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ARTICLE

# Wage Price Floors and Sectoral Employment Outcomes in Ghana

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**Abstract**
This paper investigates the effect of daily minimum wage regulation and other covariates variables on sectoral employment generation in Ghana. The Cobb–Douglas and constant elasticity of substitution production functions were employed as the theoretical foundation for this study. Secondary Data sourced from World Development Indicators (2018) from 1991 to 2018 was used while the autoregressive distributed lag was used as the estimation. The finding confirms the insider outsider and the Phillips curve argument and also shows that sectoral employment in Ghana is supported by economic growth and foreign direct investment. Daily minimum wage negatively affects the sectoral employment, with the agricultural employment being the worst affected. Interest rate decreases total employment, whereas population growth decreases employment in the agricultural sector. The study recommends that the agricultural sector should be given a lower interest rate for loans acquired as this will help expand agricultural business and capacity.

**Keywords** Sectoral employment · Labour demand · Minimum wage · Economic growth: Ghana

**JEL Classification** E24 · J31

## 1 Introduction

Globally, the past thirty years have been characterised by significant changes in both the supply and demand sides of the labour markets of many countries (Bandick and Karpaty 2011; Duanxiang and Yao 2019). McKenzie (2017). It posits that four

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global shocks necessitate the need for an employment policy concern; The first is the global financial crisis of 2007–2008. This is followed by the rising demographic pressures in some part of the developing world, especially the Middle East and North Africa (MENA) region. The third is the high rate of youth unemployment, particularly in developing countries. The fourth is the enormous progress in automation, leading to massive unemployment in many manufacturing jobs. Despite these, the impact of an economic structure on employment creation is very different and largely depends on whether the growth pattern experienced by a country is based on natural resources, rural-oriented agricultural production, exports, and manufacturing production.

In many Sub-Saharan Africa countries, the overall perception of employment performance is rather negative and a long-standing debate as unemployment, especially youth unemployment, remains obstinately high despite improved macroeconomic fundamentals (Alagidede et al. 2013; McMillan and Rodrik 2011). The introduction of automation in many Sub-Saharan African countries have led to headlines like "Robots could eat all of Ethiopia's jobs; South Africa, Nigeria and Angola not safe either" (Mwiti 2016), whereas employment creation has been dropped off in the agenda of most central banks (Epstein and Yeldan 2008) in many Sub-Saharan African countries. Though there is a consensus regarding the benefits of FDI on the receiving country's wage levels and productivity (Hanousek et al. 2011; Radosevic et al. 2003), empirical research has failed to provide consistent results on the overall effect of FDI on employment (Bandick and Karpaty 2011; Jenkins 2006). In many cases, studies have shown that minimum wage increased by 10% in real terms leads to a 2.1% fall in employment (Kalenkoski and Lacombe 2013; Akçoraoğlu 2010).

Concerning economic growth in Ghana, many questions have been raised among the general populace on the growth figures published by governments over the years. Published empirical articles have indicated that Ghana's employment growth has not kept pace with economic growth (Aryeetey and Baah-Boateng 2016; Alagidede et al. 2013). Worst still in Ghana, the quantity and quality of remuneration from employment generally falls far short of its potential (Epstein and Heintz 2006), hence, there is agitation to governments to foster an environment to improve employment outcomes. An important worry is the rising cost of borrowing because of increases in interest rates which initially raise the rate of inflation. The usually high inflation rates, together with other macroeconomic variables, have made it not only difficult for the country to meet the convergence criteria for the West African monetary zone but have resulted in high-interest rate which has threatened the survival of many private businesses and their ability to create employment (Alagidede et al. 2013).

Furthermore, the past two decades have witnessed a shift of employment from agriculture to services due to structural and productive transformation. Though, many private and public industries with large wage employment, notably the manufacturing and textile industry, have been on the decline for several years and have shed workforce. Evidence from the empirical research in Ghana has passively suggested that increases in minimum wage negatively affect employment as a result of the high cost of labour (Aryeetey et al. 2014), but studies that analyse the impact of daily minimum wage and economic growth on sectoral employment are

rarely fruitful, which provides an indication of research space for this paper. Sectoral employment in Ghana is focussed on five main sectors, that is, the agriculture, service, transport, commerce, and the manufacturing, due to data limitations though, this study focusses on three out of the four main sectors, namely agriculture, manufacturing, and the service sectors in Ghana. To this end, the study aims at examining the effect of economic growth and the minimum wage regulation on total and sectoral employment in Ghana. From this objective, this paper answers important unanswered questions on the effects of economic growth and minimum wage regulation on employment in Ghana by asking the following questions:

1. Does economic growth lead to higher levels of total and sectoral employment in Ghana?
2. Do increases in the daily minimum wage lead to decreasing total and sectoral employment growth in Ghana?

In this respect, to achieving the objective and answering the research questions, the study provides a comprehensive time series analysis of the Constant Elasticity of Substitution (CES) production function of the long-term and short-term analyses of the impact of economic growth and daily minimum wage regulation on key sectoral employment by using the Autoregressive Distributed Lag (ARDL) on a database spanning 1991 to 2018. This paper is organised into five main sections. Following the introductory section is Section 2, which provides a literature review of the relationship between growth, minimum daily wage, population growth, interest and inflation rates and employment. Section 3 derives an empirical model of employment demand in Ghana using a production function approach and the related econometric estimation of the demand model. Section 4 presents and analyses the empirical results while Section 5 concludes the paper.

