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Macroeconomic adjustment, socio-demographic change, and the evolution of income distribution in Côte d'Ivoire

A decomposition by microsimulation

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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 socio-demographic population structure. I show, for instance, that the increase in income inequality in Abidjan was the result of changes in the socio-demographic 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.

Ajustement macro-économique, changements socio-démographiques et évolution de la distribution du revenu en Côte d'Ivoire — Une décomposition par microsimulation

Résumé

Cet article propose une décomposition micro-économique de l'évolution de l'inégalité en Côte d'Ivoire dans les années 1990, en vue d'identifier les contributions simultanées de quatre types de phénomnes à la distribution du revenu : un changement des taux de rémunération des déterminants observés et non-observés du revenu, un changement du comportement de l'offre de travail et un changement de la structure socio-démographique de la population. Je montre, par exemple, que l'augmentation de l'inégalité du revenu Abidjan a été le résultat de changements dans la structure socio-démographique de la population et de variations des taux de rémunération des déterminants non-observés du revenu, et ce en dépit de taux d'activité et d'entrées dans le salariat plus forts, d'une baisse des rendements de l'éducation et du différentiel de salaire entre Ivoiriens et Non-Ivoiriens, qui ont joué à l'inverse en faveur de l'égalité des revenus. Concernant le lien entre croissance et inégalité, il est intéressant à noter que la croissance négative du revenu à Abidjan comme la croissance positive dans le milieu rural ont été, tous les deux, accompagnées d'une hausse de l'inégalité.

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Contents

1 Introduction

Côte d'Ivoire experienced strong and sustained growth during the 1960s and 1970s with real GDP per capita increasing 3.9 percent a year in an environment of rising international commodity prices.[2] In contrast, from 1978 to 1993 Côte d'Ivoire saw its average annual GDP per capita growth rate 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).

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[3] 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. Among them, a recycling of the external debt, privatization and a public enterprise reform, an overall reduction in the number of civil servants, a freezing of public wages, a price and trade liberalization reform, a partial liberalization of domestic and external marketing in the cocoa/coffee sector, and an adoption of a new labour code easing hiring-and-firing. Whereas public investment remained weak, the post-devaluation period was marked by important private investments and resurgent concessional aid flows from the international community (Cogneau and Mesplé-Somps 2001; IMF 1998).

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. The overall fiscal deficit declined from about 12 percent of GDP in 1993 to 2.5 percent in 1998. Growth recovery was mainly due to a strong increase in the production of export crops

[2] Côte d'Ivoire is the world's largest producer of cocoa, before Ghana and Indonesia.
[3] *Communauté financière d'Afrique.*

(cocoa +62 percent, coffee +107 percent in volume) and cotton (+9 percent), favoured by the devaluation and high world market prices,[4] and due to a good performance in the manufacturing sector, agro-industry, and energy sector. The high income from the coffee and cocoa exports rehabilitated the accounts of the price stabilization fund (CAISTAB)[5] and helped to reduce the fiscal deficit (IMF 2000).

Since late 1998 growth has slowed, partly due to poor climatic conditions, and real GDP per capita has stagnated and even declined in 1999. The process of structural adjustment retarded. The economy has also been adversely affected by a sharp decline in the terms of trade, with cocoa prices in the summer 2000 40 percent below their level at the end of 1998 (IMF 2000). Moreover, the political instability since the *coup d'état* in December 1999 impedes further the Ivorian economy.

Population growth remains high in Côte d'Ivoire with an annual average growth rate of 3.7 percent between 1993 and 1998 (IMF 2000). During this period, the country was exposed to large immigration flows constituted mainly by unskilled agricultural workers from Burkina Faso, Mali and other neighbouring countries and to a slight extend by skilled workers and entrepreneurs from Europe and Lebanon (Tapinos, Hugon and Vimard 1998). Although mortality was declining for a long time, signalling the entry in the demographic transition, the country is now strongly affected by the AIDS epidemic. The adult prevalence rate is on average 10.8 percent with much higher rates in Abidjan, implying a violent impact on the population structure, individual poverty risk, and the country's economic development process (UNAIDS/WHO 2000; Aventin and Huard 2000; World Bank 1999). At the end of the 1990s almost half of the Ivorian population lived in urban areas against 20 percent in 1965. Urbanization slowed down during the crises of the late 1980s, but seem to have

[4] 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).

[5] *Caisse de stabilisation et de soutien des prix des productions agricoles*, created in 1962. The CAISTAB guaranteed a fixed price to exporters at the beginning of each season. In the case of world market prices above the guaranteed fix price, the CAISTAB collected the surplus. In August 1999 the *new* CAISTAB was created whose role was limited to regulatory and advisory functions. Finally, in April 2000, the new CAISTAB was abolished and replaced by a fully private entity that will manage a privately run system of forward sales (IMF 2000).

accelerated after the devaluation in 1994 (Tapinos, Hugon and Vimard 1998).

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 flavour, used computable general equilibrium models to compare the distributional effects of different adjustment strategies having been 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 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 answer the following questions. What has been the impact of the favourable evolution in the export crop sector on rural incomes and their distribution? Have rural incomes grown because of higher returns to earnings determinants, or because of a reallocation of work to more profitable activities, or both? What has been the distributional impact of the reduction in the number of public employees and declining real wages in urban areas? To which extent has it been offset by a change in participation behaviour, and changes in family composition? How have these forces interacted and how have they affected the national income distribution and poverty? These kind of questions have to be answered in order to assess adjustment strategies, regarding their effect on inequality and individual

welfare levels.

In this regard, I try to distinguish the respective contribution of four types of phenomena to the evolution of the 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. The employed methodology has been recently applied to several Latin American and Asian middle income countries (Bourguignon, Ferreira and Lustig 1998). 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 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.

2 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 the mean household income and its components

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).[6] The 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 signifi-

[6] 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 differences and especially the urban/rural price differential.

Tab. 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] I used the price deflator series 1992-1998 published by the *Institut National de la Statistique* (INS) of Côte d'Ivoire and the World Bank (2000). To adjust incomes to the level of Abidjan, I used regional deflators constructed by Grootaert and Kanbur (1994) and revised by the INS (see Jones and Ye 1997).
[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. I imputed wages and profits for the other household members supplying labour in these activities to make the data of the two surveys comparable. The method used is described in section 4.2. Furthermore, I detected for 1992/93 113 households (1998 42 households) with implausibly low, and 77 households (1998 43 households) with implausibly high agricultural profits. It came out that the first group concerns over proportionally households in the five upper deciles of the distribution of expenditures (excl. self-consumption) per adult equivalent, and that the second group is relatively equally distributed over the distribution of expenditures. For all these households agricultural profits were imputed. The method used is also described in section 3.2.
[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. 108 households in the 1992/93 survey (12 in 1998) did not declare any food consumption. For them regional means of households with less than seven members were imputed. Home produced food in the EP 1992/93 was corrected as proposed by Jones and Ye (1997).
Source: EP 1992/93 and ENV 1998; computations by the author.

cant rise in world market prices, but also by an exceptional increase in cocoa production by historical standards, independent of the former evolutions.[7]

[7]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.

