

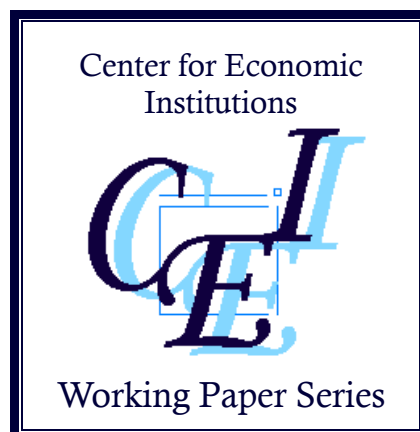
**Center for Economic Institutions**  
**Working Paper Series**

No. 2016-1

**“Heterogeneous Structural Transformation and Growth  
Incidence across the Income Distribution: the Kuznets  
Curve Revisited”**

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**April 2016**



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Draft: April, 2016

# Heterogeneous Structural Transformation and Growth Incidence across the Income Distribution: the Kuznets Curve Revisited

Saumik Paul\*

## Abstract

In 1955, in an influential study Kuznets (1955) predicted an inverted-U relationship between development and inequality, mainly through structural transformation. Since then a large body of research has empirically tested the Kuznets hypothesis, but consensus is far less evident. In this paper, I argue that a heterogeneous process of structural transformation across the income distribution may explain such empirical irregularities. I specifically link the heterogeneity in growth incidence resulting from a shrinking agriculture sector across income quantiles to inequality measures. Empirical evidence drawn from the Cote d'Ivoire household survey data supports this theoretical prediction. However, the decomposition results indicate a relatively small contribution of structural transformation to total changes in inequality.

Keywords: Structural Change, Inequality

JEL Classifications: J13, J15

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I thank Nusrate Aziz, Arusha Cooray, Takashi Kurosaki, Norman Loayza, David Prentice, Vengadeshvaran Sarma, Michael Woolcock and participants at the World Bank Development Research Seminar in KL, Malaysia and Globalization and Economic Policy (GEP) conference at Kuala Lumpur for their useful comments. Usual disclaimer applies.

## **I. Introduction**

In 1955, in an influential study Kuznets (1955) predicted an inverted-U relationship between development through changes in the structure of production and inequality. The main aspects of such structural transformation that he envisioned were (a) declining share of agriculture in total output, and (b) migration from the low income agricultural sector to the high income industrial sector (Kuznets, 1955). Since then a large body of research has empirically tested Kuznets hypothesis, but consensus is far less evident<sup>1</sup>. A couple of issues help shed light on this puzzle. First, empirical research on the Kuznets curve has been dominated by cross-country studies. This might allow for factors other than the Kuznets process to set the motion of inequality, while the Kuznets hypothesis was largely meant for income inequality within a country (Kuznets, 1955). Second, as Kanbur (2000) aptly points out, attention has mostly been paid to fit data to the inverted-U relationship. But, application of theoretical models justifying the inverted-U shape of the Kuznets curve has been limited<sup>2</sup>.

I provide here a brief review of the literature on theoretical explanations for the existence of the Kuznets curve. The first strand of literature relates growth theories based on imperfections in the capital market (Banerjee and Newman, 1990; Aghion and Bolton, 1992) to inequality. Another group of studies focused on economic structure and political participation (Alesian and Rodrik, 1994; Persson and Tabellini, 1994) and how they explain the nexus between growth and inequality over time. And finally, the dual economy model literature, which is directly related to this paper. Based on these models, the shift of population between sectors (owing to the original work by Kuznets, 1955) and intersectoral differences in average income explain the shape of the Kuznets curve (Robinson, 1976; Fields, 1980;

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<sup>1</sup> See Gallup (2012) for a comprehensive summary.

<sup>2</sup> Deutsch and Silber (2004) provide an excellent overview of the theoretical work that has been done on the Kuznets Curve.

Bourguignon, 1990). The dual economy structure has been used to accommodate other explanatory factors such as mineral resources (Bourguignon and Morrisson, 1990) and various sources of income (Deutsch and Silber, 2004), amongst others. A relatively less-researched area on this topic is individual migration decisions and their effects on the Kuznets motion of population shift. To put it differently, do population movements at different parts of the distribution and at different points in time contribute to the Kuznets motion? This issue was highlighted by Anand and Kanbur (2005) but has not been followed up since then.

In this paper, building on a dual-economy framework, I link structural transformation to income growth across the distribution. The structural transformation of moving out of agriculture not only has enormous potential for productivity growth (McMillan and Rodrik, 2014), but it also exposes the population to new challenges with varying levels of adjustment capacity (Aizenman, Lee and Park, 2012). Less is known on how structural transformation affects income growth<sup>3</sup> at different quantiles of the income distribution. I specifically examine this heterogeneity in income growth, resulting from structural change, across income quantiles and consequently, its impact on inequality. Repeating this exercise for multiple periods provides a link between inequality and growth through structural transformation over time. I use this relationship to predict the shape of the Kuznets curve depending on two factors: (1) heterogeneity in the level of structural transformation across the distribution and (2) differences in returns to agricultural and non-agricultural sectors. Empirical evidence drawn from the Ivoirian household survey provides support. However, the relative contribution of structural transformation to total changes in inequality compared to other factors is weak. This leads us to conclude that (1) heterogeneous structural transformation across the distribution opens up various possible relationships between development and inequality other than inverted “U”

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<sup>3</sup> Bourguignon and Morrisson (1998) show that per capita income differentials between agricultural and non-agricultural households are disparate and constitute a strong explanatory factor for the total inequality.

relationship and (2) there could be factors other than structural transformation that more closely explains the Kuznets motion. Together, they help explain why the existing empirical evidence on the Kuznets curve remains inconsistent.

I organize this paper as follows. Section II provides a dual-economy framework where I derive conditions pertaining to the shape of the Kuznets motion. Section III is divided into three parts. In the first part, using three rounds of household survey data (1993, 2002 and 2008) from Cote d'Ivoire, I provide summary evidence on structural transformation moving out of agriculture for the period from 1993-2008. The second part of section III explains unconditional quantile regressions outcomes on the link between structural transformation and inequality across the distribution. And the third part discusses the relative contribution of structural transformation to inequality as demonstrated by generalized Oaxaca-Blinder decomposition outcomes. Section IV concludes.

## **II. A Simple Theoretical Framework**

### **A. Kuznets Motion using Growth Incidence Curves**

Figure 2.1 depicts the Kuznets motion. Inequality is low at point A, where earnings are predominantly from agriculture. At point B, inequality rises through structural transformation moving out of agriculture and earnings differences between agricultural and non-agricultural sectors. With further movement out of agriculture, there is a drop in inequality at point C when the economy fully transforms into an industrial economy.

