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Abstract: This paper examines the relationship and the direction of causality between average sectoral earnings and minimum wages in Malawi using annual formal employment data between 1968 and 1995. The policy of imposing minimum wages in Malawi was inherited from the colonial administration at independence in 1964, but culminated in national wages policy in 1969 and a wages restraint policy in 1971. However, changes in the nominal statutory minimum wages have been erratic and *ad hoc*, with only eight changes between 1965 and 1992. Using cointegration analysis, this study establishes the existence of a long-run relationship between real average sectoral earnings in the formal labour market and real statutory minimum wages. The results suggest the existence of a long-run relationship between real average earnings and real minimum wages in the formal labour market and in four of the eight sectors of the economy. We also find strong evidence that real minimum wages unidirectionally Granger-cause real average earnings in Malawi.

Key words: Labour Market; Average Earnings; Minimum Wages; Employment Policies

JEL Classification: E24, J23, J42

1. Introduction

Minimum wages laws are one of the labour market institutions and regulations that have been blamed for labour market inflexibility in most developing countries (see Agenor, 1996; ILO, 1996). The main contention is that minimum wages in developing countries are set at higher levels than what would obtain if forces of demand and supply were freely to operate in the labour markets. Under competitive labour market conditions, minimum wages will reduce employment but will increase average earnings of those in employment. However, under monopolistic market conditions, minimum wages tend to increase both employment and average earnings. Minimum wages in Malawi were introduced in the pre-independence period through the Regulation of Minimum Wages and Conditions of Employment Act of 1958. The policy of imposing minimum wages in the formal labour market was inherited at independence in 1964 and has been maintained to date.

The main objective of this study is to consider the possible existence of a long-run relationship and the direction of causality between real average earnings and real statutory minimum wages in various sectors of the economy. The rest of the paper is organized as follows. Section 2 reviews the policy developments in the regulation of wages in Malawi. In section 3, we delve into

the theoretical insights of the relationship between average earnings and minimum wages. Section 4 describes the methods of analysis and the data used in the analysis. In section 5, we present empirical results on long-run relationships and Granger-causality between earnings and minimum wages. Finally, section 6 provides concluding remarks.

2. Minimum Wages Policies and Reforms in Malawi

The regulation of earnings in the formal labour market in Malawi dates back to the pre-independence era. The Regulation of Minimum Wages and Conditions of Employment Act of 1958 provided institutional mechanisms for review, assessment and regulation of minimum wages through the establishment of the Wage Advisory Board for general unskilled workers and industry-specific Wages Advisory Councils for semi-skilled workers. Accordingly, the Wage Advisory Board and six Wages Advisory Councils were established and existed for many years. These institutional arrangements were inherited at independence in 1964. However, as Bose and Livingstone (1993) note, these institutions were very ineffective and often the government made changes to the minimum wage without consulting the Board and Councils.

Within a few years of independence, against the background of the statutory minimum wage, Malawi introduced the National Wages and Salaries Policy in 1969. The main objectives of the policy were to contain wages for unskilled and semi-skilled workers in order to encourage labour absorption and create paid employment opportunities in industrial and agricultural estates; and to restrain domestic inflation in order to stabilize labour costs and maintain international competitiveness (Bose and Livingstone, 1993). In addition, the policy also aimed at containing the income differentials between the modern wage earning (largely urban) sector and poorer rural sector. In the 1960s, the average income for Malawian households in urban areas was five times the cash incomes of rural households. In a way, the containment of the rural-urban income gap also served as a policy of mitigating the massive rural-urban migration.

The National Wages and Salaries Policy stipulated some guidelines for the determination of wages and salaries in the formal sector. First, the government would take the lead in stabilizing wage costs by adjusting wage rates and salaries selectively to attract scarce skills and encourage the acquisition of experience through continuity of service. Secondly, in the private sector the

government would only accept general wage increases if and only if matched by increases in labour productivity. Thirdly, the minimum wage would be maintained at 1969 levels as the main incentive to employers to increase the volume of paid employment, while scarce skills and experience would be awarded by significant wage differentials.

The provisions of the National Wages and Salaries Policy were enhanced by the introduction of the Wage Restraint Policy in 1971. The Wages Restraint Policy requires the employers to seek approval from Wages and Salary Restraint Committee of the Minister of Labour and Manpower Development for salary increases in excess of 5 percent per year. Others have argued that by 1972, the Wages Restraint Policy successfully led to increases in formal employment and minimised inflation and rural-urban income differentials (Banda et al., 1996).

There are several problems in implementing minimum wages laws in a developing country like Malawi. First, minimum wages cover formal employment which is just about 12 percent of the total labour force. Secondly, minimum wages are not enforceable and employers that pay employees below the minimum wage are not penalized for violating the minimum wage regulation. Many employers pay unskilled labour far below the statutory minimum wage. Thirdly, government's inflexibility in adjusting minimum wages to changing economic conditions implies that the real incomes of the unskilled employees has fallen over time. Minimum wage adjustments have been very infrequent, and with increases in the price level has meant that real wages have fallen substantially in Malawi. For instance, between 1965 and 1992 minimum wages were reviewed 9 times with a maximum of 7 years interval (see Bose and Livingstone, 1993). Fourthly, the problem of infrequent adjustment is in part due to the weak institutional mechanisms for reviewing and setting wages. Bose and Livingstone (1993) conclude that the regulatory mechanism provided in the form of the Wages Advisory Board and Wages Advisory Council has been virtually inactive and ineffective, with employer representatives having more influence in the board and councils.

