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Earnings gaps, Segmentation and Competitiveness in the Ghanaian Labour Market

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Abstract

This paper examines the labour market dynamics of Ghana by specifically assessing: (1) the informal-formal earnings gaps in the country, and (2) whether informal sector employment is due to labour market segmentation (i.e. last resort) or comparative advantage (voluntary). Our findings indicate that there are significant formal/informal earnings gaps in the Ghanaian labour market which is robust to industry and regional differences. Interestingly, we find that, even though males suffer earnings penalties within the informal sector, the penalty is much higher for females. Additionally, the study identifies the existence of two distinct segments within the informal labour market, each characterised by a different earnings profile. Thus, there is both segmentation and competitiveness within the informal labour market. Our results highlight the importance of designing appropriate policies that can tackle both voluntary and involuntary informal sector employment.

JEL classification: J46, O17, C14, N17

Keywords: Informal labour market; finite mixture model; segmentation; comparative advantage; Ghana

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1. Introduction

Ghana has been heralded as one of six African Lions due to its impressive economic growth which peaked at 15% in 2011 (Aryeetey and Baah-Boateng, 2016). Indeed, the country experienced an average growth rate of more than 6% over the past two decades (World Bank, 2020). Yet, the remarkable growth has not resulted in improved labour market outcomes. Thus, the labour market remains weak and unable to create meaningful employment for a large proportion of the population. As a result, around 70% of the population are in some form of informal sector employment with poor earnings, working conditions and the absence of basic safety nets (Sparreboom and Gomis, 2015).

The existing studies on the labour market dynamics in Ghana (Sparreboom and Gomis, 2015; Aryeetey and Baah-Boateng, 2016) implicitly assume homogeneity within the informal sector. However, evidence suggests that the informal sector in developing countries is heterogeneous in nature (Nordman, Rakotomanana and Roubaud, 2016). According to the so-called “segmented” view of the labour market, informal sector workers are made up of disadvantaged workers who are waiting to be employed in the formal sector (Lewis, 1954). For instance, the presence of entry barriers in the formal sector restrict workers from accessing work in the formal sector, causing them to seek employment in the informal sector where wages tend to be lower for equally productive workers. Furthermore, employers also ration formal sector work which in turn leads to a queue for these jobs. In the absence of entry barriers and with the availability of jobs in the formal sector, a worker is likely to choose the sector that offers the highest earnings and non-wage benefits.

Proponents of efficiency wage theory also argue that formal wages are set higher than the clearing wage in the market in order to increase worker productivity and discipline, which creates segments in the labour market (Solow 1979). However, several researchers have argued that it is more efficient for entrepreneurs to operate in the informal sector (Tybout, 2000). This emphasises the voluntary nature of some workers to seek employment in the informal sector due to the cost and benefits of working in the informal sector. In other words, as posited Maloney (2004) informal sector employment has desirable non-wage features that cause workers to voluntarily move from the formal sector to the informal sector. Fields (1990) stresses that the informal sector consists of two sectors: upper and lower tier. Whilst the upper tier comprises of workers who voluntarily move out of formal sector work, the lower tier consist of disadvantaged workers who cannot access formal sector employment, hence settling

for low paying jobs in the informal sector. This in effect highlights the two contrasting points: one view sees informal sector employment as a competitive choice whilst the other argues that informal sector work is due to labour market segmentation.

In this paper, we examine the labour market dynamics of Ghana by specifically assessing: (1) the informal-formal earnings gaps in the country, and (2) whether informal sector employment is due to labour market segmentation (i.e. last resort) or comparative advantage (voluntary). To shed light on this issue, we employ two cross-sectional datasets - GLSS 5 (2005/06) and GLSS 6 (2012/13), which allow us to gain a comprehensive understanding of how the Ghanaian informal sector has fared. As the earnings gaps may differ along the earnings distribution, we utilise the unconditional quantile regression estimator to ascertain the earnings gap between the two sectors. Furthermore, we use a finite mixture model to test the heterogeneous nature of the Ghanaian labour market.

Our results show that there are statistically significant earnings gaps between the two sectors and these gaps persist even when we control for industry and regional differences. The finite mixture modelling analysis reveals that the informal sector is made up of two segments and that these two segments make up a considerable size of the entire labour market. In particular, we find that, not only is the informal sector a place of last resort for some workers who may want to escape unemployment, but for others it offers comparative advantage. Taking into consideration the rapid growth and development of informal sector employment, the process of dynamic change in relation to Ghana's informal sector employment makes it of great interest.

Our findings are of significant relevance to policymakers. More specifically, given the segmented nature of the informal labour market, our results call for labour market policies that can tackle entry barriers and rigidities. With regards to those workers with comparative advantage in the informal sector, policies that can enhance their welfare is paramount.

The paper is structured as follows. Section 2 provides the research background and data being used. Section 3 outlines the empirical methodology while Section 4 presents the results. In Section 5, we offer some discussion of the findings. Section 6 contains concluding remarks and identifies some potential policies.

2. Research background and data

2.1 Background

The structure of the labour market in Ghana is similar to that of many African economies in that it has both formal and informal sectors. In general, due to constraints to capital accumulation, the formal sector has so far been unable to absorb the growing demand for employment (Bhorat and Tarp, 2016). Consequently, the informal sector plays a pivotal role in the Ghanaian economy, with the share of employment in this sector increasing from 83% to 88% over the past 30 years while the share in the formal sector has declined (Aryeetey and Baah-Boateng, 2016). Across the Sub-Saharan Africa region, it is estimated that the informal sector accounts for about 55% of overall economic activity and about 70% of total employment (Aryeetey and Baah-Boateng, 2016). Women account for the bulk of the labour force in the informal sector and poverty remains a significant issue within the Ghanaian informal sector workers (Abraham et al. 2017; Aryeetey and Baah-Boateng, 2016).

The literature on the informalisation of the workforce suggests that, even though the influence of the informal sector should wane as the economy grows and becomes more developed, the informal sector remains a near-permanent feature of the labour markets of countries such as Ghana (La Porta and Shleifer, 2014; Bekkers and Stoffers, 1995; Fapohunda, 2013). Consequently, the overall rate of unemployment provides a less informative picture of the dynamics of the labour market and the extent to which the economy has become more productive (Fields, 2011). This is because new workers tend to find employment in the informal sector, which offers poorly paid and precarious jobs. Associated with this is the issue of discouraged workers who are unemployed but not engaged in job search due to, for example, their distorted perceptions about job availability and the inaccessibility of job centres that can match them to available employment opportunities (Baah-Boateng, 2015). One seemingly stylized fact is that workers in the informal sector, even if they are equally as productive as their counterparts in the formal sector, receive low earnings (Mazumdar, 1983; Heckman and Hotz, 1986).

Due to the dynamic nature of the Ghanaian labour market, it is imperative to ascertain how workers in the informal sector are compensated relative to those in the formal sector. Also, it is crucially important from policy perspective to understand whether the rapid growth in

informal sector employment is driven by labour market segmentation or comparative advantage.

