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Regional Differences in Labour Force Activity Rates of Persons Aged 55+ within the European Union

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1 Introduction

Labour force projections – together with demographic projections – play an important role in the support and preparation of European policies, regulations, directives and recommendations. Insight in the development of the labour force is needed for various economic and social issues, at the European, national and regional level. From a European perspective, it is important to obtain both general information about the overall developments in labour force participation in the European Union and detailed information about specific regional and national developments within the member states.

This study is particularly aimed at providing a better understanding of the factors that influence labour supply of the elderly in the EU. Two questions are of central importance: Firstly, it will be investigated what factors influence labour supply of individuals aged 55 years of age and older. Secondly, it will be tried to identify the main factors that cause activity rates to display diverging patterns at the national and the regional level.

The labour supply of elderly is the outcome of processes on the labour market. Therefore, before going into an empirical study of the labour force activity rates, it is necessary to have knowledge concerning the economic processes that play a role in the labour market. Labour supply may be dependent on individual characteristics like age group, educational level and gender. But institutional differences can also lead to large differences in the observed labour force behaviour (Kerkhofs, 1998). For example, there are differences between countries in the old-age pension systems and early retirement schemes which influence the participation behaviour of the elderly. This study will contain a review of the relevant economic literature with respect to the participation rate of the elderly.

The difficulty with statistical models describing regional labour force developments is that, even if adequate data are available for a number of years, there are so many possible aspects influencing labour participation that the underlying trends can be derived only to a limited extent. In addition, the large number of regions that can be distinguished makes it difficult to obtain statistically plausible results for all regions. Especially because the time span of the available data – ranging from 1993 to 1997 – is relatively short, it will probably be difficult to provide reliable estimates – and therefore reliable projections – for a particular region, if only data for this specific region can be used. In the econometric literature, this kind of problems is solved by using multilevel models with random coefficients. These models impose some structure on the data, which make them suitable tools for a structured analysis of the diversified labour market developments at a low level of aggregation, e.g., the analysis of labour force participation rates with regard to gender, educational backgrounds, regions, et cetera.

2 Review of the literature

2.1 Introduction

In this Chapter a review of the relevant literature on labour force participation is presented. Although the analyses in the following Chapters are not at an individual level, in this Chapter the focus is on the individual labour supply literature. This may be rationalized by noting that labour supply is to a large extent an individual decision, where total labour supply is simply the aggregate of all individual decisions. Therefore, when explaining differences in labour force participation rates between countries, the starting point has to be to explain labour force participation between individuals. This Chapter is structured as follows: Section 2.2 is devoted to labour supply, Section 2.3 to labour demand. Section 2.4 explicitly deals with the institutional factors. The emphasis in this review is on economic issues, and not on the empirical literature, although some empirical findings will be presented. Next, some empirical aspects are discussed.

2.2 Labour supply

Economic theory usually describes individual behaviour assuming that individuals try to maximize their well-being. This well-being is known in the economic literature as utility. Individual preferences can thus be described by a so-called utility function which allows to compute the value of a given package of consumption goods. Individuals choose a package of consumption goods which maximizes the value of this utility function.

In this maximization consumers face restrictions: consumption goods (including leisure) have a price. Therefore, the first restriction consumers face is their income budget restriction: the value of total consumption has to be equal to or less than total income. The second restriction they face is a time budget restriction: the number of hours per day that can be used for paid labour is limited. Thus, depending on the level of income to be spent and the relative commodity prices, individuals choose their preferred bundle of goods. Using this framework, neoclassical economic theory describes labour supply as the solution to the following (mathematical) problem in which individuals maximize their utility function:

$$U = U(x, h; A, \text{å}) \qquad (1)$$

where U is utility, x is the consumption of commodities, and h is hours of work. An extensive review of this model, including a number of extensions to it, can be found in Killingsworth (1983) and Pencavel (1986).Total utility depends not only on the commodities consumed, but also on individual preferences å, which can be seen as the individual's "tastes". These preferences can depend on individual characteristics A, such as age, gender, marital status, level of education and social class.

