Does Effeciency Wage Hypothesis Hold in Tanzanian Labour Market?

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Abstract

The primary objective of this paper is to test the hypothesis of efficiency wage in the context of Tanzania labour market. The test is facilitated via estimating the correlation between firm level productivity and firm level weighted average wage in Tanzania manufacturing enterprises. The study uses panel dimension of the data to estimate Cobb Douglas' production function that controls for time invariant characteristics. It also estimates translog production functions to allow for factor substitution. Estimates based on Cobb Douglas production function suggests that controlling for firm fixed effects, one percent increase in real wage results into 0.28 percent increase in productivity. The estimates are stable even when translogs are estimated, though they are reduced up to 0.2. Such findings are taken as evidence of the existence of efficiency wage in Tanzania's labour market, as wage level can account for about twenty percent of observed productivity in a firm. The paper concludes that firms can use efficiency wage as a policy to induce increased productivity. Partly, this may be due to the fact that a wage premium above the market tends to discourage worker shirking, reduce worker turnover, and mitigate worker adverse selection behaviour. Finally, it is evident that efficiency wages are highly correlated with unobserved firm specific characteristics, suggesting that firms with some characteristics self-select into payment schemes that have efficiency wage aspects.

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1. Introduction

The prime assumption of efficiency wage theory is that firms would find it profitable to pay above-the-market clearing wage level, as long as work effort is positively correlated with firm performance, so that worker productivity will be a positive function of wages. Firms may, therefore, be reluctant to reduce wages in the face of excess supply, since the associated decrease in productivity may result in a decrease in firm performance. In the light of the efficiency wage hypothesis, the above-the-market wages are intended to induce high output as they discourage worker shirking, reduce worker turnover, and mitigate worker adverse selection behaviour. This possibility comes in variants of the efficiency wage hypothesis. In principle, such variances are traceable in at least four models—shirking, turnover, adverse selection, and sociological models—also referred to as variants of efficiency wages. According to the shirking model, higher wage payments reduce shirking by increasing the cost of losing a job (Solow, 1979; Shapiro & Stiglitz, 1984). The turnover model argues that firms have incentive to pay efficiency wages to deter labour turnover that is costly to a firm (Salop, 1979). The adverse selection model states that offering higher wages will increase the average quality of the job applicants, and thus raise the average quality of workers (Weiss, 1980). The sociological model of efficiency wage states that a higher wage can build loyalty among workers, and hence increase workers' efforts (Akerlof, 1982). In this model, moral hazards tend to influence wage rates that employers will be willing to pay. The models suggest a causal relationship between wage levels and a worker's on-the-job productivity. Workers with similar observable characteristics, such as schooling, occupations, etc. may, therefore, experience differences in wages that are due to these productivity differences.

The most straightforward relationship envisaged through the efficiency wage hypothesis is thus a positive impact of wage on productivity. A market wage should have a zero impact on productivity. This is because labour is one of the factors of production, and once in a Cobb Douglas that assumes constant returns to scale, it is not possible to increase labour without change in capital. When the relationship is negative, it implies that a worker is shirking, hence leading to less than possible output. The most interesting and striking result is a possible positive effect. This is only possible if a worker exerts a higher than average effort. An employer can only ensure this if an employee is given incentive pay, i.e., pay above-the-market wage.

However, empirical estimation of the wage impact on productivity requires an establishment of the causality between productivity and wage. Unfortunately, omitted variable bias that typically leads to endogeneity is one of the major estimation problem reported to affect previous estimates in this area. Such previous studies have confirmed that there is a potential for a simultaneity problem when estimating production function, especially when a firm's decision to pay for more wages might be correlated with firm specific characteristics of the fact that high wage would motivate productivity. Therefore one of the outstanding research gap in testing the efficiency wage hypothesis is estimating the wage effect on productivity while containing the endogeneity problem. Lack of panel data has been mentioned as one of the reasons for the persistent estimation gap. This paper adds knowledge to this empirical gap by using rich panel data that allows control for both endogeneity and simultaneity bias. It utilizes panel dimension of the data to estimate the dynamic models of production functions using generalised methods of moments [GMM] techniques along with the standard Ordinary Least Squares [OLS].

2. Trends in Wage Policy in Tanzania and Possibility of Market based Pay

The history behind wage policy in Tanzania provides critical insights on the possibility and applicability of efficiency wage payment. It will be recalled that since independence of Tanzania in early 1960s, major changes were introduced into the Tanzanian economy that affected both the wage policy and productivity aspects of manufacturing firms. Given the span of the data used in this study, the estimate reveals the time dimension of the changes in both the wage and productivity regimes in Tanzania. Changes in the labour market partly introduced liberalization of wage settings, hence providing a potential ground for testing efficiency wage. It is well documented that at independence, in 1961, Tanzania inherited a wage policy that favoured market-determined wages, and a pay structure that reflected wide wage differences between high level staff (such as managers and other administrators), technical classes, and lower-level staff (Stevens, 1994). Thus, during that period efficiency wage could, in a way, be tested to see if they explained the substantial wage differences. Stevens (1994) reports that the gap between the top and bottom wage scales in Tanzania declined from 40:1 in 1960s to 6:1 in the 1980s after adopting a regulated labour market. However, when Tanzania became a socialist country in 1967, wage policy was re-designed to reduce income differentials and increase employment.