The other major problem in the institutional mechanism was the extreme weakness of trade unions prior to 1992. While the employers organization, the Employers' Consultative Association of Malawi (ECAM) was more organized, well equipped and more consultative among its members, the Trade Union Congress of Malawi (TUCM) was very weak and informally affiliated to the

ruling political party (Chirwa, 1999). In 1991 only about 11.5 percent of labour in the formal sector was unionized with only five industry specific trade unions affiliated to the Trade Union Congress of Malawi. The weakness in employees organizations implied the lack of balance of power between employers and employees.

Changes in labour relations in Malawi were a by-product of political reforms in 1992 which focused on democracy and freedom of speech. Arguably, structural adjustment programs implemented in Malawi since 1981 were not designed to remove distortions in the labour markets. The 1990s witnessed a major change in labour relations and policy after the political-cum-labour riots in major urban centres in Malawi (see Newell, 1995). The unfair distribution of wealth and the payment to labour services were among the central issues that justified the need for political change in Malawi in 1992 (Catholic Bishops, 1992). Reforms in the labour market policies have been in the form of reviewing the basis for minimum wage fixing from static and *ad hoc* reviews to wage indexation. The new policy implies that minimum wage reviews are necessary when either the cumulative change in retail price index reaches 20 percent or at least every two years.

The government has also been encouraging collective bargaining through the promotion and strengthening of trade unions and employers' organizations since 1992. The trade union movement was given impetus within democratic reforms. A new Labour Relations Act of 1996 replacing the Trade Unions Act and The Trade Disputes (Arbitration and Settlement) Act became operational by the end of 1997. The new Industrial Relations Act of 1996 also provides for the establishment of an Industrial Relations Court which will have jurisdiction over all labour disputes not resolved through conciliation. Following the changes in labour relations the Trade Union Congress of Malawi has been revitalized and some thirteen trade unions were affiliated by 1998 (NEC, 1998). The government with the assistance of the International Labour Organization is drafting a new Employment Act that is intended to regulate individual employee-employer relations.

3. The Theoretical Relationship Between Earnings and Minimum Wages

The orthodox view is that institutional interventions in labour market such as job security regulations, social security contributions, minimum wage laws, unemployment benefits and trade unions are distortions in otherwise perfectly functioning competitive markets. The immediate impact of these distortions is to raise the cost of labour in the formal sector and therefore reduce labour demand, exacerbate inequalities between formal and informal sectors, impede adjustment to economic shocks by reducing employment and wage flexibility (ILO, 1996). However, this orthodox view has been a subject of considerable debate, with other authors raising doubts about the existence of excessively high and discretionary regulations in the labour markets of developing countries and advance broader benefits of market regulations.[1] For instance, others stress that labour market institutions and policies help to reduce poverty, improve productivity and foster economic growth, and thus enhance social welfare in developing countries. The available evidence does suggest that minimum wages in developing countries are set at relatively low levels and lax enforcement and incomplete coverage characterize minimum wage regulations. ILO (1996) indicates that the level of minimum wages was as low as 33 percent of the average wage in Chile, Argentina, Mexico and Korea, and ranged from 61.7 percent to 75.8 percent in Thailand. Agenor (1996) notes that minimum wages in most developing countries increased less rapidly than average wages or income per capita and have declined in real terms in many countries, particularly in Africa and Latin America.

Theoretically, the effects of minimum wages on average earnings and employment depend on the structure of labour markets. In competitive labour markets, an effective minimum wage - that is set above the market clearing wage rate, reduces the quantity of labour demanded and hence lead to unemployment but increases the earnings of those in employment. On this basis, proponents of the free labour market mechanism argue that minimum wages in developing countries are set too high relative to average income and other wages in the economy, thus raising production costs in the formal sector and discouraging employment (see Brown et al., 1982; Agenor, 1996). However, empirical work does not show equivocal support for this conventional wisdom.

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[1] See Agenor (1996) and ILO (1996) for a review of the relative importance of labour market institutions and regulations.

Others such as Dickens et al. (1995) present a model in which the labour market is imperfect and labour is immobile such that employers have some monopsony power. Their model demonstrate that in monopsonistic labour markets minimum wages raise average wages and increase employment when the marginal revenue product of labour is above the minimum wage, in the unconstrained and supply-constrained regimes. However, in the demand-constrained regime, in which the firm's marginal revenue product of labour is sufficiently low such that it can not profitably employ all the workers at the proposed minimum wage, the effect on employment will depend on the productivity of firms. Employment would be higher for most productive firms, but will be lower for least productive firms. The heterogeneity among firms means that an increase in minimum wages will reduce employment in some firms and increase employment in others (Dickens et al., 1995). In all the regimes of monopolistic labour markets, minimum wages will tend to increase the earnings.

