Chapter 3

Labour participation: Theoretical framework

3.1 Introduction

The labour economics literature contains a multitude of theoretical models explaining labour supply. Labour supply models may differ with respect to the unit of analysis (individual, family), their structure (static, dynamic) and their context (e.g. neoclassical, search).

The static neoclassical model of individual behaviour is the theoretical starting point of this chapter, which we use to show the difference between the labour force participation decision and the hours of work decision. A setback of this standard model is that it is very cumbersome to incorporate the influence of unemployment in order to explain labour participation. Although negligible at the individual level, the interaction between unemployment and labour force participation is important at the regional level.

A common denominator of most theoretical models is that a person will participate if the benefits of doing so exceed the costs. The theoretical framework in this chapter uses this common denominator as a starting point and then integrates aspects of other models into a unified framework of individual labour force participation. The next step is to aggregate this microeconomic framework across individuals to obtain an explanatory model of regional participation rates.

The chapter is set up as follows. In section 3.2 some issues specific
to modelling labour supply in terms of participation instead of hours of work are addressed. The differences between hours of work and participation are illustrated by using several basic models. The theoretical framework of individual labour force participation is formulated in section 3.3.1, while in section 3.3.3 the labour force participation framework is aggregated in order to explain regional participation rates. Interactions specific to regional participation, e.g. the interaction between regional participation and unemployment, are discussed in section 3.4. Finally, concluding remarks are presented in section 3.5.

3.2 Participation versus hours of work

While for the most part the same variables have been shown to influence both the participation decision and the hours of work decision, the effects of these variables may be rather different for these decisions (cf. Lewis, 1972). Moreover, the participation decision depends on the levels of utility associated with participating and non-participating. In contrast, the optimum number of hours of work is determined by the marginal rate of substitution between leisure and consumption. In section 3.2.1 the basic static labour supply model is used to illustrate this. In section 3.2.2 the relation between labour supply and unemployment is discussed, and two possible views on the regional participation rate are presented in the context of a static model and a life-cycle model in section 3.2.3.

3.2.1 Participation and hours of work in the static neoclassical model

In the static neoclassical core model an individual is supposed to maximise his utility by choosing a particular consumption-leisure combination. Consumption is financed by working in the market at a certain wage at the expense of leisure time. We will use this model to illustrate the difference between the hours of work decision and the participation decision.

In the core model an individual maximises his utility function ($U$)
subject to a budget constraint ($bc$) and a time constraint ($tc$) (cf. Pencavel, 1986)

$$\max_{x,l} U = U(x, l| O, \varepsilon), \quad \text{(3.1)}$$

$$\text{s.t. } px = wh + y, \quad \text{(3.2)}$$

and \( T = h + l, \quad \text{(3.3)}$$

where

\( x \) = consumption of commodities,
\( l \) = leisure,
\( h \) = hours of work,
\( T \) = total available time,
\( w \) = wage rate,
\( O \) = observable personal characteristics,
\( \varepsilon \) = individual “tastes” unobservable to the researcher,
\( p \) = fixed price of the bundle of commodities \( x \),
\( y \) = non-wage income.

The utility function is real valued, continuous and quasi-concave,\(^1\) with a positive partial derivative with respect to both \( x \) and \( l \). A graphical illustration of a solution of the maximisation problem is shown in figure 3.1. At the interior optimum \( A \) the indifference curve is tangent to the budget constraint and the individual offers \( h^* \) hours of labour and consumes \( x^* \) commodities. Furthermore, the negative of the real wage equals the marginal rate of substitution of leisure for commodities

$$-\frac{w}{p} = \frac{\partial U/\partial l}{\partial U/\partial x}. \quad \text{(3.4)}$$

The reduced form equations for leisure and hours of work can be derived by solving (3.4) jointly with the budget constraint (3.2)

$$l = l(\frac{w}{p}, y| O, \varepsilon),$$

and since \( T = l + h, \)

\(^1\)The assumption of a quasi-concave utility function is needed to satisfy the second-order conditions for a constrained maximum.
Figure 3.1: Individual labour supply: interior solution.

\[ h = h\left(\frac{w}{p}, y \mid O, \varepsilon\right) \text{ if } h > 0 \]