## 2 Literature Review

### 2.1 Theoretical Literature

#### 2.1.1 Cobb–Douglas and Constant Elasticity of Substitution (CES) Production Functions

Most theoretical literature examining the relationship between growth and unemployment has applied the Okun's Law, which statistically formalises and stipulates the inverse relationship between the unemployment rate and growth in real output. Despite this, the theoretical model adopted in this study is the Cobb–Douglas (CD) and the constant elasticity of substitution (CES) production functions. The macroeconomic CD production function is a mathematical expression that describes a systematic relationship between inputs and output in an economy. The important aspect of the CD is its elasticity of substitution parameters between capital and labour. Authors, such as Solow (1956), Arrow et al. (1961) and Brown and de Cani (1963),

have made a significant contribution to extending the firm-level CD model to macroeconomic theory dynamics and further contributions to the developing the theoretical and econometric foundations of the CES production function.

### 2.1.2 Insider Outsider Model

The insider–outsider theory developed by Assar Lindbeck and Dennis Snower was originally used to explain unemployment from the microeconozmic point of view. In recent times, the insider–outsider theory has been used to explain how national welfare, firm behaviour, and wage negotiations are influenced by a group in a more privileged position (Lindbeck and Snower 1984). The "insiders" are incumbent workers whose positions are protected by labour turnover cost and enjoy more favourable employment opportunities, whereas "outsiders" who are usually unemployed or work in the informal competitive sectors of the labour market do not enjoy such protection. The theory zeros in at explaining the absence of wage underbidding even when many unemployed workers are willing to work for wages lower than existing insider wages, hence, the conflict of interest between the insider and outsider. The insider–outsider theory explores how insiders are granted their market power by different forms of labour cost and how their actions influence outsiders and vice versa. The disparity incurred by firms in the labour turnover costs arises when they replace insiders by outsiders, the costs of hiring, firing, and providing firm-specific training, nonetheless additional costs can arise from the efforts of insiders to resist competition with outsiders by declining to cooperate with or harassing outsiders who try to underbid the wages of incumbent workers (Lindbeck and Snower 2001). The dilemma of the insider–outsider model is that when there is an increase in the minimum wage and employers increase the wages of workers, it will increase the cost of production and, hence, decreasing output. Employers again may decide not to increase the wages of their employees with the notion that the "outsiders" are more than willing to offer themselves for employment under the current wage or even lower even though hiring and firing costs, including training costs may be incurred. But the "insiders" may decide to stay on and pretend to be working that affects output negatively.

### 2.1.3 Phillips Curve

The Phillips curve, developed by A. W. H. Phillips, represents the relationship between the rate of inflation and unemployment. In an economy, the Phillips curve is used to describe the inverse relationship between rates of unemployment and corresponding rates of rises in wages. According to Phillips, the lower the unemployment rate, the tighter the job market and, as a result, the quicker companies would increase wages to recruit scarce labour. It depicts that the rate of wage inflation that would occur if a certain degree of unemployment is sustained for an extended period of times. The sticky wage theory posits that employee pay is immune to decline under poor economic conditions.

### 2.2 The Minimum Wage Debate

The minimum wage debate is unsettled and has received varied views in the academic literature. There are two main discerning views, that is, either minimum wage has negatively impact economic outcomes, hence on employment; or it directly impacts productivity and reduces inequality. In spite of this, the empirical literature has reported very little consensus on minimum wage and its effect on employment creation. For instance, Kim and Jang (2020) indicated that "…there is currently no empirical consensus. While some researchers … support the neoclassical perspective that a minimum wage has adverse effects on employment, others … fail to conclude that a minimum wage adversely influences employment." Similarly, Meer and West (2016) have posited that "The voluminous literature on minimum wage effects offers little consensus on the extent to which a wage floors impact employment."

In their empirical work on the time series relationship between minimum wage and employment, Card and Krueger (1995) identified structural change as a possible true effect of the minimum wage and not productivity. This has called into questions, the validity of the time-series approach if there has been a structural change. Neumark and Wascher (2006) have reviewed the growing literature on the employment effects of minimum wages in the USA and other countries and have reported a lack of consensus about the overall effects on low-wage employment of an increase in the minimum wage. Despites this, a sizable majority of the studies give a relatively consistent indication of negative employment effects of minimum wages. Neumark and Wascher (2006) further report that fewer studies have provided convincing evidence of positive employment effects of minimum wages.

### 2.3 Empirical Literature

Numerous empirical studies have been conducted to investigate the relationship between output and employment. Madden and Tuckwell (1975), using a disaggregated data on the relationship between output and employment by sector within Australian industry, concluded that in diverse sectors, changes in output had no relationship to changes in employment. Employing the Johansen co-integration and Engle-Granger cointegration methods to investigate the long-run relationship between employment and GDP, Akçoraoglu (2010) concluded that there exists a bi-causality relationship between employment and GDP.

