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ABSTRACT

Job Competition and the Wage Curve

The wage curve literature consistently finds a negative relationship between regional unemployment rates and regional wages; the most widely accepted theoretical explanations interpret the unemployment rate as a measure of job competition. This paper proposes new ways of measuring job competition, alternative to the unemployment rate, and finds that the negative relationship still holds when job competition is measured following the job search literature. While for men the wage impact of the theoretically-based measures of job competition is rather similar to the wage impact of the unemployment rate, for women the difference is substantial.

JEL Classification: J31, R23

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1. INTRODUCTION

The large empirical literature on the Blanchflower and Oswald (1994) wage curve consistently finds a negative relationship between regional unemployment rates and regional wages (see Blanchflower and Oswald 2005; and Nijkamp and Poot 2005 for reviews of the literature); the most widely accepted explanations of the wage curve are efficiency wage and labour turnover costs theories (Card 1995; Nijkamp and Poot 2005). In these models, the local unemployment rate is interpreted as a measure of job competition, of how difficult it is for workers to find a (new) job if they quit or are fired.

In theoretical models of job search, job competition is measured by the ratio of unemployment to vacancies or hirings (Pissarides 1984; Rogerson et al. 2005; Mortensen 2007), rather than by the unemployment rate. Besides neglecting the demand side, the regional unemployment rate also neglects part of the supply side, i.e. it neglects the possibility that some workers hold a temporary job, that some might be dissatisfied with their current job, and that a large part of competition for jobs might come in the form of employed workers engaging in on-the-job search (e.g. Pissarides 1994). Hence, we might expect the regional unemployment rate to be an imprecise measure of job competition.

Using data from the quarterly Labour Force Survey (LFS) for Great Britain over the period 1997-2005/6, this paper estimates wage curves using different measures of job competition, and can therefore be seen as an indirect test of a fundamental hypothesis of most of the theoretical explanations of the wage curve, namely, that the local unemployment rate correctly measures job competition. Measures based only on the regional unemployment rate are compared to more complete measures accounting for changes in labour demand, on-the-job search, and accessibility of the local labour market. The results show a negative correlation between wages and the theoretically-based measures of job competition, and are therefore consistent with efficiency wages, labour turnover, and other theories interpreting the unemployment rate as a measure of job competition. However, while for men the theoretically-based measures of job competition have a negative impact on wages which is similar to the impact of the unemployment rate, for women the difference between these measures is substantial.

2. THE WAGE CURVE: BACKGROUND

In its original specification, the wage curve is essentially a Mincer regression in which the regional unemployment rate appears among the explanatory variables (see Blanchflower and Oswald 1994):

$$\ln w_{rt} = \alpha + \beta \ln U_{rt} + \mathbf{X}_{rt} \gamma + \varepsilon_{rt} \qquad (1)$$

The dependent variable is the log of average hourly wages at time t in region r (w_{rt}), and the explanatory variable of interest is the log of the unemployment rate in region r at time t. The vector $\mathbf{X}_{rt}$ includes various control variables, and ε_{rt} is the error term.

Blanchflower and Oswald (1994) offer three explanations for the wage curve: a labour contract model; a union bargaining model; and an efficiency wage theory. The labour contract model assumes that regions differ in their amenities, but that the outside option for workers who are laid-off is constant across regions. Since firms and workers decide the level of wages and employment to maximise their joint utility, regions with better amenities will have lower wages and higher unemployment. As suggested by both Card (1995) and Blanchflower and Oswald (1994), the empirical evidence seems to contradict the prediction of the model; i.e. there is evidence that long run wages and unemployment are positively correlated (see also Bell et al. 2002). In the union bargaining model, unemployment affects wages by reducing the bargaining power of workers, and by lowering the alternative wage that workers would get in case of a dispute. Also in this case, however, the empirical evidence is inconsistent with the theoretical model: it has been found for example that the slope of the wage curve is lower for union than non-union workers, and that the wage curve seems to be less elastic in highly unionised countries (Card 1995; Nijkamp and Poot 2005).

The most widely accepted explanations of the wage curve are efficiency wage and labour turnover costs theories (Card 1995; Nijkamp and Poot 2005). In the efficiency wage model it is costly for employers to monitor work effort of their employees, and firms will offer a wage premium to deter workers from shirking (Shapiro and Stiglitz 1984). Since when caught shirking the worker is fired, the penalty for shirking is higher when it becomes harder to find a job. The threat of unemployment should act as a disciplinary device, and firms will offer a lower wage premium in periods of high unemployment. In the labour turnover costs model, firms economise the cost of hiring new workers by paying higher wages at times of tight labour markets to discourage existing workers from quitting (Campbell and Orszag 1998). Clearly, in both theoretical models the unemployment rate is interpreted as a measure of job competition, of how difficult it is for workers to find a (new) job if they quit or are fired.

