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City Size and Unemployment

Joan Vipond

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Introduction

The objective of this analysis is to test the hypothesis that there are economies of scale in urban labour markets which influence unemployment rates. Beneficial economies can arise because larger markets offer greater choice to workers and employers which, by reducing the search time of both parties, lowers frictional unemployment. On the other hand this choice might free employers from the need to hoard labour during slack times. Diseconomies may result from the difficulties of communication between those seeking work and those offering vacancies as the size of the market increases. Additionally, in large cities the distance between workplace and residence may result in higher unemployment if the unemployed live in areas without jobs and travelling costs are high. Spatial specialisation within urban areas can increase this tendency, especially if accompanied by job relocations that leave unemployed workers stranded in areas that previously provided good employment opportunities. The hypothesis can be stated as

$$U = f(\text{Size})$$

where U is the urban unemployment rate, Size is some measure of scale and the function may be either positive or negative, linear or non-linear.

Population is most suitable as the index of scale, so the analysis implies a test of the efficiency as labour markets of large as compared to small towns. An alternative measure of size, the number of workers in each urban area, is less satisfactory since it is unrealistic to consider workers in isolation from their dependents and their environment. Moreover, by using city size it is possible to draw on previous research, both theoretical and empirical, in interpreting the results of this analysis and, perhaps, to add to the existing evidence of the costs and benefits of city size.

Analysis

It is easier to test the hypothesis with unemployment rates from a cross-section of cities of different sizes than attempt to collect consistently defined time-series data for a long period. The only objection to this procedure might be that unemployment tends to be more cyclically unstable in some sizes of cities than others. Providing that variations occur in the amplitude and not the periodicity of cyclical unemployment rates, this problem can be overcome by

The author is a Lecturer in Economics, University of Kent at Canterbury

taking the cross-section at the midpoint of an upswing or downswing of a cycle. At these times cyclical effects are about the same in all cities; only at the peak and the trough would the most unstable cities have much lower and much higher unemployment rates. The data used in this analysis were collected in April 1966 and, though the dating of business cycles in the U.K. is not very precise, this was about half-way through the 1965-67 downswing. Furthermore, it was possible to isolate the influence on unemployment rates of one of the main sources of cyclical instability in cities, the share of manufacturing in total employment.

Though cross-section data are more readily available than time-series data they are far from perfect. In Great Britain there are two sources of recent statistics on unemployment: the Sample Census 1966 which has comprehensive figures of unemployment in urban areas and the Employment Exchanges which collect information on the number of *registered unemployed* for areas that are broadly defined in terms of journey-to-work patterns. The choice is thus between the Census with good unemployment data for imperfectly defined areas and Employment Exchanges with biased unemployment figures for well-defined areas. The former source was chosen because female unemployment rates were required and Employment Exchange data on women are particularly inadequate.[1] Moreover, the techniques used permit combining data on three different aspects of cities, population, amount of commuting and existence of conurbations, to compensate for the defects in spatial definitions of labour markets. Finally, use of Census boundaries greatly facilitated the collection of other data for the analysis.

The data from the Sample Census 1966 are published for medium and large towns but, unfortunately, not for small urban areas, so it was possible to analyse the effect of size on unemployment only in cities ranging from 50,000 to 7 million. There were 155 such cities in Great Britain in 1966 and these form the sample for this analysis.

The simplest test of the hypothesis that can be carried out on these data is to correlate unemployment rates with city size. The correlation coefficient between population and male unemployment is $+0{\cdot}031$ while that with female unemployment is $-0{\cdot}049$; though the difference in signs is interesting, the degree of linear association is weak in both cases. However, the hypothesis cannot be rejected by these results because there is no reason to assume the relationships are linear. Furthermore, small cities are not scale reproductions of large ones and many of the characteristics of cities which vary with size will influence unemployment through their effects on the supply of and demand for labour. The hypothesis can be tested more rigorously by multiple regression analysis in which population and other factors affecting the labour market are included as independent variables, and unemployment is the dependent variable. The basic regression equation, applied to male and female rates separately, was:

Unemployment = *f* (City Size, Commuting, Conurbation, Region, Social Class, Age Structure, Activity Rates, Ratio of Non-Manufacturing Employment).