2.2 Data description

The data used for this paper comes from individual responses to both the fifth and sixth rounds of the Ghana Living Standards Surveys (GLSS), which were conducted in 2005/06 and 2012/13 respectively by the Ghana Statistical Service. The Living Standards Surveys is probably the most popular survey and it has become the standard dataset when looking at labour market analysis in developing countries (Nguyen et al., 2013). The GLSS data is therefore of great relevance to this paper due to its multidimensionality, providing rich sources of information on, not only individuals, but also household's labour market conditions. The analysis covers respondents in the population between the ages of 15 to 64 years with positive wages in the non-agricultural sector. We restrict the age range from 15 years due to the need to avoid critical issues such as child labour. In addition, most of the empirical literature on labour market dynamics tends to focus on the working age population. Regarding the wage variable, we convert employee compensation and hours of work (reported on daily, weekly, fortnightly, monthly or yearly basis) into monthly earnings. The final sample consists of 6,610 observations for GLSS5, out of which, 3,490 were in employment and 11,307 observations in the GLSS6, out of which, 6,640 were in employment.

One of the many challenges that arise when defining informality is how agricultural work is treated and also that there is no consistency in the definition followed across countries (Narayanan, 2015). The definition of employment in informal sector stipulated by the ILO allows for some degree of flexibility because, they do not state whether agricultural work should be included or excluded in the estimation of employment in informal sector but then excluding agricultural work from the informal sector estimation is the most preferred option in majority of instances (Wills, 2009). In addition, in the labour market, non-agricultural employment in informal sector competes with employment in formal sector more than it does with agricultural activities in developing countries (Aikaeli and Mkenda, 2014).

The formal and informal sectors make up the active population. The formal sector, in turn, is made up of both the public and private formal sectors. Both private formal and public sectors are put together because the focus of this paper is to identify the heterogeneity in the informal sector and not the formal sector. Thus, in order to avoid loss of information, it is better to

combine both public and private formal sectors. In order to identify employment in the informal sector, it is important to use the right criterion. Indeed, previous studies have shown that results may differ depending on whether a productivity-based, social protection or legalistic definition is used in describing employment in the informal sector (Lehmann, 2015).

The criterion used in this paper to identify employment in the informal sector within the active population is self-employed or employed without a written contract. This is in line with the statistical measurement introduced and approved by the International Labour Organisation. Hence, the paper follows the legal definition by distinguishing workers based on their (formal) contract status. Furthermore, we consider individuals who are involuntarily unemployed and those who voluntarily stay out of the labour market as inactive. Earnings data are collected for self-employed people so excluding them may not give a true representation of employment in informal sector. This is because statistics on employment in informal sector are important in obtaining a clear understanding of the contribution of all workers especially women. The informal sector therefore serves as a fall back for women who are excluded from waged employment and since the dominant part of informal sector is self-employment (Babbitt et al., 2015). It is important to include self-employment in all estimations of formal and informal sector. In addition, in sub-Saharan Africa, self-employment accounts for 53% of non-agricultural employment which means that self-employment constitutes a greater proportion of informal sector employment (non-agriculture) than wage employment (ILO, 2015). Including self-employed is also supported by Gunther and Launov work (2012) and also that of Barlet (2013, p.195-198).

[Figures A1 & A2 here]

Figures A1 and A2 show the kernel densities of monthly log earnings in the formal and informal sectors in 2005/06 and 2012/13, respectively. Monthly earnings, rather than hourly earnings, are used because hours of work in the informal sector are often considered to be constrained. Therefore, monthly earnings provide a better reflection of earning opportunities in the informal sector (Salem and Bensidoun, 2012; Gunther and Launov, 2012). The figures show that there is a considerable difference in mean earnings between the two sectors. Rightward shifts of the formal sector employment curves in both figures indicates that the earnings distribution of formal sector workers is statistically higher. Nonetheless, both Figures A1 and A2 show that the densities of the formal and informal log earnings overlap. This implies that not all informal

sector employment pays less than formal sector jobs. In other words, there are some informal sector workers who earn more than formal sector workers.

Table 1 provides summary statistics of the data we use for the wage and selection equations. The data covers both individual characteristics (gender, age, education, religion and marital status) and household characteristics (household size, number of active household members, number of children in the households). The additional variables used in the selection equation in modelling the probability of entering the labour market are: household size, the number of children under 14 years in the household, the number of infants in the household, the number of elderly people in the household and the number of active members in the household. These factors are theoretically postulated to matter for selection because dependents play an important role in determining the sector choice of a worker, but how they influence that choice is an empirical one (Narayanan, 2015).

On the one hand, a worker with many dependents would favour a job in the formal sector because of the potential benefits that may come with that employment (e.g. job security and social security). This suggests that the higher the number of dependents, the more the likelihood of accepting formal sector jobs over informal sector jobs. On the other hand, a higher number of dependents may incentivise a worker to seek employment in the informal sector as a last resort. This may reduce their search time for employment in the formal sector (Narayanan, 2015). Therefore, these variables are chosen because they may affect sectoral choice, that is, the decision to either participate or not in the labour market, by determining the opportunity cost of not participating in the labour market. However, this should not affect potential earnings of individuals. These additional variables may impact on the labour supply decision without impacting on the wages directly.

Demographic characteristics such as marital status and religion are employed in the wage estimation. Being married can help an individual to secure employment in the formal sector. We account for religion due to the level of religiosity of the country and some denominations are more likely to have easier job prospects in the formal labour market. Human capital theory argues that educational and skills levels are crucial in determining the type of employment one is likely to secure. Individuals with higher level of education and skills are more likely to secure employment in the formal sector followed by the upper tier segment of the informal sector. The lower tier segment of the informal sector tends to accommodate those with lowest education

and skills. The selection equation variables should provide enough exclusion restrictions (Gunther and Launov, 2012; Olsen, 1980).

As can be seen, Table 1 reports the percentage shares for gender, education, religion and marital status and the means for the other remaining variables for both 2005/06 and 2012/13. The information is provided for four groups: the whole population, the active population (formal and informal sectors) and the inactive group.

Table 1 Summary Statistics

	2005/06				2012/13			
	Total*	Inactive	Active		Total*	Inactive	Active	
			Informal	Formal			Informal	Formal
Sample (% share)	100	47.3	32.8	19.9	100	41.2	41.5	17.1
Monthly Earnings	126.8	-	88.7	189.3	623.6	-	498.9	925.6
Variables in Wage Equation								
Age (means years)	31.5	24.7	36.8	38.8	32.2	24.5	37.3	38.3
Gender (% share)								
Male	46.0	43.8	41.8	58.3	42.0	43.9	37.8	63.7
Female	54.0	56.2	58.2	41.7	58.0	56.1	62.2	36.3
Education (% share)								
None (no qualification)	11.3	9.36	17.1	6.29	10.6	7.70	16.4	3.86
Low	54.9	55.7	63.9	38.1	56.3	59.9	64.3	28.5
Medium	21.0	28.4	11.1	19.5	18.3	23.6	12.2	20.2
High	12.7	6.38	7.74	35.9	14.6	8.73	6.97	47.3
Religion (% share)								
Christian	75.6	75.6	72.8	80.0	77.6	76.8	75.2	85.5
Muslim	17.6	17.8	19.8	13.4	19.7	20.5	21.8	12.9
Indigenous	6.77	6.51	7.33	6.44	2.54	2.64	2.87	1.49
Marital Status (% share)								
Married	38.1	17.3	55.0	59.3	40.8	16.2	57.9	58.8
Previously married	9.86	5.77	15.4	10.3	10.0	5.10	15.0	10.0
Single	52.0	76.8	29.4	30.3	49.0	78.6	27.0	31.0
Exclusion variables in selection equation								
Infants in HH	0.24	0.21	0.28	0.22	0.27	0.24	0.31	0.26
Children in HH	1.30	1.38	1.26	1.21	1.27	1.32	1.34	0.98
Elderly people in HH	0.14	0.20	0.10	0.08	0.19	0.26	0.14	0.12
Active HH members	1.59	1.32	1.80	1.86	1.77	1.50	2.00	1.89
HH size	4.83	5.45	4.20	4.39	4.69	5.33	4.36	3.94

Source: GLSS 5 & 6. Author's calculations Notes: Monthly earnings in local currency. Old Ghana cedis was converted to new Ghana cedis at a rate of 10,000:1 in 2007, therefore the figure in the column for 2005/06 reflects the change. *Total refers to individuals 15 to 64
Education: We define low education as primary & Mid/JHS; medium education as secondary.
Vocational/technical, post-secondary and tertiary as high education. The residual group none has no education participants.