3. THE REGIONAL UNEMPLOYMENT RATE AS A MEASURE OF JOB COMPETITION

There are various reasons why the regional unemployment rate might not be a good measure of job competition in the local labour market. In theoretical models of job search the arrival rate of job offers to workers – i.e. the probability that the worker will find a (new) job, the inverse of job competition – is computed as the number of job matches divided by unemployment, and is therefore an increasing function of vacancies divided by unemployment (Pissarides 1984; Mortensen 2007). From a different perspective, in the literature on wage posting the employer posts a wage given unemployment and wages offered by other employers; the length of the queue of workers applying for the job is measured by the ratio of unemployment to vacancies (Rogerson et al. 2005). This ratio is interpreted as the inverse of labour market tightness, a measure of job competition.

Besides neglecting the demand side, the unemployment rate also neglects that part of the labour supply which is due to on-the-job search. It has been found that individuals who look for a job while working receive more job offers than the unemployed (Blau and Robins 1990), and that in periods of 'high hiring' on-the-job search tends to increase and to reduce the outflow from unemployment (Burgess 1993; Broersma 1997; Eriksson and Lagerstrom 2004). Pissarides and Wadsworth (1994) model the decision process leading to on-the-job search versus unemployed search and find that some groups of people engage in on-the-job search more than others (for example, highly qualified workers are more likely to engage in on-the-job search than workers with lower qualifications). On-the-job search is relevant in Britain, where, according to the LFS, in 2005 only 45 percent of people who were actively looking for a job were unemployed; 50 percent already had a job; while the remaining 5 percent were either self-employed, in government training programs or unpaid family workers. This suggests that the unemployment rate is likely to be an imprecise measure of job competition in the local labour market; the relationship between the unemployment rate and job competition might vary in a complex way over the business cycle and across groups of people.

Pannenberg and Schwarze (1998) estimate a wage curve for Germany including in their measure of job competition people who participate in labour market training programs. Workers participating in such training programs, they argue, are looking for a job, but are not included in the official unemployment statistics. Although in the short run workers participating in training programs seem to have a lower probability of re-employment than unemployed people not participating in any program (Lechner et al. 2006), Pannenberg and Schwarze (1998) find that their new measure of job competition yields the estimation of wage impacts that are bigger than the ones obtained when the unemployment rate is used. Carlsen et al. (2006) estimate wage curves for Norway, in which the probability of transition from unemployment to employment is used instead of the regional unemployment rate, and still find support for the wage curve.

Finally, by being computed at the regional level, the unemployment rate considers regions as separate entities thus neglecting possible spatial relationships: job competition in the neighbouring regions is assumed to have no effect on local wages (Longhi et al. 2006). Such misspecification is sometimes corrected in the literature by means of spatial lag or spatial error models (e.g. Buettner 1999; Elhorst et al. 2007). Rather than adding a spatial lag as a separate explanatory variable, in this paper space is directly included in the measure of job competition by weighting the regional measure of job competition by (rescaled) interregional commuting flows. Job competition in other labour markets are all taken into account, and neighbouring labour markets where the worker is likely to commute are given higher weight than distant ones, where the worker is unlikely to commute to work.

Below, the wage curve is estimated using different measures of job competition, which take into account these criticisms. The aim is to analyse wether different ways of measuring job competition yield substantially different wage elasiticities.

4. DATA AND ALTERNATIVE WAYS OF MEASURING JOB COMPETITION

4.1. The unemployment rate

The data used in this analysis is the British quarterly LFS from autumn 1997 to winter 2005/6. The focus is on people of working age (16-64 for men and 16-59 for women). The data identifies 18 regions of residence and of work, thus allowing the computation of interregional commuting flows. Because data on the region of work is not available for the summer quarter of 1999, the analysis uses data for 33 quarters. The regional unemployment rate U_{rt} is computed from the LFS by dividing the number of unemployed by the number of people in the active population. The active population is measured here as the sum of the number of employees, self-employed, workers participating in government training programs, unpaid family workers, and unemployed. This, and all other measures of job competition are computed using 'person-weights', and are therefore representative of the population measures (for more details on weights see the LFS User Guide, Volume 1; also note that official statistics for the unemployment rate are generally computed using the LFS). To avoid small-cell size problems, those cells including less than ten individuals have been dropped. In the period of the analysis the regional unemployment rate ranges from a minimum of 2.88 percent to a maximum of 11.95 percent, with a mean of 5.87 percent and a standard deviation of 1.76.

