Unemployment and wages in South Africa: A spatial approach

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Geeta Kingdon and John Knight

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Correspondence: Geeta Kingdon/John Knight, Institute of Economics and Statistics, University of Oxford, Oxford, OX1 3UL. Tel: 44 1865 271065.
email: geeta.kingdon@economics.ox.ac.uk or john.knight@economics.ox.ac.uk

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Abstract: A large amount of recent evidence finds a negative relationship between local unemployment and wages in OECD countries, a relationship christened a 'wage curve'. This contradicts the conventional model of the labour market in which high unemployment regions have higher wages to compensate for search and other costs. This paper discovers a wage curve in South Africa, a country with several times the typical unemployment rate of OECD countries. The wage curve elasticity in South Africa is similar to that in OECD countries (-0.1) but persists over a much larger range of unemployment rates, implying that unemployment can have a large impact on wages in South Africa. However, this wage flexibility does not extend to union wages which are well insulated from local unemployment conditions. The results here also shed light on the segmentation of the labour market based on labour immobility and on the debate about the appropriate definition of unemployment in South Africa.

1. Introduction

The conventional model of the labour market - in which high unemployment regions have higher wages to compensate for search and other costs - seems contradicted by a large amount of recent evidence of a negative relationship between local unemployment and wages in many economies. This relationship has been called 'the wage curve' and claimed as an empirical 'law' of economics (Blanchflower and Oswald, 1994). Using mesoeconomic analysis[1], Blanchflower and Oswald (1994) present an impressive array of evidence in favour of the wage curve from the US, UK, and some OECD countries. The evidence shows that wages are negatively related to contemporaneous unemployment, and the unemployment elasticity of the wage has a value of approximately -0.1, so that a 10% increase in the unemployment rate leads to a 1% decrease in wages. This finding is now corroborated by evidence from a large number of OECD countries. Carruth and Oswald (1987), and Blanchflower and Oswald (1990, 1994) provide theoretical models of the labour market consistent with the wage curve. In a searching review article, Card (1995) does not counter the validity of the wage curve, taking issue instead only with the interpretation of the results and the robustness of the elasticity.

The object of this paper is to test the robustness of the wage curve relationship under conditions of very high unemployment using data from South Africa where average unemployment rates are 31-37% (Klasen and Woolard, 1998; StatsSA, 1998). These rates are several times the typical OECD unemployment rates and twice that in urban Cote d'Ivoire - the only African country where the wage curve has been tested (Hoddinott, 1996). Are wages as flexible at the high South African unemployment rates as in other countries?

When unemployment is very high, its definition itself becomes an issue. If many unemployed people stop actively searching for work because they become discouraged, then it may be misleading to measure the unemployment rate by considering as unemployed only those who actively looked for work, *i.e.* by the narrow definition. At high rates, the measure of unemployment is endogenous because the number actively seeking work itself depends upon the unemployment rate. The wage curve can help assessment of alternative definitions of unemployment by showing which measure of the unemployment rate is more important in explaining wages. If, as an ILO report on the South African labour market (ILO, 1996, p104) argues, those wanting work but not actively seeking (included in the broad definition of unemployment) may be outside the labour force, we would expect the wage curve to be steeper for narrow than for broad unemployment.

There are several further reasons why an examination of the wage curve in South Africa is of interest. First, estimates of the unemployment elasticity for different areas can provide tests of labour immobility based on labour market segmentation - whether, for instance, segmentation is clearer as between rural and urban areas or between (former) 'homeland' and non-homeland areas. Second, the wage curve has implications for poverty in South Africa. A negative relationship means that high unemployment in a locality not only has a direct effect on poverty among its households but also an indirect effect via the lower wages of their employed members. Lastly, the trade union movement is apparently powerful and allied with the new government in South Africa, and there is an institutional framework - the Industrial Councils and Wage Boards - to set minimum wages in much of the formal sector. It is of interest to examine whether this implies less wage flexibility than in countries with weaker unionisation and weaker wage-setting institutions.

[1] Applying microeconomic data and methods to macroeconomic questions.

The paper is organised as follows. Section 2 presents a brief theoretical analysis of the relationships between wages and unemployment. Section 3 provides the South African context, and Section 4 discusses the data, model, and tests. The empirical results appear in Section 5, and Section 6 concludes.

2. Unemployment and wages: theory

The literature has generally rejected the notion that the wage curve is the result of temporary departures from competitive labour market outcomes, essentially because a wage increase above equilibrium should raise, not lower, unemployment. Two main forms of explanation for a negatively sloped wage curve $W = f(U)$ have been suggested in the literature. One is an incentive wage hypothesis, i.e. profit-maximising firms choose to set the wage above the competitive level in order to influence the behaviour of their employees. This is normally presented along the lines of the Shapiro-Stiglitz (1984) efficiency wage model, to which imperfect monitoring and the need to prevent shirking are central. Workers have little incentive to put in effort if the cost of shirking is low. Firms respond by raising the wage above the market level so as to increase the cost of job loss. If local unemployment is high, the difficulties of finding work are great and workers are afraid of dismissal. This acts as a disciplining device, so that it is not necessary for firms to pay such high efficiency wages. The profit-maximising efficiency wage is therefore inversely related to the unemployment rate. This wage curve has been termed the 'no-shirking' curve since it shows the wage just high enough to deter workers from shirking. Another incentive wage mechanism concerns firms' training costs, which depend on the rate of labour turnover (Stiglitz, 1974). Firms raise wages above the competitive level to discourage voluntary quits. However, high local unemployment increases workers' expected costs of quitting, so decreasing the profit-maximising wage and giving rise to a negatively-sloped wage curve.

The second rationalisation of the wage curve draws on the union bargaining model. High local unemployment frightens workers and weakens their bargaining power in negotiations over rent-sharing. If trade unions worry about their unemployed as well as their employed members, then negotiating unions may place greater weight on employment and less on wage objectives where local unemployment is high and the chances of finding employment consequently low. The wage curve accordingly has a negative unemployment elasticity.

Labour economists have used the notion of compensating differentials to hypothesise that wages and unemployment are positively correlated across space. In fact, this hypothesis was developed in an African context and formalised in a model by Harris and Todaro (1970): high wages in a locality attract more workers to it until unemployment rises sufficiently to equalise the 'expected wage' across localities. The relationship, representing $U = f(W)$, is depicted by the curve *HT* in Figure 1. However, that is not what researchers have found in other countries: the negative wage curve, interpreted as $W = f(U)$, is depicted by *WC* in the figure. The two relationships are mutually compatible. The *HT* relationship may indeed prevail in the long run but labour may not be sufficiently mobile for *HT* to be observed in the short run. The long run effect can be picked up by the inclusion of locality dummy variables in the wage equation, so permitting the short run wage curve *WC* to be isolated (Blanchflower and Oswald, 1995, p93; Hoddinott 1996, pp1613-4).

What would be the shape of the wage curve if wages were entirely market determined? This question is relevant to our hypothesis tests, some of which compare non-market with market outcomes. If labour is perfectly mobile, a single market wage is established (apart from compensating differences for local amenities). However, the (voluntary) unemployment rate is also invariant (apart from differences arising from local tastes). The outcome is likely

to be a wage blob rather than a curve. If labour is perfectly immobile, as is assumed in Figure 2, local labour demand curves differ in relation to local labour supply, causing market clearing wages to differ across labour markets (being W_1, W_2 , and W_3 in the figure). In response, voluntary (scive) unemployment may vary inversely with the wage: a conventional wage curve can result but it is likely to be steep. Imperfect mobility of labour tends to reduce, but does not eliminate, the wage differences between W_1, W_2 , and W_3, and voluntary unemployment can again generate a conventional wage curve.

Finally, there is a presumption in the existing literature that the wage curve relationship be interpreted as $W = f(U)$, *i.e.* the direction of causation is implicitly assumed to run from unemployment to wages. However, it is possible that a negatively sloped wage curve represents the effect of the wage on involuntary unemployment. In Figure 3 the supply curve *S* can be downward-sloping (scive unemployment) or upward-sloping (search unemployment), but for clarity it is assumed to be vertical, *i.e*. there is a fixed amount of voluntary unemployment. The three different local demand curves would produce market-clearing wages W_1, W_2 , and W_3. However, assume that incentive wage determination, or institutional wage determination, or bargaining (conducted at a non-local level or based on comparisons) raises the wage above the market equilibrium in localities where the latter is low. The lower the market-clearing wage, the greater is the gap. This can then generate a downward-sloping ($cd>ab$) wage curve *WC* based on involuntary unemployment, as shown in the figure.

3. The South African context

In the apartheid years, the organisational power of African workers and their freedom of movement were heavily controlled. Permanent urban settlement of rural people was prevented and even temporary labour migration was regulated to keep supply in line with demand. In particular, the residents of the so-called 'homelands' - accounting for over half of the African population - faced limited employment opportunities and had negligible bargaining power. Knight (1982) argued that there was much disguised unemployment in the homelands which reflected both the above-market wage in the formal sector, governed by incentive wage and institutional wage determination, and also the effective rationing of formal sector jobs. By 1993 - the year of our survey - the influx control regulations had been recently repealed, all workers were free to organise, and trade unions were generally recognised.

Trade unions now play an important role in wage determination in South Africa. Their impact was recently explored by Schultz and Mwabu (1997) using the 1993 data set. African unionised workers received a wage 19% higher than that received by African non-union workers with the same observed characteristics. Moreover, this measure may understate the effect of unions on wages. Although firm-level bargaining occurs as well, minimum wage floors are set in many industries via the agency of Industrial Councils (ICs) or Wage Boards (WBs). ICs are formed if enough employers in a particular sector and area get together and negotiate. The minimum wage agreements reached through collective bargaining within ICs are generally extended to employers in the industry and area who are not parties to the negotiations. In effect, very few employers are exempt from such extension, and there are penalties for flouting the prescribed minima. Thus, wherever ICs operate, all workers enjoy minimum wages and the union-nonunion distinction is less important.