If real wages rise, the number of hours of work may either increase (figure 3.2, graph I) or decrease (figure 3.2, graph II). The latter occurs if the positive substitution effect (the movement along the old utility curve \( U \) from point \( A \) to point \( B \)) is outweighed by the negative income effect (the movement from point \( B \) on utility curve \( U \) to point \( C \) on curve \( U' \)). This phenomenon results in a backward bending supply curve (cf. Killingsworth, 1983, pp. 12-13). The influence of a wage increase on the labour force participation decision in this model, conversely, can only be zero or positive. The increase in real wages (figure 3.2) does not change the participation status of the individual. In fact, his real wage has to fall substantially before he withdraws from the labour market (figure 3.3, graph II). Alternatively, a large increase in non-wage income (figure 3.3, graph I) or a stronger preference for leisure (figure 3.3, graph III) will induce him to refrain from participating.

At this point it is useful to introduce a concept that is closely linked
3.2 Participation versus hours of work

Figure 3.2: The effect of a real wage increase on hours of work.

to the participation decision, the reservation wage. The reservation wage is the highest wage at which a person will not participate in the labour market. In figure 3.3 the reservation wage is equal to the highest real wage at which a person remains in the corner solution point A’.

In sum, a wage change or a change in another variable alters a person’s participation status if two conditions are met: (i) Obviously, the variable has to change in the right direction; and (ii) the change in the variable is sufficiently large to make a difference. The size of the necessary adjustment depends on the distance between the current position of the individual and his corner solution. The closer the real market wage is to the reservation wage \( (w/p)^r \) of an individual (see part I figure 3.4), the less a variable has to change in order to alter a person’s participation status. In contrast, if the real market wage \( (w/p) \) is far below an individual’s reservation wage (see part II and III of figure 3.4) variables have to change more dramatically to induce a change in participation status. In other words, the real market wage (see part II, figure 3.4) has to increase substantially, or the individual’s preferences (see part III, figure 3.4) have to change drastically to affect the participation decision.
3.2.2 Hours of work, participation and unemployment

The effect of a variable on hours of work may differ from the effect on the participation decision, as discussed in the previous section. This is also true for labour market conditions, such as the unemployment rate, which is commonly used as a proxy for labour market tightness. Attention is paid below to the effect of unemployment on labour supply in terms of hours of work in a static neoclassical model of individual labour supply. Afterwards, two possible effects of unemployment on labour participation are discussed.

Unemployment and hours of work

The effect of unemployment on hours of work is indeterminate for a single person household taking decisions in a static context. Despite several attempts, no satisfactory integration of unemployment and hours of work in the core neoclassical model has yet been accomplished.

Hartley and Revankar (1974) try to incorporate uncertainty due to the existence of unemployment in the neoclassical individual labour sup-
Figure 3.4: Reservation wage versus real market wage.

ply model. The employment status of an individual in their model is given by a binary random variable, and the probability of being employed depends negatively on the unemployment rate. A person receives unemployment insurance payments if he is unemployed. If a person is employed, his earnings depend on a known wage rate and the number of hours worked. Due to the randomness of unemployment, consumption and leisure are random variables too. An individual maximises his utility, which depends on the expected values of consumption and leisure, since the utility function is assumed to be without certainty bias (i.e. people are risk neutral). The expected values of consumption and leisure are conditional on the hours of labour supplied.

In the Hartley and Revankar model real wages and the probability of unemployment appear to have a positive effect on labour supply, whereas real unemployment compensation and real non-wage income have a negative impact. The positive effect of the probability of unemployment can be illuminated by decomposing the effect of the probability of unemployment on planned labour supply into an income and a substitution effect. The substitution effect is positive: in order to preserve the same level of utility an individual has to increase his labour
supply if the probability of becoming unemployed increases. The income effect can be either positive or negative. If leisure is a normal good and, by implication, work is inferior, the income effect is negative. Hartley and Revankar (1974) postulate that as long as the larger substitution effect is not offset by the smaller income effect, the probability of unemployment will have a positive effect on planned labour supply.

Sjoquist (1976) criticises the Hartley and Revankar (1974) approach by showing that maximising the utility of expected values is equivalent to the maximisation of expected utility. Expected utility equals utility when being unemployed times its probability plus utility when being employed times its probability. Obviously, utility when being unemployed is independent of hours of labour supplied. Moreover, Sjoquist demonstrates that individuals choose the same number of hours independent of the probability of unemployment. In other words, the number of hours an individual wants to work to maximise his utility does not depend on the probability of being employed. The effect of the probability of unemployment on labour supply in terms of hours of work is therefore zero.

