Spatial Decomposition of Poverty in Niger: Shapley Decomposition Approach

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Major Paper presented to the
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in partial fulfillment of the requirements of the M.A. Degree
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Ottawa, Ontario
December 2016

Abstract. This paper examines the prevalence of poverty in Niger, using the Shapley approach. In doing so, I use a cross-sectional data for 2011/2014. The measurement index for well-being is consumption (the aggregate of food and non-food expenditure). The choice of consumption is premised on the common knowledge that it is not easily influenced by the volatility of income to price shocks and changes, as it tends to smoothen over time. The results obtained from the Shapley decomposition approach support the prevalence of poverty in Niger, with the rural areas being the more affected group.

Acknowledgement

I would like to thank my research supervisor: Professor Paul Makdissi for his mentorship and feedback in the last few months. I have greatly benefitted from your insight and encouragement in bringing my research topic this far.

I am also thankful to my family: many thanks to my late dad, my mum, my husband and my siblings especially my brother for his continuous patience, understanding and unconditional support. I would not be able to complete my studies without their unwavering encouragement.

Abbreviations

CWIQ	Core Welfare Indicators Questionnaire
DASP	Distributive Analysis Stata Package
ECVMA	National Survey of the Living Conditions of Households
ENBC	National Budget Survey and the Household Consumption
FGT	Foster, Greer and Thorbecke
GDP	Gross Domestic Product
HDI	Human Development Index
IFAD	International Fund for Agricultural Development
INS	National Institute of Statistics
LSMS-ISA	Living Standard Measurement Study-Integrated Survey on Agriculture
MDGs	Millennium Development Goals
PCE	Per Capita Expenditure
PDES	Economic and Social Development Plan
QUIBB	Unified Questionnaire of Basic Indicators of Well-being
UN	United Nations
UNDP	United Nations Development Program
USD	United States Dollars
WHO	World health Organization

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Section 1

1.1. Introduction

Poverty remains one of the most pressing issues in Africa, so much that numerous studies have been conducted to understand its prevalence {see for example (Kakwani (1993), Chen and Ravallion (2004), Alkire and Housseini (2014), Batana (2013), Olinto et al (2013))}. While the majority of economies have shown noticeable progress in combating poverty over the past four decades, poverty still remains a deep-rooted issue in Sub-Saharan Africa, where about one-sixth of its people are considered chronically poor (Adepoju and Yusuf, 2012).

The key factors contributing to poverty are low per capita incomes and inequality in the distribution of income (Bourguinon, 2004). Poverty is predominant in both rural and urban communities in sub-Saharan Africa, although some of its constituent countries record greater incidence of poverty in rural communities due to inaccessible health facilities, poor nutrition, and fewer educational facilities to mention but a few. Also, most African nations have low per capita income stemming from low productivity in the manufacturing sector and lack of basic infrastructure such as health facilities, education and credit facilities to support extensive productivity. The presence of weak government institutions and unstable regimes also makes it hard to achieve sustainable economic development over the long term. Corruption is rife within the very fabric of government institutions and private organizations such that even the low available income is not evenly distributed in the country; this manifests itself as a great economic divide between a small minority that can afford the luxury of life and a significant part of the population who do not have sufficient resources to meet their minimum needs. In addition, most countries in sub-Saharan Africa are faced with volatile economies, making it difficult for poor people to attain significant economic breakthrough, as they are constantly fighting against the wind of rapidly changing economic fortunes resulting from price shocks and climate changes. These obstacles only serve to impede the economic growth process in these countries.

Following the inception of the Millennium Development Goals (MDGs) in 2000, the United Nations (UN) through several of its initiatives has been providing humanitarian aid to help ameliorate the living conditions of individuals living in the developing parts of the world. Although some level of success has been recorded, the poverty situation still remains worse for the sub-Saharan Africa region. One of such countries of notable mention is the Republic of Niger.

According to the 2013 Human Development Index (HDI) of the United Nations Development program (UNDP), Niger ranked 186th, occupying the last position; with 76 percent of Nigeriens living on less than US$2 a day.

Niger is a landlocked country confronted by dire ecological and climatic conditions that encroach on her very survival, thus making Niger a highly vulnerable agricultural economy. As reported by the World Bank, GDP per capita in Niger is approximately 3 percent of the world's average, ranking 182nd out of 187 countries. Since 1960 until 2015, Niger's GDP per capita has only averaged 452.60 USD, reaching a peak of 714.61 USD in 1965 and an all-time low of 325.84 USD in 2000. Niger's GDP per capita was estimated at 388.16 USD in 2011, with about 63 percent of Nigeriens living below the international poverty line of 1.25 USD per day. Niger's rapid population growth rate (3.9 percent) also worsens the country's adverse economic outlook as population increase puts pressure on the few resources available (IFAD, 2014). According to the World Health Organization (WHO), health facilities are inadequate even in the capital Niamey and other urban areas, while the rural communities (where the majority of Nigeriens reside) lack basic health access. Hence, treatable diseases such as malaria, cholera and typhoid regularly claim hundreds of lives in the country (Our Africa). Niger's economy indeed calls for some strategic poverty alleviation program. Since most of its poor population reside in rural areas (nearly 80 percent) (IRIN, 2006), it is expedient to take a demographic/sectoral poverty approach as to better understand and identify the extent to which poverty thrives within the sectors and regions of Niger and the driving factors. This will allow us to propose measures that will potentially improve well-being, foster growth and reduce crippling poverty in the rural and urban areas of the country.

In order to accurately quantify the effects of poverty, it is important to have consistent methods for measuring its prevalence. As such, the issue of effective poverty measurement has been the subject of keen interest since the UN adopted the MDGs in 2000. Previous empirical studies on poverty measurement in Niger by the World Bank had concentrated more on comparing poverty trends over time (so as to monitor changes in poverty, if any) as well as take a holistic approach to capture the economic performance of Niger. In an attempt to provide a sector-specific analysis, this paper seeks to provide an update on the poverty profile in Niger by employing sectoral decomposition to better quantify the dynamics of poverty in the country. This study adapts Ravallion and Huppi (1991) poverty decomposition framework using the Shapley decomposition procedure by Kolenikov and Shorrocks (2005) to analyze Spatial Decomposition

of Poverty in Niger. Using data obtained from the National Survey on Household Living Conditions and Agriculture – ECVMA 2011 and 2014, (the 2011 survey coincided with the adoption of Niger's current growth and poverty reduction strategy, the PDES, while the recently released 2014 survey is a concluding part of the 2011 survey), this paper seeks to provide an analysis of poverty in rural-urban Niger and estimate the marginal contribution of cross and intra groups and sectors to poverty across the eight regions of Niger. The contribution of this paper is to adapt a Shapley type of decomposition to Ravallion and Huppi (1991) sectoral decomposition technique. This new approach provides a better understanding of poverty in Niger, so that evidence-based policies can be articulated to improve the living conditions of Nigeriens.

As will be further demonstrated in this study, the results indicate that poverty is prevalent in Niger. The findings show that a larger proportion of Niger population reside in rural areas, thus, poverty is severe in rural areas when compared to urban areas, so that rural communities contribute largely to overall poverty in Niger.

The structure of this paper is as follows: Section 2 introduces the existing literature on poverty, Section 3 describes the data used, gives a presentation of the measurement framework and the empirical results and Section 4 summarizes the findings and concludes the analysis.

Section 2

2.1. Literature Review

In order to alleviate poverty, maximize social welfare and ensure that international aid is given to countries with the most need, it is important to have a clear understanding of poverty, by unpacking its characteristics and the factors driving and driven by it.

According to the World Bank (2000), "poverty is (extreme) deprivation in well-being." Ravallion (1996), Sen (2000), and Wagle (2002) opined that poverty should be addressed as a complex social problem as opposed to seeing it as just another economic problem. According to Wagle, in defining poverty there is a need to adopt a more integrative (i.e incorporating economic well-being, capability and social/cultural exclusion) approach rather than a reductionist one. He further stressed that credence be lent to social, behavioral and political underpinnings of human well-being in order to fully capture the factors that lie at the core of poverty problems. To him, this approach will help characterize poverty better as well as place development issues in clearer perspective, thereby providing guidelines to improving human well-being.

