URBAN JOBLESSNESS, LOCATION AND HYSTERESIS - A THEORETICAL APPROACH

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Abstract

The paper develops and solves a simple model of urban location choice when there is a location-based income externality such as a tendency for schools to be better in high income areas than low income areas. In the model, households choose between consumption of a location externality, paid for by rent, and consumption of ordinary goods and services. It is shown that the extent to which groups with different incomes separate into different areas depends non-linearly on the unemployment rates and benefit levels can lead to a rapid clustering of jobless people into low rent areas.

A recent study has shown how the rise in unemployment in Australia since 1975 has led to a substantial concentration of jobless (and poor) people in a few urban neighbourhoods (Gregory and Hunter, 1995). Some of the empirical findings of this study have been replicated in a subsequent analysis of the changing unemployment situation in Wellington between 1981 and 1991 (Morrison, 1997). This paper establishes a broad framework for considering the policy implications of the increased geographical concentration of jobless people. A simple model of location in which different types of people choose to live in different neighbourhoods is formulated and solved. The implications of this model for the location of unemployed people when aggregate employment patterns change are then derived. The results show that once benefit levels or aggregate unemployment rates change beyond certain levels or thresholds, rapid clustering of jobless people into a particular region occurs. Once this clustering happens, working people tend to leave the region.

The results of the model are of interest when there is a location-based income externality. A location-based externality occurs if the level of utility a household derives from living in a particular location depends in part on the income of their neighbours. A location externality would occur if, for instance, a random pupil would do better attending a school in a wealthy neighbourhood than if they were to attend a school in a poor neighbourhood or if there were less crime in a wealthy neighbourhood than in a poor neighbourhood. An externality would also occur if it were easier for a random person to find a job if they lived in a wealthy neighbourhood rather than a poor neighbourhood. These types of externality have often been discussed in literature about ghettos and poor housing estates in the US and Europe, although the evidence about their importance is mixed.

The essence of the model is a tradeoff between the consumption of ordinary goods and services and the consumption of the location externality. The cost of the location externality is the rent to be paid to live at a particular location, and the cost of transportation to get to work. Jobless people will typically choose to consume less of the location externality than working people, in part because they have less income and in part because their location costs are different as they are less concerned with transportation.

Even though in such a model jobless people are consuming an optimal amount of the location externality given their income, several policy issues arise. First, if the externality concerns education or crime, the state may be providing inadequate levels of education (or too much crime) to certain urban locations even if it is providing the same levels of funding to all regions. This would be the case if schools in poor neighbourhoods are typically worse than schools in wealthy neighbourhoods, for instance. Three implications follow. First, the state may be providing a poorer quality of services than it deems acceptable. Secondly, the cost to the state may be increasing in the degree of spatial income inequality, and it may be the case that the state can design policies that deliver a set of outcomes more efficiently if they take the location externality explicitly into account. Third, the state may be concerned that such outcomes would accentuate intergenerational correlation of incomes, given that education is a prime determinant of future income levels.

A second type of policy concern would arise if the household decision maker choosing the residential location is different from the people in the household benefiting from the externality (as would be the case if the externality was related to schooling). The state may be concerned if it is interested in the welfare of all members of the household rather than just the decision maker.

A third potential reason for Government interest in the topic is that the welfare costs associated with macroeconomic changes will be different if location decisions are explicitly

taken into account. This will be the case even if the transactions costs of moving location prevent a liquidity constrained household from shifting to consume more of the location externality.

The literature examining how individual location choices based upon the characteristics of neighbours can affect the aggregate makeup of neighbourhoods has a long lineage, often traced to the work of Schelling (Schelling, 1971). Along with the literature on hedonic pricing (Griliches, 1971; Rosen, 1974) which shows how neighbourhood characteristics get capitalised into property values, this literature has established how market discrimination can cause the segregation of groups with different income and social characteristics into different urban areas (for a review see Muth and Goodman, 1989). The analysis in this paper is derived from these ideas. The basis of the paper is a simple model which shows how changes in the aggregate unemployment rate and welfare payments can affect location choice and determine overall welfare levels.

A model of location choice

Consider the following simplified model of location choice in an urban area. The model has the following features.

1. There are three types of people: white collar and blue collar workers, and jobless people. Each class $t = \{w, b, o\}$ earns a different income $I_t = \{I_w, I_b, I_o\}$.

2. There are three separate residential locations $l = \{a, b, c\}$.

3. There are two commercial locations. All white collar work is in the centre city (for definitiveness, closest to location a) and all blue collar work is at the periphery (closest to centre c). It costs T^w_l and T^b_l respectively to travel from residential location l to the white collar and blue collar workplaces.

