What constrains the demand for labour in firms in Sub-Saharan Africa? Some evidence from Ghana.

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This paper is a preliminary draft reporting on firm and worker data for the determinants of labour demand in Ghana over the period from 1987 to 2003.

Abstract

The number of jobs in Ghana's manufacturing sector expanded very rapidly over the period from 1987 to 2003, almost entirely in small firms. Such firms have a much lower level of labour productivity than larger ones. In this paper the possible reasons for this pattern of job expansion in the lower productivity sector are examined by combining census and survey data. It is shown that large firms use a much more capital intensive technology than smaller ones and, it is argued, this is explained by the fact that their capital costs are lower and the wages they pay higher. Possible reasons for these higher wages are investigated including the efficiency wage hypothesis, rent capture, market frictions in search models and a rising labour supply function. Evidence is presented that all these aspects of the labour market may be present. While conclusions are at present tentative there is evidence that the possible rising supply curve large firms may face reflects high returns to physical capital in smaller enterprises.

Outline of paper

1 Introduction

Do wage earners in Sub-Saharan Africa (SSA) constitute an aristocracy within the labour market with high wages preventing the expansion of wage employment for most? The origin of the term seems to be early discussions among socialists and Marxists in Europe concerned to explain the reluctance of the working class to lead the socialist revolution.

'The expression 'aristocracy of labour' was current in mid- and late-19th century Britain, being applied to the highly-skilled and (consequently) strongly unionized stratum of the working class that was economically, socially and politically allied to the middle class of the time.' In 1858 Engels referred to the English proletariat as 'becoming more and more bourgeois': and in 1892 to the skilled artisans in the 'great Trades Unions' as forming an 'aristocracy among the working class'. In the latter item he referred to the working class as a whole as having shared to some extent in the benefits of Britain's industrial monopoly, this explaining why 'since the dying-out of Owenism, there has been no Socialism in England'?' Waterman (1975).

This notion of a labour aristocracy was transferred to labour markets in Africa where it was recognized early on that certain elements within that labour market were relatively well paid and 'privileged'. Exactly how they were 'privileged' was a matter for dispute but key elements in the debate were the role of urban workers relative to rural ones, the role of trade unions in creating a well paid, but very small, group of workers either in mines or unionisable activities such as railways. These distinctions were usually made not with a focus on the demand for labour but in the political role that different groups may play in both the demands for independence and then post-independence economic policy.

A focus on a 'labour aristocracy' has at its core the observation that well paid wage employment is scarce in SSA and a perception that it has become more so. In contrast to the focus of political scientists and sociologists on distinctions within Africa labor market has been the concern of economists as to the level of wages in SSA relative to other countries. That these will be high as SSA is well endowed with natural resources and land has been the central argument of Adrian Wood (see Wood (1994), Wood and Berge (1997) and Wood and Mayer (1998)). Indeed in parallel with the discussion of the existence of a 'labour aristocracy' has been a literature on the difficulty of employing wage labour in SSA, see the discussion of labour coercion in early Kenya colonial history in Collier and Lall (1986).

Most recently the view that firms in Sub-Saharan Africa pay workers more than similar firms in other countries has been advanced by Gelb, Meyer and Ramachandran (2013) who argue that SSA worker are paid substantially more than they 'should' be given the level of development of the economies. The analysis of Gelb, Meyer and Ramachandran (2013) shows that once their cost of labour equation conditions on GDP there is a positive African dummy on the labour costs. If GDP is not included in the equation there is a negative African dummy so labour costs are lower than would be predicted by firm size and education, the controls the equation does contain. What their analysis shows is GDP is positively associated with labour costs - higher income economies have higher wages. Africa's lower level of GDP does not reduce labour costs as much as the level of GDP in poor non-African countries does so including GDP as a control produces a positive African effect. The conclusion they draw is that while Africa may be poor its labour is not cheap and this high cost is an important part of the failure to create sufficient wage jobs in SSA.

In parallel with these macro approaches to the problems posed by the links between wages and labour demand across countries has been an extensive discussion within developed countries of insider-outside models of the labour market. Such models have clear parallel with labour market models in developing countries which see a divide across different classes of labour ensuring that otherwise similarly skilled workers are paid very different wages. The problem posed in this micro approach is why wages differ so much within countries, a question we will explore in detail for Ghana in the sections below with the objective of linking those wages to the demand for labour. Such an approach has the disadvantage that it is unclear how any conclusions will generalise across other SSA countries. Its advantage is that data

is available which enables firm census data to be linked to panel firm level survey data which has data on both the productivity of firms and the wages of workers in those firms.

In the next section the firm census data is presented showing the changing patterns of job growth in Ghana over the period from 1962 to 2003. The issues that arise in modelling the demand for labour in Africa economies are briefly discussed in section 3. Section 4 outlines a framework for both efficiency wages and rent sharing models of the labour market. The empirical model and the underlying data are presented in section 5. Sections 6 and 7 present the production and earnings functions respectively. The issues suggested by the data analysis of the respective roles of job search, labour supply, the costs of capital and underlying productivity are discussed in section 8. A final section concludes.

2 Manufacturing firms and employment in Ghana 1962 -2003

In this section the pattern of labour demand by firms in Ghana is examined for the years 1962, 1987 and 2003, three years in which Ghana undertook a census of its manufacturing firms. These censuses enable us to understand how labour demand has changed across the size distribution of firms. Such changes are important in part because of the view that there is a 'missing-middle' of firms which arise due to the constraints on firm growth and partly due to the very different patterns of labour demand across the size distribution.

Teal (2016) argues that in understanding the evolution of labour demand across firms in Ghana's manufacturing sector the role of those enterprises classified as self-employed with employees needs to be understood. For Ghana's manufacturing sector the 1962 census recorded 95,158 enterprises with an average size of 3 employees and total employment of 254,247, the 1987 census recorded 8,349 enterprises with an average size of 19 and total employment 157,084, the 2003 census recorded 26,088 enterprises with an average size of 9 and total employment of 243,516 (see Teal (2016). Thus if this data is taken as an accurate representation of labour demand in Ghana's manufacturing sector then employment scarcely changed over a period when the population tripled.

In Teal (2016) it is shown that two differences across the three censuses are crucial for understanding how such different numbers arose. These are the geographic coverage of the censuses and how the firm is defined. The high number of enterprises recorded in 1962 reflect that that census covered rural areas and included in the definition of a firm enterprises run by the self-employed. In Table 1, which is taken from Teal (2016, Table 7), the data for the three censuses is presented on a consistent basis for urban areas where data from the population census has been used to add enterprises run by the self-employed. Table 2 (taken from Teal (2016, Table 8) represented the data in terms of growth rates and Figure 1 summarise how firms, using this definition, have evolved over the period from 1987 to 2003.

Tables 1 and 2 show the dangers of generalising even within a single country as to the patterns of firm and employment growth over time as these patterns are very different over the two sub-periods for which we have data, 1962 to 1987 and 1987 to 2003. In the first sub-period large firms (those employing greater than 100) grew far more rapidly than medium and small ones. In the second sub-period, 1987 to 2003 this pattern was completely reversed with an explosion in the growth of the number of small firms (those employing fewer than 10). The pattern of employment growth is also very different across the two sub-periods with, in the first sub-period, the growth rates of small and large firms being the same and very little employment growth in middle-sized firms, while in the second sub-period employment growth was confined to the small firm category with employment in large firms actually falling.