Ahlfeldt et al. (2018), using the difference-in-difference specification with a continuous treatment variable model to a data from Germany, show that the minimum wage introduced in Germany in 2015 resulted in spatial wage convergence without reducing relative employment in low-wage regions. Furthermore, Ham (2018) used repeated cross-section data from Honduras to examine the consequences of legal minimum wages. The quantification from Ham (2018) shows that higher minimum wages reduce covered (formal) employment but increase uncovered (informal) employment. A greater labour supply in the informal sector leads to a negative net effect on wages. Duanxiang and Yao (2019) analysed and compared the effect of

a change in the real minimum wage on employment rate both in China and in the USA. Controlling for the unobserved heterogeneities using the fixed effect estimations, they found a significant and negative correlation between real minimum wage and employment rate in both countries.

As indicated by the Li and Tanna (2019), foreign direct investment (FDI) provided an important source for the Less Developing Countries (LDCs) to benefit from channels such as capital accumulation, technological and knowledge transmission, employment creation and trade opportunities. Jude and Silaghi (2016) have suggested that FDI leads to creative destruction because FDI leads to the introduction of labour-saving techniques leading to an initial negative effect on employment, but progressive on the vertical integration of foreign affiliates into the local economy gradually converge toward a positive long-run effect for the EU countries. Furthermore, Jude and Silaghi (2016) indicate that the job content of economic growth seems relatively low, and the coefficient for output growth ranges between 0.19 and 0.23, implying a 1% increase in output should lead to around 0.2% increase in employment.

Onaran (2008) in her analysis of the impact of FDI on employment in the manufacturing industries within eight Central and Eastern European countries (CEEC) found mixed evidence of the contribution of FDI to employment, leading to an overall insignificant impact. She also concluded that FDI had a significant positive effect on employment only in Lithuania and in some medium and low-skill sectors in Slovakia. Hunya and Geishecker (2005) supported the hypothesis of job destruction in CEEC during the early stages of transition, arguing that multinationals moved faster in the restructuring process and thus laid-off workers at an earlier stage than the domestic firms do. As the transition process evolves, privatisations are replaced by greenfield investment, which create new production capacities and new jobs. The creative destruction idea has been reiterated by de Loecker and Konings (2004) for Slovenia, contending that privatisation has eliminated unproductive jobs and replaced them at a later stage with more productive ones. Studies in Ghana have shown that the availability of credit and prevailing interest rates directly impact employment outcomes in both the formal and informal economies (Epstein and Heintz 2006).

In Ghana, Kofi (2019) estimated the size and trends of the informal economy in Ghana and observed that the size of the informal economy in Ghana has been increasing over the past four decades and has doubled from the 14% of the GDP in 1960 to 30% by 2004. Furthermore, the relative strong growth period shows that formal sector employment contracted significantly while the informal sector employment saw rises.

## 3 Methodology and Data

### 3.1 Theoretical Model

The theoretical foundation of this empirical study is the demand function for labour derived from the CES production function by solving the marginal product of

the labour equation for the labour input variable (Upender 2006). The CES production function adopted in this study is specified as follows:

$$\mathrm{GVA}_{it} = A\left\{\alpha {K_{it}}^{-\rho} + (1-\alpha){E_{it}}^{-\rho}\right\}^{-\eta/-\rho} \tag{1}$$

where $\mathrm{GVA}_{it}$ is Gross Value Added (sectoral output); $K_{it}$ is the capital (input): $E_{it}$ is employment/labour (input); $A$ is the efficiency parameter and $A > 0$; $\eta$ is the returns to scale parameter and $\eta > 0$; $\alpha$ is the distribution parameter and is $0 < \alpha < 1$; $\rho$ is the extent of substitution (between $K$ and $E$) parameter, $\rho > -1$, related to the elasticity of substitution: $\alpha = 1/1 + \rho$.

The marginal product of labour ($\mathrm{MP_L}$) derived from Eq. (1) is written as:

$$\mathrm{dGVA}_{it}/\mathrm{d}E_t = \eta(1-\alpha)/A^{\rho/\eta} \cdot \mathrm{GVA}_{it}^{(1+\rho)/\eta}/E_{it}^{\rho+1} \tag{2}$$

The above $\mathrm{MP_L}$ expression is solved for the $E_{it}$ input variable to derive the empirical labour (employment) demand function:

$$\begin{aligned} &\eta(1-\alpha)/A^{\rho/\eta} \cdot \mathrm{GVA}_{it}^{(1+\rho)/\eta}/E_{it}^{\rho+1} \\ &[\eta(1-\alpha)/A^{\rho/\eta} \cdot \mathrm{GVA}_{it}^{(1+\rho)/\eta}]^{1/\rho+1} = E_{it} \\ &E_{it} = [\eta(1-\alpha)/A^{\rho/\eta} \cdot \mathrm{GVA}_{it}^{(1+\rho)/\eta}]^{1/\rho+1} \\ &E_{it} = \beta \mathrm{GVA}_{it}^{\beta 1} \end{aligned} \tag{3}$$

where

$$\begin{aligned} 0 &= [\eta(1-\alpha)/A^{\rho/\eta}]^{1/\rho+1} \\ \beta_0 &= [\eta(1-\alpha)/A^{\rho/\eta}]_0^{1/\rho+1} \\ \beta_1 &= (1+\rho/\eta)(t/\rho+1) \\ \beta_1 &= 1+\rho/\eta \cdot \sigma \\ \sigma\ &(\text{elasticity of substitution}) = 1/\rho+1 \end{aligned}$$