4.2. The ratio of unemployment to hirings

Following the job search literature (e.g. Pissarides 1985; Mortensen and Pissarides 1994; Rogerson et al. 2005), the first alternative measure of job competition is computed as the ratio of unemployment to hirings.

Data on the stocks and flows of vacancies and hirings notified by employers to job centres is not appropriate for the analysis in this paper. First, there are no data on vacancies that are consistent over the whole period of this analysis; secondly, only a fraction of vacancies are notified to job-centers (e.g. Robson 2001). Since low-skill jobs are more likely than high-skill jobs to be notified to job centres, such data would underestimate labour demand for jobs requiring higher skills. For this reason, this paper takes the unconventional approach of estimating hirings and vacancies from the individual data. The LFS provides data on the month and year in which each worker started her current job; it is therefore possible to estimate the number of workers hired each quarter. If we assume that vacancies in each quarter lead to hirings mostly within the quarter, then the number of hirings can be used as a proxy for the number of vacancies.[1] At the national level, the correlation between hirings computed from the LFS and most recent series of official figures for (notified) vacancies is as high as 0.699.

The second measure of job competition, UV_{rt}, is therefore computed as:

$$UV_{rt} = \frac{U_{rt}}{V_{rt}} \tag{2}$$

where U_{rt} is the number of unemployed living in region r at time t, and V_{rt} is the number of vacancies in region r at time t. Since the log of the ratio equals the difference between the logs, in the wage equation it is possible to estimate the impact on wages of either the log of UV_{rt}, or the separate impact of the log of the unemployment rate (U_{rt}/AP_{rt}) and of the vacancy rate (V_{rt}/AP_{rt}). Although the difference between the logs might be preferred for a direct comparison to the traditional wage curve, the wage impact of the ratio of unemployment to vacancies is empirically more interesting and, arguably, theoretically more correct.

Admittedly, measuring vacancies by the number of recently hired workers assumes that there are no unfilled vacancies. The presence of unfilled vacancies would generate an underestimation of V_{rt} and an overestimation of UV_{rt}. Because there is a large negative correlation between unfilled vacancies and unemployment (-0.819 for the older official series of unfilled vacancies, and -0.765 for the more recent series of live unfilled vacancies), the possible overerestimation of UV_{rt} would be lower at higher levels of unemployment. This will bias the estimated regression coefficients of job competition on wages upwards. Thus, the results shown in the next sections should be interpreted as upper bounds of the elasticity of wages to the measure of job competition. This needs not to be a problem for this analysis since the empirical findings point toward extremely low estimated elasticities.

In the data, the difference between unemployment and vacancies (both rescaled by the active population) ranges from minus 5.01 percent to 9.28 percent with a mean of only -0.39 percent. The proportion of vacancies might exceed the proportion of unemployed if, as pointed out by Pissarides (1994), most of the new hirings are job-to-job – rather than unemployment-to-job – moves.

4.3. On-the-job search

The second alternative measure of job competition includes on-the-job search. Also on-the-job search can be computed from the LFS, which collects information on whether the respondent is actively looking for a job. Since the question is asked to both the unemployed and workers who already have a job, the numerator of the third measure of job competition includes the total number of persons – either unemployed, employed, self-employed, participating in government training programs, or unpaid family workers – who are actively looking for a job. The third measure of job competition, JC_{rt}, is computed as:

$$JC_{rt} = \frac{U_{rt} + O_{rt}}{V_{rt}} \qquad (3)$$

where O_{rt} is the number of employed, self-employed, people participating in government training programs, or unpaid family workers living in region *r*, who are actively looking for a job at time *t*. As before, U_{rt} is the number of unemployed, V_{rt} is the number of vacancies, while $U_{rt} + O_{rt}$ can be interpreted as the total labour supply in region *r*. For comparison, in the estimation of the wage curve the impact of unemployed and of employed job-seekers is analysed separately from the impact of the other job-seekers.

Again, it is possible to estimate wage equations using either the combined wage impact of log JC_{rt}, or the separate impact of the logs of the labour supply rates ($(U_{rt}+O_{rt})/AP_{rt}$) and the log of the vacancy rate (V_{rt}/AP_{rt}).

Although some job-to-job movements might create a corresponding vacancy, this is likely to appear with a delay, and to be picked up by V_{rt}. In any case, any overestimation of JC_{rt} would bias the regression coefficients of job competition on wages upwards and, again, the results shown in the next sections would have to be interpreted as upper bounds of the elasticity of wages to the measure of job competition. Also, the fact that employed and unemployed job-seekers might search with different intensity, is not relevant here since the only quantity of interest is the number of people actively looking for a job. The difference between labour supply and demand in the data ranges from minus 0.38 percent to 14.39 percent with a mean of 5.70 percent.

