

Wage Dispersion, Job Creation and Development: Evidence from Sub-Saharan Africa

Very Preliminary

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Abstract

Labor markets in least developed countries are characterised by small wage sectors and low productivity and wages. Using household level data for many countries in Sub-Saharan Africa, we document that they also show a greater level of wage dispersion. This is in stark contrast with the positive correlation between income mean and income inequality for the same countries. We propose a labor search and matching framework with entry costs and firm heterogeneity that delivers endogenously the negative correlation between (i) wage dispersion and size of the wage sector and (ii) wage dispersion and wage mean. We also show that this model can reconcile the differences between wage and income inequality by accounting for labor reallocations between wage and self-employment sectors. We focus on three channels to explain these phenomena in Sub-Saharan Africa: entry costs (e.g. regulations, financial constraints to starting a business), differences in countries' underlying productivity distribution (e.g. due to lower capital intensity, or poor infrastructure) and labor market frictions. A numerical simulation shows that the model does a good job in reproducing the main stylised facts and reveals how these different constraints interact to reduce labor market performance.

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Labour markets in developed and developing countries are strikingly different. First and foremost, the size of the wage sector among the poorest regions in the world is very small, falling below 15% in many Sub-Saharan African countries¹. This evidence suggests that there are not enough jobs for the number of people willing to work for a wage and, as a consequence, most end up in less desirable self-employment occupations, own-account work or helping family activities for no pay. Furthermore, the wage sector is characterised by relatively low levels of productivity, and hence low earnings. For example, labour productivity in Sub-Saharan Africa is, on average, fourteen times lower than in advanced economies and four times lower than in Latin America².

In this paper we use household level data to draw attention to a fact that has not been well documented but seems to be intrinsically linked to labor market underperformance in developing countries. Namely, that the wage sector in developing countries exhibits very high levels of wage dispersion. For example, we find that the top 10% of wage earners in Uganda and Ghana are paid 36 and 24 times more than the bottom 10%, respectively, while in the US this ratio is only 8 times³. Furthermore, we document that wage inequality is greater in countries with smaller wage sectors and lower average wages. This stylized fact also provides a new insight into a well-established fact that economists have long associated with the Kuznets curve, namely that for the poorest countries (mostly in Sub-Saharan Africa) there is a positive cross-country correlation between average *income* and inequality. High wage inequality and low income inequality can coexist in a country, when a large fraction of the workforce is engaged in low-income non-wage activities.

This indicates the importance of modelling the determinants of wage levels and of the size of the wage sector simultaneously. It also suggests that understanding the performance of the wage sector should be an integral part of the understanding of income inequality in developing countries. Albeit being very small and relatively unproductive, the wage sector still outperforms non-wage occupations and has been identified as desirable both by workers looking for a steady source of income and as an engine of economic growth⁴. However, the prevalence of frictions in labour markets (e.g. segmentation) and inefficiencies in other markets and institutions (e.g. credit

¹See ILO (2012).

²See ILO (2012). Note that these differences in productivity and pay are not explained by the composition of the labour force, such as workers' education, skills, etc. For example, Clemens, Montenegro and Pritchett (2008) estimate the wage gain obtained by foreign workers who arrive to work in the United States relative to their country of origin and find that the same person would earn on average more than 7 times when relocating from Ghana to the US and less than 3 times if coming from South Africa.

³Based on our own calculations using Uganda National Household Survey 2010, Ghana Living Standards Survey 2005, and Survey of Income Program Participation (SIPP) 2004 for the US. These calculations are based on individuals aged between 15 and 65, excluding public sector employees.

⁴See Fields (2011), Banerjee and Duflo (2007) and World-Bank (2014)

rationing and entry barriers) hinders the reallocation of workers from self-employment to the wage sector. In this paper, we propose and estimate a framework that shows how these frictions prevent job creation and affect labour productivity, wages and wage inequality in developing countries.

We present a model of labor markets in developing countries that can endogenously deliver a link between the size of the wage sector, the level of productivity and wages, the dispersion of wages and income inequality. In particular, we extend the standard frictional search framework to allow for firm heterogeneity and entry costs. There are two labor markets in the economy, namely a wage sector and a home production (or self-employment) sector. The former operates as a frictional labor market while the latter is the outside option, with a unique income determined competitively. Firms are heterogeneous in their productivity level, revealed only after they paid an entry cost to operate in the wage sector. The model delivers two equilibrium outcomes, namely the economy's market tightness (a measure of competition in labor markets, defined as the ratio of vacancies to job seekers) and the productivity threshold (the minimum productivity level at which a firm can survive in the wage sector). There are three key elements in the model that endogenously generate the link between the size of the wage sector and the wage distribution. First, a wage bargaining process that links wages to firms' productivity and the outside option (i.e. income in self-employment). Second, a zero profit condition that truncates the distribution of productivity as firms with productivity below a threshold exit the market immediately after entry. Finally, there is a free entry condition such that firms enter until the expected value of an open vacancy equals the entry cost. Because the market tightness is positively correlated to the job creation rate (and the job destruction rate is exogenous), it directly determines the size of the wage sector. The productivity distribution of the active firms, that directly affects wage mean and variance, is a function of the productivity threshold.

We subsequently present a numerical simulation of the model, aimed at illustrating its main mechanisms affecting wage inequality across countries, as well as their interactions. We focus on three channels in explaining a small size of the wage sector, low average wages and greater wage dispersion in Sub-Saharan Africa. Namely, the level of entry costs that includes various barriers to entry (e.g. regulations, financial constraints to starting a business, etc.), differences in countries' underlying productivity distribution (e.g. due to lower capital intensity, or poor infrastructure) and labor market frictions (captured by a measure of matching efficiency). The simulation exercise shows that variation in the exogenous components of the model can qualitatively reproduce the

main stylised facts of labor markets in developing countries and point out to some interesting interactions that cannot be recovered analytically from the model. For example, the effect of a change in labor market frictions on wage inequality is amplified in the presence of higher barriers to entry. Similarly, the results of this numerical simulation help us identify particular moments that play a key role in identifying structural parameters in the estimation of the model.⁵

Our framework builds on recent progress in the development and labor economics literature. The development economics literature has established, both theoretically and empirically, a number of factors that shape labour market outcomes in developing countries including the size of wage employment and the level of wages⁶.

However, looking at wages levels is not always sufficient to characterise labour markets: conditional on the same mean, a greater wage dispersion reflects a higher degree of market inefficiencies and, hence, it is more informative about constraints to job creation and wage growth. Still, productivity wage dispersion remain under-explored in developing countries⁷. The importance of productivity and wage dispersion in industrialised economies has already been recognised and recent advances in labor economics (driven primarily by the availability of large comprehensive datasets and the use of rich structural models) have deepened our understanding of its determinants⁸.

The paper is organised as follows. In the next section we discuss a set of stylised facts that characterise labor markets in developing countries. Subsequently, we present the model and its main predictions, followed by simulations that reproduce the main set of stylised facts. In section 4 we expand the model and estimate main parameters for a set of countries in Sub-Saharan Africa and we show some counterfactual experiments. In Section 5 we conclude.

⁵Estimation is still work in progress

⁶ For example, credit constraints can affect the occupational choice of individuals and determine both the size of the modern sector and the level of wages (e.g. (Banerjee and Newman, 1993) and (Ghatak and Nien-Huei Jiang, 2002)). Similarly, regulatory barriers to firm entry have been associated with higher employment in non-wage activities ((Djankov, La Porta, Lopez-de Silanes and Shleifer, 2002) and (Herrendorf and Teixeira, 2011), among others). Finally, misallocation of resources or human capital accumulation have also been identified as constraints to job creation and as important determinants of wages (see (Hsieh and Klenow, 2009) and (Vollrath, 2014) for misallocations, (Galor and Zeira, 1993) for the link between human capital and credit constraints, and (Hsieh and Klenow, 2010) for productivity and misallocations).

⁷There are several examples in the literature that focus primarily on the size and composition of the informal sector, i.e. non-registered wage workers (see for example (Amaral and Quintin, 2006), (Meghir, Narita and Robin, 2012), (Satchi and Temple, 2009), (Ulyssea, 2010) and (Zenou, 2008)). Note that the wage sector in Africa, albeit small, also includes informal salaried work. Only for middle income countries such as Brazil the distinction between formality and informality becomes relevant, as informal wage employment accounts for around 20% of the labour force.

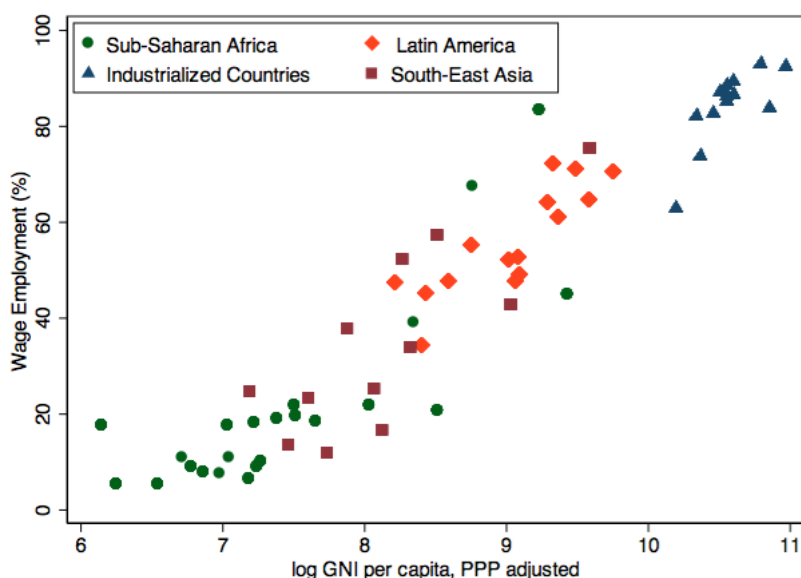
⁸See Lentz and Mortensen (2010) and Rogerson, Shimer and Wright (2005) for a survey of the literature, see Bontemp, Robin and van den Berg (2000) for France, Jolivet, Postel-Vinay and Robin (2006) for a set of European countries and the U.S.

