An empirical analysis of the relationship between minimum wage, investment and economic growth in Ghana

Obeng, Samuel Kwabena

Department of Economics, Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana

July 2015

An Empirical Analysis of the Relationship between Minimum Wage, Investment and Economic Growth in Ghana

Samuel Kwabena Obeng[10]

Abstract

The paper determines whether minimum wage stimulates economic growth in Ghana, for the period 1984-2013, using autoregressive distributed lag (ARDL) bounds testing approach to cointegration, within an error correction framework. A preliminary test provides evidence of correlation between minimum wage and investment, thereby allowing for an examination of the wage-growth relationship. Four equations are used to determine the relationship between minimum wage and economic growth. The results from the simple regression of minimum wage on economic growth indicate a positive and statistically significant impact of minimum wage on economic growth both in the long-and short-run. However, the results from other estimations of the wage-growth relationship when investment, credit to the private sector and an interaction term of wage and investment are controlled for precludes any naïve policy formulation which may be solely based on the positive wage-growth relationship obtained. Specifically, the results from the other estimations imply minimum wage can only be growth enhancing if it is met by simultaneous increases in investment spending, as well as deliberate and sustained policies aimed at ensuring credit to finance private investment are readily available, easily accessible, and affordable. In addition, the ratio of public investment to tax revenue must increase as minimum wage increases since such complementary changes are more likely to lead to economic growth.

Keywords: minimum wage, investment; economic growth, ARDL, DOLS, ECM.

JEL Codes: C22, D92, E22, J38, O47

[10] Department of Economics, Kwame Nkrumah University of Science and Technology (KNUST), Email: sammyatom2007@yahoo.com, Phone Number: +233246219421

1. Introduction

Minimum wage increases has been a popular policy tool used by governments to tackle poverty. The main idea of fixing minimum wages is to ensure low-wage-low-skill workers earn "decent" wages from their jobs. Moreover, it can "pull" households that are below the poverty line above the poverty line since it raises household income. In addition, it creates and sustains at least, a "subsistence standard of living" for poor and low-skilled workers.

However, minimum wage increases may not be the most efficient way to achieve poverty reduction (Card and Krueger, 1995). This is because, while increases in minimum wages reduce poverty levels, they also lead to higher levels of unemployment. Specifically, the category of workers most likely to suffer from minimum wage increases is low-skilled workers. Such workers are easily substituted for high-skilled workers. Unemployment increases most amongst them. This is worsened by the fact that jobs that require low skills and those that pay low wages are the most likely to decline when minimum wages increase (Neumark, 2014). Therefore, as far as efficiency is concerned, the ability of minimum wages to reduce poverty is not costless (Lustig and McLeod, 1996).

Added to this, when minimum wage increases are highly enforced, their effects on the employment and income levels of the targeted workers (mostly low-skill-low-income workers) are negative (Clemens and Wither, 2014). Vuillemey (2008) indicates that, "by imposing a minimum wage, law makers close off access to employment for any workers if what they produce is worth less than the value of the minimum wage, payroll taxes included…far from protecting the weakest, which is part of its initial purpose, the minimum wage excludes them from the labour market, relegating them to unemployment or to 'parallel' forms of employment" (pp. 2, 3). Dube (2013) however posits that, a negative relationship between minimum wages and total employment growth may be because we fail to account for the differences between states with high minimum wages and those with low minimum wages. In addition, the timing of increases in minimum wages is also an important factor. Therefore, the negative relationship between minimum wage increases and employment is no proof of a causal relationship. Moreover, minimum wages lead to price increases. The inflationary effect of minimum wage increases turn to hurt the poor since they spend greater proportion of their incomes on consumables. Hence, the poor are more likely to suffer from the inflationary effects of minimum wage increases.

What are the implications of minimum wage increases for growth? This can be analyzed by considering the indirect effect of minimum wage increases on growth through investment. For instance, increases in minimum wage may serve as an incentive for increases in production (a situation this paper refers to as the *"output inducement principle"* of wage increases), thereby encouraging investment which eventually causes growth. The reason is that, wages and salaries are the economic reward workers receive from work. Therefore when minimum wage increases, workers earn more than they used to for the same hours of work. This incites positive attitude to work and increased efforts at work. Given that other factors of production are available and in good conditions at the place of work, productivity and output will increase, eventually encouraging investment spending to stimulate growth. Added to this, increases in wages can enlarge local market size. This is because, wages as well as wealth increases when minimum wage increases. The enlarged market size can increase firm profitability. Hence, a single firm's wage increase can serve as an externality, creating increased demand for the goods and services of other firms, and thereby increasing their profitability (Magruder, 2011). This is possible as long as there are no adjustments in prices

(Taylor and Selgin, 1999). Employment may likely rise and this can lead to economic growth through increased output.

However, increasing expenditure on wages may reduce investment spending by firms. This is likely to reduce productivity and production, making firms even worse off and less profitable. Investment may be rendered unattractive and growth may be retarded. In addition, other forms of spending by the firm are likely to suffer. Almost immediately, what the firm might consider doing is to reduce the amount of their "surplus" they spend on social responsibility programs and projects. Moreover, on the product demand side, wage increases may immediately cause job cuts since producers would want to minimize cost of production. The resulting unemployment reduces purchasing power and causes a fall in demand for goods and services. Another side of this is that, even if workers are retained, the increase in wages may arouse desire for variety. Tastes and preference may favor foreign goods and services. With rising income levels, demand for foreign goods and services may increase given their prices, eventually leading to currency depreciation, trade deficits, inflation, among others, which ultimately inhibit growth. Besides, a country with frequent labour unrests and a continuously rising minimum wage is unattractive to investors (both local and foreign). This is because it does not guarantee the security of one's investment. Moreover, it indicates that making profit and expanding investments will be difficult. It will only attract investment if investors realize that the rising wages are met by either corresponding or even higher rise in productivity. All these possibilities indicated here may imply increases in minimum wage are likely to retard growth.

