

Regional Income differences in Ghana: the importance of socio-demography and ethnicity



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Abstract

Following the increased attention income differences/inequality has gained within the area of economic geography and among policy-planning; this study seeks to explore and analyze the factors affecting income differences in the regions of Ghana. From the use of regional (10 regions) panel data for 1960, 1970, 1984 and 2000; the results show a direct link between socio-demographic factors and regional income differences/inequality and also the impact of ethnic and religious composition on regional income differences. It was identified that ethnicity and religious compositions have different impacts on regional income differences. Christians have positive effect on regional income due to their fairly representation in almost all the regions likewise the Akans, but have negative effect on regional income. And also high population density in a region reduces the mean regional income, similarly high concentration of population aged 60years and over reduces the regional income. Evidence from the results empirically conclude that regions with high share of aged population, Akans, Muslims and high population density have low regional income compared with regions with high share of Christians.

Keywords: income differences/inequality, ethnicity, religion, region, Ghana

1. Introduction

This paper aims to explore and analyze the factors that influence income differences/distribution in Ghana. There have been numerous studies on the possible factors that affect income differences across regions. Lazear (1995) argued that income is equitably distributed in an economy which is linguistically homogeneous. Irrespective of the economic importance of ethnic diversity in terms of experience and expertise as posited by Alesina and La Ferrara (2005), going by Lazear's (1995) argument, income may not be equally distributed across Ghana due to the ethnic and religious heterogeneity. There is substantial evidence that ethnicity is a possible determinant of income inequality. Regions with relatively greater ethnic diversity experience greater ethnic income inequalities (Robinson, 2002). Studies by Malan (2000) revealed the effects of high ethnic diversity on income inequality in South Africa between mid-1970 to mid-1990's. Although many factors account for income differences/inequality, income inequality based on ethnicity and religion is predominant in most countries, especially in Africa.

Also educational attainment differences affect income differences, literatures suggest that people with higher level of education usually ensure higher income (Chevan and Stokes, 2000; Cornia and Kiiski, 2001). Although the government of Ghana is committed to providing Free Compulsory Universal Basic Education (FCUBE), education at higher level is self-sponsored which affects the less privilege or the disadvantage. Studies have also shown that population with different individuals and different age structures have difference levels of influence on income (Deaton and Paxson, 1997; Kaasa, 2005). Deaton and Paxson (1997) suggest that older population have large income dispersion, hence insure income inequality. Therefore a greater share of older people in Ghanaian regions is likely to affect income distribution going by the assertion of Deaton and Paxson (1997).

Literatures on income inequality in Ghana had mainly centered on the differences between the southern and northern regions. Therefore there are relatively fewer studies on likable socio-economic and demographic factors that affect income differences/inequality in these regions. On the other hand, exploration of income inequality at the regional level is a relatively unattended area in research literature. It is against this background that this paper seeks to address the role of demographic and socio-economic factors explaining regional variations in income in Ghana.

Specifically this paper seeks to find answers to the following research questions;

1. What is the link between socio-demographic factors and income differences in regions of Ghana?
2. What is the impact of ethnic and religious composition on income differences in Ghanaian regions?

This paper will contribute to the bulk of literature on income inequality, importantly with much emphasis on the factors affecting income differences. Specifically this paper will contribute to literature by providing an empirical linkage between socio-demographic factors and income inequality at regional levels. On a broader note, this paper will put forward the impacts of ethnic and religious diversity on income inequality in Ghana. These contributions will facilitate in future socio-economic and infrastructural developments since income inequality has the propensity to increase/decrease over time as countries develop both in socio-economic and demographic terms.

The paper is structured into four sections. Section one introduces the work on the perceived gap/problem, purpose and the contribution of the paper to regional development. Section two reviews the most relevant theoretical and empirical literature and findings on income inequality. Section three introduces the empirical analysis of the paper, i.e. data and statistical approach used and the

empirical results. Section four discusses the empirical findings and concludes on possibilities for future researches.

2. Theoretical development

This section presents the theoretical background of the study. The theoretical nexus of this study juxtaposes possible factors affecting income differences/inequality and empirical evidence for the discussions.

2.1. Factors affecting income differences/inequality

i. Demographic factors

Income inequality is influenced by couples of demographic factors such as age structure, household size, density, population educational level etc. (Kaasa, 2005). There are opposing schools of thought on the effect of high population density on income differences. Crenshaw (1993) argues that high population density lowers income inequality through better social organization, whereas Litwin (1998) also asserts that high population density and urbanization increase inequality. Taking a reflection of the two arguments, Glaeser (1999) for example suggests that density may influence the wages of different workers in different ways through learning. Assuming individuals learn by observing and high urban population density increases the rate of interaction; Low- skilled workers may have the opportunity to learn from high-skilled workers (Wheeler, 2004). In such scenarios the effects on learning can have both negative and positive impacts on income levels. Household sizes and composition affect income differences as well. According to Kaasa (2005), households of different individuals with different skills have different income levels hence affects the mean income of such household. Also age structure within a population can also have effect on income. On the other hand older people have larger dispersion of income (Deaton and Paxson, 1997), therefore higher share of older people in a household or population increases income differences.