Definitions of variables and sources of data are included in the Appendix.

The importance of the correct specification of independent variables was indicated previously by the need for three variables to define the urban labour market spatially. Damage caused by misspecification can be great. If some significant determinants of unemployment are missing, and if size is correlated with one or more of these, then the regression coefficient between size and unemployment could be a measure of a derived rather than direct association. The analysis, instead of revealing the influence of size on unemployment, would indicate the effect of an excluded variable on unemployment.

Results of regression analysis

Table 1 shows the regression equations that gave the best explanations of unemployment. Before attempting an economic interpretation account must be taken of their statistical validity. The main potential problem is multicollinearity. Klein's rule of thumb check on the correlation matrix suggests that multicollinearity was 'tolerable' (Huang, 1970, p. 154). Klein's rule ensures only that no two independent variables are seriously correlated but multicollinearity may also arise because a group of variables are associated, even though no pair in the

[1] Many unemployed married women are not entitled to unemployment benefit, and therefore do not register at the Employment Exchanges, but they are counted in Census returns as seeking work.

group is highly correlated. On this point the results of other research are helpful. There have been a number of studies, such as that by Moser and Scott (1961), which have used Census material to find the degree of association among various social indicators. None of these findings have revealed close relationships among particular components of Census data. However, in an analysis of activity rates there were some significant associations between female activity rates and other variables; this may indicate multicollinearity, though its extent cannot be measured. In any event, multicollinearity creates problems mainly in interpreting insignificant coefficients, of which there were very few in this analysis.

The R^2 values shown in Table 1 are satisfactory. Variations in male unemployment are better explained than female rates. This is not unexpected, given the importance of non-economic factors in determining female participation in the labour market and hence female unemployment.

Interpretation of the results

City size

Regression tests on data from the sample cities revealed no statistically significant linear relationship between city size and either male or female unemployment but, as shown in Table 1, there are highly significant non-linear size effects. This finding is compatible with that of Duncan and Reiss (1956, p. 40) on United States Census data, that socio-economic characteristics tend to be linearly related not to absolute city size but to the logarithm of city size. These non-linearities may be a feature of the hierarchical nature of city size distributions which imply relatively few large cities. Although extreme observations may dominate the measured relationships, to exclude them would preclude any analysis of the whole range of city sizes. For example, in Great Britain the primate city has more than seven times the population of cities in the next rank and

Table 1

Unemployment and city size, Great Britain, 1966

	Coefficient values			
	Male unemployment		*Female unemployment*	
Variable	*Equation 1 Quadratic*	*Equation 2 Logarithmic*	*Equation 3 Quadratic*	*Equation 4 Logarithmic*
1. City size (in millions)	+1·929**	—	−3·332**	—
	(3·494)		(2·348)	
City size²	−0·232**	—	+3·137*	—
	(3·224)		(2·033)	
Log city size	—	+0·727**	—	−0·459*
		(3·126)		(1·832)
2. Commuting	−0·007*	−0·006*	−0·005	−0·005
	(2·040)	(1·857)	(1·505)	(1·512)
3. Conurbation	−0·184	−0·149	−0·102	−0·058
	(1·067)	(0·865)	(0·553)	(0·315)
4. Region	+1·885**	+1·891**	+0·998**	+1·004**
	(9·431)	(9·393)	(4·792)	(4·813)
5. Social class	−0·080**	−0·079**	−0·075**	−0·074**
	(5·924)	(5·740)	(4·759)	(4·685)
6. Age structure	+0·060*	+0·065*	+0·015	+0·015
	(2·054)	(2·190)	(0·606)	(0·578)
7. Activity rates	—0·198**	−0·197**	−0·041*	−0·039*
	(6·681)	(6·637)	(2·079)	(1·996)
8. Ratio of non-manufacturing employment	+0·003	+0·003	+0·012*	+0·013*
	(0·470)	(0·555)	(1·645)	(1·758)
9. Residual from equation 1	—	—	+0·573**	+0·568**
			(6·548)	(6·486)
Constant	+19·042	+15·330	+5·465	+7·323
D.F.	145	146	143	145
R^2	0·698	0·691	0·512	0·505
Greater London included	Yes	Yes	No	Yes