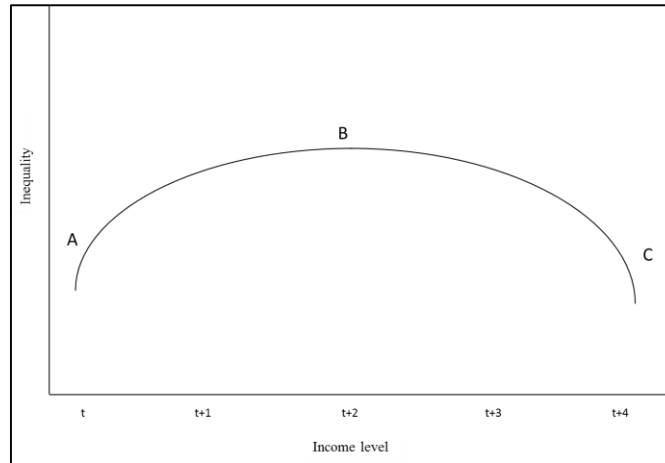


Figure 2.1 The Kuznets Motion

Let's consider any two consecutive points in time on the Kuznets curve. I adopt the concept of growth incidence curve (GIC, hereon). As defined by Ravallion and Chen (2003), the GIC identifies how the gains from aggregate economic growth are distributed across households based on their initial welfare status. More formally, the GIC shows the mean growth rate  $g(p)$  in  $y$  at each quantile  $p$ . In particular, the growth rate of income at the  $p^{\text{th}}$  quantile from  $t=0$  to  $t=1$  can be written as:

$$g(p) = \frac{\Delta y(p)}{y_0(p)} = \frac{y_1(p)}{y_0(p)} - 1 \quad (1)$$

In continuous time, this can simply be written as  $g(p) = \frac{dy(p)}{y(p)}$ . Letting  $p$  vary within the closed interval  $[0,1]$  traces out the growth incidence curve<sup>4</sup>. It can be shown that if the GIC is a decreasing function for all  $p$  in its domain of definition, then all inequality measures that respect the Pigou-Dalton principle of transfer will indicate a fall in inequality over time. If instead the GIC is an increasing function of  $p$ , then the same measures will register an increased in inequality (Ravallion and Chen 2003). When inequality does not change the GIC will show

<sup>4</sup> Alternatively we have  $g(p) = d \ln(y)$  where  $= \int_0^y f(v)dv$ , and  $f(\cdot)$  is the density function characterizing the distribution of the living standard indicator.

the same growth rate for all  $p$ . It satisfies both the first-order and second-order dominance criteria (Son, 2004).

Next, I present the Kuznets motion using the GICs. In Figure 2.1, I consider two cases. Case 1 shows the inverted “U” Kuznets motion, where the rising part of the curve is associated with pro-rich growth spells represented by the GICs as an increasing function for all  $p$ . After period  $t+2$ , a fall in inequality is associated with pro-poor growth spells and the GIC becomes a decreasing function for all  $p$ . Thus, with continuing structural transformation through movement out of agriculture, the pro-rich growth spells are followed by the pro-poor growth spells.

However, structural transformation exposes the population to new challenges with varying levels of adjustment capacity (Aizenman, Lee and Park, 2012), and as a result we may expect a different order of growth spells, as shown in case 2. In case 2, pro-rich and pro-poor growth spells appear alternately, starting with a pro-rich growth spell between  $t$  and  $t+1$ . There may be other hypothetical cases with different orderings of growth spells. The main purpose of this expositional exercise is to understand that heterogeneity in growth incidence across the distribution may not necessarily produce an inverted “U” shaped relationship between development and inequality. As a next step, I derive conditions under which the Kuznets motion may deviate from its predicted inverted “U” shape.

Case 1	Case 2
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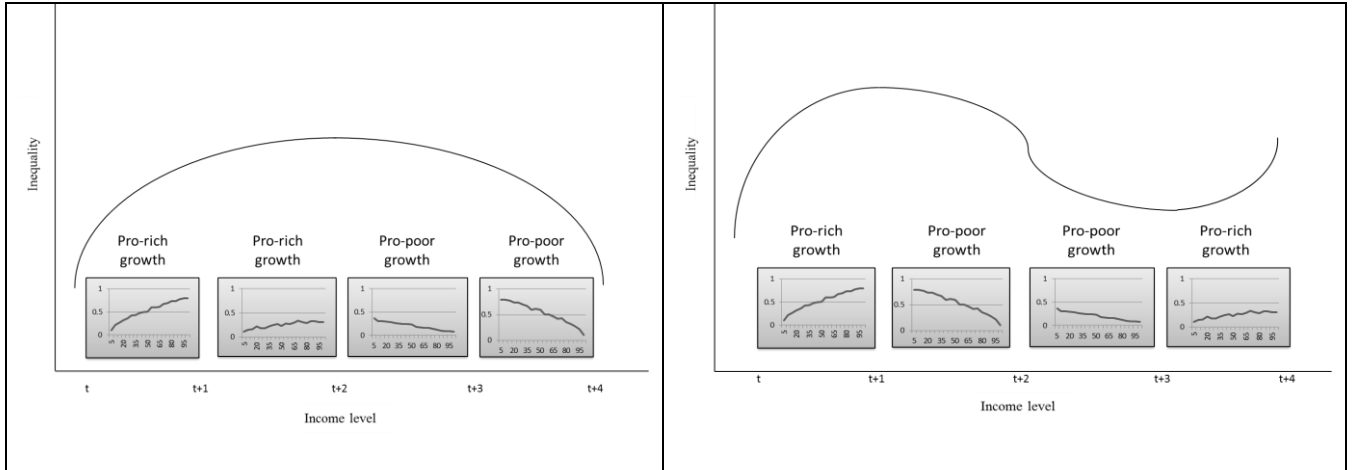


Figure 2.2 The Kuznets Motion using Growth Incidence Curves  
Notes: GICs are shown in the boxes below the Kuznets curve

## B. Model Assumptions

I consider a simple theoretical framework. The assumptions are:

- The growth in income and total employment is positive (following Kuznets, 1955).
- The economy is divided into agriculture ( $A$ ) and non-agriculture ( $N$ ), with different income distributions and within-sector inequality exists (Robinson, 1973).
- Total income in the economy is  $Y$  distributed across two income quantiles, h-quantile and l-quantile; mean income in h-quantile ( $\bar{Y}_H$ )  $>$  mean income in l-quantile ( $\bar{Y}_L$ ). The mean income in quantile  $p$  is  $\bar{Y}_p = S_p^A \bar{Y}_p^A + S_p^N \bar{Y}_p^N$  where quantile is denoted by  $p (= L, H)$ ,  $\bar{Y}_p^k$  denotes mean income of sector  $k (= A \text{ or } N)$  in quantile  $p$ , the population share in non-agri (agriculture) sector in l-quantile and h-quantile are denoted as  $S_L^N (S_L^A)$  and  $S_H^N (S_H^A)$ , respectively.
- The population growth in both sectors is constant.
- Define structural change from agricultural to non-agricultural sector in the  $p^{th}$  quantile as an increase in the ratio between population shares,  $\frac{S_p^N}{S_p^A}$ .



- Define earnings ratio in the  $i^{th}$  quantile as the proportion of average returns to non-agricultural sector to the average returns to agriculture sector,  $\frac{\bar{R}_L^N}{\bar{R}_L^A}$ .
- Considering any two consecutive points in time on the Kuznets curve, the GIC indicates a fall in inequality over time if  $g[\bar{Y}_H] < g[\bar{Y}_L]$  satisfying the Pigou-Dalton principle of transfer. Similarly, the GIC indicates a rise in inequality over time if  $g[\bar{Y}_H] > g[\bar{Y}_L]$  satisfying the Pigou-Dalton principle of transfer.
- Last but not the least; growth is affected only through structural transformation. I relax this assumption later.