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[8]) 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 per adult equivalent. 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 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.

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

Tab. 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
Proportion of individuals below x% of the median household income per adult equivalent								
50 %	0.196	0.198	0.214	0.212	0.165	0.194	0.199	0.207
40 %	0.137	0.145	0.159	0.148	0.109	0.138	0.139	0.147
30 %	0.089	0.103	0.100	0.091	0.064	0.082	0.085	0.089
20 %	0.057	0.064	0.055	0.055	0.038	0.041	0.046	0.049
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
WAGE INCOME PER WAGE WORKER (PRINCIPAL ACTIVITY)[d]								
Gini coefficient	0.495	0.578	0.501	0.541	0.662	0.645	0.539	0.593
Theil index	0.427	0.685	0.422	0.551	0.795	0.874	0.506	0.705
Mean logarithmic deviation	0.487	0.654	0.519	0.571	0.993	0.832	0.644	0.704
Atkinson (e=0.5)	0.203	0.282	0.208	0.243	0.366	0.348	0.246	0.295
Atkinson (e=1)	0.386	0.480	0.405	0.435	0.630	0.565	0.475	0.506
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).
[d] Population 12 years and older, outside school and training.
Source: EP 1992/93 and ENV 1998; computations by the author.

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).[9] The high level of income inequality in Côte d'Ivoire, particularly in urban

[9]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.

areas with a Gini coefficient ranging from 0.48 to 0.53 is in line with estimates for the 1980s. Kozel (1990), for instance, estimated a Gini coefficient for incomes of 0.54.

The distribution of wage income calculated over the individuals employed as wage workers, shows a very strong increase in inequality in Abidjan (+8.3 points in Gini) and in the other Ivorian cities (+4 points). The distribution widened particularly at its top (see Theil index).

Demographic change

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 shows a rejuvenating of the male and female population at working age between 1992/93 and 1998. This can be explained by high fertility accompanied by increasing mortality due to HIV/AIDS and by international immigration. A striking feature of the Ivorian age structure, also detected in the Ivorian population census of 1988 (INS 1992), is the gender disequilibrium in Abidjan and rural areas. Besides an over-mortality of young men, a different migration age profile of men and women is an important explanation for this phenomenon (for details see Tapinos, Hugon and Vimard 1998).

The proportion of Non-Ivorians among the total population 12 years and older was relatively stable in Abidjan (around 27 percent for males and 23 percent for women) and declined in other cities and in rural areas. The share of married men and women dropped, particularly in Abidjan. The average household size (non-comprised domestics) decreased slightly from 6 to 5.8. The average number of active household members stagnated and was higher in rural areas (around three) than in urban areas (around two).

Tab. 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
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
Average no. of active hh. mem.	1.8	1.8	2.1	1.9	2.9	3.1	2.5	2.5

Notes:
[a] The shares of individuals in the different occupations are not directly comparable to those noted in the transition matrices (Table 10), 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.

Changes in the educational structure

Between 1992/93 and 1998, the data shows a reduction in the proportion of non-educated men and women and an increase of men and women with primary education in rural areas, and men with higher secondary education and post-secondary education in urban areas (Table 3). Again, all these modifications in the socio-demographic population structure may have influenced the income distribution.

Changes in occupational structure

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 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.

Men were more often wage workers and independent farmers than women,

but less often non-farm self-employed and additional family workers. 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.

3 Methodological framework: a decomposition by microsimulation

The chosen methodology was first proposed by Jiang (1992) and Juhn, Murphy and Pierce (1993), and was subsequently further developed and applied by Steiner and Wagner (1996), Blau and Kahn (1996), and particularly by Bourguignon and Martinez (1996), Bourguigon, Fournier and Gurgand (1999, 2001), Alatas and Bourguignon (2000), and Fournier (1999). Therefore, this section is quite short and orientated to the presentations given in the quoted studies.[10]

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:

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

[10] A very detailed presentation of the methodology is given e.g. by Fournier (1999).

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:

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

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'. Accordingly, to measure the effect of a change of the remuneration rates of the unobservable earnings determinants, the initial distribution has to be compared with the distribution obtained by simulating on the observed population at date t, a change of the variance of the residuals in individual earnings functions from σ_t^2 to $\sigma_{t'}^2$.[11] The occupational choice effect is measured analogously, that means by comparing to the distribution at date t a hypothetical distribution obtained by simulating on the population observed at date t, the occupational preferences observed at date t'. The effect of changes in the distribution of observed and unobserved earnings determinants could be estimated either, if panel data were available, by running the same type of simulation, and otherwise by computing it as a residual of the three other effects. This can be seen by the following identity:

$$C_{tt'} = B_{tt'} + S_{tt'} + L_{tt'} + P_{tt'} \quad (4)$$

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

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 of 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. In general, each decomposition of the price or the occupational choice effect is sensitive to the underlying population structure. Symmetrically, each decomposition of the population structure effect is sensitive to the retained prices and occupational preferences. This means, that generally $P_{tt'} \neq P_{t't}$, and likewise for B, S, and L. The more substantial price changes are associated with substantial changes in occupational preferences, or substantial changes in population structure, and *vice versa*, the less the decomposition will work perfectly. 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 and i stand now for the household and the individual respectively):

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

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

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

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

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 a 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 a family help (H) in either the family farm or the family non farm business. 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 which arguments are typical human capital proxies, as education and professional experience, 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: wage income, non-farm profits and agricultural profits. The term y_{0m}^t 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 farm self-employment is observed at the household level. As head of a farm, the person with the highest order number among all household members declaring to manage a farm is selected. The other involved family members are coded as family workers in that farm.[12]

4 Occupational choice, wage and profit functions

4.1 Estimation of the occupational choice functions

Assuming that the Ivorian labour market is imperfectly competitive, the following six occupational choices are distinguished: (i) inactivity, (ii) family help (either in a family non-farm business or in a family farm) (iii) wage worker, (iv) non-farm self-employed, (v) self-employed farmer, and (vi) 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.