The log-transformation of Eq. (3) gives the following:

$$\mathrm{In}E_{it} = \mathrm{In}\beta_0 + \beta_1 \mathrm{InGVA}_{it} = \beta_0 + \beta_1 \mathrm{InGVA}_{it} + \cdots + \beta_n \mathrm{In}X_{nit} + \varepsilon_{it}. \tag{4}$$

### 3.2 The Empirical Model

To capture the employment elasticities and the differential partial elasticities of employment with respect to the real wage rate, the user cost of capital, population growth and foreign direct investment, the double-log linear regression is estimated. Equation (5) is rewritten as:

$$\begin{aligned}\ln E_t =& \beta_0 - \beta_1 \ln \mathrm{DMW}_t + \beta_2 \ln \mathrm{GVA}_t + \beta_3 \ln \mathrm{LINTRATE}_t \\ &+ \beta_4 \ln \mathrm{IRATE}_t + \beta_5 \ln \mathrm{Pop}_t + \beta_6 \ln \mathrm{FDI}_t + \varepsilon_t\end{aligned} \tag{5}$$

where $t = 1, \ldots, 28$ indicate annual data. The dependent variable, $E_t$, represents employment in thousands of persons in the total employment (LTE), service sector (LSE), agricultural sector (LAE), and manufacturing sector (LIE). The explanatory variables are: $\mathrm{DMW}_t$ is the nominal daily minimum wage in Ghana Cedis;[1] $\mathrm{GVA}_t$ is the gross value-added (GVA) in constant 2010 prices for the three sectors, that is, the total value added (GDP), agricultural sector value added (LAY), service sector value added LSY, value-added for the industry sector (LIY); LINTRATE is the user cost of capital, proxied by long-term bond interest rates; IRATE is the inflation rate measured in terms of the Consumer Price Index (CPI); Pop is the population growth rate, and FDI is the foreign direct investment; $\varepsilon_t$ is the error term. Based on the empirical literature, the functional relationship and the hypothesized signs to be analysed are presented as follows:

$$E_t = f\left(\overset{-}{\overbrace{DMW_t}}, \overset{(+/-)}{\overbrace{IRATE_t}}, \overset{(+/-)}{\overbrace{LINTRATE_t}}, \overset{(+/-)}{\overbrace{GVA_t}}, \overset{(+/-)}{\overbrace{Pop_t}}\ \overset{(+/-)}{\overbrace{FDI_t}}\right)$$

### 3.2.1 Apriori Expectations

From the empirical literature, FDI leads to employment creation in the short-run through new production capacity and new jobs. After this, there is an employment crowding-out since the inflow of FDI makes the competition more intense, making some domestic firms reduce employment to improve their competitiveness (Hunya and Geishecker 2005; Girma 2005). This results in transfer of workers to new enterprises, and employment loss. Thus, the apriori expectation is that FDI will either be positive or negative on employment creation. From this perspective, increased FDI inflows can have a negative impact on employment due to their higher efficiency in the use of labour (Hu et al. 2021). Thus, FDI can have either a positive or negative effect on employment. Output growth is the main determinant of employment dynamics in CEEC (Jude and Silaghi 2016). From the Okun's law, an increase in GDP is associated with a decrease in unemployment (increase in employment), implying positive apriori effect of output on employment.

An increase in the population implies a higher labour supply than labour demanded, resulting in high unemployment rates. Given the limited structural transformation high population growth could results in under employment and increase in discourage workers. Hu et al. (2021) stated that a booming sector leads to an increase in employment and has a positive spill-over effect in other sectors which

[1] After 2007 the currency was redenomination; hence, earlier values were converted to the new currency value.

could result in population growth and job creation, but it may also lead to higher local wage prices, which in turn may negatively impact on employment. We expect either a positive or a negative effect of population on employment creation.

With low interest rates, consumers are more likely to increase spending now rather than wait to consume later. Low interest rates also reduce the cost of borrowing to invest in productive capital. The increased demand for consumption and investment then leads to higher demand for labour. However, in the recent times, the low interest rates do not seem to be having much of the intended effect, either on spending or on job growth (Yilmazkuday 2020). Thus, the apriori expectation is either positive or negative. Following the debate on minimum wage presented (Section 2.2), the apriori expectation is that increase in the daily minimum wage is associated with decrease in sectoral employment.

### 3.3 Estimation Strategy

To overcome the spurious nature of the results from the estimated results of Eq. (5), stationarity test was performed on the variables to guarantee that they contain no unit root at either level or first difference. Thus, the augmented Dickey–Fuller (ADF) and the Phillips–Perron (PP) tests developed by Dickey and Fuller (1979) and Phillips and Perron (1988), respectively, were conducted for the stationarity test. The ADF can deal with the problem of serial correlation and heteroscedasticity in the residuals using parametric autoregression and the PP uses nonparametric methods to correct for any serial correlation and endogeneity of regressors. Since most of the variables are integrated at order one ($I(1)$), the existence of level (cointegration) relationship between sectoral employment and their respective determining factors are tested by relying on the bounds testing approach within the autoregressive distributed lag (ARDL) framework. The main advantage of this method is that it can be applied independently whether the regressors are 1(0) or 1(1) and avoids the pretest with standard cointegration. Finally, the study estimates the short- and long-run multipliers of sectoral employment from Eq. (5) using the ARDL cointegration technique.

