Chapter 5

Regional unemployment and centralised wage bargaining*

5.1 Introduction

Involuntary unemployment is one of the major policy concerns in the European Union (OECD, 2005b). Unemployment levels vary widely between countries, but the variation in unemployment rates between regions within countries is even larger. Unemployment differences between countries in Europe have decreased markedly in the past decade, whereas regional unemployment differences within countries have remained stable. However, in some European countries regional unemployment differences have even increased (OECD, 2005a). Recent evidence on the persistence of regional unemployment differentials in European countries has been provided in several studies1 showing that regional unemployment differentials persist over time and that the unemployment ranking of regions within a country hardly changes.2

One underlying cause of the persistence of regional unemployment disparities is the lack of regional wage flexibility due to centralised wage setting in a large part of Continental Europe. Both the European Commission (2003) and the OECD (1994, 2004, 2005a) advocate decentralisation of wage bargaining in order for wages to adjust more easily to

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*This chapter is based on Toolsema and Zeilstra (2007).

1See e.g., Baddeley, Martin, and Tyler (1998a); Brunello, Lupi, and Ordine (2001); Jimeno and Bentolila (1998); Overman and Puga (2002); and Taylor and Bradley (1997a). See Elhorst (2003a) for an overview.

2Recent evidence by the (OECD, 2005a) shows that 80% of European regions with high unemployment in 1993 still have high unemployment rates in 2003.
local labour market conditions. However, the wage bargaining structure is deeply embedded in the economic and social structure of countries, which are therefore reluctant to follow these recommendations. As a consequence, wage bargaining remains highly centralised in large parts of Continental Europe.\(^3\)

Our aim is to analyse the effect of national institutions on regional labour markets in an economy with centralised wage bargaining; the framework developed in this chapter can be used to study the influence of changes in bargaining power, moving costs, and unemployment benefits on regional labour markets under centralised wage bargaining. Theoretical models with centralised wage bargaining and regional unemployment are still relatively scarce and, although previous studies usually incorporated migration, they did not include participation. We contribute to the existing literature by specifying a model that addresses both migration and participation.

Our theoretical framework consists of four stages encompassing two regions and one sector within one country. Wages are determined at the national level through wage negotiations between employer federation and union. At the regional level individual firms then decide how many workers they want to hire, and working-age individuals determine whether they want to participate in the labour market in their own region, in the other region, or whether they do not want to participate.

In order to enhance our analysis, section 5.2 provides information on wage bargaining in Continental Europe and the influence of wage bargaining on regional labour markets. We describe the model in section 5.3 and its solution in section 5.4. Section 5.5 discusses the effect of different unemployment benefits and different moving costs on regional unemployment differences through the use of simulations. Section 5.6 concludes.

5.2 Wage bargaining

5.2.1 Wage bargaining in Continental Europe

In large areas of Continental Europe wage bargaining is highly centralised. Sectoral wages are determined at the national level rather

\(^3\)Other reasons for the slow implementation of reforms are concerns for equity and social cohesion and doubts that these reforms can effectively increase employment (OECD, 2004).
than at company or regional level. In Austria, Belgium, Finland, Germany, Greece, Ireland, the Netherlands, Norway, Spain, and Sweden wage bargaining takes place predominantly at either the sectoral or national level. Only in Italy and France are wages negotiated at both industry and company level. Moreover, the sectoral wages as negotiated by the union and the employer federation at the national level apply to a large number of people working in that sector. Although union density has decreased over the past decades, collective bargaining coverage remains high (OECD, 2004). In part, due to legal and administrative extensions of agreements, bargaining coverage in most of the abovementioned countries has varied between 79 and 96 percent in 2000. An extensive overview of wage setting institutions and outcomes in Europe can be found in the annual Employment Outlook reports of the OECD (e.g., OECD, 2004, Chapter 3).

5.2.2 Wage bargaining and regional labour markets

The result of the high degree of centralisation of wage bargaining in Continental Europe is that sectoral wages do not vary across regions to the extent that they would if they reflected local labour market conditions. Wages do differ due to skill, firm size and sectoral differences, but less so due to varying local labour market conditions (European Commission, 2003, p. 115). As an example, consider the case of Italy. Brunello et al. (2001) find that real wages in the high unemployment regions of Italy do not depend on local labour market conditions, but rather on the unemployment rate of the leading areas. At the end of the 1960s institutional rules allowing for the existence of regional wage differentials in union contracts were abolished (Brunello et al., 2001). According to Brunello et al. (2001), the abolition of these institutional rules has sharply de-

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4OECD (2004, Table 3.5) and European Commission (2003, Table 27).
5Union density is the number of union members as a percentage of the number of employees.
6Bargaining coverage represents the real extent to which salaried workers are subject to the union-negotiated wages and other conditions of employment.
7An exception is Portugal, with 70% coverage, according to the European Commission (2003, Table 27). According to the OECD (2004, Table 3.5), however, coverage in Portugal exceeds 80%.
increased regional wage differentials in Italy and thereby contributed to the increase in regional unemployment differentials.

The influence of wage-setting institutions on national labour market performance has been given considerable attention.\(^8\) The influence of regional unemployment on regional wages (the *wage curve*)\(^9\) is equally well researched. One of the possible theoretical explanations behind this empirical relationship involves wage bargaining at the local level (see the seminal book by Blanchflower and Oswald, 1994). On the other hand, the influence of wage-setting institutions on regional labour markets has received little attention in the literature. Theoretical articles combining wage bargaining and regional labour markets are relatively scarce, but Faini (1999) is a nice example.

Faini (1999) models the influence of regional trade unions on regional development in a two-region dual economy with skilled and unskilled workers. One region leads with favourable labour market conditions and the other region is backward with less favourable labour market conditions. Faini (1999) employs a *monopoly union model*\(^10\) in which regional unions unilaterally determine the wage rate of the unskilled workers, and firms choose employment. Moreover, he shows that the regional unions raise unskilled wages and hamper growth (especially in the backward region) if labour is immobile. However, if skilled workers are allowed to migrate, regional unions moderate their wage demands to reduce migration. In this situation, regional unions have an incentive to coordinate their wage demands across regions. Faini argues that this would raise unskilled wages (especially in the backward region) and

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\(^8\)Surveys of this literature are provided by, for example, Blau and Kahn (1999) and Nickell and Layard (1999).

\(^9\)In their book *"The wage curve"* Blanchflower and Oswald (1994) establish a downward sloping relationship between individual wages and local unemployment for a dozen countries and claim to have found a new “empirical ‘law’ of economics” (Blanchflower & Oswald, 1994, p. 1). Moreover, they argue that the unemployment elasticity of pay is in general -0.1 (Blanchflower & Oswald, 1994, p. 5). For an introduction to the wage curve, see Blanchflower and Oswald (1995) and for a critical review, see Card (1995). The research by Blanchflower and Oswald has inspired authors such as Nijkamp and Poot (2005), who perform a meta-analysis on a sample of 208 elasticities derived from the literature and find an elasticity of -0.07.

\(^10\)In a monopoly union model the union maximises its utility subject to a labour demand curve. The equilibrium wage is determined by the point of tangency of the union’s utility curve and the labour demand curve of the firm.
decrease economic convergence of the two regions. As a result, Faini (1999) advocates decentralised wage-setting instead of centralised wage setting, and favours increased labour mobility in order to obtain regional convergence.