The utility of individual i associated with the labour supply choice j is supposed to be

$$U_{ij} = \lambda'_{jx} x_{ij} + \lambda'_{jz} z_{ij} + \upsilon_{ij}, \tag{9}$$

where x_{ij} is a vector of personal characteristics, and z_{ij} a vector of some household characteristics (to simplify the presentation, the index for the household, h, is omitted here and in what follows). λ_{jx} and λ_{jZ} are the corresponding vectors of parameters. υ_{ij} is a disturbance term. If the agent makes choice j, it is assumed that U_{ij} is the maximum among the J utilities,

$$U_{ij} > U_{ik} \qquad \forall k \neq j. \tag{10}$$

The J disturbances 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), where the probability that the random variable Y_i takes choice j reads

$$\text{Prob}(Y_i = j) = \frac{e^{\lambda'_{jx} x_{ij} + \lambda'_{jz} z_{ij}}}{\sum_{j=1}^{J} e^{\lambda'_{jx} x_i + \lambda'_{jz} z_i}}. \tag{11}$$

[12] 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.

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.[13] 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 market.

The model is estimated 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.

The model is estimated as a reduced form model. As explanatory variables, I select education (years of schooling, without repeated years), potential experience[14], a dummy for sex, a dummy for being born in an urban area, dummies for religion, dummies for the marital status, a dummy for Ivorian nationality, variables of the household composition, its mean age and mean education (without accounting for the individual on the left-hand-side of the equation), dummies for the size of the land possessed by the household, and dummies for

[13]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.

[14]Potential experience is measured as age minus years of schooling minus five (official school entry age).

the regional location of the household.[15]

The estimated coefficients of the multinomial logit model are hardly interpretable, because of their normalization. It is more intuitive to consider marginal effects providing an information about the sensitivity of the probability of choosing occupation j if the explicative variable x varies by one percent, which is: $\epsilon_j = \mathrm{dPr}_j/(\mathrm{d}x_j/x_j)$. These marginal effects are computed at the sample means of x_{ij} and are recorded in Tables 4a-c. It would take too much space to shed a light on every coefficient for each outcome, both years, and each type of household member, so only some major findings are commented.

For household heads (Table 4a) schooling increased the probability of wage work and decreased the probability of self-employment. Being a woman and household head, all else equal, increased the probability of being inactive or being self-employed in a non-farm activity, but decreased the probability of being farmer or wage worker. These effects had in both years almost the same magnitude. Having a foreign nationality reduced the probability of being a wage worker in 1992/93, whereas it raised this probability in 1998. Furthermore, Non-Ivorians compared to Ivorians had a higher probability of being non-farm self-employed and a smaller probability of being farmer or inactive. Access to land and its size were positively associated with self-employment in agriculture, in 1992/93 more than in 1998. The land variables, sex, and the regional variables are clearly the most important predictors in the estimated occupational choice functions.

For the spouse of the household head (Table 4b) an activity as family help was strongly linked to the labour market choice of the household head. If the household head was working as independent farmer the probability of being family help was stronger in 1998 than in 1992/93. The probability of being self-employed in a non-farm activity increased if the household head was wage worker, in 1998 more than in 1992/93. The effect of schooling on

[15] 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.

Tab. 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 *
Experience	0.011 *	0.009 *	-0.001 *	0.000 *	0.001 *	-0.001 *
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 *
Born in urban area	-0.031 *	-0.007	0.027	0.049	-0.014	-0.054 *
Moslem (Ref.)						
Christian	0.024	0.033	-0.098 *	-0.096 *	0.055	0.033
Other religion	-0.001	0.057	-0.090	-0.104 *	0.082 *	0.042
Non-Ivorian	-0.028 *	0.052 *	0.169 *	0.107 *	-0.070	-0.073
Square root hh-size	0.026	0.001	0.009	-0.012	-0.053 *	0.014
Inactive adults in hh. (dummy)[a]	0.080 *	0.039	0.034 *	0.041	-0.068	-0.051
Mean age of hh. members[a]	-0.003 *	-0.002 *	-0.001 *	0.001	0.000	-0.002 *
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
Experience	0.002 *	0.001 *	-0.013	-0.009
Experience^2/100	-0.005 *	-0.002 *	0.028	0.023
Woman	-0.075 *	-0.039 *	0.092	0.085
Born in urban area	-0.013 *	-0.011 *	0.030	0.022
Moslem (Ref.)				
Christian	0.004	-0.005	0.015	0.035
Other religion	0.009	-0.005	0.000	0.010
Non-Ivorian	0.017 *	-0.009	-0.088	-0.078
Square root hh-size	-0.004 *	0.007 *	0.021	-0.011
Inactive adults in hh. (dummy)[a]	0.000	-0.005	-0.046	-0.025
Mean age of hh. members[a]	0.000 *	0.000 *	0.003	0.003
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.
[a] Without accounting for the individual for whom the left-hand-side variable is estimated.
Source: EP 1992/93 and ENV 1998; estimations by the author.

the probability of being a wage worker were positive, but rather weak. An increase in the household size decreased the probability of being inactive. The influence of regional location of the household on occupational choices seems

Tab. 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 *
Experience	-0.003 *	-0.005 *	0.004 *	0.009 *	0.028 *	0.026 *
Experience^2/100	-0.001 *	0.002	-0.006 *	-0.011	-0.037 *	-0.036 *
Born in urban area	-0.040 *	-0.015	-0.006	0.011	0.029	-0.004
Moslem (Ref.)						
Christian	0.084 *	0.029	-0.004	-0.027	-0.058	-0.033
Other religion	0.099 *	0.074	0.001	-0.037	-0.047	-0.049
Non-Ivorian	-0.045 *	0.063	0.000	-0.008	-0.058 *	-0.033 *
Square root hh-size	0.040 *	-0.001	0.002	0.016	-0.022	-0.035 *
No. of women in hh.	0.023 *	0.066 *	0.007 *	0.007 *	0.031 *	0.015 *
No. inactive adults in hh.[a]	-0.092 *	-0.100 *	0.003 *	0.002 *	-0.022 *	0.003 *
Mean age of hh. members[a]	0.001	0.001	0.000	-0.001	-0.003 *	-0.004 *
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
Experience	0.000 *	0.001	-0.029	-0.030
Experience^2/100	0.000 *	-0.001	0.043	0.046
Born in urban area	0.000	0.001	0.017	0.007
Moslem (Ref.)				
Christian	0.000 *	-0.005	-0.022	0.037
Other religion	0.000 *	0.004	-0.054	0.008
Non-Ivorian	0.000	0.006	0.103	-0.029
Square root hh-size	0.000	-0.007	-0.020	0.027
No. of women in hh.	0.000	-0.002	-0.062	-0.085
No. inactive adults in hh.[a]	0.000	0.003	0.111	0.092
Mean age of hh. members[a]	0.000	0.000	0.002	0.004
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.
[a] Without accounting for the individual for whom the left-hand-side variable is estimated.
Source: EP 1992/93 and ENV 1998; estimations by the author.

more important in 1998 than in 1992/93.