WB determinations cover some of the industries not organised in ICs or, if an IC exists, some parts of the country not covered by the IC. In 1993 26% of the formal sector employees were covered by ICs or WB determinations, another 31% (in mining and the public services) were also subject to minimum wages, and 54% of the formal sector employees were

unionised. The commercial agriculture and domestic service sectors were effectively outside these institutions until 1993[2]. While ICs and WBs must limit wage flexibility in South Africa, it should be noted that most of these institutions are sub-national and impose local rather than national wage minima. For instance, in 1996 minimum wages for labourers in the clothing industry ranged from 97-100 (ICs in the main metropolitan areas) to 69-76 (ICs in particular non-metropolitan areas) to 30-36 (WBs in particular undeveloped, labour-surplus areas).

4. Data, model, and tests

The data for this study come from the South African Living Standards Survey, collected jointly by the World Bank and the South African Labour and Development Research Unit (SALDRU) at the University of Cape Town in the second half of 1993. This integrated household survey, based on the pattern of the World Bank's LSMS surveys, produced cross-section data on 8848 households in 360 clusters. The sample was stratified by province, and used a two-stage self-weighting design in which clusters were selected with probability proportional to size, and an equal number of households selected from each cluster. The data contain detailed information on sample adults' labour force participation, employment status, earnings (wages as well as housing and transport subsidy, bonuses, and in-kind payments), hours worked in the past week, job-search activity, occupation, industry, and employer-type. Moreover, data are also available on food prices by cluster and on a number of individual and household demographic characteristics.

There is no *a priori* guidance about what geographical boundaries are appropriate for dividing up the country into 'local' labour markets for the purposes of wage curve analysis. In a country such as the US, a meaningful and convenient definition of the 'local' labour market may be the state: variations in state labour laws probably lead to 'different' state labour markets, data are routinely collected stratified by state, and there are more than 50 states. In South Africa, at the time of the survey, new labour market boundaries were probably emerging as a result of the abolition of apartheid laws such as the Group Areas Act and the Influx Control Act which previously limited the mobility of many Africans. Thus, it is not clear what geographical boundaries constituted meaningful 'local' labour markets in 1993. Our decision was governed by the data. There are only 14 provinces (by the old definition) and only 9 (by the new definition). Given that our dataset is a cross-section, the number of province-level unemployment rate observations available is too small for reliable inferences to be drawn. Both district and cluster boundaries are available but the use of the cluster is preferable since the number of clusters in the dataset (360) is about double the number of districts (187)[3].

For the link between local unemployment and local wages to be meaningful, it is important that a worker living in a particular local labour market also works in that local labour market. The fact that the local labour market as defined for the wage is potentially broader than that as defined for unemployment introduces a potential source of error.

[2] The data sources are CSS (1994, pp. 2.92, 2.146, 5.3, 5.4) and ILO (1996, p145).

[3] Moreover, while cluster characteristics and cluster prices are available in the dataset, there is no information on district characteristics and district prices except by aggregation of cluster characteristics. Furthermore, the district unit aggregates rural and urban areas - several districts have both rural and urban clusters in them - which may represent very different types of labour markets. Clusters, being smaller geographical units, are likely to represent more homogeneous labour markets. Finally, it is well known that the standard errors in an OLS regression are significantly downward-biased when an aggregate variable is used as an independent variable - such as cluster/district/state unemployment rate - because of the correlation of errors across individual observations within each cluster/district/state (Moulton, 1990). The bigger the level of aggregation, the larger is the scope of the bias. From this technical point of view also, then, it seems prefer to use cluster rather than district as the definition of the local labour market.

Unfortunately, there is no information in the dataset on distance to work or travel to work to enable us to identify whether an individual works in the cluster of residence.

The cluster-level 'broad' unemployment rate has been calculated as follows: in each cluster, let the 'broad' labour force participants comprise all employed persons and all unemployed persons, *i.e*. those persons who wanted work and were either looking for work in the past week or who did not actively look for work in the past week because they believed that no job/work was available. In accordance with these definitions, the 'broad' unemployment rate (URATEB) is the ratio of the number of unemployed persons to labour force participants. Broad unemployment includes the narrowly unemployed (those who searched for work in the past week) and discouraged workers (those wanting work but not actively searching in the past week). The narrow unemployment rate (URATEN) excludes discouraged workers from both the numerator and the denominator. It is thus the ratio of narrowly unemployed persons to persons who either worked or looked for work in the past week.

For the purposes of estimating the wage function, we include in our analysis persons aged 16-64 who were residents in the cluster in which their household is situated (*i.e*. not oscillating migrants), in wage employment, and for whom wages, hours worked, cluster food prices, and cluster characteristics are available. This yields a sample of 6498 individuals[4].

The wage function estimated is of the form:

$$\ln W_{ir} = bX_{ir} + gU_r + D_r + e_{ir} \qquad (1)$$

where W_{ir} is the hourly wage rate for person *i* observed in the local labour market *r*, U_r is the unemployment rate in labour market r, D_r is a vector of regional dummies, X_{ir} is a set of measured characteristics of individual *i* such as gender, education, marriage status, race, region, occupation, and potential experience, and e_{ir} is an error term. The *logarithm* of the unemployment rate is not used on the right hand side of the wage function because in some 7% of clusters the computed unemployment rate was zero[5].

Figures 4 and 5 present a first look at the cluster level data and help to check whether the shape of the wage curve is sensitive to outliers. It seems that the cubic form apparent in the simple correlation between wages and unemployment in Figure 4 occurs because of a few outliers. Figure 5 constrains both URATEB and wage to lie within two standard deviations of their respective mean values at the cluster level, and it shows that when the few outlying observations are removed, the relationship is first downward-sloping and then approximately flat at very high rates of unemployment. However, we have not as yet controlled for other influences on the wage and, in order not to impose a particular form on the unemployment-wage relationship *a priori*, we experiment with specifications containing quadratic, cubic, and quartic terms of U_r.

[4] Of all 'resident' persons aged 16-64 who reported working in the past week in wage employment (n=8118), earnings information is missing or incomplete for 941 individuals and hours worked information is missing for 144 persons. Moreover, information on cluster food prices is missing for one cluster leading to the loss of 53 wage employee observations. Finally, cluster characteristics are missing for 36 clusters altogether, which leads to the loss of a further 482 observations.

[5] Experimentation with imputing alternative small positive values to the zero unemployment rate observations showed that the estimated wage unemployment elasticity was quite sensitive to the choice of value imputed.

Some specification issues bear discussion. The inclusion of regional fixed effects in the wage equation is generally preferred because it allows the permanent component of wage to have a correlation with the permanent component of unemployment, and uses only the deviations of unemployment and wage from their average values to estimate the wage curve elasticity. Card (1995) emphasises this as the reason why the inclusion of region dummies was an important issue in Blanchflower and Oswald's estimation of the US wage curve[6]. However, given institutional features that prevented free movement of people until recently in South Africa, such as the Group Areas Act, the Influx Control laws, and the confinement of large numbers of Africans to the so called 'homeland' areas, we expect a large degree of 'permanence' in the geographical pattern of unemployment in South Africa and do not expect regional dummies strongly to affect the wage curve elasticity. Since our dataset is a cross-section, only a single value for the cluster unemployment rate is available and, as a result, it is not possible to use cluster dummies. However, nine province dummies are available and these are used as crude regional fixed effects.

Since the cost of living can vary substantially among regions, a specification that uses price-deflated wages is preferable. In the SALDRU data, price information by cluster is available only on food prices. A price index is created by weighting cluster food prices by their weight in the Consumer Price Index and assuming that non-food prices are uniform across the country. This index is then used to deflate wages. Deflating wages by an index of food prices only (i.e. assuming that non-food prices vary across clusters as much as food prices) would probably over-correct for regional price variations since food prices tend to vary more across regions than the prices of other commodities[7].

Turning to hypothesis testing, the two main explanations for the wage curve are best tested by estimating the unemployment elasticity of the wage for particular sub-groups. If efficiency wage behaviour provides the explanation for the wage curve, we expect the negative slope to be steeper for workers who cannot be easily monitored. If the labour turnover argument applies, we expect the negative slope to be steeper for workers in whom the firm has invested, such as those with much firm-specific training[8]. The test is complicated, however, by the likelihood that workers with firm specific skills are less in danger of dismissal for shirking. Because education and training are normally complementary, and because educated workers are likely to be monitors (rather than the monitored), education may serve as a proxy both for poor monitoring and firm-specific skills. The same is true for age, length of employment experience, and more skill-intensive and responsible occupations. Under the bargaining power explanation, workers with bargaining power - provided that it is localised bargaining - should have a steeper wage curve than workers without bargaining power. For this reason, unionised workers may display a more elastic wage curve. However, if bargaining is conducted

[6] Card (1995) states that for the US data the inclusion of the state fixed effects matters because average levels of unemployment across states are weakly *positively* correlated with average wages, whereas 'transitory' wages and unemployment rates are strongly *negatively* correlated. As a result, the US wage curve elasticity tends to be small in magnitude unless location dummies are included. In the UK data, the addition of region dummies does not affect the estimated wage curve elasticities, perhaps reflecting the greater degree of 'permanence' in the geographic patterns of UK unemployment, as noted by Pencavel (1994). For the US, region dummies may have had an important effect on the wage curve elasticity also because there were no regional price deflators available for the US regions.

[7] For example, Kanbur and Grootaert (1994) find that in Cote d'Ivoire, non-food prices were roughly uniform across the country but food prices varied substantially.

[8] For workers whose effort input is difficult to monitor, firms need to pay them more under conditions of low unemployment in order to raise the cost of dismissal and thus provide them with the incentive not to shirk. For workers with much firm-specific training, firms will need to pay higher wages under conditions of low unemployment in order to prevent labour turnover of workers in whom they have invested.

centrally, the reverse is the case. Thus, for instance, public sector workers can be expected to have a flatter wage curve than those in the private sector. Finally, what if efficiency wage behaviour, institutional wage setting, or non-local bargaining raise the wage above the competitive level in low-wage areas, so generating involuntary unemployment and a negative function $U = f(W)$? We would expect the relationship to be less negative, *i.e*. the market distortion to be stronger, in the case of the uneducated, the unionised, production workers, and those employed in the public sector. These are the characteristics which are less prone to market wage determination.