Kanbur and Venables (2005) explore the widespread of the nature of poverty by looking at the effect of geography on the well-being of people. They explain the increasing importance of spatial inequality and its policy implication in most developing countries. They find wide geographical disparities in per capita income, amongst other socioeconomic indicators within many developing countries, further highlighting that there are intrinsic factors that drive poverty within these countries.

Chen and Ravallion (2004) point out that poverty in sub-Saharan Africa has not only become more widespread but also grown deeper in the lives of the affected people when compared to the poor in the rest of the world. They suggest that future economic growth will unlikely reduce poverty in Africa unless inequality falls, thus implying that while economic progress can help achieve higher levels of income growth to lift people out of poverty, it is important that development policies are enacted to address the problems of chronic and prevalent income inequality. Likewise Obadan (1997) finds that in sub-Saharan Africa, poverty thrives largely due to inadequate access to employment opportunities; inadequate physical assets such as financial capital, land and minimal access to credit facilities by the poor; inadequate access to viable means of enabling rural development in poor regions; inadequate access to markets where

the poor can sell goods and exchange services; low endowment of human capital, destruction of natural resources resulting in environmental degradation and low productivity; and more generally, the failure to include the poor in the design of development programs.

In addition to investigating the widespread nature of poverty, many authors have also come up with methodologies to understand and measure poverty. For example, Bourguignon (2004) opines that poverty in any given country is fully captured by the rate of change in the mean income of the population and the change in income distribution. According to him, the real challenge to proposing a development strategy that will help reduce poverty lies in understanding the individual effects and combined interactions from mean income growth and income redistribution.

Source: Bourguignon (2004)

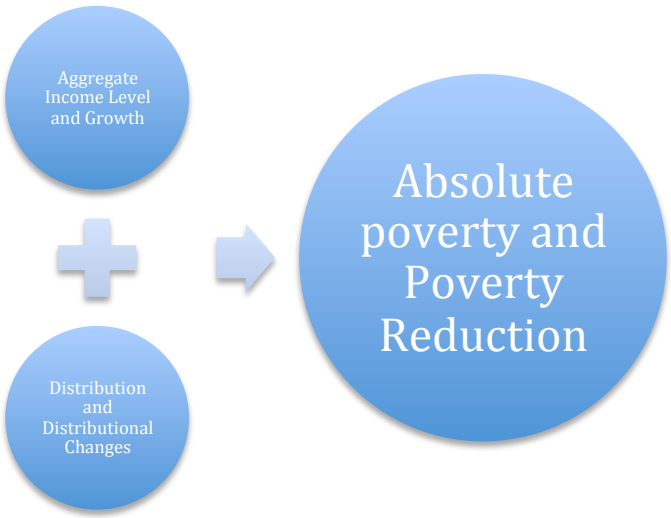


Figure 1: The Poverty Triangle

Like Bourguinon, Datt and Ravallion (1992) and Kakwani (1993) show that change in poverty can be decomposed into two effects: the mean effect and the distribution effect. In other words, if the distribution of income does not change, poverty reduction can only be achieved with growth in income: and without growth in mean income, redistribution of income in favor of the poor is the only option to reduce poverty.

In his seminal paper, Sen (1976) proposes new measures that would correct the violations inherent in the poverty measures that were in wide use at the time. His paper draws motivation from the need to construct an acceptable poverty index that accurately allows one to measure

poverty. He presents an axiomatic approach and considers his poverty index P easier to interpret, where P is made up of the widely used head-count ratio (H) but multiplied by the income-gap ratio (I) augmented by the Gini coefficient of the distribution of income among the poor weighted by (1 – I). That is, P = [I + (1 - I) G] * H. According to Sen, his poverty index P is superior to previous poverty indices because it follows an ordinal approach to welfare comparisons, so that P is sensitive to the extent of the shortfall of the poor from the poverty line. Ultimately, P is sensitive to the exact pattern of distribution of the incomes of the poor. Foster, Greer and Thorbecke (FGT) (1984) in their classic paper, provide another measure for identifying the poor, a framework now popularly known as the FGT poverty framework. In their paper, they provide a decomposable poverty measure, using the Integrated Rural Household Survey data for Kenya, thus improving on the poverty analysis proposed by Sen which is sensitive to both average shortfall and inequality in the distribution of the poverty gap. FGT offer a poverty measure that allows one to consider incidence, shortfall and inequality, yet still be able to additively decompose poverty. The FGT class methodology has been adapted and extended severally to assess trends in poverty or identify attributes peculiar to the poor. It is on these improved poverty measurement techniques that several existing papers take departure.

Huppi and Ravallion (1991) use stochastic dominance technique and decomposable poverty index to describe the sectoral composition of poverty in Indonesia in the mid 1980's. They examine the structure of poverty in Indonesia by employment sector, and how it changed during the adjustment period of 1984 to 1987. The FGT poverty measures were computed to analyze the impact of macroeconomic shocks. The sectoral decomposition revealed that gains accrued within and between sectors accounted for the country's success at alleviating poverty during the period under study. The results also revealed that poverty was more concentrated in the rural sector with the rural region of Java accounting for a large share of aggregate poverty in Indonesia. Further results showed that gains to the rural sector in the main regions were quantitatively crucial to Indonesia's success in alleviating poverty, with rural farming accounting for the most gains. Thorbecke and Jung (1996) also applied the FGT poverty measures to Indonesia. Their findings reveal that total poverty reduction effects were largely from agricultural production activities; informal activities and services also helped reduce poverty. Other sectors such as food processing, manufacturing and textiles, which have inter-production linkages with agriculture, also made relatively large contributions to poverty reduction.

Datt and Ravallion (1992) also applied the FGT poverty measures to compute comparative analysis of poverty measures in Brazil and India, using available data for the 1980's. The paper studied the relationship between growth, distribution and poverty, by measuring the differences in means and the differences in distribution and how they contribute to changes in poverty and poverty rates respectively.

Kakwani (1993), using data obtained from Cote d'Ivoire's Living Standard Survey conducted in 1985 investigated the relationship between economic growth and poverty. He opined that the extent of poverty hinges on two factors namely, the average level of income and the magnitude of inequality in income distribution. Such that an increase in average income will reduce poverty but an increase in inequality increases poverty. This study expectedly finds poverty to be highly correlated with economic growth, though it is expected to decrease faster than economic growth rate if the growth process does not lead to an increase in income inequality. He evaluated the distribution of the estimated poverty values and showed that it asymptotically follows a normal distribution; that is, poverty levels can be compared using simple difference of means test.

Chen and Ravallion (2008), using cross-country data found persistent high incidence and depth of poverty in Sub-Saharan Africa. A revised study using new sensitivity tests was conducted as well. The results, in contrast to results obtained in other literature, suggest continually declining poverty incidence and depth since the early 1980's.

Although these studies have provided outstanding insights on poverty measurement, there had also been arising issues regarding the robustness and validity of the results obtained given the different approaches used and results gained. Against these backdrops of discrepancies in measurement methodology yielding contrasting results, Shorrocks (2013) proposes a solution to general problems encountered using a decomposition technique. Following cooperative game theory, he proposes the Shapley value for all forms of distributional analysis. The Shapley procedure provides several basic features, which makes it applicable for a general decomposition rule. Makdissi and Wodon (2004) based on a game theory result previously propose the use of Shapley value in order to obtain a unique solution for the allocation of the total poverty reduction obtained through multiple programs to each individual program. They applied a Shapley value decomposition to analyze the impact of multiple government transfer programs. The results

suggest that the use of the Shapley decomposition approach is helpful and crucial when the programs under implementation are many and they overlap when the beneficiaries are considered.

Kolenikov and Shorrocks (2005) applied a decomposition technique based on the Shapley value to the study of variations in poverty across regions in Russia. The study was done to explain the variation of poverty across the regions of Russia in terms of differences in income per capita. The results revealed that despite the very large differences in per capita income across regions, inequality explains a greater impact on the poverty rate than real income per capita in about half of the regions in Russia. Price variations were said to have partially offset the impact of nominal income levels on regional poverty levels.

This major paper is akin to Huppi and Ravallion (1991) in the sense that we provide a sectoral decomposition of poverty. It differs from it in two aspects. First, it uses a Shapley approach to decomposition as in Shorrocks (2013), Makdissi and Wodon (2004) and Kolenikov and Shorrocks (2005). Second, it studies Niger.