For other household members, as children, nephews, or other relatives of the household head (Table 4c), an activity as family help was strongly associated with self-employment (in and outside agriculture) of the household

Tab. 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 *
Experience	0.026 *	0.012 *	0.010 *	0.014 *	0.009 *	0.009 *
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 *
Born in urban area	-0.049 *	-0.102 *	-0.004	0.002	0.002	0.011
Moslem (Ref.)						
Christian	0.064 *	-0.021	-0.026 *	0.008	-0.023 *	-0.005
Other religion	0.056	0.021	-0.032 *	0.019	-0.030 *	-0.016
Not-married	0.015	0.046	0.013 *	0.014	-0.007	-0.005
Son/daughter of head	0.041 *	-0.010	-0.025 *	-0.011	0.003	0.017 *
Non-Ivorian	0.047 *	-0.077 *	0.011 *	0.037	0.002	0.004 *
Square root hh-size	0.137 *	0.123 *	-0.004 *	0.018 *	-0.017	-0.009 *
No. inactive adults in hh.[a]	-0.098 *	-0.094 *	0.003 *	-0.005 *	0.002 *	0.002 *
Mean schooling of hh. members[a]	0.002	-0.004	0.004 *	-0.003 *	-0.003	-0.003 *
Mean age of hh. members[a]	0.005 *	0.003	-0.001	-0.001	0.000	-0.001
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
Experience	0.000 *	0.000 *	-0.046	-0.036
Experience^2/100	0.000 *	0.000 *	0.075	0.062
Woman	-0.002 *	-0.002 *	0.138	0.133
Born in urban area	0.000	-0.002 *	0.051	0.091
Moslem (Ref.)				
Christian	0.000	-0.001	-0.015	0.020
Other religion	0.000	0.000	0.006	-0.024
Not-married	-0.002 *	-0.001	-0.020	-0.053
Son/daughter of head	0.001 *	0.001	-0.020	0.003
Non-Ivorian	-0.001	-0.001	-0.059	0.037
Square root hh-size	-0.002 *	-0.002 *	-0.115	-0.130
No. inactive adults in hh.[a]	0.001 *	0.001	0.093	0.096
Mean schooling of hh. members[a]	0.000 *	0.000	-0.004	0.011
Mean age of hh. members[a]	0.000	0.000	-0.004	-0.001
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.
[a] Without accounting for the individual for whom the left-hand-side variable is estimated.
Source: EP 1992/93 and ENV 1998; estimations by the author.

head, in 1998 even stronger than in 1992/93. Whereas in 1992/93 Non-Ivorians were more often family helps relatively to being inactive, the contrary seems true in 1998. The effect of schooling on the relative risk of being a wage worker was also more pronounced in 1998 than in 1992/93. Female secondary members were more often found in non-farm self-employment activities or in inactivity (or house work) than male secondary members.

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).

4.2 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). For its estimation, the following tobit model is used (Heckman 1979):

$$\left.\begin{array}{rl} \text{selection model :} & \\ s_i^* = & \lambda'(z_i, x_i) + \upsilon_i, \;\; s_i = 1 \text{ if } s_i^* > 0 \text{ and} \\ & 0 \text{ otherwise.} \\ \text{regression model :} & \\ \ln(w_i) = & \beta' x_i + u_i \text{ observed only if } s_i = 1, \text{ with} \\ & (u_i, \upsilon_i) \sim \text{bivariate normal } [0, 0, 1, \sigma_u, \rho]. \end{array}\right\} \quad (12)$$

The first equation describes the selection process indicating whether the individual is a wage worker and if his/her corresponding wage is observed. 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 an upward bias in the mean of the observed wages and in the estimated returns to the different earnings determinants. This selection effect has to be corrected in the wage equation in addition to the selection "being a wage worker or not".[16] The second equation is the semi-logarithmic wage equation. The terms υ_i and u_i are the error terms of the selection and wage equation respectively.

The variables z are assumed to influence only the participation process and the selection "being first or second decision maker" in the household. The variables x are supposed to determine the selection process as well as the wage rate. 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.

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.

The model is estimated by maximization of the likelihood. It is specified separately for men living in urban areas and men living in rural areas, because of the different structures of the urban and rural labour markets in Côte d'Ivoire. For women, this difference seems less pronounced, therefore for them only one model is estimated, but a dummy variable for rural location is introduced.

[16] 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.

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.

Unfortunately the two surveys contain no precise and compatible information about hours spent in different occupations. However, it is clear that wage earners who run also a farm provide certainly a smaller quantity of wage work than full-time wage earners, and in consequence are likely to have a lower potential wage. To account for this effect, 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 $U_{wf} > U_{w}$.

Tab. 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)
Experience	0.057	(0.010)	0.048	(0.008)
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.

Tab. 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)
Experience	0.102	(0.023)	0.090	(0.017)
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	

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.

Tab. 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)
Experience	0.080	(0.015)	0.090	(0.014)
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.

The estimated wage equations show that for men located in urban regions of Côte d'Ivoire (Table 5a) the return to schooling decreased between 1992/93 and 1998 (statistically significant). The returns to experience were almost identical in both years. This variable may mix age with cohort effects. The wage differential between Ivoriens and Non-Ivorians narrowed. The wage advantage associated with an occupation in Abidjan relatively to an occupation in another Ivorian city turns out to be constant. The dispersion of earnings due to unobserved wage determinants, possibly heterogeneity in working-time among individuals, increased between 1992/93 and 1998.

Returns to schooling and experience for men were significantly higher in

rural areas than in urban areas (Table 5b),[17] and decreased over the period under study. The wage differential between Ivorians and Non-Ivorians decreased as well, but remained positive for Non-Ivorians in both years. Interesting is the symmetric increase and decrease of the advantage associated with the West Forest region and the Savannah region respectively, relatively to the East Forest region. This reflects very well the favourable evolution of the export crop sector after the devaluation and its positive impact on the West Forest region. In contrast to the urban areas, the residual variance for the rural wage equations declined between 1992/93 and 1998.

For women the return to schooling dropped by almost 6 points. The return to experience remained quite constant. I tested an interaction variable of schooling and regional location, to account for eventual differences in the effects of schooling in urban and rural areas, but this variable turned out as unsignificant. The wage differential between Abidjan and the other urban centres became negative between 1992/93 and 1998. The wages earned by women in rural areas caught up with those earned in urban areas. The residual variance increased over the period under study.