In implementing wage policy during the pre 1990s when Tanzania had centrally managed economy, the government controlled both employment and the wage bill, and introduced a guaranteed employment scheme to school leavers. By 1968 the government controlled 53 percent of wage employment, and 57 percent of the wage bill. The control increased gradually reaching 70 percent ten years later (JASPA, 1982). According to Knight and Sabot (1990), the policy of wage compression extended beyond government employment to parastatals and the private sector when the government established the Standing Committee on Parastatal Organization (SCOPO), and the Permanent Labour Tribune (PLT). In addition to these changes, trade union activities were integrated to political party activities. Thus, it could not have been easy to find an employer paying above-the-market wage during the state-controlled labour market as there was a monopolistic employer who fixed both employment and the wage. Efficiency could not be traced easily either because balancing of employment was done more through having high numbers of employees rather than more individual effort.

The Tanzanian economy has gone through profound changes since the early 1990s. The labour market, like other segments of the economy, has seen many changes, including the pay policy. The specific reform measures undertaken in the Tanzania labour market that may have had direct impact on previous wage policy include the abolition of guaranteed employment for graduates (announced in 1992); gradual elimination of fixed wages[1] and the introduction of wage bargaining at enterprise level (both individually and collectively);[2] and allowing employers to provide fringe benefits (such as food, housing, transport, and other allowances) to their employees (Tsikata et al., 1999; Mjema et al., 1998; Mans, 1994). To facilitate wage bargaining at firm level, SCOPO, which was responsible for reviewing wages and salaries in parastatals, was dissolved in 1993, and a fixed wage system in parastatals was abolished (Kusilati, 1996). This paper takes all these changes in pay system, especially after 1990s, as the basis for suspecting the existence of market-based pay.

[1] Following the deregulation of wages in profitable parastatals increased substantially in 1999s (Mans,1994).

[2] In 1992, autonomous trade unions were introduced to replace the state-led single trade union that was affiliated to the single ruling party. Workers can influence wages through go slow, threatened strikes, bargains with employers collectively through a trade union for a commonwage rate.

The efficiency wage hypothesis is also possible when an employer might be targeting highest capture of rent. This is facilitated by the ability to elicit more effort of an employee while maximizing the profit. The realization of profit result into rent that enables an employer to induce further efforts of an employee by paying above the market wage. There is no doubt that before the reforms, profit was not the main motive in production in Tanzania. But, trade liberalization was introduced in the 1990s. The liberalization aimed at increasing market competition for manufactured products, which in turn affected profitability, productivity and efficiency: aspects that affected wages.

Previously, the governments subsidized loss-making firms to the extent that a company ability to pay wages had little link with its profitability and overall performance. Hence, efficiency wage test could not be possible. The reason for such regime was that the trend towards industrial development in Tanzania in the 1960s was influenced by the overall industrial development in developing countries. During that period it was contended that free trade did not allow true comparative advantage situation to develop due to differences between marginal social and marginal private costs. Based on this argument, industrialization was undertaken through highly protective industrial and trade policies, particularly through the argument of the protection infant industries. While there were some gains in industrialization, the general performance of inward-looking protected industrialization programs was not very successful. But, over three decades, the post-reforms period has seen a reversal of trade and industrial policies. Trade liberalization is an important reform measure introduced, aiming at increasing market competition for manufactured products, and this has affected profitability, productivity and efficiency; aspects that might also affect wages. In the absence of subsidization, increased competition benefits some firms (productive, efficient and competitive ones), and harms some (less productive, inefficient and uncompetitive ones) through affecting their ability to pay wages, and therefore affect their factors of demand, including labour.

Other measures undertaken in the product market that may have directly or indirectly affected wages were product price deregulation, sales reforms aimed at improved competitiveness through increasing incentives for efficiency, increased access to productive resources, abolition of non-tariff protection, and reduced tariffs aimed at reducing the cost of imported inputs shortage of goods. Previously, Tanzania had a price control system whereby the government controlled prices of 373 product categories, including 1,134 product types (JASPA, 1982). In addition, it exercised a restrictive trade policy, in the form of quantitative restrictions, to protect both infant industries and external trade balance. Tariff rates were also prohibitive, ranging between '0 to 300[3]' (Mans,1994). The reduction in trade barriers led to increased importation of manufactured products competing with domestic manufactured ones. In the absence of subsidization, increased competition will tend to benefit some firms (productive, efficient and competitive ones) and harm some (less productive, inefficient and uncompetitive ones) through affecting their ability to pay wages, and therefore affect their factors of demand, including labour.[4] Due to the changes introduced in this area, there are more factors that support the effectiveness of efficiency wage and its applicability altogether.

[3] The bulk of imports were subject to tariff rates of 0, 25 and 60 percent. There were other 15 rate ranging between 15 and 200 percent.