Fanti and Gori (2011) and Watanabe (2013) indicate that increases in minimum wage is growth enhancing when it is complemented by an increase in the ratio of public investment to tax revenue. In addition, minimum wage increases are growth enhancing when previous levels of minimum wage are low. However, they may have no effect on growth when previous levels of minimum wage are high (Cukierman et. al, 2001). This is a likely case because increases in minimum wages act as an incentive for workers to commit more efforts to work in order to increase output. Therefore, when initial levels of minimum wages are low, they are more likely to induce increased worker effort to stimulate growth than when they are high since workers will prefer leisure to work because they can afford leisure. Besides, labour unions are better able to influence income distributions as against efficiency and growth (Freeman, 2000).

Recent fiscal slippages in Ghana have been attributed in part to the rise in Ghana's wage bill. Ghana's wage bill for instance accounted for almost 70% of government spending in 2012. The Single Spine Salary Structure (SSSS) was implemented in 2010 to among others, raise the low levels of public sector pay, and to reduce inequalities in public service pay within and across service classifications. However, with the ever increasing cost of living, labour unions in Ghana continue to "rage" and "rant" for increased wages and salaries. Sadly, wage increases have not been met by corresponding increases in productivity and output (see ISSER, 2013). In other words, wage increases faster than increases in productivity of labour, particularly in the area of service provision (Baumol, 1967). Ghana's government (like any other government) engages in service provision. This is causing government recurrent expenditure as a component of total government expenditure to be rising continuously since 1990 (see ISSER 2013). Stated differently, increasing minimum wages imply rising cost of providing public sector goods, a situation referred to in economic policy literature as Baumol's "Cost Disease" (see Baumol, 1967). The rising cost of providing public goods is

not adequately met by increases in productivity and output. Therefore continues increases in wages without corresponding increases in productivity implies constant fiscal slippages and a reduced pace of economic growth.

Although an argument may be made that in Ghana (for most developing countries), only formal sector employees (both public and private sector) benefit from increases in minimum wages and therefore the effects of minimum wages may not be felt in the entire economy, such an argument is partly flawed by the following points; i) the fact that public sector workers and workers of large enterprises are mostly paid wages that are above the minimum wage may imply wages must induce higher increases in output among such workers, ii) in addition, since such workers normally have relatively larger numbers of dependents, the multiplier effect (hereby referred to as the "*demand-driven multiplier effect of wages"*) of their spending goes "deeper" and "wider" within the economy to eventually affect growth, iii) it is also an undeniable fact that formal sector employees' contribution to growth is more easily quantifiable than those in the informal sector, making a determination of a wage-growth linkage plausible.

Therefore the study investigates the effect of increasing minimum wages on economic growth in Ghana for the period 1984-2013. The economy has generally seen GDP growth over this period and minimum wage has also been trending upwards. Before proceeding to examine the wage-growth linkage, the paper analyses the wage-investment correlation in order to effectively provide evidence of a pass-through effect of minimum wage on economic growth through investment. This will clearly provide a theoretical basis for analysing the wage-growth relationship. To the best of the researcher's knowledge, there is hardly any study on the effect of minimum wage increases on economic growth in Ghana.

The rest of the paper is put into the following sub-sections. The next section discusses the methodology used for the study. The estimation results are presented and discussed in section three. Finally, conclusions and policy recommendations are given in section four.

2. Empirical Strategy Data

To examine the relationships between minimum wage, investment and growth, we first assume that minimum wage affects growth indirectly through investment (could be positive or negative). In view of this, the study first examines the relationship between minimum wage and investment since it potentially affects firm productivity positively through its ability to induce labour productivity and negatively because it can lead to layoff of workers. By this, the study examines the long-run wage-investment relationship using dynamic ordinary least squares (DOLS) approach. If a long-run relationship is established between minimum wage and investment, an appropriate basis will then have been established to examine the wage-growth relationship in Ghana. Hence, the wage-investment relationship is investigated in an equation given below, controlling for interest rate (lending), inflation, and credit to the private sector:

$$GFCF_t = f(M_t, INTRS_t, INF_t, CRED_t) \quad \text{(i)}$$

Where $GFCF_t$ represents Gross Fixed Capital Formation, a proxy for investment, M_t refers to minimum wage, and $INTRS_t, INF_t, CRED_t$, represent lending interest rate, inflation, and credit to the private sector. There is no relationship between wage and investment if the coefficient of the wage variable is zero (0), in which case, there will be no need

considering an investment-pass-through wage-growth relationship. If the coefficient is a non-zero(0), then an appropriate foundation is created for a wage-growth linkage analysis. Here, a positive coefficient on minimum wage implies minimum wage induces labour productivity and hence encourages investment while a negative coefficient implies wage reduces investment through its potential to lead to layoff of workers.