Another study combining wage bargaining and regional labour markets is Carmeci and Mauro (2002). They include wage bargaining in a neoclassical growth model and show that centralised wage bargaining leads to higher minimum wages than decentralised wage bargaining in regions where the levels of per capita consumption are lower than the medium voter’s consumption. A drawback of Carmeci and Mauro’s (2002) model is that it does not allow for regional migration. Carmeci and Mauro defend the exclusion of migration from their model by stating that it has been developed for the Italian case and migration between the North, and the South of Italy had ceased since the 1970s.

In Hazari and Sgro (1987) the advanced region produces a manufacturing good using union labour, while in the backward region an agricultural product is produced using non-union labour. Each region has a geographically determined specific factor that is fixed in supply. Wage bargaining sets wages above the competitive level in the manufacturing sector and causes unemployment in the advanced region. By contrast, labour is hired beyond the point of zero marginal productivity in the backward region. Consequently, there is disguised unemployment and lower average income in the backward region. These disguised unemployed workers may stay in their own region or migrate to the advanced region where they either find work or receive a benefit. Labour does not move from the manufacturing sector to the agricultural sector. Unemployed manufacturing workers remain in the urban region, unless they originally came from the rural region, then they may return. In Hazari and Sgro’s (1987) model an increase in the specific factor in the rural region raises welfare, but increases disguised unemployment.

Suedekum (2004) presents a two-region one-sector model with skilled regionally mobile labour and unskilled immobile labour equally distributed across both regions. Unskilled wages are determined by centralised wage bargaining, whereas skilled labour is paid according to its marginal product. Output is produced according to a Cobb-Douglas

\footnote{Due to the fixed amount of the specific production factor, marginal labour productivity drops to zero after a certain point.}
technology. The aim of Suedekum’s (2004) model is to show the disequilibrium effects of selective migration. Initially, high skilled labour is equally distributed across both regions within the country, North and South. If an asymmetric exogenous negative shock hits the North, its demand for unskilled labour decreases, skilled labour payments decline, and skilled labour migrates to the South. The outflow of skilled workers shifts the marginal productivity curve of unskilled workers further downwards in the North. Conversely, the inflow of skilled workers shifts the marginal productivity curve of unskilled workers upwards in the South. As a result, unemployment further increases in the North and decreases in the South. An asymmetric negative shock in the North therefore causes an upward spiral in the South and a downward spiral in the North.

Finally, Sanner (2003) analyses the desirability of two unemployment insurance schemes to workers and firms in two regions under different degrees of centralisation of wage bargaining. The two regions differ only with respect to the availability of infrastructure. The rich region is endowed with more infrastructure and, as a consequence, has higher labour productivity than the poor region. Workers are either employed or unemployed and may migrate from the poor to the rich region to maximise utility. Sanner’s paper compares a uniform payroll tax scheme for both regions to a scheme where the payment depends on the systematic risk of unemployment of a worker. Taxes are adjusted in order to balance the unemployment insurance budget, either at the federal level (in the case of a uniform regime) or regional level (in a differentiated regime).

Although Sanner does not focus on regional unemployment, some findings on unemployment can nonetheless be distilled from his paper. Under both unemployment insurance schemes, a higher degree of centralisation of wage bargaining leads to lower wages and thereby higher employment and lower unemployment. Centralisation leads to lower wage demands due to internalisation of the negative effect of higher wages on aggregate employment, and consequently, on unemployment insurance payments. Moreover, under a differentiated unemployment insurance payment regime, an increase in centralisation has a stronger negative effect on wages than under a uniform payment regime, because the unemployment risk of higher wages is spread over fewer unions.

We use a Right to Manage (RTM) wage bargaining model, which is
more general than Faini’s *monopoly union* model. In an RTM model union and employer bargain on the wage rate, and the employer chooses the number of employees he wants to hire.\(^\text{12}\) Moreover, whereas previous studies have not taken account of participation, and in some cases also neglected migration, we include the participation behaviour of individuals in a model with both regional unemployment and migration under centralised wage bargaining.

## 5.3 The model

The country in our model has one sector and two regions \((r = 1, 2)\),\(^\text{13}\) and the two regions have different labour market conditions. Without loss of generality, we denote the region with the less favourable labour market conditions as region 1. Firms are identical and transport costs of goods are zero, but migration costs are positive. The aim is to model the influence of national institutions on regional labour markets after a *general* positive demand shock hits the economy; a positive demand shock raises output per firm and thereby raises employment. Assuming that the relative number of firms in region 1, \(N_1/N_2\) with \(N_r\) the number of firms in region \(r\) does not change, a *general* positive demand shock raises employment in both regions in the same proportion.

In the first stage wages are determined by wage bargaining at the

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\(^{12}\)An alternative model is the *Efficient Bargaining* (EB) model (see e.g., Teulings & Hartog, 1998) in which the union and employer federation negotiate over both wage and employment. However, we think that an EB model is less realistic, especially in the case of Continental Europe where wage bargaining is highly centralised. First, in an EB bargaining model the firm has a commitment problem (Teulings & Hartog, 1998, Section 4.2). During negotiations the union and firm can agree to a wage-employment combination that lies north-east of the labour demand curve. However, after the wage has been set, the firm nevertheless has an incentive to set employment according to its own labour demand curve (and lower than that agreed with the union). Second, reaching agreements on employment levels for all individual firms is hardly feasible under centralised wage bargaining (see e.g., Aidt & Tzannatos, 2002, Table 3.1). To cite an example, in the Netherlands unions and employer federations briefly considered negotiating wages and employment simultaneously during the 1970s. However, this idea was short-lived, because the employers objected to it (Teulings & Hartog, 1998, Section 4.4). Nowadays, employment is generally not covered in centralised wage bargaining in the Netherlands (Van de Wijngaert, 1994, Chapter 3).

\(^\text{13}\)Unless stated otherwise, the subscript of a variable indicates the region.
national level. In the second stage individual employers maximise profits by choosing the optimal number of employees they want to hire, given the outcome of the national wage bargaining process. In the third stage individuals maximise their utility by deciding whether they want to participate in the labour market in their own region, in the other region, or whether they do not want to participate. In the fourth stage the product market clears. In this model, depending on the parameters, the change in participation and the level of migration determine the distribution of unemployment over the regions. We discuss the four stages of the model in more detail below.

5.3.1 Stage 1: Nash wage bargaining

In stage 1 after the positive demand shock, union and employer federation engage in Nash bargaining at the national level, according to a Right To Manage wage bargaining model. The result of the wage bargaining process is a nationwide wage rate \( W \). We interpret \( W \) to be, say, an annual wage, and all calculations are on an annual basis.

The union is assumed to maximise the sum of all working-age individuals’ income. The objective function of the union is \( V - A \), where \( V \) is the sum of all working-age individuals’ income when the union reaches an agreement with the employer federation; and \( A \) is the sum of all working-age individuals’ income when bargaining breaks down (i.e. the outside option). For inactive people the financial equivalent \( b^I \) of the leisure they can enjoy because they do not search for a job is interpreted as income. Thus, the union aims to maximise

\[
V - A = E(W) W + (J - E(W) - I) b + Ib^I - A,
\]

where \( E \) is the number of employed people, \( W \) is wage, \( J \) is the number of working-age individuals, \( I \) is the number of inactive people, \( b \) is the unemployment benefit, and \( b^I \) is the ‘income’ of the inactive people.