Employment in the formal sector accounted for the smallest share of total employment in Ghana across the two periods. The analysis reveals that, across both years, majority of workers

in the formal sector are males (58.3% in 2005/06 and 63.7% in 2012/13) whilst the reverse is the case in the informal sector and among the inactive population. With regard to age, the analysis shows that the average age of formal sector workers is the highest, which is 38.8 years in 2005/06 and 38.3 years in 2012/13 whilst informal sector workers are slightly younger at 36.8 years and 37.3 years in 2005/06 and 2012/13 respectively. The data further shows that the inactive population is the youngest in both periods (24.7 years in 2005/06 and 24.5 years in 2012/13).

In terms of religious background, Christian workers are the majority, followed by Muslims workers and then indigenous workers in both formal and informal sector and among the inactive population in both years. In terms of dependents, in both 2005/06 and 2012/13, formal sector workers have fewer dependents (i.e. infants, children and elderly) than their counterparts in the informal sector. In comparing with the active population, on average, the inactive population comes from larger households. These significant variations across the different sectors and among the inactive population imply that there may be selection issues.

The distribution of marital status shows that there is a higher proportion of married people in the formal sector than in the informal sector in both years; among the inactive population, there are more single individuals. Finally, individuals with a high level of education tend to be employed in the formal sector (35.9 percent in 2005/06 and 47.3 percent in 2012/13). Conversely, the informal sector workers tend to be in low education category (63.9 percent and 64.3 percent in 2005/06 and 2012/13, respectively).

3. Empirical methods

Our initial objective is to ascertain the size of the formal-informal earnings gaps. To this end, we use a quantile regression model as the earnings gaps may differ along the earnings distribution. We use log monthly wages as the dependent variable. The explanatory variables are education, age, age squared, marital status and gender. We include four industry dummies to capture sector specificities in relation to earnings. Also, we account for regional differences as local economic conditions may vary.

Our second main objective is to check the heterogeneity of the informal sector, as there may a number of segments within this sector. However, since the data only provides information on people in the formal and informal sectors, the number of segments within the informal sector are unobservable. Therefore, in order to determine the number of segments in the informal

sector, the distribution of observed wages is employed. The main reason why the observed wage function is used is that different segments exist in the informal sector and each of these segments would have their own unique wage function. For this purpose, this paper follows the specification model of Gunther and Launov (2012).

The entire labour market Y is made up of J segments Y_j , such that, $Y = \bigcup_{j=1}^J Y_j$. The assumption is that, within each segment, there would be a unique wage function:

$$\ln Y_{ij} = x'_i \beta_j + u_{ij}, \quad i \in Y_j, \quad (1)$$

where Y_{ij} are the earnings of an individual i in segment j . There is no cross-segment correlation so the errors in each segment are independent of each other. However, the earning function and returns (β_j) to individual characteristics varies from segment to segment. Thus, the sample may suffer from selection bias because the distribution of observed earnings is influenced by the decision of the individuals to either enter or not enter the labour force (Heckman 1979). In particular, individuals are faced with a binary decision based on the utility of the individual (Narayanan, 2015). Therefore, if the utility from working is less than that of not working, the individual would stay out of the labour force. Since utilities are not observed and the earnings are only observed for individuals in the labour force (employment), estimating the earnings equation would lead to biased estimates.

In order to take into account this selection bias, we assume that individual's decision to work or not is a function of their personal characteristics (Z_i):

$$y_{is} = z'_i \gamma + u_{is}, \quad u_{is} \sim N(0,1), \quad (2)$$

such that earning y_{is} is observed only if the outcome of the selection Eq. (2) is positive. If the errors from the wage equation in Eq. (1) and the selection equation in Eq. (2) are correlated, the estimation of (β_j) will be biased. Under the assumption that the error terms in equations (1) and (2) follow a bivariate normal distribution, their correlation coefficient equal to ρ_j . The distribution of observed wages in the j^{th} segment of the labour market takes the form:

$$f(y_{ij} | y_{ij} > 0) = \frac{1}{\sigma_j} \varphi \left(\frac{\ln y_{ij} - x'_i \beta_j}{\sigma_j \phi(z'_i \gamma)} \right) \Phi \left(\frac{z'_i \gamma + (\rho_j / \sigma_j) [\ln y_{ij} - x'_i \beta_j]}{\sqrt{1 - \rho_j^2}} \right) \quad (3)$$

Here $\varphi(.)$ represents the distribution function and $\Phi(.)$ denotes the cumulative function of the normal distribution.

The conditional distribution of wages across the entire labour market can be derived from the conditional distributions of observed wages in each segment, using the size of each segment as weights. However, as affiliation to segments is unobserved, the probability that individual i belongs to segment j is estimated such that each segment is composed of homogenous workers, from the point of view of the relationship that links their wages to their individual characteristics. This probability can be written as $P(i \in Y_j) = \pi_j$. Using the notation $\theta_j = (\beta_j, \sigma_j, \rho_j)$, the distribution of observed wages in the entire labour market is written as:

$$f(y_i) = \sum_{j=1}^j \pi_j f(y_i | y_{is} > 0, \theta_j) \quad (4)$$

The model above is finite mixture model with sample selection. Its advantage over a simple finite mixture model is that sample selection is considered when estimating the model, which gives consistent estimation of segment specific returns to individual characteristics. In addition to the finite mixture estimation, the model also allows us to explore whether the distribution of individuals across sectors is due to labour market segmentation or comparative advantage. In order to shed light on this issue, the assumption is made that workers are not only earning maximisers, but that they know their wage function (i.e. they know their earnings potential given their own personal characteristics for each segment of the labour market). In this situation, comparative theory would imply that workers, given their own personal characteristics, would choose the segment that offers them the highest returns. In a competitive labour market, the hypothetical distribution of workers across sectors would be written as:

$$P(i \in Y_j) = P(E[\ln y_{ij} | y_{is} > 0; x_i] = \max_{l, l \in [1, j]} \{E[\ln y_{il} | y_{is} > 0; z_i]\}) \quad (5)$$

The above distribution is based on the individual characteristics and returns to these characteristics in each of the segments in the labour market, assuming that no entry barrier exists within sectors. Thus, individuals choose the segments where their expected earnings would be the highest. The actual distribution of individuals across sectors is given by Eq. (4). If the hypothetical distribution given by Eq. (5) and the actual distribution Eq. (4) are equal, then it is easy to infer that there is a perfect sectoral mobility. When both distributions are the same, the market can be referred to be competitive in nature. However, if both actual

distribution and hypothetical distributions are not the same across sectors, this means that some sort of entry barrier exist which is preventing certain individuals from been in the sector that offers them the highest wage. When both distributions are not the same, the labour market can be referred to be segmented in nature.