There have also been several studies on Niger. Here, I provide a brief literature review of what has been done so far by researchers to explain how poverty has evolved over time in Niger. The general view from research on Niger is that poverty thrives in the country as a whole, with the rural areas being the most vulnerable group. Some of the studies conducted by the World Bank have measured poverty dynamics by assessing the trend in its incidence and severity. These studies are all directed towards ensuring a precise poverty measurement so that effective government antipoverty strategies can be put in place and resources from international agencies can be utilized efficiently and appropriately.

The World Bank (2015) report reveals that the incidence of poverty in Niger remains high, with underperforming results achieved under the implementation of Niger's first poverty reduction strategy. Using the Core Welfare Indicators Questionnaire (CWIQ 2006) survey and a Participatory Survey on Poverty, the study reveals a small decline in the incidence of poverty between 2002 and 2005. The poverty incidence was estimated at 62 percent in 2005 while the depth and incidence of poverty increased from 21.7 and 10.1 percent in 1993 to 24.14 and 12.3 percent in 2005 respectively. The designing of policies targeting the vulnerable groups of Nigerien population was birthed following the trend noticed that little to no improvement was evident in the living standard of the people. The report also presented the evolution of poverty between 2005 and 2007 using survey data collected through the Unified Questionnaire of Basic

Indicators of Well-being (QUIBB) and National Budget Survey and the Household Consumption (ENBC) survey. The study provides a poverty and inequality assessment of Niger's poverty trends and profile. In Niger, surveys done within 2005-2010 do not allow for easy tracking of the evolution of living standards. According to the World Bank (2012) report, this assessment suffers major drawbacks because measurement of poverty performance overtime in Niger is imprecise because of lack of comparable data. The results of the study, which estimate the propensity score using a probit model, show that both national poverty gap and squared poverty gap have decreased sharply, implying that depth of poverty has decreased and average income among the poor has drawn closer to the poverty line. Although the incidence of poverty decreased in 2007/2008, the findings show that the absolute number of the poor has not changed. This is so because the rapid increase in population growth automatically cancels out the gains in poverty reduction so that the relative number of poor did not diminish in Niger.

Another study by the World Bank (2014) provides a robust analysis of poverty trends in Niger from 2005 to 2011 using 2011 National Survey of the Living Conditions of Households (ECVMA) survey as the basis for assessing the poverty trends and correcting for methodological differences in the 2005 and 2007/2008 surveys. This work by the World Bank recognizes that the process of monitoring poverty dynamics between 2005 and 2011 were complicated by methodological differences in the household surveys conducted over these periods. The findings of this World Bank report reveal that although the overall poverty rate in Niger has diminished significantly between 2005 and 2011, changes in the poverty incidence are highly uneven across the country with poverty rates decreasing rapidly in urban areas compared to rural areas. A significant 4 percent decrease in the rural poverty rate over the 2005-2011 period was recorded as a result of 6.7 percent annual growth rate in the agricultural sector. The report stresses that in spite of the noticeable decrease in rural and national poverty rates since 2005, poverty in Niger remains extremely severe. The World Bank report identifies four underlying factors contributing to poverty's pervasiveness in the country, namely: Niger's per capita GDP growth rate is relatively low and unstable; inequality continues to be on the rise; production volatility in agricultural activities; and Niger's extremely high population growth rate. The analysis understudies inequality by looking at the Gini Index, Generalized entropy Class-inequality and Theil Index to quantitatively capture the evolution of inequality in Niger. The findings indicate that inequality increased in Niger between 2005 and 2011.

Taking a queue from these literatures and building on the FGT class of indices and decomposable poverty measures, this study seeks to further explore the sectoral base approach to poverty analysis in Niger. By using the FGT method to estimate the incidence, severity and depth of poverty trend in Niger and also using a Shapley decomposition approach for the sectoral contributions, this study seeks to analyze the poverty dynamics in Niger in ways that can inform the objectives of policy makers and international development organizations.

Section 3
Data and Methodology

3.1 Data Description

The data used for this paper are obtained from the Niger National Survey on Household Living Conditions and Agriculture (ECVMA- 2011 and 2014). Food and non-food expenditures as well as basic socio-demographic and labor market characteristics information are collected for all household members. The ECVMA has a national coverage, including both the rural and urban areas in all eight regions (Agadez, Diffa, Dosso, Maradi, Niamey, Tahoua, Tillaberi, Zinder) of the country, with the exception of Arlit (a strata in the Agadez region) due to accessibility constraints and sparse population density.

The ECVMA dataset is an integrated multi-topic household survey conducted primarily for the purpose of evaluating poverty and living conditions in Niger, thus, used to evaluate the progress of the MDGs. Being a part of the Living Standards Measurement Study- Integrated Surveys on Agriculture (LSMS-ISA program), this survey was implemented by the National Institute of Statistics with technical and financial support from the World Bank in order to improve upon previous recent surveys (CWIQ, QUIBB and the ENBC). Being the third survey in Niger, the ECVMA was carried out in 2011 to monitor poverty as well as identify vulnerable population while providing basic data for analyses of public policies in the field of agriculture. The ECVMA provides a better platform for comparisons across time – this is one crucial feature that previous surveys could not offer. Thus, the ECVMA is considered the new poverty monitor base for poverty related studies in Niger. The unit of observation in both surveys is the household; there are 3,859 observations in the 2011 dataset and 3,617 observations in 2014 dataset. The ECVMA involves two visits, the first visit occurs during the planting season while the second visit is done during harvest season. During these visits, household and agriculture/livestock and community/price questionnaire are administered.

The sample used for this study makes the weight representative of the individual, by multiplying the survey weight by the household size; this is done to improve comparison across the country. The wellness indicator proxy, per capita expenditure (PCE) which allows a certain level of well-being to be attributed to an individual is generally built on income or consumption. In this study, it is the aggregate of household consumption per head. That is, dividing the

aggregate of consumption[1] by the household size and further dividing by a spatial deflator[2] the PCE is obtained. The spatial deflator takes into account the differences in costs of living between rural and urban areas. Dividing the per capita expenditure by the national poverty line then normalizes the PCE. The normalized per capita expenditure is used for the descriptive statistics in this study.

Table 1 simply shows the weighted means and standard deviations of the variables of interest: urban and rural sectors, eight regions, five educational levels, five industries and nine occupational categories. Using the 2014 dataset, the statistical summary reveals the per capita expenditure pattern across key sectors of the nation. The level of urbanization influences poverty to some extent. Urban dwellers earn more than rural dwellers[3] whereby approximately 64 percent of Nigeriens reside in rural areas while only 36 percent of the population lives in urban areas. The poverty rate is significantly higher in the rural areas than in the urban areas. This result conforms to the result obtained in the literature. The low-income regions include Diffa, Tillaberi, Zinder, Dosso and Maradi (occupying the bottom position), while the high-income groups are Tahoua, Agadez and Niamey (occupying the topmost position). With the exception of Niamey[4], the other seven regions have both rural and urban parts. Three of the regions: Maradi, Tahoua and Zinder constitute about half of the population. Agadez and Dosso are medium in size, with about 11 percent each of the population. Diffa and Tillaberi are less populated, while 21 percent of the population lives in Niamey. From Table 1, one can also observe that having a university education affords a Nigerien thrice as much purchasing power when compared with a primary school certificate holder. Thus the level of education also plays a contributing factor in the well-being of a person. Unfortunately, approximately 76 percent of the population has the lowest educational attainment (preschool education) while only 4 percent have a university education. This explains the low skilled manpower, high illiteracy rate and the huge deficit in Niger's human capital formation. Table 1 further shows that 78 percent of the population engages in individual businesses (which usually is of low capital base), thus contributing little to revenue generation for the economy. Roughly 43 percent of the population engages in agricultural activities (mostly at

[1] Consumption is the sum of food and non food expenditures.
[2] The spatial deflator is calculated as a ratio of the poverty threshold.
[3] Living in an urban area allows an individual to earn twice as much as someone living in a rural area.
[4] Niamey is exclusively an urban area. It is the political and economic capital of Niger.

the subsistence level) and approximately 10 percent are unemployed, this further describes the poverty profile of Niger.