4.4. Spatial interactions

The last measure of job competition takes into account job opportunities and job-seekers in other regions. Since distances and travel times are not available, a reasonable proxy for accessibility of the neighbouring labour markets can be obtained from commuting flows. The measure of job competition below weights both labour supply and demand by inter-regional commuting flows; more accessible labour markets – identified by larger commuting flows – are given high weights, while less accessible labour markets – identified by smaller commuting flows – are given lower weights:

$$^{W}JC_{rt} = \frac{\sum_j {}^{I}\omega_{rj}(U_{jt} + O_{jt})}{\sum_j {}^{o}\omega_{rj}V_{jt}} \qquad (4)$$

Labour supply is weighted by the flow of incoming commuters (${}^{I}\omega_{rj}$) to account for all those workers who might compete for jobs available in the region: labour supply in the neighbouring regions increases labour supply in region *r* in a way which is proportional to the flow of workers commuting to the region. Similarly, vacancies are weighted by the flow of outgoing commuters (${}^{o}\omega_{rj}$) to account for all those vacancies that might be available to residents of the region: vacancies in the neighbouring regions increase the possibility of residents to find a suitable job within a reasonable commuting distance.

Since the flows of commuters are rather stable over time, the weights are computed using the average number of commuters over the whole period and are, therefore, time-invariant. Supply in the own region and jobs which are available in the region of residence are given weight equal to one. The remaining weights are computed as the number of commuters rescaled by the number of workers who live and work in the region. The maximum inter-regional incoming-commuters weight is equal to 0.291 for commuters from the Rest of the South East to London; while the maximum inter-regional outgoing-commuters weight is equal to 0.197 for commuters from the Rest of West Midlands to West Midlands Metropolitan.

Again, U_{rt} is the number of unemployed; O_{rt} is the number of employed, self-employed, people participating in government training programs, or unpaid family workers looking for a job; while V_{rt} is the number of vacancies. The difference between the weighted labour supply and the weighted labour demand ranges from minus 1.24 percent to 17.19 percent with a mean of 5.41 percent.

5. ESTIMATION OF THE WAGE CURVE

5.1. The model

Following Bell et al. (2002), the wage curve models are estimated using a two-step procedure. The first step consists of a Mincer equation estimated at the individual level, including regional dummies; these regional dummies can be interpreted as average wages in the local labour market, corrected for composition effects:

$$\ln w_{irt} = \alpha_{0t} + \alpha_{rt} + \mathbf{X}_{irt}\,\gamma + \varepsilon_{irt} \tag{5}$$

where $\ln w_{irt}$ is the log of hourly wages of individual i working in region r at time t. The model is estimated using 'income weights' and, as suggested by ONS (Office for National Statistics), nominal hourly wages lower than £2 and higher than £100 have been excluded from the analysis since they can be considered as outliers (for more details see the LFS User Guide, Volume 3). α_{0t} is the intercept, while α_{rt} are dummies for region of work. The matrix $\mathbf{X}_{irt}$ includes age and its square; years of tenure with the current employer; dummies for part-time and married workers; three dummies for broad groups of potential experience (6-15 years; 16-30 years; and more than 30 years). The model includes only workers employed in the private sector. The composition corrected wages α_{rt} are computed by estimating model (5) separately by gender and over time periods.

In the second stage, wage curves are estimated using the composition corrected wages as dependent variable:

$$\hat{\alpha}_{rt} = D_{rt} + \beta_1 \hat{\alpha}_{rt-1} + \beta_2 \ln JobCompetition_{rt} + \beta_3 \ln JobCompetition_{rt-1} + \varepsilon_{rt} \qquad (6)$$

where *JobCompetition* is one of the measures of job competition discussed in the previous sections, while D_{rt} includes regional and time dummies.

Finally, the wage curve is modelled in a dynamic way. To account for wage inertia equation (6) includes the (quarterly) lag of the composition corrected wages among the explanatory variables, and the lagged measure of job competition is included to account for the possible delay to which wages might react to job competition.

In a first instance the model is estimated using bias-corrected least square dummy variable estimators as suggested by Kiviet (1995), Bun and Kiviet (2003), Bruno (2005). However, maybe because equation (5) models real – rather than nominal – wages, the regression coefficient of the lag of composition corrected wages is always small and never statistically significant. Real wages do not seem to show any persistence over time: there seems to be no remaining variability when regional and time dummies are included in the model. Hence, the final model is estimated without the lag of composition corrected wages, using a (regional) fixed effects estimator.

Finally, the wage curve has a double log specification. Because some of the measures of job competition shown in the previous sections might be exactly zero, and since this is not artificially generated by the lack of data (i.e. empty time-region cells), to avoid relevant observations from dropping out of the regressions, a value of 0.1 percent is used when the measure of job competition would be exactly zero.