4. The price of land in each centre, P_l is an increasing function of the number of people who live in the centre. The cost of living in a particular location, or the rent, equals the interest rate times the price of land.

5. There is a wealth externality $W(I^*_l)$ which depends on the average level of wealth I^*_l of the people who live in the location.

6. All individuals i have an independent idiosyncratic preference over the three locations, represented by a term ε_{il}.

7. Individuals choose their location to maximise their utility $U(.)$ based upon:
(a) their location preferences ε_{il} ;
(b) the location externality $W(I^*_l)$ they get;
(c) their consumption of other goods, C.

The solution of the model is a (9 x 1) equilibrium probability function $\Pi(.)$ that determines the proportion of each type of person that lives in each location. In equilibrium everybody is optimising conditional on what everybody else does. Note that an individual's decision is affected by everybody else's decisions in two ways: first, because the number of people who locate in each region affect the rent in that region; and secondly, because of type of people who locate in the region affect the wealth externality.

Various functional forms can be used to generate a solution to the model. The easiest approach is to assume logarithmic preferences over consumption and Weibull distributed location preferences, for then the model fits nicely into a multivariable logit framework. Consider the utility maximisation of an individual i of type t.

Let

$\Pi_{lt}(.)$		= proportion of type t locating at l
N_t		= number of people of type t
N_l	$= \Sigma_t \Pi_{tl} N_t$	= number of people at location l
Pl	$= \alpha_0 Nl^{a1}$	= price of land at location l
I^*l	$= \Sigma_t \Pi_{tl} N_t I_t$ / $\Sigma_t \Pi_{tl} N_t$	= average income in location l

$W(I^*_l) = I^*_l$

Suppose individual utility is given by

$$U(l, C, W(I^*l)) = \ddot{U}_{tl} + \varepsilon_{il}$$
$$= \beta_{0l} + \beta_1 \ln(C) + \beta_2 \ln(W(I^*l)) + \varepsilon_{il}$$
$$= \beta_{0l} + \beta_1 \ln(I_t - T^t_l - r P_l) + \beta_2 \ln(W(I^*_l)) + \varepsilon_{il}$$

Then the proportion of type t people who locate in region l is

$$\Pi_{tl} = \frac{\exp(U_{tl})}{\Sigma_l \exp(U_{tl})} = H_{tl}(\Pi, I_t, N_t, T)$$

This result follows from the assumption that ε_{il} is Weibull distributed.

Because each proportion Π_{tl} is a function of all other proportions Π, a closed form solution to the model does not exist. The model can be solved numerically, however, by calculating the 9x9 Jacobian matrix for Π, and explicit derivatives can be calculated using the implicit function theorem. The model was solved numerically using a Newton-Rhapson procedure.

The effect of increasing unemployment on urban location

The model was used to calculate the effect of rising unemployment on the spatial location of unemployment. It was initially calibrated as follows, with an unemployment rate of 5 percent, and benefit rates equal to half the blue collar income.

$N_w = 145$	$I_w = 100$	$T^w_a = 5$	$T^w_b = 7.5$	$T^w_c = 10$
$N_b = 140$	$I_b = 80$	$T^b_a = 10$	$T^b_b = 7.5$	$T^b_c = 5$
$N_o = 15$	$I_o = 40$	$T^o_a = 0$	$T^o_b = 0$	$T^o_c = 0$

The solution Π was found for this initial calibration, and then the unemployment rate was raised progressively, assuming that only blue collar workers lost their jobs. The model was solved for two different parameter values, reflecting differ-

ent relative preferences for consumption goods and the location externality. In the first model, $\beta 1 = 5$ and $\beta 2 = 5$; in the second model consumption of goods is more highly valued, with $\beta 1 = 11$ and $\beta 2 = 5$.

The solution to the first parameterisation of the model is shown graphically in Figures 1-3. Graphs of the proportion of unemployed people living in each location, the proportion of people in each location who are unemployed, and the fraction of the total population living in each location are presented. Graphs for the second parameterisation were not included as they were very similar to the first parameterisation, except (as is discussed below) as unemployment increased unemployed people clustered in a different centre.

In each of the two cases, a threshold effect is observed. Beyond a particular level of total unemployment, the extent to which unemployed people are concentrated into one location accelerates, accompanied by a drop in the total population of that location. The cases differ in that the location of the unemployment is different. In the first case, in which the location externality is valued relatively highly, unemployment concentrates in region c, the centre closest to the blue collar work location (Figure 1). The reason is that this centre is furtherest away from the central city, and thus initially has a smaller white collar population than centre b, and so has the smallest initial wealth externality. As total unemployment rises, unemployment increases in centre c and employed blue collar workers move to centre b to take advantage of the greater location externality despite higher rents and higher transport costs relative to centre c (Figure 3).