Theoretically most studies have found a negative relationship between income inequality and countries' average education attainment (Park, 1996; De Gregorio and Lee, 2002). Higher educational inequality is associated with higher income differences; highly educated individuals duly ensure higher income (Cornia and Kiiski, 2001). Population with a higher share of higher and lower educational levels are usually associated with higher income differences (Chevan and Stokes, 2000). According to Barro (1999) income inequality has a negative relationship with primary education attainment but a positive relationship with higher levels of education. Globalization through Structural Adjustment Policies in developing countries (e.g. Ghana) affected educational systems through the implementation of fiscal austerity measures which included decreased public spending on education

etc. (Stromquist, 1999). This creates the platform for only those who can afford education to attain the skills and knowledge that will ensure them better wages, therefore education inequality can be assumed to increase income differences.

ii. Cultural and environmental factors

According to Gupta et al. (2002) the abundance of natural resources is often associated with higher concentration of ownership and rent; hence higher land concentration among individuals increases income inequality (Lundberg and Squire, 2003). Notwithstanding the impact, the influence of land and other natural resources on income differences diminishes over time. Muschinski and Pickering (2000) also believe that religious and ethnic/tribal variations have significant influence on income inequality. A study by Clarke et al. (2003) revealed that societies with larger ethnic and religious diversity are less interested in redistribution of resources, therefore ensures higher income differences. Ethnic diversity is seen by Alesina and La Ferrara (2005) in reference to language/group and membership in different clans and tribes; interestingly, people in Africa identify themselves more strongly with their kinships, ethnicity and religion than with their nations (Collier et al., 2001). Diversity in ethnicity brings about varieties in ability, experience and culture that may be harnessed to improve innovation and creativity. At the same time fragmented society based ethnicity and religion is often prone to infightings that may pose major politico-economic challenges which can further aggravate the extent of inequality (Alesina and La Ferrara, 2005). Alesina et al. (1999) argue that the interests of some ethnic minorities are suppressed in countries where there is ethnic/religious polarization. This is often the case when politicians and public workers associate themselves with ethnic/religious constituencies and spending on public goods is reduced to favor the interest of the affiliated ethnic/religious constituencies (ibid).

iii. Socio-economic and political factors

Socio-economic development in terms of increase in country's wealth is likely to increase income differences. Chang and Ram (2000) believe that increase in country's wealth is likely to widen the gap between the rich and the poor. Labor movement between different sectors of the economy as a result of changes/development in socio-economic structures due to technological development influences income levels (Cornia and Kiiski, 2001; Kaasa, 2005). According to Kaasa (2005) in cases of intensive technological changes, skilled workers tend to contribute immensely to socio-economic development and as such ensure higher wages than less skilled workers; in some extreme cases the skilled workers take over jobs for less skilled workers.

Income inequality is widened tremendously by some political decisions or factors. Privatization for instance increases income differences, in such scenarios poorer households have less chances to benefit from privatized state-assets. Ferreira

(1999) argues that there are higher earning inequalities within privatized or private institutions, therefore income inequality is assumed to be higher in capitalist states. Governments' investment in education rather than privatization can minimize income differences when/if poorer families can have access to subsidized public education. An empirical analysis of 50 countries by Sylvester (2002) showed that countries with larger government expenditure on education have lower income differences/inequality. Also according to Gradstein and Milanovic (2002) and Lundberg and Squire (2003), income inequality in democratic societies is comparatively lower than in none-democratic societies. Gradstein and Milanovic (2002) further emphasized that the current state of democracy does not matter in reducing income differences but rather the length of democratic experience. This proves that political decisions can in diversified ways affect income differences.

2.2. Income differences and economic performance/development

Recent literature has shown both theoretical and empirical examination of the relationship between income differences/inequalities and how these differences affect levels of economic performance (Frank, 2009). According to Becker (1994), Human Capital Theory (HCT) suggests that education/training raises workers productivity by imparting useful knowledge and skills, therefore raising workers future income. Useful education has been hindered by income inequality since investment in education takes national, parental and individual commitment. The correlation between education and economic performance is influenced by income. Investment in children's time and expenditure by parents affect their skills and quality of performance hence minimizing income inequality at the long-run (Erosa et al., 2010). Therefore human capital is developed and made sustainable but not transferable by investing in education and health-care.

Education can be related to economic growth and performance in two broad ways. First, where the growth rate of an economy is linked to the accumulation rate of human capital/resource (Lucas, 1988) and secondly, where the growth rate is based on the stock of human capital/resource (Aghion and Howitt, 1998). Recent developments in growth theories stress that education creates positive externalities (Parts, 2003). The increment in society's total wealth is explained by Parts (2003) as economic development. The distribution of this wealth affects social cohesion and development when done unfairly and investment in education and health-care are pushed down to the populace. In such circumstances the quest of some groups to fully invest in education and healthcare is restricted (Parts, 2003). Mayer (2001) has estimated the effects of income inequality on educational attainment between rich and poor children. Among her findings were that; income inequality/differences can affect educational attainment through the incentives provided by higher returns to schooling, the declining utility of family income etc. However growth in income differences is a credible factor to increase inequality in educational attainment and perhaps affect performance level.

i. Income differences and space

There is a growing recognition of the importance of space to many socio-economic processes (Goodchild et al., 2000) on the analysis of regional income growth/distribution and spatial income inequalities/differences. This is more evident in the spatial patterns of inequality and dynamics of geographical income differentials (Rey and Janikas, 2005). The need then arises concerning levels of spatial income differences and their persistence over time. Income inequality results in income polarization, which is a dispersion of the distribution from a central value towards extreme points (Chakravarty 2009, 105); this does not foster equal spatial development. Income inequality has often been dismissed as too insignificant to worth serious attention (Atkinson, 1997), but current developments have proven such assertions wrong considering its effect on economic development. There have now been numerous researches on factors affecting income differences within and among geographical locations. Income inequality is highly pronounced in urban areas and relatively affects human capital and skills return (Wheeler, 2005). Moreover, market imperfection in regions limits low income families to invest in education leaving the productivity gains of such people unexploited (Galor and Zeira, 1993; Aghion and Bolton, 1997).

