and self-employed outside agriculture) and potential experience had an equalizing effect. Together, price changes had a strong non-equalizing effect. This can be clearly seen in Figure 3, showing that the upper tail of the household income distribution knew significant income gains.

Changes in the socio-demographic population structure, including possible changes in the distribution of land,[20] worked towards a more unequal income distribution.

In spite of the increase in inequality, poverty significantly decreased in rural areas. The simulations show that this decline is mainly due to modifications in remuneration rates of observed and unobserved earnings determinants. Occupational choices *per se* had a poverty enhancing effect. But in connection with the price changes they allowed a large part of the rural population to rise above the poverty line (table not presented).

National – all regions

After analyzing the forces behind the evolution of inequality in the three different strata "Abidjan", "other cities", and "rural", it is interesting to see how these forces interacted at the national level. The decomposition of the evolution of the mean logarithmic deviation shows (Table 8), that within-region inequality increased, whereas between-region inequality decreased, such that overall inequality rose only slightly. The share of urban households among the poor increased from 28 to 37 percent and from 31 to 38 percent if the US$1 poverty line and the US$2 poverty line respectively is retained. This result confirms the phenomenon of an urbanization of poverty in Côte d'Ivoire, which was also stated by Grimm, Guénard and Meslplé-Somps (2001).

[19] The problem of "path dependance" arises frequently in this type of decomposition. For instance, in the Indonesian study of Alatas and Bourguignon (2000), this problem appears when trying to distinguish the respective contribution of changes in occupational preferences and changes in the socio-demographic population structure. The authors assume that unobserved determinants of migration decisions, which should indeed only be taken into account by changes in the socio-demographic population structure, introduce a bias in the occupational choice functions.

[20] It is evident that the treatment of the input "land" as an exogenous given "endowment" is less satisfactory. Investment in land, and decisions about its use are without doubt crucial behaviours even in the short and medium term.

The simulations (Table 8) show that the changes in returns to observed earnings determinants had an equalizing effect on overall income distribution (Gini -1 to -3 points). Changes in returns to schooling and experience as well as regional remuneration differentials contributed mainly to this decline. Modifications in the variance of unobserved income determinants had a non-equalizing effect (Gini +0.4 to 2.6 points). Possible explanations have been given above. Changes in the employment structure had only a weak distributional effect. In contrast, changes in the socio-demographic population structure had a non-equalizing effect in all three strata and thus also on the national level.

5 Conclusion

The purpose of this study was to analyse Ivorian income distribution between 1992/93 and 1998, to identify the various forces behind its evolution, and to connect them with the profound economic and socio-demographic changes which occurred in the 1990s, including the devaluation of the CFA Franc in 1994 and the accompanying structural adjustment policy.

The microsimulations show that in Abidjan changes in the employment structure, i.e. a decline in unemployment, a higher activity rate and a boost in employment in the private (formal) wage sector, in connection with changes in the returns to observed earnings determinants on the labour market led to less inequality and poverty. However, these effects were offset on the one hand by more heterogeneity in unobserved earnings determinants, probably due to the very distinct impact of macroeconomic shocks on the different economic sectors, and, on the other hand, by changes in the population structure.

In contrast, rural areas experienced strong growth in household income accompanied by a significant rise in inequality but also a remarkable decline in poverty. The major factors behind the rise in inequality were changes in the socio-demographic population structure and changes in returns on the labour market. Changes in the employment structure *per se* had only a weak distributional effect. Furthermore, the positive evolution of the export crop sector benefitted mainly the West Forest region, which also led to rising income differentials within rural Côte d'Ivoire. However, the changes in returns to the observed and unobserved earnings determinants allowed a large part of rural households to increase their incomes and to escape poverty.

Concerning the growth and inequality link, it is interesting to find that both the negative income growth in Abidjan and the positive income growth in rural Côte d'Ivoire, were connected with rising inequality. However, the devaluation of the CFA Franc, and the structural adjustment program (including the recovery of international aid), coupled with the price boom in the coffee/cocoa sector caused a significant redistribution between rural and urban areas.[21] Within-region inequality increased and

[21] ...which would have been even higher if the CAISTAB had not absorbed a part of the surplus due to the increase in coffee and cocoa prices.

between-region inequality decreased. The share of the urban population among the poor rose, whereas that of the rural population declined. Thus the Ivorian experience between 1993 and 1998 is quiet different from that of the 1980s. The 1980s were marked by a phase of structural adjustment (without devaluation of the currency) followed by a phase of destabilization. Grootaert (1995), for example, showed that during this period poverty rose in urban areas as well as in the countryside, especially among export crop farmers.

The findings in this paper comply with most of the short and medium term predictions of computable general equilibrium (CGE) models applied to the Ivorian case. Cogneau and Collange (1998), for instance, predict, as a result of the devaluation, a reduction in unemployment by almost 2 points as well as a regression of real incomes in urban areas, but an increase in real incomes in rural areas. They also find, a strong redistribution between the urban and rural sector, and thus a decrease in between-inequality. Bourguignon, de Melo and Suwa-Eisenmann (1995) underline the role of wage moderation in diminishing unemployment and thus allowing the industry to benefit fully from the devaluation. In contrast, whereas the CGE models predicted income stability for urban (informal) self-employed workers, this study suggests that their earnings declined.