5. Empirical results

Table 1 presents two different specifications of the wage function, one with and the other without the squared term of U_r, defined both broadly and narrowly. Robust t-values are reported rather than raw, to take account of the fact that the regression errors may be correlated across individual workers within each cluster (Deaton, 1997, p77; Moulton, 1990). The table shows that there is no significant relationship between narrowly measured unemployment and wages but that there is a significant quadratic relationship between broadly measured unemployment and wages[9].

The usual Mincer-type relationships are found between wages and productive characteristics: for example, wages increase with experience but at a decreasing rate[10]. Marginal returns to education increase with years of education, a result similar to Moll's (1996b) finding that the returns to primary education are very low in South Africa. Each of the race groups Africans, Coloureds, and Indians earn significantly lower wages than their white counterparts even after controlling for gender, region, productive characteristics, and occupation, and the wage disadvantage is greatest for Africans. We attempted to examine how much the effect of race on wages declined when quality of schooling was accounted for, but our efforts were thwarted by the lack of adequate data on quality of schooling[11].

Service occupations are the base category: workers in professional, clerical, and production occupations receive higher wages, but farming workers and labourers receive significantly lower wages than service workers. Male, urban and married workers receive significantly higher wages than their female, rural, and unmarried counterparts. Controlling for productive characteristics and institutional factors, homeland workers receive significantly

[9] The quartic U variable was insignificant in all experiments. Though the cubic term of URATEB was significant at the 1% level, this turned out to be due to the influence of outliers. Upon exclusion of the very few observations (29 out of 6498) that had a URATEB of >80% (more than three standard deviations above the mean of URATEB at the individual level), the cubic term became insignificant. This confirms that the quadratic shape of the wage curve seen in figure 4d is robust to the control for other factors that influence the wage, such as personal traits, occupation, employer-type, and region of residence. The results shown in the tables include all observations, including outliers.

[10] Experimentation with cubic and quartic terms in experience showed that their inclusion made virtually no difference to the estimated wage curve elasticity.

[11] We wanted to use cognitive skill test scores as proxies for quality of schooling received. However, there are several drawbacks associated with the test score data in the SALDRU survey. Firstly, tests were administered only to one in six of the sample households and within each of these households, it was given to only 2 members of the household, one of whom was in the age group 13-17 and one over 17. In total, 1330 individuals older than 17 took the test, but less than 200 of these are waged workers. The test takers over the age of 17 are split 65:35 women to men. Although the descriptive material does not say so, it seems that the tests were administered at times when school children were present, but when working adults were likely not to be. As a result, the adult test takers are predominantly women and less than a quarter report any wage income. As Case and Deaton (1997) point out, this selection is likely to jeopardise any general inferences from the test scores, particularly about the links between test scores and earnings.

higher wages than non-homeland workers, though their raw, unstandardised hourly wages are much lower. This standardised wage premium could be interpreted as a compensating differential for working in low-amenity homeland areas.

As expected *a priori*, public sector and union workers are significantly better paid than private sector and non-union workers. Province dummies are important, signalling that there is significant regional variation in pay levels. Finally, cluster variables are significant influences on wages. Lack of a tarred road in the cluster and greater distance to various facilities (such as post office, bank, restaurant, phone, etc.) reduce wages.

The elasticity of wage with respect to the local unemployment rate estimated from these and similar models is presented in Table 2. The first row provides basic evidence on the wage curve in South Africa as a whole. Using the quadratic specifications in Table 1 as the basis, the broad unemployment elasticity of the wage evaluated at the mean is nearly -0.11. In other words, a doubling of broad unemployment generates an 11% reduction in wages. However, the narrow unemployment elasticity of wage is close to zero.

The remaining rows of Table 2 provide further estimates of the wage unemployment elasticity (WUE) under a number of alternative specifications. It shows that departures from the basic specification make little difference to the estimated WUE of about -0.11 using broad unemployment and about zero using narrow unemployment, that is, the differences are not statistically significant[12].

These findings shed new light on the on-going debate about the appropriate definition of unemployment in South Africa. The ILO Report (ILO, 1996, p104) argued that the broad measure exaggerates unemployment by including in labour supply persons who did not actively look for work in the past week (*i.e.* discouraged workers). The results here show that broadly measured unemployment has a far greater impact on wages than narrowly measured unemployment. In other words, discouraged workers are taken into account by wage-setters and their numbers in a locality do influence local wage determination. These appear to be persuasive grounds for retaining the broad definition as the more appropriate definition of unemployment in South Africa.

To test the alternative theories we compare the wage curves of those workers for whom theory appears particularly apposite and of other workers. The shirking theory might apply more to workers whose performance is more difficult to monitor or for whom the threat of dismissal is more credible. These might, for instance, be workers in discretionary or supervisory jobs or workers in whom the firm has not invested heavily. By contrast, the labour turnover theory appears most relevant to workers in whom the firm has invested heavily. Thus alternative versions of the incentive wage hypothesis make different predictions. The bargaining theory is more likely to apply to unionised workers who engage in local bargaining and less to workers subject to non-local wage determination or to workers without

[12] The full set of regressions is available from the authors on request. In common with Blanchflower and Oswald (1994) and other wage curve studies, the basic specification does not correct for the sample selectivity of waged workers. Experimentation with the district (as opposed to cluster) unemployment rate showed that the point estimate of the coefficient on the district broad unemployment rate (DURATEB) was lower but insignificantly different from the point estimate of the coefficient on the cluster broad unemployment rate (URATEB). However, the coefficient was imprecise and insignificant at the 5% level. This is not surprising since the standard error of DURATEB was much higher (than of the cluster URATEB) because of fewer district observations. The estimated wage curve elasticity using DURATEB was -6% (t-values: -1.70 on DURATEB and 1.67 on the square of DURATEB).

organisation or power. The wage curve of the relevant group should be downward-sloping whereas that of the residual group need not be. Unfortunately, the prediction for the residual group is ambiguous. If the wage is market determined the wage curve tends towards the vertical whereas if the wage is governed by non-local bargaining, the wage curve tends towards the horizontal.

Table 3 presents the broad unemployment elasticities of wage for different groups of workers, disaggregated by education, experience, sector, gender, race, and region. In South Africa, the pay of many public sector workers is set centrally[13]. We would expect workers whose wages are negotiated centrally to have a flatter wage curve than workers who engage in local level bargaining. In line with this hypothesis, Table 3 shows that the wage curve is substantially flatter for public than for private sector workers.

A comparison of union and non-union workers in Table 3 shows that unionised workers' wages do not respond negatively to local unemployment rate at all[14]. The bargaining hypothesis implies that the wage curve exists when local bargaining takes place but not if bargaining is national or regional: non-local bargaining insulates workers' pay from local labour market conditions. In South Africa, much union bargaining is non-local and unionised workers are in a better position to ensure that IC non-local wage agreements are implemented by recalcitrant employers who were not party to the IC wage negotiations. Thus, the results for unionised workers (proxying bargained wages) are as expected. We are left to explain the results for non-unionised workers.

Table 3 shows that the wages of older, more experienced, and more educated workers are less sensitive to local unemployment than are those of younger, less experienced, and less educated workers. These former characteristics are liable to encourage efficiency wage setting so as to avoid shirking, whereas the latter are more likely to produce market wage setting. The results are thus in line with one version of the efficiency wage rationalisation of the wage curve.

The fact that women have a very flat wage curve may be due to our use of the overall cluster unemployment rate, rather than the gender-specific unemployment rate. If women's and men's jobs are not substitutes (as may be the case in certain occupations and industries, *e.g.* mining, domestic work and health care), then the relevant unemployment rate to use is the gender-specific one. There is support for this hypothesis. When we use gender-specific unemployment rates, the wage-unemployment elasticity is marginally lower for males than for females: -0.040 for males (t= -2.8, 3.2) and -0.063 for females (t = -2.7)[15].

Table 3 also shows that the wages of rural workers are about as flexible with respect to local labour market conditions as those of urban workers. By contrast, while a highly significant negative wage curve elasticity is obtained for non-homeland areas, homeland wages are not negatively related to unemployment in South Africa. The wages of non-African

[13] But not in all cases, e.g., provincial administrations and local governments may set their own wages and these may take account of local labour market conditions.

[14] Union membership information is available only for regular wage workers and not for casual wage workers. We have assumed that none of the casual workers are unionised. However, if some are unionised, as is likely, then the true UEW for non-union workers should be greater (i.e. a bigger negative) than the reported figure.

[15] For women, the wage-unemployment relationship is linear. Although it may be desirable to use gender-specific unemployment rates in wage curve estimation, computing the gender-specific unemployment rate implies that only about half the number of labour force participant observations are available for each gender and the sample sizes become too small for reliable estimates of the cluster unemployment rates.

workers are apparently substantially more responsive to unemployment than are those of African workers but this arises from their enforce spatial concentrations. As will be seen later, non-Africans are concentrated in low unemployment regions, *i.e.* regions where the wage curve is steeply downward sloping, whereas Africans are concentrated in high unemployment clusters where the wage curve is flatter.

Table 1 showed that South Africa apparently has a U-shaped wage curve, with the minimum point occurring at a broad unemployment rate of 36%. Is the nature of the wage-unemployment relationship significantly different between South Africa and other countries? In their analysis of wage curves in the UK and USA, Blanchflower and Oswald (1994) did find that a substantial part of the wage curve slopes upward, and they said that this "might, in principle, reflect Harris-Todaro forces, although such an interpretation would be highly speculative" (p106). They suggest (Blanchflower and Oswald, 1993, p245) that the upward-sloping part of the wage curve in UK and USA rests on small numbers of observations in the high unemployment portion of the curves and on wage functions in which it was not possible to control fully for regional and industry fixed effects. They also argue that since the upward-sloping part occurs at very high rates of unemployment which are not observed in the actual data, one could reasonably ignore that part of the wage curve. However, one cannot dismiss the upward-sloping part in the South African wage curve because a significant minority (27%) of wage employees live in clusters in which the broad unemployment rate is greater than 36%.