It is an established phenomenon that high level education correlates better job prospects, relative high performance and higher wages across space. People are therefore denied attaining such heights of education due to the large differences in income. This gives an important implication for labor market inequalities and performance (Machin, 2009: 419). Education to some extent provides the route out of difficulty by enabling people from poorer families to break away from poverty (ibid: 426). However in some cases education reinforces or aggravates the already existing inequality. He further asserts that education has now become an important element in the current labor market; where those with low level education are rewarded with low wages. In spite of the extensive welfare state and the modern societies, income inequality is still extreme in some countries. Esping-Andersen (2002) argues that the relation between income and health mainly rely on the uniqueness of a welfare regime and the path of governance. Through redistribution and subsidized welfare services (i.e. education and health-care), regional income differences can be reduced (ibid). On the contrary Clarke et al. (2003) also argue that redistribution is the least expected policy in heterogeneous ethnic societies, therefore income and health gap is always likely to widen. It is however obvious that economic performance is affected by the negative relationship between income, health-care and education.

ii. Population change and regional income inequality

Population change in this paper is considered as the variation in the composition of a given population at a specific geographical area over periods of time. These changes in both numbers and composition can affect income differences.

According to Njoh (2003) factors that are associated with and propel urbanization in developing countries in general are entirely different from the factors that affect urbanization in developed countries. Going by Njoh's (2003) assertion, urbanization and personal development in terms of wealth creation (i.e. industrialization) are not linked in developing countries. Therefore urbanization in developing countries can be seen to be associated with many challenges and opportunities which affect the living conditions under which people live and work hence influencing their incomes.

In most cases the process of urbanization inadvertently ignores other groups and places in terms of development, therefore some regions may fall behind others in the process of urbanization and industrialization for number of reasons. However these lagging regions become national concern when the variation affects the quest for personal development. According to Fajnzylber et al. (2002) there is a connection between income inequality and crime. This connection is very strong across regions in income polarized countries. Income inequality/differences can therefore degenerate into political uprising (Glaeser et al., 2009). However the quest to control these levels of income differences by creating a welfare state through redistribution has been challenged by Glaeser et al. (2009) as a possible policy to reduce the effort of saving and innovation. However it is the least expected policy in heterogeneous ethnic societies (Clarke et al., 2003).

Conclusively, population composition will always be interrupted since people continue to migrate. Migration changes the age and sex structure of population (i.e. education, experience, health status and socio-economic characteristics), therefore affecting the labor supply and income distribution (Breau, 2007). There are opposing but related ideas about the relationship between changes in the age structure of population and income differences. Gustafsson and Palmer (1997) and Fritzell (1993) argue that changes in the age structure of households have little impact on income differences/inequality whereas Nielsen and Alderson (1995) also assert that there is a positive relationship between age difference and income. Going by these empirical findings, one can be assertive that age structure is related to income differences.

2.3. Summary and hypotheses

The above discussed factors have been posited as likely to affect income differences/inequality given relevance to the empirical and theoretical aspects. That is, these factors either increase or decrease the average disposable income of persons/regions. Literature is explicit on how these factors affect income in many forms. According to Breau (2007) an extreme level of income inequality is not only socially and economically unjust in terms of overall living standards but can also impact on regional competition. These regional differences ultimately affect the quest in developing required human capital to match-up expected

development. It can become generational problem unless conscious efforts are made toward it.

Building on this premise, I test the relationship between the socio-economic and demographic factors that affect income inequality. In support of past literature and research on income differences/inequality, I *hypothesize* that:

1. Populations of 60years and above are positively related to income differences within regions.
2. Akans^{**} are positively related to income differences within regions.
3. Christians^{††} are negatively related to income differences within regions.

3. Empirical analysis

This section of the paper explains the data and data sources as well as the variables used in the model. The statistical approach and empirical results from the model were presented here as well.

3.1. Data and data sources

The data used in this paper were panel data assembled from various official reports from the Ghana Statistical Service (GSS) on population and housing censuses (4 consecutive censal years). However these official reports included the Ghana Living Standard Survey (GLSS 3 and 5) in March 1995 and September 2008 respectively, Population data analysis reports on the 2000 Population and Housing Census (vol. 1 and 2) in August 2005, CICRED series (World Population Year) in 1976 by Gaisie and De Graft-Johnson. Due to the unavailability of data at the district level (micro level), the analysis were delimited to the 10 administrative regions in Ghana (macro level) but however analyzed across four censal years. Most of the variables in this paper were categorized based the research focus of this paper. Notwithstanding these categorizations, they still represent the stock of people and effect as provided in the statistic reports.

3.2. Variables

The variables used in this analysis were carefully chosen socio-economic and demographic variables based on the developed line of argument for discussion. Based on the discussed factors that influence regional income differences, the variables were selected based on their availability in the data sources.

^{**} Refer to the 'variables' under empirical analysis in section 3 for explanation (p.10)

^{††} Refer to the 'variables' under empirical analysis in section 3 for explanation (p.10)

3.2.1. Dependent/Goal variable

For the purposes of this paper, mean income is used as the dependent/goal variable in the analysis; for that matter mean annual income per household in every region was used. The mean annual income per household was used purposefully to ascertain the influence of the factors at household level. Treating income differences at household level will clearly show the effect and decisions that affect household and individual's development (i.e. especially on education) with respect to the effects from the socio-economic and demographic factors. Measuring and determining the accurate influence of the variables on mean income, the disposable mean annual income per households were used. The income is expressed in Ghana Cedi (US\$1 = GH¢1.699, SEK1 = GH¢0.255 at the conduct of the research).