5.2. Estimation of Regional Wage Curves

The results of wage curve estimations are shown in Table 1 for men and in Table 2 for women. Although the composition-corrected wages are gender-specific, the measures of job competition are computed including both men and women, under the reasonable assumption that both men and women compete for the same jobs, but might be affected differently by job competition.

As shown in equation (6), all models include both the contemporaneous and the lagged measures of job competition. Although it might be argued that such variables are highly collinear, the exclusion of either of them does not have a relevant impact on the coefficient of the remaining variables, or on their level of statistical significance.[2] Since men and women seem to be affected differently by the contemporaneous and lagged measure of job competition, not including both measures would hide an interesting part of the results.

Column (1) of Tables 1 and 2 replicate the 'traditional' wage curve in which job competition is measured by the regional unemployment rate. While the contemporaneous unemployment rate does not seem to have a statistically significant impact on wages, its one-quarter lag has a negative coefficient which is also statistically significant. The coefficients are -0.035 for men and -0.029 for women, and can be considered small compared to the -0.10 found by Blanchflower and Oswald (2005). Nevertheless, these coefficients are close to what previously found for Britain by Bell et al. (2002) and Black and FitzRoy (2000) using the New Earning Survey, and by Johnes (2007) using the British Household Panel Survey. Consistently with most of the previous literature (see e.g. Nijkamp and Poot 2005), the results in the first column of Tables 1 and 2 also suggest that wages of women are less affected by the local unemployment rate than wages of men.

Consistently with the job search literature, in column (2) of Tables 1 and 2 job competition is measured by the ratio of unemployment to vacancies. The wage elasticity is still negative and statistically significant for both men and women, but economically small: a ten percent increase in job competition would reduce wages of men by only 0.32 percent, and wages of women by only 0.31 percent. It is also interesting to note that it is the current measure of job competition that has an impact on wages of women, and the lagged one that has an impact on wages of men.

Since the model in column (2) measures job competition by the log of U_{rt}/V_{rt}, it clearly imposes some restrictions compared to a model separately estimating the wage impact of the log of unemployment and of the log of vacancies. The unemployment rate and the ratio of vacancies to the active population are included as separate regressors in column (3) of Tables 1 and 2. The separate inclusion of vacancies in the traditional model of the wage curve has only a small impact on the coefficient of the unemployment rate, which slightly decreases for men, and slightly increases for women. Vacancies show a statistically significant positive coefficient, larger for women than form men. Again, the wage impact is immediate for women and delayed for men. Columns (3) also report the probability associated with the

Wald test on the validity of the restriction that the sum of the regression coefficient of ln U_{rt} and of ln V_{rt} (models in column (3)) equals the regression coefficient ln U_{rt}/V_{rt} (models in column (2)). The results of the tests are reported for both the restrictions on the levels and on the lags. Taking a conventional level of statistical significance of five percent, the Wald tests do not reject the coefficient restrictions imposed in column (2); hence we can conclude that the model in column (3) is equivalent to the restricted model in column (2) which, as previously mentioned, should be considered theoretically more correct.

TABLE 1 ABOUT HERE

TABLE 2 ABOUT HERE

As mentioned in the previous sections, part of the competitive pressure on wages might come from workers engaging in on-the-job search. This is captured in column (4) by the measures of on-the-job search, and of others (i.e. self-employed, people in government training programs and unpaid family workers) searching for a job. The results in column (4) confirm that a higher number of vacancies has a positive impact on wages, while higher on-the-job search has a negative impact, which is also statistically significant for women. On-the-job search and vacancies are relevant explanatory variables that should not be neglected in the estimation of a wage curve relationship. In column (5) the four measures are combined in a single measure of job competition as in equation (3). This combined measure of job competition shows a negative impact on wages of both men and women. Compared to column (2), the coefficient remains fairly stable for men (-0.036 compared to -0,035), while for women it becomes much larger (-0.047 compared to -0.017). Job competition seems now to have a larger impact on wages of women than on wages of men.

The Wald test in column (4) tests the restriction that the sum of the regression coefficients of the unemployment rate, of on-the-job search rate, of search rate of others, and of the vacancy rate (models in column (4)) equals the regression coefficient of the combined measure of job competition (models in column (5)).[3] The test suggests that the models in column (4) are equivalent to the ones in column (5), and the composite measure of job competition should be the preferred one.