To explore further the nature of the wage-unemployment spatial relationship, we sought to divide the country into low and high unemployment regions. We expected unemployment to be quite different in rural and urban parts of the country. However, Tables 4a and 4b show that the rural-urban division does not capture labour market segmentation in the South African labour market well and that the clearest labour market fault-line occurs along 'homeland'-non homeland lines. Broadly measured unemployment is catastrophically high in the (former) homeland regions, and it is much lower in non-homeland regions. Consequently, we fitted separate wage functions for homeland and non-homeland regions (Appendix Table 1). A Chow test rejected the pooling of the two samples.

The first row in Table 5 shows that *homeland* South Africa - with its very high unemployment rates - exhibits no significant relationship between local unemployment and wages. This flatness of the wage curve suggests that at the disastrously high levels of unemployment found in homeland areas, relatively small changes in unemployment do not affect wages. This may be because the high levels of unemployment reflect long duration of unemployment (rather than high inflow into unemployment) and the obsolescence of human capital and skills of the long-term unemployed mean that they provide less competition for jobs, so that their presence in the labour force exerts little downward pressure on wages.

However, *non-homeland* South Africa displays a significant convex relationship between unemployment and wage, with a WUE of -0.111: a doubling of the unemployment rate there leads to a 11.1% reduction in wages. The minimum point occurs at a high broad unemployment rate of 36%. Since the vast majority (87%) of the non-homeland workers live in clusters which have a unemployment rate below 36%, the downward-sloping part of the wage curve is the more relevant.

The wage curve elasticities estimated for different groups of workers in homelands and non-homelands are presented from the second row onwards in Table 5. Since in the case of the homeland areas, there is no significant non-linear relationship between unemployment and pay, and since in non-homelands, the downward sloping part of the wage curve is the more

relevant, we refer to the elasticities in the linear columns. The elasticities for different groups of workers in homelands are almost invariably insignificant. The elasticities for different groups of workers in non-homelands South Africa show that the results are quite similar to those for South Africa as a whole in Table 3, and bear the same interpretations. There is, however, one interesting difference. In rural non-homelands, with their low unemployment rates, wages are three times as responsive to unemployment as urban non-homeland wages. This is likely to be because wages tend to be less determined by bargaining in rural non-homelands - home of South African non-subsistence agriculture - because employers are smaller, there is little unionisation of agricultural workers, and the dominant rural industry (farming) was not covered by an Industrial Council in 1993.

Table 6 sets out the wage curve elasticities by industry/sector in non-homeland areas, the part of South Africa where a negative relationship exists[16]. In all sectors except the two smallest (electricity and restaurant/entertainment), there is a large negative wage curve elasticity. The elasticity is low - a small negative - in 'other sectors', *i.e.* in educational, legal, medical, and armed forces sectors where public sector workers are concentrated and centralised bargaining is likely to determine wages. The wage curve elasticity is high (a large negative) in agriculture, fishing, and forestry industry where there is little institutional wage determination. The elasticity is also high in transport and construction sectors where the large majority of workers are non-unionised. While some sub-industries within these sectors are covered by IC agreements, the relevant ICs are very localised and their wage agreements are likely to take local market wages and local unemployment rates into account.

We are interested not only in the shape of the wage curve but also in the size of the wage curve elasticity over a range of unemployment. Table 7 shows that in non-homelands, the unemployment rate can be tripled from 10% to 30% without reducing the wage curve elasticity below about -0.1. In South Africa as a whole, the unemployment rate can be increased two-and-a-half times from 10% -25% without reducing the size of the wage curve elasticity below about -0.1. In other words, the wage-unemployment elasticity is robust over a large range of unemployment.

Until now both the dependent variable and all the independent variables except the unemployment rate and cluster characteristics were measured at the individual level. Unemployment was measured at the aggregate, *i.e*. cluster, level. The fact that the unemployment variable U_r in equation (1) has no *i* subscript has an important implication. It is reasonable to expect that individuals living in the same locality may share some common unobservable characteristics that would lead the regression disturbances to be correlated within the cluster. Following Moulton (1990), it can be shown that even small levels of such correlation can cause conventional standard errors of U_r to be significantly downward-biased, resulting in spurious findings of statistical significance of U_r. All the regressions reported thus far show t-values based on standard errors corrected for this possible source of bias. However, as a further test of the robustness of the wage curve elasticity, we estimate a model using cluster means of characteristics instead of individual observations. Making the level of aggregation same on both sides of the wage function eliminates the downward bias on the standard errors.

[16] While one would expect that workers in industries where ICs exist will have flatter wage curves than other workers, in practice it is not straight-forward to test this. This is because ICs are organised for sub-industries rather than for the broad industrial categories available in the dataset. Most ICs also cover small areas, not large regions, so they may apply to some but not all workers in a given industry.

The wage functions using cluster-level means of hourly wages and individual characteristics are presented in Table 8 and the elasticities computed from these regressions are contained in Table 9. Table 9 shows that, when aggregate data are introduced, the estimated wage unemployment elasticity falls from about -0.11 to about -0.07 for all South Africa, and the coefficient on unemployment ceases to be significant. However, for non-homeland South Africa, the elasticity is virtually unaffected and the coefficient of unemployment is still significant at the 1% level.

A further issue of importance is the potentially simultaneous determination of unemployment and wages: it is possible that unemployment does not merely affect wage but is itself a function of wage. Since the effect of endogeneity will be to impart an upward bias on the parameters of unemployment, correcting for endogeneity bias should raise the elasticity (produce a larger negative coefficient).

A correction for the endogeneity of U_r requires plausible instruments. The instruments most often used in the literature are lagged local unemployment rates but, given our cross-section data, lagged unemployment rate is not available to us. We employ a number of cluster characteristics as instruments for the cluster unemployment rate, using those cluster level variables as instruments that are insignificant in the wage equation but which are well correlated with unemployment[17]. Table 10 shows that in each case (homeland, non-homeland, and all South Africa) the elasticity estimated from the 2SLS model is larger (a bigger negative coefficient) than that from the corresponding OLS model. This is consistent with the existence of an even steeper wage curve than previously reported in Tables 3 and 5. In the non-homeland case, the 2SLS result is highly significant, both in the linear and quadratic forms. The fact that the negatively-sloped wage curve does not disappear when we allow for the endogeniety of unemployment in the wage regression is consistent with causality running from unemployment to wages in South Africa[18].

Our final issue concerns the comparability of wage flexibility in South Africa and other countries. Whereas the relevant definition of the unemployment rate for South Africa is the broad definition - as argued earlier - the definition of unemployment used in wage curve analyses in OECD countries (Blanchflower and Oswald, 1994) and in urban Cote d'Ivoire

[17] Different sets of instruments were used for U in the 2SLS estimation of wages in the three sectors (homelands, non-homelands, and all S. Africa). They included the following variables: whether community has roads that become impassable at certain times of the year, whether community has any public transport passing by it, distance to nearest transport, whether the main religion in the community is Christianity, number of facilities in the community such as post offices, banks, restaurants, markets, etc. Several of these variables can plausibly be thought of as influencing unemployment but not wages: for example, condition of roads, availability of transport, and distance to nearest transport are all variables that are likely to affect unemployment (because they affect the cost of job-search) but they are not thought to influence earnings directly. Following Bound *et al* (1995), in Table 10 we report both the partial R^2 and the F-statistic of the identifying instruments in the first stage estimation. These indicate the quality of our 2SLS estimates: the partial R^2's are high, as are the F-statistics of the joint significance of the identifying instruments. We also report the more common F-test of the validity of overidentifying instruments which shows that in each sector, the identifying instruments pass the overidentification test. The full set of results, including first stage estimates, are available from the authors upon request.

[18] Following Angrist, Imbens, and Rubin (1996), two conditions must be fulfilled for the identification of causal effects using instrumental variables in our model: (1) the correlation of the instrument of U with the error term in the wage equation should be zero and (2) the covariance of U and the instrument of U should be significantly different from zero. The test of the validity of overidentifying restrictions showed that the identifying instruments are jointly insignificant in the wage regression, fulfilling the first condition. The partial R-squares and the F-tests of the joint significance of the identifying instruments in the first stage regression of U showed that the second condition is also fulfilled.

(Hoddinott, 1996) is based on the narrow concept. It may reasonably be argued that any comparison of wage flexibility in South Africa and other countries requires that the narrow definition of unemployment be used for South Africa. Moreover, whereas the homeland/non-homeland segmentation was the most relevant for South Africa, the urban/rural division is necessary for comparison with other countries: for example, in Africa, a wage curve has been explored only for *urban* Cote d'Ivoire. Wage curve analyses for OECD countries are effectively predominantly urban analyses since only a very small proportion of the population in these countries lives in rural areas, and rural unemployment rates are very low. Consequently, in Table 11 we present unemployment elasticities of wage by definition of unemployment and region.

The table shows that using the *narrow* definition of unemployment, the wage-unemployment elasticity in urban areas is - 0.08, that is, close to the -0.10 found for OECD countries and the -0.12 found for urban Cote d'Ivoire. In urban South Africa, an increase of 10% in the narrowly measured unemployment rate causes wages to fall by 0.8%. On the other hand, in rural South Africa, narrow unemployment exerts a positive but insignificant impact on wages. These different results for urban and rural areas are not implausible since the mobility of African workers was much greater within homeland (predominantly rural) areas than within non-homeland (predominantly urban) areas.

6. Conclusion

The existence of a wage curve has been the subject of intensive discussion, primarily using OECD data where unemployment rates are typically 5-12% (Blanchflower and Oswald, 1994, p297). The robustness of the wage curve, both across countries and across ranges of unemployment rates, has become an interesting question. In this paper we examine the wage curve where unemployment rates average about 30%.

The paper illuminates the important debate about the relevant definition of unemployment in South Africa. The analysis indicates that the broad definition of unemployment is the appropriate one for labour market analysis in South Africa since local wage determination takes discouraged workers into account as genuine labour force participants.