To effectively establish the relationship between minimum wage and economic growth in Ghana, the paper uses four equations specified as follows:

$$\ln Y_t = \alpha_0 + \alpha_1 \ln M_t + \mu_t \quad (1)$$

$$\ln Y_t = \beta_0 + \beta_1 \ln M_t + \beta_2 \ln I_t + \varepsilon_t \quad (2)$$

$$\ln Y_t = \gamma_0 + \gamma_1 \ln M_t + \gamma_2 \ln K_t + \eta_t \quad (3)$$

$$\ln Y_t = \delta_0 + \delta_1 \ln M_t + \delta_2 \ln K_t + \delta_3 \ln CRED_t + \xi_t \quad (4)$$

Where Y_t, M_t, I_t, K_t, and $CRED_t$ represent GDP, minimum wage (given as the daily nominal minimum wage), total investment (sum of private and public investment spending, measured by Gross Fixed Capital formation; GFCF), an interaction term (given as an interaction of minimum wage and investment), and credit to the private sector by banks. The coefficients of M_t, I_t, K_t, and $CRED_t$ in the respective equations are given as α_1, β_1, γ_1, and δ_1 for minimum wage; β_2 for investment; γ_2 and δ_2 for the interaction term; and δ_3 for credit to the private sector by banks respectively. $\ln$ is the natural logarithm operator. The error terms are μ_t, ε_t, η_t, and ξ_t in equations (1), (2), (3) and (4) respectively.

In equation (1), we examine the effect of minimum wage on economic growth. That is, we investigate whether increases in minimum wage lead to economic growth. A positive and statistically significant coefficient of the minimum wage variable indicate minimum wage increases are growth enhancing while a negative and statistically significant coefficient implies they are growth inhibiting.

We add investment as an explanatory variable in equation (2). The idea is to ascertain the individual effects of investment and minimum wage increases on economic growth. Investment here is measured as GFCF which consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. We expect investment spending to be growth enhancing.

The study regresses minimum wage and an interaction term of minimum wage and investment on GDP in equation (3). The interaction term measures the effect of simultaneous changes in minimum wage and investment on growth. In other words, we examine whether the relationship between (or the effect of the variables) minimum wage and economic growth will be different when minimum wage increases solely compared with when minimum wage and investment increase simultaneously. If a positive relationship is found between growth and the interaction term, it implies that, in order for increases in minimum wage to be growth enhancing, they must be met by simultaneous increases in investment spending. This is very necessary since producers will only be willing to support the going wage levels if they come with increases in labour productivity. One way of increasing labour productivity is by increasing capital spending (or investment spending) since such spending may for

instance make better technologies available which improves labour productivity and efficiency. Moreover, the addition of the interaction term greatly increases understanding of the relationships among the variables in the model. Therefore, this study expects a priori, a positive and statistically significant relationship between growth and the interaction term.

Finally, since investment spending can only increase if there is money to spend, we introduce credit to the private sector by banks as a control variable in equation (4). In this case, it will only be possible to determine the unique effect of minimum wage increases on economic growth if the coefficient of CRED is zero (0). The intuition behind this is that, all other things being equal, the greater the share of the credit provided by banks to the private sector in the total bank credit, the greater the potential for private investment to increase. This will eventually lead to growth since such spending is growth enhancing. Therefore, a positive and statistically significant relationship is expected between economic growth and credit to the private sector. It must however be noted that, credit to the private sector may sometimes include credit to state-owned or partially state-owned enterprises.

Annual data on minimum wage is obtained from Wage Indicator Foundation (2015) database while those on all other variables are from the World Bank World Development Indicators (WDI, 2014). The study covers the period 1984-2013.

Cointegration: ARDL Bounds Test

Cointegration is done to investigate the long-run dynamics of the variables in the model. It examines the possibility of a statistically significant relationship between current and future observations of the variables in the series. Testing for cointegration implies avoiding estimating spurious regressions. The economic implication of cointegrated variables is that, such variables move jointly. In other words, they do not deviate from each other over time since any deviation returns to mean. This is a particularly important principle in economics given the nature of time series data.

Cointegration techniques provided by Engel and Granger (1987), Phillips and Ouliaris (1990), Johansen (1991, 1995), Park (1990), Shin (1994) and Stock and Watson (1988) necessitate some degree of pre-testing. This is because, they are associated with uncertainty making it imperative to determine the unit root properties of the variables involved in the equation before moving ahead with the estimation (Pesaran et.al, 2001). Moreover, these methods of investigating long-run levels relationships require the variables involved to be integrated of the same order. In this case, one can determine the short-run relationships between the variables using the first difference representations of each other variable. Therefore, specifying levels stationary variables in first difference to estimate their long-run relationships will result in misspecification error (Enders, 2004).

Unlike the cointegration methods stated above, the Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration can be used to estimate the long-run relationship between variables in a model irrespective of whether the variables are strictly $I(0)$ or $I(1)$ or are jointly cointegrated, provided the variables involved are not $I(2)$ or even more (Pesaran et. al, 2001). The Wald and/or F-statistic are used to test the presence of cointegration. ARDL cointegration analysis is done in an Error Correction (ECM) Model framework. An advantage of using ECM to estimate short run relationship is that, spurious regression is avoided since the first differences of the variables are used where there exist levels

relationships. Moreover, the error correction term provided by the error correction model shows the level of disequilibrium in long-run relationships. That is, they indicate how the dependent variable changes in the face of cointegration. Besides, the ARDL approach is appropriate in a small sample study like this (only 34 observations).