1 Labor Markets in Developing Countries

1.1 Some well-known stylised facts

Labor markets in developed and developing countries are strikingly different. First and foremost, the size of the wage sector among the poorest regions in the world is very small. Figure 1 shows the share of wage employment increases as countries get richer. In many Sub-Saharan African countries the share of wage employment falls below 20%⁹. This evidence suggests that in poorer countries there are not enough jobs for the number of people willing to work for a wage and, as a consequence, most end up in less desirable self-employment occupations, own-account work or helping family activities for no pay¹⁰. However, it does not discourage labor force participation, which is greater in Sub-Saharan Africa (around 70%), than in OECD countries (around 60%).

Figure 1: Wage employment and development



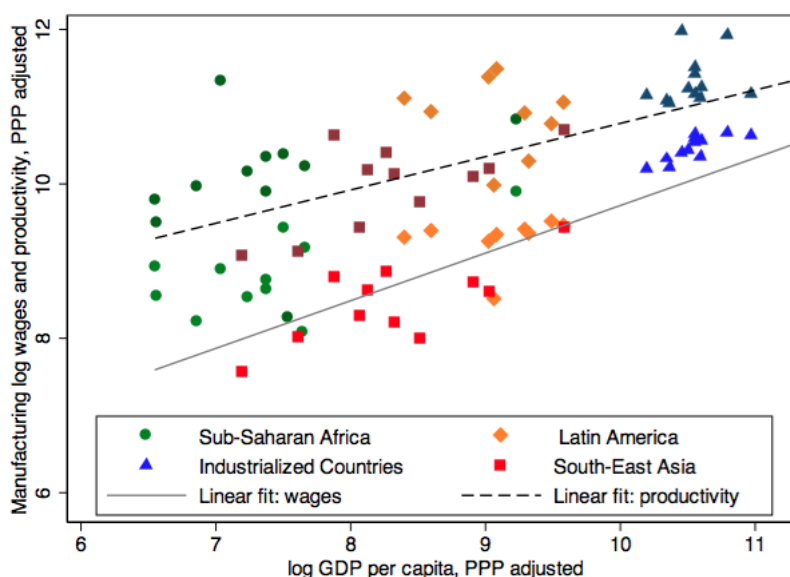
Furthermore, the wage sector is characterised by relatively low levels of productivity, and hence low earnings. For example, GDP per person employed in Sub-Saharan Africa is, on average, fourteen times lower than in advanced economies and four times lower than in Latin Amer-

⁹For example, Ethiopia, Ghana, Tanzania and Uganda among others ILO (2012). Note that this measure falls even more for African countries if public sector jobs are excluded, as they constitute a relatively large share of wage employment.

¹⁰Note that the wage sector, albeit small, also includes informal salaried work. Only for middle income countries such as Brazil the distinction between formality and informality becomes relevant, as informal wage employment accounts for around 20% of the labor force. See Meghir et al. (2012) and Ulyssea (2010).

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Figure 2: Manufacturing wages and productivity and Development

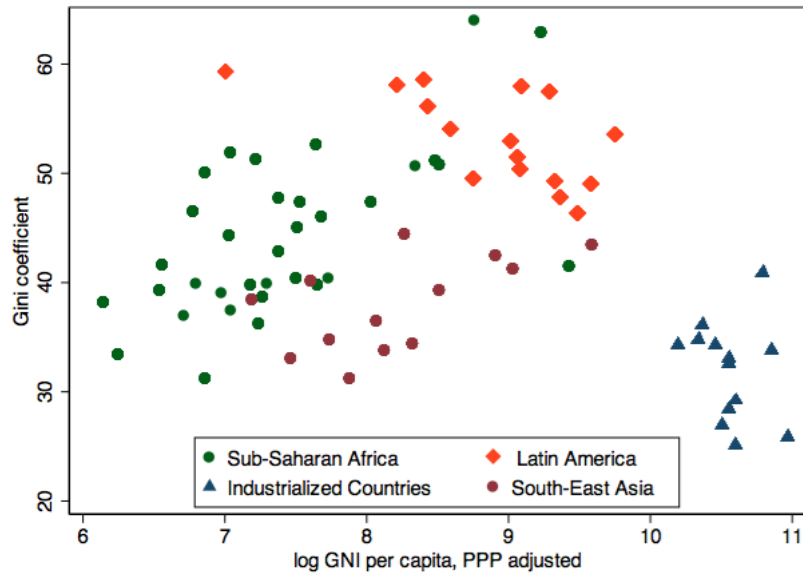


Albeit being very small and relatively unproductive, the wage sector still outperforms non-wage occupations and has been identified as desirable both by workers looking for a steady source of income and as an engine of economic growth¹². However, the prevalence of frictions in labour markets (e.g. segmentation) and inefficiencies in other markets and institutions (e.g. credit rationing and entry barriers) hinders the reallocation of workers from self-employment to the wage sector. This fact also provides a new insight into a well-established stylised fact that economists have long associated with the Kuznets curve (see Figure 3). Namely, that there is a positive correlation between average *income* and inequality for countries at low levels of income (i.e. Sub-Saharan African countries, mostly placed on the left part of Figure 3).

¹¹See ILO (2012). When focusing on the relatively high productivity manufacturing sector only, Figure 2 still shows that productivity as measured by PPP value added per employee is significantly greater for industrialized economies, by a factor of around 4 times. Unsurprisingly, average PPP wages in the manufacturing follow a similar pattern, even though the share of wages in total value added is almost twice as large in industrialized countries than in Sub-Saharan African countries. Note that these differences in productivity and pay are not explained by the composition of the labour force, such as workers' education, skills, etc. For example, Clemens et al. (2008) estimate the wage gain obtained by foreign workers who arrive to work in the United States relative to their country of origin and find that the same person would earn on average more than 7 times when relocating from Ghana to the US and less than 3 times if coming from South Africa.

¹²See Fields (2011), Banerjee and Duflo (2007) and World-Bank (2014)

Figure 3: Inequality and Income per capita



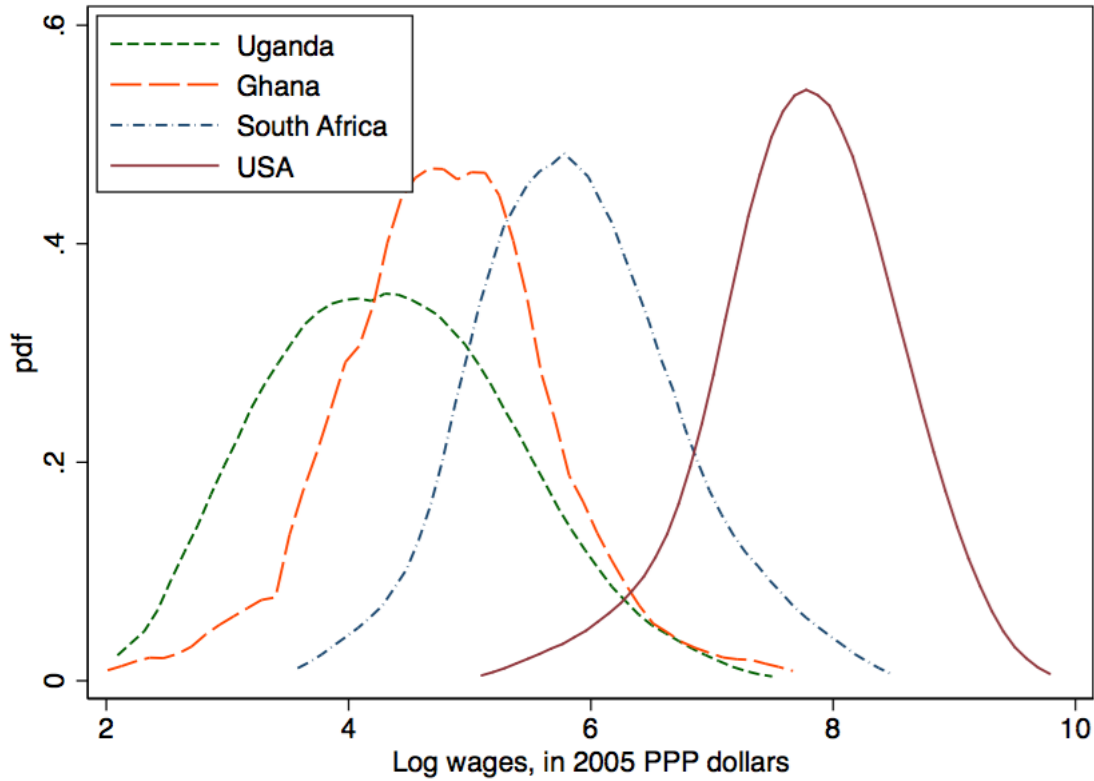
1.2 Wage dispersion and labor market performance

In this section we provide evidence that, additionally to being relatively small and unproductive, the wage sector in developing countries exhibits very high levels of wage dispersion. For example, we find that the top 10% of wage earners in Uganda and Ghana are paid 36 and 24 times more than the bottom 10%, respectively, while in the US this ratio is only 8 times. Furthermore, Figure 4 suggests that wage dispersion decreases with mean wages and with levels of GDP per capita¹³.

We propose that this is not just an empirical curiosity, but instead that it provides a more complete characterisation of labor markets that allows for a better understanding of their shortcomings. Namely, that conditional on the same mean, a greater wage dispersion reflects a higher degree of market inefficiencies and, hence, it is more informative about constraints to job creation and wage growth. This is reflected by the fact that a greater dispersion cannot fully be explained by observed characteristics of workers, such as gender, age (and age squared), levels of education, marital status, region of residence (and whether rural or urban) and industry of occupation. Figure 5 shows that log wage residuals follow a similar pattern of dispersion as the unconditional log wage realisations.

¹³We use Uganda National Household Survey 2010, Ghana Living Standards Survey 2005, and Survey of Income Program Participation (SIPP) 2004 for the US. These calculations are based on individuals aged between 15 and 65, excluding public sector employees. Note that Uganda's GDP per capita in 2005 PPP dollars is \$1268, while Ghana's is \$2612 and South Africa's, \$10413.