We find that the wage curve elasticity is extremely robust over a wide range of unemployment. Tripling unemployment from 10% to 30% reduces wages by approximately 30% in the data. The wage curve was subjected to a range of robustness tests - allowing for possible endogeneity, dividing the workers into high/low unemployment rate areas, dividing the sample into different groups of workers, and allowing for the correlation of errors across individuals within regions - but none of these reduces the wage curve elasticity below about -0.10 over the range of unemployment between 10% and 30%. At rates of unemployment above 30%, the wage unemployment elasticity falls to zero.

Our estimates of the elasticity of the wage curve for various sub-groups generally correspond to those in other studies. Like Blanchflower and Oswald (1995, pp. 148-67, 258, 261, 342, 349-51) and Hoddinott (1996, pp. 1618-19), we found that younger, less experienced, less educated, non-unionised, and private sector workers tend to have steeper wage curves. This suggests that the free-market tendency (proxied by youth, low skill, and weak organisation) is towards a vertical wage curve, and that non-local bargaining (proxied by union membership and the public sector) is towards a horizontal wage curve. The elasticities for older, experienced, and educated workers are consistent with the efficiency wage rationalisation of the wage curve, and the elasticity for private sector workers with the local

bargaining explanation. It also appears that unions, often bargaining at the non-local level, limit the impact of local unemployment on wages in South Africa.

Fallon and Lucas (1998) have produced time series evidence showing that the South African employment elasticity of the wage is large and negative (-0.7) so that, over time, a 10% increase in wages is estimated to lead to a 7% fall in employment. Such a fall in employment is likely to result in a rise in unemployment. Thus, over time, there appears to exist a *positive* relationship between wages and unemployment. By contrast, our evidence of a wage curve suggests that, across space, there is a *negative* relationship between unemployment and wages. However, this apparent contradiction would be consistent with an exogenous rise in the wage curve over time, probably associated with increased bargaining power. This would generate a new equilibrium higher up the labour demand curve, involving a higher wage and more unemployment.

Table 1
Wage functions - South Africa

Variables	Narrowly defined unemployment				Broadly defined unemployment				Variable Means
	Linear		Quadratic		Linear		Quadratic		
	Coefficient	robust t-value	Coefficient	robust t-value	Coefficient	robust t-value	Coefficient	robust t-value	
Constant	0.41530	3.29	0.41624	3.30	0.40880	3.25	0.42868	3.49	
EXP	0.03500	9.65	0.03488	9.63	0.03522	9.65	0.03488	9.53	22.830
EXPSQ	-0.00052	-8.09	-0.00052	-8.06	-0.00052	-8.06	-0.00052	-7.93	669.000
EDYRS	0.00292	0.26	0.00278	0.25	0.00371	0.33	0.00423	0.38	7.945
EDYRSQ	0.00438	5.36	0.00439	5.39	0.00435	5.34	0.00434	5.43	79.830
AFRICAN	-0.65287	-8.35	-0.63705	-7.75	-0.61136	-7.59	-0.52619	-6.01	0.654
COLORED	-0.46569	-6.53	-0.45121	-5.93	-0.43933	-6.15	-0.35170	-4.36	0.113
INDIAN	-0.47458	-5.86	-0.45869	-5.51	-0.45629	-5.76	-0.38390	-4.74	0.045
MALE	0.34432	14.68	0.34471	14.70	0.34275	14.78	0.33956	14.90	0.580
MARRIED	0.14348	5.62	0.14281	5.61	0.13825	5.40	0.13850	5.41	0.731
PROF	0.72173	15.67	0.72038	15.75	0.71946	15.67	0.71084	15.78	0.175
CLER	0.29748	8.61	0.29758	8.62	0.30164	8.77	0.30343	8.89	0.194
FARM	-0.57613	-4.95	-0.57690	-4.97	-0.57843	-5.00	-0.55614	-4.89	0.042
PROD	0.21757	5.51	0.21861	5.51	0.22276	5.68	0.23183	6.00	0.199
LABO	-0.07583	-1.49	-0.07584	-1.50	-0.07188	-1.44	-0.07700	-1.59	0.225
URBAN	0.31035	3.62	0.32314	3.87	0.33431	4.02	0.38644	5.06	0.637
PUBLIC	0.16974	5.70	0.16945	5.69	0.17194	5.83	0.17303	5.87	0.244
UNION	0.28513	8.26	0.28669	8.33	0.28453	8.35	0.27752	8.51	0.259
WCAPE	-0.14876	-2.45	-0.14808	-2.42	-0.14928	-2.48	-0.15864	-2.52	0.125
NCAPE	-0.27456	-1.38	-0.27766	-1.40	-0.25009	-1.35	-0.26668	-1.46	0.012
ECAPE	-0.18906	-2.53	-0.21010	-2.55	-0.15994	-2.12	-0.19780	-2.71	0.067
NATAL	-0.16870	-3.01	-0.17489	-3.06	-0.17153	-3.10	-0.18518	-3.35	0.185
OFS	-0.41103	-4.03	-0.41727	-4.17	-0.41805	-4.15	-0.40964	-4.34	0.094
ETVL	-0.07595	-0.65	-0.07976	-0.69	-0.08254	-0.72	-0.08105	-0.74	0.075
NTVL	-0.16602	-2.35	-0.17274	-2.39	-0.16845	-2.33	-0.19387	-2.66	0.064
NW	-0.01772	-0.18	-0.02993	-0.30	-0.03222	-0.34	-0.04916	-0.52	0.104
DISFACI	-0.00037	-2.18	-0.00037	-2.16	-0.00035	-2.00	-0.00040	-2.09	68.620
TARROAD	0.22084	2.78	0.21941	2.79	0.20996	2.75	0.18508	2.71	0.399
HOMELAND	0.26348	3.85	0.27579	4.05	0.30061	4.35	0.33023	4.98	0.260
URATE	0.11563	0.64	-0.24657	-0.52	-0.16489	-1.17	-1.30530	-3.27	0.233 b, 0.107n *
URATESQ			0.87780	0.89			1.80330	3.46	
Adjusted R-square	0.5884		0.5886		0.5887		0.5918		
Dependent variable	Mean = 1.56101, SD= 1.1113								
N	6498								

Note: The base category for occupation is ‘service’ and for province is PWV/Gauteng. Other reference categories are white, rural, female, and unmarried. * b=broad, n=narrow.
Note: EXP=potential experience; EXPSQ=square of EXP; EDYRS=years of education; EDYRSQ=square of EDYRS; AFRICAN, COLOURED, and INDIAN are race dummies (base category is WHITE); MALE and MARRIED are gender and marital status dummies (base categories are female and non-married); PROF, CLER, FARM, PROD, and LABO are occupation dummies for professional, clerical, farming, production, and labourer workers respectively (base category is SERVICE workers); URBAN and HOMELAND are region dummies and PUBLIC and UNION are dummies for public sector worker and unionised worker; TARROAD and DISFACI are cluster characteristics (whether cluster has tarred roads and distance from cluster to various facilities such as banks, post office, restaurants, markets, etc); URATEB=broadly measured unemployment rate; URATEBSQ= square of URATEB; The remaining variables are province dummies, the reference province being PWV or Gauteng.

Standard errors reported are robust (rather than raw) *i.e.* they take account of the fact that regression errors may be correlated across individual workers within a cluster. The effect of correcting standard errors is to raise them substantially, reducing the size of the t-values. For example, the raw t-value of the variable URATE (broad) was -2.35 (*i.e.* apparently significant at the 1% level) but the robust t-value is -1.17 which is insignificant. Similarly, the raw t-values of URATE and URATESQ (broad) were -7.43 and 7.07 but the robust ones are less than half that size (-3.27 and 3.46 respectively).

Table 2
Unemployment elasticity of wage
South Africa, 1993

Specification	Narrowly defined unemployment				Broadly defined unemployment			
	Coefficient	t-value		elasticity	Coefficient	t-value		elasticity
		raw	robust			raw	robust	
Basic specification								
Unemployment rate	-0.2466	-1.05	-0.52	-0.006	-1.3053	-7.43	-3.27	-0.108
Unemployment rate squared	0.8778	1.71	0.89		1.8033	7.07	3.46	
Exclude province dummies								
Unemployment rate	-0.0028	-0.01	-0.01	0.007	-1.3604	-7.70	-3.47	-0.119
Unemployment rate squared	0.2980	0.60	0.34		1.8216	7.15	3.59	
Exclude cluster variables								
Unemployment rate	-0.3509	-1.49	-0.58	-0.014	-1.4607	-8.72	-3.18	-0.131
Unemployment rate squared	1.0083	1.95	1.03		1.9281	7.99	3.37	
Exclude occupation dummies								
Unemployment rate	-0.3523	-1.43	-0.68	-0.014	-1.4882	-8.11	-3.31	-0.121
Unemployment rate squared	1.0304	1.91	0.95		2.0739	7.78	3.53	
Exclude ‘public’ and ‘union’ dummies								
Unemployment rate	-0.1109	-0.47	-0.22	0.002	-1.3912	-7.79	-3.36	-0.113
Unemployment rate squared	0.6143	1.17	0.60		1.9448	7.50	3.55	
Include only those workers who worked >=35 hours in past week (N=5699)								
Unemployment rate	-0.4131	-1.91	-0.89	-0.027	-1.2802	-7.94	-3.05	-0.122
Unemployment rate squared	0.7585	1.59	0.80		1.6292	6.87	3.03	
Use nominal wages								
Unemployment rate	-0.2515	-1.08	-0.54	-0.007	-1.2783	-7.28	-3.24	-0.107
Unemployment rate squared	0.8531	1.66	0.88		1.7586	6.90	3.42	
Correction for selectivity								
Unemployment rate	-0.1064	-0.46	-0.23	0.005	-1.1468	-6.49	-3.02	-0.082
Unemployment rate squared	0.7243	1.42	0.76		1.7050	6.69	3.20	