Note * $t \geqslant 1{\cdot}645$, significant at 0·05.
** $t \geqslant 2{\cdot}326$, significant at 0·01.
t values shown in brackets.

out of the 155 cities with populations of more than 50,000 only 17 have more than half a million. London has such a marked influence on the regression coefficients in this analysis that two types of non-linear functions, quadratic and logarithmic, were tried.

The logarithmic function for male unemployment (Equation 2) suggests that for every tenfold increase in population the unemployment rate rises by 0·7 per cent. If this held throughout the ranges of the sample it would imply a very high unemployment rate for Greater London, in view of the mean unemployment rate of 2·69 per cent and the mean city size of 178,000. Not surprisingly, therefore, a quadratic function (with a *maximum* level of unemployment found in cities of four million) gives an equally good fit (Equation 1). This predicts an unemployment rate for London only 0·002 per cent different from the actual level though the curvature of the function predicts a different scale effect in the larger towns from the logarithmic case; for example, the quadratic relation implies that cities of one million would have male unemployment 1·5 per cent higher than those of 100,000. However, in the range 50,000 to half a million the two functions yield almost identical predictions. The exceptionally low unemployment rate for London explains why the quadratic deserves attention. The unfortunate by-product of primate city size distributions (the absence of other very large cities), however, makes it difficult to assert its superiority over the logarithmic function.

The influence of city size on female unemployment works in the opposite direction. Again, Greater London is unique, for if excluded a quadratic function with a *minimum* point of 500,000 inhabitants fits the data very well (Equation 3). However, when London is included neither a linear nor a quadratic[2] relationship is statistically significant and the coefficient of the logarithm of city size (Equation 4) has a '*t*' value only significant at the 5 per cent level. This coefficient indicates a fall in unemployment of 0·46 per cent for a tenfold increase in population whereas the London-excluded quadratic function implies that a city of half a million people would have a rate of female unemployment 0·7 per cent less than one of 50,000. Thus, the analysis suggests that the rate at which female unemployment falls with increasing city size is rather less than the rate at which male unemployment rises. However, in very large cities, apart from London, female unemployment tends to rise with city size.

If city size were uncorrelated with any factors excluded from the regression analysis these coefficients would mean that scale is a significant determinant of urban unemployment, though neither economies nor diseconomies prevail throughout the whole range of city sizes. The function relating male unemployment to size is shaped like an inverted U indicating diseconomies of scale up to but not including the largest city. Economies of scale predominate in the case of female unemployment, though they are probably exhausted in cities larger than half a million. London is a special case offering lower risks of unemployment to both men and women.

The different scale effects on men and women may be due to the restricted ability of the latter to migrate when job opportunities are limited. Moreover, women often have very specific job requirements in terms not only of pay but also hours of work and location. These factors imply that a large number of vacancies in the city of residence may have to be considered before suitable employment is found. Economies of scale are obvious. Furthermore, female employment is subject to conditions outside the actual job markets. Married women in particular need ancillary facilities, such as nurseries, shops, restaurants and laundrettes, and all these are likely to be better provided in the bigger urban centres.

In the very large cities these economies of scale may become exhausted. Whether diseconomies then set in is problematic. For example, it is plausible to argue that women workers have a more limited travel-to-work area than men. They are paid less and can afford less for fares. Hence, in a very large city *total* vacancies are irrelevant to women who require jobs at specific intra-urban locations. In particular, if there is specialisation by area within the city some unemployed women may reside where few suitable vacancies occur.