[4] Gibbons (1996) mentions that severe product market competition was one of the major reasons for frequent closure and subsequent permanent shut-down of some major establishments including Sunguratex, Mwatex, Mutex, Kiltex, Mbeya Textile, Tabora Spinning, Ubungo Farm Implements, Sabuni Industries, Rubber Industries, Kibo Match Cooperation and Southern Paper Mills. These firms also appeared in the list of huge loss-making firms compiled by the Tanzania Audit Commission (Gibbons, 1996).

3. Literature Review on Efficiency Wage Determination

Theories of wage determination can be broadly classified as being based on either competitive or non-competitive assumptions about the operation of labour markets. In the competitive model it is argued that workers receive pay equal to their opportunity costs; that firms pay a wage sufficient to attract workers of the quality they require, and that wage differentials reflect only the characteristics of workers such as experience/age, schooling and skills. The competitive theory interprets inter-industry wage differentials as either a reflection of unmeasured differences in the quality of labour, or compensation for non-pecuniary job attributes that serve to equalize net advantages between industries. The human capital theory of wage determination treats the earning profile related to investment in education as reflecting the decisions to invest in skills. Other interpretations have been advanced within the competitive framework, which include theories of job matching, and viewing education as signal for ability.

In recent decades there has been a rapid development of non-competitive theories of wage determination (see Blanchflower, Oswald & Sanfey, 1996;, Krueger & Summers (1987, 1988); Katz & Summers, 1989; Carruth & Oswald, 1989; Artus, Legendre & Morin, 1991; Holmlund and Zetterberg, 1991; Nickell & Wadwhani, 1990; Hildreth & Oswald, 1997). These theories can be broadly classified as drawing on theories of efficiency wages or bargaining. Under the former, a firm has an incentive to pay above the opportunity cost of labour, as such payment induces greater effort from a worker. Under the latter, workers, or their representative in unions, bargain over the profits of a firm. The observation that firm characteristics affect earnings, in these theories, is consistent with some form of deviation from the competitive outcome.

The first approach to incorporate efficiency wage behaviour is known as the nutritional model, which basically emphasizes the connection between wages, nutrition and productivity. This model aimed primarily at explaining the link between wages and productivity for agriculture workers in developing countries. The central focus is the connection between higher wages and a worker's health. It assumes that the productivity of workers can be sufficiently increased by better nutrition and that the cost to the employer of the higher payment to workers is outweighed by their increased output. This implies that workers should receive a minimum subsistence wage to allow them to meet their nutritional needs, and thus be more productive. However, in most economies, particularly in the industrial sectors, the link between wages and a worker's health is not likely to be important because wages far exceed subsistence levels. Consequently, the nutritional model is not considered relevant in this case, and emphasis is placed on the other links between wages and productivity.

It is worth noting that, there are firm characteristics that have greater association with efficiency wage. These are capital labour ratio, and firm size. Monitoring is likely to be difficult as firm size increases factor that provide an incentive for large firms to pay higher wages to induce self monitoring and efforts of the workers (Calvo & Wellisz (1979), Oi (1983), and Bulow and Summers (1986)) as may be more difficult for a manager or supervisor to watch a large number of employees hence a firm may be forced to have several layers of management thereby increasing monitoring costs. Capital intensity might be related to many features of production and management technology, and therefore be correlated with costs underlying an efficient wage. The correlation is said to be positive if capital is complementarily to firm specific human capital.

Another version of efficiency wage that has been empirically tested is the industry wage differential due to turnover. The labour turnover model assumes that a negative relationship exists between wage and turnover. Turnover is costly to firms, hence there is an incentives to pay higher wages to deter turnover through wage policy in order to economize on such costs (Salop, 1979; Stiglitz, 1974, 1986). The costs could be direct expenditures (such as orientation programs), or indirect costs (such as lower worker productivity during an adjustment process), which are at least partially paid for by a firm. A related version of the turnover model of efficiency wage is that investment in specific human capital can reduce workers incentive to quit, and firm incentive to fire a worker (Rudolf. et al., 2000).

In areas where jobs require specific training, employers are likely to incur training costs and set efficiency wages to deter turnover. Therefore, turnover will affect productivity if it leads into a loss of specific skills that new recruits may take time to learn. The test of turnover model of efficiency wage has been undertaken using the probability models of labour turnover of both linear and non-linear probability models. Krueger and Summers (1988) estimate a linear probability model, where the dependent variable equals 1 if turnover occurs, and 0 otherwise; using industry wage as a key independent variable. In their model they control for several factors that can influence employee's turnover such as stock of human capital (schooling, experience, etc.), occupation, and others. Other empirical works in this area include the studies by Pancavel (1970), Freeman (1980), Krueger and Summers (1988), Rudolf et al. (2000), and others.

3.1 Empirical Review and Evidences of Efficiency Wage

There are studies on efficiency wage and the related wage determination process within African labor markets. For instance, Azam. et al.(2001) uses unbalanced panel of individual wages in the western African country of Ivory Coast to test efficiency wage in the context of rent-sharing and hold-up theories, and concludes that both rent-sharing and hold-up theories explain wage differences in Ivory Coast. Teal (1995) discriminates between rent- sharing and efficiency wage in the Ghanaian labour markets. In other studies, it is shown that wages increase with firm size in the manufacturing sector of most African countries (Mazumdar, 1994; Teal, 1995; Velenchik, 1996a,b Mazumdar(1994). In Hoddinott (1995) a negative relationship between wages and unemployment is reported in Côte d'Ivoire, observation that could perhaps be consistent with the efficiency wage argument. Knight and Sabot (1990), using information on urban workers and cognitive skill and reasoning ability indicated how differences in the availability of secondary education in Kenya and Tanzania have influenced productivity in the two countries.