Table 3
Wage unemployment elasticity, by worker group
All South Africa

Worker group	N	Mean cluster broad unemployment rate	Coefficients of urateb and uratebsq	t-value		Elasticity
				raw	robust	
All	6498	0.2333	-1.3053	-7.43	-3.27 ***	-0.108
			1.8033	7.07	3.46 ***	
Public	1584	0.2559	-0.8317	-2.15	-1.58	-0.081
			1.0081	2.02	1.53	
Private	4914	0.2260	-1.6338	-8.19	-3.58 ***	-0.141
			2.2308	7.43	3.68 ***	
Union	1682	0.2364	-0.3688	-1.25	-0.76	0.022
			0.9761	2.21	1.42	
Non-union	4816	0.2322	-1.1225	-5.13	-2.42 ***	-0.102
			1.4686	4.74	2.48 ***	
Urban	4142	0.2058	-0.9994	-3.58	-2.32 **	-0.135
			0.8398	1.72	1.14	
Rural	2356	0.2817	-1.2933	-4.29	-1.93 *	-0.122
			1.5298	4.15	2.16 **	
Younger	4264	0.2248	-1.5066	-6.85	-3.44 ***	-0.130
			2.0657	6.42	3.60 ***	
Older	2234	0.2495	-0.8574	-2.90	-1.98 **	-0.069
			1.1679	2.77	1.86 *	
Low education	4431	0.2585	-1.4122	-6.91	-3.09 ***	-0.117
			1.8563	6.25	3.04 ***	
High education	2067	0.1794	-1.3122	-3.79	-2.93 ***	-0.112
			1.9236	3.92	3.33 ***	
Low experience	3985	0.2200	-1.5697	-6.88	-3.57 ***	-0.132
			2.2062	6.55	3.70 ***	
High experience	2513	0.2544	-0.7963	-2.89	-1.85 *	-0.069
			1.0307	2.63	1.74 *	
Male	3768	0.2270	-2.0205	-8.80	-4.20 ***	-0.161
			2.8930	8.61	4.51 ***	
Female	2730	0.2420	-0.1355	-0.49	-0.36	-0.023
			0.0870	0.22	0.17	
Homelands	1690	0.3979	0.1486	0.29	0.19	0.052
			-0.0230	-0.04	-0.03	
Non-homelands	4808	0.1755	-1.8467	-8.02	-3.36 ***	-0.166
			2.5671	5.78	2.64 ***	
African	4250	0.3056	-1.3559	-6.58	-2.94 ***	-0.071
			1.8357	6.48	3.15 ***	
Non-African	2248	0.0967	-2.6146	-5.71	-3.90 ***	-0.180
			3.9211	3.26	2.15 **	

Note: High education workers are those with greater than or equal to 10 years' schooling; High experience workers are those with greater than or equal to 25 years' experience; and older workers are those greater than or equal to 40 years of age. The t-statistics in the last column refer to the coefficients of U_r and U_r^2.

Table 4a
Broad unemployment rates, by region

	Homelands %	Non-homelands %	Total %
Rural	50.0	14.0	40.8
Urban	39.8	22.1	23.9
Total	48.5	20.7	31.2

Table 4b
Unemployment rates by region and alternative definition

Region	Individual level unemployment rate (%)		Cluster level unemployment rate (%)		
	narrow definition	broad definition	narrow definition	broad definition	broad-narrow (% points)
Homeland	18.6	48.5	14.9	39.8	24.9
Non-homeland	10.7	20.7	9.2	17.5	8.3
Rural	14.0	40.8	9.3	28.2	18.9
Urban	12.5	23.9	11.5	20.6	9.1
All South Africa	13.1	31.2	10.7	23.3	12.6

Note: The unemployment rates calculated from data on all individual labour force participants in given regions (e.g. homeland, non-homeland, rural, and urban) are generally somewhat higher than the cluster unemployment rates averaged across all clusters in a region.

Table 5
Wage unemployment elasticity, by homeland/non-homeland and worker group

	Homeland					Non-homeland				
Worker group	**N**	**Linear**		**Quadratic**		**N**	**Linear**		**Quadratic**	
	(mean urateb)	**Elasticity**	**t-value**	**Elasticity**	**t-value**	**(mean urateb)**	**Elasticity**	**t-value**	**Elasticity**	**t-value**
All	1690	0.051	0.70	0.052	0.19	4808	-0.111	-3.00 ***	-0.166	-3.36 ***
	(0.3979)				-0.03	(0.1755)				2.64 ***
Public	569	0.027	0.31	0.006	-0.78	1015	-0.070	-1.49	-0.063	-0.36
	(0.4050)				0.86	(0.1723)				-0.18
Private	1121	0.065	0.77	0.085	0.87	3793	-0.134	-3.13 ***	-0.202	-3.86 ***
	(0.3942)				-0.74	(0.1763)				3.18 ***
Union	373	0.128	1.43	0.121	0.04	1309	-0.055	-1.04	-0.034	0.32
	(0.3856)				0.30	(0.1939)				-1.05
Non-union	1317	0.015	0.19	0.013	-0.03	3499	-0.084	-2.10 **	-0.138	-2.79 ***
	(0.4013)				0.08	(0.1686)				2.30 **
Urban	331	0.013	0.08	-0.007	-2.31 **	3811	-0.110	-3.03 ***	-0.122	-1.84 *
	(0.3612)				2.49 ***	(0.1923)				0.62
Rural	1359	0.078	1.01	0.099	0.95	997	-0.078	-1.02	-0.328	-3.59 ***
	(0.4068)				-0.79	(0.1112)				3.79 ***
Younger	1062	0.020	0.24	0.007	-0.41	3202	-0.125	-3.18 ***	-0.183	-3.35 ***
	(0.3941)				0.53	(0.1687)				2.52 ***
Older	628	0.084	0.80	0.108	1.02	1606	-0.082	-1.98 **	-0.130	-2.77 ***
	(0.4043)				-0.82	(0.1890)				2.35 ***
Low education	1217	0.064	0.74	0.075	0.58	3214	-0.149	-2.98 ***	-0.193	-3.31 ***
	(0.4018)				-0.42	(0.2042)				2.63 ***
High education	473	0.111	1.26	0.090	-0.51	1594	-0.066	-2.45 ***	-0.092	-1.75 *
	(0.3878)				0.95	(0.1176)				1.00
Low experience	983	0.061	0.74	0.034	-0.88	3002	-0.119	-3.19 ***	-0.167	-2.95 ***
	(0.3920)				1.16	(0.1637)				2.06 **
High experience	707	0.023	0.22	0.055	1.05	1806	-0.083	-1.87 *	-0.135	-3.14 ***
	(0.4061)				-1.07	(0.1950)				2.82 ***
Male	931	0.128	1.37	0.105	-0.40	2837	-0.144	-3.16 ***	-0.237	-4.44 ***
	(0.3967)				0.79	(0.1713)				3.95 ***
Female	759	-0.052	-0.61	-0.011	1.40	1971	-0.044	-1.19	-0.037	-0.18
	(0.3993)				-1.70 *	(0.1814)				-0.31
African	1686	0.058	0.78	0.060	0.32	2564	-0.205	-3.04 ***	-0.211	-3.49 ***
	(0.3984)				-0.15	(0.2446)				2.81 ***
Non-African	4	---	--	---	--	2244	-0.118	-4.85 ***	-0.181	-3.95 ***
	(---)					(0.0965)				2.23 **

Note: High education workers are those with >=10 years' schooling; High experience workers are those with >=25 years' experience; and older workers are those >=40 years of age.
The t-statistic in the 'linear' column is the robust t-value on the coefficient of U_r and the t-statistics in the 'quadratic' column are the robust t-values on the coefficients of U_r and U_r^2.

Table 6
Elasticity of the wage curve in Non-homeland areas, by industry

Industry	All wage workers N	All wage workers Linear	All wage workers Quadratic	Non-unionised wage workers N	Non-unionised wage workers Linear	Non-unionised wage workers Quadratic
Agriculture/fishing/forestry	692	-0.133 ***	-0.262 ***	664	-0.117 ***	-0.245 ***
Mining	380	-0.082 ***	-0.141 *	87	-0.252 ***	-0.381 *
Manufacturing	726	-0.093	-0.155 ***	387	-0.130	-0.196 *
Electricity and water	78	-0.119	-0.317	50	-0.168	-0.342
Construction	264	-0.147	-0.227 **	212	-0.062	-0.195 **
Wholesale and retail	549	-0.176 ***	-0.224 ***	421	-0.166 ***	-0.222 **
Restaurants/entertainment	138	-0.017	0.158	123	-0.070	-0.233
Transport & communication	334	-0.285 ***	-0.539 ***	220	-0.450 ***	-0.661 ***
Domestic	473	-0.112 **	-0.126 **	458	-0.113 **	-0.127 **
Other sectors - finance, legal, education, medical, & armed forces	1660	-0.062 **	-0.058	1345	-0.027	-0.031

Note: The wage equations from which these elasticities are computed have the same specification as in Table 1 except that the occupation dummy variables have been removed here because not all occupational categories were relevant in each sector/industry. For example, among domestic sector workers, there weren't any farmers, professionals, or clerical workers. In certain equations, the race dummy variable 'Indian' was also dropped due to no/too few Indian workers in that industry.
*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels respectively.