In order to estimate the model, we proceed in two stages in line with Heckman's (1979) approach. From selection Eq. (2), we estimate, in the first step, γ by running a probit for the employed and non-employed. Subsequent to this, the parameters obtained from the first step are then used as consistent estimates to predict Eq. (4) for all employed individuals. As stated previously, the data shows whether an individual is in the formal or informal sector. It is however unknown which segment within the heterogeneous informal sector an individual works in. The set of earnings outcomes in the formal sector is represented by Y_F whilst the number of formal sector observations is denoted by N_F . The log-likelihood to be maximized can be written as:

$$\ln L = \sum_{i \in Y_F} \ln f(\theta_F, \rho | y_{iF}, y_{is}, > 0; x_i z' \hat{\gamma}) + N_F \ln \pi_F + \sum_{i \in Y_F} \ln \left(\sum_{j=1}^{J-1} f(\theta_{1j}, \rho | y_{i1}, > 0; x_i z' \hat{\gamma}) \pi_{1j} \right) \quad (6)$$

where π_{1j} is the probability of being in the j^{th} segment of the informal sector, π_F is the probability of being in the formal sector and $f(\cdot)$ is the component density function in Eq. (3) with the j -specific parameter vector θ_{1j} . As the variance-covariance matrix from the second stage is biased, Murphy and Topel's (1985) correction method is employed.

Table 2 Model Selection

	2005/06			2012/13		
	Homogenous	2 segments	3 segments	Homogenous	2 segments	3 segments
CAIC	6231	6229	6307	13717	13687	13751
BIC	6220	6207	6274	13706	13665	13718

CAIC: Consistent Akaike Information Criterion; BIC: Bayesian Information Criterion.

The first stage in the implementation of finite mixture model is to determine the composition of the labour market (Deguilhem et al., 2019). Information criteria has been argued to be more appropriate in determining the number of segments which is based on the penalised form of the likelihood (Mclachlan and Peel, 2004; Sarstedt et al., 2011). We employ both the Bayesian

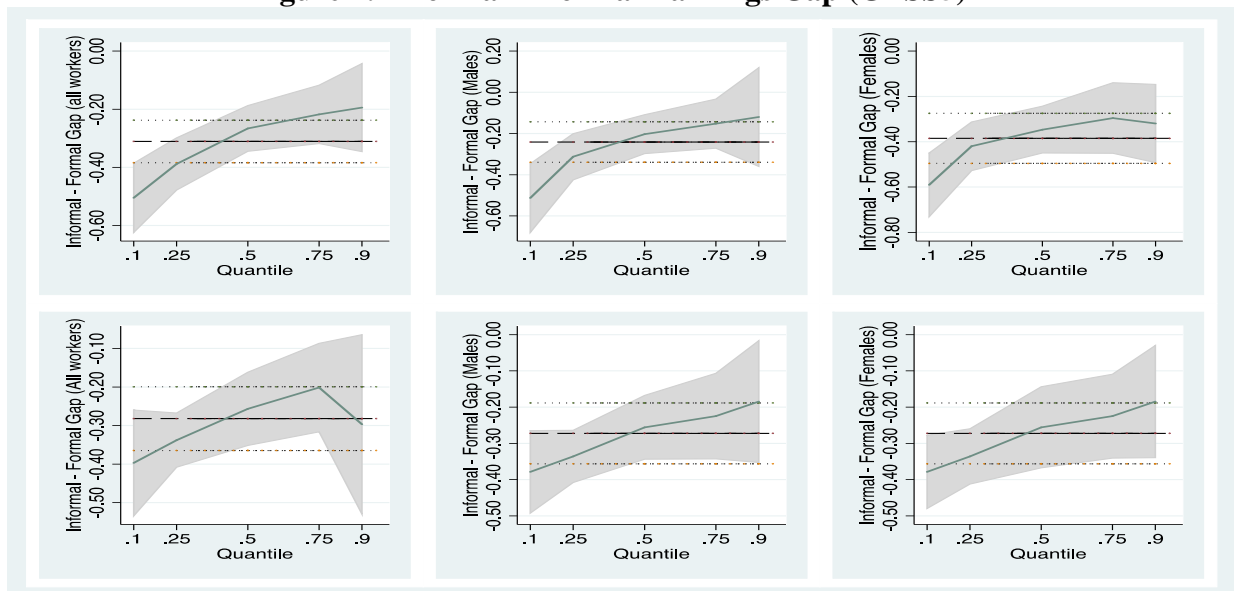
Information Criterion (BIC) and the Consistent Akaike Information Criterion (CAIC) to determine the number of segments in the informal sector.

Table 2 shows that the breakdown of employment in the informal sector and it seems that two segments fit the data better than one segment based on both information criteria. This suggests that there are two distinct segments within the informal sector: an upper tier and a lower tier. Capturing this heterogeneity is critically important for policy reasons, as alluded to earlier.

4. Estimation results

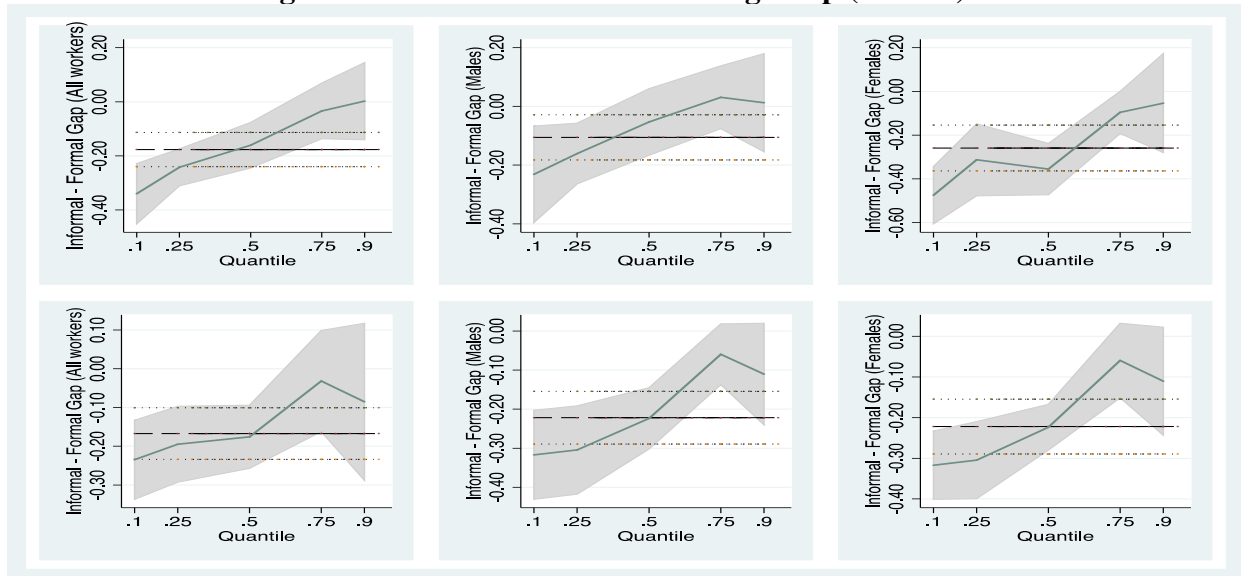
Figures 1 and 2 show that there are clear earnings gaps in both periods. In particular, for all quantiles, there is a statistically significant gap in GLSS5, ranging from -50% gap for the lowest quantile and decreasing to -19 for the highest quantile. Once industry and regional differences are taken into account, the gap narrows to between -40% and -30%. This indicates that incorporating regional and industry specificities is important. For GLSS6, the gap reduces to between -23% and -9% when industry and regional differences are accounted for. Interestingly, in both periods, it seems that there are significant differences between males and females. In particular, conditional on education, marital status, age and age squared, both males and females suffer earnings penalties if they are employed in the informal sector. However, the penalty is much higher for females.