The empirical evidence on the earnings and employment effects of minimum wages is rather mixed (see Brown et al. (1982) for a review). Recent studies of the employment effects of minimum wages mostly do not support the competitive market prediction of a negative relationship. In a study of the fast food industry in New Jersey and Pennsylvania, Card and Krueger (1994) find no evidence that the rise in minimum wages reduced employment but find evidence that the increase in minimum wages increased employment. Machin and Manning (1994) find that the toughness of the minimum wage regulation imposed by the Wage Councils in UK declined in the 1980s and this change contributed to the rising wage inequalities, while they find no evidence that an increase in adult employment resulted from a decline in the effectiveness of the Wage Councils. Dickens et al. (1995) find strong evidence of a positive effect of minimum wages on average earnings in UK agriculture and no evidence of a significant effect on employment. Tiffin and Dawson (1996) in a cointegration analysis find a long-run positive relationship between real average earnings and real minimum wages, but causality tests show that changes in minimum wages do not affect earnings while real average earnings cause real minimum wages. Dickens et al. (1999) find strong evidence that minimum wages had compressed the distribution of earnings and no evidence on their negative impact on employment in Great Britain. Jones (1998) finds a significant and negative effect of the minimum wage on formal sector employment in a study of the labour market in Ghana.

4. Methodology and Data

We investigate the existence of the relationship between sectoral earnings and minimum wages using cointegration analysis. The cointegration approach measures whether two or more time series are integrated in the long run by assessing whether the series have a common stochastic trend. Suppose we have two time series represented in the following relationship:

$$x_{1t} = \alpha_0 + \alpha_1 x_{2t} + \varepsilon_t \qquad (1)$$

where x_{1t} are the average sectoral earnings in period *t*, x_{2t} is the statutory minimum wage in period *t* and ε_t is the error term. If the two series are nonstationary but their linear combination produces a stationary series, then the series are cointegrated of order (1,1) with a cointegration parameter α_1, and equation (1) is the 'cointegrating regression'. Time series generated by a stochastic process is stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which we compute the covariance (Gujarati, 1995). If the series are nonstationary and not cointegrated of the same order, ordinary least squares regression on equation (1) are spurious. Several tests exist that are used to test the stationarity of time series including the Weighted Symmetric (WS) test (Pantula, 1994), the Dickey-Fuller (DF) or Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and Phillips-Perron (PP) test (Phillips and Perron, 1988).[2]

The literature suggests two main approaches to testing the existence of a cointegrating relationship between time series. First, Engle and Granger (1987) propose a two-step procedure to test for cointegration using the Dickey-Fuller or the Augmented Dickey-Fuller test. Two series are cointegrated of order (1,1) if the individual series are *I(1)*, and a linear combination of them, called the cointegration regression is *I(0)*. The first step is to obtain ordinary least squares (OLS) estimates of the 'cointegrating regression' in (1). The second step is to obtain residuals from the cointegrating regression and test them for stationarity using the Dickey-Fuller test by estimating the following relationship:

[2] See Enders (1995) and Hall (1995) for details.

$$\Delta\varepsilon_t = \beta + \delta\ \varepsilon_{t-1} + \sum_{i=1}^{m} \gamma_i\ \Delta\varepsilon_{t-i} \qquad (2)$$

The null hypothesis of a unit root or non-stationarity is $\delta = 0$. Rejection of this null hypothesis indicates that the two series are cointegrated. The problems with the Engle-Granger two-step procedure for cointegration are well known in the literature (see Enders, 1995). For instance, even in the two variable case, the test is sensitive to the order of the variables in small samples.

The second and more powerful test of cointegration is the maximum likelihood procedure of Johansen (1988) which relies on the relationship between the rank of a matrix and its characteristic roots. The Johansen (Trace) test detects the number of cointegrating vectors that exists between two or more integrated time series. The Johansen procedure can be used to test for the presence of a cointegrating vector between average sectoral earnings and statutory minimum wages if they are integrated of the same order. The procedure is based on maximum likelihood estimation of the error correction model and each two-variable system is modelled as a vector autoregression (VAR):

$$\Delta x_t = \mu + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \Pi x_{t-k} + \varepsilon_t \qquad (3)$$

where x_t is a matrix containing the series of interest, Γ and Π are the matrices of parameters, k is adequately large both to capture the short-run dynamics of the underlying VAR and to produce normally distributed white noise residuals and ε_t is a vector of white noise errors. The Johansen methodology involves testing whether the Π matrix in (3) has less than full rank.