We assume that the value of the union’s outside option if bargaining breaks down is given by \( A = Jb \). This can be interpreted as all individuals receiving a benefit \( b \) if the employer federation and the union do not reach an agreement during the wage negotiations. Further, we assume that from the union’s perspective there is no difference between the utility of an individual who is unemployed and the utility of an individual who chooses to be inactive. Therefore, \( b = b^I \) Using \( A = Jb \)
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and \( b = b,^I \) the union’s objective function (5.1) reduces to

\[
V - A = E(W)(W - b).
\]  

(5.2)

The objective function of the employer federation is \( \bar{\Pi}(W) - P \), where \( \bar{\Pi} \) is the sum of all firms’ profits \( (\sum_{n=1}^{N} \Pi_n(W)) \) when the union reaches an agreement with the employer federation, and \( P \) is the sum of all firms’ profits when bargaining breaks down (i.e. the outside option). The employer federation’s outside option \( P \) is set to zero for simplicity. As a result, the objective function of the employer federation is represented by \( \bar{\Pi}(W) - 0 = \bar{\Pi}(W) \).

Bargaining power is given by \( \beta \) for the union, and \( 1 - \beta \) for the employer federation, with \( 0 \leq \beta \leq 1 \). The national wage level is determined by

\[
\max_{W} (E^* (W) (W - b))^{\beta} (\bar{\Pi}(W) - 0)^{1-\beta}.
\]  

(5.3)

Note that if \( \beta = 1 \), the union unilaterally sets the wage rate,\(^{14}\) whereas if \( \beta = 0 \), the employer federation has full power to impose a wage rate on the union.\(^{15}\)

5.3.2 Stage 2: Hiring decision

In stage 2, each employer \( n_r \) in region \( r (n_r = 1, \ldots, N_r) \) determines the number of employees he wants to hire \( (E_n) \) in order to maximise profits \( (\Pi_n) \), given the nationwide wage \( W \). The total number of firms in the country is equal to \( N = N_1 + N_2 \). Production is determined by supply and demand factors, as will be discussed in more detail in section 5.3.4. Firms are ex ante identical, and therefore in equilibrium, each firm produces the same amount of goods and uses the same amount of labour. Regional trade may occur and transport costs are assumed to be zero.

Since firms are identical, total (national) employment is \( E = NE_n \) and total regional employment is \( E_r = N_r E_n \), for \( r = 1, 2 \). In other words, employment in region \( r \) only depends on the number of firms in region \( r \) and the number of jobs per firm.

\(^{14}\)The situation in which \( \beta = 1 \) is known as the monopoly union model.

\(^{15}\)The situation in which \( \beta = 0 \) may be called the monopoly employer federation model, where the wage rate is equal to the outside option of the employees \( (b) \).
We assume that total demand for labour does not exceed the number of working-age individuals in the country. Moreover, we assume that the increase in labour demand is small enough, the working-age population in each region is large enough and/or moving costs are small enough, and that preferences of individuals are such that, after migration, there will be no unfilled vacancies. In other words, each employer is able to hire the number of employees he demands.

5.3.3 Stage 3: Migration and participation decisions

Before the general positive demand shock, the number of working-age individuals in region $r$ equals $J_r^0$, employment equals $E_r^0$, and the number of firms equals $N_r^0$. Where the zero superscript denotes variables on time $t = 0$, i.e., before the demand shock. Since firms are identical, each firm hires the same number of employees and regional distribution of employees is the same as regional distribution of firms. Furthermore, because we study the effect of a general positive demand shock, employment increases in both regions in the same proportion. As a consequence, the regional distribution of previously employed people is the same as the current regional distribution of firms ($E_1^0/E_2^0 = N_1/N_2$). Note that to relax this assumption implies that people may migrate, because one region now has more firms and therefore more jobs than before. We abstract from this, because we study the effect of a general rise in employment and analyse the resulting migration and participation decision.

A working-age individual $j_r^0$ in region $r$ ($j_r^0 = 1, \ldots, J_r^0$) is either employed, unemployed, or inactive. The individuals $j_r$ who were jobless (either unemployed or inactive) before the positive demand shock decide whether they want to search for a job after the demand shock. We assume that previously employed individuals are not fired and do not quit their jobs. A previously jobless person may search for a job in either his own region or in the other region. Due to moving costs, a jobless individual seeks work outside his own region only if labour market conditions are sufficiently more favourable.\footnote{We ignore e.g. dramatical differences in regional characteristics.} On the other hand, he migrates only if he has already found a job in the other region. In
other words, we do not allow for speculative migration.\footnote{Though speculative migration is common practise in the United States, it seldom occurs in the Netherlands (Van Dijk, Folmer, Herzog, & Schlottmann, 1989).}

In sum, in stage 3 a jobless individual $j^0_r$ maximises his expected utility over three mutually exclusive options:

1. stay in his own region $r$ and try to find a job there;

2. try to find a job in the other region, and move there if and only if one is found;

3. stay in his own region $r$ and become or remain inactive.

Formally, there will be a fourth possibility, which is to move to the other region and be inactive there. However, an individual will never use this option due to the costs of moving $F$. Note that moving costs are incurred once, whereas the benefits of obtaining a job $W^*$ are more permanent. In order to make moving costs comparable, we define moving costs $F$ as the annual equivalent value of one-time moving costs.\footnote{Assuming that wages represent annual wages. Note that the annual equivalent value is the net present worth expressed as an annuity of one-time moving costs over the planning horizon, computed at the discount rate. In other words, the annual equivalent value $F$ represents an average annual value in current money terms, which sums to the net present value of one-time moving costs.}

The migration and participation decisions depend on labour market conditions, i.e. probability of finding a job in region $r$ ($\rho_r$), regional characteristics ($c_r$), wages ($W$), unemployment benefits ($b$), individual’s preference for leisure ($L$), and costs of moving ($F$).

An individual’s utility ($U$) is a function of his income ($W$ or $b$) net of moving costs ($F$), the characteristics of his home region, and leisure time ($L$), so $U = U(\text{income}, c_r, L)$. The amount of leisure an individual can enjoy depends on whether or not he is active in the labour market. For simplicity we assume that an individual has no leisure if he has a job or is searching for a job and has leisure time ($\bar{L}$) if he is inactive.

Individuals are identical in their characteristics and preferences with the exception of their preference for leisure. Suppose that individuals $j^0_r = 1, \ldots, J^0_r$ in region $r$ are ordered from having a low utility of leisure to having a high utility of leisure. Individuals with the lowest utility of leisure will want to supply their labour first. In both regions the individual with the highest preference for leisure obtains the same utility
(\(U_L^{\text{max}}\)) from leisure. We further assume that the utility function of individual \(j_r^0\) is additively separable, and that his utility from leisure is linearly increasing in \(j_r^0\). This results in the following (expected) utility function of an inactive individual \(j_r^0\) having zero income in region \(r\)

\[
U_{j_r^0}^{|\text{inactive}} = U_{j_r^0}(0, c_r, \bar{L}) = u(0, c_r) + \tilde{u}_{j_r^0}(\bar{L}) = u(0, c_r) + \frac{j_r^0}{j_0} U_L^{\text{max}}. \tag{5.4}
\]

Now let \(U_{j_r}^{|\text{employed}} = U(W, c_r, 0)\) represent the utility of an employed person in region \(r\) receiving wage \(W\) and having no leisure. If the individual is a migrant from the other region, moving costs \(F\) are subtracted from \(W\). The utility of an unemployed person receiving benefit \(b\) in region \(r\) is equal to \(U_{j_r}^{|\text{unemployed}} = U(b, c_r, 0)\). We assume that \(\frac{\partial U}{\partial W} > 0\), \(\frac{\partial^2 U}{\partial W^2} < 0\), \(\frac{\partial U}{\partial b} > 0\), \(\frac{\partial^2 U}{\partial b^2} < 0\), \(\frac{\partial U}{\partial L} > 0\), \(\frac{\partial^2 U}{\partial L^2} < 0\), \(\frac{\partial U}{\partial F} < 0\), and \(\frac{\partial^2 U}{\partial F^2} > 0\).