### C. Inequality and Structural Change

Considering any two consecutive points in time on the Kuznets curve, I write the Kuznets motion from period  $t$  to  $t + 1$  below:

#### Inequality rises with structural transformation

$$[1] \quad g[\bar{Y}_H] > g[\bar{Y}_L] \text{ if } \Delta \left[ \frac{S_L^N}{S_L^A} \right] < \Delta \left[ \frac{S_H^N}{S_H^A} \right] \text{ and } \Delta \left[ \frac{\bar{R}_L^N}{\bar{R}_L^A} \right] < \Delta \left[ \frac{\bar{R}_H^N}{\bar{R}_H^A} \right]$$

If the growth in earnings ratio over time is higher in the h-quantile compared to the l-quantile, then a faster rate of structural transformation in the h-quantile increases inequality by expanding the rich-poor gap. In other words, if gainers from structural transformation appear at a large number from the h-quantile, then following the Pigou-Dalton principle of transfer, resources move from the poor to the rich and increase the level of inequality.

#### Inequality falls with structural transformation

$$[2] \quad g[\bar{Y}_H] < g[\bar{Y}_L] \text{ if } \Delta \left[ \frac{S_L^N}{S_L^A} \right] > \Delta \left[ \frac{S_H^N}{S_H^A} \right] \text{ and } \Delta \left[ \frac{\bar{R}_L^N}{\bar{R}_L^A} \right] > \Delta \left[ \frac{\bar{R}_H^N}{\bar{R}_H^A} \right]$$

Similarly, if the growth in earnings ratio over time is lower in the h-quantile compared to the l-quantile, then a faster rate of structural transformation in the l-quantile is associated with a drop in inequality by contracting the rich-poor gap. In this case, the gainers from structural transformation predominantly come from the l-quantile, and following the Pigou-Dalton principle of transfer, resources move from the rich to the poor and decrease the level of inequality.

### **Borderline cases**

I show another two cases where the net effect of development on inequality depends on the relative strength of the rate of transformation from agriculture to non-agriculture and the growth of the earnings ratio. These cases may arise, in particular, when structural transformation and increasing returns to non-agricultural sector are observed in different quantiles. For example, a faster rate of structural transformation in the l-quantile can be associated with a slower movement in the earnings ratio (case 3). The net effect on inequality, in this case, depends on the relative strength of these two factors. If the effect of structural transformation outweighs the growth effect of the earnings ratio then there will be a drop in inequality with resources moving from the rich to the poor. In the opposite case, there will be a rise in inequality. Case 4, can be explained in a similar fashion.

$$[3] \quad g[\bar{Y}_H] < g[\bar{Y}_L] \text{ if } \Delta \left[ \frac{S_L^N}{S_L^A} \right] > \Delta \left[ \frac{S_H^N}{S_H^A} \right] \text{ and } \Delta \left[ \frac{\bar{R}_L^N}{\bar{R}_L^A} \right] < \Delta \left[ \frac{\bar{R}_H^N}{\bar{R}_H^A} \right]$$

$$[4] \quad g[\bar{Y}_H] > g[\bar{Y}_L] \text{ if } \Delta \left[ \frac{S_L^N}{S_L^A} \right] < \Delta \left[ \frac{S_H^N}{S_H^A} \right] \text{ and } \Delta \left[ \frac{\bar{R}_L^N}{\bar{R}_L^A} \right] > \Delta \left[ \frac{\bar{R}_H^N}{\bar{R}_H^A} \right]$$

Moving on, I generalize these rules for any number of quantiles (more than two). In this case, the GIC indicates a fall in inequality over time if  $g^p > g^q \forall p < q$  satisfying the Pigou-Dalton principle of transfer, where  $g^p$  and  $g^q$  represent income growth at the  $p^{th}$  and the  $q^{th}$  quantile, respectively<sup>5</sup>. The rules, (1) and (2), now become more binding as I extend the model from two to multiple income quantiles. Figure 2.3 provides a graphical illustration of the generalized rules.

### Inequality rises with structural transformation

$$[1] \quad g[\bar{Y}_q] > g[\bar{Y}_p] \text{ if } \Delta \left[ \frac{S_p^N}{S_p^A} \right] < \Delta \left[ \frac{S_q^N}{S_q^A} \right] \text{ and } \Delta \left[ \frac{R_p^N}{R_p^A} \right] < \Delta \left[ \frac{R_q^N}{R_q^A} \right] \forall p < q$$

### Inequality falls with structural transformation

$$[2] \quad g[\bar{Y}_q] < g[\bar{Y}_p] \text{ if } \Delta \left[ \frac{S_p^N}{S_p^A} \right] > \Delta \left[ \frac{S_q^N}{S_q^A} \right] \text{ and } \Delta \left[ \frac{R_p^N}{R_p^A} \right] > \Delta \left[ \frac{R_q^N}{R_q^A} \right] \forall p < q$$

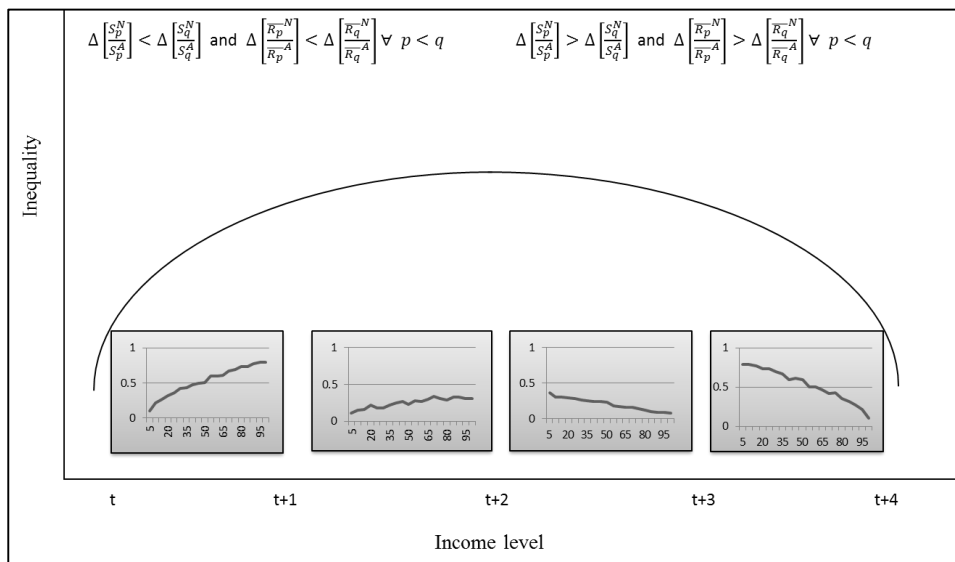


Figure 2.3 Structural transformation and the Kuznets motion

<sup>5</sup> GICs ignore the issue of re-ranking of individuals through income mobility over time, as a result of this the dominance criteria remains ambiguous across different growth trajectories (Bourguignon, 2010). However, this issue is not central to this paper.