The analysis of cointegration allows us to say something about causality. The Granger Representation Theorem states that if the series are integrated of the same order and are cointegrated, then there exist a long-run relationship among them, and the appropriate dynamic form of the model is an Error Correction Mechanism (ECM) (Engle and Granger, 1987). We specify the following error correction models to test causality between average earnings and minimum wages

$$\Delta x_{1t} = \mu_1 + \lambda_1 ECT_{(t-1)} + \sum_{i=1}^{k-1} \phi_i \Delta x_{1(t-i)} + \sum_{i=1}^{k-1} \eta_i \Delta x_{2(t-i)} + \varepsilon_{1t} \qquad (4a)$$

$$\Delta x_{2t} = \mu_2 + \lambda_2 ECT_{(t-1)} + \sum_{i=1}^{k-1} \phi_i \Delta x_{2(t-i)} + \sum_{i=1}^{k-1} \eta_i \Delta x_{1(t-i)} + \varepsilon_{2t} \quad (4b)$$

where k is the number of lags determined by the use of a suitable information criterion, *ECT* is the error-correction term - residuals from a cointegrating vector, x_1 are minimum wages, x_2 are average sectoral earnings and Δ is the difference operator. Rejection of the null hypothesis that $\eta_i = 0$ for $i = 1,2, ..., k-1$ and $\lambda_1 = 0$ in equation (4a) indicates that average sectoral earnings Granger-cause minimum wages. Similarly, rejection of the null hypothesis that $\eta_i = 0$ for $i = 1,2, ..., k-1$ and $\lambda_2 = 0$ in equation (4b) indicates that minimum wages Granger-cause average sectoral earnings. If both hypotheses are rejected, then the average earnings and minimum wages are determined simultaneously, and there is a feedback relationship. The sign and size of the coefficient of the lagged error-correction term reflects the direction and speed of adjustment in the dependent variable to temporary deviations from the long-run equilibrium relationship.

The annual data used in the empirical analysis relate to average monthly earnings in formal sector employment by economic activities and statutory minimum wages in Malawi from 1968 to 1995. Data on nominal earnings, statutory minimum wages and the consumer price index (CPI) were obtained from various issues of the *Financial and Economic Review* published by the Reserve Bank of Malawi and from the *Year Book of Labour Statistics* published by the International Labour Organization (1997). All nominal earnings and wages are converted to real values at 1980 prices using the CPI, and we investigate the existence of long-run relationships between real average sectoral earnings and real statutory minimum wages. Table 1 present definition of variables and descriptive statistics of the data. Overall, real earnings in the formal labour market in Malawi averaged MK41.47, ranging from MK11.35 to MK70.48. Real average monthly earnings are highest in the financial and business services sector and lowest in the agriculture sector. Closer inspection shows that the minimum wage is binding in the agriculture sector, supporting the observation by Bose and Livingstone (1993).

[Table 1 about here]

The trend in real earnings and minimum wages are shown in Figure 1 (a) and (b) in the appendix. The figures show a downward trend in real earnings over time. Real earnings in the financial and business services sector were much higher in the early 1970s, and were declining at a faster rate

but somehow stabilized since 1975. It is also clear from the figures that the real minimum wage is binding for the agriculture sector, with real average earnings falling below real statutory minimum wages. In 1993, the government increased the nominal minimum wage by 361 percent leading to a real increase of 275 percent. This adjustment meant that the minimum wage became binding for other sectors between 1993 and 1995.

5. Empirical Results

Unit root tests were performed on all the variables in natural logarithms both in levels and in first difference. We use three alternative tests: Weighted Symmetric (WS) test, Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. We reject the null hypothesis of a unit root if at least two of the tests suggest stationarity. Table 2 report results of unit root tests and show that for all the variables we cannot reject the null hypothesis of a unit root in logarithmic levels. The variables are nonstationary in levels. We differenced the series once, and the null hypothesis of a unit root in the first difference cannot be rejected only for LCPEP, which is integrated of order 2. At least two of the tests on the rest of the variables reject the null hypothesis, and we therefore conclude that the rest of the variables are integrated of order 1, *I(1)*. We exclude LCPEP from the cointegration analysis.

[Table 2 about here]

We report results of the Engle-Granger two-step and the Johansen maximum likelihood procedure for a cointegrating relationship in Table 3. We performed the Engle-Granger two-step procedure using both orders, and the reported Engle-Granger test is based on the cointegrating regression of minimum wages on average sectoral earnings. The results show that all real average sectoral earnings have a long-run relationship with the real minimum wages at 5 percent (and most at 1 percent) significance level. However, the cointegration tests based on the regression of average sectoral earnings on minimum wages obtained opposite results and the null hypotheses of non-existence of cointegration relationships could not be rejected for all the series. We then used the more powerful Johansen maximum likelihood procedure, that is not sensitive to the order of the variables in a cointegrating regression, to reinforce the conclusions from the Engle-Granger two-step procedure.

[Table 3 about here]

The Johansen (Trace) statistics shows that five of the nine relationships have one cointegrating vector at 5 percent significant level. We therefore accept the null hypothesis of the absence of a long-run relationship between real earnings and real minimum wages in the agriculture sector, mining and quarrying sector, building and construction sector and the transport and communications sector. Long-run equilibrium relationships between real earnings and real wages exist the formal labour market in general, but also in specific sectors including manufacturing, electricity and water, wholesale-retail and hotels, and financial and business services. In all significant cointegrating vectors, we find a positive relationship between real average earnings and minimum wages but there are wide variations in the elasticities ranging from 46.6 percent in the manufacturing sector, 86.7 percent for the formal labour market, 136.7 percent in the mainly public electricity and water sector, 168.5 percent in the wholesale, retail and hotel sector, and 308.8 percent in the financial and business services sector.

