Fiscal Policy and Sectoral Productivity Convergence in Cameroon: Implications for Poverty Reduction*

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Abstract: The literature on structural change based on cross-section and time-series data has been preoccupied with a statistical description of intersectoral linkages rather than explore their implications. This paper examines the impact of fiscal policy and other economic fundamentals on labour-productivity convergence between agriculture, manufacturing and services activities and provides the growth and poverty effects in Cameroon covering the period 1969-1998. It shows that the catch-up of the agricultural sector with the leading manufacturing/service sectors in terms of productivity is guaranteed in the long-run. We find that while government spending on road infrastructure promotes convergence, spending on health and communication reinforce inequality in the level of sectoral labour productivity by a disproportionate increase in non-agricultural sector productivity. The study reveals that the catch-up of the lagging agricultural sector with the leading industrial/service sectors in terms of labour productivity fosters poverty reduction. However, the process of sectoral convergence, both in models and history, is a long one. In Cameroon, this could be achieved by government investment on roads and manufacturing capital and to some extent in health and communication which in turn via spillovers raises agricultural productivity in the log-run. The empirical results suggest that spending on these domains have been efficacious, while spending on education and agriculture have not been, yet all these types of spending are likely to reduce poverty. Proper budget targeting, in the domains of education, agriculture, rural road infrastructure, increased mechanisation of the agricultural sector and outward oriented trade policies could foster the catch-up process and therefore could be an option towards an ultimate solution to the growth and poverty crisis in an agricultural and developing economy. Further research is needed in order to provide the contrary.

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CONTENTS
LIST OF TABLES
LIST OF FIGURES

LIST OF TABLES

LIST OF FIGURES

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I. INTRODUCTION

Productivity growth appears to have become one of the surest routes to poverty reduction. Previous literature and empirical work provides a strong consensus that growth reduces poverty (Dollar and Kraay, 2002, CSLS, 2003) and in dynamic economies most economic growth comes from productivity growth[1]. There are indications that productivity growth is important for poverty reduction and even appears stronger than the link between growth and poverty reduction (CSLS 2003). This issue is important especially for African countries generally known to be in poverty and high inequality (World Bank, 1995), in light of the development objective of the United Nations goal of reducing the 1990 poverty by half by the year 2015.

The most popular notion of productivity is that relating to labour and that compares the volumes produced to the quantity of labour employed through out the production process. Thus, studies focusing on productivity and its evolution need to be highlighted. In which sector of the economy is labour productivity greatest? Is there any dynamic interactions between sector labour productivity (i.e. spillovers) and does this interrelationship serves as impetus for productivity growth and overall reduction in poverty or increased standard of living? Labour productivity is low especially in the leading sectors of most sub Saharan African economies (i.e. agriculture) and so detecting the causes of inequality of sectoral labour productivity and exploring the role they interplay should provide reference indicators from which progress in growth and poverty reduction could be reinforced. The current analysis based its argument on the Lewis (1954) theory of structural change where labour productivity growth and the intensive use of labour occur via reallocation of labour between sectors or spillovers in

[1] Steindel and Stiroh (2001) and Catia (2003) aver that the rate of labour productivity growth can have an enormous effect on real output and living standards. There is evidence, explaining that US labour productivity growth, measured as GDP per hour worked rose faster than that of some large European Union countries and this was accompanied by a relatively high US GDP per capita in comparative terms (Ahmad et al., 2003).

production techniques from the manufacturing or service to agriculture resulting to convergence (i.e. productivity gains/loss in on or both sectors). However, sectoral convergence may take a long time to occur especially in a country that is still at low-income and agricultural as Cameroon, expected to be in the midst of the transformation process, far from full commercialisation of all labour markets. Thus, according to the Rostow doctrine, this also involves a transition from underdevelopment to development which should pass through a series of stages and as a matter of time (Rostow 1958). This paper examines the role play by fiscal policy in the process of convergence via rising agricultural productivity and the subsequent effects on food poverty[2] in Cameroon.

The remainder of the paper is organised as follows. In the next section we present the economic situation of the country in question, followed by methods and nature of data used and the empirical strategy adopted. The discussion of results follows with a summary of findings and policy implication.

II. OVERVIEW OF CAMEROON ECONOMY

Economic development in Cameroon has passed through three main phases. From independence in 1960 until 1985, the economy experienced impressive growth performance thanks to oil exploration and a sustained agricultural production backed up by strong world market prices[3]. Alongside, the government was able to meet up with its role of the provision of public goods and services, following a sustainable and consolidated public finances. After 1985, much of the progress of the previous two decades was undone due to lower export earnings that came as a result of a fall in oil and other export prices. Following the continuous decrease in world market prices or deterioration of terms of trade, the economic slump persisted in 1986/1987 and beyond.

[2] The absolute level of labour productivity in agriculture also has important implications for poverty. Food consumption per capita which takes a greater share of the income of poor households correlates with living standards and so the food situation should occupy an important place in policy issues.

[3] Positive real growth rates and steady rise in productivity could be observed on the graphs in the appendix.

This is evidenced by the negative real growth rates and declining productivity in the subsequent periods (see graphs in appendix), with repercussions on public finances or the budget.

However, with an improvement of the economic situation as from the mid 1990s, government expenditures and budgetary revenues started increasing.

Thus, the period 1985/1986 to 1993/1994 has been a decade of deep social and economic crisis for urban and rural Cameroonians as opposed to the period 1995-2001 considered as years of hope. The monetary adjustment that took place in January 1994 and achieved through the devaluation of the CFAF, coupled with other economic policy measures may have contributed to reverse the trend. The Cameroonian economy, was thus, renewed with real growth rates and steady increase in productivity beginning the 1994/1995 budget year (see figures 2, 4 and 5).

It should be understood that, Cameroon's welfare indicators also moved closely to the level of income or economic progress. The per capita income observed a steady rise since independence reaching its peak in 1984/85 and averaged as low as 249000 CFA francs subsequently (Amin 1996). Food consumption inequalities aggravated and although a large share of domestic food consumption is provided from domestic food production, the period witnessed a decline in staple food supply. The situation worsened if seen in the light of per capita food production, and consequently affecting the living standards of Cameroonians (see for instance Amin, 1996). Further, considering the evolution of food poverty in Cameroon, there are indications that the situation deteriorated between 1983/84 and 1996. The various poverty indices, p0, p1 and p2 were higher in 1996 than in 1983/84[4]. In the same study, (Fambon et al.,2004) using a higher poverty line found that in 1983/84 about 39% of Cameroonians as against 68%

[4] Foster et al.(1984) proposed a family of poverty indexes, based on a single formula, capable of incorporating any degree of concern about poverty through the 'poverty aversion parameter, α. This is the so-called P-alpha measure of poverty given as $P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}_i\right)^\alpha$ where z is the poverty line, q is the number of households or persons below the poverty line, N is the total sample of the population, yi is the income of the ith household and alpha is the Foster-Greer-Thobecke parameter taking the values 0, 1 and 2 depending on the degree of concern about poverty.

in 1996 were poor[5] with a higher incidence in the rural areas. However, the situation seemed to have ameliorated between 1996 and 2001 as observed in Table 1 below.