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 enterprise. A central argument in the non-farm profit function is the number of uncompensated family members involved (including the manager).[18] 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 es-

[17] This was also found by Vijverberg (1993) who analysed the Côte d'Ivoire Living Standards Survey, carried out in 1985-87.

[18] 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.

timator 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. For two reasons, productive assets are not added to the explicative variables. First, not many of them are available in the data set, and, second, the corresponding information is not accessible for individuals who switch for example from wage work to self-employment in the simulation model.

As for wage earners, the 1992/93 survey does not inform about earnings of non-farm self-employed not among the first and second decision makers in their household. This selection bias is corrected in addition to the bias due to self-selection into non-farm self-employment using a tobit specification. In the simulation model, earnings for non-farm self-employed whose earnings are not observed are imputed using the same procedure as for wage earners. Likewise to transform the individual earnings which are ranged in classes in the 1992/93 survey in a continuous variable the same method as for wage earners is used (see Appendix B).

Tab. 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)
Experience	0.059	(0.006)	0.073	(0.011)
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.

The results show (Table 6) that the productivity of an additional person

involved in the business declined significantly from 1992/93 to 1998. The returns to the managers education and experience were positive, as expected, and relatively stable over time. The earnings differentials between regions show that the West Forest region almost caught up in 1998 with the earnings level in the stratum "other cities". In contrast, earnings in the Savannah region relatively regressed. The gender differential slightly widened between 1992/93 and 1998. The residual variance remained almost constant.

Estimation of the agricultural profit functions

The dependent variable of the agricultural profit function is the logarithm of earnings derived from the sale and self-consumption of agricultural products (food crops, cash 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. Exogenous variables of the family composition are used as instruments. The model is estimated with 2SLS. There was no sign of a systematic self-selection into agricultural activity in the data.

Besides the number of family members involved, the amount of available land (cultivated and left fallow[19]) is the principal argument in the agricultural profit function. As stated, the nature of the performed simulations prevents me to introduce additional, more specific assets in the profit function. However, I introduce a categorical variable 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

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

(see above).

In both surveys, I detected some households with implausibly low or implausibly high agricultural profits. These households have been excluded from the estimation and profits are imputed, likewise, using the same procedure as for wage earners (see above).

Tab. 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)
Experience	0.017	(0.004)	0.022	(0.006)
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 of

available land, observed in the data, is real or simply a measurement error.[20] It is also to note that, for example, new cocoa plants need almost five years, before the fruits can be harvested (see e.g. Freud, Petithuguenin and Richard 2000).

Interesting are the estimates for the regional dummies. Whereas urban areas saw a stagnation of earnings relatively to the East Forest region all else equal, the West Forest region gained significantly and the Savannah region lost. The West Forest is the principal region of the cultivation of cocoa and coffee, so the evolution of the coefficients yields what can be expected, and confirms what has been found above for the regional wage differentials.

The returns to potential experience were significant and positive, but very weak. The years of schooling of the farm manager, and also mean schooling of all adult household members did not improve the explicative power of the model.[21] The gender differential increased between 1992/93 and 1998.

The residual variance was, as well as for the non-farm profit functions, almost constant in the two estimations. However the explicative power of the model measured by the R^2 is 6 points smaller in 1998 than in 1992/93.

5 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).

The simulation of the adult equivalent household income distribution for 1992 (1998) by applying the occupational preferences of 1998 (1992) indicates that modifications on labour market contributed to a reduction in inequality. The transition matrix (Table 10a) shows, that the activity rate rises from 52.8 percent to 59.1 percent between 1992 and 1998, if I use the preferences of 1998

[20] The *Enquête de Niveau de Vie* 1995 shows already an increase of the average amount of land held by the households, which would be coherent with the evolution derived from the surveys of 1992/93 and 1998.

[21] This is in line with the findings of Gurgand (1993).

for 1992, and from 53.3 percent to 55.6 percent if I use the preferences of 1992 for 1998. The inflow into dependent wage work (+6-7 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.[22] 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 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.

However, the dominant effect regarding the increase in inequality is the population structure effect, which is calculated as the residual between the actual observed change in inequality and the three other effects. Disequalizing forces may have been the rejuvenation of the population and longer enrol-

[22] Individuals drawn from the simulation as family help are assigned to the family business as follows: Starting with the "potential" family help with the highest order number in the survey questionnaire, I check first, if one of the household members runs a non-farm business or a farm. If the family possesses neither a non-farm business nor a farm, the individual is assigned as farmer. 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. 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.

Tab. 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
Non obs. variance	0.520	0.022	0.553	0.048	0.491	0.038	0.621	0.071
Price and variance		-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, var., and occ. 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
Non obs. variance	0.500	0.011	0.535	0.024	0.467	0.020	0.505	0.034
Price and variance		-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,. var., and occ. choice		-0.001		-0.005		-0.022		-0.010
Population structure effect		-0.001		0.034		0.020		0.038
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
Non obs. variance	0.431	0.014	0.420	0.028	0.458	0.021	0.435	0.037
Price and variance		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, var., and occ. 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
Non obs. variance	0.498	0.004	0.525	0.013	0.482	0.026	0.515	0.048
Price and variance		-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, var., and occ. 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.

ment in school of young generations. Indeed, natural population growth and immigration are still high in Côte d'Ivoire, so that each year, particularly

Tab. 9. Decomposition by microsimulation of the evolution of the incidence of poverty (poverty lines: US$1 PPP1985 (110 700 CFAF 1998) and US$2 PPP1985 (221 400 CFAF 1998) household income per capita, percentages households poor, changes in percentage points)