Table 1 Firms and Self-employment Establishments with Employees (SEEE): An Urban Based Estimate

	Number of Firms			Employment		
	(1)	(2)	(3)	(5)	(6)	(7)
No. of Employees	1962 (a)	1987 (b)	2003 (b)	1962 (c)	1987 (d)	2003 (d)
Firms 1-4		2,919	14,067		7,283	29,296
SEEE 1-4		16,250	52,438		40,625	157,314
Total 1-4	19,900	19,169	66,505	21,227	47,908	186,610
5-9	1,561	3,391	8,036	8,586	21,214	57,237
Small	21,461	22,560	74,541	29,813	69,122	243,847
10-19	765	775	2,160	8,415	10,474	35,092
20-29	246	243	559	5,909	5,891	12,314
30-49	132	166	425	4,921	6,354	7,858
50-99	105	161	276	7,212	11,455	7,709
Medium	1,248	1,345	3,420	26,457	34,174	62,973
100-199	58	83	121	7,840	12,269	9,548
200-499	38	57	90	11,000	17,671	19,010
500+	14	49	44	14,045	44,661	30,226
Large	110	189	255	32,885	74,601	58,784
Total	22,819	24,094	78,216	89,155	177,897	365,604

(a) The 1962 data is from Ghana Central Bureau of Statistics (1965). The 1962 Industrial Census recorded a total of 95,167 establishments which included enterprises run by the self-employed within households of which 72,348 were located in rural areas. As the 1987 and 2003 Industrial censuses did not cover the rural areas these have been excluded to ensure as much comparability across the censuses as possible.

(b) The number of Self-Employment Enterprises with Employees (SEEE) is taken from the population census data in Table 6 where it has been assume that 76.4 per cent of these enterprise wee located in urban areas.

(c) A total employment figures of 89,155 for urban areas is available from Ghana Central Bureau of Statistics (1965). The figure for small firms is then a residual where it has been assumed all firms with more than 20 employees are located in urban areas.

(d) To establish the employment patterns in the classification which includes the self-employed enterprise with employees it is necessary to know how many employees such enterprise have. In 2004 the CSAE carried out a labour market survey in urban Ghana which recorded the number of workers engaged as self-employed and asked them if they did employ workers. The results are as follows:

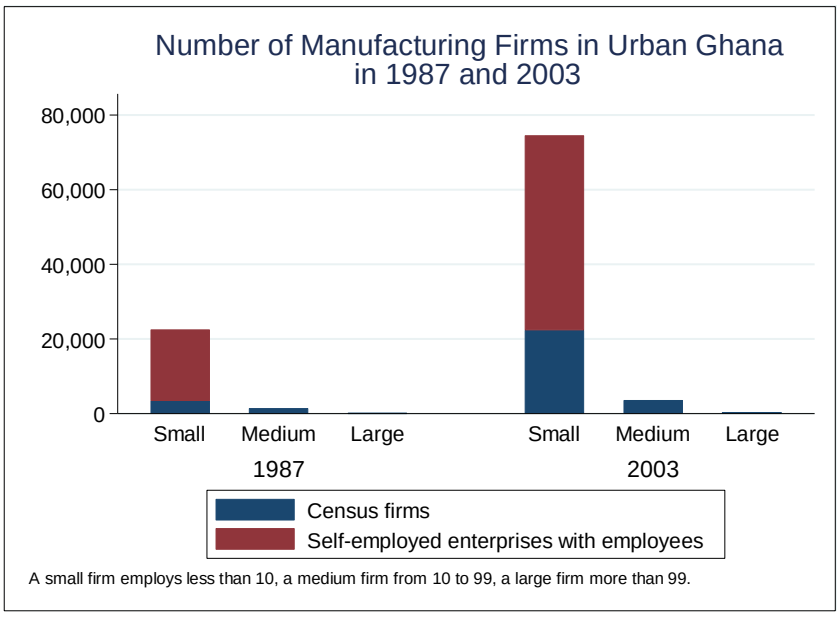
Percentage of Self-employed who employed workers	16	
Conditional on employment how many workers did you employ?	Mean	2.5
	Median	2
	Minimum	1
	Maximum	10
	Standard Deviation	1.72

The proportion of the self-employed who hired workers at 16 per cent in the CSAE survey is higher than the 12 per cent recorded in the population census for 2000 across both rural and urban areas. However as the CSAE survey was confined to urban area the implication of the data in Table 6 is that 18 per cent of the self-employed had employees in urban areas slightly higher than the number reported in Table 8 from the CSAE survey. Using the average number of employees of 2.5 based in the CSAE survey we have imputed employment in the Table.

Table 2 **The Growth in the Number of Firms and Self-employment Establishments with Employees (SEEE): An Urban Based Estimate**

	Growth in Number of Firms (Annual % Change)			Growth in Employment (Annual % Change)		
	(1)	(2)	(3)	(5)	(6)	(7)
No. of Employees	1962-1987	1987-2003	1962-2003	1962-1987	1987-2003	1962-2003
Firms 1-4		9.8	na		8.7	Na
SEEE 1-4		7.3	na		8.5	Na
Total 1-4	-0.01	7.8	2.9	3.3	8.5	5.3
5-9	3.1	5.4	4.0	3.6	6.2	4.6
Small	0.2	7.5	3.0	3.4	8.0	5.1
10-19	0.01	6.4	2.5	0.9	7.6	3.5
20-29	-0.05	5.2	2.0	0.0	4.6	1.8
30-49	1.0	5.9	2.9	1.0	1.3	1.1
50-99	1.7	3.4	2.4	1.9	-2.4	1.1
Medium	0.2	5.8	2.5	1.1	1.0	2.1
100-199	1.4	2.4	1.8	1.8	-1.6	0.5
200-499	1.6	2.9	2.1	1.9	0.5	1.3
500+	5.0	-0.7	2.8	4.6	-2.4	1.9
Large	2.2	1.9	2.1	3.3	-1.5	1.4
Total	0.2	7.3	3.0	2.8	4.5	3.4

Figure 1



The final distinctive feature of the pattern of labour demand that needs to be explained is the growth in the number of self-employed enterprises with employees. Their number more than tripled between 1987 and 2003 a faster growth rate than that of firms recorded in the manufacturing census. As a result of these differential growth rates while in 1962 small firms employed 33 per cent of all employment by 2003 they supplied twice as much at 67 per cent.

3 Modelling the demand for labour in African economies

To address the relationship between labour costs and the demand for labour in African economies requires a model that can explain the distinctive features of the African labour market. The characteristics which are highlighted by the Ghana data of the last section is the growing importance of small scale enterprises and the fact, which may be much less common in other SSA countries, of the domination within that small scale sector of household based self-employed, with employees, enterprises. This structure of the market ensures that an appropriate model must explain not only the demand for labour by firms but the choice between wage and self-employment.

The basis of the choice between wage and self-employment is the focus of a model by Lucas (1978) where managerial ability, broadly conceived, limits the sale at which an enterprise can be operated. Lucas provides a model based on Gibrat's law and assumptions as to how wages will change with growth that predicts a falling share of self-employment with rising wages. The model assumes a limited range of 'talent' for managing but also assumes homogeneity of both capital and labour. Thus the return from the 'talent' is a residual form the revenues of the firm once labour and capital costs have been met.

As will be shown in the analysis below two features of the data are the very large range of capital labour ratios seen across the firm population and the very small amounts of capital used by small firms. One possible interpretation of these findings is that it is not simply wages that differ across firms of differing size, but that the costs of capital do as well. Further, given the very small amounts of capital necessary to start a self-employed enterprise it can be assumed that the owner possesses not simply a 'talent' for manging but also owns the capital stock of the firm. If the return on those small amounts of capital are high then the decision as to whether to be a wage employee or run an enterprise will depend not simply on any 'talent' for managing the individual possesses but on access to the capital to form an enterprise.