The modification of the incidence of poverty, intensity of poverty and severity of poverty can be used to better appreciate the evolution of the monetary aspects of poverty. The general amelioration of the poverty situation by 13.1 points is more manifested in urban areas than in rural areas, that is, 19.3 points as against 9.7 respectively.

Table 1: Evolution of indicators of monetary poverty between 1996 and 2001

Indicateurs	Milieu	1996	2001	Variations
P0=incidence	Urban	41.4	22.1	- 19.3
	Rural	59.6	49.9	- 9.7
	Cameroon	53.3	40.2	- 13.1
P1=intensity	Urban	14.7	6.3	- 8.4
	Rural	21.5	18.3	- 3.2
	Cameroon	19.1	14.1	- 5.0
P2=severity	Urban	6.9	2.7	- 4.2
	Rural	10.1	9.3	- 0.8
	Cameroon	9.0	7.0	- 2.0

Source: DSCN (2002), Living Conditions and Poverty profiles in Cameroon in 2001.

Within the poor, the poverty phenomenon was less severe in 2001 than in 1996 due to the amelioration of the inequality between the poor. The incomes of the poor are less dispersed with respect to the poverty line in 2001 than in 1996. Severity or gravity of poverty as it is called; p2 was 9% in 1996 as compared to 7.0% in 2001. The amelioration of the gap between the poor was most felt in rural than in urban areas. Agriculture or food production could be strengthen through spillovers injected into the agricultural sector and thus, eliminate poverty in the rural areas in particular and the country as a whole. The latter occupies an important place in developing countries particular sub-Saharan Africa where labour is abundance and agriculture (the main sector) productivity is low.

Theory postulates that reallocation of this abundance agriculture labour to the modern industrial sector would raise agricultural productivity as well as total physical productivity faster than in non-agriculture, so productivity will tend to rise and

[5] The calculation of Department of Statistics and National Accounts indicate that poverty moved from 40.5% in 1983/84 to about 50% in 1996

converge (Lewis, 1954; Ranis and Fei, 1961). This seems not to be the case for Cameroon especially since the beginning of the crisis in 1985 where there has been a significant divergence of productivity levels though convergence tendencies occurred as from the 1990s just like in the early periods before the crisis (see figures 4 and 5 in appendix). As observed in figure 6 there seem to be divergence of sector labour productivity growth rates in the late 90s with a faster growth of agricultural productivity, indicating the possibility of convergence in productivity levels. In figure 5, the measure of convergence[6] portrays a slight upward shift from 1985 but drops in the late 1990s. Agriculture labour productivity remains low throughout the period while industry dominates from the 1980s with the service sector productivity lying between them[7]. However, all were declining at the close of the 90s. Normally, rising productivity in agriculture through convergence which may also occur through spillover from productivity techniques in manufacturing to agriculture should result to the production of more food with fewer workers, with a consequent decline of employment in agriculture. The sector contributes less in terms of output share lying between industry and service at the early stage and in the 90s.

The service sector dominates throughout competing with industry at the beginning of the exploitation of off-shore oil in the early 80s (see figure 1). Finally, agriculture continues to employ a greater proportion of the work force showing a rise in the 1990s while levelling at the close of the period whereas the service sector rank second and slightly tailed by industry. These trends were, however maintained for the non-agricultural sectors as depicted in figure 3 of the appendix.

[6] The notion of convergence is explained in details in section 3.

[7] It should be understood that though the agricultural sector enjoys rapid long-term productivity and GDP growth sometime in the late 90s, the value of productivity or GDP in current CFA value is well below the economy-wide average due to the relatively low price of agricultural goods.

III THEORETICAL AND EMPIRICAL BASE

III.1 Theory and Literature Review

Similar to the literature on international convergence[8] of labour productivity, national convergence of sectoral productivity levels can also be explained from the [9]endogenous growth model. Productivity convergence and productivity growth are not interchangeable. Sectoral productivity levels can converge while productivity falls or rises in one or both sectors. Nevertheless, the driving forces behind overall productivity growth would equally have an effect on sectoral productivity changes for convergence to occur. However, it should be understood that for sectoral productivity levels to converge, e.g. agriculture (AGRlp) and industry (INDlp) or service (SERlp), the ratios (AGRlp/INDlp or AGRlp/SERlp) should tend to 1 and this requires differences in growth rates where agricultural productivity must grow faster than the others. Thus, the sources of productivity performances or growth and convergence are synonymous.

The usual presentation of the sources of growth as well as productivity is based on the result of the Cobb-Douglas model using two factors of production, labour and capital, and the embodied technical progress.

$$Y = F\,(TFP, K, L) = TFP \times K^{\alpha} \times L^{\beta} \qquad (1)$$

In this model Y is the production, TFP is the technical progress trend or total factor productivity, K is physical capital and L is labour. Taking logarithmic differences, i.e. the rate of growth, the relationship is expressed as:

$$\Delta y = \Delta\, tfp + \alpha\, \Delta\, k + \beta\, \Delta\, l \qquad (2)$$

and provides the GDP growth breakdown, split between improvements in technical progress and growth of the two factors of production with α and β representing the elasticities of the production factors, whose sum is equal to one, $\alpha + \beta = 1$.

$$\Delta\,(y - l) = \Delta\, tfp + \alpha\, \Delta\,(k - l) \qquad (3)$$

[8] A vast literature exist on this issue whereas national convergence of sectoral productivity levels has featured less prominently in theoretical models (see de la Fuente, 2002 for details).The latter is very important especially for an agricultural economy like Cameroon where the low productivity agricultural sector can benefit from higher productivity techniques in the manufacturing sector through spill over imported from advanced countries.

[9] The endogenous growth like the neoclassical growth models provide theoretical framework for analyzing income growth using a production function. The former discard the neoclassical assumption of diminishing returns to scale in aggregate production, and frequently focus on the role of externalities such as human capital in reinforcing the rate of return on capital investment (Todaro 2000).

The relationship (3) determined from (2) is of interest to this study and provides a breakdown of the change in labour productivity Δ (y –1) into two effects: the effect linked to capital deepening or capital intensity Δ (k - l), and the effect linked to total factors productivity Δ tfp. The multi-factor productivity concept embraces all variables that affect output for any given level of inputs. It accounts for the growth not accounted for by capital accumulation or increased inputs. The components usually included in this unexplained growth are: advances in knowledge (i.e. education and training), research, and efficiency in the allocation of resources. Thus, labour productivity is determined by the amount of available factor inputs, i.e. labour (including human capital), physical capital and intermediate inputs (Vander and Wiel 1999)[10]. Inspiring from the link between tfp and labour productivity performance, Ratts∅ and Stokke (2003) provide econometric results and review similar cases in agriculture and industry.