	Initial population 1992/93				Initial population 1998			
	US$1	dUS$1	US$2	dUS$2	US$1	dUS$1	US$2	dUS$2
ABIDJAN								
Initial values	12.13		34.18		14.54		35.24	
Observed change		2.41		1.06		2.41		1.06
Price observables	10.98	-1.15	32.19	-1.99	15.97	-1.43	37.49	-2.25
Returns to school.	13.17	1.04	38.98	4.80	13.15	1.39	30.59	4.65
Returns to exp.	12.60	0.47	35.51	1.33	14.53	0.01	33.61	1.63
Ivoir./Non-I. wage diff.	11.42	-0.71	33.22	-0.96	15.02	-0.48	36.67	-1.43
Non obs. variance	13.50	1.37	34.78	0.60	12.58	1.96	31.78	3.46
Price and variance		0.22		-1.39		0.53		1.21
Occupational choice	10.06	-2.07	31.50	-2.68	15.20	-0.66	35.24	0.00
Price, var., and occ. choice		-1.85		-4.07		-0.13		1.21
Population structure effect		4.26		5.13		2.54		-0.15
OTHER URBAN								
Initial values	26.26		55.74		23.32		50.18	
Observed change		-2.94		-5.56		-2.94		-5.56
Price observables	23.02	-3.24	51.46	-4.28	27.51	-4.19	54.18	-4.00
Returns to school.	27.27	1.01	59.28	3.54	22.28	1.04	46.05	4.13
Returns to exp.	24.49	-1.77	54.80	-0.94	23.35	-0.03	50.52	-0.34
Ivoir./Non-I. wage diff.	26.03	-0.23	55.11	-0.63	23.64	-0.32	50.61	-0.43
Returns to land	26.30	0.04	55.62	-0.12	22.78	0.54	49.71	0.47
Non obs. variance	26.34	0.08	55.86	0.12	21.17	2.15	48.61	1.57
Price and variance		-3.16		-4.16		-2.04		-2.43
Occupational choice	26.12	-0.14	55.17	-0.57	23.84	-0.52	50.85	-0.67
Price, var., and occ. choice		-3.30		-4.73		-2.56		-3.10
Population structure effect		0.36		-0.83		-0.38		-2.46
RURAL AREAS								
Initial values	36.25		70.84		27.06		58.26	
Observed change		-9.19		-12.58		-9.19		-12.58
Price observables	32.43	-3.82	66.51	-4.33	38.05	-10.99	67.87	-9.61
Returns to school.	36.44	0.19	71.25	0.41	26.81	0.25	57.67	0.59
Returns to exp.	27.86	-8.39	62.80	-8.04	25.64	1.42	55.87	2.39
Ivoir./Non-I. wage diff.	36.37	0.12	71.06	0.22	26.86	0.20	57.93	0.33
Returns to land	33.50	-2.75	67.84	-3.00	23.58	3.48	54.09	4.17
Non obs. variance	30.68	-5.57	65.02	-5.82	24.17	2.89	55.60	2.66
Price and variance		-9.39		-10.15		-8.10		-6.95
Occupational choice	38.57	2.32	72.71	1.87	26.85	0.21	58.21	0.05
Price. var.. and occ. choice		-7.07		-8.28		-7.89		-6.90
Population structure effect		-2.12		-4.30		-1.30		-5.68
NATIONAL								
Initial values	29.38		60.41		23.47		51.36	
Sub-group poverty share								
Abidjan	7.80		10.93		12.93		14.81	
Other cities	19.83		20.46		24.17		23.57	
rural	72.46		68.61		62.90		61.62	
Observed change		-5.91		-9.05		-5.91		-9.05
Price observables	26.20	-3.18	56.54	-3.87	30.75	-7.28	58.02	-6.66
Returns to school.	29.91	0.53	62.37	1.96	22.78	0.69	49.03	2.33
Returns to exp.	24.17	-5.21	55.76	-4.65	22.70	0.77	49.80	1.56
Ivoir./Non-I. wage diff.	29.26	-0.12	60.22	-0.19	23.54	-0.07	51.59	-0.23
Regional differential	26.75	-2.63	57.91	-2.50	22.61	0.86	50.36	1.00
Returns to land	27.78	-1.60	58.63	-1.78	21.45	2.02	48.99	2.37
Non obs. variance	26.40	-2.98	57.15	-3.26	20.96	2.51	48.79	2.57
Price and variance		-6.16		-7.13		-4.77		-4.09
Occupational choice	30.30	0.92	60.86	0.45	23.62	-0.15	51.49	-0.13
Price, var., and occ. choice		-5.24		-6.68		-4.92		-4.22
Population structure effect		-0.67		-2.37		-0.99		-4.83

Notes: Positive change=increase of poverty from 1992/93 to 1998. Negative change=decrease of poverty from 1992/93 to 1998.
Source: EP 1992/93 and ENV 1998; simulations by the author.

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. For instance, whereas in 1992 in Abidjan 69.8 percent of the 12 year old children were enroled, this proportion was about 73 percent in 1998.[23] Another factor, included in the population effect, could be a higher mortality of adults of working age due to AIDS.

Tab. 10a. Simulated changes in occupational choices (in percent) , Abidjan

	Simulated with 1998 occupational choice behaviour						
observed 1992	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1992
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
	Simulated with 1992 occupational choice behaviour						
observed 1998	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1998
inactive	89.8	2.5	3.7	0.3	3.5	0.1	44.4
pure wage labour	13.5	77.4	6.3	0.6	1.9	0.4	34.7
self-empl. non-a.	10.0	4.3	83.2	0.8	1.7	0	18.3
self-empl. agric.	0	15.1	0	84.9	0	0	0.5
family help	8.0	0	0	6.1	85.9	0	1.9
wage labour/s-empl. agric.	0	0	0	11.1	18.2	70.7	0.2
Total 1992′	46.5	28.8	19.1	1.1	4.2	0.4	100

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

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 poverty (Table 9). 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

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

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.

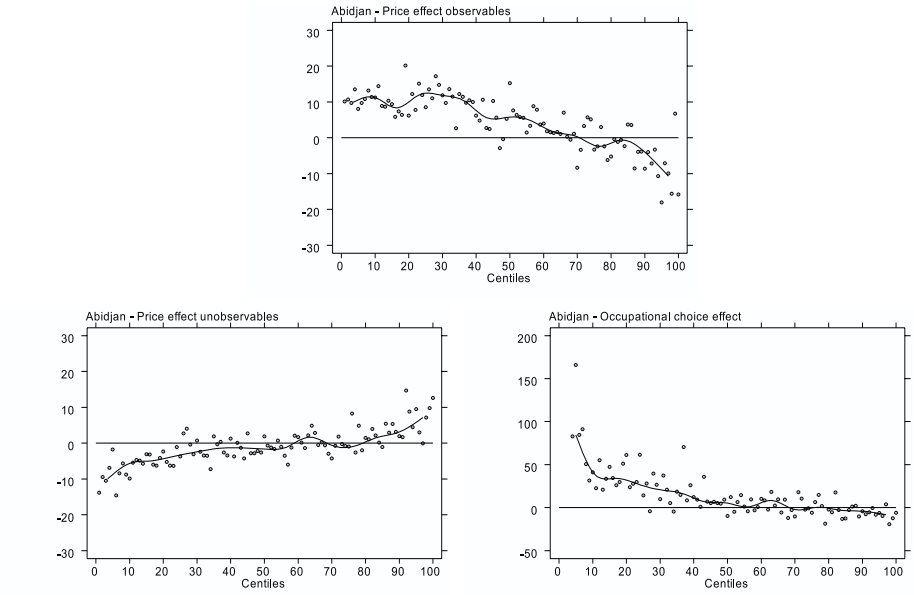

Fig. 1. Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for Abidjan using as starting point 1992 (smoothing by a cubic spline)

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

Tab. 10b. Simulated changes in occupational choices (in percent) , other urban

	Simulated with 1998 occupational choice behaviour						
observed 1993	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1993
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
	Simulated with 1993 occupational choice behaviour						
observed 1998	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1998
inactive	81.8	2.0	6.9	1.5	7.8	0	38.3
pure wage labour	6.4	74.9	7.5	4.5	5.4	1.3	22.7
self-empl. non-a.	5.8	1.4	87.4	2.0	3.2	0.2	22.8
self-empl. agric.	0.7	0.8	0.7	93.2	3.7	0.9	4.8
family help	5.7	2.3	2.4	1.5	88.1	0	9.7
wage labour/s-empl. agric.	4.2	0.0	0.0	41.3	0.0	54.6	1.7
Total 1993′	34.7	18.4	24.6	7.4	13.7	1.3	100

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

(Table 10b). 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.