Finally, the model in column (6) measures job competition by means of the weighted measure shown in equation (4). In this case the wage impact of job competition is larger than when using the unweighted measure. Again, the elasticity increases much more for women than for men: the coefficient for women is now -0.065, while the coefficient for men is only -0.040. This suggests that wages of women are more sensitive to job competition than wages of men. Although the finding of a larger elasticity for women is not standard in the literature, it is nonetheless consistent with what found for Australia by Kennedy and Borland (2000).

5.3. Discussion

The inclusion of vacancies and on-the-job search separately from the unemployment rate does not seem to have a large impact on the regression coefficient of the unemployment rate. Despite their relevance, neglecting these additional explanatory variables does not seem to generate problems of omitted variable bias in the traditional specification of the wage curve. Nevertheless, vacancies and on-the-job search do provide interesting insights; for example, women seem to be more affected than men by competition with people searching on-the-job. Furthermore, the theoretically-based measures of job competition, including vacancies and on-the-job search, show a negative impact on wages which is similar to the impact of the unemployment rate for men, while for women the difference between these measures is substantial.

The relationship between the wage elasticity for men compared to that of women varies with changes in the way job competition is measured. A traditional wage curve would suggest that women’s wages are less affected by job competition than men’s wages. The theoretically-based measures of job competition, instead, suggest a much larger impact on wages of women. This might not be due to gender differences in (on-the-)job search and in commuting behaviour since the measures of job competition used in this analysis are not gender specific. Such differences might instead be related to different behaviours of men and women in the labour market, e.g. in terms of wage settings. A lower wage elasticity for women is often interpreted in terms of outside options, leading to a higher elasticity of women’s labour force participation. However, in modern economies, with higher average levels of education, women tend to have higher attachment to the labour market. For women with high labour market attachment, unwilling to drop out of the labour force, accepting comparatively lower wages in response to an increase in job competition might be preferable to leaving the labour force. This is consistent with the existence of gender pay gaps.

The theoretically-based measures of job competition that account for inter-regional commuting are the ones showing the largest wage elasticities. Despite their statistical significance, they can be considered economically small: a one percent increase in the unemployment rate would decrease men's wages by 0.040 percent, and women's wages by 0.065 percent. If, as mentioned, the measures of job competition are overestimated, these figures have to be interpreted as upper bounds. The elasticity of a traditional wage curve, as in columns (1), would suggest even smaller wage impacts.

6. CONCLUSIONS

The most widely accepted explanations for the Blanchflower and Oswald (1994) wage curve are efficiency wage and labour turnover costs theories in which the unemployment rate is a measure of how difficult it is for workers to find a (new) job if they quit or are fired (job competition). Since it fails to correctly measure labour supply and demand, the unemployment rate is likely to be an imprecise measure of job competition. Using data for Great Britain over the period 1997-2005/6, this paper tests the robustness of the wage curve to different ways of measuring job competition. Measures of job competition based only on the unemployment rate are compared to more complete measures accounting for on-the-job search, changes in labour demand, and accessibility of the local labour market.

The results support the previous findings of a negative relationship between the local unemployment rate and local wages, which is robust to different ways of measuring job competition. This is consistent with efficiency wages, labour turnover, and other theories interpreting the unemployment rate as a measure of job competition. Although the inclusion of vacancies and on-the-job search does not have a relevant impact on the regression coefficient of the unemployment rate, the theoretically-based measures of job competition show wage elasticities that differ quite substantially from the wage elasticity of the unemployment rate. Vacancies and on-the-job search do provide interesting insights; for example, women seem to be more affected than men by competition with people searching on-the-job. Only for men the theoretically-based measures of job competition have a negative impact on wages which is similar to the impact of the unemployment rate; for women the difference between these measures is substantial

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NOTES

[1] Measuring vacancies by the number of hirings in the following quarter under the assumption that vacancies in *t* mostly lead to hirings in *t+1*, does not significantly modifies the conclusions of this analysis.
[2] The results of the models including only the contemporaneous or only the lagged measure of job competition are not shown here, but are available on request.
[3] Because the log of the sum does not equal the sum of the logs, the models in Column (4) and (5) do not use exactly the same variables. This choice is motivated by the need to compare the results with a traditional wage curve and to analyse which component of the supply of labour (unemployed search versus on-the-job search) has a bigger impact on wages. A model specification using the log of the supply of labour (rather than the sum of the logs of its components) would lead to essentially the same results as the models in Column (4). Furthermore, the Wald test comparing the regression coefficients to those in Column (5) would reject the hypothesis at the ten, but not at the five percent level.