The measured relationship between city size and male unemployment may be due to diseconomies of scale in communications. Meier (1962) has suggested that 'an intensification of communications, knowledge and controls seems to be highly correlated with the growth of cities'. But the transactions that he refers to are those 'occurring in the public sphere,

[2] The coefficient of Size (in millions) is $-0{\cdot}796$ ($t = 1{\cdot}334$) and of Size^2 is $+0{\cdot}108$ ($t = 1{\cdot}391$) in the London included sample.

rather than the family, clan or friendship group' and the latter may decline with city size since 'urbanisation implies a deprivatisation of time'. Rees and Shultz (1970) have indicated that informal sources of information are very important in the search-for-work process, especially for blue-collar workers. Communications problems might have been avoided in the largest city, London, by the use of specialist job agencies not available elsewhere. Similarly, if, as suggested, diseconomies of scale are related to high travel costs, London again could be the exception as its transportation services are probably more developed than those of other cities.

It is even possible that the rise in male unemployment is due to positive economies of scale in urban labour markets but that the benefits are seen in higher productivity among the employed. Suppose employers' hoarding of labour is negatively associated with the size of the pool of unemployed—the more men there are to choose from, the more likely a suitable worker will be found—then in large towns this lower rate of hoarding would imply greater turnover rates in jobs and, probably, higher frictional unemployment. Workers in these towns would have to be compensated for the loss, or they would migrate. However, it is not essential that they have higher incomes since there may be other non-monetary advantages from living in big cities.

Although scale economies and diseconomies can explain the association between size and unemployment their claim to be the sole determinants depends on the quality of the specification of the whole regression model. Have all the relevant explanatory variables been included? Do the coefficients of city size isolate the effects of scale?

The spatial characteristics of cities

Two variables reflect aspects of the spatial separation of jobs and residents: the higher the values of Commuting and Conurbation the greater are nearby job opportunities. Commuting (Variable 2) measures the extent to which the town is a centre for commuters in the surrounding areas, while Conurbation (Variable 3) is a dummy variable to reflect whether or not the city is part of a conurbation. The signs of both variables are negative—the more jobs there are in the neighbourhood the lower is unemployment —but only one coefficient is statistically different from zero. To be precise, these effects are agglomeration economies rather than economies of scale since they indicate the *proportionate* relationship between people and jobs independently of their absolute values. The lack of statistical significance is reassuring for the selection of Census definitions of towns as proxies for urban labour markets within this size range (i.e. $>50{,}000$).

The regional effect

The dummy variable for regions (Variable 4) indicates that male unemployment is 1·9 per cent and female unemployment is 1·0 per cent higher in development areas than elsewhere in the country. The sole purpose of including this variable was to separate regional influences from those of city size. Regional effects are difficult to specify but may be due to the locational disadvantages of peripheral regions in Great Britain and to the bias in their industrial structures towards declining industries (McCrone, 1969).

Social class

The greater the proportion of professonal and managerial workers[3] in a town, the lower are both male and female unemployment rates. This variable reflects both demand and supply factors, such as the occupational skills demanded in the city and the degree of education and training of its labour force.

Population structure

The extent to which unemployment produces low activity rates has been measured by Gordon (1970). The results here suggest a further association: that higher activity rates of both men and women reduce their unemployment rates. The latter effect is probably derived from the link between activity rates and population structure since the lower is economic participation the greater the proportion of disadvantaged groups (older workers and married women) in competitive labour markets. The coefficient of the female activity rate has less statistical significance than that for men because male activity rates are very closely related to age structure whereas the influences on female activity rates are more varied and complex.

The other measure of population structure, Age

[3] More precisely, the variable refers to males, both active and retired. However, interdependence between male and female class scores may be assumed.

Structure (Variable 6) reveals a significant, positive association between the proportion of the population under 15 and male unemployment. A possible explanation is some excluded factor, not fully accounted for by the standardisation for social class and region, making for high birth rates and large families in the economically depressed towns. Plausible candidates include an inverse relationship between fertility and income levels and/or selective out-migration.

Interdependence between female and male unemployment

The residual term from the male unemployment equation (Variable 9), was an explanatory variable in the analysis of female unemployment, as the same factors which influence the 'unexplained' part of unemployment among men may also affect women. If, instead, the total value for male unemployment had been used there would have been a greater danger of multicollinearity. The impact of the residual accords with expectations that, since male and female labour are to some extent substitutes, there is some correspondence between unemployment rates for both sexes in each town.