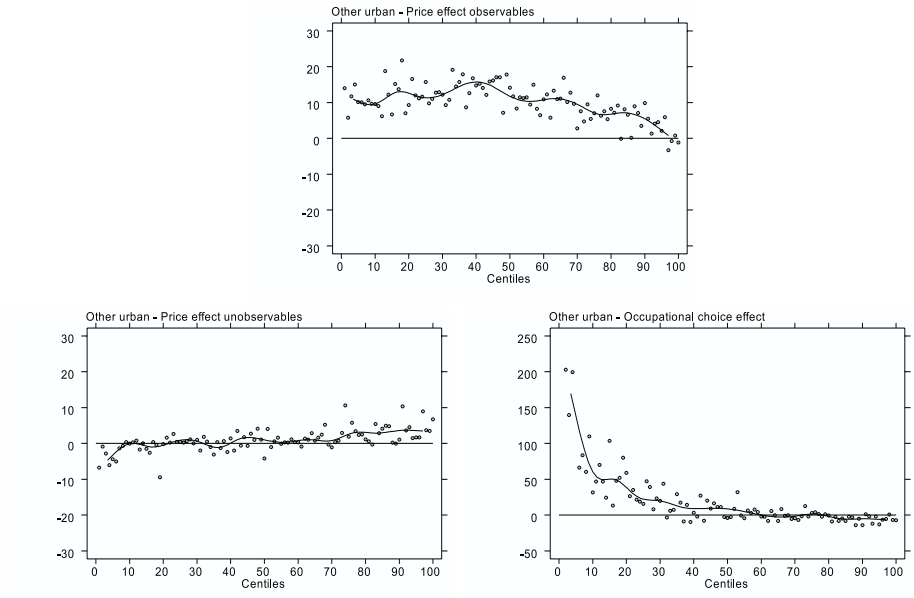

Fig. 2. Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for other urban areas using as starting point 1993 (smoothing by a cubic spline)

As in Abidjan and rural areas (see below), changes in the population struc-

ture 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 9).

Rural areas

Rural areas experienced a strong increase in inequality with a Gini coefficient rising from 0.417 in 1993 to 0.480 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 10c). 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, a 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.

Tab. 10c. Simulated changes in occupational choices (in percent) , rural areas

	Simulated with 1998 occupational choice behaviour						
observed 1993	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1993
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
	Simulated with 1993 occupational choice behaviour						
observed 1998	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1998
inactive	70.5	0.4	2.9	3.6	22.6	0.0	14.8
pure wage labour	10.4	45.4	10.5	15.0	16.8	1.9	7.5
self-empl. non-a.	5.2	0.6	76.6	6.8	10.8	0	4.8
self-empl. agric.	1.4	0.1	0.5	96.1	1.8	0.1	20.8
family help	3.8	0.3	2.2	0.8	92.8	0.0	48.9
wage labour/s-empl. agric.	0.8	2.5	0.0	47.5	0.9	48.3	3.2
Total 1993′	13.7	3.8	6.1	23.9	50.9	1.7	100

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

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).[24] 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) had an non-equalizing effect on the income distribution. Changes of the returns to unobservable earning determinants increased the income inequality too. Important unobservable factors may be the use of fertilizers and market access. In contrast decreasing returns to

[24]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.

schooling (concerns only wage workers and self-employed outside agriculture) and potential experience had an equalizing effect. In sum, 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.

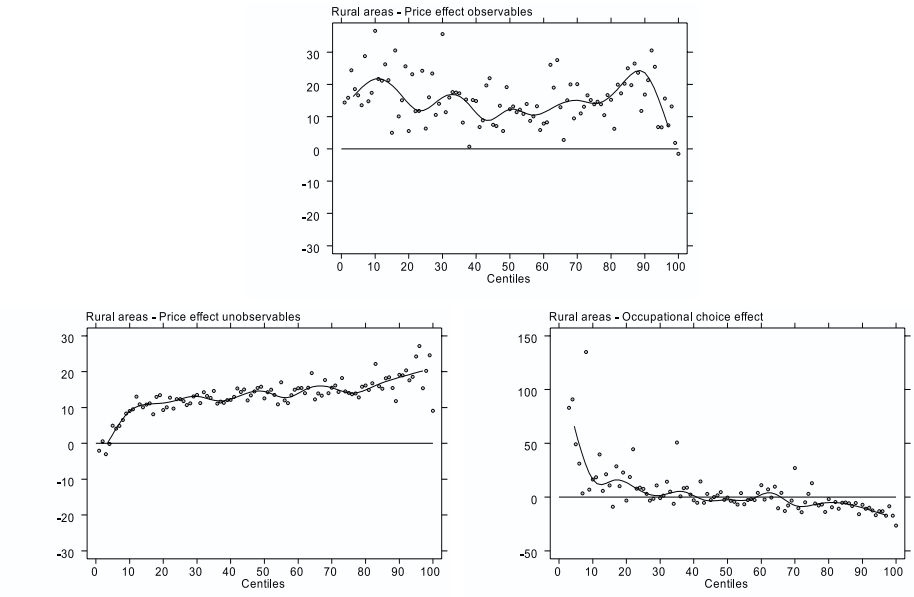

Fig. 3. Relative change of mean household income for each household income centile, when performing the three counterfactual simulations for rural areas using as starting point 1993 (smoothing by a cubic spline)

Changes in the socio-demographic population structure, including possible changes in the distribution of land (remember that land enters as factor dotation in the population structure vector[25]), had a non-equalizing effect on the income distribution.

In spite of the increase in inequality, poverty significantly decreased in rural areas. The simulations in Table 9 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.

[25]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.

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 (Table 9). 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).