Table 4 report results of the error correction models and vector autoregressions for Granger causality tests. Except in two cases, we find strong evidence of Granger-causality running from real statutory minimum wages to real average sectoral earnings at 5 percent level. These results support the theoretical predictions of a positive relationship and causality between average earnings and minimum wages. We find a feedback relationship only in the financial and business services sector. Granger causality is rejected for the agriculture and minimg and quarrying sectors. The coefficient of the error correction term in the cointegrating relationships is statistically significant at 5 percent level only in formal sector employment and financial and business services sector and takes a positive sign in both cases. These results show that positive deviations from the long-run equilibrium are corrected by increases in real average earnings. The coefficients of ECT is small, implying slow adjustment toward long-run equilibrium. The causality from minimum wages to real earnings reinforce the results of other empirical studies such as Dickens et al. (1995) in UK agriculture, but is in contrast to Tiffin and Dawson (1996) who find causality from earnings to wages in UK agriculture.

[Table 4 about here]

6. Concluding Remarks

This paper set out to determine the possible existence of long-run relationships between average sectoral earnings and statutory wages in real terms using sectoral data from the formal labour market in Malawi. Our results show evidence of the existence of long-run relationships between real earnings and real minimum wages in the formal labour market and in four of the eight economic sectors. In particular, the existence of one cointegrating vector could not be rejected in the formal labour market in general, the manufacturing sector, the electricity and water sector, the wholesale, retail and hotels sector, and the financial and business services sector. In all these cases, we find strong support for the positive relationship between real average earnings and real statutory minimum wages with elasticities ranging from 46.6 percent in the manufacturing sector to 308.8 percent in the financial and business services sector. The results also indicate strong evidence that real minimum wages unidirectionally Granger-cause real average earnings in various sectors in the formal labour market, except in the financial and business services sector in which there exist a feedback effect.

These results impinge on the policy implications of maintaining minimum wage regulations in the formal sector. First, the results suggest that minimum wages have the potential for enhancing the real incomes of the labour force, and the infrequent review of nominal minimum wages adversely affected the earnings of those in formal employment. Secondly, while the labour market average earnings in general tend to respond positively to real minimum wages, the sectoral variations imply that a uniform minimum wage level for all industries might not be appropriate if the policy intention is to safeguard the earnings of unskilled workers especially in sectors that mainly employ unskilled workers such as agriculture, building and construction and transport and communications. While the study shed some light on the relationship between earnings and minimum wages, further research is necessary to investigate the impact of minimum wages on formal sector employment after controlling for other factors such as productivity in various sectors of the economy.

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Figure 1(a) Trends in Real Earnings and Real Minimum Wages by Sector, 1968 - 1995 (Malawi Kwacha)