Table 1
Summary Statistics

			Percent population (%)
Sector			
Urban	2.4218	(1.5543)	35.89
Rural	1.1691	(0.6511)	64.11
Region			
Agadez	1.9204	(1.2824)	10.56
Diffa	1.4929	(0.7789)	10.04
Dosso	1.1024	(0.6679)	10.84
Maradi	1.0196	(0.7627)	12.75
Tahoua	1.6192	(0.8941)	11.81
Tillaberi	1.2824	(0.7184)	10.15
Zinder	1.169	(0.6891)	13.13
Niamey	2.8937	(1.894)	20.74
Educational Level			
Kindergarten/preschool	1.2413	(0.7257)	75.95
Primary school	1.5924	(1.144)	11.17
Secondary 1	2.0818	(1.3924)	7.52
Secondary 2	3.2755	(2.6033)	1.8
University	4.6408	(2.1458)	3.57
Industry			
Public sector	2.6479	(1.7961)	6.72
Big business	2.3775	(1.6554)	4.95
Individual business	1.2626	(0.787)	77.97
Household	1.2278	(0.8594)	0.69
Unemployed	1.844	(1.4888)	9.68
Occupation			
Agriculture	1.1467	(0.6345)	42.91
Livestock/forest/fish	1.3442	(0.8055)	8.24
Industry	1.6229	(1.0875)	8.79
Commerce	1.6603	(1.0388)	12.25
Transport	1.9062	(1.2294)	2.96
Education/health	2.7213	(1.8068)	3.65
Person services/domestic	1.2712	(0.8127)	4.56
General	2.4854	(1.7939)	6.97
Admin/telecom/financial/other			
Unemployed	1.844	(1.4888)	9.68
Observations	3,617		

NOTES: Weighted means and standard deviations (in brackets)

3.2. Measurement Framework

A class of additively decomposable measures is one of such proposed by Foster, Greer and Thorbecke (1984). The FGT poverty index is calculated to assess the poverty profile among the regions.

The FGT poverty index takes the form:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{j}\left(\frac{z - y_i}{z}\right)^\alpha \qquad (1)$$

where,

i is the household; households are ranked by increasing order of income

P is the poverty index

n is the number of households

z is the poverty line for the household

y_i is the household income

j is the number of poor people

α is the poverty aversion parameter; as α tends to infinity, the condition of the poorest is all that matters

Three members of FGT class are considered:

The FGT poverty measure when $\alpha = 0$ is simply the head-count index, given by $P_0 = \frac{j}{n}$. It is also called the incidence of poverty and it describes the proportion of the population with a standard of living that falls below the poverty line; however, it does not quantify the extent of poverty. The head-count ratio as a measure of poverty violates both monotonicity[5] and transfer [6]axioms.

[5] Monotonicity Axiom: All other things being equal, a reduction in income of a person below the poverty line must increase the poverty measure.

[6] Transfer Axiom: All other things being equal, a pure transfer of income from a person below the poverty line to anyone who is richer must increase the poverty measure.

The FGT poverty measure when $\alpha = 1$ is the average poverty gap in the population, expressed as a proportion of the poverty line. It is given by $P_1 = \frac{1}{n}\sum_{i=1}^{j}(\frac{z-y_i}{z})$. It is also called the Depth of Poverty. However, the poverty gap index is not sensitive to the distribution of the standard of living indicator among the poor. Thus, although the poverty gap measure satisfies the monotonicity axiom it violates the transfer axiom.

The FGT measure when $\alpha = 2$, unlike the previous two is sensitive to the distribution of income among the poor. It satisfies the main axioms for a desirable poverty measure, including Sen's (1976) "transfer axiom" which requires that when a transfer is made from a poor person to someone poorer, there should be a decrease in aggregate poverty measure. It is given by $P_2 = \frac{1}{n}\sum_{i=1}^{j}(\frac{z-y_i}{z})^2$. It is also called Severity of Poverty. This index weighs the poverty of the poorest household more heavily than those just slightly below the poverty line. Its desirable properties make it a preferred measure of poverty.

3.2.1 Sectoral Decomposition

To quantify some of the factors underlying the changes in aggregate poverty, two decomposition methods can be employed, namely: Growth-Redistribution decomposition and Demographic-Sectoral decomposition.

This study will be limited to the Demographic and Sectoral decomposition of differences in FGT indices. The decomposition allows for a rigorous quantification of the contribution of population shifts to poverty alleviation, controlling for intrasectoral shifts and interactions within sectors and the contribution of intrasectoral shifts to poverty alleviation controlling for population shifts and the interaction between sectors.

Analyzing the sources of observed reduction in aggregate poverty by following Ravallion and Huppi (1991) sectoral decomposition procedure, and also exploiting the additive property of the FGT class of measure the model takes the form:

$$P_B(z;\alpha) - P_A(z;\alpha) = \sum_{i=1}^{j}[P_{Bj}(z;\alpha) - P_{Aj}(z;\alpha)].\Theta_j^A + \sum_{i=1}^{j}P_{Aj}(z;\alpha).\left(\Theta_j^B - \Theta_j^A\right) + \sum_{i=1}^{j}(P_{BJ}(z;\alpha) - P_{AJ}(z;\alpha)).(\theta_J^B - \theta_J^A) \quad (2)$$

The first part of the equation provides the within-group contribution, the second part reflects the demographic or sectoral contribution of j sectors representing a share Θ_j of the total population and the third part is an error term. This decomposition indicates how the aggregate change in

poverty is explained by intrasectoral gains versus intersectoral shifts in population. This approach seeks to assess the relative gains to the poor within specific sectors and to quantify the impact of changes in the distribution of the population across these specific sectors.

The above decomposition technique suffers from a major drawback on deciding which anchor point to use, either A or B as there is no guidance on how to choose one over the other. Also the result leaves an error term (which constitutes the interaction between sectoral changes and population shifts), and in a case where this discrepancy is large the decomposition would leave unexplained the bulk of the difference in poverty; because the sign of the interaction effect tells whether people tend to switch to the sector where poverty was falling or not.

Thus to eliminate this discrepancy, this paper adapts Kolenikov and Shorrocks (2005) Shapley decomposition framework to Ravallion and Huppi (1991). This basically consists of using A as an anchor point then also using B as an anchor point and finally taking the average impacts.

Equation 2 therefore can be rewritten in a convenient form by weighting the within-group poverty effects by the average population shares and weighting the demographic and sectoral effects by the average poverty index. This gives,

$$P_B(z;\alpha) - P_A(z;\alpha) = \sum_{i=1}^{j} \theta^j (P_B(z,\alpha) - P_B(z,\alpha)) + \sum_{i=1}^{j} P(z,\alpha)(\theta_B^J - \theta_A^J) \quad (3)$$

where $\theta^j = 0.5\left(\theta_A^j + \theta_B^j\right)$ and $P(z,\alpha) = 0.5\left(P_A(z,\alpha) + P_B(z,\alpha)\right)$

From equation (3), it can be observed that introducing the Shapley decomposition framework removes the error term. So in the context of this study, the right-hand side of equation (3) shows the first part which is the intrasectoral effect that tells us the contribution of poverty changes within sectors, controlling for the base period (2014) population share; while the second part which is the population shift effects tell us how much of the poverty in 2010 was reduced by the various changes in population shares of sectors between 2010 and 2014 in Niger.

3.3. The Results

The estimation of the incidence, depth and severity of poverty have been carried out following the FGT (1984) additively decomposable indices, using the DASP by Araar and Duclos (2009). The estimated results are presented in Tables 2, 3 and 4. A review of the incidence, depth and severity of poverty using the ECVMA 2014 dataset shows that the rural sector records 55.04 percent incidence of poverty; both the depth and severity of poverty are also higher than the urban areas. This result reinforces the notion that rural areas should be the favorite targets of poverty-eradication policies.

Table 2
Poverty indicators by region

	Incidence of poverty	Depth of poverty	Severity of poverty
Sector			
Urban	10.9	1.57	0.43
Rural	55.04	16.68	6.8
Region			
Agadez	17.53	2.93	0.72
Diffa	34.6	7.71	2.57
Dosso	60.4	16.6	6.27
Maradi	67.4	23.98	11.12
Tahoua	27.91	6.32	1.81
Tillaberi	48.16	13.73	5.76
Zinder	56.61	16.45	6.37
Niamey	6.16	0.68	0.15
ALL	48.03	14.19	5.79

Table 2 shows that the regions of Maradi, Dosso, Zinder and Tillaberi have the highest incidence, depth and severity of poverty. This suggests that the average amount between the levels of consumption of the poor and the poverty line is much higher in these regions. As such, one can infer that there exists a wide inequality gap among these regions. This also shows that the incidence, depth and severity of poverty are higher in rural areas. Relative to the national level, half of the regions have worse poverty indicators.