The conditional unrestricted Error Correction Model (ECM) used in the ARDL framework to determine the existence of levels relationships between two variables Y and X is generally specified as follows:

$$\Delta Y_t = \omega_0 + \sum_{i=1}^{z} \omega_1 \Delta Y_{t-i} + \sum_{i=0}^{z} \omega_m \Delta X_{t-i} + \pi_1 Y_{t-1} + \pi_m X_{t-i} + \mu_t \quad (5)$$

Where Y_t is the dependent variable, X_t represents a vector of observations of regressors that are used in equation (5). Δ represents the first difference operator, the number of regressors is given by m, and ε_t represents error term. For the equations estimated in this research, m=1, 2, 2, and 3 for equations (1), (2), (3) and (4) respectively and z=4. Y_{t-1} refers to the first level lag values of the dependent variable and X_{t-i} indicate the lagged values of the regressors. ω_n is the vector of the estimated short-run parameters of the vector of observations of regressors adopted in the equation.

The null hypothesis of the existence of cointegration relationship is tested against the alternative hypothesis of no cointegration relation. Two critical bounds values are provided; the upper bound and the lower bound. The upper bound assumes all the series in the model are *I*(1) while the lower bound consider the series as *I*(0). If the calculated F-statistic lies outside the two bounds, then conclusive statements can be made. Specifically, there is cointegration if the calculated F-statistic is greater than the upper bound critical value and there is no cointegration if the statistic is lower than the lower critical bound. However, if the calculated F-statistic lies within the critical value bounds, then the deductions become inconclusive. In this case, there is a need to determine the order of integration of the variables before any inferences can be made. The implication is that, it may not be necessary to determine the order of integration of the variables when conclusive inferences can be made from the cointegration results obtained. For this reason, the researcher goes ahead to investigate cointegration using the ARDL bounds testing approach and will not determine the order of integration of the variables if cointegration is present in equations (1), (2), (3) and (4).

3. Results and Discussion

Preliminary estimations: Equation (i)

The preliminary test to examine cointegration between minimum wage and investment is given in Table 1. Both the Engle-Granger and Phillips-Ouliaris tau-statistic and z-statistic reject the null hypothesis of no cointegration relationship. This is because both test statistics are significant at 10 percent level. The test is done with one (1) lead and one (1) lag selected using the Schwartz Information Criterion (SIC). Hence, there is indeed a case for a long-run relationship between minimum wage and investment. We therefore provide the estimated long-run results for equation (i) using the DOLS methodology in Table 2.

Table 1: DOLS Test for Cointegration Relationship in Equation (i)

Equation	Engle-Granger		Phillips-Ouliaris	
	tau-statistic	z-statistic	tau statistic	z-statistic
Equation (i)	-4.138005*	-21.53248*	-4.138915*	-21.55930*

Note: H_0: no cointegration; H_1: cointegration.

The results indicate a positive and a statistically significant relationship between minimum wage and investment. The coefficient is significant at 1 percent level of significance. Hence, the long-run results also lend support to the pass-through effect of minimum wage on growth through investment.

Table 2: Estimated Coefficients of Equation (i) using DOLS Approach-Dependent Variable *LOGGFCF*

Regressor	Coefficient
LOGM	1.360221***
	(0.109834)
LOGCRED	-0.078516
	(0.367960)
LOGINTRS	-0.472618*
	(0.262085)
C	10.73906***
	(0.932045)
$R-squared$	0.997272
$Adjusted\ R-squared$	0.994934
Durbin Watson statistic	1.273730

Note: *** (**) (*) indicates that the null hypothesis of no cointegration is rejected at the 1%, 5% and 10% levels of statistical significance.

Having established a correlation between minimum wage and investment, the paper proceeds to discuss the wage-growth linkages. We first discuss the cointegration results below;

Cointegration test results using the ARDL approach

The ARDL bounds test results for cointegration relationship are stated in Table 3. The test statistic clearly indicates (except for equations 3 and 4) the presence of cointegration in the equations estimated. The F-statistic for equations (1) and (2) are greater than their upper bound values at 5 percent level of significance. This shows that, there is cointegration relationship among the variables in the model.

The F-statistic for equations (3) and (4) however lies between the upper and lower value bounds at 5 percent level of significance. This makes the results for the two equations inconclusive. Therefore, as already noted in the methodology, we examine the unit root properties of the variables in equations (3) and (4) to be sure none is *I*(2). Figures 1-4 in the appendix indicate plots of the first differences of these variables. The graphs show that all the variables in equations (3) and (4) are at most first difference stationary. The implication is that, there must be some level of long-run relationship between the variables even though the results do not clearly indicate so. Besides, the fact that there are long-run estimates of the

variables also give evidence of the possibility of a cointegrating relationship existing since testing for cointegration amounts to examining long-run properties.

In addition, further support for cointegration is provided by the error correction terms in the short-run estimates of all the equations. All the error correction terms (ecm[-1]) are negative and statistically significant, also implying that shocks to the equations will only be short-lived. They also indicate moderate speed of adjustment to long-run equilibrium every year after a short-run shock. Specifically, long-run equilibrium will adjust by 20%, 33%, 32% and 30% respectively for equations (1), (2), (3), and (4), every year after a short-run shock. Therefore, there is indeed a valid cointegration relationship in all the estimated equations.

Table 3: ARDL Bounds Test for Cointegration relationship

Equation	1	2	3	4
Test Statistic	6.9313**	9.565120**	4.060535	2.652366

Note: *** (**) (*) indicates that the null hypothesis of no cointegration is rejected at the 1%, 5% and 10% levels of statistical significance.