3.2.2. Independent/Explanatory variables

The predictor variables used in this paper were mainly demographic and other socio-economic factors. Among the independent variables are: population density and educational characteristics representing demographic factors; share of employment in industrial classifications and share of religious and ethnic or tribal affiliations or characteristics representing social and cultural factors. Ghana is a multi-ethnic and religious country; therefore their impact on income distribution is necessary for regional planning. The four main ethno-cultural groups (Akan, Ewe, Ga and Mole-Dagbani) constitute about 86% of the population in Ghana. The Akans are the largest ethnic group of about 49% and comprise other 20 smaller sub-ethnic groups, with the Ashantis been the largest of about 15%. They are very predominant in five regions (i.e. Ashanti, Brong Ahafo, Eastern, Western and Central regions). An important characteristic of the Akan group is their matrilineal line of inheritance which distinguishes it from the other ethnic groups which practice patrilineal inheritance (Langer, 2007). Mole-Dagbani is the second largest ethnic group of about 17% and comprises 10 smaller sub-ethnic groups. They are predominant in the three northern regions (i.e. Northern, Upper East and Upper West regions). The Ewes and Gas are the third and fourth largest ethnic groups with 13% and 8% respectively (Ghana statistical service, 2005a). Ghana is also largely Christian country with about 70% of the population been Christians (i.e. Catholics, Protestants etc.) and also 16% been Muslims. Muslims form important part of the population in the northern regions, 42% of the population in the 3 northern regions is Muslims (ibid).

3.2.3. Proxy variables and data

For comparison within and across the regions, proxy data were generated for some years where data were unavailable. The proxy data were calculated based on possible causative variables. Proxy income for 1970 and 1960 for the regions were based on the levels of highest levels of education (i.e. post basic and tertiary education). Therefore, income values and highest levels of education for 1984 in every region were used as the yardstick to ascertain probable incomes for 1970 and

1960, believing higher education ensures higher income. On the other hand since information on ethnicity and religion in 1970 and 1960 were also unavailable, survey in 1984 on ethnicity and religion were used as determinant on the total population to ascertain their shares in 1970 and 1960 across the regions (see appendix A). For accurate estimation of the inequality in the panel, the mean income of households in 1960, 1970 and 1984 were converted to their worth in 2000 (see appendix B). These together with other provided census and survey data were employed in the estimation of the effects of the socio-economic and demographic variables on regional income differences across space and time.

Table 1 below is showing the definition of the variables used in the model.

Table 1: Main variables and definition

Variables	Definition
InkLog	Log. of average regional household income
Zeroyears	Population aged zero to 15years
Sixtyyears	Population aged 60years and over
Popden	Population density, per square kilometer
Akan	Largest ethnic group (dominant in at least 5 regions)
Christians	Largest religious group (dominant at least 7 regions)
Muslims	Second largest religious group (dominant in at least 3 regions)
Basicsch	Population with only basic education (junior high school)
Unemp	Population who are unemployed (by GSS definition)
Regcode	An assigned codes for Stata consumption
Years	Used censual years

3.3. Methodology/statistical approach

Panel data analysis was used in this paper, the importance of this model is that it gives information on the time-ordering of event and also allows control for individual unobserved heterogeneity. Panel data analysis gives two main modeling-effects which are of great relevance to this paper. However a clear distinction was made between these two effects and the most appropriate one was used in the analysis; the importance for the distinction was to be forthcoming in the interpretation of the results. The effects are the *fixed-effects and the random-effects*. The fixed-effects model explains the intercept and the slope of the sample as a whole whereas the random-effects model also explains the intercept and the slope that can vary across subgroups in a sample; it is a generalized linear regression model allowing the inclusion of random deviation other than the deviation associated with the overall error term (Hedges and Vevea, 1998).

Debate of choice

The choice between the two effects has sometimes been associated with the question of homogeneity of the effect-size parameters, sample and the quest of inference making (Hedges and Vevea, 1998). They argue that when the estimates produce almost common effect-size parameters, the fixed-effects model is the most appropriate. They however assert that evidence of heterogeneity among the effects estimates support the use of random-effects model. Irrespective of the similar estimates likely to be produced when both effects are applied, the inference preference remains unique. Also according to Hedges and Vevea (1998), emphasis on the choice between fixed-effects and random-effects is placed on homogeneity (refer to appendix, C).

One set panel data estimator allows for heterogeneity across panel units i.e. across time, but confines that heterogeneity to the intercept terms of the relationship (Baum, 2006: 219). Therefore, one way fixed-effects model however eases the assumption that the regression function is constant over time and space. The fixed-effects model allows each cross sectional unit to have its own constant term while the slope coefficients are constrained across units (ibid: 221). Panel data has two sources of variation: within and between variation, however according to Cheung (2008) the fixed-effects model shows one source of variation, i.e. the sampling variance (within), whereas the random-effects model shows more than one sources of variation. The regressors' coefficients in the fixed-effects model and the unexplained effects in the random-effects model make it more explicit to explain variations across entities over space and time (ibid).

$$\gamma_{it} = \beta X_{it} + \alpha_i + \varepsilon_{it} \text{-----} [\text{Fixed-Effects, a}]$$

$$\gamma_{it} = \beta X_{it} + \alpha + \mu_{it} + \varepsilon_{it} \text{-----} [\text{Random-Effects, b}]$$

Equation [a] and [b] are depicting the Fixed-Effects and Random-Effects Models respectively. γ_{it} denotes the goal variable (income level) at i region and t time. The β in the equations represent the coefficients of the predictor variables. X_{it} also represent the predictor variables at i region and t time. ε_{it} in [a] is the sampling error in the study, the error is assumed to be normally distributed with a mean of zero and a known variance. α_i in [a] is the unknown intercept for each region. μ_{it} in equation [b] is the random intercept which explains intercept variation from one year to the other across the regions (between region error) and ε_{it} is the within region error term. The random intercept allow for the possibility that the mean level of γ (income) is systematically varied among the regions of the same years.