Figure 4: Distribution of log wages for Uganda, Ghana, South Africa and the US



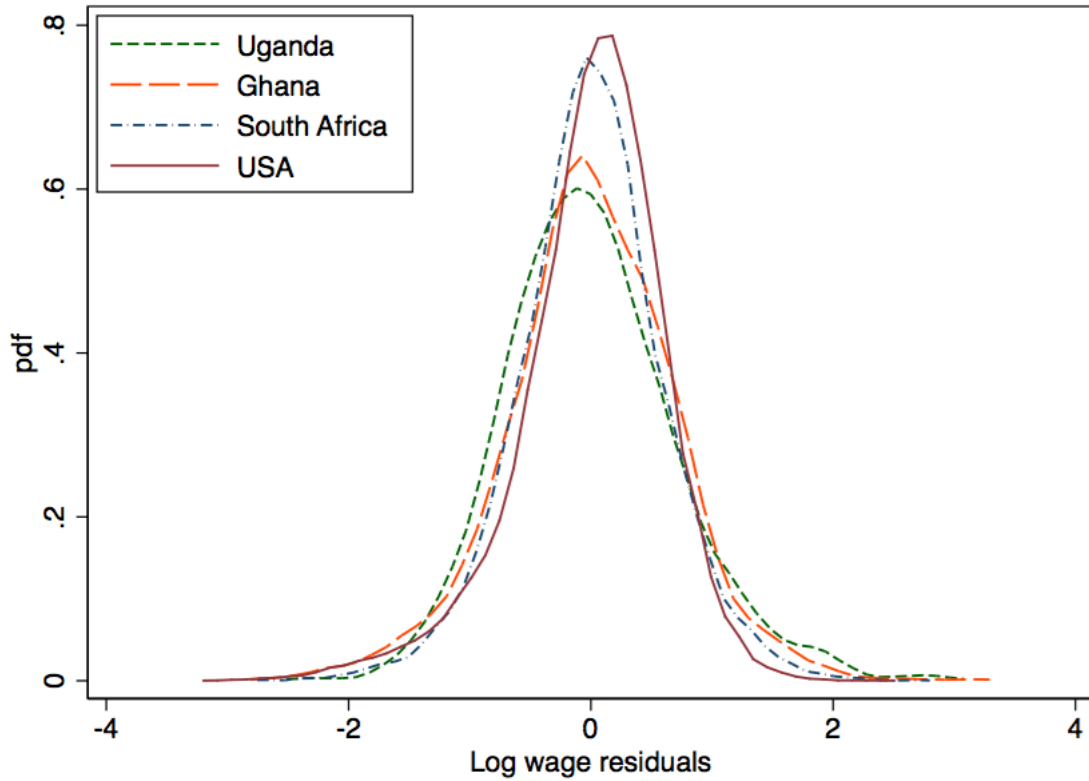
An important conclusion we can take away from this evidence is that the variation in wages cannot be mostly explained by demographics or differences across sectors, such as agriculture and manufacturing, or their location (regions and urban or rural). A simple variance decomposition in Table 1 shows that regional and industry variation do matter to explain wage dispersion, suggesting the presence of high mobility costs.¹⁴ However, as in the US, most of the variation comes from within region-industry groups, suggesting that frictions in labor markets are important. This is an important detail that will inform our modelling choice of labor markets in developing countries in the next section.

Having established that there is a substantial wage dispersion in poorer countries, that cannot be fully explained by differences across regions or sectors, we can now link this to the set of stylised facts presented above to generate some new empirical regularities. In particular, we focus on the residual variance of wages for a set of Sub-Saharan African countries for which there is microdata available that allows us to obtain different measures of labor market outcomes¹⁵.

¹⁴The fact that there exists a large and persistent labor productivity gap across sectors (especially in agriculture versus manufacturing) in developing countries is well known (see, for example, (Gollin, Lagakos and Waugh, 2014) for recent evidence).

¹⁵Namely, Cameroon (2007), Ethiopia (2005), Ghana (2006), Kenya (2005), Nigeria (2010), South Africa (2007), Tanza-

Figure 5: Distribution of residual log wages for Uganda, Ghana, South Africa and the US



Note that for this subset of countries, the above evidence suggests that, even when comparing countries at the lowest levels of GDP per capita such as countries in Sub-Saharan Africa, weakly richer countries have, on average, a greater wage sector and are more productive (and pay higher wages). In Figures 6 and 7 we do find a negative correlation between residual variance of log wages and both the mean of log wages and the size of the wage sector. It follows that a model of labor markets in developing countries that attempts to rationalise poor performance in terms of wages and size of wage employment needs also to be consistent with a greater wage dispersion.

This relationship also has an interesting implication in terms of the link between income levels and inequality. Sub-Saharan African countries are generally located in the left section of Figure 3, implying that relatively richer countries are also more unequal. That implies that we expect a negative correlation between inequality in labor markets (as measured by wage dispersion) and inequality in income (that includes workers in the wage sector and in self-employed activities). High wage inequality and low income inequality can coexist when a large fraction of the workforce is engaged in low-income non-wage activities. This is what we find in Figure 8, using

nia (2010), Uganda (2010) and Zambia (2010)

Table 1: Variance decomposition

	Percentage of log wage variance explained by		
	Region	Industry	Region*Industry
Uganda	11%	20%	33%
Ghana	10%	4%	18%
South Africa	22%	26%	39%
USA	3%	11%	18%

Note: The sample is limited to 16-65 year old private sector employees. Regional variance includes distinction between rural and urban areas. Source: Authors' calculations based on Uganda National Household Survey 2010-2011, Ghana Living Standards Survey 2005, South Africa Labour Force Survey 2000-2004, and Survey of Income Program Participation (SIPP) 2004 for the US.

information from the same surveys for both measures¹⁶.

Taken together, the evidence indicates the importance of modelling the determinants of wage levels and of the size of the wage sector simultaneously. It also suggests that understanding the performance of the wage sector should be an integral part of the understanding of income inequality in developing countries. More importantly, the evidence suggests that wage dispersion is intrinsically linked to the performance of labor markets in developing countries.

¹⁶We follow the same approach as The World Bank and we use expenditure data to compute measures of inequality.

Figure 6: Residual Variance and Mean of log wages in Sub-Saharan Africa

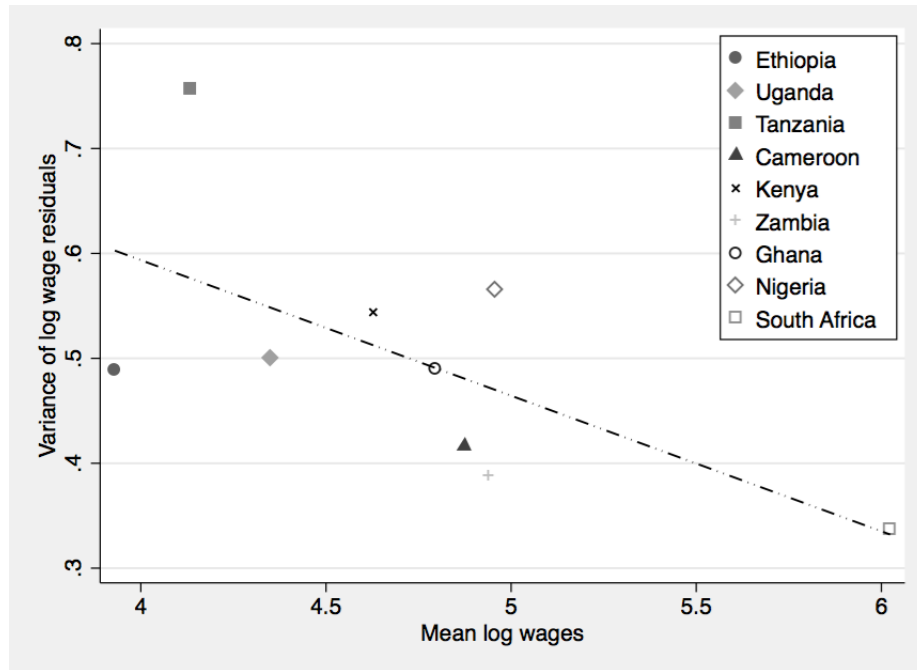


Figure 7: Residual Variance of log wages and Size of the wage sector in Sub-Saharan Africa

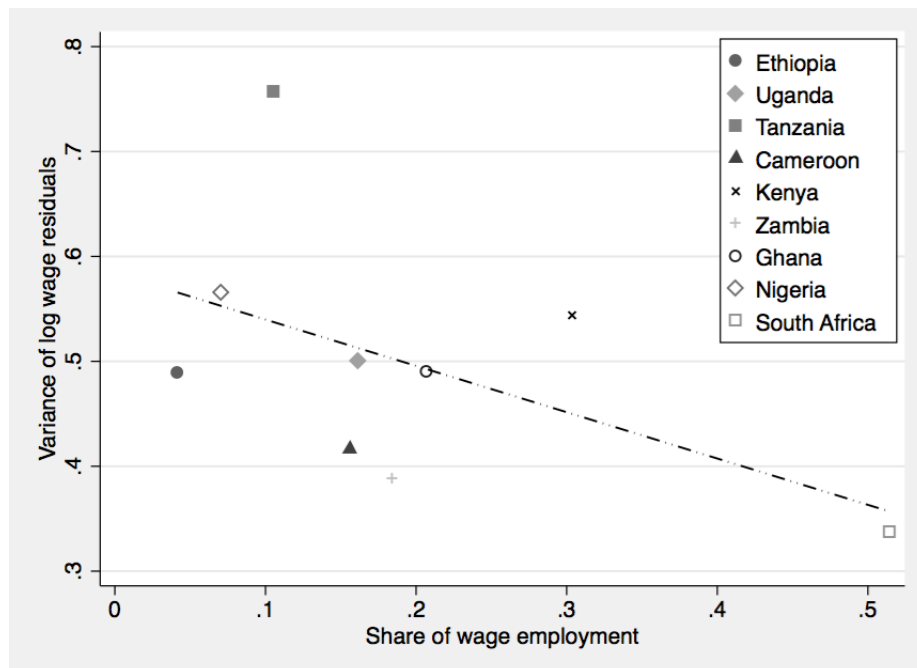
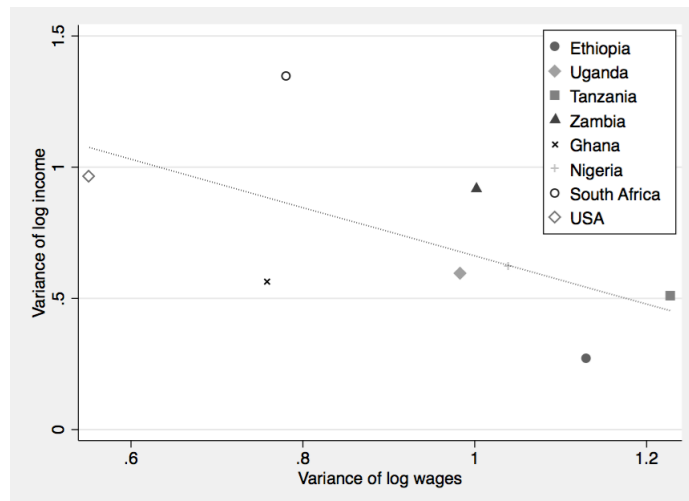


Figure 8: Variance of log Wages and Income Inequality.