Industrial structure

Industrial structure may be important for, if it is highly correlated with city size, the effects of variations in industry mix between cities have to be isolated before scale economies in labour markets can be revealed. As mentioned, the regional variable may indicate, *inter alia*, declining sectors in a city though not all development area towns are dominated by such industries. Non-manufacturing's share in total employment (Variable 8) was introduced as another measure of structure, partly to take account of the greater cyclical instability of the manufacturing sector.

Its positive effect on unemployment rates shows that in 1966 manufacturing had lower unemployment levels than other sectors, possibly reflecting slight traces of the 1964 boom. However, the variable's influence on male unemployment is statistically insignificant, suggesting perhaps that cyclical effects were negligible in 1966. A test for a different phase of the cycle will be feasible with 1971 Census data, since in that year national unemployment was much higher than in 1966.

The greater value and significance of the coefficient for the female non-manufacturing employment ratio is unlikely to be associated with cyclical forces, since female employment is concentrated in the more stable sectors of manufacturing. The difference in these coefficients between the sexes may be due to the simpler structural characteristics of women's work. For instance, women do not generally work in the extractive industries, transport and construction, so that the non-manufacturing ratio for women is a fairly precise measure of service employment.

Two of the explanatory variables in the regression analysis have probably identified the major industrial and occupational characteristics of female employment. The non-manufacturing ratio divides cities with large manufacturing sectors from those without. Manufacturing job opportunities for women are only available on any scale in some areas of the country, while service employment is ubiquitous. Social Class, though in these tests a measure of male occupational status, can also be assumed to reflect variations in the demand for trained women workers, particularly in professional and technical occupations. Together they account for the distribution of female employment between high and low paid work and between factory and service employment. The absence of manufacturing industries (high value for Variable 8) and of salaried employment (low value for Variable 5) in a town are associated with higher female unemployment rates. They suggest that female jobs are mainly in the low-paid service sector which are more prone to unemployment. Any remaining effects of industry and occupation mix on female employment are picked up by the regional variable and the residual from the male equation.

Since measures of the simple structural patterns of female employment have been included in the regression equation it can be argued that, in the analysis of female unemployment, city size reflects scale effects alone. The male employment structure, because it is more complex, presents more difficult measurement problems. However, this is serious only if city size and structure are related in ways not identified by this study, i.e. other than through the social status of occupations, extent of manufacturing activity, type of region, and so on. Although city size has been shown to be a significant determinant of male unemployment, further research into city size, unemployment and industrial structure may be worthwhile. The results of these tests have been interpreted as indicating diseconomies of scale in urban labour markets, but there is the alternative explanation that as city size increases the proportion of high-unemployment industries also rises.[4] However, the evidence from other studies suggests that there is no clear-cut relationship between city size and employment structure (Richardson, 1973).

Excluded variables

It is sometimes argued that large cities contain more people who are unfit to work—perhaps because of the stress induced by their environment. However, the direction of causation is unclear. Does ill health, such as mental instability create higher unemployment or does the complex nature of large city functions provide fewer opportunities for the economically inadequate who, because they are so often unemployed, suffer from various stress-linked illnesses? Are there more unemployables in big towns, or are they simply more visible when concentrated in inner city slums? Another thesis is that large cities attract too many migrants over optimistic of their chances of finding work. But this problem is more likely in underdeveloped countries where rural-to-urban migration is common and information about jobs less widespread than in Britain, where most movement is inter-urban and communications systems fairly sophisticated. A further suggestion that implies a high degree of frictional unemployment is that a common psychological trait of inhabitants of large towns is to seek change, including changes in jobs. Since it is impossible even to guess the importance of these factors they could not be included in the regressions. The only variations in the quality of the labour supply between cities accounted for are those associated with social class and age structure.