There has also been considerable interest in studying the elements of efficiency wage and wage determination in labour markets in various countries. In studies such as Basu et al. (1997) Grosfeld and Nivet (1997), Estrin and Svejnar (1998), Köllö (1997), Dhar (1998), Basu et al. (1995), and Köllö (1997), they estimate wage-sales, wage-sales per worker and wage-value added per worker elasticities in countries of Hungary, Poland, Czech and Slovakia and generally find positive and increased wage relationship with variables like sales, sales per worker and value added. There are authors who have focused attention on the impact of value added or sales per employee together with quasi-rents on wages. These include: Nickell & Wadwhani (1990), Holmlund & Zetterberg (1991), Currie & McConnell (1992) and Nickell & Kong (1992). For example, Nickell & Wadwhani (1990) use a sample of 219 large manufacturing companies in the UK over the period 1972-1982, reporting a significant positive impact for the firm's average revenue product growth and financial performance.

In general, all studies find a significant impact of value-added or sales per employee on wages. Sanfey (1992) estimates an elasticity of wages with respect to profits-per-worker for the U.S. economy of 05, while Blanchflower et al (1996) estimate elasticities between 0.2 and 0.4. Abowd and Lemieux (1993) estimate a much higher elasticity for Canada (0.20). Similarly, using a panel of U.K. firms and employing technological innovations as instruments, Van Reenen (1996) estimates a rent-sharing coefficient of 0.29. Abowd and Lemieux (1993) have suggested that foreign competition and changes in world prices could have impact on wages, and there are other authors who have studied the impact of product market power on wages. These include Machin & Manning (1992) and Konings & Walsh (1994).

Major concern raised in estimating the efficiency wage is its possible overlap with rent sharing. Levin (1992) summarizes four variants of rent sharing that are also variants of efficiency wage; firstly when workers perceive it fair that productivity improvements be shared as wage gains, secondly when employers may find it profitable to pay higher wages to avoid unionism, thirdly when high wages increase insiders propensity to train and finally when highly paid workers are more enjoyable subordinates. Krueger and Summers (1988) provide some ways of overcoming the identification problem of efficiency wage and rent sharing. These may include; use of case studies with detailed company level information like in Krueger (1987) examination of wage differences and turnover between company-owned and franchisee-owned fast foods, Raff (1986) and Summers(1987) case study of Henry Ford's introduction of the dollar day. The other solution to the problem of discriminating between rent sharing and efficiency wage is the use of production function as in (Teal, 1995, Medoff and Brown, 1978). To overcome these difficulties, in this study a Cobb-Douglas production function is estimated using a unique data set that contains detailed firm level information.

4. Model Estimation and Data

The model estimated in this paper adopts the approach used by Wadhwani and Wall (1991), and Levine (1992) to estimate the correlation between wage and productivity. The estimates consider constant returns to scale for a Cobb-Douglas production function with two inputs: effective labour $(e^{a}L)$ and capital K:

$$Y = (e^{a}L))^{b} K^{(1-b)} f \quad \text{......} \quad (1)$$

This specification includes a firm-specific productivity factor that is invariant over time, f, and i.i.d. shocks to the production function,which is assumed to be uncorrelated with changes to a, L or K. Under the efficiency wage hypothesis this can be shown to yield the following equation, where firm fixed effects are allowed for by differencing:

$$\Delta\ Ln\ Y/L = b\Delta\ ln\ Rel\ (w) + (1 - b)\ \Delta\ Ln\ K/L + \Delta\ \epsilon \quad \text{......} \quad (2)$$

where $Rel\ (w)$ is the relative wage in the firm.

$$Ln\ w = \beta_o^{\ w} + \beta_1 Ln\ Y/L + \beta_2 Ln\ w^{e} + \beta_3 H + controls \quad \text{......} \quad (3)$$

Based on the equations [1], this paper specifies a gross output production function that uses weighted average wage as one of the explanatory's for productivity. In addition, a weighted log of Wage acts as a wage premium. The logic of including a wage premium is that, if the predictions of the efficiency wage hold, then real earnings should be one of the determinants of productivity, hence its coefficient estimate should have a positive sign and statistically significant. Given the potential endogeneity problems mentioned before, the model estimates control for a range of individual characteristics especially the human capital variables. The advantage of considering such human capital variables is to enable the real earnings variable entering the production function to serve as a wage premium. The specification of Cobb-Douglas production that is estimated takes the following form:

$$LnQ_{jt} = \alpha_0 + \alpha_1 LnK_{jt} + \alpha_2 LnL_{jt} + \alpha_3 LnI_{jt} + \alpha_4 LnR_{jt}\ \alpha_3\ LnW_{jt\,+}\ \mu_{j\,+}\ \epsilon \ \ldots\ldots (4)$$