Tab. 10d. Simulated changes in occupational choices (in percent) , national - all regions

	Simulated with 1998 occupational choice behaviour						
observed 1993	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1993
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
	Simulated with 1993 occupational choice behaviour						
observed 1998	inact.	wage lab.	s-empl. non-a.	s-empl. agric.	fam. help	wage/ s-agr.	Total 1998
inactive	81.0	1.7	4.5	1.8	11.1	0	26.1
pure wage labour	10.6	68.3	7.8	5.5	6.8	1.1	16.5
self-empl. non-a.	7.1	2.2	83.4	2.8	4.5	0.1	11.6
self-empl. agric.	1.4	0.3	0.5	95.8	1.9	0.2	13.1
family help	4.0	0.5	2.2	0.9	92.4	0	30.5
wage labour/s-empl. agric.	1.3	2.1	0.0	45.7	1.1	49.8	2.3
Total 1993′	25.1	12.2	12.8	15.5	33.0	1.3	100

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

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. The most striking feature of the occupational transition matrices obtained by the two counterfactual simulations (Table 10d) is the

significant increase of wage earners and the drop of self-employment in and outside agriculture. However, on the national level 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 on the income distribution in all three strata and thus also on the national level (Gini +1.9 to 2.8 points). Fast natural population growth and immigration connected with the entry of young unexperienced cohorts (even if better educated than they preceding cohorts) on the labour market were surely important factors in this context. Another important element may have been a worsening of the health status due to the AIDS epidemic, which has hit particularly strong the economic capital of Côte d'Ivoire.

6 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.

Abidjan sustained a significant decrease of mean household income, which went along with an increase in inequality and poverty. The major equalizing forces were an increase of activity and thus probably a reduction in involuntary unemployment, a rise of the share of wage earners, and a decrease of the returns to schooling as well as a fall of the Ivorian/Non-Ivorian wage differential. In contrast, a greater dispersion of unobserved income determinants, changes in the population structure (may be the general rejuvenating of the population), had a non-equalizing effect on the income distribution. Changes in the returns on the labour market and modification in occupational choices (incl. the decline of unemployment) reduced poverty, but this effect was more than offset by changes in the population structure.

The other urban centres, which are, as mentioned, a very heterogenous strata, knew a stagnation of income growth, a stable income distribution and a slight reduction in poverty. Non-equalizing forces stemming from modifi-

cations in the socio-demographic population structure and a higher variance of unobserved income determinants were offset by equalizing forces stemming from a drop in the returns to schooling and changes in occupational preferences.

Rural areas experienced strong growth in household income accompanied by a significant rise in inequality but also a remarkable decline of poverty. The major factors driving 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 favoured mainly the West Forest region, which also led to rising income differentials within rural Côte d'Ivoire. However, the changes in the 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 note 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.[26] Within-region inequality increased and between-region inequality decreased. The share of the urban population among the poor rose, whereas that of the rural population declined.

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

[26] ...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.

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. Another factor with a potential strong impact on the macro as well as on the micro level is the AIDS epidemic. Of course, the data used do not allow to study directly this issue, but the strong negative effect of changes in the population structure identified for Abidjan could be a piece of evidence that AIDS had already a strong effect on inequality and poverty during the period under study.

Besides the reestablishment of political stability, future policies should improve the productivity of agricultural households by promoting new technologies, and by diversifying the sources of incomes by varying the cultivated crops and increasing the share of non-agricultural income. These measures are particularly important in the Savannah region, which remains the poorest area of Côte Ivoire. Furthermore, policies should enhance labour-intensive manufacturing and increase investment in physical infrastructure, health care, and human capital. In fact, what has been suggested after analyzing the Ivorian household surveys of the 1980s in terms of inequality and poverty reducing policies (see e.g. Grootaert 1996) seems today at least as relevant as in the 1980s.

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. The used model does not offer a macroeconomic closure of the labour market. The modelling of the labour supply is based on reduced form equations, which do not explicitly account

for changes in the remunerations associated to the different occupations. 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 treated in 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 (see section 3.1, the vector of household characteristics is here ignored):

$$U_j = \lambda_j' x_j + \upsilon_j, \tag{13}$$

where the residuals υ_j 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:

$$F(\upsilon_j|\hat{\lambda_j}' x_{j^\circ} + \upsilon_{j^\circ} > \max_{j \neq j^\circ}(\hat{\lambda_j}' x_j + \upsilon_j)). \tag{14}$$

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:

$$f(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{f(\upsilon_{j^\circ})}{\Pr(\text{act} = j^\circ)} \int_{\dots}^{\dots} \int_{(\upsilon_{j^\circ} > \max_{j \neq j^\circ}(g_j + \upsilon_j) - g_{j^\circ})}^{j \neq j^\circ} f(\upsilon_j) \mathrm{d}\upsilon_j, \tag{15}$$

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:

$$F(\upsilon_{j^\circ}|\text{act} = j^\circ) = \exp\Big(- \frac{\sum_j \exp(g_j)}{\exp(g_{j^\circ})} \exp(-\upsilon_{j^\circ})\Big). \tag{16}$$

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

$$F(\upsilon_j|\upsilon_j < g_{j^\circ} + \tilde{\upsilon}_{j^\circ} - g_j) = \frac{F(\upsilon_j)}{F(g_{j^\circ} + \tilde{\upsilon}_{j^\circ} - g_j)}, \;\; \forall j \neq j^\circ \tag{17}$$

which yields under the specification of the multinomial logit model:

$$F(\upsilon_{j^\circ}|\text{act} = j^\circ) = \frac{\exp(-\exp(-\upsilon_j))}{\exp(-\exp(g_j - g_{j^\circ} - \tilde{\upsilon}_{j^\circ}))}. \tag{18}$$

The conditional distributions defined in (16) and (18) 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).[27] 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:

$$\ln(W_{li}) < \beta' x_i + \epsilon_i < \ln(W_{ui}) \text{ with } \epsilon \sim N(0, \sigma_\epsilon^2), \tag{19}$$

where x_i is a vector of exogenous explanatory variables as education, experience etc. The error term, ϵ_i, is assumed to be normally distributed across

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

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:

$$\mathrm{L} = \sum_i \ln\Big[\phi\Big(\frac{\ln(W_{ui} - \beta' x_i)}{\sigma}\Big) - \phi\Big(\frac{\ln(W_{li} - \beta' x_i)}{\sigma}\Big)\Big], \tag{20}$$

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,

$$\ln(W_{li}) < \hat{\beta}' x_i + u_i^* < \ln(W_{ui}), \tag{21}$$

and thus

$$z_i = \hat{\beta}' x_i + u_i^*. \tag{22}$$

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