Conclusion

The hypothesis predicting economies of scale in urban labour markets has been tested for both men and women workers by measuring the association between city size and unemployment. The relationships were found to be statistically significant, but the signs for each sex were different. In both cases this may represent the influence of scale—positive economies for women and diseconomies for men. However, it is possible that part of the effect of size on male unemployment is derived from unidentified relationships between size and industrial structure (or size and the 'employability' of a city's population). The analysis highlights, therefore, the need for further empirical research into the economic and social aspects of city size.

Appendix

Definitions and Sources

All variables except Region rely on data from the *Sample Census, 1966* for *England and Wales* and for *Scotland*—the relevant volume titles are given with the definitions of the variables used in the analysis.

Male unemployment

Males defined as 'out of employment' in census as percentage of total economically active males resident in area.
From: Table 1: *Economic Activity County Leaflets*, Mean Value 2·690 per cent, Standard Deviation 1·465 per cent.

Female unemployment

Females defined as 'out of employment' in census as percentage of total economically active females resident in area.
From: Table 1: *Economic Activity County Leaflets*, Mean Value 3·188 per cent, Standard Deviation 1·206 per cent.

City size

Enumerated population 1966.
From: Table 1: *County Reports*, Mean Value 0·178 million, Standard Deviation 0·623 million.

Commuting

Variable indicating amount of commuting in area. Measured as employment in area as percentage of residents of area in employment.
From: Table 1, col. aa: *Workplace and Transport Tables. Part 1*, Mean Value 106·745 per cent, Standard Deviation 25·693 per cent.

Conurbation

Dummy variable value = 1 where town in part of a conurbation, 0 if not.

[4] A possible first approach might be to create an index of structure in terms of unemployment-prone industries. For example, an unemployment level could be specified and an index formed from the proportion of industries in each town with above-benchmark unemployment rates. Empirical investigation would be needed to establish the most suitable benchmark since the correlation-coefficients between this index and city size might depend on the selected level of unemployment.

From: Definition of conurbations p. XXIX *Summary Tables*.

Region

Dummy variable value = 1 where town is in development area, 0 if not.
From: Development areas defined in *Ministry of Labour Gazette* (October 1966), p. 667.

Social class

Professional workers and employers and managers as percentage of economically active and retired males aged 15 and over; i.e. socioeconomic groups 1, 2, 3, 4 and 13 as percentage of total in all groups.
From: Table 14: *County Reports*, Mean Value 14·010 per cent, Standard Deviation 6·165 per cent.

Age structure

Population aged 15 years or less as percentage of total population.
Calculated from: Table 1: *Economic Activity County Leaflets*, Table 1: *County Reports*, Mean Value 24·061 per cent, Standard Deviation 3·288 per cent.

Activity rates

Total males economically active as percentage of total male population, aged 15 and over, resident in area.
From: Table 1: *Economic Activity County Leaflets*, Mean Value 84·368 per cent, Standard Deviation 3·668 per cent.
Total females economically active as percentage of total female population, aged 15 and over, resident in area.
From: Table 1: *Economic Activity County Leaflets*, Mean Value 42·955 per cent, Standard Deviation 5·206 per cent.

Ratio non-manufacturing employment

Males in non-manufacturing industries, i.e. males employed in S.I.C. orders I, II, XVII, XVIII, XIX, XX, XXI, XXII, XXIII and XXIV as percentage of total males employed, by area of workplace not residence.
From: Table 3: *Economic Activity County Leaflets*, Mean Value 58·373 per cent, Standard Deviation 15·760 per cent.
Females in non-manufacturing industries, i.e. females employed in S.I.C. orders I, II, XVII, XVIII, XIX, XX, XXI, XXII, XXIII and XXIV as percentage of total females employed, by area of workplace not residence.
From: Table 3: *Economic Activity County Leaflets*, Mean Value 67·627 per cent, Standard Deviation 13·822 per cent.

Residual

Residual from Equation 1 explaining male unemployment, i.e. actual male unemployment minus male unemployment estimated by Equation 1 shown in full in Table 1. Mean Value 0·000 per cent, Standard Deviation 0·805 per cent.

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