The expected utility of individual \(j^0\) living in region 1 (the region with the least favourable labour market conditions) in the event that he searches for a job in his own region, is given by

\[
E U_{j_1^0}^{|\text{stay}} = \rho_1 U(W, c_1, 0) + (1 - \rho_1) U(b, c_1, 0) = \rho_1 U_{1,\text{emp}}^1 + (1 - \rho_1) U_{1,\text{unemp}}^1, \tag{5.5}
\]

where in the last line we use a superscript/subscript of \(U\) to represent the origin/destination region of the individual. If the individual searches for a job in the other region, his expected utility is given by

\[
E U_{j_1^0}^{|\text{move}} = \rho_2 U(W - F, c_2, 0) + (1 - \rho_2) U(b, c_1, 0) = \rho_2 U_{2,\text{emp}}^1 + (1 - \rho_2) U_{1,\text{unemp}}^1 \tag{5.6}
\]

and if he does not search for a job, but instead decides to be inactive, his expected utility is given by

\[
E U_{j_1^0}^{|\text{inactive}} = u(0, c_1) + \frac{j_1^0}{j_1} U_L^{\text{max}} = U_{1,c}^1 + \frac{j_1^0}{j_1} U_L^{\text{max}}. \tag{5.7}
\]

Analogous to individuals living in region 1, the expected utility of an individual \(j\) living in region 2 (the region with more favourable labour
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market conditions) if he searches for a job in his own region is given by

\[
EU^2_{j_0}\big|_{\text{stay}} = \rho_2 U(W, c_2, 0) + (1 - \rho_2) U(b, c_2, 0)
\equiv \rho_2 U^2_{2,\text{emp}} + (1 - \rho_2) U^2_{2,\text{unemp}}
\]  

(5.8)

and in case he decides to be inactive is given by

\[
EU^2_{j_0}\big|_{\text{inactive}} = u(0, c_2) + \frac{J_0^2}{J_2^2} U^\text{max}_L
\equiv U^2_{2,c} + \frac{J_0^2}{J_2^2} U^\text{max}_L.
\]  

(5.9)

For an individual from region 2, the expected utility of searching for a job in his own region is always higher than the expected utility of searching for a job in region 1; this is because the probability of finding a job in region 2 is higher than the probability of finding a job in region 1; and \( F \) is equal to zero if a job is found in the home region. Consequently, individuals living in region 2 do not search for a job in region 1.

Below we use \( \gamma_{1,M} \) to denote the fraction of previously jobless people in region 1 who decide to search for a job in region 2 (and migrate if and only if they find a job there), and \( \gamma_{1,A} \) and \( \gamma_{2,A} \) to denote the fraction of previously jobless people in region 1 and 2 who decide to search for a job (become active). As a result, the fraction of jobless people in region 1 who search for a job in region 1 equals \( \gamma_{1,A} - \gamma_{1,M} \). A fraction \( \gamma_{2,A} \) of jobless people in region 2 searches for a job in region 2, supplemented with the fraction \( \gamma_{1,M} \) of jobless people from region 1 who search for a job in region 2. Taking into account migration and participation, the probabilities (\( \rho_r \)) of finding a job in region 1 and region 2 are then the ratios of the number of vacancies in a region to the number of people who look for a job in that region

\[
\rho_1 = \frac{N_1 E_n - E^0_1}{(\gamma_{1,A} - \gamma_{1,M})(J^0_1 - E^0_1)},
\]

(5.10)

\[
\rho_2 = \frac{N_2 E_n - E^0_2}{\gamma_{2,A} (J^0_2 - E^0_2) + \gamma_{1,M} (J^0_1 - E^0_1)}
\]

(5.11)

(provided, of course, that these expressions are between 0 and 1).

In equilibrium, the marginal individual will be indifferent between the different options. Therefore, in equilibrium, the marginal individual
has equal expected utility for all options. For the marginal individual (we denote this individual by $k_1$) living in region 1, $EU_{k_1}^1|_{stay} = EU_{k_1}^1|_{move} = EU_{k_1}^1|_{inactive}$, and for the marginal individual $k_2$ living in region 2, $EU_{k_2}^2|_{stay} = EU_{k_2}^2|_{inactive}$. Note that the marginal individuals in the two regions do not have the same expected utility because of moving costs. Moreover, the probability of finding a job is not identical in both regions. Migration does not lead to equal probabilities of finding a job in both regions, because expected utility also depends on regional characteristics $c_r$ and moving costs $F$.

### 5.3.4 Stage 4: Production and consumption

In stage 4 the firms engage in production. The production function of firm $n$ is given by

$$Y_n = \varphi E_n^\alpha,$$

where $Y_n$ is output of firm $n$, $E_n$ is employment at firm $n$, and $\varphi$ and $\alpha$ are parameters with $\varphi > 0$ and $0 < \alpha < 1$. Note that this is a Cobb-Douglas production function where capital is independent of firm $n$ and taken as given (and incorporated in the parameter $\varphi$). Firm-level demand is given by the constant-elasticity demand function

$$Y_n = \theta P_n^{-\varepsilon},$$

where $Y_n$ is the quantity demanded, $P_n$ is the price, $\theta$ is a parameter ($\theta > 0$), and $\varepsilon$ is the price elasticity of demand for the firm’s product, which is treated as constant and exogenous (see e.g., Layard, Nickell, & Jackman, 1991, chapter 2; K. C. Lee & Pesaran, 1993). Note that $\varepsilon$ is the firm specific elasticity of demand, not the elasticity of aggregate demand $\varepsilon^{ad}$. $\varepsilon = \varepsilon^{ad}$ in case of monopoly or full collusion, $\varepsilon = N\varepsilon^{ad}$ for the symmetric Cournot case, and $\varepsilon \rightarrow \infty$ with perfect competition. In other words, $\varepsilon$ increases if aggregate demand is more elastic and if firms behave more competitively. We assume that $\varepsilon > 1$.

Demand and supply determine the product’s price and the quantity demanded. The product market clears immediately.
5.4 Solution of the model

We use backward induction to solve for the equilibrium of the model. The solution of the model is split into two parts. As we have assumed for simplicity, that parameters are such that in each region sufficient workers (either living there, or coming from the other region) will be available to fill all vacancies, we can initially skip the solution of the third stage of our model. Even without solving this stage explicitly, we are able to solve for equilibrium price (stage 4), equilibrium employment (stage 2), and equilibrium wage (stage 1), as described in section 5.4.1. The solution of the third stage describes equilibrium migration and participation and is discussed in depth in section 5.4.2.