3.3.1. Statistical presentation

Table 2: Summary of panel identifier

Variable	Obs.	Mean	Std dev.	Min.	Max.
InkLog	overall	5.1914	1.1285	3.7612	7.3324
	between		0.1307	4.9937	5.3983
	within		1.1215	3.8540	7.3060
Zeroyears	overall	44.8725	3.1886	33.1	49.2
	between		2.3434	39.025	47.6
	within		2.2578	38.9475	48.6475
Sixtyyears	overall	5.9325	1.4605	3.2	8.9
	between		1.0595	4.175	7.25
	within		1.0473	4.3325	8.3575
Popden	overall	96.325	152.0282	7.6	895.4
	between		126.4799	15.1	445.45
	within		91.3561	-182.125	546.275
Akan	overall	39.3325	34.7172	0	88.6
	between		35.9384	0.125	88.125
	within		3.6152	33.6575	54.1325
Christians	overall	57.005	26.4591	5.4	83.6
	between		27.2446	10.575	80.25
	within		3.8621	51.83	72.53
Muslims	overall	17.2475	16.2121	2.7	60.6
	between		16.7702	3.45	59.875
	within		1.7964	14.4225	25.7225
Basicsch	overall	30.48	12.8995	16.5	56.9
	between		3.2012	25.325	33.75
	within		12.5275	13.33	53.63
Unemp	overall	6.03	4.3476	0	20.1
	between		2.1338	3.925	10.575
	within		3.8339	-1.495	17.605
Regcode	overall	5.5	2.9089	1	10
	between		3.0277	1	10
	within		0	5.5	5.5
Years	overall	1978.5	15.2501	1960	2000
	between		0	1978.5	1978
	within		15.2501	1960	2000

Table 2 above presents the descriptive statistics of the variables in the observations; it shows the measure of location in terms of mean (i.e. within between and overall mean) and the measure of spread or dispersion from the mean in terms of standard deviation (i.e. within between and overall standard deviation). It shows the minimum and maximum observations of the variables. It also provides additional importance information on the variables. It shows the level at which the variables were identified “within” and “between” the regions and also the level of variations between and within the regions. By the illustration, the panel identifier “Regcode” does not vary “within” the panel, i.e. it is time-invariant. This is evident from the “within” standard deviation of “Regcode” which is zero. However from the panel identifier any variable with zero “within” standard deviation was dropped from the model. Also variables with small “within” standard deviations show they were not well identified within the panel; the variables all seem to be well identified, but however some are more identified than others.

3.4. Empirical results and analysis

The Hausman Specification Test (HST) tests the null hypothesis that the coefficients estimated by the efficient random-effects estimator are the same as the coefficients estimated by the consistent fixed-effects estimator. However from the test the p-value is significant (i.e. Prob>chi2 is smaller than 0.05). From the different point estimates generated by the Hausman Specification Test (HST) in table 3, the individual estimate effects are correlated with the independent variables hence FE estimators are consistent but RE estimators are not, therefore the null hypothesis is rejected. It therefore suggests that it will be inappropriate to use random-effects; hence the fixed-effects model better explains the relationship in this scenario. Irrespective of the adoption of the FE in this analysis, results from the RE can also be compared in table 4 below.

Table 3: Hausman Specification Test

Variables	Coefficients		(b-B) Difference	Sqrt (diag(V_b-V_B) S.E.
	(b) Fix	(B) Ran		
Zeroyears	0.0915	0.0375	0.0540	.
Sixtyyears	0.0982	0.1600	-0.0618	0.1346
Popden	0.0002	0.0006	-0.0004	0.0004
Akan	0.0012	0.0000	0.0003	0.0219
Christians	0.1271	0.0044	0.1227	0.0497
Muslims	-0.2218	0.0192	-0.2410	0.0604
Basicsch	0.0525	0.0578	-0.0053	0.0039
Unemp	0.1196	0.1150	0.0047	0.0270

b = consistent under Ho and Ha; obtained from the xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{Chi } 2 (8) &= (b-B)' [(V_b-V_B)^{-1}] (b-B) \\ &= 35.69 \end{aligned}$$

$$\text{Prob}>\text{chi2} = 0.0000$$

(V_b-V_B is not positive definite)

Table 4: Combined results (Fixed-Effects (within)/Random-effects)