Despite all the indicators of a possible cointegration relationship alluded to above, the paper adopts the Phillips-Ouliaris and the Engel-Granger cointegration tests within the Dynamic Ordinary Least Squares (DOLS) framework (see Saikkonen, 1992; Stock and Watson, 1993) as a robustness check on the cointegration properties of the variables in equations (3) and (4). Specifically, the Engel-Granger method adopts a parametric Augmented Dickey Fuller (ADF) approach while the Phillips-Ouliaris method uses the nonparametric Phillips-Perron approach. DOLS provides an asymptotically efficient estimator that removes the feedback in the cointegration system. The use of leads and lags in DOLS also makes the derived cointegration error term orthogonal to the entire profile of the stochastic regressor innovations. The cointegration test is simply a unit root test of the residuals of the series. The test assumes that given no cointegration among the variables, all linear combinations of both the dependent and the independent variables are unit root non-stationary. The null hypothesis of no cointegration is examined against the alternative hypothesis of the presence of cointegration. It is similar to testing a null hypothesis of unit root and hence non-stationarity against an alternative hypothesis of no unit root, implying stationarity. The test is done using two (2) lags and one (1) lead. The SIC is adopted for the lag selection and the results are given in Table 4.

Table 4: DOLS Test for Cointegration Relationship

Equation	Engle-Granger		Phillips-Ouliaris	
	tau-statistic	*z*-statistic	*tau* statistic	*z*-statistic
Equation 3	-4.077811**	-21.96785**	-4.021124*	-20.47976*
Equation 4	-4.386400*	-24.18779**	-4.297882*	-20.61192

Note: *** (**) (*) indicates that the null hypothesis of no cointegration is rejected at the 1%, 5% and 10% levels of statistical significance.

The results indicate that for Equation 3, using the Engel-Granger procedure, both the *tau*-statistic and the *z*-statistic (which is the normalized autocorrelation coefficient) reject the null hypothesis of no cointegration at 5 percent level of significance. Therefore, there are

no unit roots in the residuals. The Phillips-Ouliaris *tau*-and *z*-statistics confirm similar results at 10 percent level of significance for Equation 3. In the case of Equation 4, the Engel-Granger *tau*- and *z*-statistics confirm cointegration at 10 and 5 percent levels of significance respectively. The *tau* statistic from the Phillips-Ouliaris procedure indicates cointegration at 10 percent while the *z*-statistic fails to confirm cointegration. Therefore, the results from the robustness check using the DOLS methodology also generally confirm the existence of cointegration.

Results and analysis of long-run relationships

The long-run results of the estimated equations using the ARDL approach are giving in Table 5. The results for equations (1), (2), (3), and (4) are given in columns 2, 3, 4, and 5 respectively.

From the results for equation (1), minimum wage has a positive and statistically significant impact (at 1% level) on economic growth. This may arise from the "output inducement" principle of wage increases as well as the demand-driven multiplier effect of wage increases which are both investment-enhancing. Eventually, national output increases, leading to growth in the long-run.

In equation (2) when investment is added, minimum wage still has a positive and statistically significant (at 1% level) effect on economic growth. However, its impact on growth reduces. The coefficient of the investment variable is also positive and statistically significant at 1% level. This therefore implies an increase in investment spending has a greater potential to be growth enhancing in the long-run than increases in minimum wage. This is because investment spending directly influences labour efficiency and productivity which lead to economic growth. On the other hand, an increase in minimum wage has an indirect effect on economic growth through increased labour productivity and output (which are determinants of investment) following from the *output inducement principle* of wage increases.

As already indicated, we introduce an interaction term (i.e. an interaction of minimum wage and investment) in equation (3). Column four displays the estimated coefficients of equation (3). The coefficient of the interaction term is positive and statistically significant at 1% level. Curiously, the coefficient of the minimum wage variable is now statistically insignificant. What this implies is that, ignoring the interaction between the two variables will mean ignoring an important determinant of economic growth when minimum wage increases. Hence, for increases in minimum wages to cause economic growth, they must be met by simultaneous increases in investment spending. Therefore if policy makers want to stimulate economic growth, then they must create opportunities for investment spending to increase as minimum wage increases. This can be done for instance by ensuring interest rate levels are low. Since investment here is measured by gross fixed capital formation, both public and private investment spending must therefore increase in order to stimulate growth as minimum wage increases. For instance, while private investors spend to import machines and equipment, the government must spend to ensure that its ports are expanded enough to contain the huge flow of cargo. Such combined investment spending met by increases in minimum wage is what is likely to be growth enhancing.

Now, we discuss the results for equation (4) given in column 5. The coefficient of the credit variable (CRED) is positive and statistically significant at 1% level. The coefficient of the interaction term is also positive and statistically significant at 1% level. More importantly, the

results show that when the availability of credit to the private sector by banks is taken into consideration, the "joint" minimum wage-investment variable becomes even more growth enhancing. The implication is that, a simultaneous increase in minimum wages and investment spending can lead to higher levels of economic growth when banks increase their lending to the private sector. This is because private investors are more likely to spend the monies they borrow on investment. Eventually, they will pay their debts and the interest on them with the profit levels that accrue on their investments. Moreover, when credit is available, accessible and less costly, investors can borrow and spend on new machines and equipment and also pay their employees (sometimes) at the going minimum wage. That is capital accumulation and hence increased output is possible and can be easily done when credit is readily available, easily accessible and "affordable".