### III. The Ivoirian Case

#### A. Trends in Inequality: 1993 - 2008

Figure 3.1 presents the growth incidence curves for Cote d'Ivoire for two time periods 1993-2002 and 2002-2008<sup>6</sup>. The GICs in both periods reveal some heterogeneity in the impact of growth on the living standards. In the period from 1993 – 2002, the bottom-half of the distribution shows a higher level of income growth. People located between the 5<sup>th</sup> and the 35<sup>th</sup> percentile experienced a positive income growth. Overall, the shape of the GIC in the period from 1993 – 2002 suggests a drop in inequality as households experienced more income gain in the bottom half than the top half of the distribution. In the period from 2002 to 2008, there exists an opposite trend. The average growth in income at each quantile up to the 65<sup>th</sup> percentile remains negative, and depicts an overall positively sloped GIC. It suggests a rise in inequality in the period from 2002 to 2008.

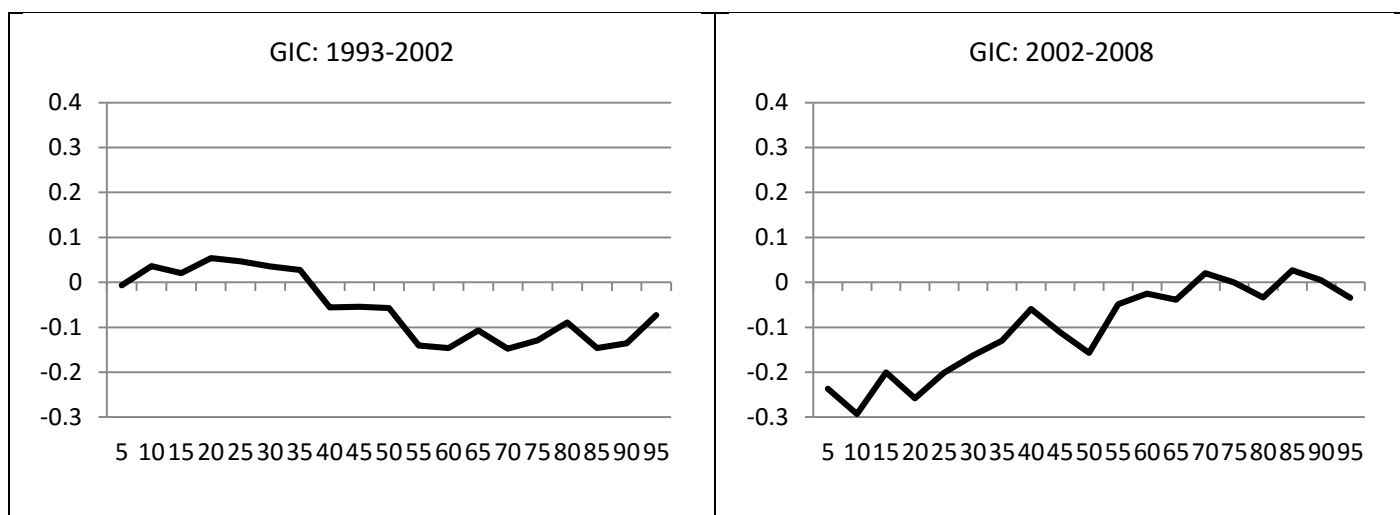


Figure 3.1 Growth Incidence Curves in Cote d'Ivoire, 1993-2002 and 2002-2008.

#### B. Structural Transformation, 1993 - 2008

<sup>6</sup> I use three rounds (1993, 2002 and 2008) of nationally representative household survey (Enquête Niveau de Vie des Ménages - ENV) data collected by the National Institute of Statistics in Cote D'Ivoire.

Figure 3.2 presents a snapshot of the changing structure of the Ivoirian economy from 1993-2008. The share of participation in agriculture sector dropped by almost 8 percentage points from 60% between 1993 and 2002 and it continued to drop by another 4 percentage points between 2002 and 2008. Among non-agricultural sectors, participation only in manufacturing, wholesale and retail trade and transport, storage and communications increased from 1993 – 2008. Particularly, in transport, storage and communications sector, the number of employees almost doubled during this period of time.

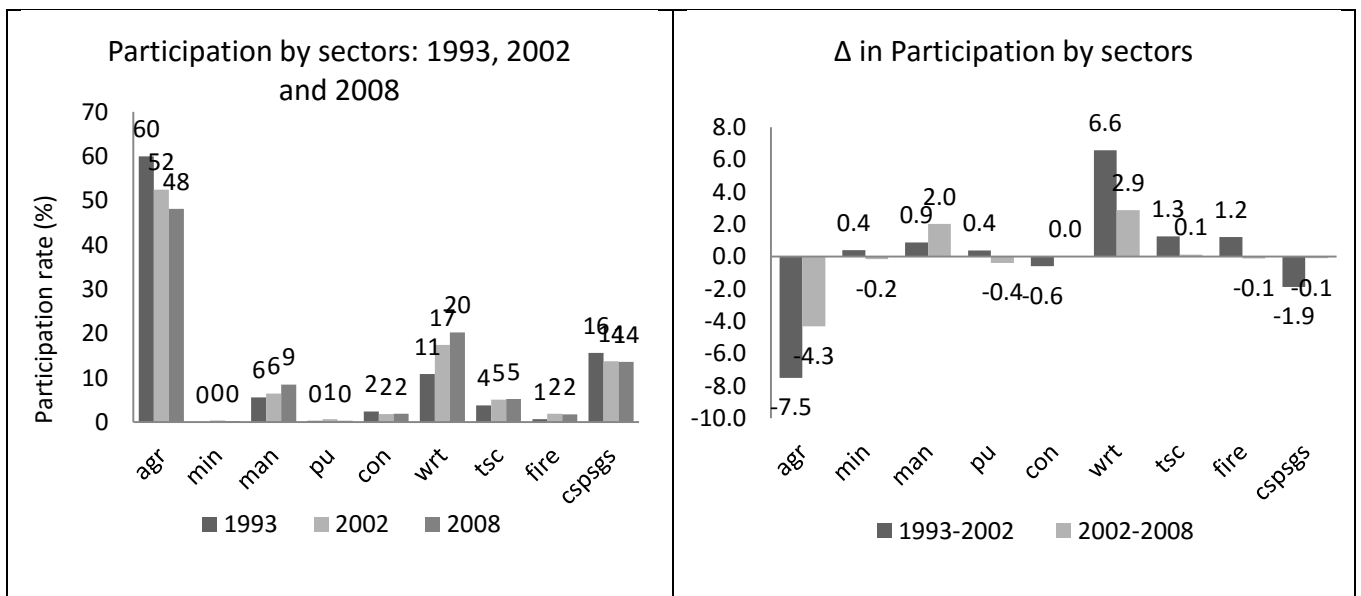


Figure 3.2 Changing Structure of the Ivoirian economy: 1993 to 2008

Note: Industry classifications as follows: agr: Agriculture, Hunting, Forestry and Fishing; min: Mining and Quarrying; man: Manufacturing; pu: Public Utilities; con: Construction; wrt: Wholesale and Retail trade, Hotels and Restaurants; tsc: Transport, Storage and Communications; fire: Finance, Insurance, Real Estate and Business Services; cspsgs: Community, Social, Personal, and Government services (based on McMillan and Rodrik, 2014)

Figure 3.3 shows changes in participation rates in agriculture across the distribution. For the period between 1993 and 2002, structural transformation was prominent in the bottom 70 percentiles, where participation in agriculture dropped, on average, by 5 to 10 percentage points. However, in the period from 2002 to 2008, we see a reverse trend. Participation in agriculture increased in the bottom half of the distribution, whereas structural transformation is evident mostly in the 50<sup>th</sup> percentiles and above. I create a combined sector, MWT, consisting

of three industrial categories where participation rate improved in the period from 1993 to 2008, which are *manufacturing*, *wrt* (Wholesale and Retail trade, Hotels and Restaurants), *tsc* (Transport, Storage and Communications). In both periods, MWT shows an exact opposite trend of participation. In the absence of panel data it is difficult to argue that migration from agriculture to MWT is the main channel of structural transformation; however, Figure 3.3 strongly suggests existence of such possibilities.