This utility function is maximized subject to the time budget restriction, which states that total time T is equal to the sum of hours worked for pay, h, and hours spent in other activities, l:

$$T = h + l \tag{2}$$

The other restriction is the income budget restriction which states that total income is equal to total expenditures:

$$px = wh + y \tag{3}$$

In this income budget restriction p and w are the price and real wage level respectively. There can be additional income independent of the working decision, such as capital income. This income is denoted by y, the non-wage income. As the model is presented as a static model, it is assumed that there are no savings.

This mathematical problem can be solved, given a few regularity conditions on the utility function, and given the assumption that the individual is fully informed of all the values of the relevant parameters. The maximization problem thus results in a labour supply function which gives optimal labour supply given the exogenous prices and non-labour income, depending on individual preferences and characteristics:

$$h = h\ (p, w, y; A, \text{å}) \tag{4}$$

Thus, what follows from the neoclassical model of labour supply is that an individual's allocation of his work time depends upon prices, the (real) wage rate and non-wage income. Of course, h has to be positive. When the mathematical solution leads to negative values of working hours, the individual is at a boundary solution of the optimization problem, and will not participate in the labour market.

The above model is formulated in a one-period, static way. Individuals will probably determine their labour supply for longer periods: in other words, labour supply in subsequent periods will be related. This relationship has several causes. The first is that tastes and characteristics will be rather stable over time. An other reason is that changing the amount of labour supply may be costly due to search costs. Also, the income budget restriction will be intertemporally related, due to savings. For these reasons, individuals will probably take both the past and the future into account when deciding on labour supply. Therefore, labour supply should be analysed in a dynamic or intertemporal context.

In intertemporal models, both the utility function and the income budget constraint are specified in a multi-period way. In these so-called multi-period life-cycle models decisions in each period on consumption and labour supply are made with regard to prices and wage rates in all periods. This type of models also needs assumptions on the relative

value of income and leisure in the current period against income and leisure in future periods. An relatively straightforward life-cycle model of labour supply can be found in MaCurdy (1981), who specifies life-cycle labour supply as a dynamic optimization problem in the absence of uncertainty. In that specification the utility function as specified in Equation (1) is generalized to a multi-period life-cycle utility function:[1]

$$U = \sum_{t=0}^{T} (1-\tilde{n})^{-t} U_t(x_t, h_t; A_t, \alpha_t) \qquad (5)$$

with $\tilde{n}$ being the intertemporal preference rate, which indicates the value of utility now against utility in the future. Also the income budget restriction is generalized to a life-cycle budget restriction:

$$\sum_{t=0}^{T} (1-r)^{-t} p_t x_t = \sum_{t=0}^{T} (1-r)^{-t} (w_t h_t + y_t) \qquad (6)$$

In this restriction the value r is the (one-period) interest rate, which is assumed to be constant over time. Solving this optimization problem leads to an expression for 'optimal' labour supply over the life cycle:

$$h_t = h(p_t, w_t, r, \tilde{n}; A_t, \alpha_t), \qquad t = 0 \ldots T \qquad (7)$$

As in the static model, in this dynamic model labour supply is determined by the tastes and characteristics in every period. In this case, however, labour supply is also determined by the possibilities and preferences for intertemporal substitution of work and consumption. The model described above is relatively simple: all information is assumed to be known at the start of the life-cycle. In real-world situations though, prices and wages are not known over the total life-cycle. This requires a more sophisticated model in which uncertainty about future values of prices, restrictions and preferences are allowed for. This type of models will not be presented here[2].

A special case of intertemporal models that may be of importance for the present study, is a model of habit formation (Woittiez, 1990). In such models current labour supply is influenced by labour supply in the past. The reasons for this are multiple. The first one is that changes in labour supply may take time, so-called inertia-models (see, e.g.,

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1. In this specification the utility in one period is independent of the value of utility in any other period, i.e., the utility function is intertemporally strongly separable. It is, in principle, also possible to specify the individual's utility function in period t as conditional on the individual's consumption and hours of work in the previous period.

2. Interested readers are referred to MaCurdy (1976, 1985).

Nakamura and Nakamura, 1985). The other reason is that individuals or social groups get used to a given pattern of labour supply. An extensive study of both individual and social habit formation and persistence is given by Vendrik (1993). Habit formation implies that labour supply will in general be higher in those regions where labour supply is traditionally high.