InkLog	Coef.		Robust Std Err.		T/Z	
	FE	RE	FE	RE	FE	RE
Zeroyears	-0.0166	-0.0168	0.0080	0.0139	-2.08	-1.21
Sixtyyears	-0.0920*	-0.0956**	0.0411	0.0332	-2.24	-2.88
Popden	-0.0003*	0.0001	0.0001	0.0002	-2.65	0.55
Akan	-0.0143***	0.0015	0.0024	0.0018	-5.84	0.82
Christians	0.0536*	-0.0011	0.0176	0.0018	3.05	-0.62
Muslims	-0.0917**	-0.0038	0.0255	0.0035	-3.59	-1.08
Basicsch	-0.0018	0.0045	0.0040	0.0121	-0.45	-0.37
Unemp	-0.0281*	-0.0380*	0.0102	0.0158	-2.77	-2.40
Iyears_1970	0.9510***	0.9559***	0.0385	0.0923	24.69	10.35
Iyears_1984	1.0634***	1.0802***	0.0901	0.2717	11.80	3.98
Iyears_2000	3.1823***	3.5132***	0.2273	0.5385	14.00	6.52
_cons	4.5236***	5.5527***	0.6450	0.8720	7.01	6.37
Fixed-effects statistics (FE)						
Sigma_u	2.4160	Rho = 0.9992 (fraction of variance due to u_i)				
Sigma_e	0.0667	Corr (u_i, xb) = -0.9017				
R²	Within = 0.9983 Between = 0.0782 Overall = 0.2070					

Note: ***/**/* indicate significance level at 1, 5 and 10% respectively

The model shows a negative correlation between the error terms and the regressors (-0.9017). Irrespective of the sign before the T-values, the null hypothesis that the coefficients are not different from zero is rejected on the variables with T-values higher than 1.96. Also the higher the T-value (either + or -) the higher or lower the variable is relevant or affects to the goal variable. The model also suggests that the regional differences in income are related to the variations in inter-region differences in income across the panel (i.e. 99.9% intra-region correlation). The explanatory variables explain up to 99.8% of variance within the regions (see NB in appendix for explanation).

Most of the explanatory variables used in the analysis are significant and had relationship with regional income differences, with most of the significant variables having negative effect on income with the exception of Christians and the dummies. It is obvious that higher share of Christians in a region tend to correlate with higher regional incomes (table 4). On the contrary, regions with higher percentage of Muslims have negative influence on income (i.e. higher share of Muslims correlate with lower regional incomes). Putting this in perspective, Christians in Ghana are over 60% in most of the regions and can be related to employment. The null hypothesis is therefore rejected. The dummy variables indicate that there had been year differences (increases) in regional income. It is also clear that regions with higher share of aged populations have lower regional income compared to regions with fewer share of aged population. Therefore the hypothesis is also rejected.

Akans been the most dominant ethnic group in almost five regions and also fairly represented in other regions is significant. But however it has negative impact on regional income (quite revealing). Its negative influence can be attributed to the level of average increase in unemployment in these regions over the years. Unemployment is also significant but with negative impact regional income. Juxtaposing the rate of unemployment and the share of Akans in the regions, it is understandable that it has a minimal negative impact on regional income. Therefore the hypothesis is rejected. It explains that regions with high proportion of Akans have high regional income differences (i.e. higher share of Akans correlate with lower regional income). Population density is also significant and has negative influence on regional income. Among the significant variables, population density has the least negative influence on regional income. Therefore regions with high population density have high income differences (i.e. in better words high population density correlate with low regional income).

Table 5: Pooled-OLS regression

InkLog	Coef.	Std Err.	T
Zeroyears	-0.0125	0.0148	-0.84
Sixtyyears	-0.0855**	0.0272	-3.15
Popden	0.0004	0.0002	1.66
Akan	0.0022*	0.0011	2.08
Christians	-0.0012	0.0016	-0.75
Muslims	-0.0016	0.0024	-0.68
Basicsch	-0.0034	0.0051	-0.67
Unemp	-0.0334**	0.0104	-3.21
Iyears_1970	0.9372***	0.0682	13.74
Iyears_1984	1.0486***	0.1144	9.17
Iyears_2000	3.4133***	0.2022	16.88
_cons	5.1882***	0.7331	7.08
R² = 0.99.2		Adjust R² = 0.988	
		Root MSE = 0.122	

Note: ***/**/* indicate significance level at 1, 5 and 10% respectively

Considering the effect that FE model control for observed and more importantly, the unobserved time constant variables; the effect of Pooled-OLS (see table 5) which is still bias because of unobserved heterogeneity, comparison between the two models on the basis of selection bias is more important. From the OLS model, the explanatory variables explain 99.2% of variance in the goal variable with dummies and 86% without the dummies. It also explains the intense selection bias in the model. Comparing the results from the two models, the significant rate of the variables in the FE is higher than the OLS based on the control of unobserved heterogeneity.

Going by Litwin (1998) assertion that population density and urbanization increase income inequality/differences, the FE model presents a significant effect on income within the regions, it can therefore be concluded that regions with higher population density are likely to experience higher income differences/inequality than regions with smaller population density. Considering

the notion that unemployment and high population density is common in highly populated regions and the ability to secure good paying job is always a constraint, population density has a negative influence on income in such regions, as expressed in the FE model (i.e. Ashanti and the Greater Accra regions)

Studies by Clarke et al (2003) and also Muschinski and Pickering (2000) agree on the fact that ethnic and religion heterogeneity have a great influence on income differences. Going by this argument, the FE estimators produce the same influence on regional income differences. Ethnicity and religious variables (i.e. Akans, Christian and Muslims) used in the model showed both negative and positive relationship with regional income. Considering the fact that Christians are the majority in almost all the regions, it is economically wise and acceptable to conclude that the mass of the employed are or will be Christians and all other things been equal will be ensured some level of income irrespective of the employment type. On the other hand this same group will also be subjected to minimal or even no income if unemployment shoots up (i.e. all other things been equal). On the contrary, Muslims being the second largest religious group totaling about 1/5th of Christians in almost all the regions except the northern regions have negative influence on income. The situation I guess will be different in regions where Muslims are dominant but due to their relatively smaller size pose negative influence on regional incomes.