Figure 1: Informal – Formal Earnings Gap (GLSS5)



Notes: Estimated earnings gaps based on quantile regression models. The reference category for earnings is formal sector workers. The bottom row controls for industry and regional differences.

Figure 2: Informal – Formal Earnings Gap (GLSS6)



Notes: Estimated earnings gaps based on quantile regression models. The reference category for earnings is formal sector workers. The bottom row controls for industry and regional differences.

Table 3 shows the results of the estimations for GLSS5 for the wage and selection equations. The first thing to note from the estimation is the significance of the correlation coefficient (ρ) for GLSS 5, which indicates that accounting for sample selection is paramount. Secondly, the estimations also reveal that, in the two-segment model for GLSS 5, both segments of the informal sector employment are sizeable. In particular, Informal-1 covers 69 percent of total informal sector employment while Informal-2 covers the rest. However, in the entire labour market of Ghana, Informal-1 accounts for 43.1 percent whilst Informal-2 represents 19 percent. This highlights the fact that Informal-1 has a higher proportion of individuals employed in the entire labour market. Additionally, the expected log earnings in the formal sector are significantly higher than the expected log earnings in the two segments of the informal sector. The estimations also show that whilst Informal-1 has a higher proportion of workers than Informal-2, the expected log earnings in Informal-2 are much higher than the expected log earnings in Informal-1 which shows that Informal -1 is the lower paid amongst the two segments of the informal sector.

Thirdly, significant differences exist in the wage equations across the different segments of the labour market. Gender significantly affects earnings of workers in all segments in the labour market which is highlighted by the fact that the male-female earnings gap within the formal sector is smaller than that of the gap within each of the informal segment. In other words, males in the formal sector earn 25.1 percent more than females in the same sector, in informal-1 males earn 50.3 percent more in wages than females and in informal-2 males earn 51.5 percent more

than females. The results indicate that female workers in informal sector employment tend to face much more discrimination than the female workers in the formal sector. Whilst there may be other factors that contribute to the wage discrimination in the informal sector, the possible reasons could be attributed to the existence of anti-wage discrimination laws in the formal sector which do not exist in the informal sector. Also, women with better education and experience may self-select themselves into the formal sector. The age variable is also a very powerful predictor of earnings of workers across all segments but then, as people get older the effect of age on earnings is lessened.

Table 3 Finite Mixture Model with a two segment Informal labour Market (GLSS5)

Variables	Formal		Variables	Informal-1		Variables	Informal-2	
	Coeff.	Standard error		Coeff.	Standard error		Coeff.	Standard error
Intercept***	11.295	0.3776	Intercept***	11.680	0.3577	Intercept***	9.9042	0.9273
Gender***	0.2518	0.5459	Gender***	0.5037	0.0602	Gender***	0.5156	0.1591
Age***	0.0822	0.0187	Age**	0.0458	0.0192	Age***	0.1330	0.0501
Age ² /100***	-0.0826	0.0225	Age ² /100**	-0.0517	0.0251	Age ² /100***	-0.166	0.0632
Education/Low	0.1822	0.1142	Education/Low	0.1108	0.0895	Education/Low**	0.5205	0.2349
Education/Medium***	0.5324	0.1227	Educ/Medium***	0.2852	0.1103	Education/Medium*	0.5097	0.2962
Education/High***	0.9692	0.1152	Education/High***	0.4534	0.1410	Education/High***	0.9088	0.3531
Christian	-0.1222	0.1031	Christian	-0.0664	0.1047	Christian	-0.143	0.2835
Muslim**	-0.1222	0.1225	Muslim	-0.0749	0.1180	Muslim	-0.364	0.3228
Couple	0.0799	0.0685	Couple*	0.1256	0.0699	Couple	0.2451	0.1965
Previously married	-0.1727	0.1034	Previously married	0.0549	0.0961	Previously married	0.2909	0.2651
ρ ***	0.1386	0.0421						
π_F	0.3782		π_{I1}	0.4318		π_F	0.1900	
Expected log-wage:	13.7201		Expected log-wage:	13.058		Expected log-wage:	13.192	8
Selection Equation								
Intercept***	0.3236	0.0437				Censored observation:	3,120	
Gender*	0.0631	0.0353				Uncensored observation:	3,490	
Infants***	0.5031	0.0388						
Children***	0.4779	0.0208						
Elderly*	0.0800	0.0479						
HH size***	-0.5295	0.0141						
Active members***	0.9457	0.0253						

* significant at 10%; ** significant at 5%; ***significant at 1%; Dependent variable is monthly wage. Educ which is education has been shortened due to space.

In terms of marital status, being married in informal-1 shows that one is more likely to earn 12.5 percent more in wages than not being married whilst being married in the formal sector and informal-2 has no impact on the earnings of the workers. In addition, whilst being a Christian relative to the base category has no impact on the earnings of workers across all segments, being a Muslim relative to the base category is found to negatively and significantly impact on the earnings of workers in the formal sector.

Whilst all three levels of education are important in terms of having a positive and significant impact on one's earnings in informal-2, only medium and high educations relative to the base category have a positive and significant impact on one's earnings in both formal sector and informal-1. This is expected because education is important and valued across the board, which means that individuals with education relative to those without education tend to maximize their wage gain with their educational background. Even though jobs in the formal sector are shrinking and the informal sector is open, education is still important. In addition, a worker with a high level of education earns much more monthly wage in the formal sector in both segments of the informal sector. Furthermore, a worker with medium education relative to the base category in the formal sector earns about 53.2 percent more wages than a worker with no education. The effects for the two informal sectors (informal-1 and informal-2) are, in workers 28.5 percent and 50.9 percent, respectively. This can be explained by the fact that, in Ghana, access to jobs is partly based on an individual's level of education (Kingdon and Soderbom, 2008). In particular, those with a high level of education earn much more wages than a worker without which is partly due to the possibility that given the poor labour standards, educated individuals tend to have a higher bargaining power coupled with the fact that higher levels of education can facilitate progression.

From the analysis, it is evident that informal-2 is more dynamic whilst informal-1 is not so much dynamic. In addition, whilst age and education are highly important in informal-2, in informal-1 anyone could get a job, making age and education a bit more redundant in that segment. Moreover, in informal-2, workers earn a wage whilst, in the formal sector, workers earn a salary making the formal sector more secured than the informal sector.

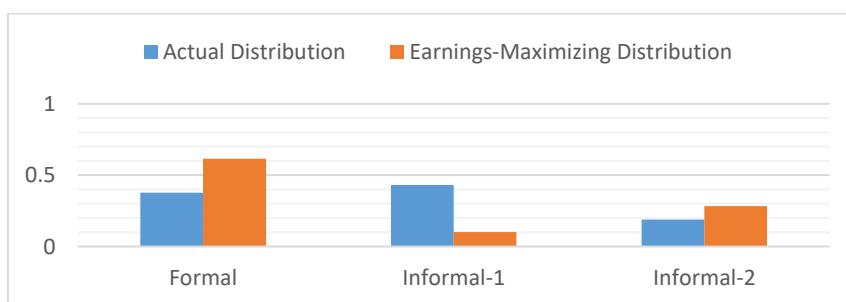
Estimations from Table 3 also highlight a distinct pattern of returns to individual characteristics. Thus, employment in the informal sector cannot be considered homogenous in nature. However, the existence of different patterns of returns to individual characteristics alone is not sufficient to argue that the labour market is segmented. According to Dickens and Lang (1995), a labour market with two different sectors and wage equations does not necessarily imply that it is segmented as long as individuals can freely move between sectors. In order to determine whether the labour market is segmented or competitive in nature, the next section would examine whether entry barriers exist across the three segments.