Table 3
Poverty indicators by labor market characteristics

	Incidence of poverty	Depth of poverty	Severity of poverty
Occupation			
Agriculture	56.67	16.82	6.74
Livestock/Forestry/Fish	50.58	15.27	6.38
Industry	38.01	12.72	6.09
Commerce	30.004	8.59	3.52
Transport	23.69	6.72	3.64
Education/Health	7.22	1.12	0.26
Personal Services/domestic	52.95	16.94	7.82
Gen. Admin/telecom/fin./other	12.63	3.31	1.39
Unemployed	25.71	4.94	1.75
Industry			
Public Sector	9.53	2.13	0.89
Big Business	28.85	12.14	5.4
Individual Business	51.24	15.17	6.18
Household	59.23	23.97	13.93
Unemployed	25.71	4.94	1.37
ALL	48.03	14.19	5.79

Table 3 provides a profile of poverty indicators by some labor market characteristics, where the incidence, depth and severity of poverty are highest in agriculture, personal services and livestock/forestry/fish. This indicates that household heads engaging in agricultural related activities have worse poverty indicators than those in other occupations. Since this table does not give insight into some of the confounding variables, the observation linking agricultural occupation and poverty may in part be explained by weak human capital, low productivity in agricultural activities that in turn leads to low revenue generation; this reasoning is consistent with the observation that households and individual businesses also have high poverty indicators.

Table 4
Poverty indicators by socio-demographic characteristics

	Incidence of poverty	Depth of poverty	Severity of poverty
Gender			
Male	49.1	14.51	5.93
Female	34.22	10.12	3.93
Educational Level			
Kindergarten/Preschool	50.19	14.76	6.06
Primary School	48.29	15.93	6.54
Secondary 1	25.59	6.09	1.82
Secondary 2	1.35	0.1	0
University	0	0	0
ALL	48.03	14.19	5.79

Table 4 shows that poverty rate is higher in households where the head is a man than in those where the head is a woman. Just like table 3, some other dynamics may be at play in explaining this trend. Table 4 also shows that poverty decreases significantly with the level of education. Each additional school education brings about a rapid decline in the poverty rate; household heads with a preschool education have an incidence of 50.9 percent and household heads with a university education do not contribute to poverty.

When comparing measurement of poverty among distributions, another approach to examine differences in poverty rate is to compare the FGT curves (also known as dominance curves) using the welfare indicator. A region dominates another when the dominance curve corresponding to it is above that of the other regions. Figures 1-3 show the FGT curves for the incidence, depth and severity of poverty across the eight regions. An examination of the graphs confirms that the regions of Niamey and Agadez hold the lowest levels of poverty with their curves lying significantly below those of other regions. The graph also shows that the regions of Maradi, Tahoua, Zinder and Tillaberi have the highest poverty indicators. There is no statistical dominance between the two intermediately poor regions of Diffa and Dosso whose dominance curves intersect in all three measures. Figures 4-6 show the FGT curves for the incidence, depth and severity of poverty across the employment sector. The graphs confirm that Agriculture and Personal services/domestic hold the highest level of poverty with their dominance curves lying

high above other occupations. Education and General Administration/telecom/financial/other indicate the lowest level of poverty with their dominance curve lying significantly below the other occupations. Industry, Commerce, and Transport contribute less to poverty when compared to agriculture and personal services. This profile gives a vivid direction for targeting the poor population.