### 3.4 Data Description and Source

Influenced by data availability, this study used annual time series data covering the period 1991–2018 sourced from WDI (2019) database. The daily minimum wage figures were however obtained from the Ministry of Finance and Economic Planning. The dependent variables are measured in logs using four (4) variables, namely total employment (LTEM), service sector employment (LSE), agricultural employment (LAE), and manufacturing employment (LIE).

The independent variables used in this study measured in logs using service output (LSE), agricultural output (LAY), manufacturing output (LIY), gross domestics product (LGDP), daily minimum wage (DMW), foreign direct investment (LFDI), population growth rate (LPOP), interest rate (LINTRATE) and inflation rate (LIRATE). The descriptive statistics presented in Table 1 shows that the mean of

**Table 1** Descriptive statistic

| | LTE | LSE | LAE | LIE | LGDP | LSY | LAY | LIY | LDMW | LFDI | LIRATE | LINTATE | LPOP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 7.211 | 6.487 | 6.653 | 6.121 | 10.390 | 9.547 | 9.480 | 9.388 | 3.980 | 8.658 | 1.228 | 1.226 | 7.327 |
| Median | 7.216 | 6.444 | 6.655 | 6.109 | 10.358 | 9.405 | 9.522 | 9.342 | 4.090 | 8.377 | 1.185 | 1.209 | 7.328 |
| Maximum | 7.330 | 6.765 | 6.713 | 6.358 | 10.746 | 11.105 | 10.753 | 11.012 | 5.027 | 9.542 | 1.774 | 1.553 | 7.469 |
| Minimum | 7.069 | 6.271 | 6.558 | 5.942 | 10.103 | 7.958 | 8.043 | 7.615 | 2.663 | 7.301 | 0.853 | 0.949 | 7.177 |
| SD | 0.077 | 0.153 | 0.049 | 0.118 | 0.200 | 1.049 | 0.869 | 1.025 | 0.726 | 0.760 | 0.214 | 0.190 | 0.090 |
| Skewness | −0.226 | 0.435 | −0.230 | 0.610 | 0.271 | −0.028 | −0.142 | −0.008 | −0.288 | −0.084 | 0.705 | 0.232 | −0.036 |
| Kurtosis | 1.900 | 1.987 | 1.734 | 2.570 | 1.755 | 1.600 | 1.752 | 1.904 | 1.880 | 1.554 | 3.216 | 1.881 | 1.771 |
| Jarque–Bera | 1.650 | 2.079 | 2.115 | 1.951 | 2.152 | 2.291 | 1.913 | 1.401 | 1.851 | 2.473 | 2.376 | 1.711 | 1.768 |
| Probability | 0.438 | 0.354 | 0.347 | 0.377 | 0.341 | 0.318 | 0.384 | 0.496 | 0.396 | 0.290 | 0.305 | 0.425 | 0.413 |
| Sum | 201.896 | 181.634 | 186.273 | 171.380 | 290.924 | 267.303 | 265.440 | 262.857 | 111.451 | 242.426 | 34.388 | 34.319 | 205.158 |
| Sum Sq. Dev | 0.162 | 0.631 | 0.065 | 0.379 | 1.083 | 29.722 | 20.395 | 28.344 | 14.244 | 15.597 | 1.234 | 0.972 | 0.217 |
| Observations | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |

**Table 2** Unit root test results

| Variable | ADF | | PP | |
|---|---|---|---|---|
| | Intercept | Intercept and trend | Intercept | Intercept and trend |
| LSE | 0.620 | −1.873* | 1.754* | −0.945 |
| DMW | 3.564** | 5.394*** | 27.765*** | 24.467*** |
| LSY | −0.311931 | −2.174 | −0.302 | −2.174 |
| LFDI | −1.470 | −1.976 | −1.486 | −1.976 |
| LPOP | −2.736* | −1.003 | −2.989** | −0.082 |
| IRATE | −2.687* | −3.278* | −2.725* | −3.278* |
| LTEM | −1.381 | −2.456 | −4.331*** | −2.641 |
| LGDP | 1.203 | −1.713* | −1.808* | −1.438 |
| LAE | −2.018 | −1.354 | −1.872 | −0.979 |
| LAY | −1.337 | −0.924 | −1.512 | −1.132 |
| LIE | 0.997 | −2.775 | −1.031 | −1.074 |
| LTE | 0.018 | −1.952 | −0.118 | −2052 |
| *After the first difference* | | | | |
| LSE | −2.154 | −2.392 | −2.171 | −2.392 |
| DMW | 3.432** | 0.855 | 6.952 | −0.1642 |
| LSY | −5.065*** | −4.966*** | −5.107*** | −5.042 |
| LFDI | −4.187** | −4.186** | −4.129*** | −4.173** |
| LPOP | −0.739 | −6.633*** | −1.064 | −1.571 |
| IRATE | −7.430*** | −6.096*** | −5.811*** | −5.731*** |
| LTEM | −2.111 | −2.205 | −2.060 | −2.205 |
| LGDP | −2.563 | −2.975 | 2.563 | −2.975 |
| LAE | −2.507 | −3.670** | −2.436 | −2.862 |
| LAY | −4.221*** | −4.587*** | −4.183*** | −5.499*** |
| LIE | −1.620 | −2.463 | −3.030** | −2.996 |
| LTE | −4.220*** | −4.188** | −4.210*** | −4.181** |

*,**, ***Significance levels at 10%, 5%, and 1%, respectively

log of total employment is 7.21, while the average sectoral employment shows that employment in the service sector is highest (6.86), followed by the agricultural sector (6.653) and the manufacturing sector (6.121). The descriptive statistics further indicate that on average almost all the variables are skewed to the left while the kurtosis range is within the acceptable range.