In the second case, in which consumption is valued more highly than the externality, the unemployment concentrates in centre b. Jobless people move to this centre to take advantage of the lower rents, as fewer employed people (of both types) initially live there because of the higher transport costs; moreover, as unemployed people move in to centre b, employed people move out, further lowering the rent.

In both cases there is a threshold (which in these models is about 10 percent, but which depends on the parameterisation) after which there is an accelerated concentration of jobless people in one region. It appears that after a certain level of joblessness in a region is reached, there is a tendency for employed people to move out, further accentuating the problem. Note that because all people have idiosyncratic preferences over locations, there will not be a mass migration; rather, the movement is at the margins. The stronger are the idiosyncratic preferences, the less moving occurs and thus the less acute the problems of joblessness concentration.

The effect of benefit levels on urban location

The effect of benefit levels on urban location can be demonstrated by selecting an initial level of joblessness and then varying the income going to the jobless. In this illustration, unemployment of 10 percent was used, and the benefit level was varied from 30 to 50, compared to an income of 80 for blue collar workers and an income of 100 for white collar workers. The model was solved for the same parameterisations as the previous case and the results are graphed in Figures 4-6.

The results are similar to those above in that the jobless tend to cluster in different centres, depending on the way in which the location externality is valued. Nonetheless, the two results have considerable similarity, despite the clustering in different regions: in each case, once the benefit level falls below a particular threshold, almost all unemployed people cluster into the lowest rent region (Figure 4). In the first example, for instance, at benefit levels equal to 40, 11 percent of the unemployed live in region a, 56 percent in region c, and 33 percent in region b; but when benefit levels are dropped to 35, all unemployed people live in location c. This benefit level change also sees the proportion of the population living in region c fall from 31.6 percent to 28.9 percent, as flight by employed people occurs (Figure 6).

Conclusion

This simple model of location choice demonstrates how benefit levels and the aggregate unemployment rate can affect the distribution of jobless people in an urban area when there is a location-based income externality. The externality could be a tendency for crime to be less in rich neighbourhoods than poor neighbourhoods, or schools to be better. In the model, people choose between consumption of a location externality, paid for by rent, and consumption of ordinary goods and services; in equilibrium, people with high incomes tend to live together as they can afford to purchase more of the income externality without sacrificing other goods and services. The model shows that there are threshhold type effects, where small changes in the aggregate jobless rate, or small changes in benefit and income levels for jobless people, can lead to dramatic clustering of jobless people into certain areas. The clustering occurs not only because the people on low incomes choose to live in low rent regions but because of flight of employment people from these regions.

The model has policy implications if the Government is concerned about the consumption of the externality, particularly if the externality is consumed by household members who are different than the household decision maker (as would be the case if the externality was education related). In this case poverty traps could result, as income constraints imposed by the joblessness of one generation could be passed onto a second generation.

Future research

At least three aspects of the issues examined in this paper could be researched further. First, the model could be extended to make it more realistics. For instance, it would be possible to model each household as having two generations, with the location externality affecting the income of the second generation: in this case some results concerning the correlation of intergenerational income could be generated. Secondly, the extent to which location externalities

Figure 1. Location of unemployed persons (percentage of unemployed people living in each region: b1=5. b2=5)