5.4.1 Wages and employment

In stage 4 the product market clears. Demand and supply determine the product price and the quantity demanded, which are

\[ P_n^* = \left( \frac{\phi}{\theta} E_n^\alpha \right)^{-\frac{1}{\varepsilon}} \quad \text{and} \quad Y_n^* = \theta (P_n^*)^{-\varepsilon}. \]  

(5.14a)

We use the superscript * to denote equilibrium values of the variables.

In stage 2, each firm maximises its profits \( \Pi_n \) by selecting the number of jobs \( E_n \). Since we have

\[ \Pi_n = P_n^* \phi E_n^\alpha - W E_n \]
\[ = \theta \frac{1}{\varepsilon} \phi^{1-\frac{1}{\varepsilon}} E_n^{\alpha(1-\frac{1}{\varepsilon})} - W E_n, \]

(5.15)

the first-order condition for profit maximisation yields

\[ E_n^* = \left( \frac{\theta^{-\frac{1}{\varepsilon}} \phi^{-(1-\frac{1}{\varepsilon})}}{\alpha (1 - \frac{1}{\varepsilon})} W \right)^{1/(\alpha(1-\frac{1}{\varepsilon}))}. \]

(5.16)

The second-order condition requires \( \varepsilon > 1 \) (which we assume to hold).

In stage 1 the Nash bargaining between union and employer federation results in a wage \( W \), which satisfies

\[ \max_W (E^*(W) (W - b))^{\beta} (\Pi(W) - 0)^{1-\beta}, \]

(5.17)
where \( \bar{\Pi}(W) \) is given by

\[
\bar{\Pi}(W) = N \theta^{\frac{1}{\varepsilon}} \varphi^{1-\frac{1}{\varepsilon}} \left( \frac{E^*}{N} \right)^{\alpha(1-\frac{1}{\varepsilon})} - WE^*
\]

\[
= N \left[ \theta^{\frac{1}{\varepsilon}} \varphi^{1-\frac{1}{\varepsilon}} \left( \frac{\theta^{-\frac{1}{\varepsilon}} \varphi^{-(1-\frac{1}{\varepsilon})}}{\alpha (1 - \frac{1}{\varepsilon})} \right)^{\alpha(1-\frac{1}{\varepsilon})} - \left( \frac{\theta^{-\frac{1}{\varepsilon}} \varphi^{-(1-\frac{1}{\varepsilon})}}{\alpha (1 - \frac{1}{\varepsilon})} \right)^{\alpha(1-\frac{1}{\varepsilon})-1} \right]^{\alpha(1-\frac{1}{\varepsilon})}
\]

\[\times W^{\alpha(1-\frac{1}{\varepsilon})-1}\]

\[= N \delta W^{\alpha(1-\frac{1}{\varepsilon})-1}, \tag{5.18}\]

where we use \( \delta \) to refer to the term between square brackets, which is a function of parameters \((\theta, \varphi, \varepsilon, \) and \(\alpha)\) only. The first-order condition for maximisation of (5.17) can be written as

\[
\beta (E^* (W) (W - b))^{\beta-1} \left( E^* (W) + \frac{dE^* (W)}{dW} (W - b) \right) (\bar{\Pi}(W))^{1-\beta}
\]

\[+ (E^* (W) (W - b))^{\beta} (1 - \beta) (\bar{\Pi}(W))^{-\beta} \frac{d\bar{\Pi}(W)}{dW} = 0, \tag{5.19}\]

which can be simplified to

\[
\beta \left( E^* (W) + \frac{dE^* (W)}{dW} (W - b) \right) \bar{\Pi}(W)
\]

\[+ (1 - \beta) E^* (W) (W - b) \frac{d\bar{\Pi}(W)}{dW} = 0. \tag{5.20}\]

Note that by using the envelope theorem

\[
\frac{d\bar{\Pi}(W)}{dW} = -E^* (W). \tag{5.21}\]

We can moreover derive that

\[
\frac{\bar{\Pi}(W)}{E^*(W)} = \frac{\Pi(W)}{E^*_n(W)} = \frac{1 - \alpha (1 - \frac{1}{\varepsilon})}{\alpha (1 - \frac{1}{\varepsilon})} W. \tag{5.22}\]

\[\text{Using the envelope theorem we have } \frac{d\bar{\Pi}(W)}{dW} = \frac{d\Pi(W)}{dW} = \frac{\partial \Pi_n(W)}{\partial E^*_n} \frac{\partial E^*_n}{dW} + \frac{\partial N \Pi_n}{dW} = 0 \frac{\partial E^*_n}{dW} - NE^*_n(W) = -NE^*_n(W) = -E^*(W).\]
5.4 Solution of the model

Using (5.16) we have

\[ E^*(W) + \frac{dE^*(W)}{dW} (W - b) = \left(1 + \frac{1}{\alpha (1 - \frac{1}{\varepsilon})} - 1 \left(1 - \frac{b}{W}\right)\right) E^*(W). \] (5.23)

Using (5.21) - (5.23) we can solve (5.20) for \( W \) to give the equilibrium wage

\[ W^* = \left(1 + \beta \left(\frac{1}{\alpha (1 - \frac{1}{\varepsilon})} - 1\right)\right) b. \] (5.24)

It appears that \( W^* \) depends only on the parameters \( \alpha, \beta, \varepsilon \), and on unemployment benefits \( b \). \( W^* \) turns out to be a positive markup over \( b \). An increase of the unemployment benefits raises the equilibrium wage. When substituting \( W^* \) into (5.16) we see that equilibrium employment depends on the parameters \( \alpha, \beta, \varepsilon \), and \( b \), as well as on \( N, \theta \) and \( \varphi \).

5.4.2 Migration and participation

Now we solve for the equilibrium of the third stage of the model, in which working-age people decide whether they want to participate and if so in which region they will search for a job. In equilibrium the fraction of people who want to migrate (\( \gamma_{1,M} \)) and the fractions of people who want to become active (\( \gamma_{1,A} \) and \( \gamma_{2,A} \)) are such that the expected utility of the marginal individual is equal for all options.

The equilibrium is determined by the following equalities (using (5.5) - (5.9)):

\[
\begin{align*}
\rho_2 U_{2,emp}^1 + (1 - \rho_2) U_{1,unemp}^1 &= U_{1,c}^1 + \frac{j_1^0}{J_1^0} U_{L}^{\text{max}}, \\
\rho_1 U_{1,emp}^1 + (1 - \rho_1) U_{1,unemp}^1 &= U_{1,c}^1 + \frac{j_1^0}{J_1^0} U_{L}^{\text{max}}, \\
\rho_2 U_{2,emp}^2 + (1 - \rho_2) U_{2,unemp}^2 &= U_{2,c}^2 + \frac{j_2^0}{J_2^0} U_{L}^{\text{max}},
\end{align*}
\]

(5.25) - (5.27)

where it should be emphasised that the fractions \( \frac{j_1^0}{J_1^0} \) and \( \frac{j_2^0}{J_2^0} \) in (5.25) - (5.27) equal \( \gamma_{1,A} \) and \( \gamma_{2,A} \). In order to derive the equilibrium for stage 3, we seek a solution for the fraction of people living in region 1 who want to search for a job in region 2 (\( \gamma_{1,M} \)), and solutions for the fractions of people who become active in region 1 (\( \gamma_{1,A} \)) and region 2 (\( \gamma_{2,A} \)).
Solving (5.25) for $\rho_2$ we have
\[
\rho_2 = \frac{U_{1,c} + U_{L}^{\text{max}} \gamma_{1,A} - U_{1,\text{unemp}}^{1}}{U_{2,\text{emp}}^{1} - U_{1,\text{unemp}}^{1}}
\]
(5.28)
and using (5.27) we have
\[
\rho_2 = \frac{U_{2,c}^{2} + U_{L}^{\text{max}} \gamma_{2,A} - U_{2,\text{unemp}}^{2}}{U_{2,\text{emp}}^{2} - U_{2,\text{unemp}}^{2}}.
\]
(5.29)
Consequently, we can write $\gamma_{2,A}$ as a function of $\gamma_{1,A}$
\[
\gamma_{2,A} = \left[ \frac{U_{2,\text{unemp}}^{2} - U_{2,c}^{2}}{U_{L}^{\text{max}}} + \frac{U_{1,c}^{1} - U_{1,\text{unemp}}^{1}}{U_{L}^{\text{max}}} \right] \gamma_{1,A}
\]
\[
\quad \equiv d_1 + d_2 \gamma_{1,A},
\]
(5.30)
where we use $d_1$ and $d_2$ to refer to the first and second term between square brackets, respectively.