On the other hand, Sjoquist makes the somewhat dubious alternative assumption that hours of planned labour supply are considered as working hours by the individual even if he becomes unemployed, while the individual will not receive any payment for ‘working hours’ if he is unemployed. As a result of this alternative assumption, planned labour supply decreases if the probability of becoming unemployed increases. Obviously the alternative assumption by Sjoquist (1976) is not very appealing. That hours of planned labour supply are considered as working hours by the individual even if he becomes unemployed is not a realistic assumption. An individual will probably spend fewer hours on job search the moment he becomes unemployed than he would spend on working while having a job.

Yaniv (1979) proposes another alternative, which consists of an insurance against unemployment provided by an employment agency. The individual declares his planned labour supply to the employment agency. If he becomes unemployed he will receive an insurance payment proportional to his loss of earnings. Under this assumption an individual will increase his planned labour supply if the probability of becoming unemployed increases, because in this way he insures himself against unemployment.

Depending on the chosen assumption, individual labour supply de-
creases (Sjoquist, 1976) or increases (Yaniv, 1979) if unemployment increases in a static individual labour supply model under uncertainty. The assumptions made by Yaniv, however, are more plausible than those made by Sjoquist.

**Unemployment and labour participation in a family context**

The positive effect of an increase in unemployment on labour participation has been labelled the “added worker effect” (cf. Isserman, Taylor, Gerking, & Schubert, 1986, p. 557; and Killingsworth, 1983, p. 16). This effect only exists in a model where the family is the decision unit.

In a static neoclassical family utility/family budget constraint model a household with two family members, say a man \((m)\) and a woman \((w)\), maximises a joint family utility function \(U_f\) subject to a linear budget constraint (cf. Killingsworth & Heckman, 1986; and Bosworth, Dawkins, & Stromback, 1996)

\[
\begin{align*}
\max_{x, l_m, l_w} U_f &= U_f(x, l_m, l_w | O_m, O_w, \varepsilon_m, \varepsilon_w), \\
\text{s.t. } px &= w_m h_m + w_w h_w + y_f, \\
\text{and } T_i &= h_i + l_i, \text{ with } i = m, w,
\end{align*}
\]

where

\(U_f\) = family utility function,
\(x\) = family consumption of commodities,
\(h_i\) = hours of work of family member \(i\),
\(O_i\) = observable personal characteristics of family member \(i\),
\(\varepsilon_i\) = (unobservable) individual “tastes” of family member \(i\),
\(w_i\) = wage rate of family member \(i\),
\(p\) = fixed price of the bundle of commodities \(x\),
\(y_f\) = family non-wage income,
\(l_i\) = leisure of family member \(i\).

The utility function is defined as real-valued, continuous and quasi-concave with positive partial derivatives with respect to \(x\) and \(l_i\). In addition to a person’s own wage and the price of the composite commodity, a person’s labour supply in this model also depends upon the wage rate of the other family member. Note that the family utility/family budget constraint model reduces to the basic neoclassical individual labour participation model if a family consists of one person.
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A graphical illustration of the solution of the utility maximisation problem in (3.5)-(3.7) is given in figure 3.5, where

\[ h^\text{max} = \text{maximum number of hours a person can work.} \]

Figure 3.5: Family labour supply for a two-person household (revision of MacRea & Yezer, 1976, Figure 4).²

In the graphical example of figure 3.5 the family indifference surface is tangent to the budget surface at the optimum point A. In this particular optimum the man works \( h^*_m \) hours, while the woman stays at home; this is because the leisure of the woman is valued relatively more than the leisure of the man and because the male wage \( (w_m) \) is assumed to be higher than the female wage \( (w_w) \) in this figure. If the man becomes unemployed, the only feasible solutions remaining are those in the plane parallel to the \( L_w \)-axis, where \( h_m = 0 \). Suppose both the man and the woman are looking for work, and the woman finds a job but the man does not. At the new optimum point B the woman works \( h^*_w \) hours,

²MacRea and Yezer (1976) show a figure with one indifference surface and one budget surface, in which at the optimum both persons in the household are working.
while the man does not work. So in a family model the unemployment of one family member may lead to the participation of the other member to uphold family income. Note, however, that due to the restraint on feasible solutions, family utility has fallen from $U_f$ to $U_f'$.