The demand for labour depends on the technology available to firms and the implication of differing capital labour ratios, shown below, is that this technology choice differs across firms of differing size. The simplest static model of labour demand in a competitive market with a Cobb-Douglas technology ensures that the elasticity of labour demand with respect to capital will be unity, Hamermesh (1993, p.29). In this simplest model labour demand will be a function of the prices of capital and labour and the capital stock available to the firm. Again in the simplest competitive model the capital stock is given as are the prices of capital and labour and labour demand is thereby determined.

The implication of such models is that wages do not vary across firms. There have been broadly three approaches to understanding why wages within firm do vary. The first simply focuses on the skills of the worker and argues that wage differences will be a reflection of those skills. In such a model the competitive market assumptions are still assumed to hold and market wage rates simply reflect skills differences. The second group of theories assume a non-competitive labour market and initially focused on efficiency wages and rent sharing as reasons why workers may be able to charge more than their outside wage option. In parallel with this concern as to how non-competitive features of the labour market can arise has been the development of search models which, even within a competitive framework, will generate a wage distribution which depends on the characteristics of firms. In these search models there is no simple labour demand function but a matching process by which workers and firms seek the best available match between the worker and the firm.

Both non-competitive models of wage determination and matching are potentially relevant for an understanding on labour markets in Ghana. However the data suggest that in addition to these concerns the costs of capital to the firm may play a crucial role in who gets employed where. Shifts in the size distribution to the very small will ensure that the returns to ownership rise relative to wages. The modelling problem is to identify the factors which are changing that size distribution. One possibility that this paper will investigate is that large firm growth has been limited by wage setting institutions which have generated higher wages in large firms but limited employment growth in such firms. The rising supply of labour available to the smaller firms sector will have exerted downward pressure on wages and thus increased the attractiveness of the self-employment option.

In the next section a framework for testing some of the non-competitive theories of the labour market is set out.

4 A general empirical framework for bargaining and efficiency wage models

Both bargaining models and efficiency wage models come in various forms. To illustrate these models in a general framework, define net profits as

(1)

$$\pi = AF(K, eL) - wL - rK$$

where *A* is total factor productivity, *F* is the production function, *K* is physical capital, *e* is labour effort, *L* is labour, *w* is the unit price of labour and *r* is the unit price of capital.

The firm and the employees bargain over w and L such that the solution is obtained by maximising omega:

(2)

$$\Omega = \max_{L,K,w} \phi log L(w - \overline{w}) + (1 - \phi) log \pi$$

where ϕ is the relative bargaining power of the employees. Provided that workers have some bargaining power, i.e. $\phi > 0$, the first order condition with respect to *w* can be written

(3)

$$w = \overline{w} + \frac{\phi}{1 - \phi} \cdot \frac{\pi^G - rK}{-\pi_w}$$

where $\pi^G = AF(K, eL) - wL$ is gross profit, and π_w is the partial derivative of π with respect to *w*.

If the employees have no bargaining power, so that $\phi = 0$, then the optimal wage will satisfy $w = \overline{w}$. In other words the wage will be the outside option. This may of course vary depending on the skills of the individual but - and this is the key part as far as non-competitive theories of wage determination are concerned - it should not be a function of the firm attributes. For the moment we need to put to one side that workers may have preferences about attributes of the firm, eg firms may offer better working conditions.

If we abstract from any efficiency wage considerations then $\pi_w = -L$ so our equation (3) simplifies to:

(4)

$$w = \overline{w} + \frac{\phi}{1 - \phi} \cdot \frac{\pi^G - rK}{L}$$

Wages will be a function of the outside options and the profits per employee. It is equations of this form that that have provided the basis for theories by which bargaining leads to the sharing of the rents of the firm. Now how can this bargaining process come about? One obvious institutional feature that will lead to bargaining is unions. You have already covered how unions have been modelled and their possible impact of wages. There is in virtually all data sets a strong union mark-up whether that shows union do successfully bargain is another issue.

The possibly surprising finding in the literature is that profits can be shown to impact on wages in non-unionised labour markets. Blanchflower et al (1996) carries out a test for rent sharing on US markets where unionisation is relatively low. Teal (1996) presents some evidence this is also true in the Ghana labour market.

Why might we observe this effect without unions? There are at least three possible answers. One is based on insider-outsider models of the labour market. Insiders may be able to exert pressure for a range of reasons - costs of hiring, threats of disruption - which can occur even if there are no unions present. Second based on an interpretation of the result as one not of rent sharing but of risk sharing. If workers are risk adverse and firms and risk neutral then an optimal contract will guarantee workers a fixed wage. However if we relax the assumption that firms are risk neutral we will set up a link from the profits of the firm to wages. A third is based on market frictions which we will consider after the evidence for rent sharing and efficiency wages has been presented.

Let us turn to the efficiency wage model. Efficiency wages implies that w will impact positively on labour effort, hence:

(5)

$$-\pi_w = L - AF_{eL}Le_w \equiv L(1-g)$$

If we have no bargaining then $\pi_w = 0$ and we get the result that

(6)

$$AF_{eL}e_w \equiv 1$$

If we now consider the problem of choosing the labour input we will have:

(7)

$$\pi_L = AF_{eL}e - w = 0$$

Combining (6) and (7) we have

(8)

$$we_w/e = 1$$

This result is originally due to Solow and shows that the wage elasticity with respect to effort is unity in this model. While very simple this equation is the basis for some of the initial tests of the efficiency wage model (see Levine (1992)) who does a test of the efficiency wage hypothesis using this result proceeding as follows:

$$Y = AF(K, eL)$$

$$Y = (eL)^b K^{(1-b)}[f\varepsilon]$$

which is slightly less general than what Levine assumes but that does not change his specification.

$$LnY = bLne + bLnL + (1-b)LnK$$

$$dLnY = bdLne + bdLnL + (1-b)dLnK$$

From (8)

$$we_w/e = 1$$

We can write this as:

$$wde/dw = e$$

$$dLn(e) = de/e = dw/w = dLn(w)$$

$$dLnY = bdLnw + bdLnL + (1-b)dLnK$$

We will estimate in the next section an equation in the spirit of this specification.

5 The empirical model and data

Over the period from 1992 to 2003 panel data was collected on firms and their workers in Ghana. This data enables a comparison of the production technology of the firm with the earnings function of the worker, a paper adopting this approach using a comparison across Africa firm level data is Bigsten et al (2000). The extension possible with the Ghana data is that a longer period is possible and for the latter part of the survey a panel of workers in the firm was collected.

In this section we briefly outline the data and the specifications that will be estimated. We will begin by setting up a test for the role of efficiency wages and rent sharing in the panel of firms and workers. We begin by specifying a gross output production function with the following specification:

Equation (1)

$$\begin{aligned} Ln\,(Output)_{it} = {} & \beta_0 + \beta_1\, Ln(Capital)_{it} + \beta_2\, Ln(labour)_{it} + \beta_3 Ln(Material\ Inputs)_{it} \\ & + \beta_4(Other\ costs)_{it} + \beta_5(Human\ Capital)_{it} + \beta_6(FirmAge)_{it} \\ & + \beta_7 Unionisation_i + \beta_8(Sector\ Dummies)_i + \beta_9(Location\ Dummies) \\ & + \beta_{10}(Time\ Dummies)_t + \mu_i + \varepsilon_{it} \end{aligned}$$

This specification is chosen as research has shown the value-added specification imposes restrictions on the production function which are unlikely to be satisfied (see Harris and Moffat (forthcoming) for a similar approach using UK data and the background justification for using a gross output specification). There are also controls for the human capital of the workers which is obtained from the worker level survey which provide the basis for the earnings function which will be estimated to test a rent sharing interpretation of the data.