However, recent evolutions in the world market prices of export crops show that a large part of the Ivorian population remains vulnerable. Furthermore, the political instability evident since December 1999 and the subsequent freeze of international aid discourages and hinders private investment, suggesting that the Ivorian economy today faces a crisis comparable to that experienced at the beginning of the 1990s.

I believe that this case study provides deep insights about the possible links between growth, inequality and poverty during macroeconomic adjustment, which may apply to other countries too. However, it is obvious that the chosen approach is not without its limits. A complete representation of the equilibrating process on the labour market would be more satisfactory, but this would go beyond the scope of this paper, and will therefore be left for future work.

Appendix

A Simulation of residuals for the multinomial logit model

As shown by Fournier (1999), it is possible to generate residuals for the multinomial logit model that are compatible with the observed occupational choices and the hypothesis about the distribution of the disturbance term of the multinomial logit model.

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

$$U_j = \lambda_j' x_j + \upsilon_j, \tag{9}$$

where x_j is a vector of individual and household characteristics and υ_j are residuals, which are independent and identically distributed with Weibull distribution (McFadden 1973).

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

$$F(\upsilon_j|\hat{\lambda_j}'x_{j^\circ} + \upsilon_{j^\circ} > \max_{j\neq j^\circ}(\hat{\lambda_j}'x_j + \upsilon_j)). \tag{10}$$

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

$$f(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{f(\upsilon_{j^\circ})}{\Pr(\text{act} = j^\circ)} \int_{\dots}^{\dots} \int_{(\upsilon_{j^\circ} > \max_{j\neq j^\circ}(g_j+\upsilon_j)-g_{j^\circ})}^{j\neq j^\circ} f(\upsilon_j)\mathrm{d}\upsilon_j, \tag{11}$$

thus

$$f(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{f(\upsilon_{j^\circ})}{\Pr(\text{act} = j^\circ)} \int_{\dots}^{\dots} \int_{(\upsilon_{j^\circ} > g_j+\upsilon_j-g_{j^\circ})}^{j\neq j^\circ} f(\upsilon_j)\mathrm{d}\upsilon_j,$$

and

$$f(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{f(\upsilon_{j^\circ})}{\Pr(\text{act} = j^\circ)} \prod_{j\neq j^\circ} F(\upsilon_{j^\circ} + g_{j^\circ} - g_j).$$

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

$$F(\upsilon_{j^\circ}|\text{act} = j^\circ) = \exp\Big(- \frac{\sum_j \exp(g_j)}{\exp(g_{j^\circ})} \exp(-\upsilon_{j^\circ})\Big). \tag{12}$$

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

$$F(\upsilon_j|\upsilon_j < g_{j^\circ} + \tilde{\upsilon}_{j^\circ} - g_j) = \frac{F(\upsilon_j)}{F(g_{j^\circ} + \tilde{\upsilon}_{j^\circ} - g_j)}, \quad \forall j \neq j^\circ \tag{13}$$

which yields under the specification of the multinomial logit model:

$$F(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{\exp(-\exp(-\upsilon_j))}{\exp(-\exp(g_j - g_{j^\circ} - \tilde{\upsilon}_{j^\circ}))}. \tag{14}$$

The conditional distributions defined in (12) and (14) can be easily inverted, and residuals can be calculated by drawing F_j's and F_{j°'s from a uniform distribution on the interval $[0, 1]$.

B Transformation of discrete to continuous earnings

In the *Enquête Prioritaire* 1992/93 individuals were not asked their exact wage, but instead to situate it in one of nine different income classes and to give the corresponding period during which this wage was earned (day, week, month, or year).[22]

[22] Almost 100 percent of the declarations concern wages per month or per year.

This section explains how I simulated continuous values of the unobservable endogenous variable, following a method proposed by Gourieroux *et al.* (1987), afterwards allowing to implement the same regression and diagnostic tools as for the 1998 data.

Knowing that the logarithm of the unobserved monthly wage w_i^* of individual i is included in the interval $[\ln(W_{li}), \ln(W_{ui})]$, a tobit model of the following form can be formulated:

$$\ln(W_{li}) < \beta' x_i + \epsilon_i < \ln(W_{ui}) \text{ with } \epsilon \sim N(0, \sigma_\epsilon^2), \tag{15}$$

where x_i is a vector of exogenous explanatory variables such as education, experience etc. The error term, ϵ_i, is assumed to be normally distributed across observations. Using maximum likelihood techniques, an estimate of the parameter vector β and of the residual variance σ_ϵ^2 can be obtained. The log likelihood reads:

$$\mathrm{L} = \sum_i \ln\Big[\phi\Big(\frac{\ln(W_{ui} - \beta' x_i)}{\sigma}\Big) - \phi\Big(\frac{\ln(W_{li} - \beta' x_i)}{\sigma}\Big)\Big], \tag{16}$$

where $\phi(\ )$ is the standard cumulative normal.

It is now possible to simulate values z_i for the logarithm of the latent endogenous variable from the conditional distributions of $\ln(w_i^*)$, given $\ln(W_{li})$ and $\ln(W_{ui})$ by drawing residuals u_i out of $N(0, \hat{\sigma_\epsilon})$ such that,

$$\ln(W_{li}) < \hat{\beta}' x_i + u_i^* < \ln(W_{ui}), \tag{17}$$

and thus

$$z_i = \hat{\beta}' x_i + u_i^*. \tag{18}$$

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