Table 5: Estimated Long-run Coefficients using the ARDL Approach- Dependent Variable *LOGY*

Regressor	Equation 1	Equation 2	Equation 3	Equation 4
LOGM	1.1413***	0.44562***	0.13274	-1.1799*
	(0.035296)	(0.20128)	(0.33273)	(0.60107)
LOGGFCF	_	0.52104***	_	_
		(0.14937)		
LOGK	_	_	0.42838***	0.96225***
			(0.14233)	(0.25476)
LOGCRED	_	_	_	0.44081***
				(0.17394)
C	13.0083***	8.0837***	9.0641***	3.4106
	(0.51246)	(1.3934)	(1.3588)	(2.5816)

Source: Author
Note: LOGY is the dependent variable. Standard errors are given in parentheses. *** (**) implies the coefficients are significant at 1% (5%) level.

Interestingly, the coefficient of the minimum wage variable becomes negative and statistically significant at 10% level in equation (4). It is however "normal" and "expected". Private investors mostly borrow to either establish or expand their businesses. They hardly borrow to pay "salaries" like governments do. Therefore, if minimum wage increases cause them to borrow to pay wages, then such spending may not be growth enhancing, other things equal. This is because, as already stated, minimum wage increases have a positive but an indirect effect on a company's output (it even takes too long to occur) but an immediately negative effect on the "accounting books" of the investor. Therefore, it will increase the firm's debt profile. The debt position can only be reduced when profit levels increase. The latter can only be achieved with increased output through increased investment spending which increases efficiency and productivity.

It is important to comment on the variations in the minimum wage coefficient form equations (1) to (4). The coefficient of the minimum wage variable reduces from one equation to another, and even turned negative and statistically significant at 10% level in equation (4). The potential for minimum wage to be growth enhancing in the long-run reduced as more and more possible growth enhancing variables were considered. Specifically, unique increases in minimum wages and investment spending are growth enhancing (see Column 3). On the

other hand, minimum wage ceases to have an impact on economic growth in the long run when a simultaneous increase in minimum wage and investment spending is also considered. As expected, minimum wage increases tend to be growth inhibiting when credit to the private sector is introduced as a control variable. One can therefore infer that it will be naïve to consider that increasing minimum wages will lead to economic growth when other growth enhancing variables that are necessary to investors (producers) have not been considered.

Results and analysis of short-run relationships

Table 6 shows the estimated short-run coefficients. The short-run results for equation (1) are not significantly different from those of the long-run therefore the researcher does not discuss them. The short-run results for equation (2) are however different from the long-run. In the short-run, investment does not determine economic growth. This is because the coefficient of the investment variable is not statistically significant. The reason may be that, since capital investments are long-term investments, it will take a longer time for their effects on growth to be felt. Hence, an investor should not expect an "immediate" impact of capital investment on output even though its impact on efficiency and productivity will be felt earlier and faster.

Table 6: Error Correction Representation for the ARDL Model

Regressor	Equation 1	Equation 2	Equation 3	Equation 4
$\Delta LOGY1$	0.54329***	0.52679***	0.49510***	0.24356
	(0.14163)	(0.13085)	(0.13340)	(0.15506)
$\Delta LOGM$	0.22357***	0.14523***	0.042234	-0.057923
	(0.056317)	(0.062162)	(0.10340)	(0.10459)
$\Delta LOGM1$	_	_	_	0.23200**
				(0.079957)
$\Delta LOGM2$	_	_	_	0.18218**
				(0.077581)
$\Delta LOGM3$	_	_	_	0.20305**
				(0.075544)
$\Delta LOGI$	_	0.064950	_	_
		(0.056292)		
$\Delta LOGK$	_	_	0.066301	0.11630*
			(0.056025)	(0.056797)
$\Delta LOGCRED$	_	_	_	0.13220**
				(0.050490)
ΔC	2.5482***	2.6345***	2.8840***	1.0228
	(0.56337)	(0.53123)	(0.56715)	(0.92445)
ecm(-1)	-0.19589***	-0.32590***	-0.31818***	-0.29990***
R-Bar Squared	0.54071	0.61655	0.61828	0.71394
F-statistic	10.8107***	11.2995***	11.3732***	9.0492***
DW statistic	2.2153	2.0331	1.9450	2.2976

Source: Author

Note: $\Delta LOGY$ is the dependent variable. Standard errors are given in parentheses. *** (**) implies the coefficients are significant at 1% (5%) level.

The coefficients of the interaction term and the minimum wage variable are not statistically significant in the short-run in equation (3). The interaction term is probably insignificant because it requires a period longer than the short-run to affect growth. However, the coefficient of the lagged dependent variable is positive and statistically significant at 1% level implying previous levels of economic growth enhance current levels of growth in the short-run. This may probably be due to the fact that elements that stimulated growth in the

one period lag may still be "alive, relevant and powerful" to enhance growth at least in the short-run.