The second equation that will be estimated is an earnings function which, in addition to the standard human capital variables, will be augmented with size, profitability and monitoring variables to provide empirical evidence for the possibility of either efficiency wages or rent sharing in Ghana's labour market.

Equation (2)

$$\begin{aligned} Ln\,(Real\ Monthly\ Earnings)_{it} & \\ = {} & \beta_0 + \beta_1 Male + \beta_2 Age_{it} + \beta_3 Age_{it}^2 + \beta_4 Education_i + \beta_5 Education_i^2 \\ & + \beta_6 Tenure_i + \beta_7 Ln(Employment)_{it} + \beta_8(Real\ Profits\ per\ employee)_{it} \\ & + \beta_9(Firm\ Level\ HumanCapital)_{it} + \beta_{10}(Proportion\ of\ Managers)_{it} \\ & + \beta_{11}(Proportion\ of\ Supervisors)_{it} + \mu_i + \varepsilon_{it} \end{aligned}$$

The two equations provide the basis for an initial assessment of the potential role of non-competitive factors in the determination of wages and their links to the underlying performance of the firms. As will be seen the role of firm size is crucial for both the production function and the earnings function so we begin by showing how firm size, profitability and productivity are linked in the data we are using as a prelude to presenting the econometric results. These cross tabs will show the nature of the problem posed in identifying a demand for labour from the data.

Figure 2 shows how output per worker and capital per worker differ across the size distribution. Figure 3 show the relationship between the two variables. The key point from the data is how large is the variation in the cross section in the capital per worker across the size distribution. Figure 4 presents the data for 1991 and 2002 separately to confirm that this dispersion in the capital per worker is a function of the cross section and not of any time series changes in the variables.

Figure 2

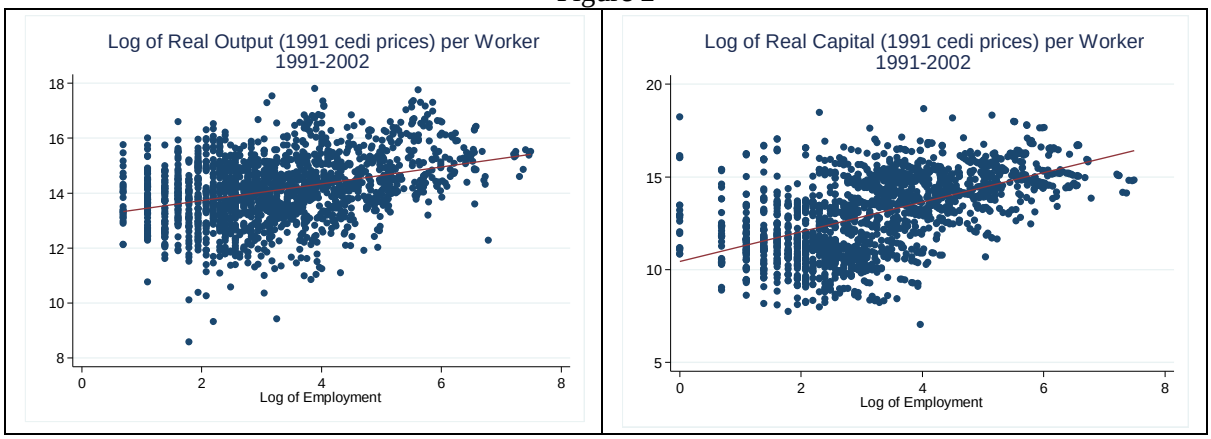


Figure 3

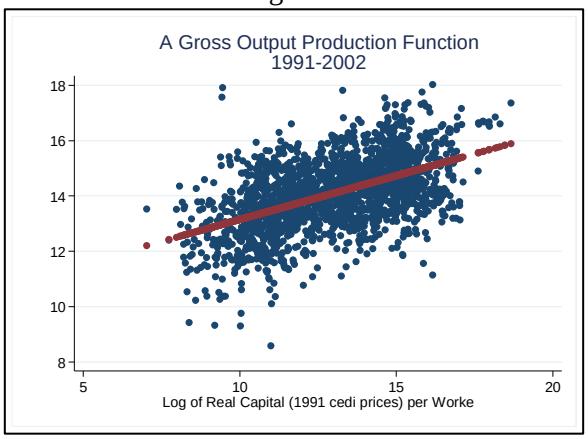
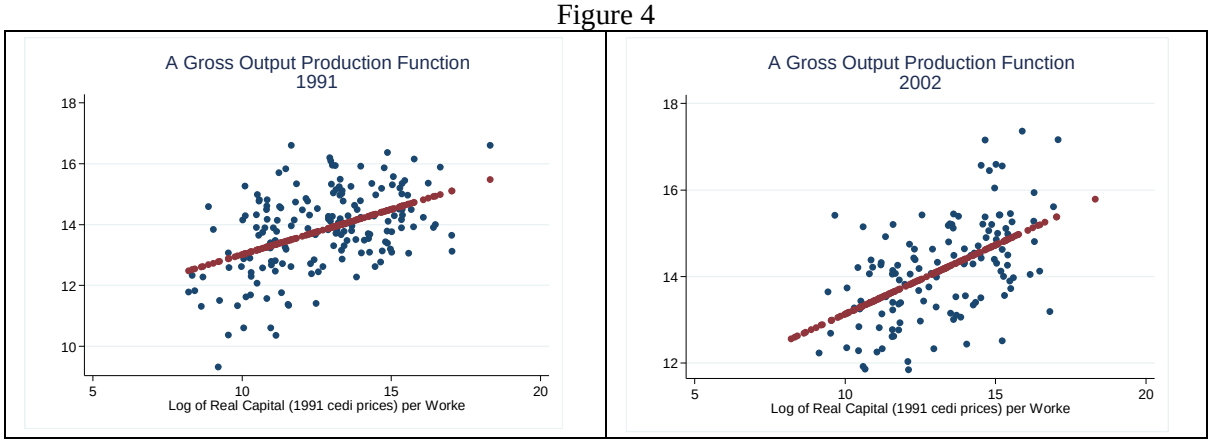


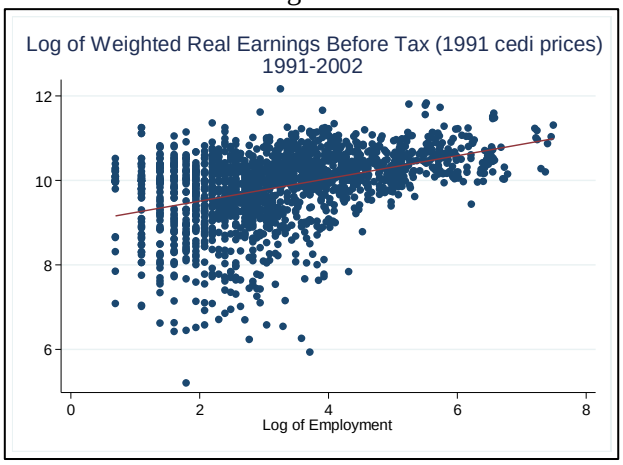
Figure 4



If a production function were to be identified from the data then in the simplest model of labour demand the demand for labour could be inferred either conditioned on output or conditioned on capital (see Hamermesh (1993)). Indeed in the simplest Cobb-Douglas model the elasticity of labour with respect to both wages and capital is unity. It is labour demand functions of this form that seem to underlie the notion that decreasing wages will increase the demand for labour.