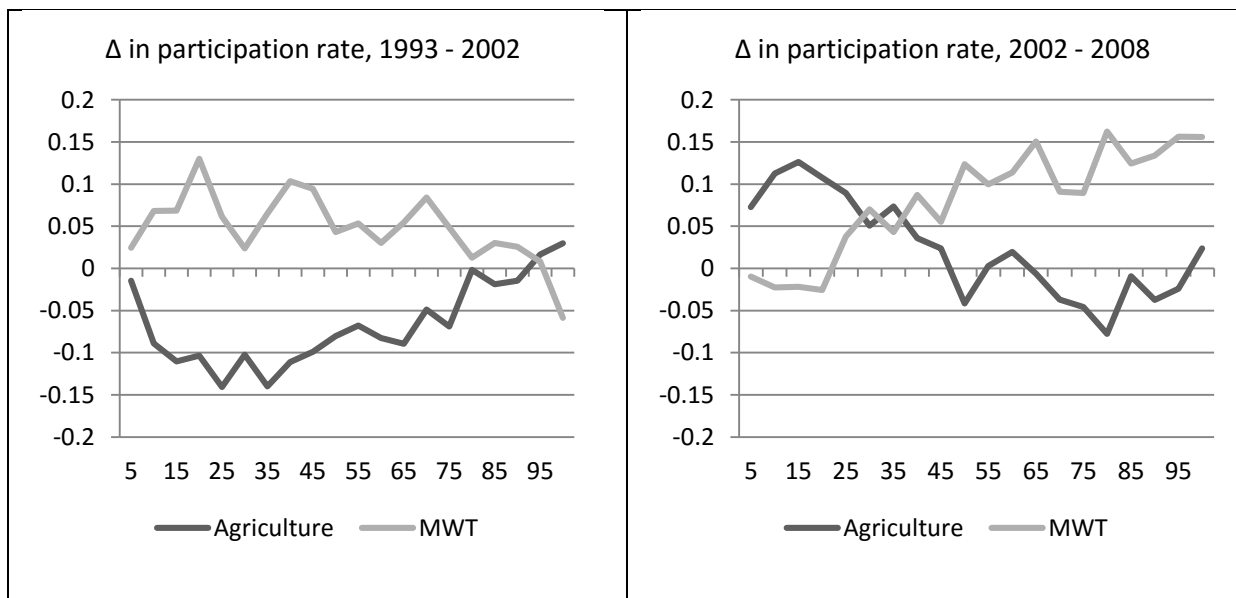


Figure 3.3 Change in participation rate in agriculture across income quantiles

## B. Returns to structural transformation across quantiles

To find the returns to structural transformation across the distribution, I need a way to link unconditional (marginal) quantiles to observables including household characteristics. Recentered influence function (RIF) regression offers a simple way of establishing this link and performing both aggregate and detailed decompositions for any statistic for which one can compute an influence function (Fortin, Lemieux and Firpo 2010). For a distributional statistic  $\theta(F)$  (where  $F$  is the underlying distribution function of the random variable  $y$ ), we denote the

corresponding influence function as  $IF(y; \theta, F)$ . The influence function of the  $p^{\text{th}}$  quantile of the distribution of  $y$  is given by the following expression

$$IF(y; q_p) = \frac{[p - I(y \leq q_p)]}{f_y(q_p)}$$

where the distribution function is kept implicit,  $I(\cdot)$  is an indicator function for whether the outcome variable is less than or equal to the  $p$ th quantile, and  $f_y(q_p)$  is the density function of  $y$  evaluated at the  $p$ th quantile. Firpo, Fortin and Lemieux (2009) define the recentered or rescaled influence function (RIF) as the leading terms of a von Mises (1947) linear approximation of the associated functional. It is equal to the functional plus the corresponding influence function. Given that the expected value of the influence function is equal to zero, the expected value of the RIF is equal to the corresponding distributional statistic. The rescaled influence function of the  $p$ th quantile of the distribution of  $y$  is:

$$RIF(y; q_p) = q_p + IF(y; q_p) = q_p + \frac{[p - I(y \leq q_p)]}{f_y(q_p)}$$

By the law of iterated expectation the distributional statistic of interest can be written as the conditional expectation of the rescaled influence function (given the observable covariates). This conditional expectation is known as a RIF regression. We express the RIF regression for the  $p$ th quantile of the distribution of  $y$ , as  $E[RIF(y; q_p)|X]$  so that the unconditional or marginal quantile is equal to  $q_p = \int E[RIF(y; q_p, F_y)|X]dF(X)$ . Thus, the RIF regression for the  $p^{\text{th}}$  quantile of the distribution of income ( $y$ ):

$$RIF(y; q_p) = \beta_0 + \beta_1 Agri + \beta_2 MWT + X'\gamma + \varepsilon$$

where the unconditional or marginal quantile  $q_p = \int E[RIF(y; q_p, F_y)|X]dF(X)$ . *Agri* refers to participation in agriculture sector<sup>7</sup> and *MWT* refers to participation manufacturing,

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<sup>7</sup> Choice of the base group influences the decomposition outcomes (Oaxaca and Ranson, 1999). The goal is to put emphasis on change in participation in agriculture, I consider the rest of the sectors as the base group to minimize the role of unobserved component.

wholesale and retail and transport sector. The omitted group is composed of participation in other industry categories. X refers to other predictors including demographic and household characteristics<sup>8</sup> and  $\varepsilon$  stands for the error term.

Figure 3.4 depicts returns (estimated RIF coefficients) to agriculture and MWT for 1993, 2002 and 2008. In 1993, return to agriculture remained negative across the distribution. In 2002, it improved significantly in the bottom 25 percentiles and in the top 20 percentiles. In 2008, it improved significantly in the bottom 25 percentiles and in the top 20 percentiles. In 2008, the estimated coefficients show a somewhat opposite trend. Returns to agriculture improved mainly for the people between the 25<sup>th</sup> and the 75<sup>th</sup> percentiles. Turning to MWT, returns across the distribution were less volatile in general. In 1993, returns to MWT were positive across the distribution. Returns to MWT dropped in the bottom 20<sup>th</sup> percentiles and the top 30 percentiles in 2002. But in 2008, it improved especially for the people in the bottom 20<sup>th</sup> percentile.