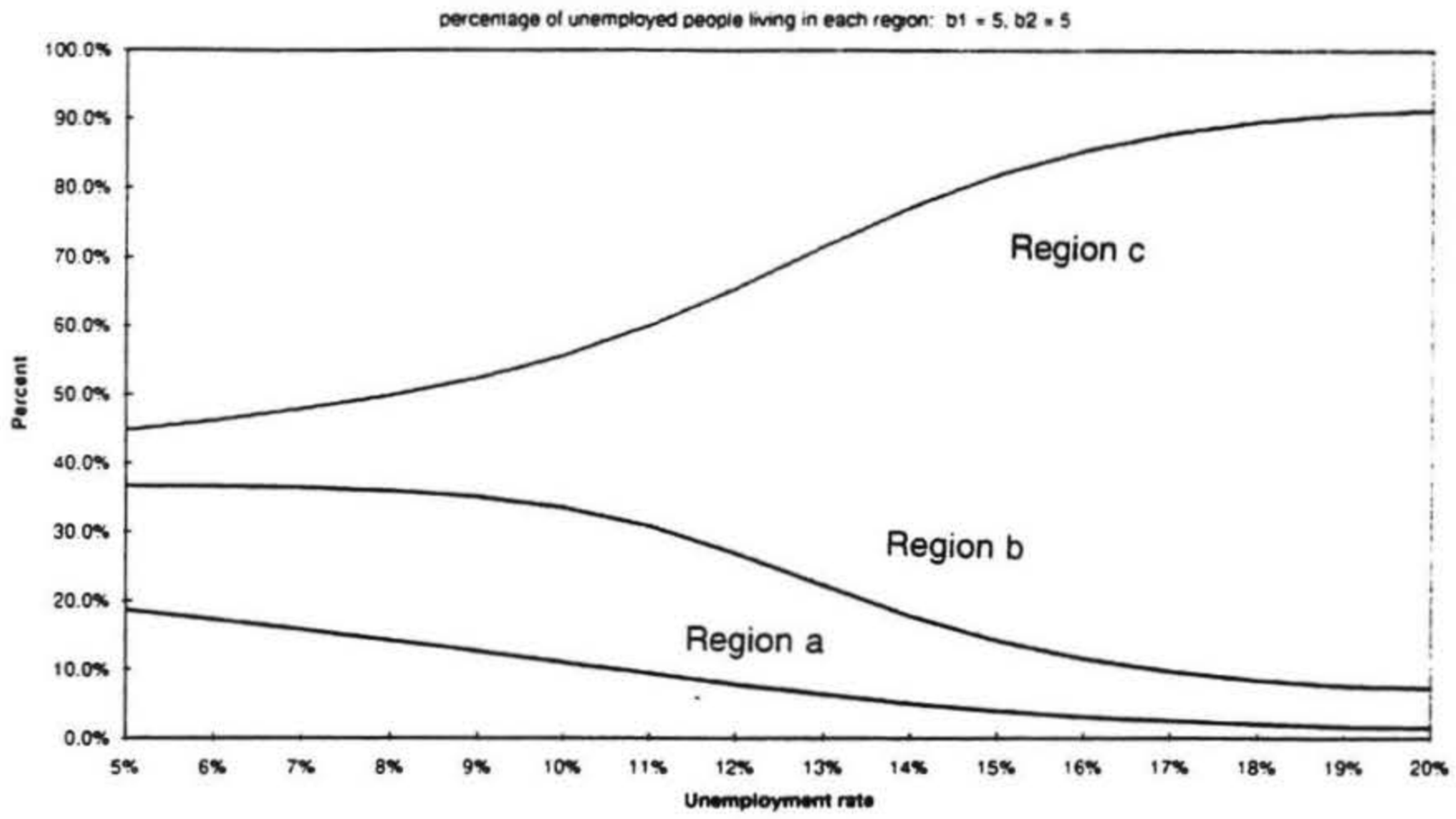


Figure 2. Unemployed rate by region. (percentage of people in region who are unemployed b1=5. b2=5)