The reason that identifying the labour demand function is not possible simply from a knowledge of the production function is the finding in the data, which is a very general one, that wages are positively correlated with aspects of the firm particularly its size. The possible reasons for such a correlation are surveyed in Oi, and Idson (1999). Its potential importance in our data is shown in Figure 5.

Figure 5



Clearly one reason for the strong association of wages with size is that larger firms use more skilled labour so we will need a full set of controls to establish if the correlation in Figure 5 does imply any kind of casual relationship between wages and firm size.

6 A production function

We begin in Tables 3 and 4 presenting our estimation of Equation (1). Summary statistics are given in the appendix. Column (1) presents the pooled OLS estimate, column (2) uses firm fixed effects, column (3) uses the differenced GMM estimate due to Arellano and Bond S (1991) and column (4) the system GMM estimator due to Blundell and Bond (2000). The only difference between the tables is that in Table 3 constant returns to scale is not imposed but it is in Table 4. As the test results show there is little evidence that constant returns is not accepted by the data. The test rejects at the 5 per cent significance level only for the difference GMM specification in which the point estimates for both capital and labour are negative and insignificant. The difference GMM specification depends on using levels as instrument for differences and, as has been widely found, produces very imprecise estimates when the time variation in the data is limited. The equation also controls for the human capital of the firm by a weighted average of the education, age and tenure of the workers. Of these in the pooled OLS estimation of Column (1) only the age variable is significant, and negative.

The variable of interest for testing for efficiency wages in this specification is the wage variable which is a weighted average of the earnings of workers in the firm. In a simple efficiency wage model the parameter estimate on this variable should be the same as on the labour variable. It will be noted that in Columns (1) and (2) this variable is highly significant but the point estimate is clearly below that implied by the efficiency wage model. Column (2) controls for firm fixed effect and with such controls the point estimate on the wage term only declines marginally and not significantly. In Columns (3) and (4) we seek to control in additional for time varying unobservables by means of the differenced and system GMM estimators. It will be noted that in Table 3, with constant return to scale not imposed, the parameter estimates on the wage term are greatly reduced and no longer significant. However in Table 4, where constant returns to scale are imposed, the point estimate differs little in the difference and system GMM results from the fixed effects results in Column (2). Indeed the point estimates in Columns (2) and (4) are identical.

Table 3
Gross Output Production Function: Dependent Variable Ln (Real Output)

	(1)	(2)	(3)	(4)
	Pooled OLS	Firm Fixed Effects	Diff GMM	Sys GMM
Ln (Capital)	0.030***	0.016	-0.092	0.065***
	(0.007)	(0.038)	(0.126)	(0.023)
Ln (Raw Materials)	0.658***	0.623***	0.669***	0.718***
	(0.009)	(0.032)	(0.088)	(0.043)
Ln (Other Costs)	0.171***	0.141***	0.103*	0.116***
	(0.009)	(0.020)	(0.061)	(0.040)
Ln (Employment)	0.158***	0.164***	-0.059	0.126**
	(0.017)	(0.031)	(0.118)	(0.057)
Ln (Earnings)	0.079***	0.059***	0.028	0.016
	(0.014)	(0.022)	(0.077)	(0.041)
Age_weighted	-0.007***	-0.008***	-0.007*	-0.005
	(0.002)	(0.003)	(0.004)	(0.004)
Tenure_Weighted	0.003	0.006	0.006	0.008*
	(0.003)	(0.005)	(0.007)	(0.004)
Educated_Weighted	0.001	-0.004	0.005	0.006
	(0.004)	(0.007)	(0.008)	(0.007)
Firm_Age	0.003***	0.002		0.003*
	(0.001)	(0.006)		(0.002)
Unionised	0.079**			
	(0.035)			
Constant	2.107***	3.767***		1.911***
	(0.192)	(0.627)		(0.566)
Observations	1,707	1,707	1,426	1,707
R-squared	0.971	0.781		
Number of firms		236	216	236
Test for constant returns to scale	F(1,1671) = 2.55 Prob > F = 0.1102	F(1, 235) = 1.71 Prob > F = 0.1925	chi2(1) = 4.81 P > chi2 = 0.028	chi2(1) = 0.20 P > chi2 =0.651
Arellano-Bond AR(1)			Pr > z = 0.000	Pr > z = 0.000
Arellano-Bond AR (2)			Pr > z = 0.000	Pr > z = 0.000
Sargan Test			chi2(80) = 65.39 P > chi2 = 0.881	chi2(125) = 143.56 P > chi2 = 0.123
Hansen Test			chi2(80) = 76.20 P > chi2 = 0.600	chi2(125) = 136.81 P > chi2 = 0.222
Endogenous variables			Ln (Capital), Ln (Raw Materials), Ln (Other Costs), Ln (Employment), Ln (Earnings)	
Instruments used			Lags 3 to 4	Lags 3 to 4
Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1				

Table 4
Gross Output Production Function: Dependent Variable Ln (Real Output/Worker)

	(1)	(2)	(3)	(4)
	Pooled OLS	Firm Fixed Effects	Diff GMM	Sys GMM
Ln (Capital/ Worker)	0.032***	0.049*	0.073	0.063*
	(0.010)	(0.029)	(0.061)	(0.033)
Ln (Raw Materials/Worker)	0.657***	0.624***	0.692***	0.699***
	(0.026)	(0.032)	(0.083)	(0.054)
Ln (Other Costs/Worker)	0.173***	0.142***	0.108*	0.129***
	(0.022)	(0.020)	(0.059)	(0.046)
Ln (Earnings)	0.081***	0.058***	0.038	0.058
	(0.023)	(0.021)	(0.038)	(0.037)
Age_Weighted	-0.007**	-0.008***	-0.004	-0.006
	(0.003)	(0.003)	(0.003)	(0.004)
Tenur_Weighted	0.003	0.006	0.004	0.007*
	(0.004)	(0.005)	(0.007)	(0.004)
Educated_Weighted	0.001	-0.004	0.005	0.000
	(0.006)	(0.007)	(0.007)	(0.007)
Firm Age	0.003*	0.001		0.003
	(0.001)	(0.006)		(0.002)
Unionised	0.114**			0.074
	(0.057)			(0.098)
Constant	2.146***	3.167***		1.781*
	(0.281)	(0.430)		(0.955)
Observations	1,707	1,707	1,426	1,707
R-squared	0.908	0.753		
Number of firm		236	216	236
Implied labour coefficient	0.138 (0.018)***	0.185 (0.028)***	0.127 (0.092)	0.108 (0.058)*
Arellano-Bond AR(1)			Pr > z = 0.000	Pr > z = 0.000
Arellano-Bond AR (2)			Pr > z = 0.000	Pr > z = 0.000
Sargan Test			chi2(64) = 63.18 P>chi2= 0.506	chi2(100)=111.9 P >chi2=0.196
Hansen Test			chi2(64) = 64.64 P > chi2 = 0.454	chi2(100)=101.52 P > chi2 = 0.439
Endogenous variables			Ln (Capital/ Worker) Ln (Raw Materials/Worker) Ln (Other Costs/Worker) Ln (Earnings)	
Instruments used			Lags 3 to 4	Lags 3 to 4
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1				

The implication of the results in Table 4 is that while there is some evidence that time invariant unobservables are positively correlated with the wage variable there is none tha time varying unobservables are a significant factor. Equally important is to note that the cross section figures used in the previous section are replicated in the econometric analysis. The production function can with only small amounts of bias be estimated from the cross section. One possible interpretation of this result is that factor prices are exogenous to the firm and the higher capital labour ratios observed at higher level of employment reflect the variation over the size distribution of those factor prices. Such a possibility is a further motivation to examine the determinants of wages which will be taken up in the next section.