Not only actual unemployment, but also the risk that the breadwinner becomes unemployed may lead to the participation of the other spouse. The risk of becoming unemployed is higher in a high unemployment region than in a low unemployment region, which implies that a positive sign of the coefficient of unemployment in a regional analysis of participation rates may be attributed to the “added worker” effect.

**Unemployment and labour participation in a search context**

An increase in regional unemployment may also reduce labour participation, because individuals may become discouraged from entering the labour market and engaging in job search, the so-called “discouraged worker effect” (Isserman et al., 1986, p. 557).

Most (empirical) search models do not study the decision whether or not an individual participates in the labour market.\(^3\) Usually the size of the labour force is assumed to be fixed. People are then either employed or unemployed and actively searching for a job.\(^4\)

Assuming a fixed labour force, however, is not very appealing, because the participation decision is an integral part of a theoretical search model. In fact, the participation decision determines whether to search at all, and can be seen as the first step in such a model (McKenna, 1985, p. 29). McKenna (1985, pp. 18-30) shows how the participation decision can be modelled in a basic sequential search model. A person participates if his expected return on search using an optimal reservation wage\(^5\) exceeds the benefits he receives when he is not participating. The expected return on search and thereby the probability that an individual participates decreases if search costs increase (see McKenna, 1985, p. 30). Therefore, if deteriorating labour market conditions (i.e.

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\(^3\) An exception is the paper by Berg (1990) in which the transition from unemployment into non-participation is included in a search model.

\(^4\) Tripier (2003) is one of few authors to include endogenous participation in an equilibrium search model. He studies the effect of business cycles on employment, unemployment and non-participation.

\(^5\) The optimal reservation wage is that which makes an individual indifferent between accepting an offer equal to the reservation wage and continuing search (McKenna, 1985, p. 24).
higher unemployment) cause search costs to rise, expected return on search falls as does participation.

### 3.2.3 Two interpretations of the regional participation rate

A subject closely related to the distinction between the hours worked and participation is how the regional participation rate is conceived. In the static one-period neoclassical framework the interpretation of the participation rate is straightforward. The participation rate represents the percentage of people willing to work at the current wage rate (see, in particular, Ben-Porath, 1973).

The situation becomes a little more complex in a multiperiod dynamic or life-cycle model. Here the timing of labour force participation comes into play. The second interpretation of the regional participation rate originates from an influential paper by Mincer (1962). The core of Mincer’s model is presented below in his words (p. 68):

> In a broad view, the quantity of labour supplied to the market by a wife is the fraction of her married life during which she participates in the labour force. Abstracting from the temporal distribution of labour force activities over a woman’s life, this fraction could be translated into a probability of being in the labour force in a given period of time for an individual, hence into a labour force rate for a large group of women.

Some authors adopt Mincer’s paper as a framework for estimating income and substitution effects of wage changes on *hours of work* using *regional labour participation rates* instead of data on hours of work (cf. Ashenfelter & Heckman, 1974). Loosely speaking, they interpret the labour participation rate as the proportion of time an individual wants to devote to market work instead of the proportion of individuals who want to participate in the labour market. According to this interpretation, the coefficients from participation rate regressions represent income and substitution effects of wages on *hours of work* (cf. Ashenfelter & Heckman, 1974).

This interpretation, however, is only valid under two quite strict assumptions (Heckman, 1978; Pencavel, 1986, p. 35). Suppose an indi-
individual determines his lifetime labour supply as a fraction of total time by maximising lifetime utility subject to a budget and time constraint. Since the time period is a person’s lifetime, the budget constraint variables are defined in terms of their permanent values. The labour participation rate at a point in time represents the proportion of time devoted to market work under the following three assumptions: (i) Apart from transitory factors the timing of participation over the life-cycle is random. This assumption is necessary in Ben-Porath’s (1973) interpretation of Mincer’s framework. However, following Heckman (1978), it is sufficient to assume that either the economic environment is stationary, or that it is possible to control for cyclical and cohorts effects. (ii) Every person in the population works at some point in his life (i.e. there are no corner solutions). (iii) A person works either full-time or not all.6

According to the first static one-period interpretation, the appropriate variables for explaining the regional participation rate are those that relate to participation in microeconomic models. In contrast, following the second interpretation, variables that explain hours of work in microeconomic models should be used to explain the labour participation rate. In the second interpretation unemployment is voluntary, whereas in the first unemployment is involuntary. Most studies on regional labour participation rates seem to prefer the first interpretation in which participation rates represent the percentage of people willing to work (Elhorst, 1993).7

### 3.3 Theoretical framework

At the micro level the decision to participate in the labour market can be considered as a dichotomous random variable that takes the value of 1 if the decision is positive, and 0 if it is negative. If we start from data observed in spatial units (regions) instead of individual data, the observed variable consists of a proportion $L_j$ of a group of individuals belonging to the working-age population in region $r$ ($r = 1, ..., R$) who decide to participate.