Whereby j and t are firm and time subscripts, LnQ is log of real output, LnK is log of physical capital, LnW is the log of earnings, LnI is the log of intermediate inputs, LnR is the log of raw materials, $\mu$is the firm fixed effect, and ϵ is the error term. Given the limitations of the OLS estimation, especially failure to control the fixed effects that may lead to inefficient estimations, the paper estimates equation (4) using fixed effects models and GMM. Furthermore, the estimates make use of translog production as a means to ensure control for factor substitution possibilities. This is important because in a situation where an employer can maximize productivity using labour saving technology, s/he might not necessarily be paying efficient wage. In principle, Chan and Mountain (1983) proposed the following translog production function with technology and scale parameter:

$$\text{In } Q = a_0 + a_t T + \sum_{k=1}^{n} a_i \ \text{In } X_i + 0.5\left[\sum_{k=1}^{n}\sum_{j=1}^{n} akj \ \text{In } X_k + a_{tt}T^2 + \sum_{k=1}^{n} akt \ \text{In } X_k T,\right] \ldots\ldots (5)$$

Where Q is real output , X_i is the *i*th factor of production, *T* is technology, and subject to the following restrictions on the parameters:

$$akj = ajk, \sum_{k=1}^{n} akj = \sum_{j=1}^{n} ajk = 0, \ \sum_{k=1}^{n} akt = 0, \ \sum_{i=1}^{n} aj = \theta, \ldots\ldots (6)$$

With Θ being an unknown constant reflecting the degree of homogeneity. Then, scale effects will be constant when Θ=1, increase when Θ>1, and decreasing when Θ<1.

In order to derive an *n*-factor, CES-translog production function with technology and scale effects, we start with the following functional representation:

$$Q = Q(X_1, X_2, \ldots, X_n, T), \ \ldots\ldots (7)$$

Where Q is real output, X_i is the *i*th factor of production (i=1,2,…, n), and T is technology. Let *h* represent a scalar, such that:

$$Q = Q(hX_1, hX_2, \ldots., hX_n, T) = A(X_1, X_2), \ldots, X_n, T)h^{\theta} \ldots\ldots (8)$$

The production function specified in (7) exhibits constant RTS when Θ =1 increasing RTS when Θ>1 and decreases RTS when Θ<1.

Define the *n*-factor CES-translog production function with technology and scale effects by the following.

$$\text{In } Q = a_0 + \text{In } \left[\sum_{k=1}^{n} akX_k^{1-S}\right]^{\theta/(1-S)} + 0.5\left[\sum_{k=1}^{n}\sum_{j=1}^{n} akj \ \text{In } X_k \ \text{In } X_j + b_{tt}T^2\right] + b_t T + \sum_{k=1}^{n} b_{kt} T \ \text{In } X_k \ \ldots\ldots (9)$$

with Θ once again being the scale parameter. Similarly, the CES-translog production function presented in (9) will exhibit constant RTS when Θ=1 increasing RTS when Θ>1 and decreasing RTS when Θ<1. The following restrictions are applied to the above parameters

$$a_k = a_k^* \exp(\lambda_k T) akj = ajk, \sum_{j=1}^{n} akj = 0, \text{ and } \sum_{k=1}^{n} a_k = 1 \quad \text{...} (10)$$

which are required to uniquely identify the *a.* In this paper, the estimates are straightforward. We have the real output variable Q anda set of factors that influence productivity. The model also augments human capital aspects, and treats them as productivity factors; and later infers their impact on productivity.

Both, value added and gross output production functions are estimated for reasons given below. Previous studies in this area (see for example Soderbom and Teal (2002) indicate that there are advantages and disadvantages to both measures. According to the authors the advantage of the gross output measure is that it allows firms to have different efficiencies at transforming intermediate inputs (for example raw materials) into output. The authors mentioned the correlation of capital stock and raw materials as a disadvantage of estimating the gross output production function as it make it difficult to know what the effect of capital stock is on output. More problems of the choice between gross and net output as a productivity measure arises when firms operate in an imperfectly competitive environment (Griliches and Klette, 1996). Basu and Fernald (1997) indicated that estimates of the increasing returns to scale measured by the value added production function do not imply increasing returns to scale in the gross-output production function. Therefore, to mitigate the shortcomings of the production specifications outlined here, we will estimate both forms of production functions.
Based on the derivation above we specify both a real value added production function and then a gross real output production function. In the value added production function, we use value added as a dependent variable, and the inputs (independent variables) are log of physical capital, weighted average learning variables (human capital), log of number of employees, proportion of trained workforce and other control variables. Then a wage premium is inserted to ascertain if at all it can be one of the explanatory variables of productivity. The inputs (independent) variables in the gross real output production function include raw materials and indirect costs along with the weighted learning variables.

The models are described below;
The value added production function is specified as follows:

$$LnV_{jt} = \alpha_0 + \alpha_1 LnK_{jt} + \alpha_2 LnL_{jt} + \alpha_3 W_{jt} + \mu_{j} + \epsilon_{jt} \quad \text{...} (11)$$

Whereby j and t are firm and time subscripts,

LnV = log of value added,

LnK = log of physical capital,

LnL = log of a number of labour available in a firm,

μ = Firm Fixed effects and;

ϵ = error term.