2 A Simple Model

In this section we present a simple model that generates a link between low levels of job creation and mean wages and high levels of wage dispersion that we observe in the data. In the presence of various frictions in the labour market and a significant wage dispersion (even after accounting for differences in workers' characteristics), the search and matching model is an obvious candidate for this task. Our theoretical contribution builds on the frictional labour markets' search and matching literature¹⁷ and incorporates a set of channels identified by the development literature to generate low job creation, lower average wages and greater dispersion, such as underlying productivity differences, barriers to entry and labor market inefficiencies.

This is a continuous time model of two labor markets - the formal job sector and the home production, or the informal sector. The formal labor market is populated by heterogenous firms that differ in their productivity level p . Firm productivity is determined upon entry and is constant over the firm's lifetime. The technology exhibits constant returns to scale and uses labor as input. There is a continuum of infinitely lived workers, with a mass normalized to one, that supply labor to firms. Both workers and firms are risk neutral and they discount the future at rate r .

In the formal sector, firms and workers are brought together pairwise through a sequential and random matching process. To recruit, firms post a vacancy v at cost of c per unit of time. Reflecting search frictions, the offer arrival rate and the vacancy filling rate are exogenous to workers and firms but are determined in equilibrium. The matching function $M(v, u)$ is assumed to be increasing, concave, and homogenous of degree one in both arguments – aggregate vacancies v and job seekers u . Then, the job finding rate is given by $\lambda = \frac{M(v, u)}{u}$, while the vacancy filling rate is given by $q = \frac{M(v, u)}{v}$. Given the constant returns to scale assumption, we can express the job finding rate and the job filling rate as a function of market tightness $\theta = \frac{v}{u}$.

Jobs are subject to the exogenous destruction shock that arrives at rate δ . At the same time, there is infinitely many potential entrants that may generate a new product and enter the market after paying fixed cost k . Competition and entry costs endogenously determine the number of firms in the market. Wages in the formal sector are determined through a bargaining process between the firm and its workers.

The outside option of workers is to work in the home production, or informal, sector. Unlike in

¹⁷See Mortensen and Pissarides (1994) and Rogerson et al. (2005).

industrialised countries, the unemployment rate in developing countries is very low or virtually non-existent; therefore, self-employment income is a more relevant outside option for workers.¹⁸. The informal sector is assumed to be competitive so that wages in this sector are determined by the marginal product of labor (see for example Zenou (2008)). The production function in the home sector can be written as

$$Y_H = AF(L_H), \quad (1)$$

where Y_H is aggregate output produced in the informal sector, A is the aggregate productivity (which might include fixed factors, such land, aggregate capital, etc.), and $F(\cdot)$ is an increasing concave differentiable function of labor employed in the informal sector, L_H . Then, the wage paid in this sector is the marginal product of labor, namely $w_H = AF_L(L_H)$. Moreover, all informal sector workers are assumed to be looking for a formal job and hence the number of jobseekers is equal to $u = L_H$.

2.1 Worker's Problem

The value of employment at a firm that pays wage w satisfies the following Bellman equation:

$$rW(w) = w + \delta(U - W(w)), \quad (2)$$

where the right-hand side of the equation is the sum of income flow from working, w , and the expected capital loss if the job is destroyed and the worker becomes unemployed, or switches to the home production sector. The latter event happens at constant Poisson rate δ . The value of working can be re-written as

$$W(w) = \frac{w + \delta U}{r + \delta}. \quad (3)$$

A worker in the informal sector obtains consumption flow w_H by means of home production, and she has an option of finding a job in the formal sector. The value of search, U , solves the following Bellman equation:

$$rU = w_H + \lambda(\theta) \int (\max\{W(w), U\} - U) dG(w), \quad (4)$$

where r is the common firms' and workers' discount rate; $\lambda(\theta)$ is the job offer arrival rate, and

¹⁸Banerjee and Dufo (2007) describe how the poor choose to run their own-account businesses because they cannot find a steady well-paid job in the wage sector and not because of their entrepreneurial drive.

$G(w)$ is the cumulative distribution function of firms that pay wage w .

2.2 Firm's Problem

Firms operate a CRS technology in labor and differ in their productivity level p . The value of a job in a firm with productivity p , $J(p)$, solves the following Bellman equation:

$$rJ(p) = p - w + \delta(V(p) - J(p)). \quad (5)$$

The first term on the right-hand side of equation (5) is the firm's profit flow. The second term is the expected capital loss related to the possibility that a job is destroyed, in which case the firm ends up with the value of an open vacancy, $V(p)$.

To hire a worker, the firm needs to post a vacancy that is then randomly matched with job seekers. The hiring rate, $q(\theta)$, is derived from the matching function and depends on aggregate market tightness. The value of an open vacancy can be found as

$$rV(p) = -c + q(\theta)(J(p) - V(p)), \quad (6)$$

where c is a vacancy posting cost.

2.3 Wage Determination

Once a match is formed, the firm and the worker bargain over the wage. Bargaining between each worker-firm pair takes place in sequence of rounds and we assume that the threat point of a worker is the value of delay as in Hall and Milgrom (2008).¹⁹ During a potential delay, the worker engages in home production and receives the flow value of w_H , while the firm is idle during that period as the firm cannot replace the worker instantaneously. Then, the wage paid to the worker is a solution to the following bargaining problem:

$$w = \arg \max_w (p - w)^{1-\beta} (w - w_H)^\beta, \quad (7)$$

¹⁹We have also tried an alternative bargaining setup where the threat point of a worker is the value of search and that of a firm is the value of an open vacancy. With this alternative specification we were unable to prove the results analytically, but we can show that in simulations all the results described below still hold.

where $0 < \beta < 1$ represents the worker's bargaining power. Taking the FOCs, we obtain the following equation for the wage as a function of productivity:

$$w(p) = \beta p + (1 - \beta)w_H, \quad (8)$$

conditional on $p > w_H$. We assume that $p_{min} > w_H$, which is a trivial assumption implying that any worker is more productive in the formal sector than at home.

2.4 Labor Market Clearing

Firms are identical ex ante and their type is revealed upon entry. Productivity of potential entrants is assumed to be drawn randomly from a given distribution $\Gamma(\cdot)$ with the support $[\underline{p}, \infty)$. Firms have to pay fixed cost k per job upon entry reflecting credit constraints and other entry impediments. Hence, the free entry condition implies that

$$-k + \int_{\hat{p}} V(p) d\Gamma(p) = 0, \quad (9)$$

which means that the value of an open vacancy in expectation should be equal to the entry cost. The lowest productivity level, for which a firm would post a vacancy, is denoted by $\hat{p}$ and is such that $V(\hat{p}) = 0$. This condition is referred to as the zero profit condition. That is, firms with productivity below $\hat{p}$ exit the market immediately after entry and receive the value of zero.

Substituting for the wage function $w(p)$ into the value of a job given in equation (5) and using that we can rewrite the flow value of a vacancy as follows

$$rV(p) = -\frac{r + \delta}{r + \delta + q(\theta)}c + \frac{q(\theta)}{r + \delta + q(\theta)}(1 - \beta)(p - w_H(\theta)). \quad (10)$$

Note that the wage in the informal sector is determined endogenously in equilibrium and is a function of market tightness θ . Below, we show that since w_H is a decreasing function of the number of workers employed in the home production sector, in equilibrium w_H will depend positively on θ .

It is useful to rewrite the free market condition from equation (9) as the expected gain relative to the outside option of exiting the market, $V(\hat{p})$:

$$rk = \int_{\hat{p}} (rV(p) - rV(\hat{p})) d\Gamma(p) = \frac{q(\theta)}{r + \delta + q(\theta)}(1 - \beta) \int_{\hat{p}} (p - \hat{p}) d\Gamma(p), \quad (\text{FE})$$

where we have used the fact that $V(\hat{p})$ is equal to zero. Given that $\int_{\hat{p}} (p - \hat{p}) d\Gamma(p)$ is decreasing in $\hat{p}$, the free entry condition implies a decreasing relationship between $\hat{p}$ and θ .

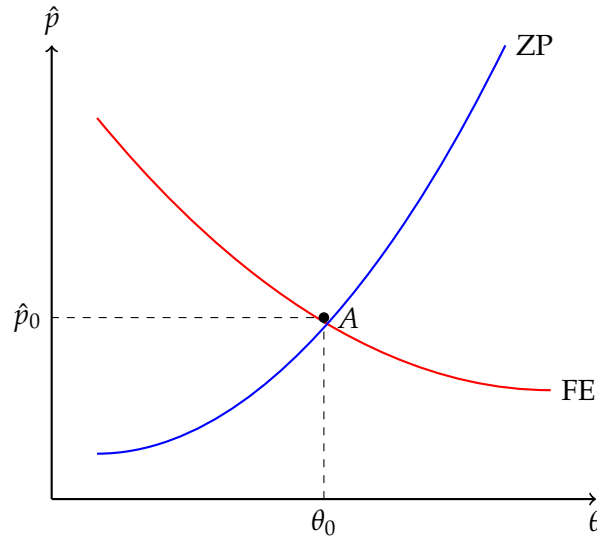
The reservation productivity level $\hat{p}$ is derived from setting $V(\hat{p}) = 0$, i.e.

$$\frac{c}{q(\theta)} = (1 - \beta) \frac{\hat{p} - w_H(\theta)}{r + \delta}. \quad (11)$$

This equation shows that at the threshold the expected cost of keeping an open vacancy (the flow cost c multiplied by the average duration of an opening $\frac{1}{q(\theta)}$) should be equal to $(1 - \beta)$ share of the present discounted value of the match surplus (output flow p less home production w_H). Since the match surplus is an increasing function of p , all $p > \hat{p}$ matches are accepted. Rearranging this equation, we get the following zero profit condition

$$\hat{p} = w_H(\theta) + \frac{c(r + \delta)}{q(\theta)(1 - \beta)}. \quad (\text{ZP})$$

Now we have two equations - the zero profit (ZP) condition defined in (ZP) and the free entry (FE) condition defined in (FE) - in two unknowns: $\hat{p}$ and θ . The zero profit condition is upward sloping, while the free entry condition is downward sloping, resulting in a unique equilibrium depicted below.