Figure 1 : FGT Curve by Region when α=0

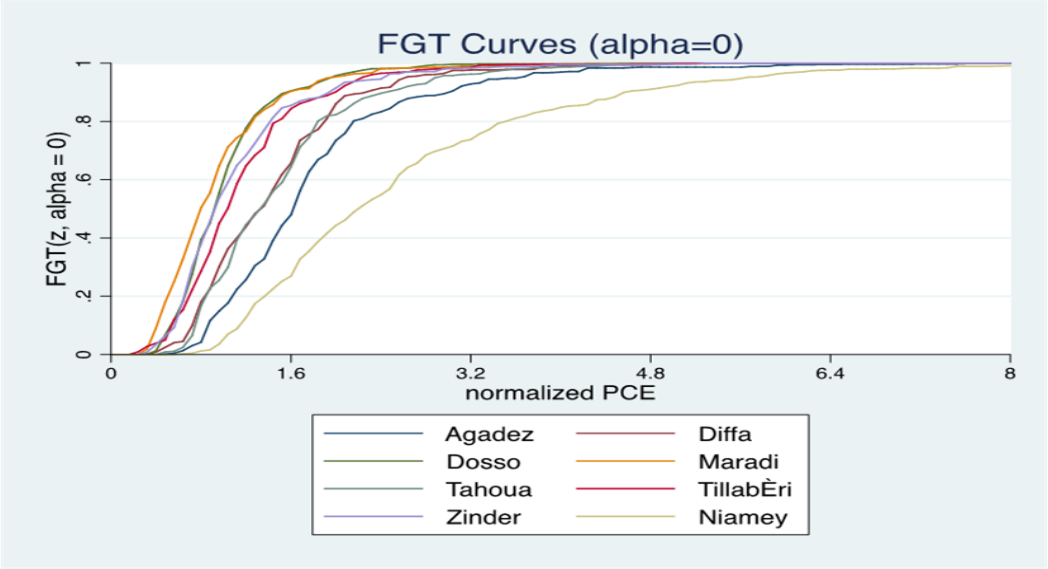


Figure 2 : FGT Curve by Region when α=1

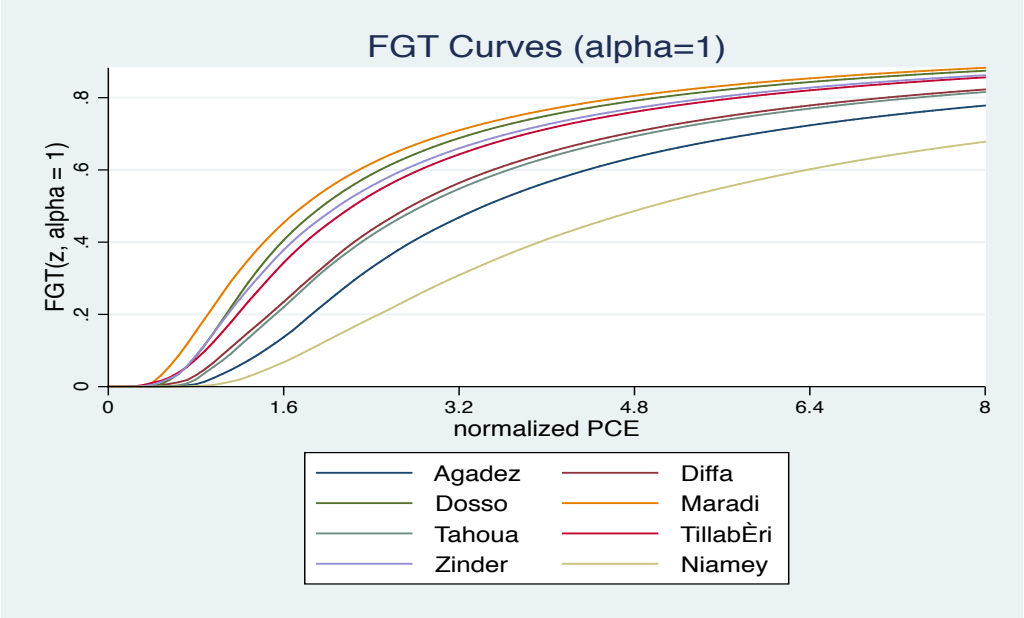


Figure 3 : FGT Curve by Region when α=2

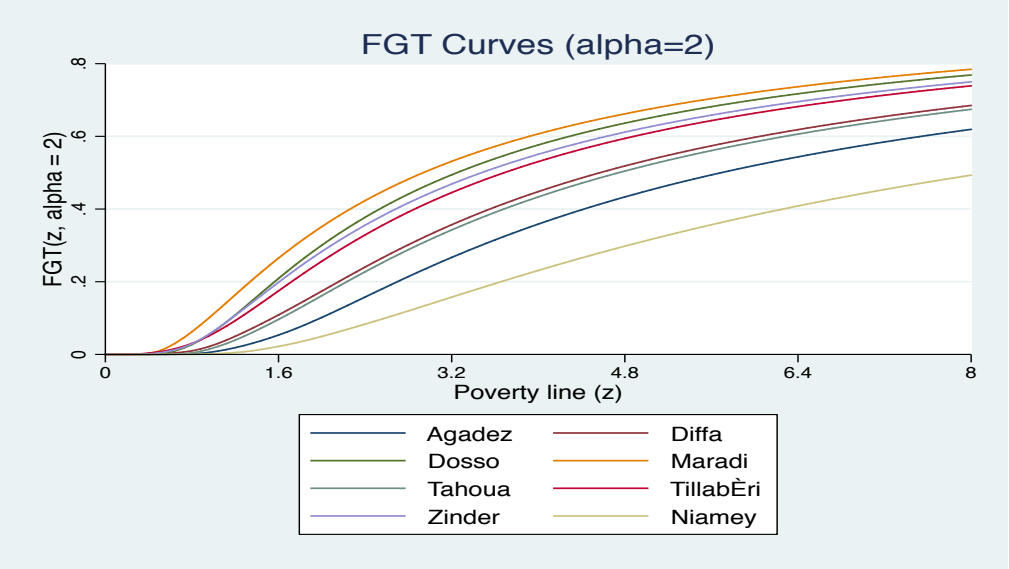


Figure 4 : FGT Curve by Occupational Category when α=0

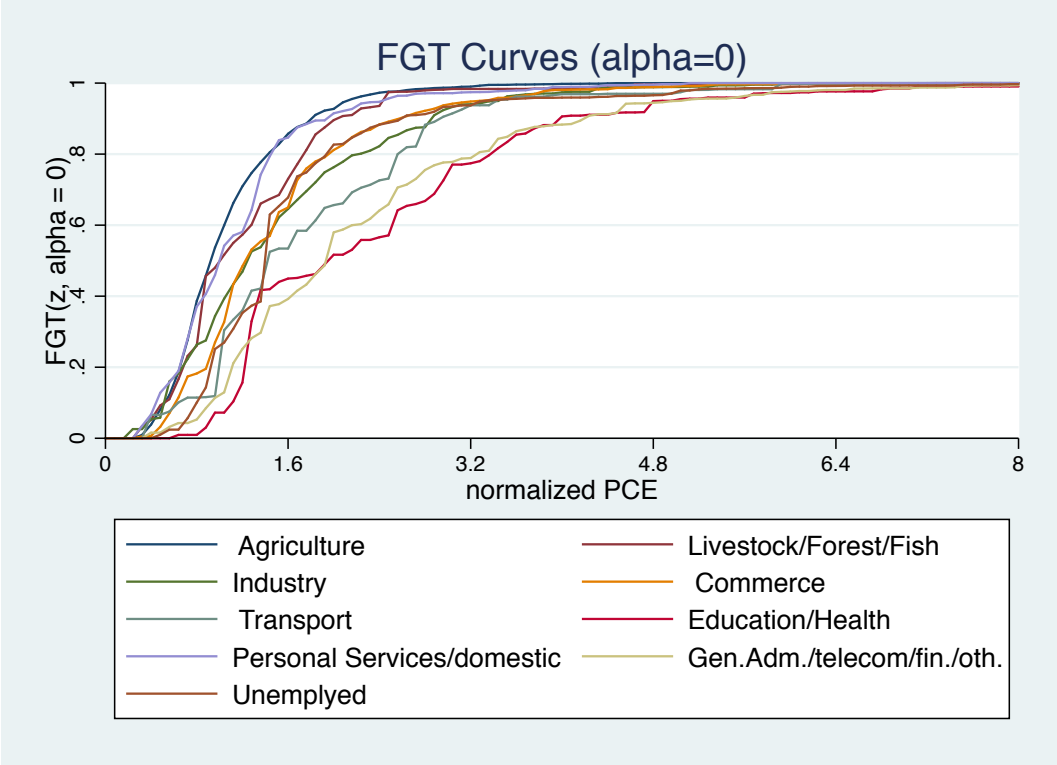


Figure 5 : FGT Curve by Occupational Category when α=1

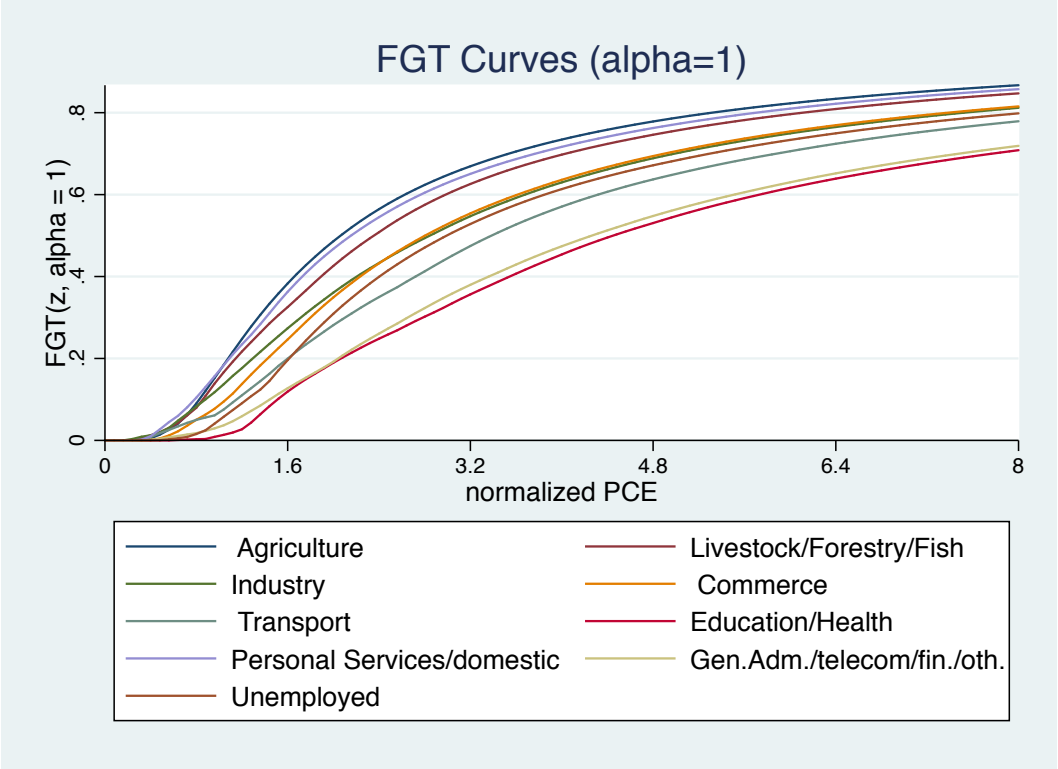
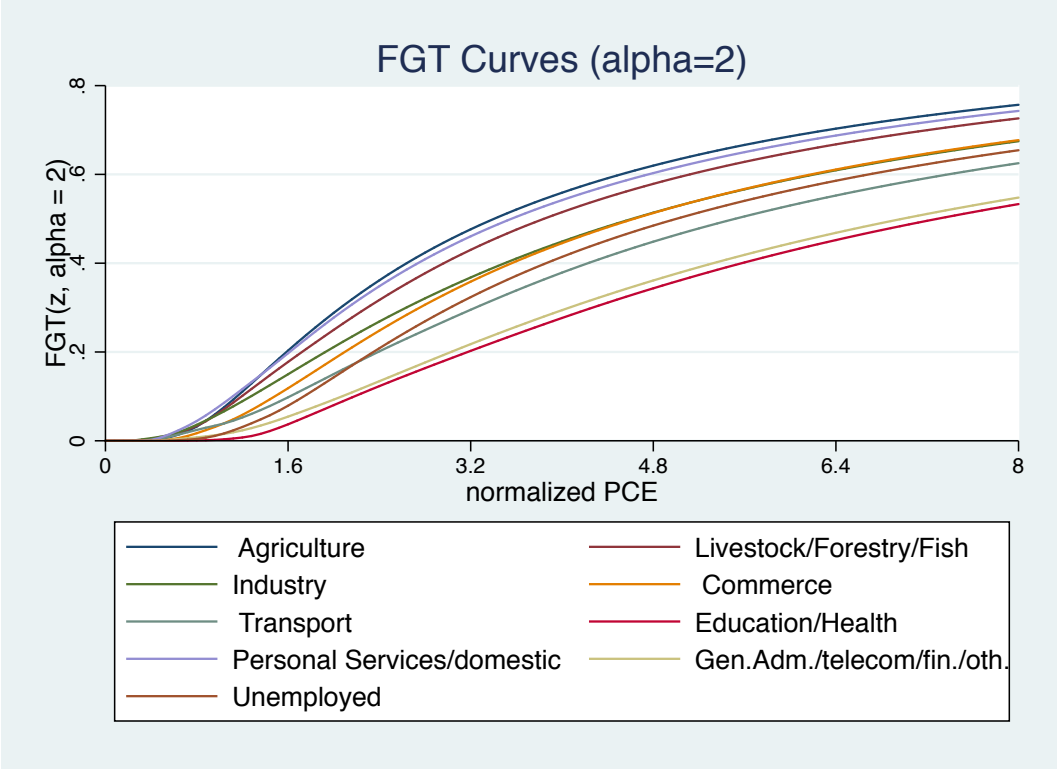