Heisey (2004) concludes that investment in research and development for agricultural production are necessary for growth of agricultural productivity. In this study, government allocation in agriculture is considered as a proxy while education and health spending enhances human capital. A number of useful literatures on the relation between social spending on education and health (variants of human capital) and productivity of workers exist. Health can affect productivity, assuming that a large proportion of the working population depends on good health, in order to function well, though the issue remains under-researched and controversial on the direction of causality between health and income (Harris 2002).

Chang and Chen (2001) introduce government taxation and infrastructure expenditure in Matsuyama's model and show that, under proper conditions, higher agricultural productivity has a positive effect on growth via such spending. The government expenditure introduced in Matsuyama (1992) model by Chang and Chen is productive in the spirit of Barro (1991), in that the learning-by doing effect of the manufacturing sector becomes enhanced with government productive expenditure, thus the reason for adapting this to explain the convergence tendencies of sectoral labour

[10] Several others also emphasised the role of physical capital accumulation as it provides more capital per unit of labour input (i.e. strengthens capital deepening) including human capital or skills acquired in training and information and communication technologies in creating sectoral or regional differences in productivity levels or growth especially when inter-industry capital intensity persist (Grossman and Helpman 1991, Corver 1996, Roa et. al. 2003).

productivity levels. Examples of this government productive expenditure are abundant and include those in the areas of infrastructure, public education, and institutional reconstructions (Chang and Chen 2001)[11]. Lastly, the literature also suggests that free market policies or small governments with open markets that encourage foreign trade foster productivity growth (Edwards 1997). Equally too, Irz and Roe (2001) point that trade liberalisation can substantially accelerate growth of an agricultural poor country through its effects on agricultural productivity while Ratts∅ and Stokke (2003) provide a positive link between foreign spillovers (assumed channelled through foreign trade or openness and foreign investment) in industry.

However, despite the various sources of productivity discussed above, sectoral productivity differences arise. Following the writings of Adam Smith, most economists seem to have regarded it as axiomatic that productivity grows less rapidly in agriculture as in the manufacturing sector.[12] The dual economy model inspired by the work of W.A. Lewis (1954) typically features a distinction between a stagnant, traditional rural sector and a dynamic modern manufacturing sector. However, other offshoots of the model that centre on the agriculture-industry interactions provide optimisms on prospects for higher rates of agricultural productivity and growth.[13] Thus, analyses on the interactions between agriculture and industry dwells on the literature of structural change embedded on the work of W. A. Lewis (1954) to explain productivity growth.

In Lewis model, development is viewed as absorption of labour from the low-productivity rural-agricultural sector into the high-productivity urban-industrial sector. This process should obviously lead to sector labour productivity convergence (i.e. productivity levels growing more equal) or divergence initiated by the reallocation of labour force. As workers migrate to the urban sector, average productivity in agriculture rises eventually, with the disappearance of the disguisedly unemployed labour force and

[11] Mahran (2000) aver that policies to improve on agricultural productivity should be reinforced by efforts to improve infrastructure, including health and education to pave the way for a positive supply response at lower cost.

[12] Matsuyama (1992) and Sachs and Warner (1995) expressed that countries with large agricultural sectors faced diminished growth prospects.

[13] Many developing countries including sub-Saharan Africa had discriminated against agriculture by adopting policies that promote the industrial sector. According to Bluch and Verner (1999), Martin and Mitra (1999) and Ratts∅ and Torvik (2003), such measures are not optimal and may reduce the growth of the economy.

the "commercialisation" of the agricultural sector and thus, the whole economy leading to increasing agricultural real wage (Todaro, 2000). Gemmell et al., (1998) reviews some studies and reiterated that such a situation could only be possible if productivity-enhancing advances in industrial technologies tend to spill over to agriculture. In the case of developing economies where technological advances are generally imported this might be expected take the form of productivity improvements in industry spilling over to agriculture. To the extent that three sectors compete in factor markets this will reinforce tendencies towards equality in labour productivity (Gemmell et al. 1998).

Rattsø and Torvik (2003), using a dynamic extension model, assuming learning-by-doing in industry and catching-up in agriculture, therefore demonstrated that discrimination against the latter may reduce growth rate of the economy and the technological advantage of industry. Finally, since in most economies, economic growth comes from productivity growth and the latter account for changes in poverty better the former (CSLS 2003), the current analysis finds sectoral growth and productivity interactions as an ultimate solution to the poverty crisis in an agricultural economy through the spill over effect.

There is no direct link between productivity convergence and poverty. The existence or not of convergence has an uncertain implications for what is happening to the level of productivity in any sector. However, convergence of productivity levels would reduce poverty if the ratio of agriculture to non-agricultural productivity tends to one, occurring when the former grows faster than the latter. Productivity growth is the main determinant of income growth (Steindel and Stiroh 2001; Catia 2003) and this explains why productivity growth reduces poverty. Economic growth or income growth is the most frequent variable used in econometric tests, as productivity measures are rarely studied in relation to poverty which explains why the literature on poverty and productivity is so limited (CSLS 2003).

Datt and Ravallion (1998) study the impact of agricultural productivity (yield per acre) on poverty in India where quality household survey data exist for a sufficient long period. Using poverty measures such as headcount poverty gap and square poverty gap, they show that increasing agricultural productivity would in the short-run reduce poverty through expanded employment opportunities or more abundant harvests while

in the long-run, poverty reduction occurs through higher wages and lower relative food prices. Productivity growth in agriculture may occur via spillovers from the non-agricultural sector even if the direct impact of fiscal or economic factors on the former is not felt.

III.2 Measuring Productivity and Convergence

The main function we model is that which indicates the convergence of agricultural productivity to that of non-agriculture, driven by both fiscal and other factors or by spillover effects. Productivity is referred to as output per unit of input such as labour, land, capital and raw materials. Total factor productivity growth is defined as output growth in relation to a weighted sum of the growth of factors of production (usually labour and capital) and this represents technical progress. Labour productivity is much more closely related to potential increases in real income and living standards than total factor productivity (CSLS 2003), and so it is used in this paper.

Labour input can be measured using either, total employment, or total hours worked, or a quality adjusted measure of labour input. Like in the literature, this study makes use of a simple aggregation of the sum of all workers or aggregate labour force as the labour input. Though quite simple and data easily available, it may not reflect the quality of labour input with productivity differentials. Labour employed in the main economic sectors including agriculture, industry and service have been used as labour inputs to compute (absolute) sector-labour productivity.