2.5 Size of the wage sector and wage dispersion in equilibrium

The labor market clears meaning that total labor over two sectors - formal and informal - sums up to one. In addition, we consider a steady state equilibrium, in which the composition of labor between two sectors is constant. Hence, the outflow from the informal sector should be equal to

the outflow from the formal sector. That is,

$$\lambda(\theta)L_H = \delta L_F = \delta(1 - L_H) \Rightarrow L_H = \frac{\delta}{\delta + \lambda(\theta)}, \quad (12)$$

where L_H is the mass of workers in the home production sector and L_F is the mass of workers in the formal sector. The number of filled jobs and vacancies in the economy is equal to the number of active firms in the market:

$$v + (1 - L_H) = \theta L_H + (1 - L_H) = \frac{\delta\theta + \lambda(\theta)}{\delta + \lambda(\theta)} \quad (13)$$

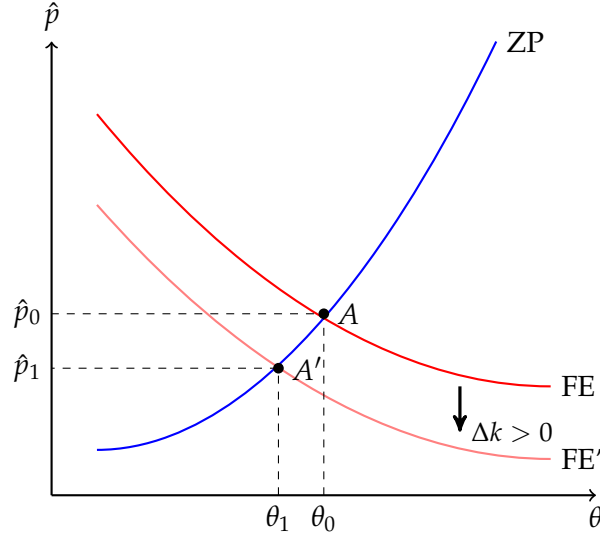
The observed mean and variance in wages are determined by the equilibrium productivity threshold $\hat{p}$, more specifically as wages are a linear function of productivity and only firms with $p \geq \hat{p}$ remain in the market. As a consequence, $\hat{w} = \beta p \mid p \geq \hat{p} + (1 - \beta)w_H$ and $\text{Var}(W) = \beta^2 \text{Var}(p \mid p \geq \hat{p})^{20}$.

2.6 Comparative statics

There are three key exogenous elements that determine the equilibrium values, namely entry costs k , labor market efficiency, captured by m (a parameter in the matching function) and the productivity distribution, $\Gamma(p)$.

We first analyze the effect of an increase in the entry costs k on the equilibrium variables. First, note that the free entry curve shifts downwards since, holding the reservation productivity constant, in order to recover the now higher fixed costs the vacancy filling rate has to rise and hence market tightness has to fall.

²⁰Similarly, a simple Taylor expansion gives us the variance of log wages as $\text{Var}(\log(w)) \approx \frac{\beta^2}{w_H^2} \text{Var}(p \mid p \geq \hat{p})$.



As a result of the increase in k , both the reservation productivity and market tightness fall. As it becomes more difficult to enter the market, lower competition leads to fewer vacancies posted and hence the vacancy-to-unemployment ratio falls and the total mass of firms $v + (1 - L_H)$ decreases as well. Perhaps counterintuitively, the increase in the entry costs also leads to a fall in the average productivity level of firms as the reservation productivity is now lower.

By simple inspection of equation 12, we can see that the decrease in market tightness θ reduces the job finding rate λ and, as a consequence, the size of the wage sector decreases, as the size of the home sector increases.

The effect on the mean and variance of wages, on the other hand, are mainly driven by the equilibrium $\hat{p}$. As the productivity threshold decreases, so does the mean. In terms of the variance, Heckman and Honoré (1990) show that the variance can be shown to be decreasing in $\hat{p}$ as shown in Figure ?? if the productivity distribution belongs to the family of log-concave distributions²¹

In this economy, the effects of increasing entry costs are unambiguous and can be summarised in the following proposition:

Proposition 1 *Assume $\Gamma(p)$ is log-concave. An increase in entry cost k reduces the size of the wage sector and the mean wage and increases the variance of wages.*

An increase in the matching efficiency m has an effect on both conditions. On one hand, as the vacancy filling rate q increases with m , the value of a vacancy increases. As a consequence, there

²¹See Proposition 1 in Heckman and Honoré (1990). Log-concave distributions include normal, exponential, logistic, beta, extreme value, among others. Note that because $\text{Var}(\log(w)) \approx \frac{\beta^2}{w_H^2} \text{Var}(p \mid p \geq \hat{p})$, log wages are also decreasing in $\hat{p}$, as the variance of observed productivity increases and w_H decreases when $\hat{p}$ drops after an increase in k .

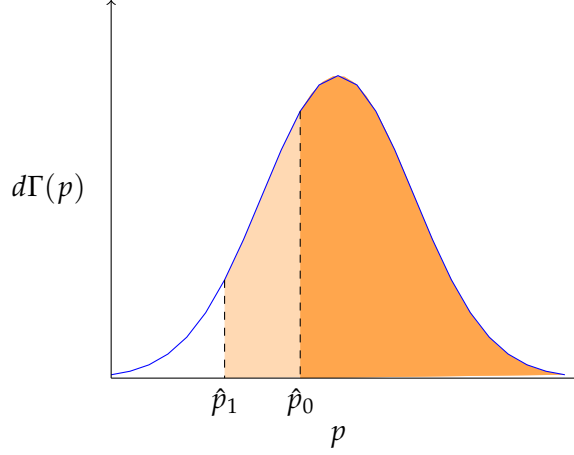


Figure 9: The effect of an increase in k on $\hat{p}$

is more entry for a given k and the Free Entry condition shifts upwards. On the other hand, the increase in q implies that the marginal firm can be less productive, thus shifting the Zero Profit condition downwards. As a result, the equilibrium market tightness unambiguously increases and the size of the wage sector increases. The effects on wage dispersion are ambiguous, as the reservation productivity can go either way.

Finally, if the productivity distribution has a greater mean value or variance, the expected gain from entry is greater, thus shifting the Free Entry condition upwards. As a consequence, the equilibrium values are greater for both the reservation productivity and the market tightness. Even though it is clear that the wage sector should be bigger, it is less clear what would happen with the observed wage distribution as it would depend on the shift of the threshold $\hat{p}$ relative to the shift of the distribution.

Similarly, the interaction between all these elements are of interest, as it can direct the attention towards how different constraints bind simultaneously in terms of job creation and wage distributions. For example, in the presence of very low labor market efficiency, the marginal effect of reducing barriers to entry might be low, relative to reducing frictions in labor markets. Because the model does not allow for an analytical characterisation of the model, we next turn to simulations to understand better the interactions between different parameters in generating key outcomes, such as job creation and wage dispersion.

3 Model simulation

The key advantage of our model is providing a unifying theoretical framework, which not only combines several development factors in a relatively simple model, but also allows us to look at interrelations between them. In this section, we analyse the role of the following channels in explaining a small size of the wage sector, low average wages and greater wage dispersion in Sub-Saharan Africa:

- the level of entry costs k include various barriers to entry – such as red-tape regulations, financial constraints to starting a business, corruption, etc., – that prevent firms from entering the market and that reduce competition;
- differences in the underlying productivity distribution $\Gamma(p)$ that might be driven by lower capital intensity, inferior technology, or poor infrastructure;
- labour market frictions captured by different matching efficiency m across countries.

This section presents a numerical simulation of the model aimed at illustrating the main mechanisms affecting wage inequality across countries, as well as their interactions. We start by discussing the choice of the functional forms and parameters used in the simulation. For each set of parameters, we solve for equilibrium market tightness and productivity threshold level given an underlying productivity distribution. We then proceed to describing how different factors in the model impact wage and income inequality, as well as the size of wage employment.

3.1 Parameter choice

The model is simulated under the assumption that the economy is in steady state. The underlying productivity is assumed to follow a logistic distribution with a location parameter μ , which is also equal to the unconditional mean, and a scale parameter σ , which implies that the variance of underlying productivity is given by $\frac{\sigma^2\pi^2}{3}$. We choose a logistic distribution because it allows us to analyze separately the effects of the changes in the mean from the the variance of underlying productivity. Moreover, a logistic distribution belongs to the family of log-concave distributions; hence, the results of our Proposition 1 are applicable here.

Suppose that the production function in the informal sector is Cobb-Douglas, i.e. $Y_H = AL_H^\gamma$, $0 < \gamma < 1$ and A is the total productivity in the informal sector that might include other fixed factors of production, namely land, capital, infrastructure, etc. Then, under the assumption that

informal labor markets are competitive, the value of home production is given as

$$w_H = \gamma A L_H^{\gamma-1}. \quad (14)$$

In order to obtain the parameters of the home production function, A and γ , we use household survey data on labor earnings of self-employed individuals. In particular, we run the following regression:

$$\ln w_{Hjt} = b_0 + b_1 \ln L_{Hjt} + \varepsilon_{jt}, \quad (15)$$

where $\ln w_{Hjt}$ are the average log monthly self-employment income in a regional market j at time t , $\ln L_{Hjt}$ is the number of workers employed in that sector in region j , b_0 and b_1 are the coefficients to be estimated, and ε_{jt} is the error term. Then, the parameters of interest can be recovered from $b_0 = \ln(\gamma A)$ and $b_1 = \gamma - 1$. Running this regression across regions in Ghana, we find that γ is close to 0.65 and the scale parameter A is computed to be 120.