For empirical purposes the theoretical model has to be estimated. There are two strategies. The fist one is to specify analytical expressions for both the utility function and the income budget restriction and to solve the mathematical optimization problem. The second strategy is to specify an analytical expression for the labour supply function, without specifying the underlying utility function. A common choice is a labour supply function which is linear in the parameters:

$$h_i = \alpha_0 + \alpha_1 \left(\frac{w}{p}\right)_i + \alpha_2 \left(\frac{y}{p}\right)_i + \alpha_3 A_i + \varepsilon_i, \qquad (8)$$

where *i* denotes the individual. This does not mean that both strategies are incompatible. Hausman (1979,1980) uses his labour supply estimates to conduct simulation-analyses on behaviour, and is therefore interested in tractable direct and indirect utility functions. As shown by Hausman a linear labour supply equation like Equation (8) can be derived from a utility maximizing framework. The linearity of Equation (8) rather forces restrictions on the functional form used for Equation (1). Stern (1986) gives examples of more general labour supply functions which can be derived from tractable utility functions.

The static labour supply models are usually estimated on cross-section data. This has a disadvantage; the estimated parameters reflect differences in labour supply between individuals of given characteristics. Some rather stringent assumptions on the preferences are needed to use these parameters to estimate how labour supply will change due to changes in characteristics. An example of this is the fact that in all studies on female labour supply that are based on cross-section data age has a negative effect on labour supply. This, however, is probably a generation effect, and not an effect of age. In other words, when the labour force ages, labour supply will fall by less than the estimations based on cross-section data would suggest. In life-cycle models, both the age effect and the generation effect can be separated, because time is a separate explanatory factor.

Life-cycle models are most convincingly estimated when using successive observations over time on the same individuals, i.e. panel data. Most research in this field is directed towards only one part of the life-cycle characterization; it supplies information on how an individual will allocate his working hours as he ages in response to evolutionary changes in his wage rates. In addition, there is the question of the response of labour supply at any age to changes in the entire wage profile. For male workers this second step seems to have been undertaken only by MaCurdy (1981).

From the utility maximizing model, it is possible to derive hypotheses about the effect of wages and non-labour income on labour supply. In general, higher wages do increase labour force participation. The effect on working hours is ambiguous, because due to higher wages, the price of unpaid time increases, which will increase labour supply. But, as wages become higher, the potential income will increase, which leads to higher consumption, including "consumption" of unpaid time. The effect of non-labour income on participation and working hours is always negative: a higher non-labour income will lead to lower labour supply. The effect of real wages has been thoroughly analysed in e.g. Baumann et al. (1988), Nord (1989) and Gallaway et al. (1991). The former and latter have also considered non-wage income, as in Schubert (1982).[3] Notice that given a gross income, the tax and social premium systems can influence net incomes, and thus influence labour supply.

As stated before, labour supply not only depends on wages and non-labour income. It also depends on preferences which, in turn, depend on individual characteristics. Economic literature presents a number of stylized facts on this dependence. The most important of these characteristics are gender, age, educational level and household composition.

In view of the results reported by earlier studies which have explained the labour force participation of both men and women (Bowen and Finegan, 1969, Fleisher and Rhodes, 1976, and Lillydahl and Singell, 1985), a distinction between men and women may safely be drawn. Men and women give evidence of different behaviour which expresses itself in different participation rates. But also the extent to which men and women react to changes in wages and income differ. With respect to age, theory suggests that there exists an inverted U-shaped relationship between age and the level of participation; participation is highest for prime-age individuals, while it is considerably lower for both younger and older individuals, albeit for different reasons. Bowen and Finegan's (1969) seminal work on the 1960 Census of Population has shown that there is a strong positive relationship between participation and schooling. This participation-schooling relationship is especially strong among older men. This does not only pertain to the level of schooling attained earlier in life but to the participation in current education and training schemes as well. In particular, when participation in continuing vocational training (CVT) is low, older workers may be driven out of the labour market due to skill obsolescence (cf. De Grip, Van Smoorenburg and Borghans, 1997). National or regional differences in CVT participation may thus explain differences in labour market participation rates of the elderly. For women too, activity rates for those who have completed university education are higher than for other women. The disparities in activity rates between women with different