Assessing whether productivity gap is reducing or increasing, takes us to the notion of convergence. In this study, convergence in sectoral productivity level is adopted in line with the objective of examining those factors that push up agricultural productivity to that of the non-agricultural productivity, more importantly industry[14]. Two measures of convergence are often used interchangeably in the literature are the standard

[14] For sectoral productivity levels to converge, e.g. agriculture (AGRlp) and industry (INDlp) or service (SERlp), the ratios (AGRlp/INDlp or AGRlp/SERlp) should tend to 1 and this requires differences in their growth rates where agricultural productivity must grow faster than the other.

deviation of productivity and the coefficient of variation[15]. Other indices used to measure inequality exist in the literature and possess desirable properties.

To obtain the Theil index or entropy the following formula has been used.

$$E_{ti} = \sum y_{ti} (\log y_{ti} / l_{ti})$$

Where y represents the different economic sectors or indicators with i numbering the different regions;(or sector in this case) l_i is the sector's share in total labour and y takes either agriculture production, industry/manufacturing output, services, etc which are the sectors' share in gross domestic product (GDP) at various time period t. In this study the model is extended to calculate entropies for the entire sectors of the economy.

The inequality measure E_i takes non-negative values. Even though any of log y_i/l_i could be negative, the entire sum is always positive. The sum is proxy to overall inequality since the various sectors make up the entire economy or GDP. An equal distribution is denoted by E = 0, which happens when each sector's labour share and their respective share in GDP are equal. Entropy is an information theoretic measure based on prior and posterior probabilities. In the measures E_i, p_i or li and y_i can be regarded as prior and posterior probabilities, because $\sum Yi = \sum Li = 1$. Thus, in this paper, E will measure inequality among sectoral labour productivity levels which represents the convergence measure (COVlp) in the estimations. One advantage of this measure is that it is independent of size-variations among regions or sectors (see Das and Barua 1996 for details).

III.3 Econometric Model and Data

In order to realise the objectives of this paper, three models are specified. The first one is the link between sectoral differences in labour productivity (i.e. the convergence term) and fiscal measures including other factors[16]. The others shall test the existence of sectoral interaction of productivity levels which provides a picture of convergence via

[15] Though it has been shown that these measures lead to different conclusions, Mulder and de Groot (2004) in their analysis found out that both measures yield an identical pattern of convergence along with small differences in the size of cross-country variance. Accordingly, size variations among countries, regions or sectors could still be instrumental to conflicting conclusions or results.

[16] The various components of the convergence term comprising absolute level of labour productivity in agriculture, industry or manufacturing and the service sectors are also regressed on some of the relevant variables in order to have a good picture of the linkage between convergence and the fiscal variables.

spillovers whereas the last estimates the subsequent poverty effect of convergence. Absolute level of labour productivity in agriculture has important implications for poverty. With the difficulty of excluding formal agriculture output and employment (e.g. plantation agriculture), food production per capita which is also affected by agricultural productivity is used as the poverty indicator. Thus, to observe the poverty implications of convergence, a food production per capita function is regressed on agricultural productivity and other variables on the basis of the interactions effects of manufacturing and service productivity on agricultural productivity. The modelling framework used is adapted from the theoretical and empirical review.

The method of analysis will be the Ordinary least square with the regressions running from 1969 to 1998. The chosen method of analysis (system of equations) is appropriate, because the theoretical relationship that exists between sectoral productivity differentials, fiscal measures and poverty reduction is a complex one and not a direct one. The system of equation modelled, emphasise the direct and indirect effects of fiscal measures on sectoral inequality in labour productivity levels, and the poverty impact from such effects. The models capture most of the variables affecting sectoral labour productivity differentials which could indirectly affect general welfare. Thus, the specifications that comprise of three behavioural equations explain convergence and its impact on food production per capita. Below are the various specifications and expected signs of the coefficients.

1. COV_{lp} =f (OPEN, CAPAGR, CAPIND, CAPSER, AGR, EDU, HLT, ROAD, COMM, LABgr, D86, D94)

$0 < f_1 < 0,\ f_2 < 0,\ f_3 > 0,\ f_4 > 0,\ f_5 \ldots\ldots\ldots, f_8 < 0,\ f_9 > 0,\ f_{10} > 0,\ 0 < f_{11} < 0,\ f_{12} > 0,\ f_{13} < 0$

2. AGRlp = h (INDlp, SER_{lp} D86, D94)

$h_1 > 0,\ h_2 > 0,\ h_3 < 0,\ h_4 > 0$

3. FODpc = i ($\hat{AGRlp}$, land, LABAGRgr, CAPAGR, INDGDP, SERGDP, D86)

$i > 0,\ i_2 > 0,\ i_3 < 0,\ i_4 > 0,\ i_5 > 0,\ i_6 < 0,\ i_7 > 0$

Definition of variables and sources

Our main data source are the world Economic out look data, Government Finance statistics and the International Financial statistics year book of the IMF, Global Development Finance and the World Bank sources. We obtained data for the computation of inequality in labour productivity from World Bank Tables and the variables of public expenditures from the Ministry of Economy and Finance, Yaounde Central statistics office, National Assembly as well as the data set published in Amin (1998). Specifically, sector share of capital inputs are obtained based on estimates of the total capital stock from Nehru and Dhareshwar (1993) as applied in Cameroon. The aggregate capital stock series obtained from the world Economic Outlook data set are disaggregated by share of each sector in the total GDP in the initial period (see Amin, 1999).

COVlp inequality index for sectoral labour productivity

FODpc food production per capita (1987= 100)

AGR/IND/SER (GDP) real GDP (1987 prices) in agriculture, manufacturing and of the service sector

CAPAGR/CAPIND/CAPSER capital inputs of sectors (1987 prices)

LABAGR/LABIND/LABSER (gr) growth rate of sector labour force

LABgr growth rate of total labour force

Rlabour Ratio of labour in non-agriculture to agriculture sector

OPEN exports + imports to GDP ratio unit

Land cultivable land in thousands of hectares

D_{86} dummy for the crisis period (1969 to 1985 =0, 1986-1998 =1)

D_{94} dummy for the devaluation period (1969 to 1993 =0, 1994-1998 =1)

AGR_{lp} absolute level of labour productivity in agriculture

IND_{lp} absolute level of labour productivity in manufacturing

SER_{lp} absolute level of labour productivity in service sector

EDU, HLT, AGR, COMM, ROAD, are government expenditure shares on GDP spent on education, health, agriculture, communication and road infrastructure.

The expected theoretical signs are given below the equations. The set of hypotheses to be tested as explained by the signs of the coefficients are as discussed in the theoretical and empirical review. The convergence model comes in to test the hypothesis of the impact of fiscal policy and other variables on sector labour productivity convergence. Equation (1) is therefore an attempt to establish whether productivity levels are converging or diverging as a result of these variables. It is hypothesised that fiscal variables should promote productivity growth and convergence via a rapid long-term agricultural productivity growth[17]. We expect both negative and positive coefficients on the components of public expenditure with respect to convergence. There is no definite literature on convergence and fiscal policy but possible links between fiscal variables and productivity growth exist. In fact expenditure on education and health results in human capital formation. Human capital is one of the factors that determines labour productivity (Corvers 1996 Vander Wiel 1999, Chang and Chen 2001, Roa et al., 2003) via increase in skills and capabilities of workers. A priori, education and health should have negative coefficients mostly benefiting the agricultural sector in line with the existence of an 'advantage of backwardness' (Gerschenkron 1952) where being relatively backward in productivity carries a potential for rapid advance (Abramovitz 1979, 1986).