We assume that the matching function is Cobb-Douglas, i.e.

$$M(v, u) = m v^\eta u^{1-\eta}, \quad 0 < \eta < 1, \quad (16)$$

where m is a matching efficiency parameter. When workers search for a job they receive an offer from the formal sector at Poisson arrival rate $\lambda(\theta) = m\theta^\eta$; while firms fill their vacancies at Poisson arrival rate $q(\theta) = m\theta^{\eta-1}$. Without data on vacancies, the matching function parameters m and η cannot be identified separately. The elasticity of the matching function with respect to vacancies, η , is usually estimated in the range of 0.3 – 0.5 (see (Petrongolo and Pissarides, 2001)). For the purpose of this simulation, we set it to 0.5, as it is common in the literature. The monthly vacancy costs c are set to be \$130 PPP adjusted dollars, which is about one month of wages based on Ghanaian household data.²²

The unit of time is a month, so that all the Poisson arrival rates are given as monthly rates. The monthly interest rate r is equal to 0.33%, which is equivalent to a yearly interest rate of about 4%. We construct transition rates between self-employment and formal employment using Ghanaian household survey information on economic activity in the past 7 days and contrast it to the respondents' main activity in the last 12 months. We define flows from the wage sector to the home

²²Note that the vacancy posting costs and the matching efficiency parameters are interconnected as what matters for the firm is the expected costs of a filled vacancy $\frac{c}{q(\theta)}$. Thus, if the matching efficiency is lower, then the expected duration of a vacancy is higher and so are the costs. Hence, instead of varying a matching efficiency parameter in the model, alternatively we could have run the same experiments by changing the vacancy cost c .

sector as those workers who are self-employed in the past 7 days and whose main occupation in last 12 months was wage employment. We find that the worker separation rate δ is around 6.4% on a yearly level, which translates into a monthly transition rate of 0.53%. This method is likely to underestimate the transitions since the survey has information only for the main occupation of a worker during the last 12 months and hence might miss workers that had more than one occupation during this period.²³

Finally, we rely on two data features in choosing the value for workers' bargaining power. Firstly, based on the UNIDO data we compute the average wage to productivity ratio (measured as value added per worker) for the manufacturing sector.²⁴ The ratio $\bar{w}/\bar{p}$ ranges between 0.1 (in Uganda) to 0.44 (in South Africa), with the average for the SSA region being close to 0.3. Secondly, we find that the average self-employment income in the SSA countries is equal to about 50% of the average wage, i.e. $w_H = 0.5\bar{w}$. Combining these data facts and using the wage determination equation above, we can solve for workers' bargaining power parameter β , which turn us to be equal to 0.18. This value is relatively low compared to what is commonly used in the literature; however, we expect the bargaining power of workers to be lower in developing countries as opposed to industrialised economies.²⁵

Table 2 summarizes the set of parameters that we use for the simulation. In the following subsections, we focus on varying the entry costs k , the matching efficiency parameter m , and the parameters of the productivity distribution, μ and σ , to illustrate what happens to wage dispersion, the fraction of people employed in the wage sector, and the overall income. Note that we do not consider transition dynamics after the changes are introduced, instead these experiments should be thought of as a comparison between steady state economies - the baseline versus a counterfactual economy with alternative parameter values.

3.2 Entry costs

Entry costs k in the model can be interpreted as a regulatory variable (e.g. government red tape) or a borrowing constraint, such as the size of the collateral required in order to get a credit. Credit constraints have been shown to be an important barrier to development.²⁶ Similarly, reg-

²³These rates will be more accurate when using the panel data for households in Nigeria, Uganda and Tanzania.

²⁴Source: INDSTAT2 (Industrial Statistics Database), the United Nations Industrial Development Organization.

²⁵Cahuc, Postel-Vinay and Robin (2006) estimate bargaining power parameters for different groups of workers by their skill levels using French matched employer-employee matched. They found that manual workers have a very low (close to zero) bargaining power parameter.

²⁶For example, Banerjee and Newman (1993) and Ghatak and Nien-Huei Jiang (2002) show how credit constraints can affect the occupational choice of individuals and determine both the size of the modern sector and the level of

ulatory barriers to firm entry have been associated with higher employment in non-wage activities.²⁷

To illustrate the relationship between the entry costs and inequality, we use ‘Starting a Business’ indicators obtained from the World Bank’s Doing Business survey for 2010. Table 3 shows different indicators of costs of entry and access to credit for the countries discussed above. Countries that show a relatively lower measure of costs of entry or higher measure of financial development have lower wage dispersion and higher means. Figure 10 confirms that a negative relationship between entry costs and a country’s level of GDP per capita, especially at high levels of entry costs.

The effects of entry barriers in the model on wages and employment are fairly intuitive. The entry costs, together with the level of labor market competition, endogenously determine the number of firms in the market. That is, more binding entry constraints reduce the size of the wage sector in the economy and put downward pressure on wages. On top of their effect on average wages, entry barriers lead to a rise in wage inequality driven by a higher survival rate of low productivity firms. This mechanism is similar in spirit to the basis of creative destruction models of, for instance, Aghion and Howitt (1992) and Grossman and Helpman (1991) that suggest that productivity growth is driven primarily by entering firms that adopt new technologies and replace less productive older firms and that restricting entry leads to lower average productivity and sluggish growth.

The left panel of Figure 11 illustrates how an increase in the entry cost parameter k leads to a fall in average log wages (solid blue line) and a rise in wage inequality (dashed green line). The effect on income inequality, however, is reverse, as can be seen in the right panel of Figure 11 (dashed green line). More prohibitive entry barriers reduce the number of firms in the market and decreases job creation in the wage sector, as can be seen on the same figure in a solid blue line. Hence, even though wage inequality is increasing, a number of workers in wage employment is steadily falling while the number of self-employed workers is growing so that the overall effect is a reduction in income inequality.

wages. Buera and Shin (2013) build a model in which financial frictions not only distort the allocation of production factors (capital and entrepreneurial talents) but also slow down their reallocation process. Ayyagari, Demirgüç-Kunt and Maksimovic (2008) examine which obstacles are more restrictive to growth and find that factors related to finance, crime, and political instability directly affect the growth rate of firms, with financial constraints being the most robust of the three.

²⁷See Djankov et al. (2002) and Herrendorf and Teixeira (2011), among others

Table 2: Fixed parameter values

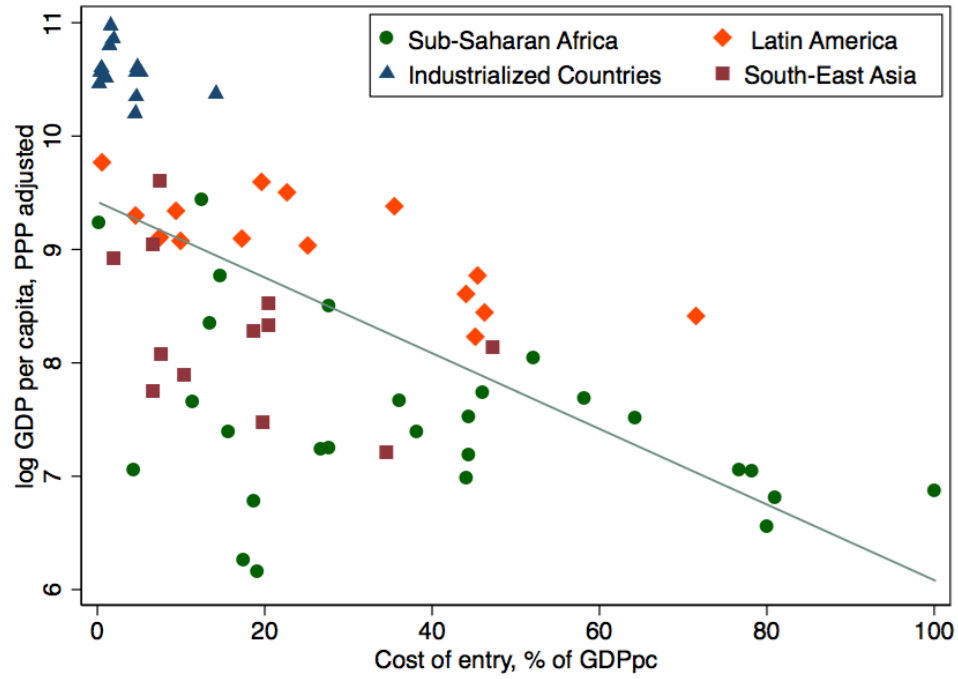
Parameter	Value
Monthly interest rate, r	0.0033
Destruction rate, δ	0.0053
Vacancy cost, in 2005 PPP \$ c	130
Curvature of matching, η	0.5
Workers' bargaining power, β	0.18
Home production technology, A	120
Labor elasticity of home production, γ	0.65
Efficiency of matching, m	{0.0025, 0.005, 0.01}
Underlying productivity distribution parameters	
Location, μ	{20,40,80}
Scale, σ	{50,100,200}
Entry costs, k	{1,10,100}

Table 3: Entry costs in selected countries

Country	Log Wages		Starting a business		Bank
	Mean	Variance	Rank	Cost	Branches
Ethiopia	3.9	1.13	163	135.3	0.91
Uganda	4.4	0.91	144	76.7	1.15
Ghana	4.8	0.76	112	18.5	3.16
South Africa	5.9	0.70	53	0.3	7.19
USA	7.8	0.55	13	1.4	33.13

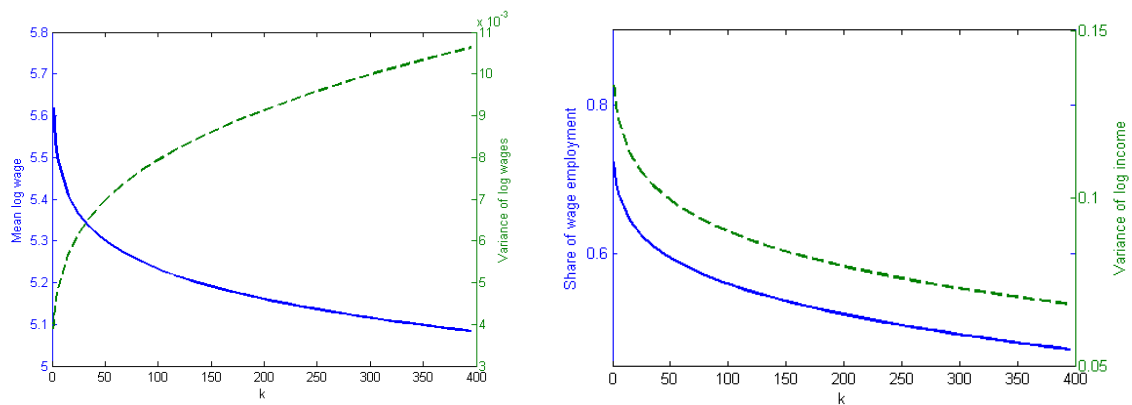
Based on the World Bank's Doing Business survey for 2010. 'Rank' orders countries on a variety of starting business indicators. 'Cost' is recorded as a percentage of the economy's income per capita. It includes all official fees and fees for legal or professional services if such services are required by law. 'Bank branches' is the number of commercial bank branches per 100,000 adults, in 2005. Wage data is in 2005 PPP dollars.