Figure 6 : FGT Curve by Occupational Category when α=2



Figures 7 and 8 present the density curves across the eight regions and the different occupations. Figure 7 shows that Niamey has a very wide distribution; this indicates that it has a higher PCE compared to the other regions. The density curve is skewed to the right, as such the regions of Maradi, Tahoua, Zinder and Tillaberi whose curves are to the far left have very low PCE compared to the other regions. Also the density curve by region shows that most of the regions deviate from the mean. Figure 8 shows the behavior of the slopes for each occupation. Agriculture appears to have the lowest PCE, with its curve shooting high above the other occupations. Education, transport and industry have wide distribution compared to the other occupations that are more clustered to the origin.

Figure 7: Density Curve by Region

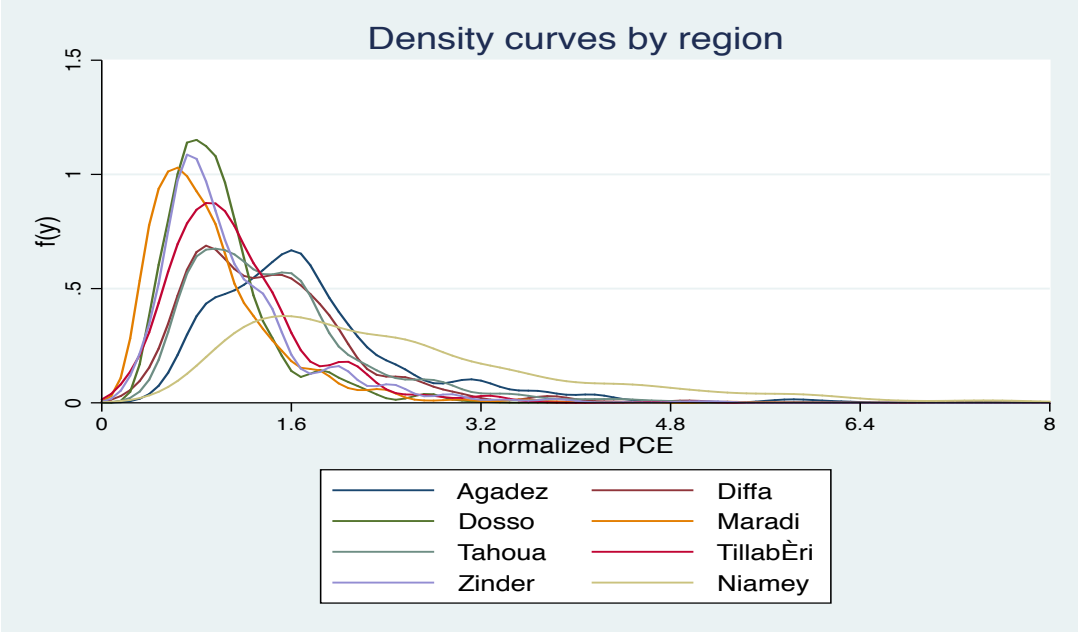
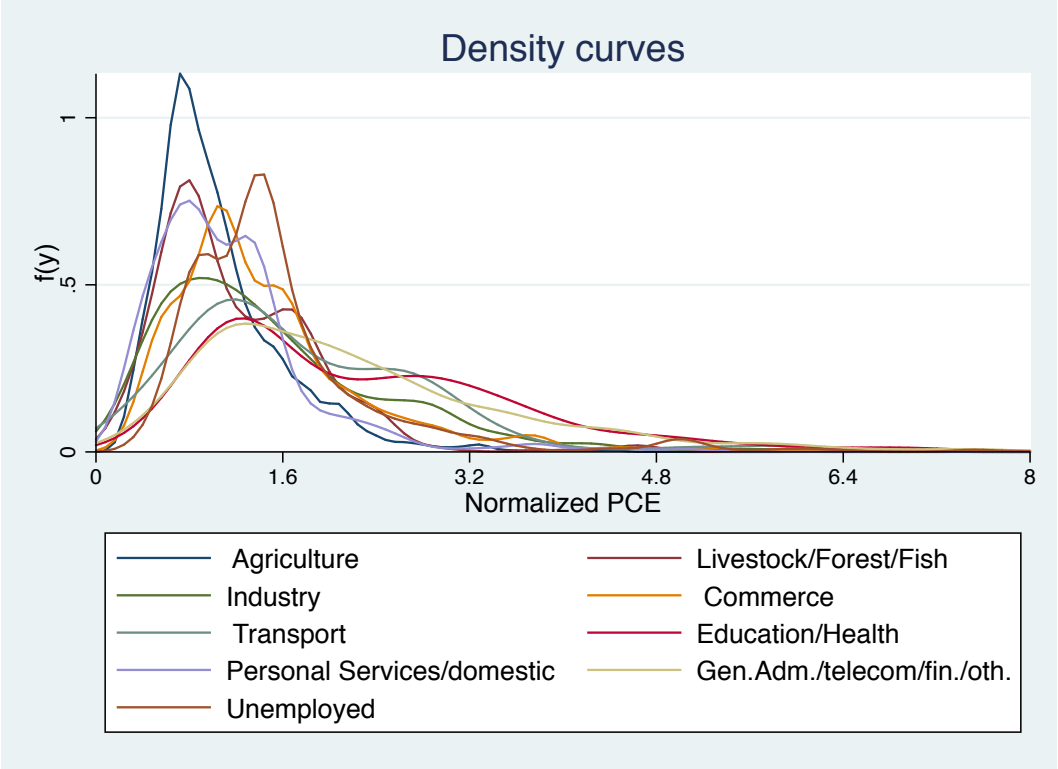


Figure 8: Density Curve by Occupational Category



The estimation of the decomposition framework as specified in equations 2 and 3 has been carried out using the DASP by Duclos and Araar (2009). The main results are presented in tables 5 and 6, which show the sectoral decomposition estimates comparing the initial period as the reference period and using the Shapley value for the FGT indices. The estimates explain how change in poverty between 2011 and 2014 (taking 2014 as the base year) is explained by intrasectoral effects and the intersectoral population shifts by region and occupational categories.

Table 5 shows estimates that explain changes within the regions and changes between inter-regional population shifts. This table reveals that in rural areas, population shift is poverty reducing. This implies that migration would largely help alleviate incidence of poverty. While intrasectoral effects are poverty reducing in only Dosso and Zinder, population shifts alleviated aggregate poverty across most of the regions in Niger. This table also shows that the rural sector, Dosso, Maradi, Tillaberi and Zinder contribute to intrasectoral poverty reduction, while population shifts among rural sector, Dosso, Maradi and Zinder contribute to reducing the depth of poverty. The table shows that changes within the regions and changes between inter-regional population shifts contribute to reducing the severity of poverty. Using the Shapley approach, the results only differ slightly in the magnitude of the gains accrued to each region. This is because the interaction effect is minimal in most cases. The aggregate poverty alleviation across the regions and sectors was dampened only slightly by the negative interaction effect for the head-count index, poverty gap index and the severity index.