Furthermore, using (5.28) and (5.11) and the expression in (5.30) for $\gamma_{2,A}$, we can write $\gamma_{1,M}$ as a function of $\gamma_{1,A}$
\[
\gamma_{1,M} = \frac{(N_{2}E_{n}^{*} - E_{2}^{0})(U_{2,\text{emp}}^{1} - U_{1,\text{unemp}}^{1})}{(J_{1}^{0} - E_{1}^{0})(U_{1,c}^{1} + U_{L}^{\text{max}} \gamma_{1,A} - U_{1,\text{unemp}}^{1})}
\]
\[
\quad - \frac{(J_{2}^{0} - E_{2}^{0})}{(J_{1}^{0} - E_{1}^{0})} (d_1 + d_2 \gamma_{1,A}).
\]
(5.31)
Using (5.10) and (5.26), we can also write $\gamma_{1,M}$ as a function of $\gamma_{1,A}$
\[
\gamma_{1,M} = \gamma_{1,A} - \frac{(N_{1}E_{n}^{*} - E_{1}^{0})(U_{1,\text{emp}}^{1} - U_{1,\text{unemp}}^{1})}{(U_{1,c}^{1} + U_{L}^{\text{max}} \gamma_{1,A} - U_{1,\text{unemp}}^{1})(J_{1}^{0} - E_{1}^{0})}.
\]
(5.32)
Finally, using (5.31) and (5.32), we obtain the (implicit) solution for $\gamma_{1,A}$. Using $\gamma_{1,A}, \gamma_{2,A}$ and $\gamma_{1,M}$, we have the following expressions for participation and migration:

\textit{Participation in region 1} = \begin{align*}
N_{1}E_{n}^{*} + (1-\rho_1)(\gamma_{1,A} - \gamma_{1,M})(J_{1}^{0} - E_{1}^{0}) \\
+ (1-\rho_2)\gamma_{1,M}(J_{1}^{0} - E_{1}^{0}),
\end{align*}
(5.33)
\textit{Participation in region 2} = N_{2}E_{n}^{*} + (1-\rho_2)\gamma_{2,A}(J_{2}^{0} - E_{2}^{0}),
(5.34)
\textit{Migration} = \gamma_{1,M}(J_{1}^{0} - E_{1}^{0})\rho_2,
(5.35)
where the first term in (5.33) and the first term in (5.34) represent regional employment in region 1 and 2, respectively. The second and third terms in (5.33) represent the number of unemployed individuals living in region 1 who search for a job in regions 1 and 2, respectively. The second term in (5.34) is equal to the number of unemployed individuals living in region 2 who search for a job in region 2. Migration in (5.35) is equal to the number of people from region 1 who search for a job in region 2, $\gamma_{1,M}(J_1^0 - E_1^0)$, multiplied by the probability, $\rho_2$, of finding a job in region 2.\(^{20}\)

Note that we obtain an implicit solution for $\gamma_{1,A}$, defined by a quadratic equation. As a result we do not have an explicit analytical solution. Consequently, we run simulations to obtain results in the next section.

5.5 Simulation

In this section we investigate the influence of the level of the unemployment benefits and moving costs on regional labour markets in case of a general positive demand shock. The set up of the simulation is described in section 5.5.1, and results are discussed in section 5.5.2.

5.5.1 Set up

For ease of interpretation, we have normalised our simulation with respect to the unemployment benefits $b$, i.e. $b = 1$. As a result, the economy faces a positive demand shock equal to a 10% increase in employment in the benchmark situation where $b = 1$.

We will simulate the effect of different unemployment benefits $b$ and different moving costs $F$, where $b$ ranges between [0.93-1.03] and $F$ ranges from [0-0.1].

Regional labour market characteristics

Table 5.1 describes the regional labour market characteristics of our

\(^{20}\)We multiply $\gamma_{1,M}(J_1^0 - E_1^0)$ with $\rho_2$ to obtain migration, because individuals move if and only if they find a job in the other region.
The outflow region (region 1) is assumed to be relatively small compared to the inflow region (region 2). Both the number of firms and the number of working-age individuals are smaller in region 1. Moreover, initial employment in region 1 is lower in both absolute and relative (jobs per inhabitant) terms than in region 2. Succinctly put, region 1 can be seen as a small peripheral region with relatively unfavourable labour market conditions, and region 2 can be regarded as a large core region with relatively favourable labour market conditions.

Since we model the effect of a general positive demand shock, the ratio of the number of firms in region 1 relative to region 2 is not allowed to change and is equal to the ratio of previous regional employment in region 1 relative to region 2 ($N_1^0/N_2^0 = E_1^0/E_2^0 = N_1^0/N_2^0 = E_1^0/E_2^0$).

### Table 5.1: Regional labour market characteristics

<table>
<thead>
<tr>
<th>region 1</th>
<th>region 2</th>
<th>region 1/region 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_1 = 2$</td>
<td>$N_2 = 8$</td>
<td>$N_1/N_2 = N_1^0/N_2^0 = 0.25$</td>
</tr>
<tr>
<td>$E_1^0 = 19.77$</td>
<td>$E_2^0 = 79.10$</td>
<td>$E_1^0/E_2^0 = 0.25$</td>
</tr>
<tr>
<td>$J_1^0 = 40$</td>
<td>$J_2^0 = 130$</td>
<td>$J_1^0/J_2^0 = 0.31$</td>
</tr>
</tbody>
</table>

**Utility function**

We adopt the following utility function for an individual $j_r$ in region $r$.

This function satisfies the conditions explicated in section 5.3.3,

$$U_{j_r} = a_1 \sqrt{\text{income}} + a_2 \sqrt{c_r} + Da_3 j_r^{00} \sqrt{L},$$

(5.36)

where

\[
\text{income} = \begin{cases} 
W^* & \text{if individual } j_r^0 \text{ is employed,} \\
W^* - F & \text{if individual } j_r^0 \text{ finds a job in the other region,} \\
b & \text{if individual } j_r^0 \text{ is unemployed,} \\
0 & \text{if individual } j_r^0 \text{ is inactive,}
\end{cases}
\]

\[
D = \begin{cases} 
1 & \text{if individual } j_r^0 \text{ is inactive,} \\
0 & \text{otherwise,}
\end{cases}
\]

\[21\text{The values of } E_1^0 \text{ and } E_2^0 \text{ in table 5.1 must satisfy two requirements. First, we study the effect of a general positive demand shock, therefore } E_1^0/E_2^0 \text{ should equal } N_1/N_2. \text{ Second, we want to study the effect of a general positive demand shock of } 10\% \text{ in our benchmark situation, therefore } 1.1(E_1^0 + E_2^0) \text{ should equal } E^* \text{ for } b = 1. \text{ As a result of these requirements, } E_1^0 \text{ and } E_2^0 \text{ are fractions instead of whole numbers.} \]
and $a_1, a_2, a_3$ are the weights of income, regional characteristics, and leisure in total utility.