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3. As Heckman (1979) has shown, the estimated effect of wages on labour force participation may be biased due to sample selection. This occurs when the random part of wages and labour supply are correlated, and the model is estimated on a sub-sample of working individuals only. Heckman proposed a two-step procedure to correct for this sample-selection bias which became standard in the labour supply literature.

levels of education reflect that more highly educated women have more job opportunities open to them. Moreover, the costs involved in the arrangement of suitable childcare represent less of a problem due to their greater earning capacity. Finally, the opportunity costs of not working are likely to be much higher so any break in employment tends to be more costly in terms of the effect on their future careers (European Commission (1993)). Finally, it is known from several studies (e.g. Grift, 1998, and Mertens, 1999) that household composition has large effects on labour supply of especially women. The more children there are in the household, the lower labour supply tends to be. As there is some tendency for women to leave the labour market completely after childbirth, labour supply of older women without children present in the household may still be dependent on their labour supply at younger ages.

The relationships between labour supply and characteristics like age and education pertains to individual decision-making and it remains to be seen what happens to labour supply when aggregation is taken into account. The most important problem here is that some individuals may be at a corner solution while others are at an interior solution to their maximization problem such that it may be hard to derive meaningful behavioural parameters from aggregate time-series data. This problem is bound to be most serious when looking at supply behaviour of older workers.

This aggregation implies that population size and structure are likely to be important as well[4]. It is to be noted that by the early decades of the next century the ageing process is likely to lead to a decline in the European population. There has, though, been considerable variation among EU countries and regions in the scale and timing of this demographic change because of their different population structures and histories (cf. Johnson and Zimmermann, 1993). In De Beer and De Jong (1996) and De Jong (1998), population trends are described as well and it is observed that the expected changes in the composition of population by age, i.e. a decrease in fertility rates in combination with an ongoing ageing process, may necessitate a rise in participation rates in order to curtail an unwanted rise in dependency ratios. Migration also plays a role in these demographic supply-side factors; if for example the number of young individuals leaving a certain country or region is large, the probability that participation of older individuals increases is correspondingly higher, assuming labour demand does not change. Despite this aggregation problem, when explaining differences in labour supply between regions, the individual labour supply models seem to be the best starting point.

4. This stems partly from the literature on spatial unemployment where the same observation is made, e.g. Evans and Richardson (1981).

2.3 Labour demand

The above represents basically the supply side of the market, i.e. the participation decision. Still, whether or not an individual really does participate clearly depends on the demand side as well. In Osberg (1993) it is investigated how important labour market demand is as a determinant of the labour market behaviour of older workers.

For the study of demand side factors, so-called job search models are useful. In these models both individual labour supply behaviour and demand side factors are explicitly modelled. Job search models describe the process of an individual searching for a job that maximizes his utility. However, the individual has to balance costs and returns against each other. Both returns and costs are determined by labour demand. In the job search literature the expected returns to continued job search ($\dot{e}$) are summarized as the product of the arrival rate of job offers ($\dot{U}$), the probability of acceptance and the expected income which is attached to acceptable job offers as in the following equation:

$$\dot{e} = \dot{U} [1 - F(W^R)] E(W \mid W > W^R), \qquad (9)$$

where $F(W)$ is the cumulative distribution function of the wage offer distribution and W^R is the reservation wage. Clearly the arrival rate of job offers is linked to developments in job creation which in turn depend on the rate of economic growth. This follows from a 1994 study from the European Commission where it was found that over the past thirty years the fluctuations in the numbers in employment coincided with variations in the rate of growth of GDP. If the arrival rate of job offers or the likely wage attached to those offers is expected to be low, some workers, notably the older unemployed, will find continued job search to be unattractive and will drop out of the labour force.

The inclusion of unemployment can be justified when the basic utility maximization model is extended by the situation in which an individual who wishes to work cannot find a job and becomes involuntarily unemployed, as has been suggested by Hartley and Revankar (1973) and Blundell et al. (1989) at the micro level. Suppose that the probability of whether an individual who wishes to work is actually being employed can be described by an index function Z_i which depends on a variety of macro- and microeconomic factors. Z_i is such that if $E_i = \dot{E} Z_i + \dot{\imath}_i > 0$ the individual would obtain employment, whereas if $E_i \leq 0$ he would not. The probability of finding a job is then simply:

$$P_E = Pr(Z_i ; \dot{E}) = Pr(\dot{\imath}_i > -\dot{E} Z_i), \qquad (10)$$

assuming $\dot{\imath}_i$ is drawn from a symmetrical distribution with zero mean. Surely then the participation rate will depend on the probability of finding a job as well.