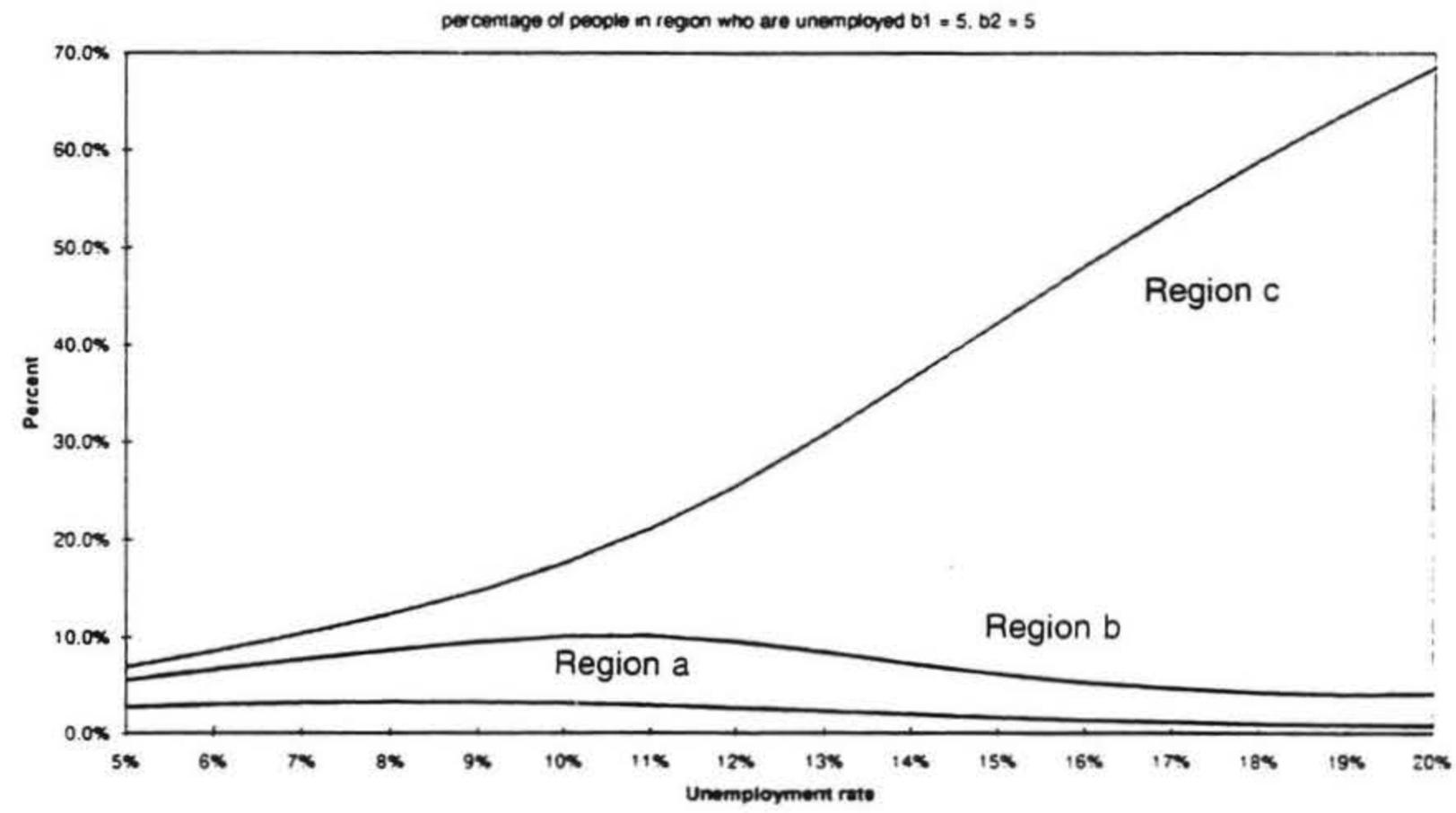


Figure 3. Regional population. (percentage of total population living in each region: b1=5. b2=5)