The variable μ represents fixed effects i.e. omitted variables that may be correlated with explanatory variables and ε is the error term. The real value added is the deflated value of the difference of total manufactured output minus indirect costs and minus raw materials used in producing the output. The capital stock is a real capital stock series based upon an initial observation of the firm's replacement value of plant and machinery, which is augmented with subsequent investments in plant, and machinery made by the firm. The gross output production function is exactly the same as the one specified in equation [4] and variables are as defined before. The models are estimated using system GMM based upon Cobb douglas and translog specifications. As indicated above the important area of knowledge contribution of this paper is to present estimates that radically control for endogeneity problem. Since the data set used has panel dimension the paper estimates the models specified above using system GMM. Details on what the system GMM does are in the appendix 1. But most significantly it should be noted that though linear GMM can be used, sometimes the lagged levels of the regressors are poor instruments for the first-differenced regressors. In this case, one should use the augmented version – "system GMM". Therefore the paper estimates system GMM because it uses the levels equation (e.g. equation (1) in this example) to obtain a system of two equations: one differenced and one in levels. By adding the second equation additional instruments can be obtained. Thus the variables in levels in the second equation are instrumented with their own first differences. This usually increases efficiency.

4.1 Data and Variables

The study used enterprises data from Tanzania . This data was collected under the Word Bank Regional Enterprises Development Surveys (RPED) in early 1990s, and then extended by Oxford University from 1999 till 2002. The University of Dar-es-Salaam extended the surveys up to 2010 through a Norwegian funded project on institutional transformation. The survey covers 200 firms from the list of establishments that employs 20 and above employees from 1992 till 2009. In all these surveys the same questionnaires were administered. The interviews for this type of data were conducted at two levels. The first level aimed at collecting employer information, and the main respondent was the chief executive of an enterprise. In the second level employees were randomly selected to collect detailed worker characteristics, including education and training information. The survey covered all major towns of Tanzania, i.e., Mwanza, Dar-es-Salaam, Arusha, Tanga, Kilimanjaro and Iringa. At the enterprise level weighted average of schooling, along with other human capital variables, were collected.

The real value added was the deflated value of the difference of total manufactured output minus indirect costs and minus raw materials used in producing an output. The capital stock was real capital stock series based upon an initial observation of a firm's replacement value of plant and machinery, which was augmented with subsequent investments in plant and machinery made by the firm. Each value was weighted by the proportion of workers in a given occupational category in a firm to obtain a weighted average for each firm. Sector variables were for four main manufacturing sector covered in the surveys: food, textile, metal, and wood. The ownership variable was derived from a direct response of whether a company is wholly or partially owned by Tanzanians or foreigners, private foreign, private Tanzanians, publicly owned, or joint venture between public and private.

5. Empirical Results

It will be recalled that the primary hypothesis tested here is whether employers pay above-the-market wage, and in return observe a positive rise in productivity. It is worth noting that if any empirical estimate has to ascertain whether or not wage premium can explain productivity one must first check whether or not human capital characteristics can explain productivity. This can only be checked by inserting human capital variables into the productivity equation. But one important condition for a production function to be a measure of productivity is the need to estimate the returns to scale. Therefore, the strategy adopted in the estimates presented here is first to estimate whether human capital has any effect in productivity, and then estimate whether a weighted average wage variable has any positive effect on firm level productivity . The results are presented in Tables 1 and 2. In both tables, the first two columns represents value added production functions as measure for productivity while the last columns [3 and 4] reports measures of productivity via gross output functions. As suggested earlier, the results in table 1 considers human capital variables as among the regressors of productivity measure. Then in the second table same productivity measures are repeated but now instead of human capital variables the wage variable is used. In table 1 first, the estimate ascertains homotheticity and the productivity effects of human capital. According to the figures reported there we cannot reject quasi-concavity and monotonicity. Furthermore, the estimates support the Cobb-Douglas specification and its translog form. Findings also suggest no statistically significant difference between translog and Cobb Douglas' models. The estimated coefficient on employment is 0.76, and that on physical capital is 0.36, and both are significant at the 1 per cent level.

As mentioned before, one of the modifications of the estimated model was to augment human capital variables into the production functions. Hence, these variables were treated among the determinants of productivity. As per results in Tables 1 and 2, there is a one to one correspondence between human capital and productivity. In fact the predicted effects of human capital on productivity (see Becker, 1964) of positive impact on productivity are confirmed. Nearly all human capita variables have significant effect on productivity. Having established that, we confidently move to the next stage to see if the reduced form human capital can survive its effect on productivity. This is central to the testing proposed in this paper. Therefore, in Table 2 we report system GMM results controlling for weighted average wage as one of the explanations for productivity. The estimates use lag of explanatory variables in levels as instruments for contemporaneous differences, and lags of explanatory variables expressed in first differences as instruments for contemporaneous levels. This is the way to control for omitted variable bias from estimates like Ordinary Least Square (OLS). Specifically, the paper estimates the variables in two-step GMM estimates, where *t*-statistics are based on robust, finite sample corrected standard errors.