## 4 Empirical Evidence: Results and Interpretations

The empirical results under unit root and cointegration analysis, and short- and long-run estimates are presented in this section.

**Table 3** Results of bounds test for cointegration

| | Model | F-statistics | K | Significant level | Critical bound | | Decision |
|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | |
| AIC | LTEM | 58.39312*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LSE | 9.166491*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LAE | 4.086461*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LIE | 6.310904*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| SIC | LTEM | 49.49454*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LSE | 9.540648*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LAE | 4.139719*** | 5 | 1% | 3.41 | 4.68 | Co-integration |
| | LIE | 7.441142*** | 5 | 1% | 3.41 | 4.68 | Co-integration |

***, **Significance levels at 1%, and 5%, respectively

### 4.1 Unit Root and Cointegration Analysis

To determine the stationarity of each variable, the unit root analysis was performed using the PP and the ADF tests. The results presented in Table 2 indicate that at levels, both the ADF and the PP tests accept the presence of unit root for some variables at levels. Almost all variables which were not stationary at levels become stationary after the first difference. This finding implies that most of the variables are integrated of either order zero, $I(0)$ or integrated of order one, $I(1)$. This indicates that estimation can be performed with the series without getting spurious results. Table 3 presents the results of the cointegration tests based on the ARDL bounds cointegration shows that the null hypothesis of no cointegration is rejected for total employment, employment in the service sectors, employment in the agricultural sector and industry employment.

Based on this finding the researchers conclude that there is the existence of a long-run relationship between the dependent variables and the set of explanatory variables. The Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC) were used to select optimal lag for cointegration, as they tend to give a model that has a good fit to the data (Akaike 1973; Burnham and Anderson 2002).

### 4.2 Discussion of the Short- and Long-Run Relationship

The results of the long-run and short-run ARDL estimates for total employment, employment in the service sector, employment in the agricultural sector and employment in the industry are reported in Tables 4 and 5. These show that the labour cost (daily minimum wage), foreign direct investment and total expenditure in the long run significantly influence employment in the various sectors while daily labour cost, foreign direct investment, population, and total expenditure significantly influence the short-run employment in the total employment, service employment, agricultural employment and industry. Furthermore, the coefficient of

**Table 4** Long-run coefficient estimates of employment in various sectors (levels equation)

| | Total employ | | Service employ | | Agric. employ | | Industry employ | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | *t* value | Estimate | *t* value | Estimate | *t* value | Estimate | *t* value |
| LTEM(−1) | −0.1305*** | −9.2133 | 0.0887*** | 2.4837 | 0.1006 | 1.7486 | 0.1208 | 1.3099 |
| Sectoral VA | 0.0457*** | 9.0078 | 0.3392*** | 9.7645 | 0.6204*** | 12.5304 | 0.5556*** | 6.7193 |
| DMW | −0.0169*** | −8.8698 | −0.0546*** | −3.4056 | −0.2898*** | −17.5696 | −0.2446*** | −5.2611 |
| LIRATE | 0.0291*** | 10.1979 | −0.0710** | −2.3075 | −0.3091*** | −10.7988 | −0.2875*** | −4.2969 |
| LINTRATE | 0.7794*** | 11.5568 | 3.4016*** | 6.7138 | −5.6148*** | −12.0735 | 4.3183*** | 4.1581 |
| LPOP | 0.0014** | 2.4614 | −0.0319*** | −3.7580 | 0.0235** | 3.4610 | −0.0278 | −1.7381 |
| LFDI | 2.6533*** | 8.1188 | 17.2520*** | 4.9660 | 43.6757*** | 14.2722 | −23.8148*** | −3.5497 |
| C | −0.1305*** | −9.2133 | 0.0887*** | 2.4837 | 0.1006 | 1.7486 | 0.1208 | 1.3099 |
| $R^2$ | 1.0000 | | 0.9998 | | 0.9960 | | 0.9977 | |
| Adjusted $R^2$ | 1.0000 | | 0.9993 | | 0.9835 | | 0.9951 | |
| S.E. of regression | 0.0004 | | 0.0039 | | 0.0057 | | 0.0079 | |
| Sum squared resid | 0.0000 | | 0.0001 | | 0.0002 | | 0.0007 | |
| Log likelihood | 179.8234 | | 122.4323 | | 116.7117 | | 99.1762 | |
| F-statistic | 38,488 | | 2047.6000 | | 79.2947 | | 392.2289 | |
| Prob(F-statistic) | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |