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6Heckman (1978) shows how alternative sets of assumptions lead to different interpretations of regional participation rates in a Mincer (1962) framework.

7For an overview of empirical studies on regional participation rates, see Elhorst (1996).
In section 3.3.1 we present a theoretical framework to identify the key determinants of the individual labour force decision. In section 3.3.2 we discuss how labour participation varies across groups. In section 3.3.3 we explain the transition from the group level to the regional level.

### 3.3.1 The decision at the micro level

A person is said to participate in the labour market if he is employed or if he is unemployed but available for work and actively seeking a job; this definition implies that both employed and unemployed people participate. People who do not participate are inactive.

A person is assumed to participate in the labour market at time \( t \) if the utility level \( (V) \) due to a positive participation decision exceeds the utility level due to a negative decision. These utility levels depend on whether the person is employed, unemployed or inactive at time \( t - 1 \). We assume that people foresee the effect of present decisions on future pensions.

First, suppose the person is employed at time \( t - 1 \). If he is able to keep that job at time \( t \), he receives an hourly wage \( (w) \) for the number of hours being supplied \( (h) \). In addition, he acquires pension claims and has to pay income tax and social security contributions \( (\tau) \), or relatively more so than a person without a job.

The concept that captures the effect of the participation decisions on future pensions is known as the pension wealth accrual \( (p) \).\(^8\) If the person is dismissed he receives unemployment benefits \( (u) \), provided that he searches for a job while being unemployed. If a person searches for a job he incurs search costs \( (s) \). The probability that someone is dismissed depends on labour market conditions \( (l) \). If labour market conditions are unfavourable (e.g. high unemployment) this probability, \( P_d(l) \), increases. If the person resigns voluntarily and becomes inactive, he receives social benefits \( (b) \); it is assumed that \( b \) is smaller than \( u \).

In sum, a person employed at time \( t - 1 \) will participate at time \( t \) as long as

\[
V\{[1 - P_d(l)](w \cdot h - \tau + p) + P_d(l)(u - s)\} > V\{b\}. \tag{3.8}
\]

\(^8\)Following Blöndel and Scarpetta (1999), the pension wealth accrual is defined as the change in the present discounted value of pension income after retirement, adjusted for the probability of survival, minus the present discounted value of pension contributions until retirement by the postponement of retirement by one year.
Note that $V$ should be interpreted as an indirect utility function of the person’s expected income level.

Second, suppose a person is unemployed at time $t-1$. If he were able to find a job at time $t$, he would obtain the benefits of being employed ($w \cdot h$ and $p$), as well as encounter the disadvantages ($\tau$). A person seeking a job incurs search costs ($s$) and the probability of finding a job depends again on labour market conditions ($l$). If labour market conditions are unfavourable (e.g. high unemployment) this probability, ($P_f(l)$), decreases. Finally, if the person voluntarily withdraws from the labour market and becomes inactive, or when the unemployment benefits are due to expire, he receives social benefits ($b$).\footnote{In reality it is also possible that someone receiving social benefits is actively seeking a job, while someone receiving unemployment benefits is not.}

A person unemployed at time $t-1$ will participate at time $t$ as long as

$$V\{P_f(l)(w \cdot h - \tau + p) + [1 - P_f(l)]u - s\} > V\{b\}.$$  \hspace{1cm} (3.9)

Third, a person inactive at time $t-1$ will participate at time $t$ if

$$V\{P_f(l)(w \cdot h - \tau + p) + [1 - P_f(l)]b - s\} > V\{b\}.$$  \hspace{1cm} (3.10)

The difference with a person unemployed at time $t-1$ is that he is not entitled to unemployment benefits ($u$), even when he is looking for a job.