The second part of Table 2 provides for the translog specification. As usual the marginal products and the partial derivatives depend both on the values of the inputs and on the estimated parameters. The results still indicate that the translog coefficient estimate for employment and labour are 0.76 and 0.36 respectively. Our main question is on whether average wage in a firm has any effect on productivity. In our estimates of both Cobb Douglas and translog functions we impose wage variable. As observed in both forms, real wage variable at firm level has impact on productivity. This is very much in line with our tested central hypothesis. It implies that increase in certain proportion of real wage is rewarded by a percentage increase in productivity. More specifically, the coefficient estimate of the weighted average real wage at firm level is 0.12, and highly significant at 1 percent level. Readings from the figures suggest that a 1 percent increase in real wage result into 0.28 percent increase in productivity. Therefore, controlling for firm specific factors, about 28 percent of observed productivity is accounted for by the level of pay.

Estimates based on translog production function reduces the coefficient of wage to 0.2. As mentioned earlier, the translog production function is most preferred because it accounts for factor substitutability. The paper thus takes 0.2 as the final impact of wage on productivity. We may recall that from the beginning this paper set out to investigate if there is any evidence of positive effect of wage on productivity. To the extent that such evidence exist makes it possible to confidently conclude that we have confirmed the efficiency wage hypothesis. Therefore, results in Table 2 can be seen as an s evidence that our efficiency wage hypothesis appears to have strong support. But the most important thing to note is that the endogeneity aspects of the model suggest that the effect of wage level on productivity work through the firm level effects.

Table 1: System GMM Estimates of Production Function Parameters

	[1] Translog	**[2] Cobb-Douglas**	**[3] Translog**	**[4] Cob-Douglas**
MARGINAL EFFECTS [(1)] Log Employment	0.76 (6.30)**	0.81 (4.11)**	0.21 (1.63)*	0.141 (3.11)**
Log Capital	0.36 (3.21)*	0.24 (4.26)**	0.05 (1.78)*	0.10 (3.11)**
Log Raw Materials			0.72 (9.08)**	0.44 (10.9)**
Log Indirect Costs			0.17 (4.91)*	0.04 (4.50)**
HUMAN CAPITAL COEFFICIENTS Education	-0.02 (0.45)	-0.004 (0.05)	0.01 (0.88)	0.004 (0.51)
Age	0.30 (4.81)**	0.34 (5.17)**	0.07 (2.81)*	0.08 (2.99)**
$Age^1/100$	-0.12 (3.70)**	-0.52 (4.21)**	-0.06 (3.25)*	-0.01 (3.10)**
Tenure	0.08 (1.26)	0.06 (1.32)	0.031 (2.00)*	0.01 (2.15)*
DIAGNOSTICS & TESTS Quasi-concavity (proportion)	0.43		0.60	
Monotonicity (proportion)	0.88		0.48	
Homotheticity[(2)](p-value)	0.82		0.52	
Constant returns to scale[(2)] (p-value)	0.69	0.91	0.65	0.74
Cobb-Douglas (p-value)[(2)]	0.53		0.42	
MI (p-value)[(3)]	0.00	0.00	0.01	0.00
M2 (p-value)[(4)]	1.00	0.97	0.76	0.11
Sargan-Hansen (p-value)[(5)]	0.62	0.85	0.28	0.61

Note: Time dummies are included in all regressions. The numbers in ( ) are t-statistics. Significance at the l per cent, 5 per cent and 10 per cent level is indicated by *, ** and * respectively.

Table 2: System GMM Estimates of Production Function Parameters

	[1] Translog	[2] Cobb-Douglas	[3] Translog	[4] Cob-Douglas
MARGINAL EFFECTS (1)	0.76	0.81	0.21	0.141
Log Employment	(6.30)**	(4.11)**	(1.63)*	(3.11)**
Log Capital	0.36	0.24	0.05	0.10
	(3.21)*	(4.26)**	(1.78)*	(3.11)**
Log Raw Materials			0.72	0.44
			(9.08)**	(10.9)**
Log Indirect Costs			0.17	0.04
			(4.91)*	(4.50)**
Weighted Average Wage	0.28	0.27	0.21	0.20
	(4.51)**	(4.11)**	(6.28)**	(5.14)***
DIAGNOSTICS & TESTS Quasi-concavity (proportion)	0.43		0.60	
Monotonicity (proportion)	0.88		0.48	
Homotheticity(2)(p-value)	0.82		0.52	
Constant returns to scale(2) (p-value)	0.69	0.91	0.65	0.74
Cobb-Douglas (p-value)(2)	0.53		0.42	
MI (p-value)(3)	0.00	0.00	0.01	0.00
M2 (p-value)(4)	1.00	0.97	0.76	0.11
Sargan-Hansen (p-value)(5)	0.62	0.85	0.28	0.61

Note: Time dummies are included in all regressions. The numbers in ( ) are t-statistics. Significance at the l per cent, 5 per cent and 10 per cent level is indicated by *, ** and * respectively.