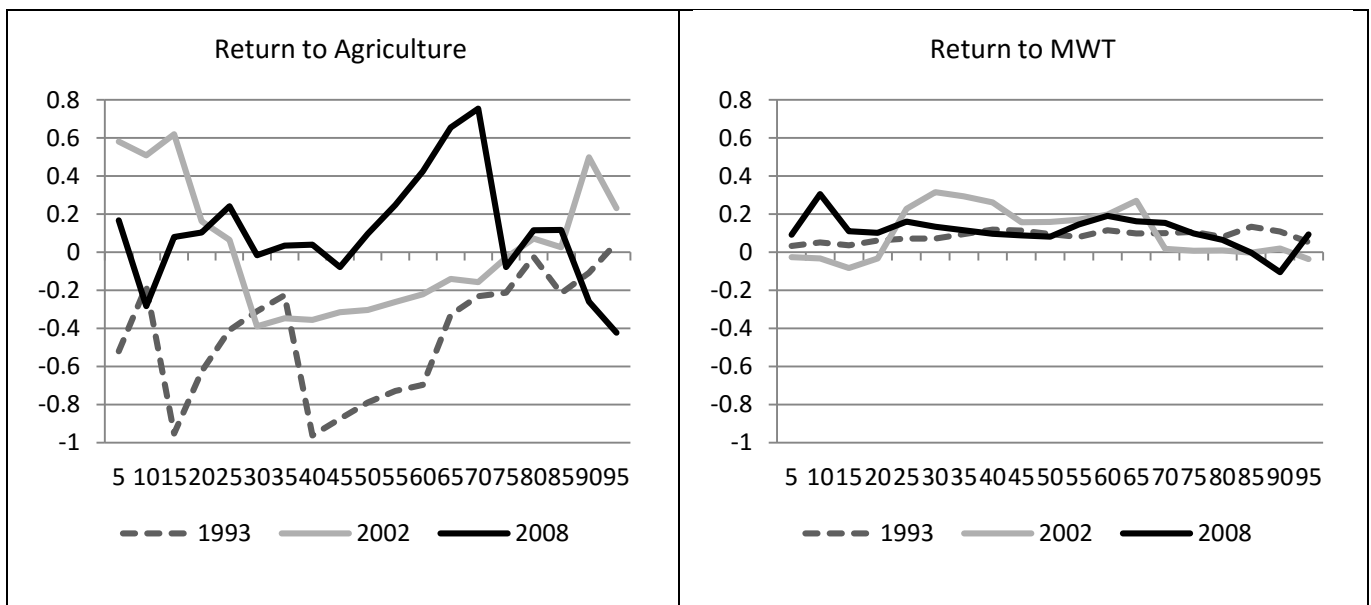


Figure 3.4 Unconditional Quantile Regression (RIF) coefficients

<sup>8</sup> I use five broad groups of covariates: household characteristics (household head's gender, education, marital status, household size, number of children in different age groups, land holding size); geography (urban, regions); occupation categories; agriculture (participation dummy)



A fall in inequality in the period from 1993 – 2002 can be attributed to structural transformation mainly in the bottom half of the distribution coupled with a steady increase in returns to MWT for people above the 20<sup>th</sup> percentile. In other words, the pro-poor growth could be partly driven by more people moving out of agriculture with better earnings prospects in the non-agricultural sectors, particularly in MWT. This closely resembles case 2 described in the previous section. Similarly, a rise in inequality is associated with structural transformation in the top half of the distribution. The returns to MWT remained steady across the distribution, but returns to agriculture dropped especially in the top 30<sup>th</sup> percentile of the distribution. Case 1 closely explains this rise in inequality in the period from 2002 – 2008. Overall, the empirical evidences in Cote d’Ivoire are in line with the theoretical predictions, with minor exceptions.

### **C. Relative Contribution of Structural Change to Inequality**

Until this point, the nature of the discussion has mostly been bi-variate, considering structural transformation and inequality through the GICs. Even if I find strong statistical evidence on the correlation between structural transformation-led growth and inequality, there could be other potential factors contributing to this nexus between development and inequality. Conceivably, the presence of such factors weakens the predictive power of the theoretical model. As a robustness check, next I consider a generalised Oaxaca-Blinder decomposition analysis (Firpo, Fortin and Lemieux, 2009) to estimate the relative contribution of structural change to inequality.

Let  $y_{0|t=1}$  and  $y_{1|t=0}$  represent counterfactual outcomes for period 1 and period 0 respectively and  $F_{y_0|t=1}$  be the distribution of the (potential) outcome  $y_0$  for individuals in period 1. If  $\theta(F_{y_0|t=1})$  expresses any distributional statistic associated with this distribution, then the standard decomposition between the periods 0 and 1 can be written as

$$\Delta_{Overall}^{\theta} = [\theta(F_{y_1|t=1}) - \theta(F_{y_0|t=1})] + [\theta(F_{y_0|t=1}) - \theta(F_{y_0|t=0})]$$

Where, I use the counterfactual for period 1 to obtain the aggregate decomposition. I continue to work with a linear approximation of the RIF regression of the pth quantile. This makes the extension of the standard Oaxaca-Blinder decomposition to RIF regressions both simple and meaningful. Let  $\gamma^{qp}$  be the estimated coefficients from a regression of  $RIF(y; q_p)$  on X. Based on Fortin, Lemieux and Firpo (2010) the generalized version of Oaxaca-Blinder decomposition technique can be written as:

$$\Delta_{Overall}^{\theta} = E(X|t = 1)(\beta_1^{\theta} - \beta_c^{\theta}) + E(X|t = 1)\beta_c^{\theta} - E(X|t = 0)\beta_0^{\theta}$$

This is a linear approximation of the true conditional expectation with the expected approximation error being zero. The linear RIF-regressions of the p<sup>th</sup> quantile of the distribution of y is estimated by replacing y with the estimated value of  $\widehat{RIF}(y; q_p)$ . This decomposition may involve a bias since the linear specification is only a local approximation that may not hold in the case of large changes in covariates. The solution to this problem is to combine reweighing with RIF regression and compute the structural effect as follows  $E(X|t = 1)^T \cdot (\hat{\gamma}_1^{qp} - \hat{\gamma}_c^{qp})$  and similarly, the composition effect is  $E(X|t = 1)^T \cdot \hat{\gamma}_c^{qp} - E(X|t = 0)^T \cdot \hat{\gamma}_0^{qp}$ .  $\gamma_c^{qp}$  is the vector of coefficients from a RIF regression at  $t = 0$  sample reweighted to have the same distribution of covariates as in  $t = 1$ . Reweighting ensures that  $(\gamma_1^{qp} - \gamma_c^{q\tau})$  reflects a true change in the outcome structure.

The use of a linear approximation of the RIF regression also allows to separate out the contribution of different subsets of covariates to the structure effect and the composition effect as parts of the aggregate decomposition similar to Oaxaca-Blinder decomposition<sup>9</sup>. To note, differences in participation rates between 1993 and 2002 (and consequently between, 2002 and 2008) in agriculture identify structural transformation<sup>10</sup>.

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<sup>9</sup> Essama-Nssah, B., Paul, Saumik, Bassol'e, L. (2013) used this tool to decompose growth incidence in Cameroon.