7 An earnings function

Tables 5 and 6 report our estimates of Equation (2) a standard earnings function which is augmented to include both the log of employment and real profits per employee. Summary statistics are given in the appendix. The data is the individual level earnings of workers in the firms used to estimate the production function of the previous section. Only the last four waves of the survey collected panel data on the workers so the sample is confined to those four waves. In addition to the log of employment and real profits per employee the specification also includes the firm level average of the human capital of the firms measured by Age and Education.

Table 5
Dependent Variable: Ln of Real Monthly Earnings before Tax in 1991 Cedis

	(1)	(2)	(3)
	Pooled OLS	Firm Fixed Effects	Individual Fixed Effects
Male	0.143***	0.077*	
	(0.036)	(0.041)	
Age	0.054***	0.044***	0.007
	(0.007)	(0.008)	(0.010)
Age_squared	-0.000***	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)
Education (in years)	-0.019**	-0.011	
	(0.008)	(0.009)	
Education_squared	0.004***	0.003***	
	(0.000)	(0.000)	
Tenure	0.006***	0.007***	-0.005
	(0.002)	(0.003)	(0.004)
Ln (Employment)	0.189***	0.051	0.009
	(0.012)	(0.050)	(0.030)
Real Profits per Worker	0.048***	0.001	-0.009*
	(0.006)	(0.005)	(0.005)
Education_weighted	0.010*	-0.015	-0.005
	(0.006)	(0.009)	(0.005)
Age_weighted	-0.011***	-0.010**	-0.009***
	(0.002)	(0.004)	(0.002)
Percentage of Managers	0.006**	-0.002	-0.005*
	(0.003)	(0.005)	(0.003)
Percentage of Supervisors	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.001)
Constant	7.724***	8.922***	10.422***
	(0.148)	(0.248)	(0.259)
Observations	6,419	6,419	6,419
R-squared	0.430	0.583	0.101
Number of individuals			2,281
Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1			

Table 6
Dependent Variable: Ln of Real Monthly Earnings before Tax in 1991 Cedis

	(4)	(5)	(6)
	Both profits and employment endogenous	Real profits per employee endogenous	Employment endogenous
Male	0.030	0.235***	0.055
	(0.054)	(0.071)	(0.052)
Age	0.031*	0.057**	0.036
	(0.017)	(0.027)	(0.031)
Age_squared	-0.000	-0.001***	-0.000
	(0.000)	(0.000)	(0.000)
Education (in years)	-0.031***	-0.012	-0.028**
	(0.010)	(0.012)	(0.014)
Education_squared	0.004***	0.004***	0.004***
	(0.000)	(0.001)	(0.001)
Tenure	-0.005	0.023	-0.003
	(0.018)	(0.044)	(0.029)
Ln (Employment)	0.529***		0.435***
	(0.095)		(0.161)
Real Profits per Worker	-0.013	0.029	
	(0.013)	(0.022)	
Education_weighted	-0.021**	0.024***	-0.013
	(0.009)	(0.007)	(0.011)
Age_weighted	-0.027***	-0.002	-0.022*
	(0.006)	(0.006)	(0.011)
Percentage of Managers	0.025***	-0.006*	0.020**
	(0.006)	(0.003)	(0.009)
Percentage of Supervisors	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Constant	8.077***	7.835***	8.030***
	(0.285)	(0.498)	(0.484)
Observations	6,419	6,419	6,419
R-squared			
Number of individuals	2,281	2,281	2,281
Arellano-Bond AR(1)	Pr > z = 0.000	Pr > z = 0.000	Pr > z = 0.000
Arellano-Bond AR (2)	Pr > z = 0.883	Pr > z = 0.848	Pr > z = 0.943
Sargan Test	chi2(31) Prob > chi2 = 0.000	chi2(15) Prob > chi2 = 0.000	chi2(15) Prob > chi2 = 0.016
Hansen Test	chi2(31) Prob > chi2 = 0.598	chi2(15) Prob > chi2 = 0.054	chi2(15) Prob > chi2 = 0.690
Instruments used	Lags 3 to 4	Lags 3 to 4	Lags 3 to 4
All equations in this Table are estimated by system GMM. Except for employment and profits all variables are treated as exogenous.			
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

These variables are included in the specification to allow for the possibility that there are externalities to human capital at the firm level and that larger firms are benefiting from these externalities. The specification also includes the proportion of the workers who are managers and the proportion who are supervisors. Certain version of the efficiency wage model imply that by increasing monitoring these variables will act to decrease wages.

Table 5 Column (1) shows that in the cross section there is a clear and highly significant positive relationship between earnings and the size of the firm as measured by employment and also profits per employee. This holds with controls for the human capital within the firm and the degree of supervision of the workers. Table (5), Columns (2) and (3), report the results first with controls for firm effect and then with control for individual effects. With either of this set of controls the significance and in large measure the size of both the employment effect and the real profits per employee disappears. Both firm fixed effects and individual fixed effects are clearly very important determinants of earnings and why this is the case is central to understanding how the labour market works. On the basis of the results reported in Table 5 we have no evidence of any causal effect from size or profits onto earnings.

In Table 6 we investigate whether the negative results in Table 5, Columns (2) and (3), are due to the problems posed by endogeneity issues not addressed by the fixed effects. In Table 6 the system GMM estimator is used and both the size and profit variables are treated as endogenous. Controls are at the level of individual effects. The results are rather striking. Once endogeneity is allowed for there is now evince of a highly significant size effect which is larger than that found in the cross-section. There is no evidence for a profits effect.

These results must be treated with some caution as it is well known that the system GMM estimator can be sensitive to the instruments used. However the results clearly confirm the importance of firm effects as a determinant of earnings. In the next section we consider why this effect may arise.

8 Searching, labour supply, the costs of capital and firm profitability

Mortensen (2003) provides an overview of search theories which will generate a wage dispersion in a competitive market with similarly skilled workers. Wage effects associated with size and industry effects are not explained by the model in its simplest form. However if labour productivity differs across firms then the model will generate a distribution in which there is a correlation between industry effects and wages.

The key point of the search models is that you do not need to postulate any non-competition in the labour market to generate a relationship between wages and firm characteristics. Further it is not necessary to assume that there is unobserved worker level heterogeneity underlying the differences in wages across those with similar human capital. Search plus firm differences in productivity will produce a wage dispersion.

In the basic model there are as many workers as firms and firm size is irrelevant. However it is clear that once firms do differ by size a high productivity firm has an incentive to attract more workers than a low productivity firm as the model predicts a higher profit on the marginal worker. Endogeneity of recruitment in the model will set up a correlation between wages and firm size.

The question posed by our data is whether the firm size effects we observe are due to such ‘frictions’ in job search or have other sources. If the result that the firm size effect is larger in the instrumented regression than in the OLS is correct it implies, quite contrary to what a job search model would imply, that there is a negative correlation between the unobservables and the firm size variable. An alternative interpretation to one in terms of job search is that the supply curve of labour to firms is upward sloping. One aspect of that upward sloping supply curve may well be the need to compensate for the income from capital available to the self-employed.