A segmented or competitive labour market?

When sectors in a labour market have no entry barriers, an individual would be free to move into the sector where their expected earnings, given their personal characteristics, are the highest, which would lead to a distribution of individuals across sectors, as shown in Eq. (5). This hypothetical distribution which would be known as earnings-maximizing distribution should be the same as the actual distribution of individuals across sectors, as formulated in Eq. (4) if no entry barriers exist. However, if entry barriers exist, individuals would not be able to access work in sectors where their expected earnings are highest, which means they would be underrepresented in sectors where their earnings are highest. Therefore, to see whether the Ghanaian labour market is segmented or competitive, the distribution of probabilities from the mixture model with two segments $\{\hat{\pi}_j\}_{j=1}^J$ which is the actual distribution in Eq. (4) is compared with the hypothetical distribution, which is known as the earnings maximization distribution $\{\tilde{\pi}_j\}_{j=1}^J$. The earning maximizing distribution which is the latter one is obtained by computing the proportion of individuals in each segment for whom, given their personal characteristics, their earnings would be the highest in that segment.

The two estimated distributions are shown in Figure 3 (GLSS 5). It shows that most individuals, based on their personal characteristics, would prefer to be employed in the formal sector if entry barriers did not exist. In terms of the two segments in the informal sector, fewer workers would want to work in Informal-1 (the lower tier) than currently employed. The reverse is the case for Informal-2. This suggests that Informal-1 is over-represented while Informal -2 is under-represented. Thus, there are entry barriers, preventing free sectoral mobility.

Figure 3 Distribution of individuals across sectors in GLSS5



Source: The Ghana Living Standard Survey 5 (GLSS 5)

The actual distribution $\{\hat{\pi}_j\}_{j=1}^J$, earnings maximizing distribution $\{\tilde{\pi}_j\}_{j=1}^J$ and their ratios $\hat{\pi}_j/\tilde{\pi}_j$ are presented in Table 4. Table 4 highlights that the ratios for the formal sector and informal-2 (higher-tier) are less than one whilst that of informal-1 is more than one. This means that, while

both formal sector and informal -2 are under-represented, informal -1 is over-represented which in other words means, there are more involuntary workers in informal-1. In addition to the above, Table 5 also identifies voluntary and involuntary employment.

Table 4 GLSS5 Distribution of Individuals across sectors

	Formal	Informal-1	Informal-2
	Value	Value	Value
$\hat{\pi}_j$	0.3782	0.4318	0.1900
$\tilde{\pi}_j$	0.6146	0.1003	0.2851
$\hat{\pi}_j/\tilde{\pi}_j$	0.6153	4.3050	0.6664

Source: Authors calculation (GLSS5)

Substantial number of individuals in the formal sector (74.8%) are working there voluntarily as against 10.04 percent in informal -1 voluntarily and 8.4 percent in informal -2. This shows that 81.6 percent of workers in the informal sector are there involuntarily. Furthermore, differences also exist in the distribution of employment amongst the two different informal sector segments. Table 5 shows that 51.4 percent of informal -1 workers will prefer to be in the formal sector whilst 34.1 percent will prefer to be in informal -2 (higher-tier). This means 85.5 percent of workers in informal -1 will prefer jobs in either the formal and informal -2 whilst only 14.5 percent of workers in that segment (informal-1) are there voluntarily. Additionally, in informal-2 (higher-tier) 14.8 percent and 57.8 percent of workers there would prefer to be in informal-1 (lower-tier) and formal sector respectively, which then means 72.6 percent of workers in informal-2, are there involuntarily leaving 27.4 percent workers there voluntarily employed.

Table 5 GLSS5 Distribution of workers across segments (earnings maximized)

	Formal	Informal-1	Informal-2
Better paid segment	% of formal workers	% of informal workers	% of informal workers
Formal	74.8	51.4	57.8
Informal-1	2.6	14.5	14.8
Informal-2	22.6	34.1	27.4
Total	100	100	100

Source: Authors calculation (GLSS5)

The formal sector also has 25.2 percent of workers who are employed there involuntarily with 2.6 percent and 22.6 percent individuals preferring to work in informal-1 and informal-2 respectively. The GLSS 5 data which was conducted in 2005/06 shows that the Ghanaian labour market is segmented with vast majority of informal workers, who could be better off in the formal sector, prevented from entry due to entry barriers. Therefore, in order to avoid unemployment, the informal sector serves as employment of last resort for workers who cannot

access employment in the formal sector. Additionally, there are also individuals in the informal sector who are there voluntarily due to comparative advantage.

How has the labour market changed over time?

Considering the rapid rise in informal sector employment rates from 2005/06 to 2012/13 (see Table 1), this subsection empirically investigates whether the Ghanaian labour market has changed since 2005/06, by employing GLSS6 data.

Table 6 shows that the correlation coefficient (ρ) is significant which is the same as that of GLSS 5 in Table 3 which means sample selection must be accounted for when estimating the mixture model. As outlined previously, the number of segments is to be determined before carrying out the finite mixture model estimation. The results of the wage and selection equations are shown in Table 6. Similar to that of the 2006 labour market (GLSS5), the formal sector pays more relative to the other two segments in the informal sector. Informal-1 has more workers than informal-2 and formal sector. In addition, amongst the two segments in the informal sector, informal-2 pays more than informal-1. Informal-1 and informal-2 represent, respectively, 64 percent and 36 percent of informal sector employment. Considering the whole labour market, Informal-1 represents 44.9 percent and while Informal-2 accounts for 25.8 percent.

It is important to note that, whilst gender significantly impacted on the earnings of all workers in the formal sector and in both informal -1 and informal -2 in 2005/06, in 2012/13, it only impacts on earnings formal sector and informal-1 significantly. It seems that gender plays no role in the earnings of workers in informal -2. Furthermore, the male-female gap in 2012/13 seems to be increasing in both formal sector and informal-1. However, whilst the increase in the formal sector is not that significant, the effect is significant in informal-1. Whilst in 2005/06, workers with medium education were likely to earn 53 percent more in salary in the formal sector, in 2012/13, this figure was 47 percent, which is a decline. However, in informal-2 in 2012/13, the figure has increased from 50 percent to 73 percent.

Marital status of workers seems to be of greater importance in 2012/13. This is because, whilst being married or not played no role on a worker's earnings in 2005/06, in 2012/13, it records a positive and significance contribution of 20 percent more in wages. In addition, in 2005/06 and 2012/13, being married was not only positive but also significant in informal-1 while it played no role in informal-2.