Labour market conditions may also be modelled as restrictions on the labour supply function (Equations (4) and (7) above). Given the particular characteristics of each individual (also region of residence, industry and skill level), there may exist an upper bound h_u on available hours of work. Most workers will be unaffected by this (unobservable) upper bound (i.e. $h^* \leq h_u$), but others will be constrained by it (i.e. $h^* > h_u$). Upon recording which workers perceive themselves to be constrained, one can define the probability of underemployment as $P_u = Prob\ [h^* > h_u]$. To estimate a labour supply equation when desired labour supply for the underemployed cannot be observed, the two-stage procedure of Heckman (1976) and Ham (1982) uses probit with the full sample of constrained and unconstrained workers. A labour supply equation which acknowledges both under- and overemployment constraints can be estimated by the two-stage procedure developed by Nakamura and Nakamura (1983) and by Maddala (1983) to account for double truncation of the dependent variable.

In the context of unemployment, mention can also be made of the so-called added and discouraged worker effects (cf. Elliott, 1991). To clarify these concepts, imagine a typical household where husband and wife may both be either working or not. Assume first that prior to the husband becoming unemployed the wife did not work. She may then decide entering the workforce if her wage income adds positively to total household income, which clearly depends on the level of unemployment compensation the husband receives. This is the added worker effect. An alternative development is where the husband's entitlement to unemployment insurance payments is related to the level of family income. Prior to the husband becoming unemployed the wife worked a certain amount of hours. Eligibility to further payments may force the wife to withdraw from the labour force which is the discouraged worker effect[5]. The 'discouraged worker effect' may also be of importance for the labour market participation rate of the elderly. Lack of opportunities in the labour market may drive the elderly into early retirement schemes. In order to be able to analyse this effect, it is necessary to have data on such schemes and the participation in these schemes (if possible, even at a regional level).

Labour supply of the elderly may also be dependent on the structure of labour demand which is directly influenced by the sectoral composition of the economy. The European economies, like many others, have witnessed a shift in employment from agriculture to industry and then from industry to services. Thus the share of services in total employment in the EU has increased from nearly 50% in 1975 to almost 65% in 1995. In this period employment in agriculture declined from 11% to just over 5%. For employment in industry the respective numbers are just below 40% and just over 30%. The relationship

5. As an illustration, note that in the United Kingdom in 1987 for example unemployed workers were entitled to unemployment benefit for a maximum of a year. The full rate for the individual was £31,45 per week but this was increased by £19,40 for a dependent such as a husband or a wife. However, if the dependent earned more than £19,40 per week this addition to household income was withdrawn in full. Hence it is to be expected that dependents with relatively low earnings opportunities would withdraw from the labour force.

between the participation rate and the extent of the services sector has been extensively debated (e.g. Nord, 1989).

2.4 Labour supply and institutional factors

In the foregoing, individual labour supply is discussed from a microeconomic decision-theoretic perspective. In this review both labour supply and labour demand played a role. The individual decisions can be influenced in several ways by institutional factors. On the one hand, institutional factors will influence individual decisions by putting direct restrictions on their behaviour. On the other hand, institutional factors will influence individual behaviour because of indirect restrictions. Examples of direct restrictions are social security systems, which restrict labour supply of individuals receiving benefits. Also pension systems can pose restrictions by imposing a compulsory pension age. Direct restrictions can also result from the absence of institutions that make paid work possible (e.g. child care facilities for working women). Indirect restrictions can result from e.g. the taxation system, which can result in very low real wages, or from the social acceptance of elderly being in paid work. With respect to labour supply of the elderly, at least two institutional factors are of importance. (See, e.g., De Grip, Hoevenberg and Willems, 1997). The first one is the pension system that is in effect in the various countries. The second one, which is of less importance, are the social policies that influence labour supply of (mainly married) women. As institutions differ by country or even by region[6] differences in these institutions can be an important cause of regional differences in labour force participation.