According to Deaton and Paxson (1997) higher share of aged population in a region increases the degree of income differences. Considering the extent of yearly increase in the proportion of aged population in these regions, the model confirms the assertion been put forward by Deaton and Paxson. Populations aged sixty years and over have negative influence on regional incomes. This means regions with high share of aged population tend to have lower regional income due to higher income dispersion among the aged population. The analysis of this scenario is most appropriately done with unemployment. Considering the poor structure and the non-existence of welfare schemes and adequate pension systems in Ghana for the retired and also the rate of increase in the share of aged population and the unemployed, these variables will continue to negatively impact regional income when their numbers increase.

4. Discussion and conclusion

In this paper, the fixed-effects model was used to explore and analyze the influence of demographic and socio-economic factors explaining income variation within regions and among regions in Ghana and also identified the link and impact of these factors on regional income differences. The model results rejected the hypotheses, which in general terms the model confirms both positive and negative influence of the socio-economic and demographic variables on regional income

differences. Both increase in the share of demographic factors (i.e. age and population density) and other socio-economic factors (i.e. ethnicity, religion, unemployment) increase or narrow the margin of income differences within the regions. Although this study did not take into account other related causalities of income inequality/differences, it has however deepened the understanding of the necessary model required in explaining a particular trend in terms of regional income differences in Ghana. However the essence was to explore and analyze, rather than to focus on an insecurely porous model to explain what is not realistic in the context of Ghanaian regions.

The results show that an increase in the proportion of population aged sixty years and over in a region, the lower the average regional income and also the higher the probability of income differences. Aging population is graduating creeping into the Ghanaian population, the proportion of 60years and over has been rising from 4.9% in 1960 to 7.2% in 2000 (Ghana statistical service, 2005a) which is a reflection of increase in regional figures. Assuming this trend continues there is going to be a higher of share aged population in almost all the regions, hence affect income levels. Following various empirical studies and results on the effects of aged population on income differences/inequality (i.e. Deaton and Paxson, 1997), aged population have higher income dispersion. Subsequently harnessing the facts that most of these aged populations never had any form of formal education and are also engaged in the informal private sectors, they often retire without appropriate financial plan hence affecting their income sources. Therefore having a high share of such population increases regional income differences. This scenario could be predominant in the three northern regions of Ghana where migration of the youth to the southern regions for better lives is gradually leaving the regions as aged population regions.

It is also explainable in the context that population density has a negative effect on income in regions in Ghana. The two most populated regions (Ashanti and Greater Accra regions) in Ghana from 1960-2000 recorded 761.9% rate of change in population density (Ghana statistical service, 2005a). Increase in the overall population in Ghana from 1960-2000 resulted in an increase in the population density even in the three northern regions. Putting in perspective the various studies on population density and income differences where Crenshaw (1993) concluded that high population density lowers income inequality/differences through various forms of socialization and a contradictory submission from Litwin (1998), that urbanization and high population density increase income differences; a conclusion can be drawn in Ghanaian context. In relation to Litwin's argument, one can compromise that urbanization in developing countries fails to realize industrialization as an important factor. So in this case increase in population without corresponding employment opportunities and social welfare systems increase the rate of unemployment, which had been the case in Ghana. In affirmation to Litwin (1998) assertion, population density has a negative influence

on regional income in Ghana; therefore an increase in population density widens income differences and also regions with high population density have low income levels (i.e. Greater Accra, Ashanti, Central and Eastern regions).

Considering the numerous empirical findings on ethnicity and religion and their perceived effects on income differences in the works of Clarke et al. (2003) and Muschinski and Pickering (2000) etc., it can be concluded that the results from the model certainly confirm that ethnicity and religion affect regional income differences. From an economic and performance point of view, a larger share of ethnic and religious groups will still have a negative influence on income if educational credentials and performance do not merit high incomes. Taking this scenario into account, the Akans (i.e. Ashantis, Bonos, Akyems and Fantis etc.) are negatively related to regional income differences in Ghana. Meaning, all other things been equal, an increase in the proportion of Akans in a region will lead to a reduction in the region's mean income. It can be concluded that regions in central and western Ghana are likely to have high income differences since they are predominantly Akan regions. On the other hand regions with high Christians (i.e. religious majority) have increase in average regional income when the number of Christians increase whereas the opposite is the case in Muslim dominated (i.e. religious minority) regions. Most jobs in the formal sectors in Ghana are religious institutions (i.e. education, health etc.), however one can conclude that employment in these institutions might be biased towards members. Discrimination towards employment in such institutions and even government ministries, departments and agencies account for the differences in regional income among ethnic and religious groups. In most cases political affiliations to some religions and ethnics groups subject some regions to higher income differences. Complementarily, studies by Malan (2000) in South Africa also revealed that high ethnic diversity influences income differences with high negative impact on the minority.