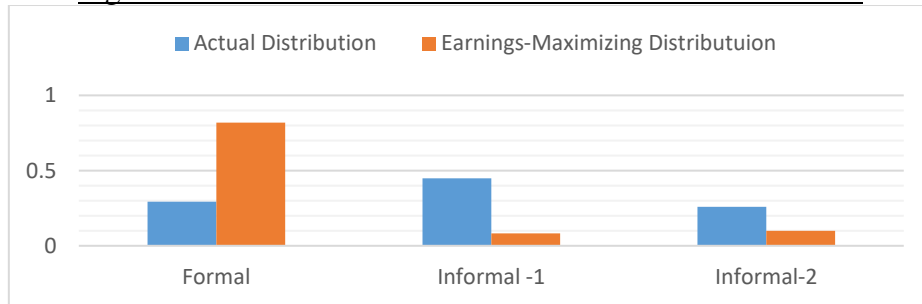
Table 6 Finite Mixture Model with a two segment Informal labour Market (GLSS6)

Variables	Formal		Variables	Informal-1		Variables	Informal-2	
	Coeff.	Standard error		Coeff.	Standard error		Coeff.	Standard error
Intercept***	3.0404	0.3691	Intercept***	3.3390	0.3240	Intercept***	2.9594	0.6760
Gender***	0.2896	0.0470	Gender ***	0.8517	0.6132	Gender	0.0563	0.1386
Age***	0.0933	0.0161	Age***	0.0795	0.0160	Age**	0.0910	0.0321
Age ² /100***	-0.0977	0.0190	Age ² /100***	-0.0959	0.0196	Age ² /100**	-0.0967	0.0391
Education/Low**	0.2899	0.1174	Education/Low	-0.0871	0.0827	Educatio/Low***	0.7033	0.1909
Education/Medium***	0.4733	0.1225	Education/Medium	0.0478	0.1041	Educ/Medium***	0.7328	0.2202
Education/High***	1.1362	0.1161	Education/High***	0.5149	0.1184	Educ/High***	0.6566	0.2202
Christian	0.0113	0.1751	Christian	0.0366	0.1350	Christian	0.2706	0.3000
Muslim	-0.0048	0.1830	Muslim	-0.0547	0.1408	Muslim	0.3466	0.3216
Couple***	0.2008	0.0490	Couple****	0.1758	0.0615	Couple	0.2072	0.1263
Previously married	-0.0056	0.0931	Previ married ***	0.2378	0.0912	Previ married	0.0389	0.1869
ρ ***	0.1299	0.0314						
π_F	0.2923		π_{I1}	0.4492		π_F	0.2584	
Expected log-wage:	6.1297		Expected log-wage:	5.3483		Expected log-wage:	5.8637	
Selection Equation								
Intercept***	0.5330	0.0336	Censored observation: 4,664 Uncensored observation: 6,640					
Gender*	0.0491	0.0278						
Infants***	0.6462	0.0295						
Children***	0.6365	0.0171						
Elderly***	0.3083	0.0324						
HH size***	-0.6654	0.0126						
Active members***	1.0041	0.2011						

* significant at 10%; ** significant at 5%; ***significant at 1%; Dependent variable is monthly wage. Previ is previously it has been shortened due to space. Same as Educ, which is education

Figure 4 captures the two estimated distributions, whilst Table 7 shows the estimated probabilities (actual and earnings-maximizing distributions). Overall, the distributions show a different trend relative to the 2005/06 labour market. The most important finding is that, in 2012/13 both informal -1 and informal -2 are above 1 which means that entry barriers still exist and that both segments in the informal sector are over-represented. This is different from 2005/06 where only informal-1 was overrepresented.

Figure 4: Distribution of individuals across sectors in GLSS6



Source: The Ghana Living Standard Survey 6 (GLSS 6)

Table 7 GLSS 6 Distribution of Individuals across sectors

	Formal	Informal-1	Informal-2
	Value	Value	Value
$\hat{\pi}_j$	0.2923	0.4492	0.2584
$\tilde{\pi}_j$	0.8191	0.0819	0.0989
$\hat{\pi}_j/\tilde{\pi}_j$	0.3568	5.4847	2.6127

Source: Authors calculation (GLSS6)

Table 8 shows that, in 2012/13, a larger proportion of workers in the formal sector (89.6%) are there voluntarily. The table further shows that there has been an increase in the number of workers in informal-1 who want to be there voluntarily in 2012/13 relative to 2005/06. In informal-2, there has been a decline in the number who are there voluntarily. Difference also exists across the two segments of the informal sector. In terms of informal-1, there are 73.5 percent of workers in that segment who prefer to work in the formal sector, which is a significant increase from that of 2005/06. Also, 9.2 percent of informal-1 workers prefer work in informal-2 which is a significant decline from that of 2005/06. Additionally, in informal-2, 87.7 percent of workers prefer to be employed in the formal sector whilst 0.6 percent prefer to be in informal-2. This is significantly different from the rate of workers in informal-2 who prefer to work in the informal-1 in 2005/06.

Table 8 GLSS 6 Distribution of workers across segments (earnings maximized)

	Formal	Informal-1	Informal-2
Better paid segment	% of formal workers	% of informal workers	% of informal workers
Formal	89.60	73.50	87.80
Informal-1	1.10	17.20	0.60
Informal-2	9.30	9.30	11.60
Total	100	100	100

Source: Authors calculation (GLSS6)

The results suggest that, whilst the Ghanaian labour market remains segmented in 2012/13, the rate of workers who prefer to work in the three sectors (formal sector, informal-1 and informal-2) has changed significantly from that of 2005/06. Whilst the differences are highly concentrated around informal-1 and informal-2, majority of workers who prefer work in any of the three segments opt for work in the formal sector, which may not only be due to expected wages in that sector but also due to the benefits that the sector can offer. The high entry barriers in the formal sector means that individuals who do not possess the high requirement needed to work in the sector are left with no choice but to seek employment in the other segments of the informal sector. This coupled with the shrinking nature of the formal sector has led to an increase in the earnings of workers in the formal sector who possess the high entry requirement in 2012/13 compared to 2005/06.

Furthermore, analysing both datasets has shown that informal-1, in both 2005/06 and 2012/13, seem to be a segment of the informal sector where anyone in search of work can access work due to the low requirements and earnings that workers in there can attain. This indicates that, whilst informal-1 in both 2005/06 and 2012/13 is made up of anyone in search of work, informal-2 seems to be made up of more entrepreneurs, which may explain the high earnings of this sector compared to informal-1.

Taken together, our results indicate that there are significant formal/informal earnings gaps in the Ghanaian labour market which is robust to industry and regional differences. Within the informal labour market, we find that there is a combination of segmentation and competitiveness. Our results clearly show that the formal sector is superior to both segments of the informal sector, suggesting that it offers better earnings and other non-wage benefits to workers. However, it has high entry barriers, which restrict those who do not possess the high requirement needed to work in the formal sector to seek employment in the more accessible segments of the informal sector. Examining the two segments of the informal sector closely, we find that workers in informal-1 earn less than those in informal-2, suggesting that informal-2 is much more dynamic than informal-1. Thus, informal-1 tends to absorb anyone seeking employment while informal-2 seems to consist of economic agents such as entrepreneurs.

5. Discussion

The key objectives of this study were, firstly, to examine the earnings gaps between the formal and informal sectors, and secondly, to ascertain whether the informal sector is heterogenous in nature. Our findings provide evidence showing that there are significant earnings gaps across the two sectors of the labour market. Interestingly, in both periods, it seems that there are significant differences between males and females. In particular, even though males suffer earnings penalties if they are employed in the informal sector, the penalty is much higher for females. This finding calls for the adoption and enforcement of anti-discrimination labour laws.