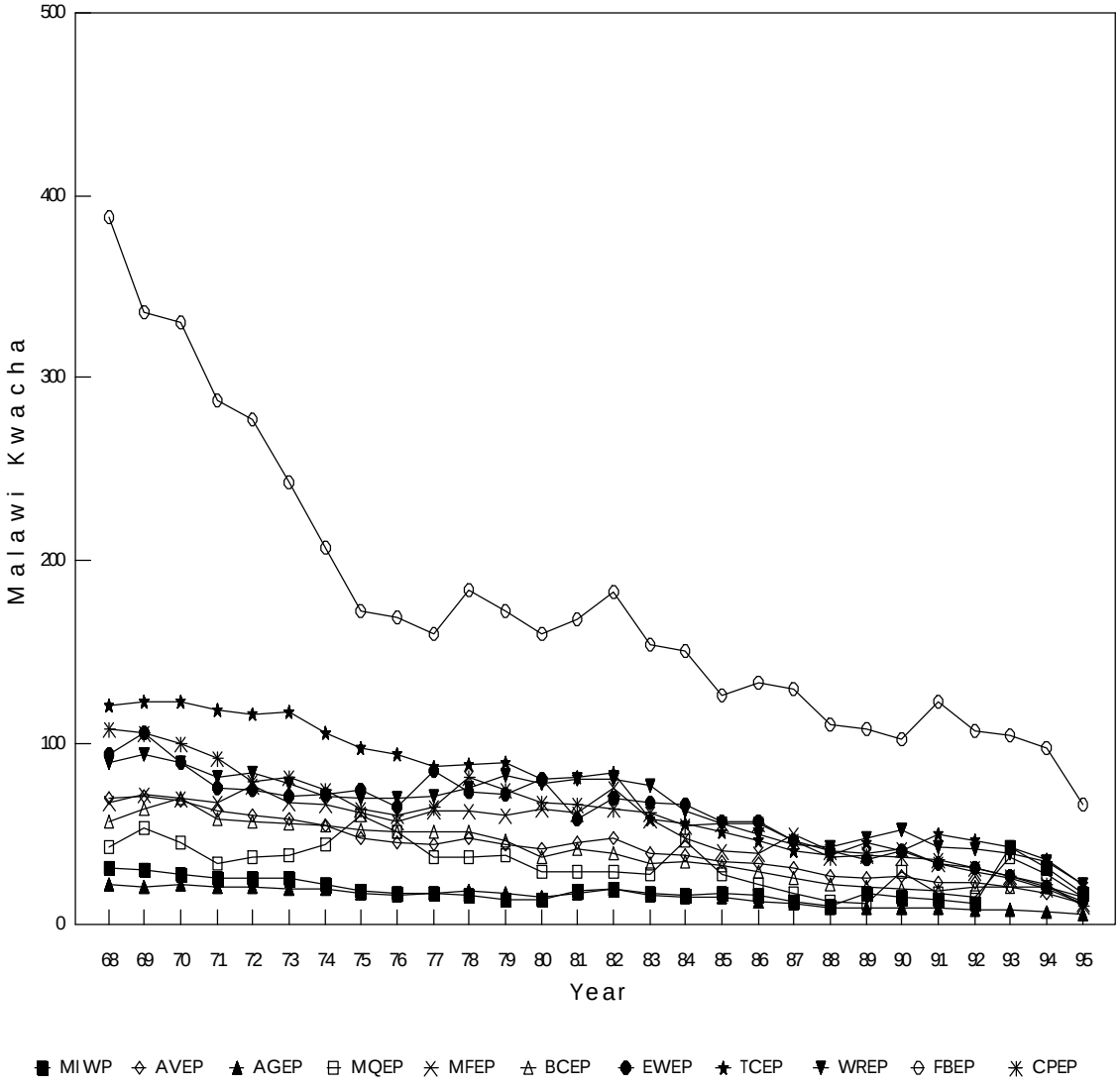

Figure 1(b) Trends in the Natural Logarithm of Real Earnings and Real Minimum Wages by sector 1968 - 1995