***, **Significance levels at 1%, and 5%, respectively

**Table 5** Short-run ARDL model

| | Total | | Service | | Agriculture | | Industry | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | *t* value | Estimate | *t* value | Estimate | *t* value | Estimate | *t* value |
| D(Sectoral VA) | −0.0077 | −0.9911 | 0.0101 | 1.1624 | 0.0322 | 1.1224 | −0.0520** | −2.5488 |
| D(DMW) | −0.0378*** | −17.7396 | −0.1279*** | −7.3549 | 0.3171*** | 12.2457 | −0.1128*** | −3.3865 |
| D(LIRATE) | −0.0104*** | −16.8466 | 0.0525*** | 9.1129 | −0.2026*** | −16.3729 | 0.0786*** | 7.6870 |
| D(LINTRATE) | 0.0254*** | 20.5875 | −0.0868*** | −8.4857 | 0.2791*** | 14.8286 | −0.1096*** | −6.0781 |
| D(LPOP) | 8.3907*** | 10.4569 | −69.0520*** | −11.2669 | −5.7220 | −0.9212 | 16.4289* | 1.8853 |
| D(LFDI) | 0.002*** | 3.093 | 0.008* | 1.683 | 0.0467*** | 9.1109 | −0.008 | −0.827 |
| CointEq(−1) | −1.8376*** | −13.3946 | −1.1011*** | −10.1547 | −2.1289*** | −9.8246 | −0.6161*** | −11.5931 |

*, **, ***Significance levels at 1%, 5% and 10%, respectively

the lagged CointEq(−1) term (Table 5) is negative and significant at 1% level for all the sectors of employment including the total employment model suggesting that when total employment, service sector employment, agricultural and manufacturing sector employment are above, or below the equilibrium level, it adjusts by 183.76, 110.11, 212.89 and 61.61%, respectively, within the first year. The findings show that the one-period lag adjustment is highest in the agricultural sector compared to other sectors of employment.

#### 4.2.1 Effect of Value Added on Sectoral Employment

From the results in Table 4, the value-added is found to increase total employment and employment in the manufacturing sector in both the long-run and short-run employment. It is important to note that, value addition increases employment in total employment, agricultural sector, service sector and employment in the manufacturing sector, an indication that value addition increases growth in employment in general. This finding contradicts Madden and Tuckwell (1975)'s finding in the Australian industry; but is consistent with the of Jude and Silaghi (2016) for Central and Eastern European Countries, which show that value addition increases growth in employment in the manufacturing sector. This signifies that as the Ghanaian economy expands there is more openings in these four sectors, hence, the increase in employment. For instance, value addition in the manufacturing sector increases the likelihood of increase employment in the manufacturing sector due to more industries being built. The increasing effect of value addition on the agricultural, service, and manufacturing sector of Ghana is largely attributed to the fact that most companies operating in these sectors are labour intensive.

#### 4.2.2 Effect of Labour Cost on Sectoral Employment

Labour cost exerts a negative effect on total employment and employment in all the four major employing sectors (at one percent level) in both long run and short run, in the period under consideration. The result implies that in the long run, a unit increase in labour cost decreases the manufacturing employment, employment in the service sector and employment in the agricultural sector by 0.2446, 0.0546 and 0.2898, respectively. Increase wages implies an increase in the cost per unit of production leading employers to decrease their labour demand for all sectors, but the impact is very much felt in the agricultural sector. Though the findings contradict those reported by Ahlfeldt et al. (2018) when minimum wage was introduced in Germany in 2015, they largely confirm those of Ham (2018) in Honduras, concerning the legal minimum wages for the formal sector. The agricultural sector is the riskiest sector among these three sectors. It is riskiest is due to the extensive reliance on the unpredictable rains, pest attacks and usage of obsolete techniques. An increase wages to attract skilled labour will lead commercial agricultural employers to reduce the number of people they are willing to employ. The study is also consistent with those reported by Duanxiang and Yao (2019) on the effect of a change in the real minimum wage on employment rate in both China and in the USA.

#### 4.2.3 Effect of Interest Rate on Sectoral Employment

The effect of interest rate on sectoral employment is much felt in all sectors, that is, increase in sectoral employment in the service sector, manufacturing sector and total employment, but decreases employment in the agricultural sector in the long run. Thus, the increase in elasticity of 0.7794, 3.4016, and 4.3183 is witnessed in employment in the total employment, service sector and manufacturing sector in the long run. The result shows that increase in interest rate greatly decrease employment in the agricultural sector in the long run by 5.6148. Thus, in the agricultural sector, an increase in long-term bond interest rates will decrease the demand by employers for capital and will decrease the demand for consumer goods and services. The decreased demand for capital in the agricultural sector will decrease labour productivity, and the decreased demand for consumer goods and services will decrease the derived demand for labour in the agricultural sector, hence, the adverse effect on employment of the long-term interest rates. Furthermore, an increase in the short-term bond interest rates may decrease the demand for capital in the manufacturing sector, and subsequently, decrease the demand for labour. In this case, short-term interest rates would be negatively related to employment in the manufacturing sector. On the contrary, the long run analysis shows that an increase in the interest rate increases the employment in the service and manufacturing sectors but still decreases employment in the agricultural sector.