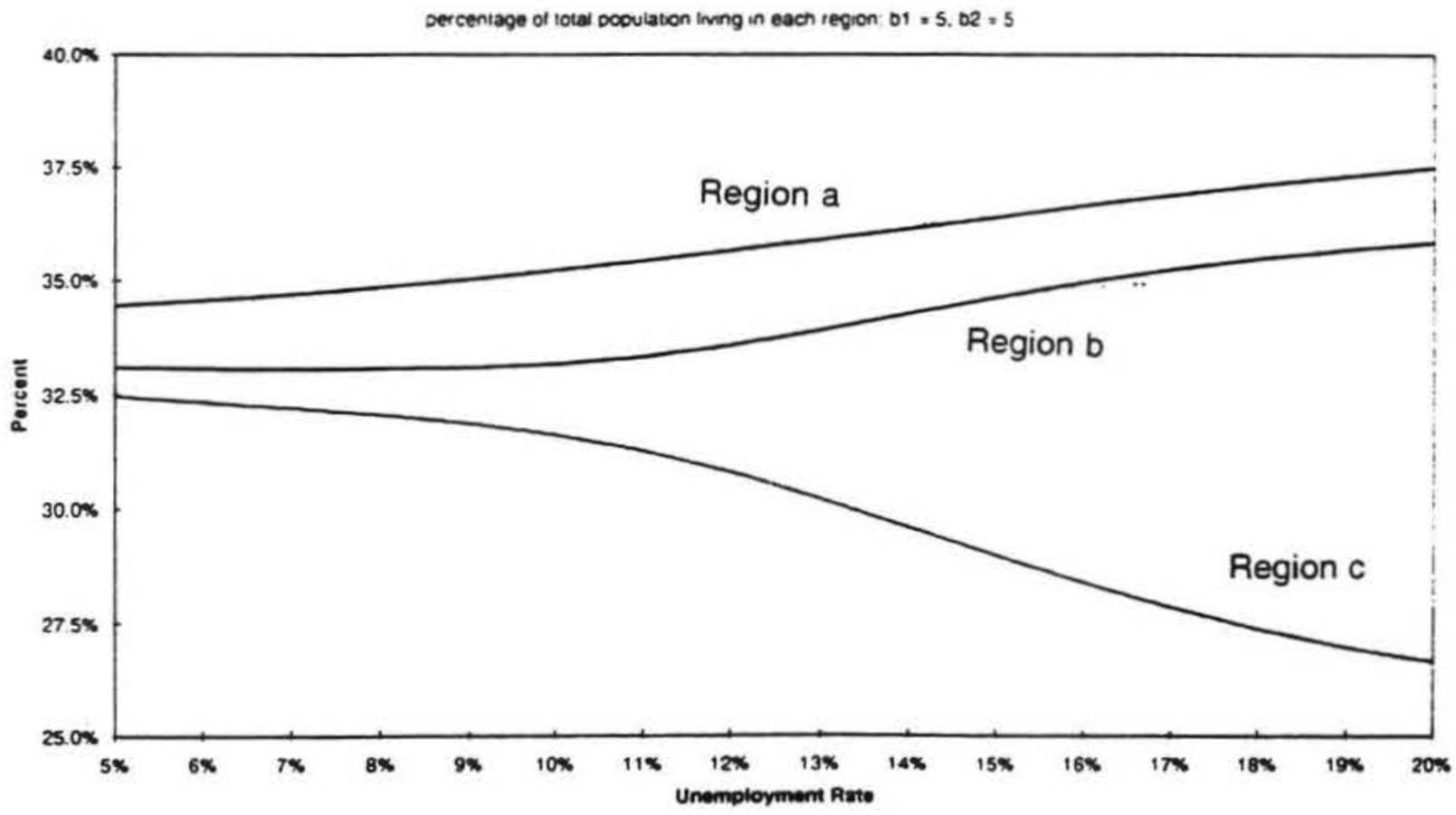


Figure 4. Location of unemployed persons (percentage of unemployed people living in each region: b1=5. b2=5)