6. Conclusion and Policy Implications

This paper looked at the possible existence of efficiency wage hypothesis in Tanzania labour market. The analysis was facilitated by testing the hypothesis whether wage and productivity are positively related. It is contended that in the light of the efficiency wage hypothesis, the above-the-market wages are intended to induce high output as they discourage worker shirking, reduce worker turnover, and mitigate worker adverse selection behaviour. This possibility comes in variants of the efficiency wage hypothesis. In principle, such variances are traceable in at least four models, also referred to as variants of efficiency wages. These are shirking model, turnover model, adverse selection model, and sociological model. This was argued as the Stiglitz famous wage unemployment hypothesis that predicts a possibility of a firm paying above-the-market wage and expecting in return a positive impact on productivity. In order to ascertain that the paper specified Cobb Douglas and translog production functions. This paper revealed that history behind wage policy in Tanzania provides critical insights on the possibility and applicability of efficiency wage payment. Market based pay is the only route an employee can enjoy an above-the-market pay. In compressed wages, especially when wage-set is fixed centrally, it is not very likely to observe performance pay or efficiency pay. The paper also argued that changes in Tanzania economy, especially labour market reforms and product market changes, also had major influence on wage and productivity observed in the market. In analysing wage effect on productivity, the main question addressed by the paper was whether average wage at a firm has any effect on productivity.

Estimates of both Cobb Douglas and translog functions were used that augmented wage as one of the variables to explain producivity. According to the results, a Cobb Douglas production function suggests that 1 percent increase in real wage results into 0.28 percent increase in productivity. But estimates based on translog production function indicates that the wage effect on productivity is about 0.2. Using a rule of thumb and the principle set right from the first section, the paper reports evidences of wage effect on productivity of 20 percent. But since the results accepted null hypothesis of exogeneity, it is conclusive that the productivity effect of wage on productivity work through a firm specific effects that are time invariant. The evidence of efficiency wage has a strong support in our data.

Several policy implications are associated with the findings of this paper. First the wage policy and institutions within the labour market influences the extent to which wage can be correlated with observed productivity. Hence government policies and labour market institutions need to address the issue of wage flexibility by providing a framework that can allow employer-employee bargaining of wage above the market for enhancing productivity. The positive correlation between productivity and wage implies that low wages can partly explain stagnated productivity growth especially in most of the African manufacturing that have not grown as fast as other establishments.

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Appendix I: The system GMM estimator

This appendix provides a brief description of the system GMM estimator. For more details see Blundell and Bond (1998).

Consider

(AI) $y_u = x'_u \beta + \mu_1 + \epsilon'$ $\quad$ t = 1,2…… T

Where i and t are firm and time indices, y_{it} is the dependent variable, x_{it} is a row vector of order k of explanatory variables possibly including lags of the dependent variable, β is a column vector of parameters of order k,μ,is a fixed effect potentially correlated with x_{it} and ϵ_{it} is a residual potentially correlated with . to eliminate the fixed effect we take first differences:

(A2) $\Delta y_{it} = \Delta x'_{it}\beta + \Delta\epsilon_{it}$, $\quad$ t = 2,3 ……. T

If Δx_{it} is correlated with the differenced residual, the standard OLS estimator will be biased and inconsistent. However, assume that there exists a set of instruments that enable us to form a vector of moment conditions of order q, defined as

(A3) $E(z'_{it}\Delta\epsilon_{it}) = 0$.

Provided q≥k, we can obtain a consistent GMM estimator or β by minimizing the quadratic

(A4) $J(Bg_{Gmm})=\hat{g}(\beta_{GMM})'W$

Where ĝ (.) is the sum over the sample moment conditions of the form in (A3) and is a weight matrix (Hansen 1982). A common procedure is to use lags of x as instruments for the differenced equation (A2), and because more instruments become available for higher t, we can form a matrix of instrument as

$$
\text{(A5)} \quad z_{il} = \begin{pmatrix} x & 0 & 0 & \dots & 0 & \dots & 0 \\ 0 & x_{il} & x_{i2} & \dots & 0 & \dots & 0 \\ - & - & - & \dots & . & \dots & . \\ 0 & 0 & 0 & \dots & x_{il} & \dots & x_{il} \end{pmatrix} \quad \begin{matrix} t = 1 + l \\ t = 2 \quad + l \\ \\ t = T \end{matrix}
$$

Where l is the lag length in use. The resulting differenced GMM estimator often performs poorly in practice due to the problem of weak instruments. Blundell and Bond (1998) proposed combining the differenced equation (A2) with the levels equation (A1) for which lagged differences of the explanatory variables may serve as valid instruments. The vector of moment conditions is then defined as

$$
\text{(A6)} \qquad E(z_{ii}^{+'} U) = 0,
$$

Where

$$
\text{(A7)} \qquad u = \Delta\epsilon_{ii} \begin{pmatrix} \\ \epsilon_{ii} \end{pmatrix}
$$

and

$$
\text{(8)} \qquad z_{ii}^{+} = \begin{pmatrix} z_i & 0 & 0 & \dots & 0 \\ 0 & \Delta x_{ij} & 0 & \dots & 0 \\ 0 & 0 & \Delta x_{iz} & \dots & 0 \\ - & - & - & \dots & . \\ 0 & 0 & 0 & \dots & \Delta x_{iT-L} \end{pmatrix} \quad \begin{matrix} \\ \\ t = l + l \\ \\ t = T \end{matrix}
$$

The system GMM estimates are then obtained by minimizing (A4).