**Other parameter values**

We simulate the model for different $(F, b)$ combinations and find feasible solutions for $F$ in the interval $[0, 0.1]$ and $b$ in the interval $[0.93, 1.03]$. To isolate the effect of differences in labour market conditions on migration, we abstract from differences in regional characteristics by setting $c_1$ equal to $c_2$. We assume that individuals put more weight on income than on leisure and put the lowest weight on regional characteristics ($a_1 > a_3 > a_2$). In line with empirical findings by Willman (2002), we set the output-labour elasticity $\alpha$ equal to 0.7.\(^{22}\) We assume that union and employer federation have equal bargaining power. The price elasticity of product demand of an individual firm $\varepsilon$ is set to 20. Finally, the parameters $\theta$ and $\varphi$ determine the production scale. The values of the different parameters are reported in table 5.2.

<table>
<thead>
<tr>
<th>parameter</th>
<th>value</th>
<th>parameter</th>
<th>value</th>
<th>parameter</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b$</td>
<td>[0.93 - 1.03]</td>
<td>$\varphi$</td>
<td>4</td>
<td>$a_1$</td>
<td>1</td>
</tr>
<tr>
<td>$F$</td>
<td>[0 - 0.1]</td>
<td>$\varepsilon$</td>
<td>20</td>
<td>$a_2$</td>
<td>0.5</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.7</td>
<td>$c_1$</td>
<td>1</td>
<td>$a_3$</td>
<td>0.75</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.5</td>
<td>$c_2$</td>
<td>1</td>
<td>$\theta$</td>
<td>10</td>
</tr>
<tr>
<td>$\theta$</td>
<td>10</td>
<td>$L$</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**5.5.2 Results**

In this section we analyse the effect of different unemployment benefits and moving costs on the national labour market and on regional employment, unemployment, participation, migration, and unemployment differentials.

**National labour market**

In the *benchmark situation* $b = 1$ and the economy faces a positive demand shock equal to a 10 % increase in total employment ($E^* = 1.1$).

\(^{22}\)Willman (2002) estimates a Cobb-Douglas production function for the Euro area and finds an output-labour elasticity of 0.71.
$E^0)$. As can be seen from table 5.3, lower unemployment benefits lead to lower wages and higher employment. By contrast, higher unemployment benefits result in higher wages and less employment.

<table>
<thead>
<tr>
<th>$b$</th>
<th>$W^*$</th>
<th>$E^*$ increase (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.93</td>
<td>1.17</td>
<td>35%</td>
</tr>
<tr>
<td>1.00</td>
<td>1.25</td>
<td>10%</td>
</tr>
<tr>
<td>1.03</td>
<td>1.29</td>
<td>1%</td>
</tr>
</tbody>
</table>

The results in this table reflect the response of $E^*$ and $W^*$ to different values of $b$ given the values of all other parameters. Since almost all parameter values are not empirically observed, the results also do not have empirical meaning.

Regional labour markets
The solution of the third stage of the model consists of two different roots for $\gamma_{1,A}$, a low one and a high one (see section 5.4.2). Fortunately, we can discard the low root, because it is either negative, or leads to negative probabilities of finding a job. We are left with a unique solution for $\gamma_{1,A}$.

Regional employment
Similar to national employment, regional employment increases if unemployment benefits decrease, because lower benefits lead to lower wages (see figure 5.1). Moving costs on the other hand do not influence regional employment, because regional employment depends only on the number of firms in a region and the number of employees per firm. Regional employment rates range between [50%-72%] in region 1 and between [62%-81%] in region 2 (figure 5.1).

Unemployment benefits and regional participation
The influence of unemployment benefits on the regional participation rate is somewhat more complicated to unravel than its effect on regional

---

23All variables (regional employment, participation, unemployment, and migration) in figures 5.1, 5.2, 5.3, and 5.5 are presented as a percentage of the working-age population in a region.
employment. On the one hand, individuals are more willing to participate if *unemployment benefits increase*, because they receive higher benefits if they fail to find a job. On the other hand, higher benefits raise wages, lower employment, and lead to a lower probability of finding a job. This effect lowers the expected benefit of searching for a job and negatively affects participation. Overall, the effect of an increase in unemployment benefits on participation turns out to be slightly negative (figure 5.2). This is in line with the negative effect of unemployment benefits on male labour participation we found in the empirical analysis in chapter 4. By way of contrast, unemployment benefits had a positive effect on female labour participation in the empirical analysis of chapter 4. Note that regional participation rates hardly change due to changes in unemployment benefits. The regional participation rate in region 1 lies between 73.16% and 73.68, and the regional participation rate in region 2 ranges from 79.65% to 81.14% (figure 5.2). The effect on participation is more visible if we take a look at the numerator of the participation rate, i.e. the number of people who participate in region 1 and region 2. On average, the number of people who participate increases by 3.7% in region 1, and decreases by 2.6% in region 2, if unemployment benefits increase.

**Moving costs, migration and participation in region 1**

In order to understand how moving costs affect regional participation in region 1, we first analyse how moving costs affect the fraction of jobless people from region 1 who want to search for a job in the other region, \( \gamma_{1,M} \), and then how moving costs affect the fraction of jobless individuals from region 1 who choose to participate in the labour market, \( \gamma_{1,A} \).

*Higher moving costs* decrease the willingness to search for a job in the other region. As a result, the fraction of jobless people living in region 1 who search for a job in region 2, \( \gamma_{1,M} \), decreases, as does migration (see figure 5.5 discussed thoroughly below). This has the effect that the probability of finding a job in region 1, \( \rho_1 \), decreases, whereas the probability of finding a job in region 2, \( \rho_2 \), increases. Let us next, consider \( \gamma_{1,A} \). The decrease in the probability of finding a job in region 1 decreases expected utility of searching for a job in region 1, and eventually lowers the fraction of jobless individuals from region 1 who want to participate in the labour market \( \gamma_{1,A} \).
Figure 5.1: Employment, moving costs $F$, and benefit $b$.

Figure 5.2: Participation, moving costs $F$, and benefit $b$. 

Figure 5.3: Unemployment, moving costs $F$, and benefit $b$.

Figure 5.4: Unemployment difference ($\Delta U$), moving costs $F$, and benefit $b$. 
However, we can verify that, in our example, the decrease of $\gamma_{1,M}$ exceeds that of $\gamma_{1,A}$, which implies that the fraction of individuals from region 1 who want to be active in the labour market in region 1, $\gamma_{1,A} - \gamma_{1,M}$, increases. To obtain a more precise picture of the different components of participation in region 1, we analyse (5.33) according to which the number of participants in the labour market in region 1 is equal to $N_1 E^*_n + (1 - \rho_1)(J^0_1 - E^0_1)(\gamma_{1,A} - \gamma_{1,M}) + (1 - \rho_2)\gamma_{1,M}(J^0_1 - E^0_1)$. An increase in moving costs does not affect the first component $N_1 E^*_n$. However, the increase in moving costs raises the second component (i.e. the number of individuals who fail to find a job in region 1), because both $1 - \rho_1$ and $\gamma_{1,A} - \gamma_{1,M}$ increase. The third component (i.e. the number of individuals from region 1 who fail to find a job in region 2) decreases if moving costs increase, because both $1 - \rho_2$ and $\gamma_{1,M}$ decrease.