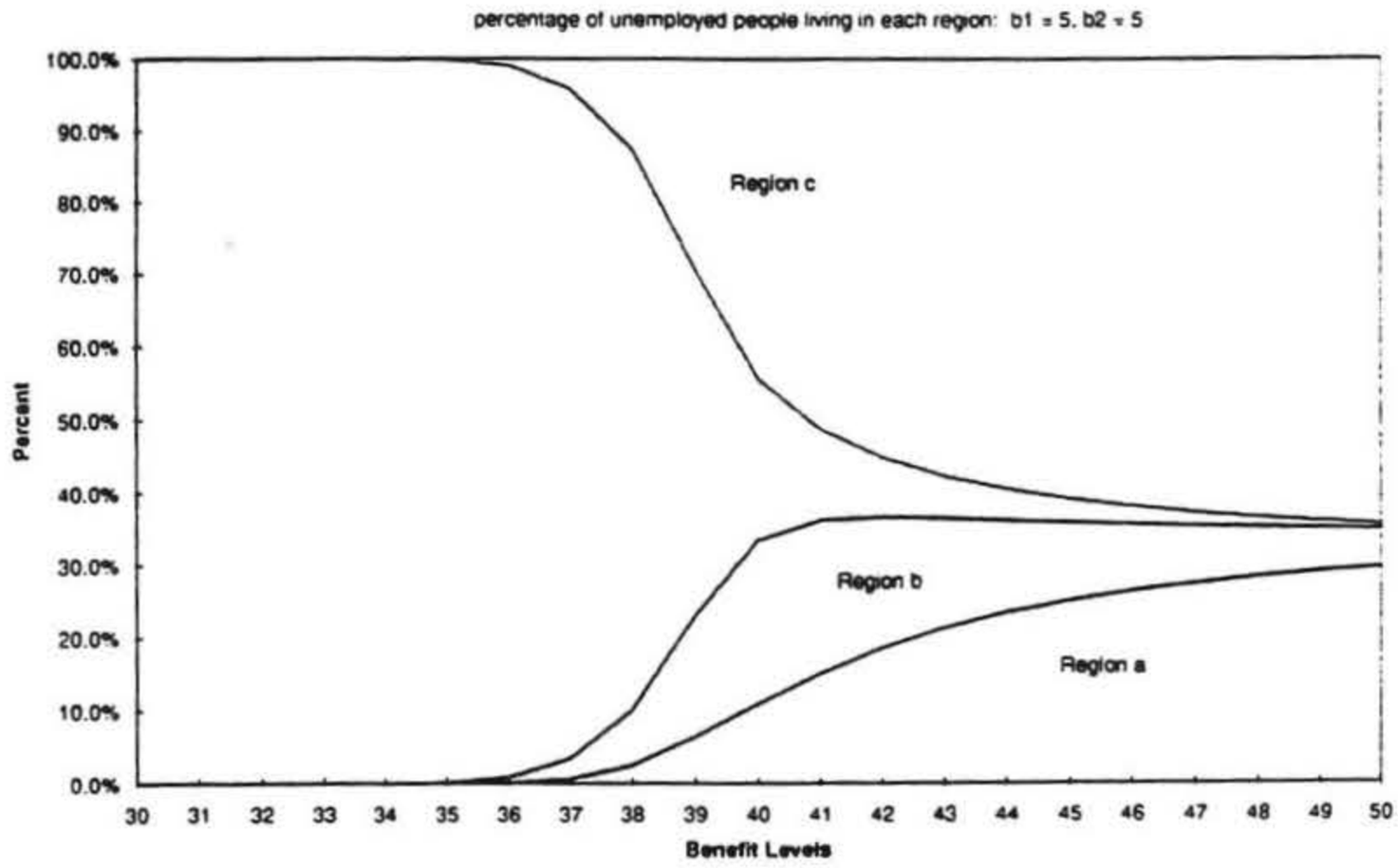


Figure 5. Unemployed rates by region (percentage of people in region who are unemployed: b1=5. b2=5)