Summarising and using the framework (3.8)-(3.10) above, it follows that the participation decision is positively related to:

1. the wage rate $w$;
2. the level of unemployment benefits $u$;
3. the pension wealth accrual $p$;
4. being employed or unemployed at time $t-1$;
5. favourable labour market conditions $l$.

Being employed instead of inactive at $t-1$ has a positive effect on participation at time $t$, because it raises the probability of being employed at $t$ and lowers the expected search cost. Being unemployed instead of
inactive at $t - 1$ has a positive effect on participation at time $t$, as it raises the probability of obtaining unemployment benefits $u$ from zero to $1 - P_f(l)$.

Favourable labour market conditions positively affect the participation decision by raising the probability of finding a job for a person unemployed or inactive and searching for a job.

The probability that the expected benefits of participation are larger than the expected benefits of non-participation is negatively influenced by:

1. the level of benefits $b$;
2. search costs $s$;
3. the income tax and social security contributions $\tau$.

The participation decision is influenced by an individual’s observable characteristics and preferences. We can group individuals according to their characteristics so that the participation behaviour of individuals within a group is more alike than the participation behaviour of individuals across groups. In the next section we will discuss four ways to classify individuals, and in section 3.3.3 we will aggregate individual participation rates per group.

### 3.3.2 Variation of individuals across groups

The components of (3.8)-(3.10) vary for different groups. The participation behaviour of individuals varies according to gender, education, age, and whether or not they have children, as we discuss below.

**Sex**

The relation between participation and the variables discussed above (e.g. $w$, $u$, and $l$) most likely differs between men and women. For this reason research on labour participation usually makes a distinction between males and females (see, for example, the overviews by Elhorst, 1996; Pencavel, 1986; and Killingsworth & Heckman, 1986). A woman may have different “tastes.” If, for some reason those different “tastes” mean that she prefers leisure relatively more than a man, her utility of participating in the labour market is lower.
Education
Higher educated people may have a higher probability of finding a job $P_f$ and lower search cost $s$, because higher educated people are likely to conduct more efficient searches. Moreover, higher educated people may receive higher wages; this implies that education may have a positive effect on the decision to participate.

Conversely, higher educated people may have higher reservation wages because they are more demanding.

Children
Having children and especially having young children may influence a person’s preferences. People may value leisure more because they want to take care of their children; consequently, having children may decrease the willingness to participate.

An alternative line of reasoning with a similar outcome utilises a so-called home production model. Becker’s (1965) home production model is an extension of the neoclassical family utility/family budget model. In home production models family utility depends on the consumption of ‘basic commodities.’ The family obtains commodities by combining market goods with home production time. A prepared meal is an example of a commodity that is prepared by combining the inputs home time and market goods (i.e. the ingredients). Different commodities require different amounts of home production time and market goods. Market goods are bought with money from either non-wage income or earnings from market work. Thus apart from time in the market and leisure time, an additional use for time is introduced: home production time. Productivity in home production can vary across family members. Home production models explicitly allow for corner solutions. According to the home production model, having children may negatively influence labour market participation of the spouse who has a relative advantage in home production and a relative low wage (cf. Cigno, 1990). Incorporating joint production in a home production model and assuming

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10Home production models can also be used for the analysis of labour supply in single person households, although some extensions of it are not applicable to a single person case.

11An example of jointness of production is when taking care of a child (home production) generates psychic income (satisfaction) above that of market work.
that raising a child generates positive utility above working in the market, strengthens the negative effect of having children on female labour participation.\footnote{For home production models that allow for joint production, see Graham and Green (1984) and Kerkhofs and Kooreman (2003).}

In contrast, having children may increase the utility of participating, because raising children may lead to an “additional income” requirement. See, for example, Bauman, Fischer, and Schubert (1988, p. 1095), who suggest that an increase in the average family size might lead to both an “additional income” requirement and a “stay at home” effect.

**Age**
The age of an individual has an important influence on the components of (3.8)-(3.10), as age influences the timing of participation. For example, in life-cycle models with exogenous wage rates, life-time utility is maximised subject to a life-time budget constraint (cf. Pencavel, 1986; Killingsworth & Heckman, 1986; and Killingsworth, 1983). Three factors then become important in the timing of labour supply: (1) The efficiency effect states that an individual tends to work more when his wage is relatively high, e.g. at later ages. (2) A high interest rate induces an individual to work more now and save the extra income. The extra income and the accumulated interest enable an individual to work less at a later date. (3) The time preference effect refers to the fact that individuals value present leisure more than future leisure and this induces them to work less now and more later.