The amounts of capital needed to form a firm are extremely small and the rate of profit on that capital very high relative to the returns for larger firms as is shown in Figure 6. The median capital stock per worker for small firms (those employing less than 10) is less than US$500. For large firms (those employing more than 100) it is US$8,500. These figures show that even for firms classified as large by Ghanaian standards the amount of capital used is modest. The right hand side of Figure 6 reports the

profit rate defined as profits divided by the value of the capital stock. This mirrors the amounts of capital available to the firm.

In Figure 7 we report how firm wages differ across the same size spectrum and how the wages differ by education level. It needs to be noted that in Figure 7 there are controls for the human capital of the individual in the wage size figure. This simply replicates in graphical form the results from our pooled OLS earning function reported in Table 5 Column (1) above. The left hand part of Figure 7 also show the implications for the returns on human capital from that earnings function. For most of the workforce, those who have ten years of education or less, the returns are negligible.

Figure 6

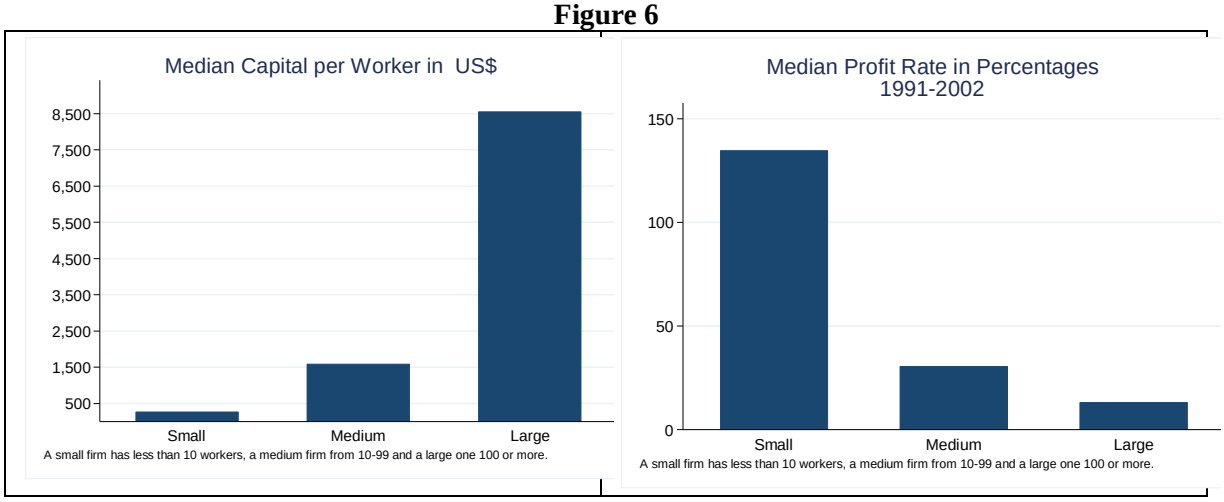
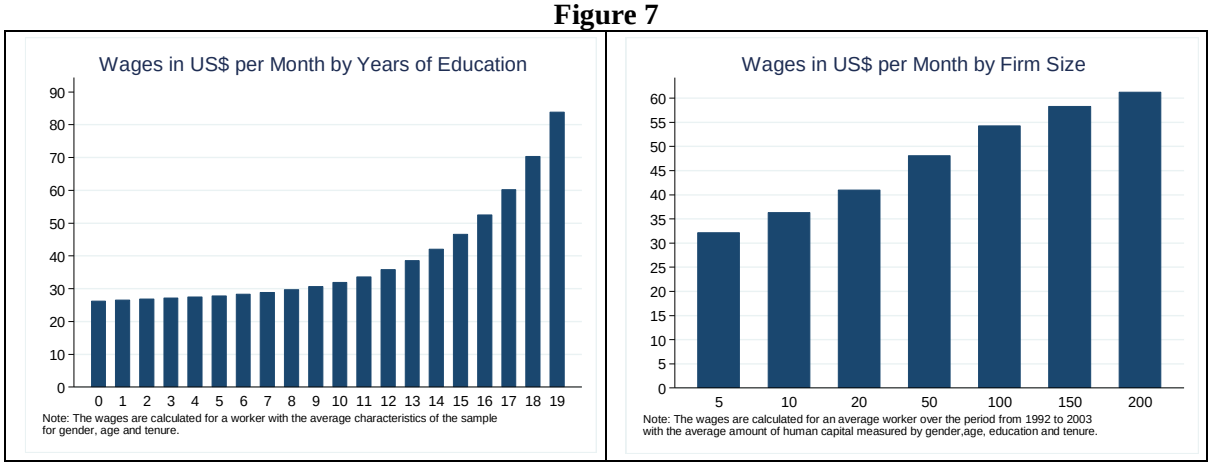


Figure 7



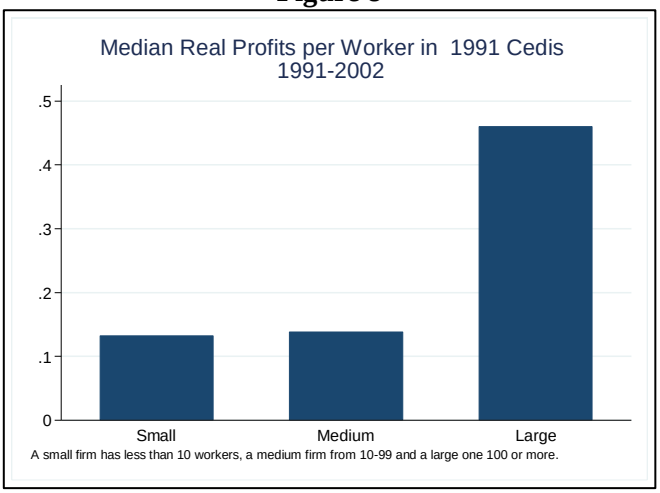
As we would expect, given our ability to identify a production function with cross section data, both profit rates and wages differ greatly across the size spectrum. The reasons for both have been the focus of an extensive literature that for wages having been surveyed above. The underlying issue for both the profit rate and the wage rate is whether the differences that are observed across firms of differing size reflect some form of market failure or are the result of differing costs of the supply of capital in the case of the profit rate or a rising supply curve of labour in the case of wages.

The nature of the labour market makes a rising labour supply curve a possible interpretation of the data. Given the very low amounts of capital necessary to start a firm and the high return on that capital any decision to work in a larger firm means forgoing the return on capital through the operation of a micro enterprise. The higher wages with size shown in Figure 7 could reflect such a process.

An alternative interpretation in terms of rent seeking is certainly not ruled out by the data. Indeed the analysis and data have shown at least three possible sources of rents to workers in large firms. If a search model is part of the explanation for the wage size relationship then 'frictions' in such models create rents for those who obtain the jobs. Secondly, the high correlation between wages and profits per worker would also be a mechanism for capturing rents, although our present evidence points against such an interpretation. A third possibility is that workers capture some of the rent available to firms facing lower capital costs. If any of these rent capturing mechanisms are in place then they offer a possible explanation for the pattern observed in the census data by which larger firms grew more capital intensive rather than more numerous.

A final piece of evidence that we will present from the survey data is the profitability of firms by size in Figure 8. The data presented in the figure is that used in the regressions reported above. It is will seen that in term of profitably defined in per worker terms there is little difference between small and medium firms while large firms (those employing more than 100 workers) are nearly five times more profitable. Even if rent capture is part of the wage determination process for larger firms it does not prevent them being massively more profitable than smaller ones.