<sup>10</sup> A richer specification including interaction terms between occupations and sectors of work is used for better estimates of the reweighing factor (Firpo, Fortin and Lemieux, 2009).

Figure 3.5 shows the total change in growth incidence decomposed into the structure and the composition effect. Overall, the pro-poor growth in the period from 1993 to 2002 is mainly driven by the structure effect whereas the composition effect solely explains the changes in the top half. In other words, changes in the returns to observable factors including structural change among others, determine the shape of the GIC. In the next period, the composition effect plays the key role. The pro-rich growth between 2002 and 2008 is mostly explained by a positively sloped composition effect. This indicates during this period, changes in the level of observable factors explain the growth incidence.

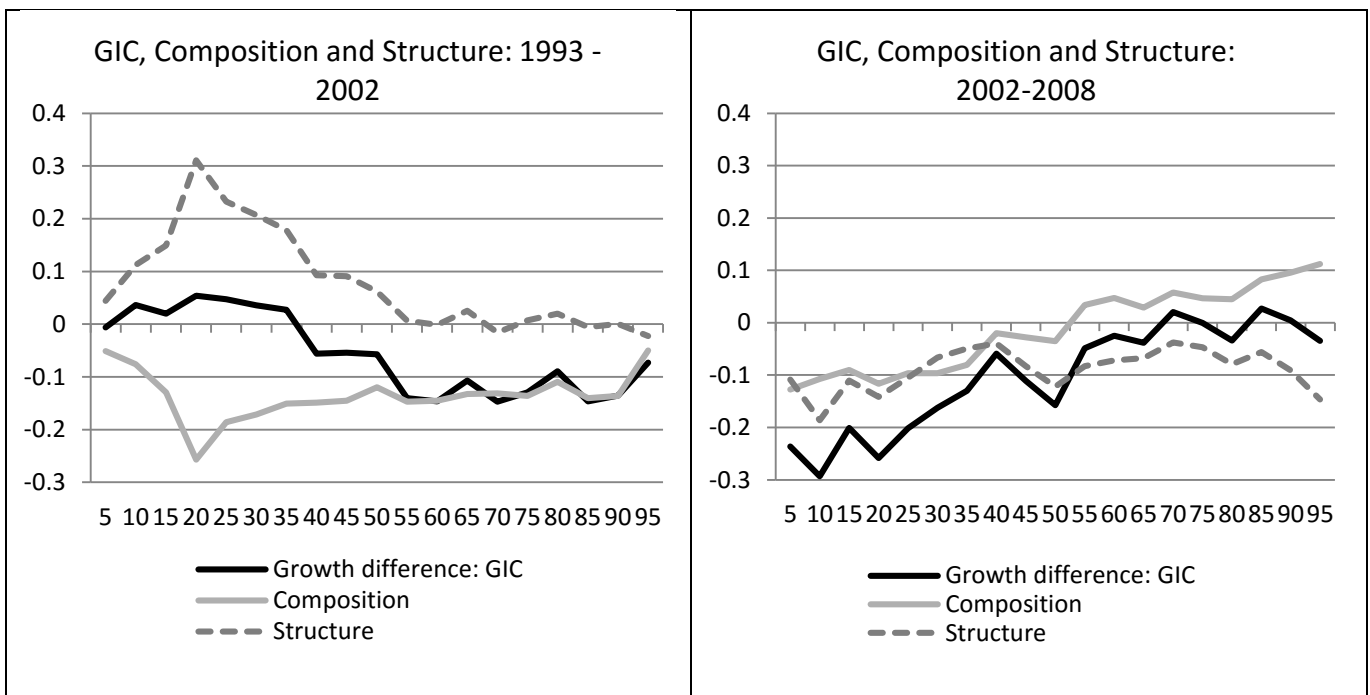


Figure 3.5 Total decomposition of growth incidence into composition and structure effect

Next, I elaborate on the detailed decomposition outcomes. Figure 3.6 summarizes decomposition outcomes between 1993 and 2002 for three standard measures of inequality: income ratios for quantiles 95 to 50, 50 to 1 and the Gini coefficient. I consider six broad categories of explanatory factors. Agri and MWT refer to participation in agriculture and MWT,

respectively. HHchar represents household characteristics, Geography accounts for rural urban and district fixed effects, Occupation category represents all occupational categories and finally Residual measures the unexplained part. In the period 1993 – 2002, household characteristics remain as the main driving factor behind a fall in inequality through the structure effect. Structural transformation in fact is associated with a rise in inequality, except for the income ratio 95-50.