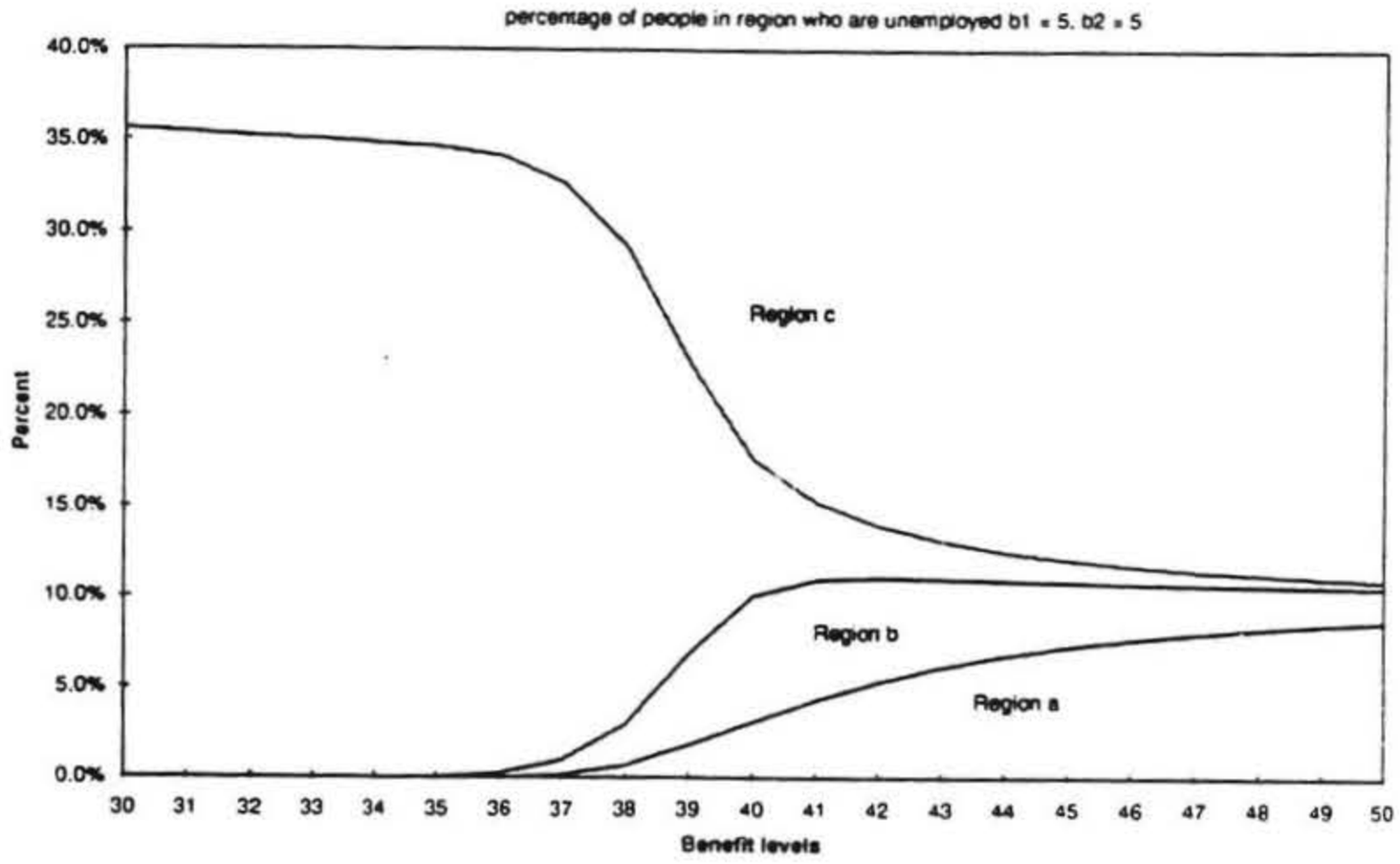
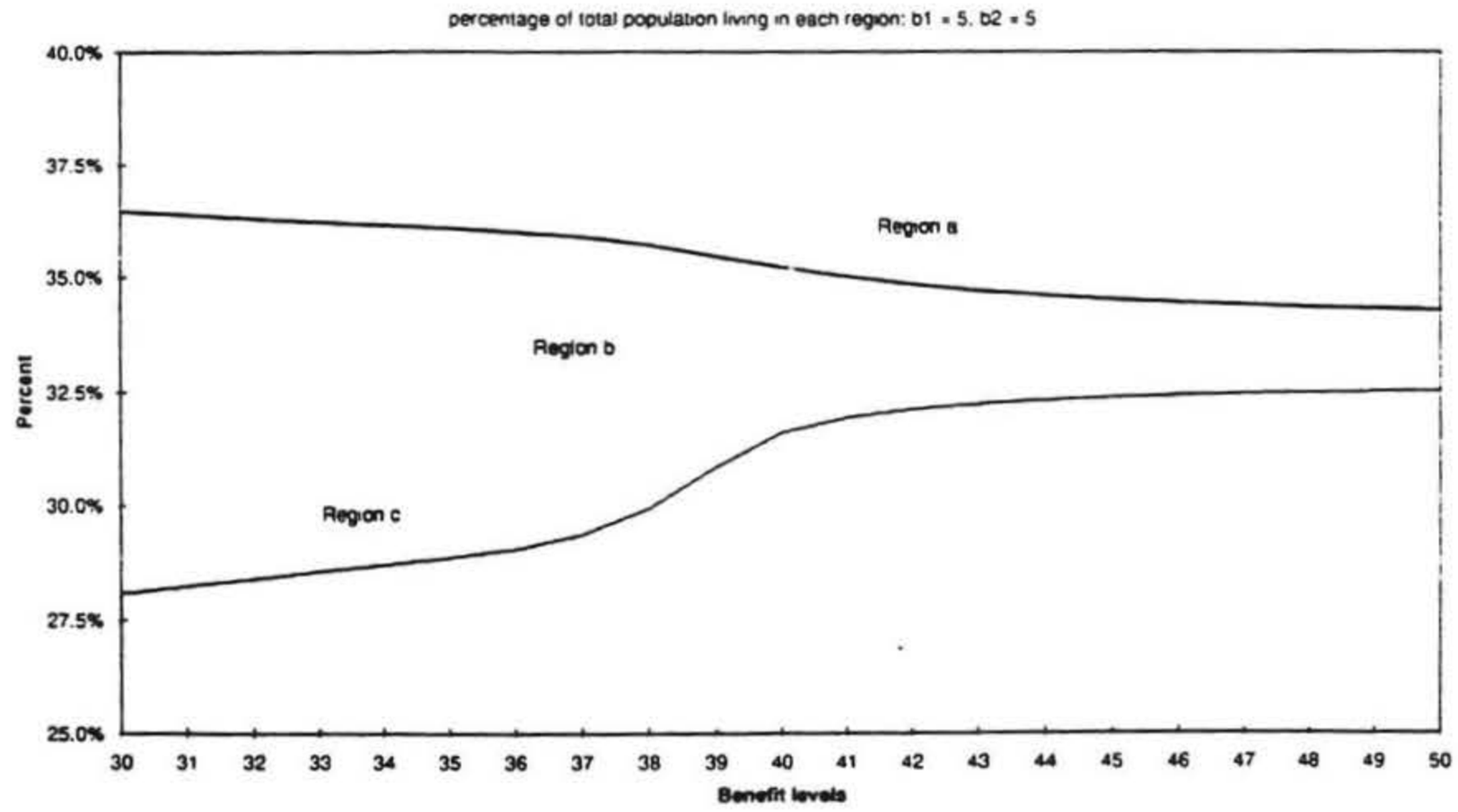


Figure 6. Regional population. (percentage of total population living in each region: b1=5. b2=5)



exist and are important in New Zealand needs to be established. Finally, the broader implications of the model could be tested; for instance, whether at a given aggregate unemployment rate the clustering of beneficiaries has become more concentrated since benefit levels were reduced in 1991.

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