Figure 8



9 An overview

We began with a question: Do wage earners in Sub-Saharan Africa (SSA) constitute an aristocracy within the labour market with high wages preventing the expansion of wage employment for most? Providing workers earning from US$60-100 per month can be regarded as an 'aristocracy' the answer implied from out data is yes such workers are relatively well paid. However it is far from clear that these higher wages are the source of a limitation on wage employment.

Over the period for which we have consistent data wage employment in urban manufacturing expanded by 4.5 per cent per annum between 1987 and 2003. This employment growth was almost entirely confined to small firms, those employing less than 10. In this category the growth rate was 8 per cent per annum. Among the large firms, those employing more than 100, employment actually fell. So the question suggested by the data is whether the higher wages paid by larger firms was a constraint on their expansion and, if not, what was.

The evidence presented in the last section has shown that large firms appear to face significantly lower capital costs than small firms. Their median return on capital is 13 per cent, much below the average rate of 60 per cent. Large firms are also massively more profitable on a per worker basis than smaller ones suggesting that, even if there are constraints on access to the capital market, internal sources of funds are available if firms did wish to expand. Thus the question posed by the data is the unwillingness

of these larger more profitable firms to expand. While large firms are more likely to export than smaller ones previous work on this data has shown that exporting is very limited. If the problem facing the firms is that demand is limited due to their dependence on the domestic market then the underlying constraint facing them is their lack of access to export markets. That question cannot be tackled with a single country data set such as that used in this paper.

References

Arellano, M., Bond, S., (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58, 277-297.

Akerlof, G. and J. Yellen (1986). *Efficiency Wage Models of the Labour Market*. Cambridge: Cambridge University Press.

Blanchflower, D. G., A. J. Oswald and P. Sanfey (1996) "Wages, profits and rent-sharing," *The Quarterly Journal of Economics* 111: 227-251.

Blundell, R. and Bond, S**.** (1998) Initial Conditions and Moment Restrictions in Dynamic Panel Data Models, *Journal of Econometrics*, **87**, 115-43.

Blundell, R. and Bond, S. R. (2000) GMM Estimation with Persistent Panel Data: An Application to Production Functions, *Econometric Reviews*, **19**, 321-40.

Brown, C. and Medoff, J. (2001) "Firm age and wages." Working Paper 8552, National Bureau of Economic Research.

Collier, P. and D. Lal (1986) *Labour and Poverty in Kenya: 1900-1980*, Clarendon Press, Oxford.

Gelb, A., Meyer, C. and V. Ramachandran (2013) 'Does Poor Mean Cheap? A Comparative Look at Africa's Industrial Labor Costs' Centre for Global Development: Working Paper 325 May 2013 (revised June 2013)

Harris, R. and J. Moffat (forthcoming) 'The UK productivity puzzle, 2008-2012: evidence using plant level estimates of total factor productivity', *Oxford Economic Papers*.

Hamermesh, D. S. *Labor Demand* (Princeton University Press, 1993).

Huang Tzu-Ling, A. Hallam, P.F.Orazem and E.M. Paterno (1998) "Empirical tests of efficiency wages", *Economica*, 65, pp. 125-43.

Levine, D. (1992) "Can wage increases pay for themselves? Tests with a production function", *The Economic Journal*, 102 (September), 1102-1115

Lucas, R.E (1978) 'On the size distribution of business firms', *The Bell Journal of Economics*, Volume 9, Issue 2 (Autumn, 508-523).

Mortensen, D. T. (2003) *Wage Dispersion: Why are similar workers paid differently?* MIT Press, Cambridge, Massachusetts.

Oi, W. Y. and Idson, T. L. (1999) "Firm size and wages." Chapter 33 in Handbook of Labor Economics, vol. 3, North-Holland.

Owens, T. and A. Wood (1997) `Export Oriented Industrialisation through Primary Processing?', *World Development*, 25 (9), September, 1453-1470.

Söderbom, M. and Teal, F. "Size and Efficiency in African Manufacturing Firms: Evidence from Firm-Level Panel Data" *Journal of Development Economics,* 2004, 73, pp. 369-394.

Söderbom,M., Teal, F. and Wambugu, A. "Unobserved heterogeneity and the relation between earnings and firm size: Evidence from two developing countries" *Economic Letters* , 87, (2005) 153-159.

Teal, F. (1996) "The size and sources of economic rents in a developing country manufacturing labour market", *Economic Journal*, July.

Teal, F. (2000) "Real wages and the demand for skilled and unskilled male labour in Ghana's manufacturing sector: 1991-1995." *Journal of Development Economics,* Vol. 61 pp. 447-461.

Teal, F. (2008) "Using firm surveys for policy analysis in low income countries" *Journal of Development Perspectives*, Vol. 4:1 October.

Teal, F. (2016) 'Firm Size, Employment and Value-added in African Manufacturing Firms: Why Ghana needs its 1 per cent', CSAE Working Paper WPS/2016-07.

Wadhwani, S. B. and Wall, M. "A direct test of the efficiency wage model using UK micro data." *Oxford Economic Papers,* 43 (1991), pp. 529-548.

Waterman, P. (1975), The 'Labour Aristocracy' in Africa: Introduction to a Debate. Development and Change, 6: 57–74. doi:10.1111/j.1467-7660

Wood, A. (1994) *North-South Trade, Employment and Inequality: Changing fortunes in a skill-driven world* (Clarendon Press).

Wood, A. and K. Berge (1997) 'Exporting Manufactures: Human Resources, Natural Resources, and Trade Policy', *Journal of Development Studies*, 34 (1), 35-59.

Wood, A. and J. Mayer (1998) Africa's Export Structure in a Comparative Perspective, Study No. 4, African Development in a Comparative perspective, UNCTAD, Geneva.

Appendix Summary Statistics

Summary statistics for the production function

Variables	Median	Mean	Standard Deviation	Max	Min
Ln (Real Output/Worker)	14.13	14.11	1.20	17.81	8.58
Ln(Capital/Worker	13.24	13.06	2.02	18.67	7.03
Ln (Raw Materials/Worker)	13.32	13.29	1.37	17.42	5.35
Ln (Other Costs/Worker)	11.55	11.48	1.71	15.96	5.44
Ln(Employment)	3.09	3.25	1.38	7.50	0.69
Ln (Earnings)	10.04	9.85	0.89	12.16	5.20
Age_Weighted	31.89	31.88	8.01	61.65	15.00
Tenure_Weighted	5.58	6.64	4.74	30.00	0.00
Education_Weighted	10.09	9.89	2.60	21.10	0.00
Firm Age	17.00	18.50	12.18	73.00	0.00
Unionised	0.00	0.30	0.46	1.00	0.00
Number of observations 1707					

Summary statistics for the earning function

Variables	Median	Mean	Standard Deviation	Max	Min
Ln (Earnings in 1991 prices)	10.13	10.18	0.83	13.49	5.40
Male Dummy	1.00	0.82	0.38	1.00	0.00
Age	35.00	36.93	11.29	82.00	3.00
Age_squared	1225.00	1491.44	922.38	6724.00	9.00
Education (in years)	10.00	11.11	4.43	26.29	0.00
Education_squared	100.00	143.09	96.25	690.94	0.00
Tenure (in years)	6.00	8.54	7.86	98.00	0.00
Ln(Employment)	3.91	3.99	1.26	7.50	0.69
Real profits per Employee	0.22	0.61	1.56	18.00	-2.36
Education_Weighted	10.66	10.34	2.51	21.10	0.00
Age_Weighted	35.68	35.36	7.28	61.65	15.00
Percentage of Managers	2.00	3.33	4.42	50.00	0.00
Percentage of Supervisors	3.23	4.67	6.26	73.53	0.00
Number of observations 6419					