In life-cycle models with endogenous wage rates an individual can influence his future wages by investing in human capital. ‘Learning by doing’ or entering in full-time education increases human capital, the individual’s productivity, and eventually the individual’s wage. Again, the efficiency effect, the interest rate, and the time preference effect are important in the timing of labour supply (cf. Killingsworth, 1983). Entering in full-time education early in life may result in lower participation rates for young adults.

Furthermore, later in life pension wealth accrual decreases, thus lowering the expected benefits of participating. The drop in pension wealth accrual is especially large at the earliest entitlement age at which pensions become available. If an individual continues to work after this
entitlement age, they forgo pensions and continue to pay pension contributions, with little or no increase in ultimate pensions after retirement (Blöndel & Scarpetta, 1997). Lower participation of older individuals can also be explained by using a life-cycle model. For a formal life-cycle model of retirement behaviour, see Gustman and Steinmeier (1986).

The expected net benefits of participating tend to increase from a relatively low level early in life, decrease when people become middle-aged, and drop when people reach their pension retirement age.

As we have illustrated in this section, different groups display different participation patterns. In the next section we show how the participation behaviour of different groups can be aggregated to obtain regional participation rates.

3.3.3 Aggregating individual decisions per group

The transition from the micro level to the meso level for homogeneous groups is discussed in Pencavel (1986). We will extend his study by addressing the problem of heterogeneous population groups. Pencavel uses the concept of reservation wage, the individual’s implicit value of time when on the margin between participating in the labour market and not participating. This reservation wage, \( \tilde{w} \), can be derived from (3.8)-(3.10) and depends on observable explanatory variables \( X = w, p, u, l, \tau, s, b \) and unobservable explanatory variables \( \varepsilon \).

Suppose individuals of a particular population group \( g \) have identical observable explanatory variables \( X^g \), but different unobserved explanatory variables \( \varepsilon \). Wages \( w \) might vary between population groups and between regions, but (like the other variables in \( X^g \)) they do not vary within population groups within regions, i.e. \( w = w^g \). Consequently, differences in reservation wages are caused by different values of the unobserved explanatory variables \( \varepsilon \) only.

Let \( f^g(\tilde{w}^g) \) be the density function describing the distribution of reservation wages across individuals of group \( g \), and \( F^g(\tilde{w}^g) \) the cumulative distribution function corresponding to the density function. This cumulative distribution function \( F^g(\tilde{w}^g) \) is interpreted as giving for any value of \( w^g \) the probability of the event \( \tilde{w}^g \leq w^g \), that is, the proportion

\[ \text{Due to early retirement systems the drop in pension wealth accrual is much earlier than at age 65; in many cases the drop lies between ages 55 and 60 (Blöndel & Scarpetta, 1997).} \]
of individuals who offer positive hours of work to the labour market since the market wage rate exceeds their reservation wage. The labour force participation rate $L^g$ of group $g$ is then the cumulative distribution of $\tilde{w}^g$ evaluated at $\tilde{w}^g = w^g$, given $X^g$ and a set of fixed but unknown parameters $\beta^g$.

$$L^g(w^g, X^g, \beta^g) = F^g(w^g|X^g, \beta^g), \quad (3.11)$$

where the dependence of the labour participation rate of population group $g$ has been made explicit on $w^g$ and $X^g$.

Since different groups of people within each region have different observable explanatory variables $w^g$ and $X^g$, the total labour force participation rate is determined by the sum of the group-specific cumulative density functions $F^g(w^g)(g = 1, \ldots, G)$ weighted by the share of each population group in the total population of working age ($a^g$). In mathematical terms:

$$L^{total} = \sum_{g=1}^{G} a^g F^g(w^g|X^g, \beta^g). \quad (3.12)$$

From this equation it follows that there are two ways to deal with the problem of heterogeneous population groups. One way is to consider as many population groups as necessary to obtain within-group homogeneity and then estimate a separate regression equation for each population group. The other, more prevalent way is to consider a limited number of regression equations for broad population groups and correct for the composition effect of groups having different observable explanatory variables $X$ (see Fair & Dominguez, 1991). In an overview paper surveying 17 empirical studies on regional participation rates, Elhorst (1996) found that four studies consider the overall population of working age and 10 studies distinguish between males and females. The latter distinction is also adopted in this thesis, since there is considerable evidence that the marginal reactions of men and women with respect to the explanatory variables $X$ are significantly different from each other. A further distinction is not considered. The implication is that differences between different age groups for both men and women have to be captured by demographic composition variables.