To the research questions and the hypotheses, the results have clearly shown a direct linkage between the socio-demographic factors and income differences which cannot be attributed as mere statistical correlation but rather as causality effect. The relationship between aged people and unemployment couple with the weak welfare system in Ghana suggest a direct linkage between these factors and income differences. In some cases these linkages can be regarded as indirect and irrelevant but however, the fact that one factor directly/indirectly triggers others, it demands attention from policy-makers. To salvage this possible negative linkage and its impact on regional income differences requires conscious synchronization of all employed people in the informal sectors into institutionalized pension schemes. This would create a source of safety net from which the aged population can resort to when they retire from active service. Also attempts should be made to spread development across all regions to ensure even distribution of both young and aged populations. Also taking into account the impact of ethnic and religious

heterogeneity on income differences/inequality, the thrust of the paper was not to measure the magnitude of the impact; however it can be asserted that the variables have some extend of impact on income levels based on the results from the model. However, the magnitude of impact of ethnic and religious heterogeneity on income differences/inequality can be taken up in another research taking into account that these linkages and impacts sometimes are driven by some latent unobserved factors.

Taking note from this model, though within regions accounted for greater part of the income differences; income differences/inequality between the northern and southern regions still remains significant in Ghana. Income difference between the urban (core) and rural (periphery) regions in Ghana is high but more serious among rural areas in the northern regions since the regions are less urbanized and attributed with substantial differences in education and job prospects. Shepherd et al. (2004) have suggested that income differences within regions in the south of Ghana may be partly explained by the relocation of people from the north (debatable) at the same time linked with their class, religion and ethnic influences. It can however be said that the spatial location of people in Ghana roughly concurs with ethnicity and religion but can sometimes be mere coincidence and irrelevant. The southern and savannah ecological regions are largely populated by the Akans (50%), Ewe (13%) and the Ga-Adangbe (8%) and over 70% Christians, whereas the three northern regions are populated by the Mole-Dagbanis (15%) and around 16% Muslims (Shepherd et al., 2004). This scenario boils down to the north-south divide in income differences accounted for by ethnicity and religion as explained in the model. Most of people in the northern regions are engaged in the informal private sector i.e. subsistence farming etc. which is attributed with low revenue. However, the same can said of most unemployed youth in the southern regions, therefore the high share of such population subjects the regions to low regional income. Therefore within regional income differences cannot be narrowed down to the northern regions only, but also, the savannah ecological and southern regions where the Akans are dominant but however income differences in these regions is compensated by the dominance of Christians. According to Shepherd et al. (2004) Akans contributed substantially to poverty incidence in 1998/9 which also supports the negative relationship of Akans on regional income differences from the model.

Conclusively, this paper has presented range of ideas and empirical findings on the socio-economic and demographic factors and their influence on regional income differences/inequality in Ghana. The results inform that the economic performance of regions with their varied population structures and compositions are important determinant of people's level of income.

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Appendix

[a] Proxy variables and data

Education (tertiary + post basic) 1984 = Income (1984)

Education (tertiary + post basic) 1970 or 1960 =? [Proxy income for 1970 and 1960]

Population (1984) = Ethnicity/Religion (1984)

Population (1970 or 1960) =? [Proxy ethnicity/religion for 1970 and 1960]

[b] Control of inflation

The conversion was based on the average annual Consumer Price Indexes i.e. 35734, 40141, 45681 and 140141 for 1960, 1970, 1984 and 2000 respectively. The index in 2000 was used as the base to assume the values in 1960, 1970 and 1984 in 2000. Also to avoid to the situation of the skewness of income across the years, 'log' of the incomes were calculated to ensure a perfect range of income distribution across the years in the regions.

140141 (2000) = 14 (1960)

35734 (1960) =? [Inflation free Income for the years]

[c] Fixed-Effects and Random-Effects Models

Fixed-effects model

The fixed-effects model explores the relationship between the outcome variable and the predictor variables within an entity (i.e. regions) over time. The reason is that every region or entity has embodied characteristics that may or may not influence the outcome variable by biasing the predictor variables and this need to be controlled. This is the reason for the assumption of the correlation between the region's error term and the predictor variables. By this assumption the effects of time-invariant characteristics from the predictor variables are removed in order to assess the net-effects of the predictors - unobserved heterogeneity (Cheung 2008). The time-invariant characteristics within regions are assumed to be unique and should not correlate with other individual characteristics. Each region is different therefore the region error-term and constant should not correlate with others. Inferences based on fixed-effects models can only be applied to the effect-size parameters in the sample under observation (Hedges and Vevea 1998). In other words the fixed-effects models make conditional inference.

Random-effects model

The random-effects model unlike the fixed-effects model, the variation across the regions is assumed to be random and uncorrelated with the predictor variables. The random-effects model assumes region's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. However it becomes a problem in random-effects models when specifications are required of individual characteristics that may or may not influence predictor variables and the omission of these variables probably due to their unavailability lead to variable bias in the model. The random-effects are the unexplained study-specific effects (Cheung 2008). In contrary to the fixed-effects model, inferences based on the random-effects model can be generalized beyond the study sample to the population the sample was drawn from (Hedges and Vevea 1998). The random-effects models make unconditional inference.

Hausman Specification Test

A statistical test on heterogeneity is often used as the criterion for selection between the fixed effects and the random effects model (Hedges and Vevea 1998). Testing the appropriateness of the random-effects in this scenario, the Hausman Specification Test (HST) was used to test the null hypothesis i.e. the difference in coefficients of the variables are not systematic. The Fixed-effects model is adopted when the hypothesis is rejected. On the other hand Hausman Specification Test (HST) tests that the coefficients estimated by the efficient random-effects estimators are the same as the ones estimated by the consistent fixed-effects estimators (Baum, 2006).

NB: To avoid the problem of endogeneity and reversed causality and to be more assertive in explaining the variation in the regional income differences, lag of the explanatory variables were alternatively used but produced insignificant and no relationship to regional income differences. Possible explanatory variables explaining the same thing or which correlate were dropped but still produced 99.8% r^2 .