Figure 10: Correlation between entry costs and income



Source: The World Bank's Doing Business survey for 2010.

Figure 11: The effect of changes in entry costs on wages



3.3 Labor market frictions

Higher wage dispersion to a large extent is associated in the literature with labor market inefficiencies. These might include a mismatch in skills required by employers and offered by workers or a labour market segmentation due to low occupational or geographical mobility. Labor market frictions lead to misallocation of resources, lower firm productivity and a fall in output (see for example (Restuccia and Rogerson, 2013), (Hsieh and Klenow, 2009), (Hsieh and Klenow, 2010) and (Vollrath, 2014)).²⁸

Some indication for a relatively high degree of labor market inefficiencies in low-income countries is given in Table 1. Regional differences in wages in the SSA countries are more persistent and significant than in the US, they also explain a higher fraction of the variation in wages (from 10% to 22% in the SSA compared to 3% in the US). Similarly, sectoral differences in wages seem to be more prominent in developing countries (especially in terms of contrasting agriculture with manufacturing). For example, Gollin et al. (2014) find that a ‘puzzlingly’ large gap between the agricultural and nonagricultural sectors remains after controlling for differences in workers’ characteristics, their human capital and hours worked. This evidence, as well as a relatively high degree of wage inequality within sectors and regions, suggests the presence of high mobility costs that leads to labor misallocation across sectors, regions and productive opportunities in general.

As it has been discussed in the comparative statics section of the model, a reduction in labor market frictions captured by an increase in the matching efficiency encourages job creation and leads to a rise in wage employment. Figure 12 shows that an increase in the matching efficiency parameter m causes a reduction in wage inequality. That is, a more efficient labor market has more compressed wages. An interesting feature of this graph is the interaction effect with the entry costs that amplifies the effect of matching frictions on wage inequality: the same increase in labor market frictions (a reduction in m) leads to a larger rise in the variance of log wages in a country with high entry costs k as opposed to a country with low k . That is, a more efficient labor market has more compressed wages. An interesting feature of this graph is the interaction effect

²⁸A number of authors have focused on specific mechanisms that result in resource misallocation and a fall in output. For instance, Lagos (2006) shows how employment regulations can lead to lower aggregate TFP if firms have different productivity. Hsieh and Klenow (2009), for example, find sizable gaps in marginal products of labor and capital across plants in the manufacturing sector in China and India relatively to the United States. They show that when capital and labor are hypothetically reallocated to equalize marginal products to the extent observed in the United States, the manufacturing total factor productivity increases by 30%-50% in China and 40%-60% in India. Bartelsman, Haltiwanger and Scarpetta (2013) provide empirical evidence on importance of distortions for within-industry productivity dispersion based on the firm-level data for the US, UK, Germany, France, Netherlands, Hungary, Romania, and Slovenia. They show that distortions not only affect the allocation of resources across firms, but also the selection of firms producing in each market.

with the entry costs that amplifies the effect of matching frictions on wage inequality: the same increase in labor market frictions (a reduction in m) leads to a larger rise in the variance of log wages in a country with high entry costs k as opposed to a country with low k .

By changing matching efficiency, the model can reproduce a negative relationship between the average wage and wage inequality observed in the data. The left panel of Figure 13 shows that an increase in the entry costs parameter k does not change the relationship between the mean and the variance of log wages - the curve stays the same, affecting only the range of the values for the mean and the variance of log wages. Symmetrically, we can show that the mean-variance relationship can be reproduced by varying the entry costs k and the curve stays the same irrespectively of the value of m . The share of wage employment, however, is very responsive to changes in matching efficiency and thus we can use the relationship between (log) wage dispersion and the size of the wage sector to identify the effect of labour market frictions on wage dispersion.

Figure 14 illustrates the non-linear nature of the relationship between the mean and the variance of log income as we change the degree of labor market frictions. As we start to reduce the degree of market frictions (increasing the values of m), wages are increasing in both the wage and the home production sectors, thus increasing the overall income level. Wage dispersion is falling, at the same time more people switch from self-employment (characterized by constant wages) to the wage sector, thus increasing income inequality initially. Eventually, a sufficient number of people move to wage employment, which together with a continuously falling (log) wage variance, has a negative effect on income inequality. Again, the inverse U-shape relationship between income levels and inequality (i.e. the initial increase in income inequality) is more pronounced for higher values of entry costs k . Note that the reason for why the initial level of income inequality is higher for low entry costs values (blue solid line) is the fact that a fraction of workers employed in the wage sector is much higher even for low values of matching efficiency m . However, the variance of log income converges for values of m above 0.01.

3.4 Underlying productivity distribution

The third channel through which differences in wage dispersion can exist across countries is differences in underlying productivity that might be driven by lower capital intensity, inferior technology, or poor infrastructure. For example, Hall and Jones (1999) argue that differences in observed TFP are driven by differences in what they call “social infrastructure”, i.e. government policies, institutions, barriers to trade, etc. Here, we analyze separately the role of having an

Figure 12: The effect of changes in matching efficiency on wage dispersion

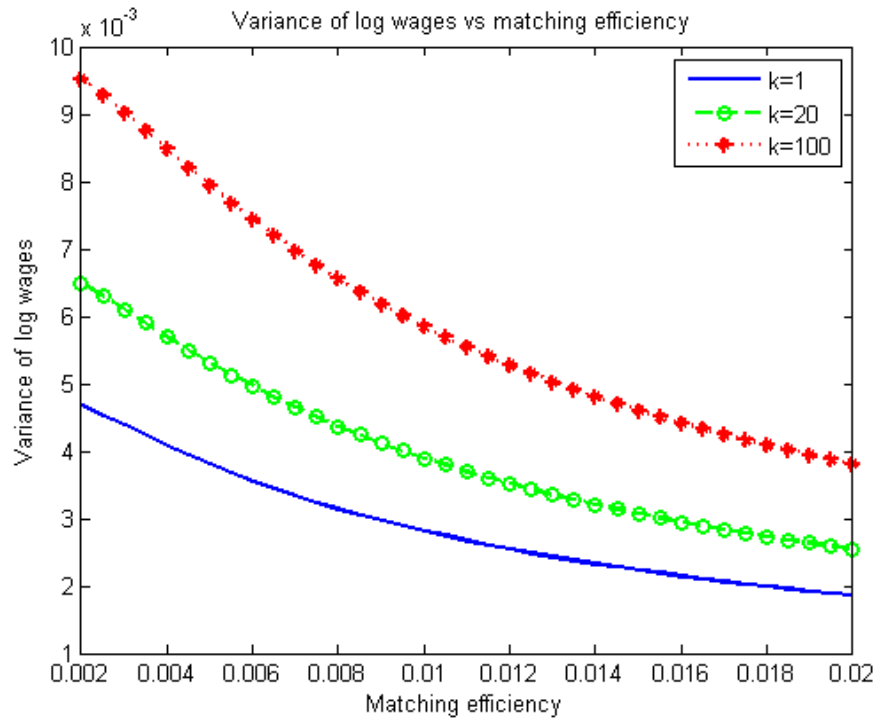


Figure 13: The effect of changes in matching efficiency on wage dispersion

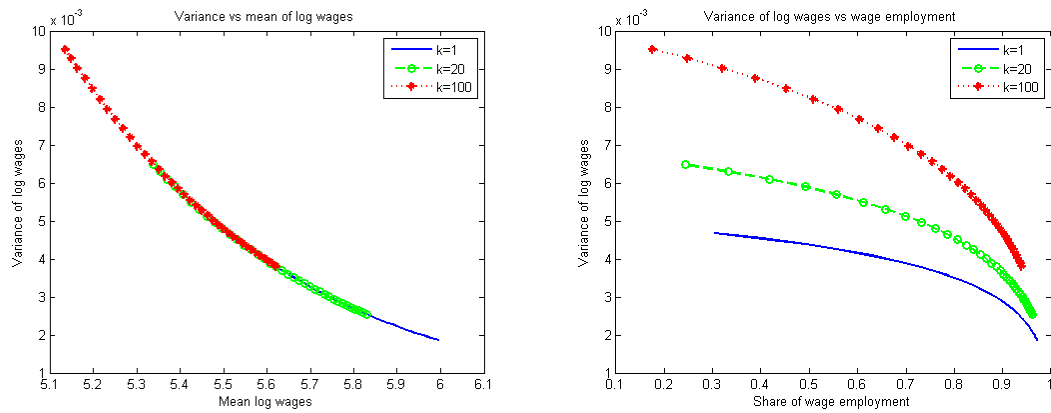
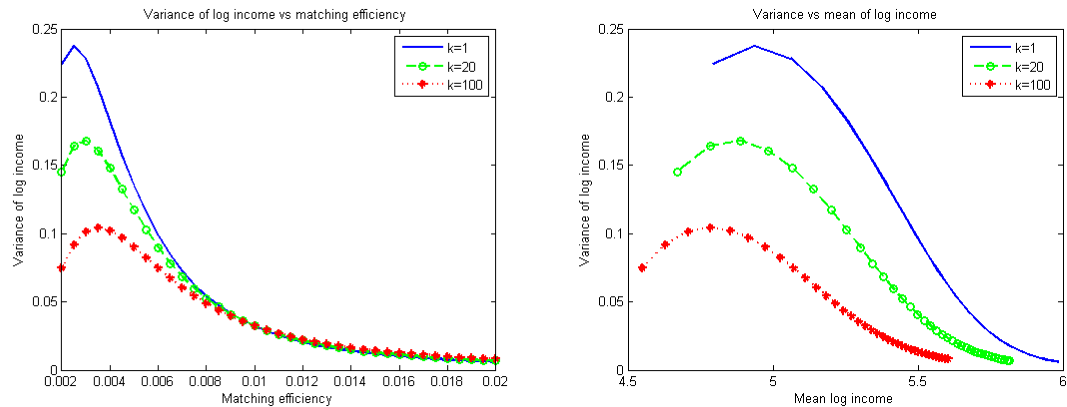


Figure 14: The effect of changes in matching efficiency on income dispersion



underlying productivity distribution with a higher mean or a higher variance.