14Only two studies disaggregate the population of working age into different sex and age groups, while one study considers different educational groups.
3.4 Regional participation in a wider perspective

A subject closely related to the aggregation from the micro level to the regional level is the interaction between regional labour participation and other regional variables, such as the regional unemployment rate. In addition, both regional labour force participation rates and other regional variables are influenced by national labour market institutions. A simplified representation of the regional labour market is presented in figure 3.6. National institutions (box 1) that directly influence labour force participation (box 3) are the unemployment benefit system and the pension system. An increase in unemployment benefits increases the benefits of participation in the labour market and raises participation rates, as shown in section 3.3.1. By way of contrast, low (or negative)
pension wealth accrual makes participation in the labour market less attractive and lowers participation rates, as we have seen in sections 3.3.1 and 3.3.2.

A national institution that influences wages (box 2) is the wage bargaining system. Calmfors and Driffill (1988) argue that decentralised wage bargaining (i.e. at the plant level) and centralised wage bargaining (i.e. at the national level) leads to lower wages than wage bargaining at the sectoral level. Higher wages in turn lead to lower employment and higher unemployment. We will discuss the influence of wage bargaining in greater detail in chapters 5 and 6. National institutions also influence the demand for labour (box 4). As an example, higher taxes on labour could lower the demand for labour.

In individual labour force participation models unemployment may influence participation, but the participation decision of one individual does not influence regional unemployment. In contrast, at a regional level unemployment (box 2) and participation (box 3) are mutually dependent. On the one hand, high unemployment may decrease regional participation through the “discouraged worker effect.” On the other hand, an increase of the number of people looking for a job may lead to higher unemployment. Contrary to the analysis of individual participation, the analysis of regional participation rates has to deal with the endogeneity of regional unemployment.

Regional studies attend to the reciprocal dependency between regional participation and unemployment in a variety of ways. For example, Fleisher and Rhodes (1976) estimate a simultaneous model using 2SLS, while Nord (1989) estimates a simultaneous model using 3SLS. Another example of a simultaneous model is the top-down interregional projection model REGAMBEV in which unemployment is a balancing factor (Kwaak, 1985).

Another reciprocal relation is that between labour market outcomes (box 2) and the demand for labour (box 4). As an example, higher wages may raise the demand for the output of firms. Moreover, if the demand for labour increases (for example, due to a positive demand shock), both wages and employment may increase.

Finally, size and composition of the population (box 5) influences labour demand (box 4) and labour supply (box 3). The larger the share of prime-aged individuals in the population, the larger the labour force participation rate (see also section 3.3). Furthermore, an increase in the size of the population raises the demand for the output of firms, which in
turn may raise the demand for labour. The interaction between the regional population and its structure, and the regional economic structure and the regional labour market is modelled in so-called demo-economic models (see e.g., Oosterhaven & Dewhurst, 1990 and Oosterhaven & Folmer, 1985). Demo-economic models are used to make a projection of output, employment, unemployment, and the population of a region.

3.5 Summary and conclusions

Analysing participation decisions is quite different from analysing hours of work decisions. First, at the individual level participation is a binary decision variable, while hours of work is a continuous decision variable. Second, the participation decision depends on the comparison of utility levels, while the hours of work decision involves marginal utilities. Therefore, it is not surprising that even though many of the explanatory variables are the same, their influence on hours of work may differ from their influence on labour participation in terms of both sign and magnitude (cf. Lewis, 1972).

Studying regional labour participation rates instead of individual participation decisions raises some further interesting issues. First, some variables that explain labour participation may be endogenous at the regional level, and as a result a correction for endogeneity has to be made. Second, due to the aggregation of a micro level theoretical framework to the regional level, several composition variables have to be included. If, for example, the government’s objective is to raise regional participation rates, it is not sufficient to concentrate on the outcomes of micro models, because meso behaviour is not equal to the sum of micro behaviour.

Analysing regional participation rates of multiple countries having different labour market institutions may deliver additional insights, as we will show in the next chapter.