#### 4.2.4 Effect of Population Growth on Sectoral Employment

The information gotten from the regression shows that a 1% increase in population growth rate increases employment in the agricultural sector by 2.4% in the long run but decreases the short-run employment in it. This implies that population growth in the short-run drives away labour from the agricultural sector but in the long run population growth leads to movement labour into the agricultural sector. A probable reason could be because population explosion will initially lead labour to search for jobs in other sectors but in the long run these labours move back to the agricultural sector once they cannot find the much-needed jobs. On the contrary, a percentage increase in the population results in a 3.2 and 2.8% decrease in the service and manufacturing sector employment, respectively, in the long run but increases employment in the manufacturing sector in the short run. The insider–outsider theory can best be used to explain the long-run negative effect of population growth on unemployment. The "insiders" protect their positions due to the high labour turnover cost, hence, the absence of wage underbidding even when many unemployed workers (outsiders) are willing to work for wages lower. This finding is also consistent with those reported by Hu et al. (2021) on the negative effect of population growth on employment.

#### 4.2.5 Effect of Foreign Direct Investment on Sectoral Employment

The elasticity of total employment, service sector and agricultural employment with respect to foreign direct investment is positive, both in the short and long run. This

**Table 6** Diagnostic tests and sensitivity analysis

| Diagnostic statistics | Test statistics | Total employ | Service employ | Agric employ | Industry employ |
|---|---|---|---|---|---|
| Serial correlation | | | | | |
| Breusch–Godfrey | F-statistics (Prob) | 0.75 (0.487) | 0.14 (0.873) | 0.23 (0.795) | 2.46 (0.116) |
| | Obs.R2 (Prob) | 2.190 (0.335) | 0.43 (0.808) | 0.72 (0.698) | 11.05 (0.749) |
| Normality | | | | | |
| Jarque–Bera | F-statistics (Prob) | 1.65 (0.438) | 1.92 (0.383) | 2.115 (0.347) | 1.95 (0.377) |
| Heteroscedasticity | | | | | |
| Breusch–Pagan–Godfrey | F-statistics (Prob) | 1.71 (0.166) | 1.10 (0.404) | 0.94 (0.499) | 0.49 (0.896) |
| | Obs.R2 (Prob) | 8.65 (0.279) | 7.77 (0.353) | 6.95 (0.434) | 1.951 (0.377) |
| Functional form | | | | | |
| Ramsey reset | F-statistics (Prob) | 1.40 (0.496) | 1.30 (0.2693) | 1.77 (0.413) | 0.01 (0.944) |

suggests that investments by multinationals in the service and the agricultural sectors lead to high employment and show the absorptive capacity of the Ghanaian economy. The findings collaborate the opinion opined by Li and Tanna (2019) that indicates that foreign direct investment (FDI) provides benefit of employment creation for developing countries. On the contrary, the study reports that FDI decreases employment in the manufacturing sector in both short and long runs. This shows that when it comes to job creation in the manufacturing sector, FDI is destructive. The finding is similar to arguments by Jude and Silaghi (2016) that FDI is a creative destruction for EU countries. In Ghana most manufacturing companies are labour-intensive, hence, increases in FDI means transfer of skills and technology and with technology means the introduction of labour-saving techniques which also implies laying off of some workers, ceteris paribus.

#### 4.2.6 Effect of Inflation Rate on Sectoral Employment

With reference to the inflation rate, the findings show that service and manufacturing employment decreases with increase in the inflation rate in the long run but the agricultural sector employment decreases with increases in the inflation rate in both the short and long runs. Due to higher inflation, industries are less certain about the profitability of investment, hence, the lower investment and therefore lower economic growth. This poor level of investment leads to higher unemployment in the long term as posited by this study. Furthermore, the study confirms the Phillip curve argument of inflation-unemployment trade-off since inflation decreases nominal wages, hence real wages fall and result in a decrease in consumer spending.

### 4.3 Diagnostic Tests and Sensitivity Analysis

Various diagnostic tests, namely test for serial correlation, heteroscedasticity, normality, and functional form, were run to examine whether the estimated models are adequate and robust. The obtained results (Table 6) on sectoral employment are correctly specified as the *p* values for serial correlation, normality, heteroscedasticity, and functional form are statistically insignificant. This is an indication that the null hypothesis of no serial correlation, normally distributed residuals, homoscedasticity, and correct functional form are not rejected at 5% level and the sectoral models are adequate and robust.

## 5 Conclusions and Policy Recommendations

The paper examines the effect of the daily minimum wage and other covariates on the intensity of sectoral employment in Ghana using time series data and employing the CES production function. Consistent with the minimum wage debate and the general consensus in the literature, the estimation shows that an increase in the daily minimum wage will have an adverse effect on all the three sectors' employment (Industry, Service and Agriculture), though the worse affecting sector's employment is in the agricultural sector. Employment in the agricultural sector is likely to reduce employment by approximately 6.4%. The increasing interest rate will severely affect two major employing sectors, that is, the agricultural and manufacturing sectors, with the agricultural sector likely to lay off more workers compared to the manufacturing sector. The employment–output relationship have indicated the existence of the long-run positive relationship between total employment, employment in industries and growth in output. This is an indication that the observed growth performances in total employment and employment in these sectors have been more labour productivity-driven than labour employment-driven. The study also concludes that employment in the Ghanaian economy is supported by the economic growth of the country. From these conclusions, the study recommends that since the agricultural sector is the traditional sector that employs majority of rural people and a significant contributor of Ghana's GDP and employment, policy makers need to give employers in the agricultural sectors subsidies on targeted agricultural inputs. Also, the agricultural sector should be given a lower interest rate for loans acquired to expand the agricultural business and capacity.

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### Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

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