In sum, there are two opposite effects of an increase in moving costs on participation in region 1. On the one hand, an increase in moving costs decreases the fraction of jobless individuals from region 1 who want to search for a job, $\gamma_{1,A}$, which has a negative effect on participation. On the other hand, the fraction of jobless individuals from region 1 who search for a job in region 2, $\gamma_{1,M}$, decreases. Since the probability of finding a job is larger in region 2 than in region 1, the decrease in $\gamma_{1,M}$ leads to an increase in the number of unemployed individuals in region 1, as can also be seen in figure 5.3. Overall, an increase in moving costs slightly increases participation in region 1 (see figure 5.2). Admittedly, the effect of higher moving costs on the participation rate in region 1 is hardly visible in figure 5.2, because both participation and the number of working-age individuals increases if moving costs increase. Since the participation rate is the ratio of participation and the number of working-age individuals, the participation rate does not increase very much. The effect on participation is more visible if we examine the numerator of the participation rate, i.e. the number of people who participate in region 1. On average, the number of people who participate in region 1 increases by 4.1% in region 1 if moving costs rise.

**Moving costs, migration and participation in region 2**

Now let us consider region 2. The increase in the probability of finding a job in region 2, $\rho_2$, resulting from higher moving costs, raises expected utility of searching for a job for individuals from region 2. Eventually this results in a higher fraction of jobless individuals from region 2, who
want to participate in the labour market, $\gamma_{2,A}$. It can be seen from (5.34) that participation in region 2 is equal to $N_2E^*_n + (1 - \rho_2)(J^0_2 - E^0_2)\gamma_{2,A}$. The first component $N_2E^*_n$ is not affected by an increase in $F$. The second component (i.e. the number of individuals from region 2 who fail to find a job) decreases, because the decrease in $1 - \rho_2$ exceeds the increase in $\gamma_{2,A}$ (see figure 5.3).

Therefore, the increase in moving costs also has two opposite effects on the labour market in region 2. First, the fraction of jobless individuals from region 1 who search for a job in region 2 decreases; as a result, fewer vacancies in region 2 are filled by individuals originating from region 1. This has a negative effect on participation in region 2. Second, the fraction of jobless individuals from region 2 who want to participate increases, which has a positive effect on participation in region 2. Overall an increase in moving costs slightly decreases participation in region 2 (see also figure 5.2). Again, the effect is difficult to observe in figure 5.2, because both the number of active individuals and the number of working-age individuals in region 2 decreases. Since the participation rate is the ratio of participation and the number of working-age individuals, the participation rate does not decrease by much. The effect on participation is more visible if we look at the numerator of the participation rate, i.e. the number of people who participate in region 2. On average the number of people who participate in region 2 decreases by 1.1% in region 2 if moving costs rise.

### Moving costs, migration and regional unemployment differentials

The variation in unemployment rates is substantial. Unemployment rates range between [1%-24%] in region 1 and [1%-18%] in region 2, while regional unemployment differentials range between [1%-6%]; see figures 5.3 and 5.4.

Generally, an increase in the unemployment benefits raises regional unemployment (see, figure 5.3) and raises regional unemployment differences (see figure 5.4). One exception is the situation in which moving costs are high (part A of figure 5.4); in this case unemployment benefits may reduce regional unemployment differentials. The willingness to migrate normally decreases if unemployment benefits rise, but not if moving costs are high. The reason for this is the following. First, recall that in equilibrium the marginal individual in region 1 has the same expected utility of searching in his home region, of searching in region
Figure 5.5: Migration, moving costs $F$, and benefit $b$.

An increase in the unemployment benefits raises equilibrium wage $W^*$ as a result both $U(W^*, c_1, 0)$ in (5.37) and $U(W^* - F, c_2, 0)$ in (5.39) increase. However, $W^*$ has a stronger effect on $U(W^* - F, c_2, 0)$ than on $U(W^*, c_1, 0)$ because utility is concave ($\frac{\partial U}{\partial W} > 0, \frac{\partial^2 U}{\partial W^2} < 0$). The difference is larger if moving costs $F$ are high because the slope of the utility function is much steeper at $W^* - F$ than at $W^*$. As a result the effect on utility of an increase in $W^*$ is much higher for $U(W^* - F, c_2, 0)$ than for $U(W^*, c_1, 0)$. Finally, note that an increase in $b$ affects the
other terms in (5.37) and (5.39) as well. However, for high values of $F$ the afore-mentioned effect dominates the other effects. Searching in the other region therefore becomes more attractive if unemployment benefits increase for high values of $F$. More individuals will search for a job in the other region, and migration increases. Note that this effect disappears when active searching does not lead to benefit entitlement.

5.6 Conclusions

In this chapter we have developed a general framework to study the influence of moving costs, unemployment benefits and changes in bargaining power on regional labour markets under centralised wage bargaining. Using this framework, the effect of the first two variables on regional employment, unemployment, migration, and participation have been simulated. The theoretical literature on regional labour markets under centralised wage bargaining is relatively sparse, therefore the novelty of this chapter is our inclusion of participation behaviour in a model with regional migration and regional unemployment under centralised wage bargaining.

We have conducted a simulation example with different unemployment benefit levels and different moving costs in which we found that lower unemployment benefits and lower moving costs lead to smaller regional unemployment differentials. Because the reduction of regional unemployment differentials is a common policy goal, a first policy implication is that lower unemployment benefits may result in smaller regional unemployment differentials. However, this policy may conflict with another policy aim, namely that to ensure equity between employed and jobless people. Furthermore, we found that, if moving costs are high, the lowering of unemployment benefits could have adverse effects on unemployment differentials.

A second policy implication is that regional unemployment differentials may be reduced by lowering moving costs. Note that moving costs are not limited to the costs of the physical movement of an individual from one region to another. Moving costs may also entail the additional (search) costs an individual encounters if he searches for a job in the other region instead of in his own region. Generally, it is harder to obtain information on job vacancies in other regions than to acquire information on vacancies in the own region. Italy is one exam-
ple (Faini, 1999). According to Faini (1999), this lack of information is caused by public sector agencies that still hold a legal monopoly on job placement activities and do not provide information on job vacancies in other regions. Moreover, individuals may also incur costs associated with selling their own house and searching for and buying another house in the destination region. In the Netherlands, for example, people have to pay a tax of 6% of the property value if they want to buy a house, the so-called “overdrachtsbelasting.” An elaborate overview of the influence of housing market characteristics, regulations, and institutions on regional labour mobility can be found in the ‘Employment Outlook’ of the OECD (2005a, Chapter 2), which also discusses the influence of both the unemployment benefit system and active labour market policies on regional labour market mobility.

In a future application of our framework we may study the effect of differences in bargaining power. Another topic for further theoretical research is the inclusion of location decisions of firms.

We examine in the next chapter the empirical effect of unemployment benefits and other national and regional variables on regional unemployment in the European Union.