REFERENCES

Bell, B., Nickell, S. and Quintini, G. (2002) Wage Equations, Wage Curves and All That. *Labour Economics* 9: 341-360.
Black, A.J. and FitzRoy, F.R. (2000) Earning Curves and Wage Curves. *Scottish Journal of Political Economy* 47(5): 471-486.
Blanchflower, D.G. and Oswald, A.J. (1994) Estimating a Wage Curve for Britain 1973-90. *The Economic Journal* 104: 1025-1043.
Blanchflower, D.G. and Oswald, A.J. (2005) The Wage Curve Reloaded, NBER Working Paper No. 11338.
Blau, D.M. and Robins, P.K. (1990) Job Search Outcomes for the Employed and Unemployed. *Journal of Political Economy* 98(3): 637-655.

Broersma, L. (1997) Competition between Employed and Unemployed Job Searchers: Is There a Difference between the UK and the Netherlands? *Applied Economics Letters* 4: 199-203.

Bruno, G.S.F. (2005) Approximating the Bias of the Lsdv Estimator for Dynamic Unbalanced Panel Data Models. *Economics Letters* 87(3): 361-366.

Buettner, T. (1999) The Effect of Unemployment, Aggregate Wages, and Spatial Contiguity on Local Wages: An Investigation with German District Level Data. *Papers in Regional Science* 78(1): 47-67.

Bun, M.J.G. and Kiviet, J.F. (2003) On the Diminishing Returns of Higher-Order Terms in Asymptotic Expansions of Bias. *Economics Letters* 79(2): 145-152.

Burgess, S.M. (1993) A Model of Competition between Unemployed and Employed Job Searchers: An Application to the Unemployment Outflow Rate in Britain. *The Economic Journal* 103(420): 1190-1204.

Campbell, C. and Orszag, J.M. (1998) A Model of the Wage Curve. *Economics Letters* 59: 119-125.

Card, D. (1995) The Wage Curve: A Review. *Journal of Economic Literature* 33(2): 785-799.

Carlsen, F., Johansen, K. and Roed, K. (2006) Wage Formation, Regional Migration and Local Labour Market Tightness. *Oxford Bulletin of Economics and Statistics* 68(4): 423-444.

Elhorst, J.P., Blien, U. and Wolf, K. (2007) New Evidence on the Wage Curve: A Spatial Panel Approach. *International Regional Science Review* 30(2): 173-191.

Eriksson, S. and Lagerstrom, J. (2004) Competition between Employed and Unemployed Job Applicants: Swedish Evidence, IFAU Working Paper 2004:2.

Johnes, G. (2007) The Wage Curve Revisited: Estimates from a UK Panel. *Economics Letters* 94: 414-420.

Kennedy, S. and Borland, J. (2000) A Wage Curve for Australia? *Oxford Economic Papers* 52: 774-803.

Kiviet, J.F. (1995) On Bias, Inconsistency, and Efficiency of Various Estimators in Dynamic Panel Data Models. *Journal of Econometrics* 68(1): 53-78.

Lechner, M., Miquel, R. and Wunsch, C. (2006) Long-Run Effects of Public Sector Sponsored Training in West Germany, Swiss Institute for International Economics and Applied Research, University of St. Gallen.

Longhi, S., Nijkamp, P. and Poot, J. (2006) Spatial Heterogeneity and the Wage Curve Revisited. *Journal of Regional Science* 46(4): 707-731.

Mortensen, D.T. (2007) Island Matching, NBER Working Paper No. 13287.

Mortensen, D.T. and Pissarides, C.A. (1994) Job Creation and Job Destruction in the Theory of Unemployment. *The Review of Economic Studies* 61(3): 397-415.

Nijkamp, P. and Poot, J. (2005) The Last Word on the Wage Curve? *Journal of Economic Surveys* 19(3): 421-450.

Pannenberg, M. and Schwarze, J. (1998) Labor Market Slack and the Wage Curve. *Economics Letters* 58: 351-354.

Pissarides, C.A. (1984) Search Intensity, Job Advertising, and Efficiency. *Journal of Labor Economics* 2(1): 128-143.

Pissarides, C.A. (1985) Short-Run Equilibrium Dynamics of Unemployment, Vacancies, and Real Wages. *The American Economic Review* 75(4): 676-690.

Pissarides, C.A. (1994) Search Unemployment with on-the-Job Search. *Review of Economic Studies* 61: 457-475.

Pissarides, C.A. and Wadsworth, J. (1994) On-the-Job Search. Some Empirical Evidence from Britain. *European Economic Review* 38: 385-401.

Robson, M.T. (2001) Regional Variations in the Competitiveness of Unemployed Job-Seekers and the Rate of Outflows from Unemployment. *Oxford Bulletin of Economics and Statistics* 63(1): 61-90.

Rogerson, R., Shimer, R. and Wright, R. (2005) Search-Theoretic Models of the Labor Market: A Survey. *Journal of Economic Literature* 43(December): 959-988.