Figure 15 illustrates the effect of changing the location parameter μ and the scale parameter σ . First, we find that a country with a higher average underlying productivity will also have a lower wage dispersion (see the left panel of the graph); while a higher underlying productivity dispersion will be translated into a higher wage dispersion (see the right panel of the graph). Hence, if industrialized countries have on average better technology or if they adapt new technology faster (e.g. getting rid of obsolete technology is likely to reduce the variance of underlying productivity in a similar way as a reduction in the entry costs reduces variance of ex-post productivity in our model) they will exhibit lower wage inequality. Moreover, entry costs seem to exacerbate the initial differences in productivity between developing and industrialised countries.

Although changes in the variance of underlying productivity generate different wage dispersions across countries, we can rule them out as a key driving factor for observed differences in wage inequality. Figure 16 shows that changes in σ alone are incapable of matching the negative mean-variance relationship in wages found in the data. As we show above, this relationship is negative when we change the entry costs parameter k (or matching efficiency m) and it is shifted up as σ increases. We can then use the mean-variance relationship in wages to identify the effect of underlying productivity dispersion on wage inequality.

Figure 15: The effect of changes in underlying productivity on wage dispersion

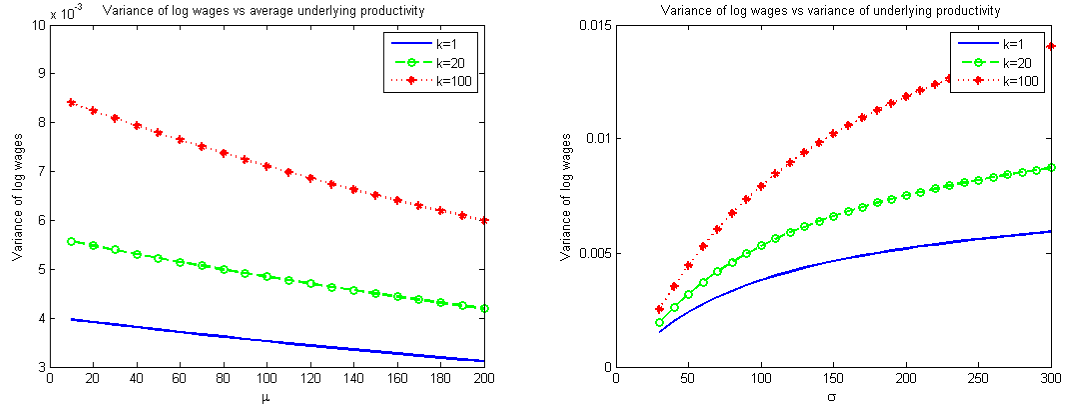
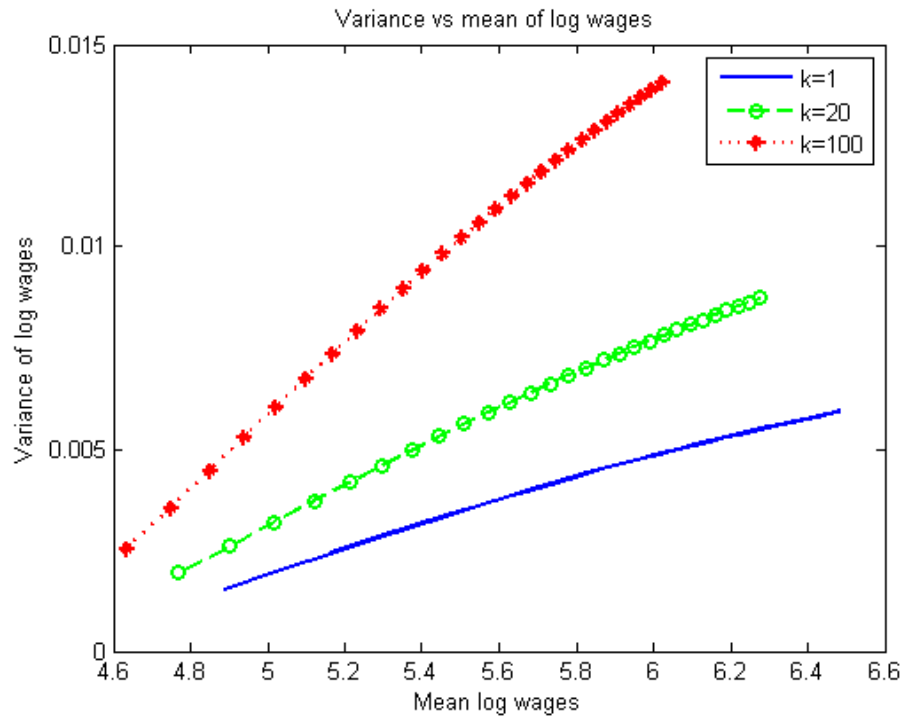


Figure 16: The effect of changes in underlying productivity dispersion on wage dispersion



4 Estimation

The results of the numerical simulations described above help us identify particular moments that play a key role in identifying structural parameters in the estimation of the model. Subsequently, the estimated model will enable us (i) to decompose differences in wage distributions across countries and ascribe them to alternative mechanisms, and (ii) to implement counterfactual analysis of how the wage sector would look if key policy areas were improved relative to a benchmark country, such as the US.

One important feature of a job search model that the resulting wage dispersion is closely linked to labor mobility parameters and worker's outside option, and to a lesser extent to the productivity distribution parameters. A recent paper by Hornstein, Krusell and Violante (2011) shows that it is not necessarily true that search models can generate any amount of wage differentials as long as the wage-offer (or productivity) distribution is sufficiently dispersed. They find that observed magnitudes for worker flows in the US imply a very small frictional wage dispersion in a basic search model. Although the labor mobility flows are much lower in the SSA countries than in the US, and hence can produce higher wage dispersion, we find that our model still under performs trying to match the observed values of wage inequality in Sub-Saharan Africa. Hence we conclude that frictions alone are insufficient to generate the required magnitudes of wage dispersion and propose to extend our basic search model to allow for heterogeneous types of workers. Adding worker types not only solves the somewhat technical wage dispersion problem, it also allows us to quantify how much of the observed wage variance can be attributed to differences in workers' characteristics (observed and unobserved) across countries.²⁹

The model can easily be extended to introduce workers' heterogeneity. We assume that a worker of a high (low) type would have a proportionally higher (lower) marginal product in the private sector and in the home sector. Firms post vacancies that are randomly matched with workers in one single market. Once the firm finds a worker, it observes her type and pays her a different wage depending on the type of the worker. This implies that the zero profit (ZP) and the free entry (FE) conditions need to be modified to account for average efficiency of workers, that will depend on the proportions of types in the population and their relative productivity.

To estimate the parameters of the model we use household survey data that include information on the size of the wage sector, self-employment income, wages and demographic character-

²⁹For example, ? argued that the relative scarcity of skilled labor in Africa is the underlying cause of the lack of competitiveness of the manufacturing sector in African economies.

istics of workers. The structural estimation of the model invokes some specific data requirements. In particular, our model relies on estimating labor market transitions into and from wage employment. Hence, we use the panel nature of the household surveys from Uganda, Nigeria, Tanzania and South Africa to estimate transitions directly. In addition, we obtain labor transitions from retrospective information on employment status provided in some cross-sectional household surveys (e.g. in Ghana). We use the “Doing Business” Survey data collected by the World Bank to find the value of entry costs for each country.

[ESTIMATION IS WORK IN PROGRESS]

5 Conclusion

Labour markets in least developed countries are characterised by a small proportion of workers on wage employment. Furthermore, the wage sector in developing countries tends to generate jobs that are relatively unproductive compared to similar jobs in industrialised and middle-income economies. As a consequence, pay is low on average, yet it varies substantially even across similar individuals in similar occupations. Despite these characteristics, wage employment in developing countries is still preferred by workers and has been identified by international organisations as key in generating economic growth and reducing poverty. This is because most of the labour force end up in less desirable and even less productive self-employment occupations (e.g. subsistence farming) or helping family activities for no pay.

We propose a unifying framework that can endogenously generate the link between size of the wage sector, mean productivity and wages and wage inequality. In particular, we incorporate channels identified by both the development and the labor literature, that can interact to generate these outcomes, such as underlying productivity differences across countries (e.g. driven by lower capital intensity, inferior technology, infrastructure, etc.), barriers to entry (such as regulations, financial constraints, corruption) that prevent firms from entering the market and reduce competition, differences in workers’ characteristics (such as the levels of human capital), as well as in their bargaining power and outside options (e.g. subsistence level farming) and labour market inefficiencies.

The model incorporates heterogeneous firms in terms of their productivity that are subject to paying entry costs before entering the market. Entry costs in the model can be interpreted as a regulatory variable (e.g. government red tape) or in a borrowing constraints setting it captures

the size of the collateral required in order to get a credit. Upon entry, the firm realises its productivity and, conditional of remaining in the market, decides to hire workers by posting vacancies. Workers search for a job in the wage sector and, if unsuccessful, settle for self-employment. Unlike in industrialised countries, the unemployment rate in developing countries is very low or virtually non-existent; therefore, self-employment income is a more relevant outside option for workers and needs to be modelled separately³⁰. In the wage sector, vacant jobs and workers are brought together pairwise through a sequential and random matching process. Finally, wages are determined through a bargaining process between the firm and its workers. This framework allows us to incorporate worker and firm heterogeneity together with entry barriers and labour market frictions. In addition, this model provides a clear link between productivity and wages. A wage bargaining process delivers a worker's wage as a weighted average of the firm's productivity and her outside option, where weights are determined by the worker's bargaining power. On the other hand, self-employment income will be endogenously determined in a competitive market.

We subsequently present a numerical simulation of the model, aimed at illustrating its main mechanisms affecting wage inequality across countries, as well as their interactions. The simulation exercise shows that variation in the exogenous components of the model can qualitatively reproduce the main stylised facts of labor markets in developing countries. It also reveals interesting results due to interactions between the main exogenous components. For example, the effect of a change in labor market frictions on wage inequality is amplified in the presence of higher barriers to entry.

This preliminary results already suggest the power of estimating an integrated model of labor markets in developing countries . First, because it allows us to combine different barriers to growth within a single framework and to examine their relative importance and interactions between them. Second, because we can use it to analyse a great number of policies from relaxing entry barriers and fighting corruption to investments in human capital, to identify the priority areas in enhancing job creation and reducing inequality, which is a key step to designing more efficient policies that generate growth and reduce poverty.

³⁰Banerjee and Duflo (2007) describe how the poor choose to run their own-account businesses because they cannot find a steady well-paid job in the wage sector and not because of their entrepreneurial drive.

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