For equation (4), the first, second and third period lags of the minimum wage are all positive and statistically significant at 5% level. Therefore, previous levels increases in minimum wage are growth enhancing, at least in the short-run. This may be explained by the fact that previous levels of positive attitudes to work may still be strong enough to cause current output to increase in the short-run, leading to economic growth. It is also not surprising that the coefficient of the interaction term (K), although positive, is only statistically significant at 10% level, given the same reason stated earlier for the situation in equation. However, unlike the earlier situation (the results for equation [3]), K may be growth enhancing in this case due to the availability of credit. This is explained by the positive and statistically significant short-run coefficient of the credit variable in equation (4)

Model diagnostics and Stability test results

The diagnostic test results indicate the absence of serial correlation and heteroscedasticity in all equations. The residuals of all the equations are normally distributed and there is no evidence of functional form misspecification in any of the equations. Besides, the CUSUM and CUSUMSQ diagrams (not provided) indicate there is no structural shift in any of the equations. Therefore, the coefficients are consistent and the equations are stable and reliable. In addition, statistically speaking, adding the interaction term increases the R-Bar squared in equations (3) and (4). This improves the adequacy and fitness of the ARDL model used which is statistically important. Serial correlation and heteroscedasticity were examined using Langrage multiplier test and a regression of squared residuals on squared fitted values respectively, while normality and functional form were respectively determined using Ramsey's RESET test and skewness and kurtosis of residuals. The results of the model diagnostics and stability tests are given in Table 7.

Table 7: Model Diagnostics and Stability Tests

Test Statistic	Equation 1	Equation 2	Equation 3	Equation 4
Serial Correlation	0.61471	0.026190	0.023269	0.96933
	(0.433)	(0.871)	(0.879)	(0.325)
Functional Form	0.69130	0.24058	1.1801	0.41986
	(0.406)	(0.624)	(0.277)	(0.517)
Normality	2.3176	1.4160	1.3263	0.22139
	(0.314)	(0.493)	(0.515)	(0.895)
Heteroscedasticity	0.065928	0.46250	0.43285	1.6843
	(0.797)	(0.496)	(0.511)	(0.194)
CUSUM	Stable	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable	Stable

4. Conclusion and Policy recommendations

The paper investigates the effect of minimum wage increases on economic growth in Ghana for the period 1984-2013. The ARDL approach in an ECM framework is used. A theoretical basis for examining the wage-growth linkage is established following the successful determination of a long-run wage-investment relationship, using the DOLS approach. The results from the simple regression of minimum wage on economic growth in equation (1)

indicate that there is a positive and a statistically significant impact of minimum wage increases on economic growth both in the long- and short-run. Although it implies that minimum wage increases stimulate growth, it will be naïve to conclude straight away that increases in minimum wage will stimulate growth. This is because, the degree of influence of minimum wage increases on economic growth reduces when other variables such as a simultaneous increase in minimum wages and investment spending, and credit to the private sector by firms are controlled for.

Moreover, minimum wage increases do not have any effect on economic growth in equation (3) in both the long- and short-run and tends to reduce growth in the long-run in equation (4). The implication is that, for increases in minimum wage to stimulate growth, they must be met by simultaneous increases in investment spending. This can only be possible if banks and other financial institutions increase the amount of credit they offer the private sector. Increased credit to the private sector will ensure they expand their investments and employ current technologies in order to increase labour efficiency, productivity and output. This will stimulate growth. In addition, the profit levels of firms will increase, enabling them pay labour at the existing wage rate.

To encourage private sector lending, the government must borrow less from banks and financial institutions. This is because government borrowing "crowds-out" private sector investments. Moreover, the high interest rate levels which increase the cost of private sector borrowing will reduce when the government borrows less from banks and other financial institutions. Therefore, to ensure that the economy benefits positively from the rising minimum wage, there must be deliberate and sustained policies to make credit readily available, easily accessible and "affordable" to finance private sector investment.

In addition, policy makers must formulate policies that encourage the use of modern technologies in production. This may include low import tariffs on the importation of machines and equipment. Another policy may possibly be tax exemptions or holidays for a period of time (say a few months) for firms that are able to bring in expensive but modern technologies to expand their production. Finally, the government must ensure that the ratio of public investment to tax revenue increases as minimum wage increases as such complementary changes are more likely to be growth enhancing.

REFERENCES

Asteriou D. and Hall G.S. (2011) *Applied Econometrics*. 2nd Edition, Palgrave Macmillan.

Baumol W. (1967) "Productivity Growth, Convergence and Welfare". *American Economic Review*, 76. pp. 1072-85.

Card D. and Krueger A.B. (1995) *Myth and Measurement; the Economics of the Minimum Wage*. Princeton University Press: Princeton.

Clemens, J., and Wither, M. (2014) "The Minimum Wage and the Great Recession: Evidence of Effects on the Employment and Income Trajectories of Low-Skilled Workers". (No. w20724), National Bureau of Economic Research.

Cukierman A., Rama M., and Ours J.V. (2001) "Long-run Growth, the Minimum Wage and other Labor Market Institutions". Centre for Economic Research, Tilburg University.

Dube A. (2013) "Minimum Wages and Aggregate Job Growth: Causal Effect or Statistical Abstract". IZA DP No. 7674.

Enders W. (2004) *Applied Econometric Time Series*. Second ed. Wiley, New York.

Engle R. F., and Granger C. W. (1987) "Co-integration and Error Correction: Representation, Estimation, and Testing". *Econometrica: journal of the Econometric Society*. pp. 251-276.

Fanti L., and Gori L. (2011) "On Economic Growth and Minimum Wages". *Munich Personal RePec Archive*, MPRA Paper No. 25842.

Freeman R.B. (2000) "Single Peaked vs. Diversified Capitalism: The Relation Between Economic Institutions and Outcomes". NBER Working Paper 7556.

Garrett, G. (2001) "Globalization and Government Spending around the World". *Studies in Comparative International Development*, 35(4). pp. 3-29.