Table 5

Sectoral Decomposition by Region

	Head-count index (α=0)					Poverty gap index (α=1)					Severity index (α=2)				
	Initial Period			Shapley		Initial Period			Shapley		Initial Period			Shapley	
	Intrasectoral effects	Intersectoral population shift	Interaction effect	Intrasectoral effects	Intersectoral population shift	Intrasectoral effects	Intersectoral population shift	Interaction effect	Intrasectoral effects	Intersectoral population shift	Intrasectoral effects	Intersectoral population shift	Interaction effect	Intrasectoral effects	Intersectoral population shift
Rural	0.0329	-0.0134	-0.0015	0.0321	-0.0142	-0.0205	-0.018	0.0014	-0.0198	-0.0173	-0.0159	-0.0072	0.0011	-0.0154	-0.0067
Urban	0.0227	0.0021	0.0018	0.0237	0.003	0.004	0.0097	0.0032	0.0056	0.0113	0.0019	0.0026	0.0015	0.0027	0.0034
Agadez	0.012	0.0004	0.0003	0.0122	0.0005	0.0014	0.0048	0.0008	0.0018	0.0052	0.0006	0.0014	0.0003	0.0007	0.0015
Diffa	0.0058	-0.0014	-0.0003	0.0056	-0.0016	0.0003	0.0003	0.0001	0.0003	0.0003	0.0001	0.0001	0.0002	0.0001	0.0001
Dosso	-0.0068	-0.0012	0.0001	-0.0066	-0.0012	-0.0092	-0.0138	0.0021	-0.0082	-0.0128	-0.0059	-0.0055	0.0013	-0.0052	-0.0049
Maradi	0.0008	-0.0046	-0.0001	0.0008	-0.0046	-0.0093	-0.0122	0.0016	-0.0085	-0.0115	-0.0072	-0.0054	0.0012	-0.0066	-0.0048
Tahoua	0.0207	0.0001	0.0001	0.0207	0.0001	0.0024	0.0109	0.0015	0.0031	0.0117	0.0014	0.0036	0.0009	0.0018	0.0041
Tillabery	0.0172	-0.0027	-0.0009	0.0167	-0.0032	-0.0006	0.005	-0.0001	-0.0006	0.0049	-0.001	0.002	-0.0001	-0.0011	0.0019
Zinder	-0.0039	-0.0037	0.0002	-0.0037	-0.0035	-0.0036	-0.0115	0.0008	-0.0032	-0.0111	-0.0027	-0.0045	0.0044	-0.0024	-0.0042
Niamey	0.0097	0.0013	0.0014	0.0104	0.002	0.002	0.0042	0.0021	0.003	0.0053	0.0009	0.001	0.001	0.0014	0.0015

Table 6 shows how much changes within occupations and changes between work-force shifts contribute to reducing the incidence, depth and severity of aggregate poverty in Niger. The table shows that changes within the Commerce and Education/Health employment sectors contribute to reduction in the incidence of poverty; while work-force shifts between these employment sectors: Livestock, Industry, Commerce, Transport and Personal services help in reducing poverty. Table 6 reveals that both changes within employment sectors and occupational migration contribute to reduction in the depth of poverty. Table 6 also confirms that occupational migration as well as changes within specific job roles help reduces the severity of poverty.

Table 6 shows a minimal interaction effect across the different occupations so that similar results were obtained when the Shapley value was used. Overall the results obtained when the initial period is used as an anchor point differ slightly from the results obtained when the Shapley value is adapted. In spite of the similarities in the results obtained using both the initial period as a reference period and using the Shapley value, it is however a useful attempt.

Table 6

Sectoral Decomposition by Employment Sector

	Head-count index (α=0)					Poverty gap index (α=1)					Severity index (α=2)				
	Initial Period			Shapley		Initial Period			Shapley		Initial Period			Shapley	
	Intrasectoral effects	Intersectoral population shift	Interaction effect	Intrasectoral effects	Intersectoral population shift	Intrasectoral effect	Intersectoral population shift	Interaction effect	Intrasectoral effect	Intersectoral population shift	Intrasectoral effect	Intersectoral population shift	Interaction effect	Intrasectoral effects	Intersectoral population shift
Agriculture	0.02729	0.02069	0.00256	0.02857	0.02197	-0.00784	0.01573	-0.00064	-0.00816	0.01541	-0.00712	0.00621	-0.00057	-0.00741	0.00592
Livestock/forest/fish	0.00361	-0.00064	-0.0001	0.00356	-0.00069	-0.00332	-0.00012	0.00002	-0.00331	-0.00011	-0.00222	-0.00005	0.00002	-0.00222	-0.00004
Industry	0.00038	-0.00104	-0.00002	0.00036	-0.00105	-0.00211	-0.00238	0.00033	-0.00195	-0.00222	-0.00149	-0.00097	0.00023	-0.00138	-0.00085
Commerce	-0.00822	-0.00394	0.00124	-0.0076	-0.00332	-0.00934	-0.01198	0.00456	-0.00706	-0.00969	-0.0054	-0.00501	0.00264	-0.00408	-0.00369
Transport	0.00026	-0.00014	-0.00011	0.00025	-0.00015	-0.00036	-0.00021	0.00003	-0.00034	-0.00019	-0.00054	-0.00009	0.00005	-0.00052	-0.00007
Education/health	-0.00049	-0.00022	0.00008	-0.00045	-0.00019	-0.00019	-0.00039	0.0001	-0.00014	-0.00034	-0.00009	-0.0001	0.00005	-0.00007	-0.00008
Person services/domestic	0.003	-0.00539	-0.00098	0.00252	-0.00588	-0.00348	-0.0039	0.00104	-0.00296	-0.00338	-0.00248	-0.00158	0.00074	-0.00211	-0.00121
General admin/telecom/financial/other	0.00212	0.00101	0.00051	0.00238	0.00127	-0.00117	0.00189	-0.00074	-0.00154	0.00151	-0.00069	0.00071	-0.00044	-0.00091	0.00049
Unemployed	0.00544	-0.00173	-0.00067	0.00511	-0.00207	0.00335	0.00065	0.00024	0.00346	0.00077	0.00188	0.00021	0.00013	0.00195	0.00028

Section 4
Conclusion

This study attempts an update on the poverty profile of Niger using the ECVMA 2014 dataset. At the national level, the incidence of poverty is estimated at 48.03 percent, while the depth and severity of poverty are estimated at 14.19 percent and 5.79 percent respectively. These figures suggest a reduction in the incidence of poverty compared to the ECVMA 2011 estimates.

No doubt that poverty thrives more in the rural areas than the urban areas, and this is partly explained by the lack of income generating activities in the rural areas. Therefore, in an attempt to reduce depth and severity of poverty, policies towards alleviating poverty should be better targeted towards rural areas. Given that the incidence, depth and severity of poverty is lower in urban areas, development policies could be geared towards urbanization, structural adjustment plan, industrialization, building of infrastructures, etc. It is worthy of note that investing more in education would largely improve the standard of living in Niger and thus reduce the poverty rate. Hence, policies that will improve literacy rate across all ages should be put in place. For instance, compulsory schooling can be mandated for all children below a certain age bracket, say 18. Also huge investment in agriculture that will ensure high productivity will greatly impact households, since most households are engaged in agricultural activities already. Thus, credit facilities, loans, mechanized farming and related policies should be put in place so as to create a viable economy in Niger. Occupational mobility of labor would play a major role in increasing the purchasing power of households in Niger, thereby improving substantially the living standard of people across regions and employment sectors in Niger.

It is important to note however that the profile of poverty presented in this analysis may not completely assess the impact of public policies. Also the decomposition cannot fully explain if an alternative growth process with better distributional implications would have been more effective in reducing poverty or not. Since this study only updates the existing profile, more research and in-depth analysis should be undertaken to fully address this area of public policies.

It is also worth addressing the role of the informal economy in Niger. Like many developing countries, Niger has a large informal economy. This results in a large part of the country's economy not being accounted for and as a result, it is difficult to accurately correlate the effects of low GDP and poverty rates.

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