Similarly, expenditures on agriculture devoted to research and extension services are required to boost agricultural productivity (Heisey 2004), thus, a negative sign of the coefficient. Storage and transportation facilities including roads are essential for ensuring the movements of persons, goods and services from one place to another. It has been shown that the building of an appropriate agricultural infrastructure in China

[17] Labour productivity convergence can take place with all, some, or none of the components of productivity levels rising or falling. The existence or not of convergence has an uncertain implications for what is happening to the level of productivity in any sector. For instance, if non-agricultural (industry and service) labour productivity falls faster than agricultural labour productivity, there is convergence just like when productivity rises in both sectors but faster in agriculture. Regressing absolute level of labour productivity in agriculture, industry or manufacturing and the service sectors on some of the relevant variables gives a good picture of the linkage between convergence and the fiscal variables (see results in Table 3). With this, one is able to tell which variable actually favours rising agricultural productivity/falling industry and service, creating productivity convergent tendencies.

improved productivity. However, Cameroon suffers from deteriorating roads and lacks rural infrastructure (Amin 1996). The coefficient of government spending on roads could take a positive sign just like information and communication technologies believed to be responsible for the gap in productivity levels (see Roa et al., 2003). The fact that such facilities are mostly found in the urban settings suggests a positive coefficient on communication, an indication of divergence of sectoral productivity level. Outward oriented policies should favour foreign trade and thus foster agricultural productivity in an agricultural based economy (Edwards 1997, Irz and Roe 2001). Openness may also encourage convergent tendencies through knowledge diffusion and competition or divergent pattern since trade advances international specialisation (Grossman and Helpman 1991). This implies an uncertainty as concerns the expected sign of the coefficient of openness, while capital invested in a particular sector should raise the stock of capital per worker (i.e. capital intensity) with the consequent rise in productivity (Vander Wiel 1999, Roa et al., 2003). In relation to the latter, we expect capital input in agriculture should to have a negative coefficient in favour of convergence. A priori, the expected sign on labour force growth is uncertain as opposed to the predictions of the Lewis-Ranis-Fei model of development. For a growing proportion of the work force will be employed outside agriculture; average productivity in agriculture will rise faster than in non-agriculture, so productivity will tend to rise and converge. However, the growth of labour force is a standard variable that should reverse the convergence trend of labour productivity especially if excess and idle labour occurs in the urban sector due to open unemployment.

Equations (2) provide the dual economy model that links up the agriculture to non-agricultural sector. After assessing the impact of fiscal measures on productivity and convergence, the question one asks is whether contrary to dual economy model sectors evolve interdependently to the benefit of another. The equation follows Gemmell et al., (1998) with the analyses ascribing importance to exogenous events such as trade shocks and policy changes. The a priori arguments offered to account for sectoral interrelationships are that agricultural productivity is positively related to

manufacturing and service productivity both in the short-and long-run[18]. In line with their arguments, an error correction modelling for the equation is initiated though our methods differ. Modern econometric methodology, which incorporates time-series properties of the variables in a model suggest that an error correction model (ECM) be estimated for cointegrated variables. It has been argued that an ECM provides a more general lag structure which does not impose an overly restrictive structure on the model (Hendry and Richard 1990) and that ECM avoids the well known fundamental 'spurious' regression problem (Engle and Granger 1978). Engle and Granger(1987) propose the specification in first-difference form that corresponds to short-run equilibrium equation and by including the 1-period lagged values of the residuals derived from the estimated long-run equations (i.e. equations in levels of individual series).

Lastly, equation (3) represents the model that seeks to examine the implications of sectoral productivity interdependence, growth and convergence as far as poverty reduction is concerned. The relation in (3) is determined based on the theory of production and the dual economy model. In African countries, agriculture is important for growth and forms a large proportion of GDP. Most of the poor people are dependent on the rural economy for their livelihood and the performance of the agricultural sector has far-reaching implications for food, poverty reduction and income generation. The Lewis-Ranis-Fei approach also views development as involving the disappearance of the disguised unemployed labour force and the commercialisation of the agricultural sector and thus, the whole economy leading to a rise in agricultural real wage. This occurs with a catch-up in agricultural productivity to that of the urban-industrial and service sectors respectively and consequently an overall rise in output or growth. Rising agricultural productivity results to increase food production and thus, poverty reduction (Datt and Ravallion 1998) and this growing productivity in agriculture is also fed by manufacturing and service productivity (Gemmell et al., 1998). In order to allow for the feedback effect as observed from equation (2), the full effect of agricultural productivity

[18] Issues also relating to sectoral growth linkages have been addressed in the dual economy model(see Gemmel et.al., 2000, Bluch and Verner 1999)

on food production is assessed. The final effect is determined by estimating a simple equation of the form:

$$AGRlp = f(INDlp, SERlp)$$

and substitutes the predicted value $\hat{AGRlp}$ in equation (3).

IV. RESULTS OF THE MODELS

Our discussion here centres on the role played by both fiscal policy and sectoral interactions on productivity convergence or rising agricultural productivity and the subsequent poverty effects observed via increased food production in the economy.

IV.1 Labour Productivity Convergence

The results of the convergence model that explains the impact of fiscal policy on productivity are presented in Table 2 whereas Table 3 provides the regression results of absolute level of labour productivity for each sector. The latter gives a clear picture of the nature of convergence, indicating whether agricultural productivity rises with falling productivity in non-agriculture or rises faster than the latter. The explanatory variables included in the models account for about 60% to 95% of the variations in Labour productivity convergence in Cameroon. Furthermore, the various models have standard errors not exceeding 6% and are not seriously subjected to serial correlation as observed, from the Durbin-Watson statistics.