Table 7
Wage curve elasticity over a range of unemployment rates

Unemployment rate	Wage-unemployment Elasticity		
	Non-Homeland	Homeland	All South Africa
5	-0.079	0.007	-0.056
10	-0.133	0.014	-0.094
15	-0.161	0.021	-0.115
20	-0.164	0.028	-0.117
25	-0.141	0.034	-0.101
30	-0.092	0.040	-0.067
35	-0.017	0.046	-0.015
40	0.083	0.052	0.048

Table 8
Aggregate-data wage functions

Variable	All South Africa				Homelands				Non-homelands			
	Linear		Quadratic		Linear		Quadratic		Linear		Quadratic	
	coefficient	t value	coefficient	t value	coefficient	t value	coefficient	t value	coefficient	t value	coefficient	t value
INTERCEP	-1.2156	-2.96	-1.1737	-2.85	-2.2005	-3.43	-2.5093	-3.59	-0.9443	-2.17	-0.7578	-1.71
EXP	0.0555	2.46	0.0506	2.21	0.0477	1.37	0.0530	1.51	0.0643	2.22	0.0521	1.77
EXPSQ	-0.0006	-1.57	-0.0005	-1.30	-0.0004	-0.60	-0.0005	-0.79	-0.0011	-2.04	-0.0009	-1.63
EDYRS	0.1951	3.77	0.2046	3.91	0.1944	2.29	0.1752	2.02	0.2144	3.34	0.2065	3.24
EDYRSQ	-0.0049	-1.12	-0.0055	-1.24	-0.0037	-0.45	-0.0024	-0.29	-0.0067	-1.41	-0.0066	-1.41
AFRICAN	-0.5319	-3.61	-0.4630	-2.93					-0.1673	-1.19	-0.0933	-0.65
COLORED	-0.4814	-3.11	-0.4318	-2.69					-0.2699	-2.11	-0.1973	-1.49
INDIAN	-0.4904	-2.97	-0.4642	-2.79					-0.4017	-3.04	-0.3627	-2.74
PUBLIC	0.2915	2.23	0.2914	2.23	0.3887	1.81	0.3854	1.80	-0.1862	-1.14	-0.1911	-1.18
UNION	0.4349	3.12	0.4322	3.10	0.4309	1.62	0.4196	1.57	0.4647	3.27	0.4542	3.22
MARRIED	0.3467	2.37	0.3517	2.41	0.5047	2.42	0.5199	2.49	0.0664	0.34	0.1069	0.55
MALE	0.6749	4.71	0.6612	4.60	0.7670	3.28	0.7676	3.28	0.4936	2.72	0.4875	2.72
PROF	1.1715	4.34	1.1345	4.18	0.9883	2.19	1.0514	2.31	1.4958	5.05	1.4857	5.06
CLER	0.3106	1.27	0.2895	1.18	0.4332	1.07	0.4953	1.21	0.0415	0.16	0.0953	0.36
FARM	-0.4819	-1.91	-0.4974	-1.97	-0.3229	-0.65	-0.2789	-0.56	-0.8358	-3.03	-0.8483	-3.10
PROD	0.3833	1.52	0.3722	1.48	0.6686	1.58	0.7420	1.74	0.1278	0.45	0.1519	0.54
LABO	0.0291	0.15	0.0020	0.01	0.2517	0.88	0.3112	1.07	-0.2972	-1.29	-0.3564	-1.55
URBAN	0.1572	1.94	0.1764	2.14	0.0660	0.46	0.0595	0.42	0.3473	3.75	0.3532	3.85
HOMELAND	0.1871	2.03	0.1948	2.11								
WCAPE	-0.0518	-0.45	-0.0522	-0.45					0.0490	0.56	0.0570	0.65
NCAPE	-0.4258	-2.07	-0.4150	-2.01					-0.2452	-1.56	-0.2407	-1.55
ECAPE	-0.1265	-1.19	-0.1254	-1.18					-0.0415	-0.39	-0.0712	-0.66
NATAL	-0.1733	-1.77	-0.1651	-1.68					0.0021	0.02	0.0042	0.05
OFS	-0.4632	-4.29	-0.4627	-4.28					-0.3934	-4.66	-0.3989	-4.77
ETVL	-0.0929	-0.79	-0.0810	-0.69					0.1571	1.30	0.1317	1.09
NTVL	-0.2072	-1.79	-0.2046	-1.77					0.2893	1.69	0.2325	1.35
NW	-0.1453	-1.32	-0.1455	-1.32					0.0722	0.60	0.0553	0.47
TARROAD	0.1288	1.59	0.1216	1.49	0.1871	0.78	0.1960	0.81	0.0874	1.34	0.0896	1.39
DISFACI	-0.0001	-0.72	-0.0001	-0.78	0.0000	-0.10	-0.0001	-0.25	-0.0002	-1.02	-0.0002	-1.08
URATEB	-0.0980	-0.62	-0.5994	-1.33	0.0415	0.16	1.2795	1.12	-0.5969	-2.78	-1.4386	-2.97
URATEBSQ			0.5936	1.19			-1.2200	-1.11			1.5330	1.93
Adjusted R^2	0.7554		0.7557		0.4291		0.4301		0.9000		0.9018	
N	324				146				178			
Dependent variable mean	1.4312				1.2519				1.5782			

Table 9
Wage unemployment elasticity, using individual and aggregate data

Specification	All South Africa			Non-homelands			Homelands		
	Coeff	**t-value**	**elasticity**	**Coeff**	**t-value**	**elasticity**	**Coeff**	**t-value**	**elasticity**
Linear									
Individual data	-0.1649	-1.17	-0.038	-0.6330	-3.00***	-0.111	0.1288	0.70	0.051
Aggregate data	-0.0980	-0.62	-0.033	-0.5969	-2.78***	-0.119	0.0415	0.16	0.021
Quadratic									
Individual data	-1.3053	-3.27***	-0.108	-1.8467	-3.36***	-0.166	0.1486	0.19	0.052
	1.8033	3.46***		2.5671	2.64***		-0.0230	-0.03	
Aggregate data	-0.5994	-1.33	-0.067	-1.4386	-2.97***	-0.165	1.2795	1.12	0.017
	0.5936	1.19		1.5330	1.93*		-1.2200	-1.11	
N									
Individuals		6498			4808			1690	
Clusters		324			178			146	

Note: The unemployment rate for a region (eg homeland or non-homeland) calculated from all individual labour force participants in that region differs somewhat from the average of the cluster unemployment rates averaged across all clusters in that region. See note in Table 4.

Table 10
Wage unemployment elasticity estimated from OLS and Two stage least squares regressions

Specification	All South Africa			Non-homelands			Homelands		
	Coeff	**t-value**	**elasticity**	**Coeff**	**t-value**	**elasticity**	**Coeff**	**t-value**	**elasticity**
Linear									
OLS	-0.1649	-1.17	-0.038	-0.6330	-3.00***	-0.111	0.1288	0.70	0.051
2SLS	-0.8505	-1.22	-0.198	-3.3147	-3.12***	-0.582	-0.1887	-0.37	-0.075
Quadratic									
OLS	-1.3053	-3.27***	-0.108	-1.8467	-3.36***	-0.166	0.1486	0.19	0.052
	1.8033	3.46***		2.5671	2.64***		-0.0230	-0.03	
2SLS	-1.3650	-0.47	-0.229	-4.0832	-1.09	-0.610	0.1646	0.06	-0.075
	0.8263	0.19		1.7333	0.21		-0.4404	-0.14	
Partial R-square									
U		0.2214			0.2169			0.1378	
U2		0.1467			0.1749			0.1231	
F-statistic									
U		54.66			80.88			63.12	
U2		46.83			65.47			52.89	
F-statistic Overid									
U		0.4601			0.7526			0.8575	
U & U2		0.5765			0.9507			1.1230	
N		6498			4808			1690	

Note: The partial R^2 of U is the adjusted R^2 in the regression of U on the identifying instruments. The partial R^2 of U2 is the adjusted R^2 in the regression of URATEBSQ on the identifying instruments. F statistic U is the F-statistic of the joint significance of the identifying instruments in the first stage regression of U and F uratebsq is the equivalent in the regression of U2. F Overid is the F statistic of the test of overidentifying restrictions.

Table 11
Unemployment elasticity of wage by definition of unemployment and region

Region	Narrow definition			Broad definition		
	coeff	**t-value**	**elasticity**	**coeff**	**t-value**	**elasticity**
Rural						
Unemployment	0.707	1.00	0.060	-1.293	-1.93 *	-0.122
Square of unemployment	-0.352	-0.27		1.530	2.16 **	
Urban						
Unemployment	-1.053	-2.21 **	-0.082	-0.999	-2.32 **	-0.135
Square of unemployment	1.473	1.41		0.840	1.14	
All South Africa						
Unemployment	-0.247	-0.52	-0.006	-1.305	-3.27 ***	-0.108
Square of unemployment	0.878	0.89		1.803	3.46 ***	

Note: * represents significance at the 10% level, ** at the 5% level and *** at the 1% level. Robust t-values reported.

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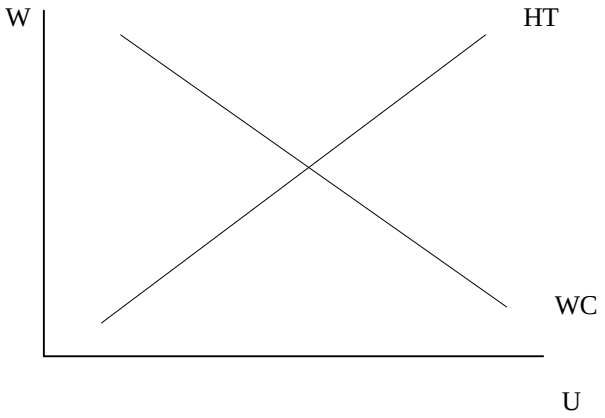