Moreover, we find that there are both segmentation and competitiveness within the informal sector. This is consistent with the findings of Gunther and Launov (2012) who studied the labour market dynamics of the Ivory Coast. The main insight emanating from our study is that the Ghanaian informal sector consists of two segments – an upper tier and a lower tier. The upper tier (informal-2) offers better earning opportunities which may imply that the workers in this sector are relatively more dynamic than those in the lower tier (informal-1). Therefore, our results call for the design of appropriate and differentiated policies that can tackle the

peculiarities of the labour market. For instance, those workers who are involuntarily employed in the informal sector require policies that can tackle entry barriers and rigidities so that efficiency losses and distortions can be prevented. With regards to those workers who have a comparative advantage in the informal sector (i.e. voluntary employment), policies which can enhance and support their welfare are needed given that the informal sector employment does offer them any safety nets.

An important caveat in our analysis is that we assume that people are earning-maximisers as opposed to being utility maximisers as workers tend to maximise utility rather than earnings (Gunther and Launov, 2012). If this is the case, then non-wage preferences would also be important to workers. It is therefore possible to argue that the rise of employment in the informal sector may be due to non-wage preferences and not due to entry barriers in the formal sector. The low wages workers in the informal sector earn would then imply that the non-wage advantages are superior in the informal sector relative to the formal sector.

However, we argue that the formal sector has more non-wage benefits for workers than the informal sector. This is because, whilst the informal sector offers much more flexibility and less regulations for workers, working in the formal sector provides workers with, not only social security and job security benefits, but also medical benefits, legal protection and pensions (Anuwa-Amarh, 2015). Hence the assumption that people are earning maximisers should not bias the results.

Another issue that can arise when analysing the labour markets of developing countries is that the growth of the informal sector may be driven by tax avoidance (see for example, Loayza, 1996, Ouedraogo, 2017, De Soto, 1989; 2001, Gokalp et al., 2017, and Nwabuzor, 2005). In order to sidestep the issues of tax avoidance, in our analysis, we utilise after-tax wages as our outcome variable. Thus, it is highly improbable that tax advantages would have any bearing on the final outcome of our study.

6. Conclusion

Informal sector employment is increasingly a challenging issue for most developing economies. The growing literature, coupled with the role of the informal sector in such economies, highlights the significance of this sector. Motivated by this, the objectives of this study were to assess the informal-formal earnings gap and the extent to which informal sector employment was due to labour market segmentation or comparative advantage. The study

employs two datasets, which show considerable heterogeneity in the Ghanaian labour market. The analysis indicates that there are significant formal/informal earnings gaps in the Ghanaian labour market which is robust to industry and regional differences. The informal sector earnings gap is significant for both males and females, but women face a much higher earnings penalty.

The existing studies on the labour market dynamics in Ghana (Sparreboom and Gomis, 2015; Aryeetey and Baah-Boateng, 2016) have implicitly assumed homogeneity within the informal sector. In this study, we applied a finite mixture model to show that the informal sector is heterogeneous in nature. In particular, we found that it is made up of two segments and that these two segments make up a considerable size of the entire labour market.

Our results show that the formal sector is superior to both segments of the informal sector, suggesting that it offers better earnings and other non-wage benefits to workers. However, it has relatively high entry barriers and may not offer enough flexibility for some workers (i.e. entrepreneurs). Examining the two segments of the informal sector closely, we find that, among the two segments, workers in informal-1 are the least paid. Thus, informal-1 tends to absorb anyone seeking employment while informal-2 seems to consist of economic agents with relatively higher skills or entrepreneurs.

Our results highlight the importance of designing appropriate policies that can tackle both voluntary and involuntary informal sector employment in the Ghanaian labour market. For instance, informal sector employment which arises as a result of labour market segmentation (involuntary) can lead to both inefficiency and distortions within the labour market. This, therefore, calls for the introduction of policies that would make the mobility of labour more fluid across all sectors of the labour market in Ghana. Additionally, policies that improve the skills of workers would also be beneficial since, in some instances, informal sector workers tend to face discrimination by way of receiving low pay returns to their skills and characteristics. For instance, monopolistic discrimination and efficiency wages, among other factors, may be some of the reasons behind discrimination and entry barriers that workers tend to face. Finally, in instances where informal sector employment is due to comparative advantage (voluntary), the labour market may show signs of flexibility to an extent. Thus, policies that would promote, for example, a stable macroeconomic environment which supports decent employment must be enacted.

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Appendix A

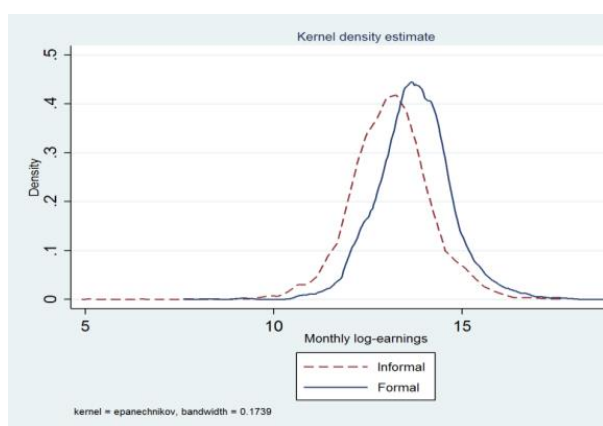
Table A1. Variable Description

Variable	Description
Age (years)	A continuous variable taking values from 15-64
Age ² /100	Age in years squared
Gender	1 = male, 0 = female
Marital status	Couple = 1, 0 = otherwise Single = 1, 0 = otherwise Previously married = 1, 0 = otherwise
Education	None = 1, 0 = otherwise Low = 1, 0 = otherwise Medium = 1, 0 = otherwise High = 1, 0 = otherwise
Religion	Christianity = 1, 0 = otherwise Muslim = 1, 0 = otherwise Indigenous = 1, 0 = otherwise
Household size	Size of the household
Number of infants in HH	Number of infants under 2 years of age
Number of children in HH	Number of children under 14 years of age
Number of elderly in HH	Number of elderly household member
Number of active HH members	Number of active household members

Source: Authors calculation

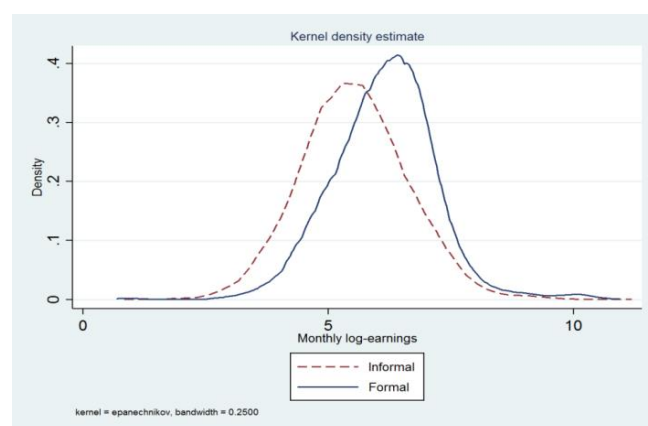
Notes: Education: None education corresponds to no qualification in both GLSS 5 & 6. Medium education corresponds to secondary in both GLSS 5 & 6. High education corresponds to vocational/technical, post-secondary and tertiary in both GLSS 5 & 6. Marital status: Previously married corresponds to divorced, separated and widowed in GLSS 5 & 6. Single corresponds to never married in both GLSS 5 & 6. Couple corresponds to married in both GLSS 5 & 6. Religion: Christianity corresponds to Christianity; Muslim corresponds to Muslim and Indigenous corresponds to traditional all in both GLSS 5 & 6

Figure A1. Density of monthly log-earnings for 2005/06



Source: Ghana living standards survey 5; author's calculation

Figure A2. Density of monthly log-earnings for 2012/13



Source: Ghana living standards survey 6; author's calculations