As observed in the results, greater portions of government spending appear not to favour labour productivity convergence. It is argued that adequate nourishment, and health and education facilities are essential for increasing labour productivity. These are variables of human capital believed to enhance productivity (Corvers 1996, Vander Wiel 1999). In this case, health and education spending have insignificant coefficients implying that government allocation in this domain has no effect on convergent tendencies of labour productivity (Table 2), rather health spending enhances divergence by raising productivity in the service sector (see the positive and significant coefficient

Table 2: Regression Results of the Convergence Model

Dependent Variable: COVlp (Sector labour productivity convergence)

Models	1	2	3
Constant	-0.57	-0.72	-0.75
	(-0.73)	(-0.67)	(-0.99)
Log(OPEN)	0.11	0.10	0.09
	(0.72)	(0.62)	(0.56)
Log(CAPAGR)	-0.15	-0.16	
	(-1.1)	(-1.1)	
Log(CAPIND)	0.27	0.26	0.17
	(2.8)[b]	(2.2)[b]	(4.2)[a]
Log(CAPSER)	0.01	0.01	-0.03
	(0.11)	(0.14)	(-0.77)
Log(ROAD)	-0.02	-0.014	-0.03
	(-0.60)	(-0.39)	(-0.80)
Log(COMM)	0.16	0.15	0.165
	(3.5)[a]	(2.8)[b]	(3.3)[a]
Log(AGR)			0.11
			(1.3)
Log(EDU)	0.05		0.03
	(0.90)		(0.51)
Log(ENRp)		0.15	
		(0.27)	
Log(HLT)	0.03	0.01	-0.07
	(0.18)	(0.07)	(-0.44)
D94	-1.03	-1.01	-1.05
	(-12.8)[a]	(-9.3)[a]	(-13.7)[a]
R^2	0.95	0.94	0.95
R^2 Adjusted	0.95	0.94	0.95
F-STAT	54.1	55.6	59.4
D-W	1.7	1.6	1.8

Note : a, b and c indicate levels of significance at 1%, 5% and 10% respectively and t-ratios are in parenthesis.

in Table 3). When spending on education is replaced by primary school enrolment ratio, it shows that education investment could enhance labour productivity convergence by raising agricultural productivity. Equally, primary enrolment raises productivity in manufacturing and service activities (Table 3). Thus, it would appear government education expenditure is inefficient or poorly targeted. Government spending on roads insignificantly influence productivity convergence and observing from Table 3, it appears to foster productivity levels in agriculture and manufacturing.

Table 3: Regression results of sectoral productivity levels

Dependent	AGRlp	AGRlp	INDlp	INDlp	SERlp	SERlp
Explanatory variables						
Constant	-8.6	-6.9	-8.5	-7.04	-2.6	-1.8
	(-9.8)[a]	(-9.5)[a]	(-7.1)[a]	(-7.3)[a]	(-2.5)[b]	(-3.3)[a]
Log(OPEN)	0.12	0.42	-0.75	-0.46		
	(0.64)	(2.1)[b]	(-3.0)[b]	(-1.8)[c]		
Log(CAPAGR/IND/SER	-0.01	-0.09	0.39	0.27	0.03	-0.02
	(-0.13)	(1.2)	(5.41)[a]	(3.21)[a]	(0.44)	(-0.41)
Log(ROAD)	0.13	0.07	0.002	-0.04	0.16	0.07
	(2.7)[b]	(1.7)[c]	(0.03)	(-0.77)	(3.1)[a]	(2.05)[b]
Log(COMM)	0.002	-0.04	0.24	0.17	-0.02	-0.014
	(0.03)	(-0.64)	(3.2)[a]	(2.4)[b]	(-0.29)	(-0.34)
Log(EDU)	-0.08		-0.03		0.11	
	(-0.97)		(-0.25)		(1.1)	
Log(ENRp)		0.98		1.5		1.61
		(2.5)[b]		(2.4)[b]		(5.72)[a]
Log(HLT)	-0.16	-0.05	-0.26	-0.19	0.44	0.56
	(-1.08)	(-0.04)	(-1.3)	(-1.2)	(2.6)[b]	(5.34)[a]
D86	(-0.19)	-0.23	-0.25	-0.27	-0.13	-0.20
	(-1.8)[c]	(-2.5)[b]	(-1.7)[c]	(-2.2)[c]	(-1.4)	(-3.8)[a]
R^2	0.72	0.77	0.82	0.86	0.65	0.85
R^2 Adjusted	0.63	0.69	0.76	0.81	0.56	0.81
F-STAT	8.03	10.5	14.6	19.4	7.1	21.4
D-W	1.5	1.5	1.3	1.2	1.4	1.6

Note : a, b and c indicate levels of significance at 1%, 5% and 10% respectively and t-ratios are in parenthesis.

Further, government spending on agriculture has no effect on agricultural labour productivity and hence equality in the level of sector labour productivity. There are indications that the existence of information networks, such as research and extension

services in agriculture which absorbs part of government spending in agriculture leads to stagnant technology. In sub-Saharan Africa, limited research investments and few technological breakthroughs as well as the difficulty of transferring research results to farmers due to limited resources for extension services (Heisey 2004), and poor management or targeting may be responsible for the result. As such there is very little applicability of research findings, and the link between the research institutions and small-scale farmers appears weak. Government spending in communication appears to favour divergence of productivity levels (Table 2) by raising manufacturing productivity (see Table 3).

On the other hand, outward oriented trade policies significantly reinforce agricultural productivity (Table 3) with the possibility of negatively affecting the productivity of manufacturing activities. This may be as a result of the low quality and uncompetitive nature of manufactured products from developing countries. Trade enhances convergence through knowledge diffusion, increasing competition and adequate market for goods (Grossman and Helpman 1991) and believed to foster agricultural productivity (Irz and Roe 2001) and thus, convergence.

Capital investment reinforces capital intensity (i.e. capital per worker) and thus a formidable positive effect on productivity in the manufacturing sector. This result is in line with the theory of production where, productivity performance is tied to capital inputs or capital deepening(Vander and Wiel, 1999). However, capital inputs in the agriculture or service sector do not effectively influence labour productivity. The reason could be due to the highly rudimentary nature of agricultural activities as well as the less importance of capital in services.

The prediction that growing proportion of the work force will be employed outside agriculture and average productivity in agriculture will rise faster than in non-agriculture resulting to convergence (Lewis-Fei-Ranis) model does not hold in Cameroon. In a situation of rising unemployment and severe crisis, most of the workforce remains idle rather than being employed. The migration of workers into the non-agricultural sector (urban areas) would encourage convergence conditional on the availability of employment opportunities. It is therefore the migration of ideas or technological spillovers that play a greater role in convergence (as observed below) and

not the actual movement of workers. Thus, the labour force variable was dropped from the models as it tended to affect the entire results.