Shapiro, C. and Stiglitz, J.E. (1984) Equilibrium Unemployment as a Worker Discipline Device. *American Economic Review* 74: 433-444.

Wald, A. (1943) Tests for Statistical Hypotheses Concerning Several Parameters When the Number of Observations Is Large. *Trasactions of the American Mathematical Society* 54: 426-482.

TABLES AND FIGURES

Table 1: Estimations of the wage curve (men)

	(1)	(2)	(3)	(4)	(5)	(6)
Ln unemployment rate	0.021		0.017	0.018		
	(0.015)		(0.015)	(0.015)		
Ln unemployment rate (t-1)	-0.035**		-0.028*	-0.029*		
	(0.015)		(0.016)	(0.016)		
Ln unemployment/vacancies		0.018*				
		(0.010)				
Ln unemploy./vacancies (t-1)		-0.032***				
		(0.010)				
Ln vacancy rate			-0.017	-0.016		
			(0.015)	(0.015)		
Ln vacancy rate (t-1)			0.037**	0.034**		
			(0.015)	(0.015)		
Ln on-the-job search rate				-0.024		
				(0.014)		
Ln on-the-job search rate (t-1)				0.006		
				(0.015)		
Ln search rate of others				0.002		
				(0.004)		
Ln search rate of others (t-1)				-0.007*		
				(0.004)		
Ln job competition					0.012	
					(0.012)	
Ln job competition (t-1)					-0.036***	
					(0.012)	
Ln job competition weighted						0.017
						(0.014)
Ln job competition weighted (t-1)						-0.040***
						(0.014)
R^2 overall	0.652	0.657	0.658	0.653	0.658	0.650
Wald test levels (prob > F)		0.427		0.245		
Wald test lags (prob > F)		0.083		0.142		

Standard errors in parenthesis; * Significant at 10%, ** Significant at 5%, *** Significant at 1%
Observations: 594 observations are region-time cells (18 regions and 33 quarters); the dependent variable is the composition-corrected regional log wage. (Regional) fixed effect estimator; other explanatory variables: time dummies. The Wald (1943) test levels in column (2/3) tests the coefficient restriction across the two models that Ln unemployment rate + Ln vacancy rate (column 3) = Ln unemployment/vacancies (column 2); the Wald test levels in column (4/5) tests the coefficient restriction that Ln unemployment rate + Ln on-the-job search rate + Ln search rate of others + Ln vacancy rate (column 4) = Ln job competition (column 5). The Wald test lags tests the same restriction on the coefficient on the lagged variables.

Table 2: Estimations of the wage curve (women)

	(1)	(2)	(3)	(4)	(5)	(6)
Ln unemployment rate	-0.017		-0.009	-0.010		
	(0.015)		(0.016)	(0.016)		
Ln unemployment rate (t-1)	-0.029*		-0.031**	-0.029*		
	(0.016)		(0.016)	(0.016)		
Ln unemployment/vacancies		-0.031***				
		(0.010)				
Ln unemploy./vacancies (t-1)		-0.008				
		(0.010)				
Ln vacancy rate			0.048***	0.049***		
			(0.015)	(0.015)		
Ln vacancy rate (t-1)			-0.010	-0.013		
			(0.015)	(0.015)		
Ln on-the-job search rate				-0.027*		
				(0.015)		
Ln on-the-job search rate (t-1)				0.017		
				(0.015)		
Ln search rate of others				-0.005		
				(0.004)		
Ln search rate of others (t-1)				0.002		
				(0.004)		
Ln job competition					-0.047***	
					(0.012)	
Ln job competition (t-1)					0.001	
					(0.012)	
Ln job competition weighted						-0.065***
						(0.014)
Ln job competition weighted (t-1)						0.006
						(0.014)
R^2 overall	0.695	0.707	0.707	0.704	0.709	0.693
Wald test levels (prob > F)		0.235		0.047		
Wald test lags (prob > F)		0.794		0.411		

Standard errors in parenthesis; * Significant at 10%, ** Significant at 5%, *** Significant at 1%

Observations: 594 observations are region-time cells (18 regions and 33 quarters); the dependent variable is the composition-corrected regional log wage. (Regional) fixed effect estimator; other explanatory variables: time dummies. The Wald (1943) test levels in column (2/3) tests the coefficient restriction across the two models that Ln unemployment rate + Ln vacancy rate (column 3) = Ln unemployment/vacancies (column 2); the Wald test levels in column (4/5) tests the coefficient restriction that Ln unemployment rate + Ln on-the-job search rate + Ln search rate of others + Ln vacancy rate (column 4) = Ln job competition (column 5). The Wald test lags tests the same restriction on the coefficient on the lagged variables.