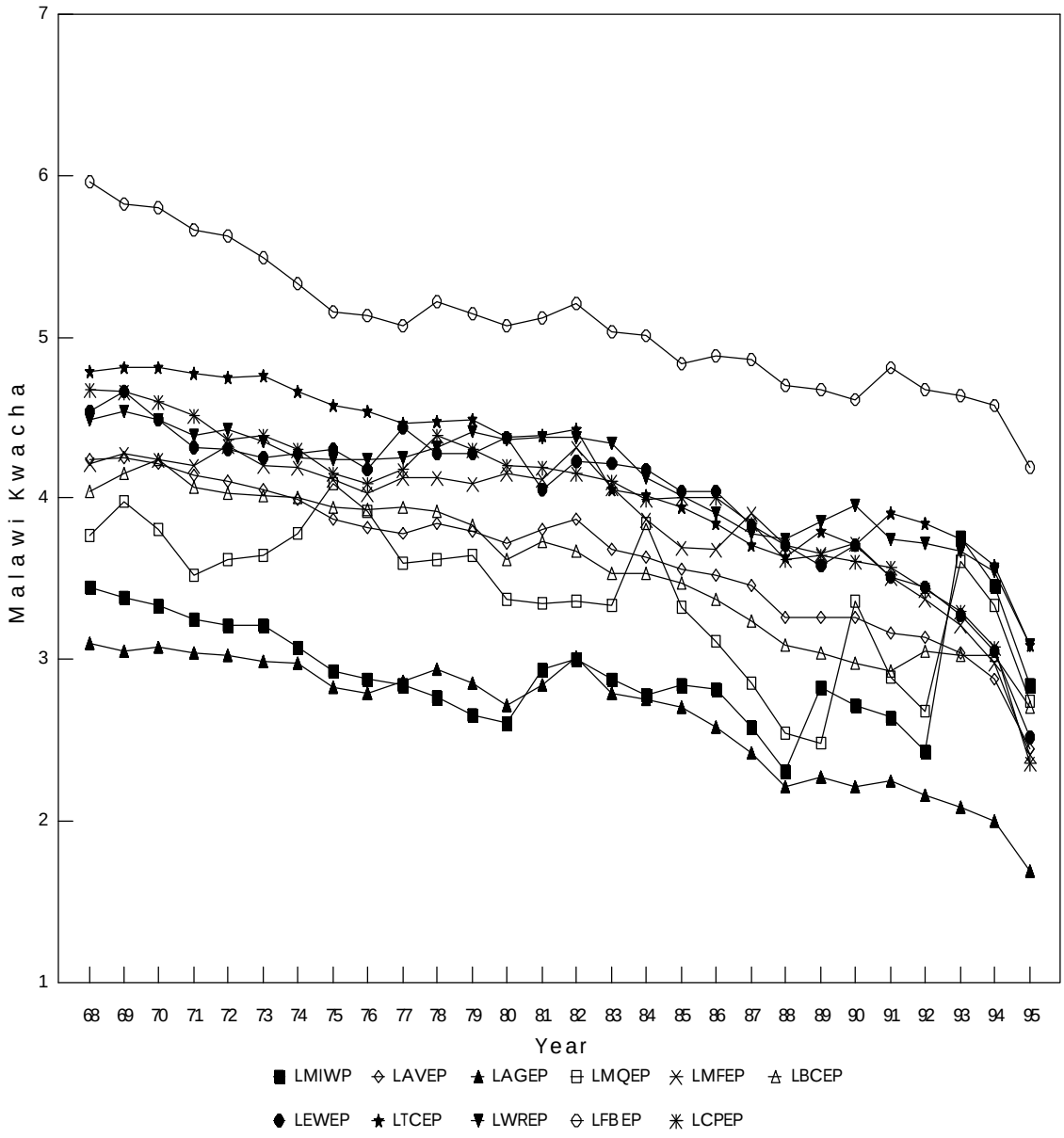

Table 1 Definition of variables and descriptive statistics, 1968 - 1995

Variables	Definition	Mean	S.D	Min.	Max.
MIWP	Real statutory minimum wages	20.13	7.39	10.02	42.77
LMIWP	Natural logarithm of MIWP	2.95	0.34	2.30	3.76
AVEP	Real formal sector earnings	41.47	16.29	11.53	70.48
LAVEP	Natural logarithm of AVEP	3.64	0.45	2.44	4.26
AGEP	Real agriculture sector earnings	15.19	5.09	5.43	22.38
LAGEP	Natural logarithm of AGEP	2.65	0.39	1.69	3.11
MQEP	Real mining and quarrying sector earnings	32.65	12.71	11.93	60.08
LMQEP	Natural logarithm of MQEP	3.40	0.44	2.48	4.10
MFEP	Real manufacturing sector earnings	52.26	17.62	11.19	79.30
LMFEP	Natural logarithm of MFEP	3.88	0.45	2.42	4.33
BCEP	Real building and construction sector earnings	39.25	16.18	14.91	69.69
LBCEP	Natural logarithm of BCEP	3.58	0.45	2.70	4.24
EWEP	Real water and electricity sector earnings	60.42	23.07	12.46	105.64
LEWEP	Natural logarithm of EWEP	4.00	0.49	2.52	4.66
TCEP	Real transport and communication sector earnings	74.71	32.03	22.13	123.01
LTCEP	Natural logarithm of TCEP	4.21	0.47	3.11	4.81
WREP	Real wholesale, retail and hotels sector earnings	64.23	19.36	22.08	93.59
LWREP	Natural logarithm of WREP	4.11	0.35	3.09	4.54
FBEP	Real financial and business services sector earnings	176.62	81.06	66.32	388.84
LFBEP	Natural logarithm of LFBEP	5.08	0.43	4.19	5.96
CPEP	Real community & personal services sector earnings	60.26	24.87	10.61	107.14
LCPEP	Natural logarithm of CPEP	3.99	0.52	2.36	4.67

Note: All the variables are average nominal monthly wages or earnings in Malawi Kwacha (MK) deflated by the Consumer Price Index (CPI) at 1980 prices.

Table 2 Unit root tests: Weighted Symmetric (WS), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests

Variables	Test Statistics on Levels			Test Statistics on First Difference			Decision
	WS	ADF	PP	WS	ADF	PP	
LMIWP	-3.110 [c]	-2.965	-14.306	-5.967 [a]	-5.655 [a]	-30.430 [a]	I(1)
LAVEP	-0.749	-1.916	-0.452	-2.632 [b]	-2.390	-17.292 [b]	I(1)
LAGEP	-1.426	-1.095	-3.511	-4.384 [a]	-4.083 [a]	-23.612 [a]	I(1)
LMQEP	-1.913	-1.989	-8.113	-6.031 [a]	-5.796 [a]	-30.323 [a]	I(1)
LMFEP	-0.971	-1.604	-0.410	-3.330 [a]	-3.134 [b]	-19.381 [b]	I(1)
LBCEP	-2.036	-2.732	-12.950	-4.420 [a]	-4.625 [a]	-26.577 [a]	I(1)
LEWEP	-0.793	-2.404	-0.451	-5.124 [a]	-5.048 [a]	-29.953 [a]	I(1)
LTCEP	-2.301	-2.112	-10.197	-3.901 [a]	-3.644 [a]	-23.788 [a]	I(1)
LWREP	-1.146	-0.648	-1.387	-2.479 [c]	-2.274	-14.623 [b]	I(1)
LFBEP	-2.091	-2.201	-10.544	-5.109 [a]	-4.905 [a]	-29.550 [a]	I(1)
LCPEP	-0.808	-1.136	-0.520	-1.469	-1.035	-7.564	I(2)

Superscripts *a*, *b* and *c* represent significance levels at 1 percent, 5 percent and 10 percent, respectively.