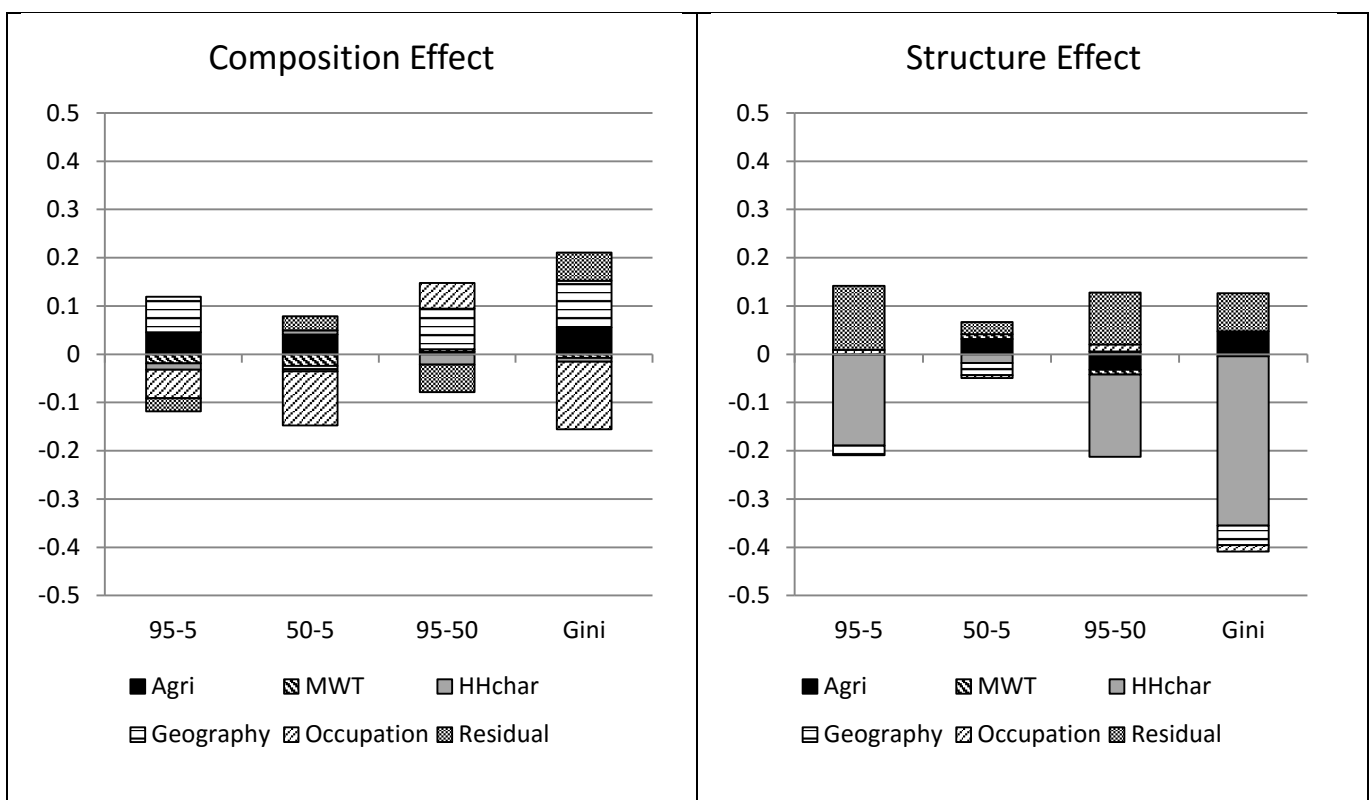


Figure 3.6 Detailed Composition and Structure Effects: 1993-2002

Figure 3.7 shows the detailed decomposition outcomes for the period between 2002 and 2008. In this period also, changes in the levels of household characteristics significantly contribute to a rise in inequality but through the composition effect. The contribution of structural transformation to the level of inequality is positive, and this is evident mainly through the

composition effect. Among other factors, unexplained variation also contributed to rise in inequality through the composition effect.

Overall, as it is evident from Figures 3.6 and 3.6, the relative contribution of structural transformation to inequality is weak. The main drivers of change in inequality from 1993 – 2008 were household characteristics, geography, occupational categories and unexplained parts both in the composition and the structure effects.

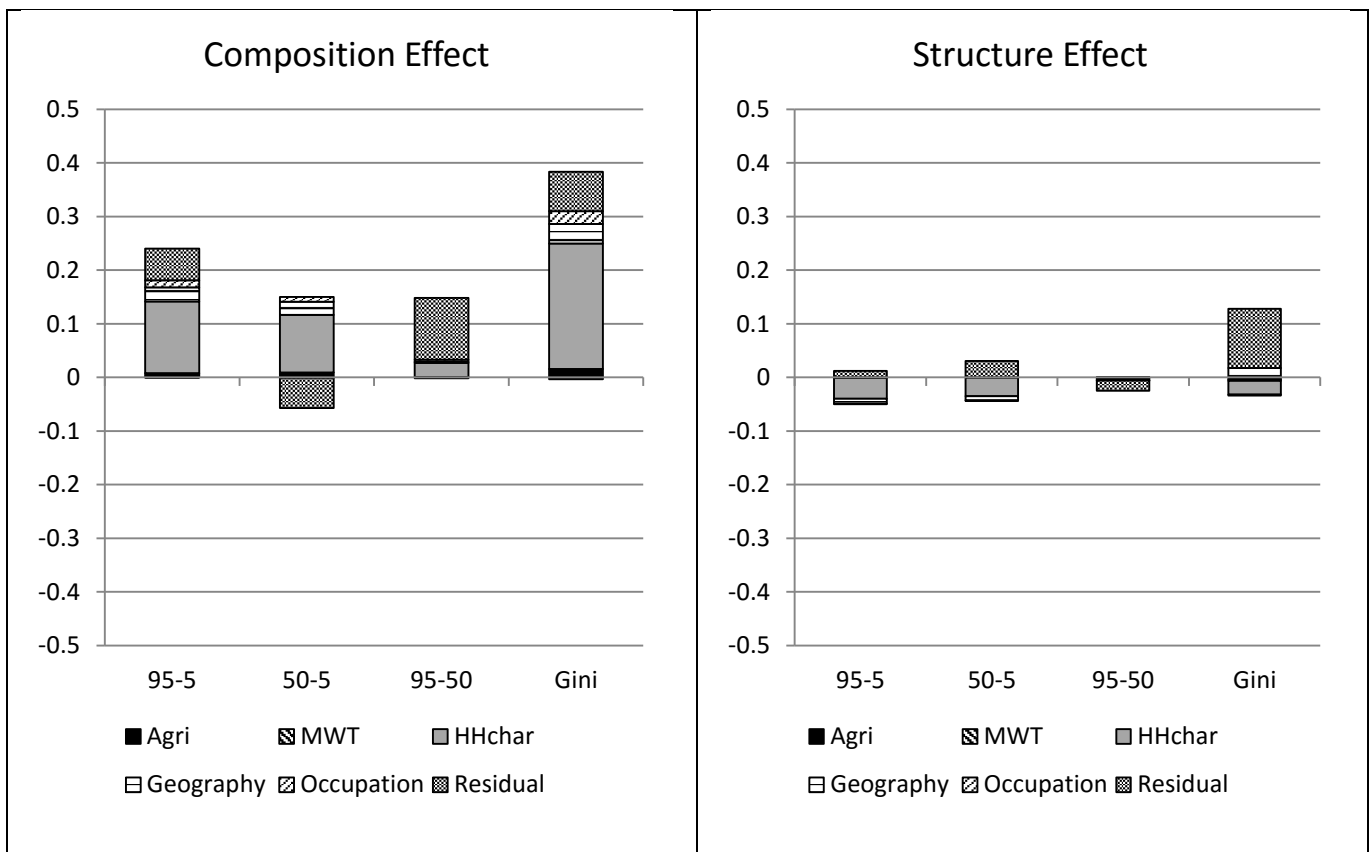


Figure 3.7 Detailed Composition and Structure Effects: 2002 - 2008

#### IV. Concluding remarks

Dual-sector models have long been used to explain the Kuznets motion both in the presence (Robinson, 1973) and in the absence (Fields, 1979) of within-sector inequality. Allowing for inequality within each sector, this paper extends this literature. I model heterogeneity of structural transformation and within-sector inequality across the distribution. I argue that the gap between returns to non-agricultural and agricultural sectors and variation in the rate of

structural transformation change across income quantiles jointly determines the direction of the Kuznets motion. Also, the relationship between structural transformation and inequality depends to a large extent on the earnings ratio and how it varies across income quantiles. This is in line with the findings of Bourguignon and Morrisson (1998).

Empirical evidence based on Ivoirian household survey data for three periods: 1993, 2002 and 2008 supports the theoretical model prediction. However, the relative contribution of structural transformation to total changes in inequality is weak. This could be due to a number of factors. First, the identification of structural transformation is simply based on the difference in the percentage of households consider agriculture as the main source of livelihood. Second, in the case of Cote-d'Ivoire the overall growth in income has been negative in the period from 2002 and 2008, which is evident from the shape of the GIC. This may provide weak links between structural transformation and growth in the first place, which in turn makes the prediction on the Kuznets motion based on structural transformation insignificant. Another caveat is that the GIC is based on anonymity principle, and as a result it ignores the issue of re-ranking of individuals through income mobility over time. Although this issue is not central to the main argument of this paper, the theoretical framework developed in this paper is incapable of linking individual mobility features to the Kuznets curve.

Nonetheless, heterogeneous structural transformation across the distribution provides a novel way to explain the Kuznets motion and it also paves a way for more theoretically satisfying models to come. Also, empirical evidence from a broad and diverse range of countries may provide more robust support to the contribution of structural transformation to the Kuznets motion.

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