IV.2 Interdependence of Sectoral Productivity

In this section, the existence of sectoral linkages or dynamic sectoral interactions is verified on the assumption that, the process of structural change involving spillovers in production techniques from agriculture to non-agriculture generates growth in terms of output and agricultural productivity. The estimated result based on equation (2) that provides the long-run relationships between sectoral labour productivity levels is presented below (t- ratios beneath parameters estimates):

$$\text{Log}(\text{AGRlp}) = -5.5 + .14\log(\text{INDlp}) + .4\log(\text{SERlp}) - .31D86 + .16D94$$

(3.56) (1.9) (1.7) (-5.2)

$\overline{R}^2$ =0.66 F-statistics= 14.9 DW= 1.5

The results indicate the presence of interdependence of sectoral productivity, suggesting that labour productivity in manufacturing/industry and services do cause productivity growth in the agricultural sector. However, an error correction model of productivity growth in agriculture is also established in order to ensure the existence of short-rum dynamic interactions. The estimated result is given as (t- ratios beneath parameters estimates):

$$\Delta \text{Log}(\text{AGRlp}) = -.01 + .25\Delta\text{Log}(\text{INDlp}) - .06\Delta\text{Log}(\text{SERlp}) + .02D86 + .03D94$$

(1.3)

$$- .63\ \text{ECT}_{(-1)}$$

(3.5)

$\overline{R}^2$ 0.24 F- Statistics 2.7 DW= 1.8

From the diagnostic testing, it is observed that the ECM is robust, thus underscoring an appropriate convergent tendencies of sectoral productivity. The error correction term, ECT has a coefficient less than one and significant at 1 percent with a feed back effect of 63%. In both the short and long-runs, increases in labour

productivity elsewhere in the economy have a positive impact on agricultural productivity though insignificantly for the short-run. Results are similar to Gemmell et al., (1998) where the dominant short-run effect is one of sectoral competition, and it is the service rather than both sectors as in Gemmell et al., that keenly appears to compete with agriculture. The coefficient on manufacturing and services are both negative and significant for the latter in Gemmell et. al, (1998). They conclude that, their results lend support to the commonly held view, that for much of the agricultural labour force, it is the service sector that represents the most likely alternative to agricultural employment. This view is mildly supported here perhaps as a result of the highly segmented labour market where labour in agriculture cannot be employed in the service sector consisting of mostly skilled workers except in the long-run after having undergone some training.

Turning again to our case, the long-run relationship presented above indicates that improvements in labour productivity in manufacturing and services leads to higher productivity in the agricultural sector, suggesting technological spillovers and thus, convergence of sectoral productivity levels over time. However, agricultural productivity may take a long time to catch-up with the non-agricultural sector productivity especially the level of productivity in the manufacturing sector where the gap between them remains wide (see figure 4). Only 2 percent of the gap is closed up each year[19]. The process of convergence as perceived in the neoclassical theory is therefore a long one.

1V.3 Poverty Effects of Productivity Convergence

The main objective of this paper has been to examine the possibility of convergent tendencies of sectoral productivity levels and find out the implication on food production or poverty reduction. The paper postulates that, the factors determining productivity convergence including the spillover effect that raises agricultural productivity foster the development of the agricultural sector and hence, raise food production to ensure food security.

[19] The average growth rate of the ratio of AGRlp to INDlp is -.4% whereas for the technology gap (INDlp/AGRlp), it is 3% over the period of study. Following Ratts∅ and Torvik (2003), productivity growth in agriculture increases by a multiple per unit rise in the technology gap. In our long-run equation, any rise in manufacturing productivity by 1% initiates a .14% rise in agricultural productivity. Thus, overall, the ratio, AGRlp/INDlp will grow annually at 0.14(3)-0.4 or 2%.

The full-effect of convergent tendencies of labour productivity on food production is presented below (t - ratios beneath parameter estimates):

$$\text{Log (FODpc)} = 58.1 + 0.91\text{Log } \hat{AGRlp} - 4.8 \text{ Log (land)} + 0.03\text{LABAGRgr}$$
$$(4.2) \qquad (-2.21)$$
$$- 0.14 \text{ log (INDGDP)} - 0.23 \text{ log (SERGDP)}$$
$$(-4.4) \qquad (2.1)$$

$\overline{R}^2$ 0.95 F – statistic = 66.9 DW = 1.5

The result indicates that convergent tendencies of sectoral productivity levels, that raises agricultural productivity leads to adequate food supply and ensures food security. The result confirms the statement Adam (2003), that the performance of agriculture in African countries has far-reaching implications for food, poverty reduction and income generation. The net benefit will be more abundant harvests, decreasing relative food prices, and rising agricultural earnings for the farming poor (Datt and Ravallion 1998). In this paper, convergence means narrowing of the gap between sectoral productivity levels more importantly raising agricultural labour productivity to the level of productivity in the industrial sector. Furthermore, as more land becomes available, farmers switch their efforts towards the production of cash crops rather than food crops, while the growth of labour in agriculture has a positive effect on food production although insignificantly (see Amin, 1996) where agricultural production is not influenced by labour inputs, rather by capital inputs. Finally, the expansion of manufacturing and service GDPs is at the expense of food production as would be expected when different sectors have to compete for relatively fixed factor supplies. Neither crisis nor devaluation had any effect on food production.

V. CONCLUSION AND POLICY RECOMMENDATIONS

The aim of this paper has been to assess the role of fiscal policy and economic fundamentals on sectoral productivity convergence and evaluate the impact of such

convergent tendencies via raising agricultural productivity on poverty. The empirical literature on sectoral interactions in the process of structural change is vast and seeks to explore the linkages from non-agriculture to agricultural activities and vice versa. In the first case, convergent tendencies of labour productivity are determined where the agricultural sector is expected to catch-up in terms of productivity growth with the other sectors. However, none of the existing studies has linked up such structural changes to explain poverty. This paper provides evidence that intersectoral linkages promote a catch-up of agricultural productivity to the level of industry and or service productivity. Furthermore, the catch-up process depends on fiscal and some economic factors, with a final effect on poverty reduction as a result of increased food production per capita.

The models developed in this paper are embedded on the literature of structural change of the Lewis-Ranis-Fei approach of development. It is assumed that development means absorption of labour from the low- productivity rural or agricultural sector into the high-productivity urban- industrial sector, in which case productivity levels should converge. However, we find that technology via knowledge diffusion plays a greater role compared to the actual movement of workers. Productivity convergence coming either from economic factors or indirectly via spillovers from sectoral interaction has the effect of raising output growth via a rise in agricultural productivity. One of the most important arguments is that food production per person which is related to poverty will experience an increase as a result of a rise in agricultural productivity.

Empirical results of the study indicate that fiscal policy has a very limited role in explaining productivity convergence among sectors of production. Apart from spending on road infrastructure, most of the public expenditure such as education and agriculture do not influence sectoral productivity levels perhaps due to inefficiency or poor targeting. Health and communication spending foster productivity divergence by increasing the gap between agriculture and non-agriculture through rising productivity in manufacturing and service activities respectively. Finally, economic fundamentals such as openness to trade play an important role in restoring equality in the level of sectoral productivity whereas investment capital crowds-out labour productivity convergence. Effectively, the non-significant effect of capital in both the service and

agricultural sectors may be explained by non-mechanised nature of the former whereas in agriculture, a greater part is rudimentary. In terms of dynamic sectoral interactions, productivity results suggest that increases in manufacturing and services both impact positively on agricultural productivity in the long-run with feedback effect from manufacturing being guaranteed also in the short-run. These are an indication of spillovers of production techniques or ideas in manufacturing to agriculture, fostering convergent tendencies in sectoral productivity levels.