Figure 1

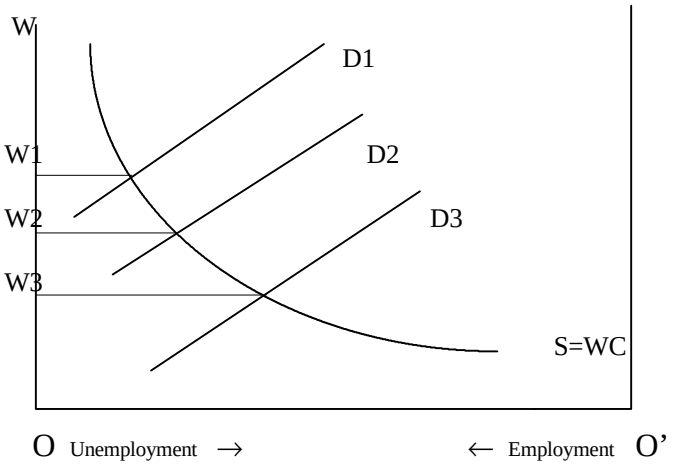

Figure 2

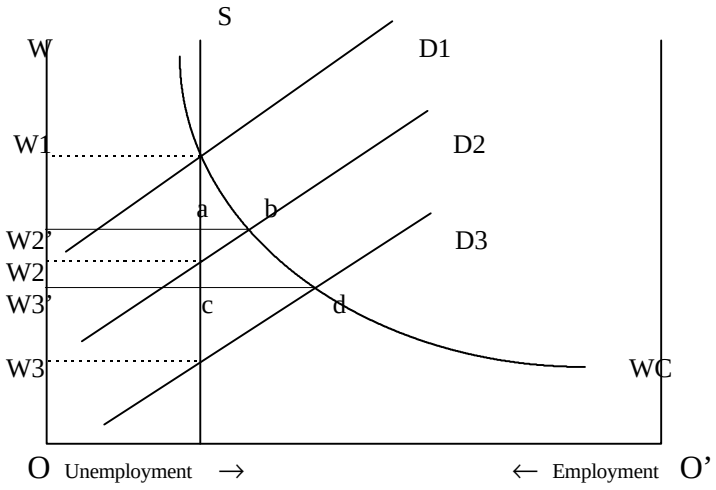

Figure 3

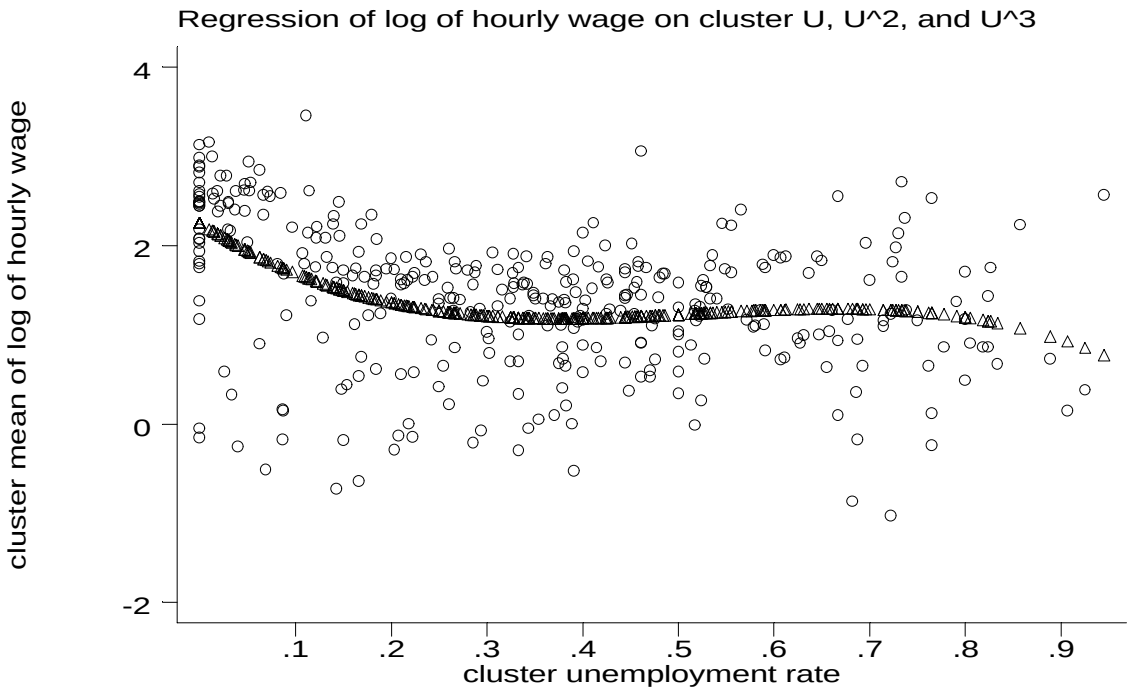

Figure 4: Unconstrained cluster data

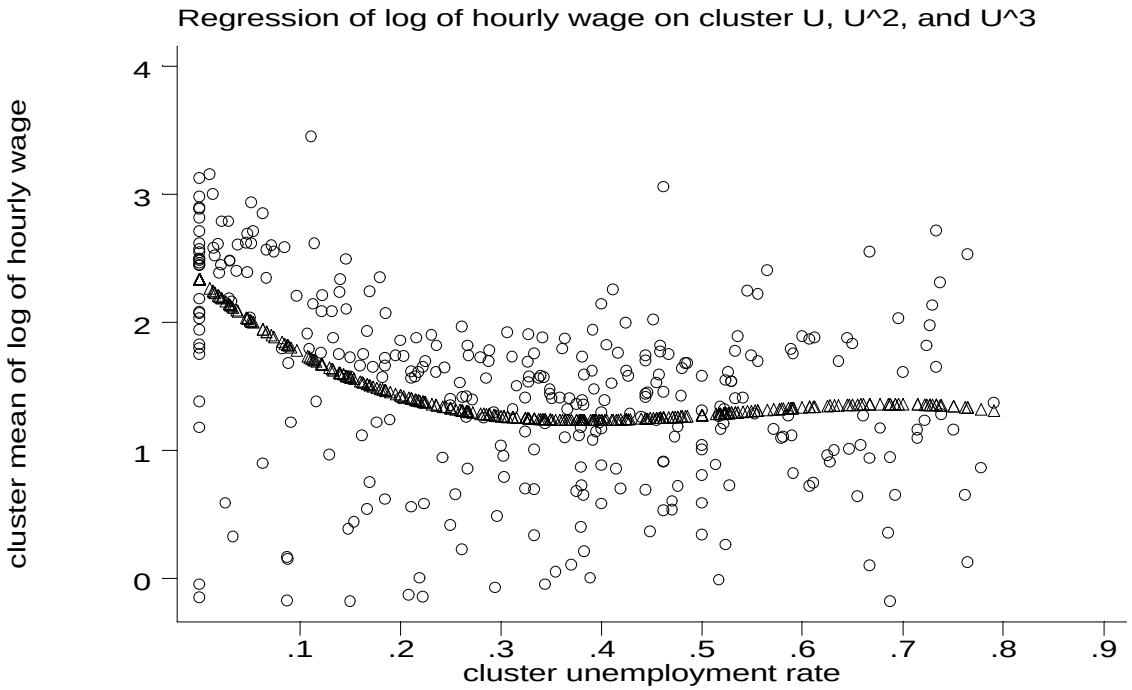

Figure 5: U and wage within 2 s.d. of their means

Appendix Table 1
Wage functions for homelands and non-homelands

Variable	Homelands					Non-homelands				
	Linear		Quadratic		Mean	Linear		Quadratic		Mean
	coefficient	robust t	coefficient	robust t		coefficient	robust t	coefficient	robust t	
Constant	-0.58168	-3.68	-0.58556	-2.59		0.42662	2.78	0.47168	3.07	
EXP	0.04869	6.81	0.04870	6.80	24.170	0.03279	7.55	0.03217	7.40	22.360
EXPSQ	-0.00070	-5.76	-0.00070	-5.74	745.700	-0.00049	-6.33	-0.00048	-6.21	642.000
EDYRS	0.01761	1.01	0.01759	1.01	7.390	-0.00519	-0.38	-0.00607	-0.46	8.140
EDYRSQ	0.00451	3.15	0.00451	3.17	70.950	0.00464	4.93	0.00468	5.06	82.960
AFRICAN						-0.53213	-5.74	-0.48921	-5.05	0.533
COLORED						-0.40456	-5.71	-0.33623	-4.03	0.153
INDIAN						-0.52212	-5.70	-0.44964	-4.70	0.060
MALE	0.37145	8.19	0.37146	8.19	0.551	0.33329	12.49	0.33430	12.59	0.590
MARRIED	0.18200	3.55	0.18207	3.52	0.674	0.12415	4.44	0.12841	4.55	0.752
PROF	0.79624	8.67	0.79654	8.62	0.156	0.67337	13.14	0.67208	13.29	0.181
CLER	0.32779	4.44	0.32794	4.48	0.168	0.27959	7.43	0.28781	7.63	0.203
FARM	-0.39829	-2.85	-0.39837	-2.84	0.025	-0.58432	-4.08	-0.56016	-4.00	0.049
PROD	0.21862	3.09	0.21874	3.12	0.162	0.23359	5.43	0.24181	5.65	0.212
LABO	-0.00314	-0.04	-0.00289	-0.04	0.305	-0.07805	-1.27	-0.08094	-1.34	0.197
URBAN	0.17662	2.71	0.17631	2.65	0.196	0.52092	4.08	0.53416	4.45	0.793
PUBLIC	0.28134	5.04	0.28133	5.04	0.337	0.08864	2.57	0.08977	2.59	0.211
UNION	0.34991	7.34	0.35001	7.31	0.221	0.26264	6.22	0.25750	6.45	0.272
WCAPE						-0.13532	-2.30	-0.14585	-2.31	0.170
NCAPE						-0.18685	-1.10	-0.23867	-1.27	0.016
ECAPE						-0.12081	-1.04	-0.21385	-1.89	0.046
NATAL						-0.06285	-4.03	-0.08035	-4.15	0.136
OFS						-0.40125	-0.99	-0.39958	-1.21	0.117
ETVL						0.08719	-2.04	0.03599	-2.20	0.045
NTVL						-0.16024	0.46	-0.19234	0.20	0.025
NW						-0.00368	-0.02	-0.03939	-0.26	0.075
DISFACI	-0.00020	-1.86	-0.00020	-1.87	95.830	-0.00052	-1.62	-0.00048	-1.36	59.060
TARROAD	0.12897	1.50	0.12928	1.46	0.050	0.18122	2.29	0.17352	2.35	0.522
URATEB	0.12878	0.70	0.14864	0.19	0.398	-0.63299	-3.00	-1.84670	-3.36	0.176
URATEBSQ			-0.02302	-0.03	0.185			2.56710	2.64	0.055
Adjusted R^2	0.4238		0.4238			0.6360		0.6386		
Dep variable	Mean = 1.30137, SD= 1.0194					Mean = 1.65227, SD = 1.1278				
N	1690					4808				

Note: The base category for occupation is 'service' and for province is PWV or Gauteng. Other reference categories are white, rural, female, and unmarried.