ISSER (2013) *Policies and Options for Ghana's Economic Development*. Legon: Institute of Statistical, Social and Economic Research, University of Ghana.

Johansen S. (1995) "Likelihood-based Inference in Cointegrated Vector Autoregressive Models". OUP Catalogue.

Johansen S. and Juselius, K. (1990) "Maximum Likelihood Estimation and Inferences on Cointegration—with Applications to the Demand for Money". *Oxford Bulletin of Economics and Statistics*, 52. pp. 169–210.

Johansen, S. (1991) "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models". *Econometrica: Journal of the Econometric Society*. pp. 1551-1580.

Lemos S. (2004) "The Effect of the Minimum Wages on Prices". IZA DP No. 1072.

Lustig N. and McLeod D. (1996) "Minimum Wages and Poverty in Developing Countries: Some Empirical Evidence". Brookings Discussion Papers in International Economics, No.125.

Magruder, J. R. (2013) "Can Minimum Wages Cause a Big Push? Evidence from Indonesia". *Journal of Development Economics*, 100(1). pp. 48-62.

Neumark D. (2014) "Employment Effects of Minimum Wages". IZA World of Labor 2014:6.

Ofori-Abebrese, G. (2012) "A Co-Integration Analysis of Growth in Government Expenditure in Ghana". *Journal of African Development*, 14(1). pp. 47-61.

Park J.Y. (1990) "Testing for Unit Root and Cointegration by Variable Addition". *Advances in Econometrics*, 8. pp. 107-133.

Pesaran M. H., Shin, Y., and Smith, R. J. (2001) "Bounds Testing Approaches to the Analysis of Level Relationships". *Journal of Applied Econometrics*, 16(February 1999). pp. 289–326.

Phillips P. C. B., and Ouliaris S. (1990) "Asymptotic Properties of Residual based Tests for Cointegration". *Econometrica: Journal of the Econometric Society,* pp. 165-193.

Phillips P.C.B. and Ouliaris S. (1988) "Testing for Cointegration Using Principal Components Methods". *Journal of Economic Dynamics and Control*, 12, 205-230.

Sabia J.J. (2014) "Minimum Wages: A Poor Way to Reduce Poverty". CATO Institute, Tax and Budget Bulletin. No. 70.

Saikkonen P. (1992) "Estimation and Testing of Cointegrated Systems by an Autoregressive Approximation'. *Econometric Theory*, 8, 1-27.

Shin Y. (1994) "A Residual-based Test of the Null of Cointegration against the Alternative of No Cointegration". *Econometric Theory*, 10(01). pp. 91-115.

Stock J.H. and Watson M.W. (1988) "Testing for Common Trends". *Journal of the American Statistical Association*, 83 pp. 1097-1107.

Stock, J. H., and Watson, M. W. (1993) "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems". *Econometrica: Journal of the Econometric Society*, 783-820.

Taylor J. and Selgin G. (1999) "By our Bootstraps: Origins and Effects of the High-Wage Doctrine and the Minimum Wage". *Journal of Labour Research, Springer*, Vol. 20(4). pp. 447-462.

Vuillemey G. (2008) "The Economic Effects of the Minimum Wage". *IEM's Economic Note*, pp. 1-4.

WageIndicator Foundation (www.africapay.org), Accessed January 10, 2015.

Watanabe M. (2013) "Minimum Wage, Public Investment, Economic Growth". *Theoretical Economic Letters*, 2013, 3. pp. 288-291.

World Bank (2014). World Development Indicators, Washington, DC: World Bank.

APPENDIX

Figures 1-4: Graphs of First Differences of the Variables in Equation 4

Figure 1: DLM

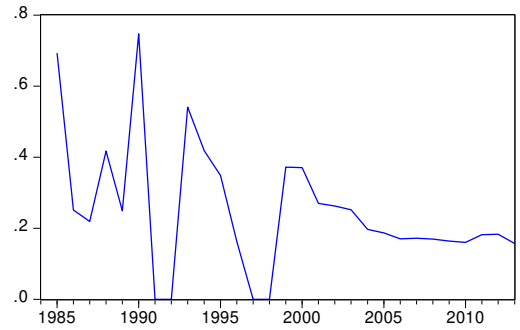

Figure 2: DLNCRED

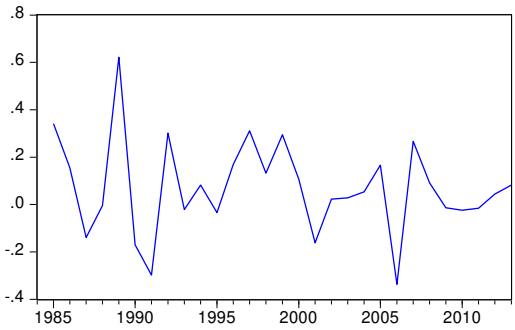

Figure 3: DLNK

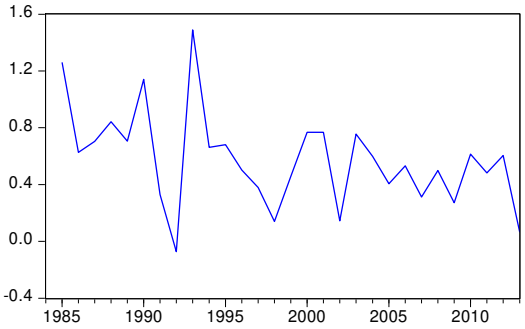

Figure 4: DLNY