The main policy recommendation of this study is that poverty reduction in Cameroon could be achieved by government investment on road infrastructures. This should facilitate the transportation of agricultural products of which a majority of the activities take place in remote areas. Empirical estimates suggest that government spending on roads and to a little extent health and communication have been efficacious, but spending on education and agriculture have not been in terms of raising agricultural productivity. The implication is that if a particular spending favours divergence of productivity levels as in the case of health and communication, they could still in the long-run, indirectly raise agricultural productivity via spillovers from the favoured sector. However, Cameroon could still benefit from food poverty reduction and growth if such infrastructure as education, health, rural roads agricultural equipments and research are rendered more accessible. Nonetheless, adequate time is required for such measures or any to get agricultural productivity to the level of manufacturing or service. The nature of targeting should be re-orientated to ensure that the agricultural sector continue to benefit from spillovers in terms of labour productivity. Attention should be focused on interdependencies in sectoral productivity as this may facilitate policy measures aimed at raising agricultural productivity and production. Specifically, the farming population and the rural world should be properly targeted to sustain growth in output and productivity. Finally, this paper should be considered as a first step and not the final word. Further research on economic convergence should now pursue analysis of labour productivity convergence across sectors or region within the same country and explore the implications of other methods to prove the contrary.

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Appendix

Figure 1: Evolution of sector share of real output

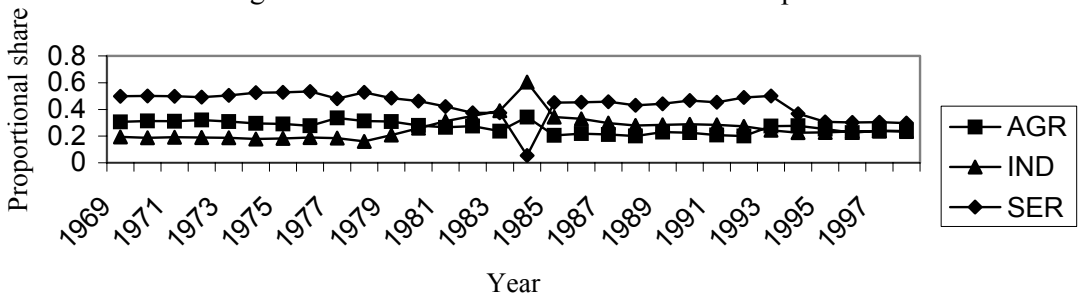

Figure 2: Real GDP and sector growth rate changes over time

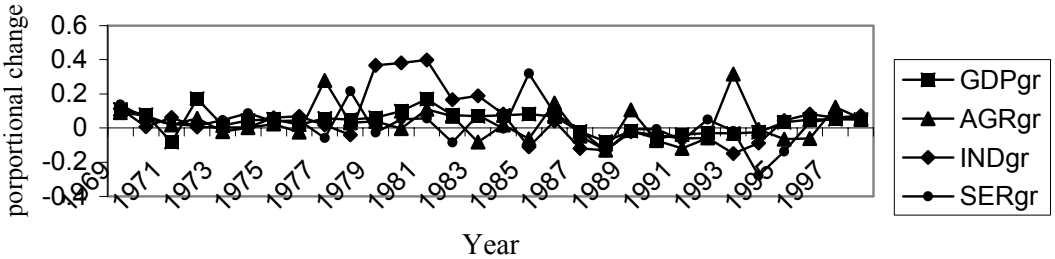

Figure 3 : Sector share of labour input in GDP

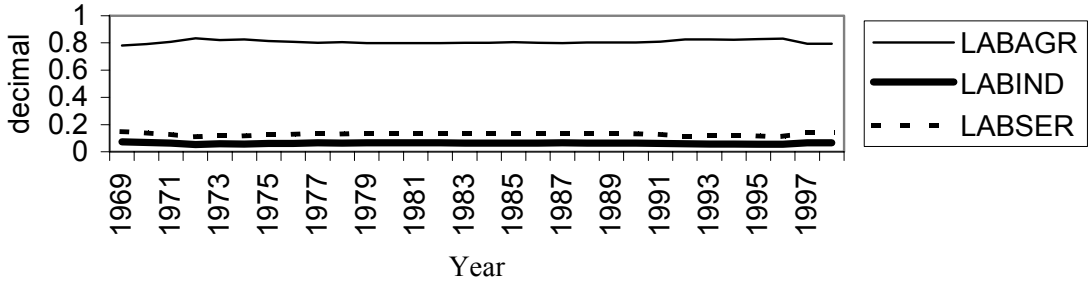

Figure 4: Evolution of total and sector labour productivity

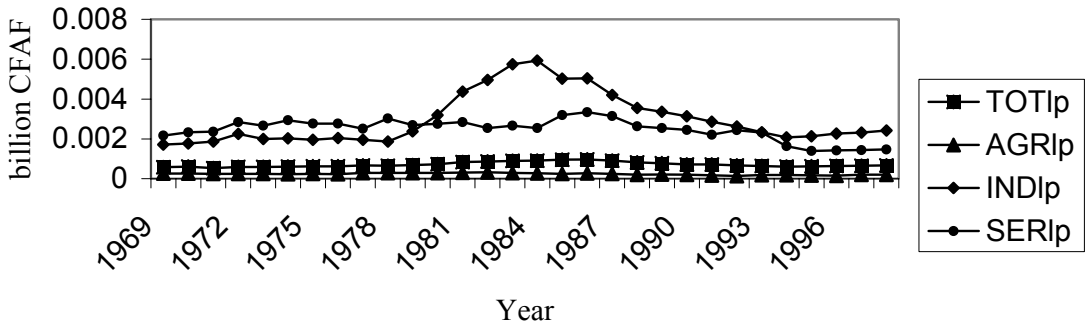

Figure 5: Real GDP growth, productivity convergence and labour growth

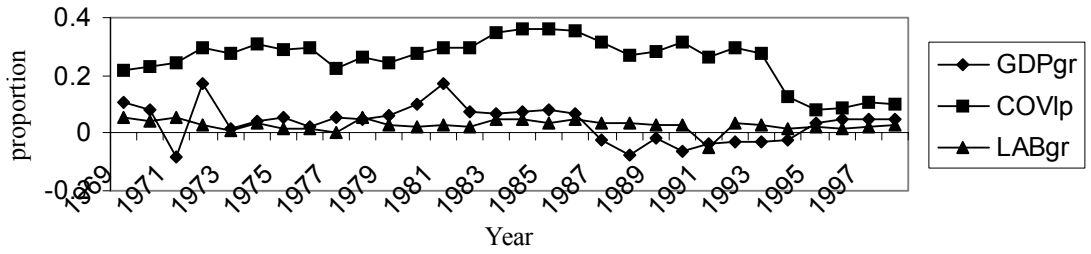

Figure 6: Total and sector labour productivity growth rate changes over time