Table 3 Cointegration tests: Engle-Granger test, Johansen Trace test and cointegrating vectors

Variables	Engle-Granger test		Johansen Trace statistic		Cointegrating Vectors	
	Test	Statistic	Ho	Trace	Earnings	Wages
LAVEP LMIWP	ADF	-2.844 (0.004)	r = 0	20.266 (0.024)	1.000	-0.867
	PP	-14.000 (0.009)	r ≤ 1	3.944 (0.294)	1.000	-2.408
LAGEP LMIWP	ADF	-2.893 (0.004)	r = 0	11.631 (0.307)	1.000	-0.111
	PP	-13.750 (0.010)	r ≤ 1	0.701 (0.732)	1.000	-1.705
LMQEP LMIWP	ADF	-2.506 (0.012)	r = 0	9.315 (0.507)	1.000	0.214
	PP	-13.950 (0.009)	r ≤ 1	2.577 (0.479)	1.000	-2.024
LMFEP LMIWP	ADF	-2.953 (0.003)	r = 0	21.568 (0.017)	1.000	-0.466
	PP	-13.587 (0.010)	r ≤ 1	4.648 (0.216)	1.000	-3.260
LBCEP LMIWP	ADF	-2.907 (0.004)	r = 0	5.681 (0.794)	1.000	-17.212
	PP	-14.732 (0.007)	r ≤ 1	0.047 (0.799)	1.000	-0.900
LEWEP LMIWP	ADF	-2.909 (0.004)	r = 0	19.543 (0.030)	1.000	-1.367
	PP	-13.698 (0.010)	r ≤ 1	4.769 (0.205)	1.000	0.944
LTCEP LMIWP	ADF	-2.999 (0.003)	r = 0	14.414 (0.144)	1.000	-2.563
	PP	-14.658 (0.008)	r ≤ 1	0.736 (0.728)	1.000	0.045
LWREP LMIWP	ADF	-2.780 (0.005)	r = 0	17.212 (0.063)	1.000	-1.685
	PP	-13.467 (0.011)	r ≤ 1	2.197 (0.534)	1.000	0.183
LFBEP LMIWP	ADF	-3.232 (0.002)	r = 0	18.019 (0.049)	1.000	-3.088
	PP	-15.719 (0.006)	r ≤ 1	0.095 (0.795)	1.000	-0.279

Notes: The Engle-Granger test is the unit root test on the residuals of the cointegrating regression of minimum wages on sectoral earnings, with one lag in the test equation. The figures in parentheses are probabilities of rejecting the null hypothesis of no cointegration generated by TSP version 4.4 for windows.

Table 4 Vector error correction and VAR estimates for Granger-Causality test

Variables (ECT)	Eq. #	ECT(-1)	Granger-Causality F-test	R^2	DW	Granger-Causality
LAVEP LMIWP	1	-0.5522	0.797	0.3368	2.33	No
		(0.229)	(0.511)			
(JOH)	2	0.1927	14.008	0.7021	2.00	Yes
		(0.042)	(0.000)			
LAGEP LMIWP	1	-0.5195	0.977	0.3531	2.07	No
		(0.122)	(0.424)			
(EG)	2	-0.0695	1.907	0.2670	2.12	No
		(0.531)	(0.163)			
LMQEP LMIWP	1	-0.3127	1.243	0.3758	1.69	No
		(0.421)	(0.322)			
(EG)	2	0.3858	0.556	0.3516	1.76	No
		(0.373)	(0.651)			
LMFEP LMIWP	1	-0.1742	0.494	0.3073	2.17	No
		(0.644)	(0.691)			
(JOH)	2	0.2261	5.834	0.4992	2.25	Yes
		(0.147)	(0.005)			
LBCEP LMIWP	1	-0.6633	1.953	0.4293	2.05	No
		(0.094)	(0.155)			
(EG)	2	0.0202	3.186	0.3863	1.53	Yes
		(0.851)	(0.047)			
LEWEP LMIWP	1	0.0835	1.077	0.3618	2.05	No
		(0.741)	(0.383)			
(JOH)	2	0.1854	3.957	0.4155	1.95	Yes
		(0.116)	(0.024)			
LTCEP LMIWP	1	-0.5644	2.778	0.4810	2.07	No
		(0.114)	(0.069)			
(EG)	2	-0.1530	5.014	0.4499	2.18	Yes
		(0.280)	(0.009)			
LWREP LMIWP	1	0.3087	2.138	0.4417	1.62	No
		(0.155)	(0.129)			
(JOH)	2	0.0356	13.139	0.7101	2.18	Yes
		(0.499)	(0.000)			
LFBEP LMIWP	1	0.2372	3.219	0.5049	2.15	Yes
		(0.099)	(0.046)			
(JOH)	2	0.1497	5.004	0.4531	2.08	Yes
		(0.007)	(0.010)			

Notes: Two lags were used in the vector error correction models, with the lagged error correction term, ECT(-1), from the Engle-Granger (EG) procedure and Johansen cointegrating vector (JOH). Granger-Causality F-test tests the null hypothesis that sectoral earnings do not Granger-cause minimum wages in equation 1 and the null hypothesis that minimum wages do not Granger-cause sectoral earnings in equation 2. The figures in parentheses are probabilities of rejecting the null hypothesis.