Pension systems: labour supply of older individuals

Retirement is an important phenomenon in life-cycle labour supply: it is defined as the moment workers leave the labour market and enter the pension system. In some respects the decision to stop working and enter the pension system is comparable to the labour supply decision at younger ages. In other respects there are important institutional features associated with retirement that do not pertain to early labour supply decisions. Pensions, social security, and mandatory retirement are all specific to the labour supply decision associated with retirement. In addition to these institutional considerations, there are theoretical reasons as well to look separately at retirement.

There are differences in the old-age pension systems and early retirement schemes between countries which influence the participation behaviour of the old (Lazear, 1986). Old-age pension systems and early retirement schemes, as well as the possibilities to participate in these early retirement schemes, may have a great impact on the participation rates of the elderly (See, e.g. Kapteyn and De Vos, 1998). As these schemes differ not only

6. For instance in the Federal Republic of Germany many of the social policies are implemented at the level of the Bundesländer.

between countries, but usually also between the various economic sectors in a particular country, the existing differences may explain (at least) part of the regional differences. These differences in participation rates result in differences in outflow of the elderly from the workforce, which in turn has an effect on the replacement demand in the labour market, i.e. the demand for new workers resulting from others having left. As shown by Willems and De Grip (1993) and Willems (1996), it is necessary to know the differences and trends in the participation of the elderly in order to be able to make reliable forecasts for labour demand.

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The first effect of the pension system is the direct restriction given by the lower and upper age for entrance in the system. All systems have a lower age below which the entrance to the system is not possible. Also, in most countries an upper age limit is present, i.e., one is not allowed to work for pay when one is older than this age. A third restriction given by the pension system is that in most systems the entrance into the system is an irreversible entrance: it is not allowed to re-enter the labour market without effects on the level of the pension benefit. These formal regulations with respect to the system put a restriction on individual labour supply decisions.

The next, and probably most important, aspect of the pension system is that when individuals stop working and enter the pension system, they will receive a benefit. In most systems this benefit is dependent on the individual labour history: the higher the income during working life, the higher the benefit. Generally, there is also a relationship between the number of years spent in the labour market and the level of the benefit. These two relationships imply that the decision whether or not to enter the pension system will have effects on utility in the current period, but also in all periods to come because the income in the future will depend on the outcome of the decision process in the current period. The exact dependence of the benefits on the work history will influence the outcome of this decision.

An other aspect of pension and early retirement systems is that benefits in these systems are in general higher than unemployment benefits. In that case retirement will be an alternative for imminent unemployment. For this reason, it is advisable to incorporate the level of other social benefits into the analysis of the effect of the pension system on the labour supply decision.

The theoretical framework for describing retirement behaviour varies from simple one-period work/leisure choice models, to dynamic optimization problems, where leisure at each point in the individual's lifetime depends on compensation at all other points in time. The simplest models of retirement treat each year independently and think of the retirement decision as affecting one year at a time. This is easily embedded in the standard work-leisure framework, in which the returns of working are the income, while the returns of retirement are given by the pension. The problem using this model is that it does not account for the specific character of the retirement decision.

The major problem with the one-period model of retirement is the requirement of intertemporal separability in a very strong sense, i.e., decisions in one period are unaffected by decisions in other periods. The one-period model does not allow for the fact that utility in time *t* can depend on consumption or leisure during other time periods. Burkhauser (1976,1979) recognized early that this simplification was likely to be misleading. In particular, he argues that pensions need not be actuarially fair in the sense that the pension value is not independent of the age of retirement. He observed that the pension value associated with early retirement often exceeded that for normal retirement. He argued that not only was the current pension value likely te affect retirement choice, but so was the ratio of current pension benefits to those at the normal age of retirement. Reimers (1977) generalizes the point somewhat by recognizing that it is not merely the ratio of current benefits to those received at the normal age of retirement, but the ratio of benefits now to benefits receivable at all other ages. Stated alternatively, it is the entire path of pension entitlements as a function of retirement age that must be considered. Bulow (1981) points out that the true compensation at a point in time consists of two components: the current wage plus the value of the pension accrual. Other studies have not limited attention to the effect of pension accrual on retirement decisions. For example, Blinder, Gordon and Wise (1980), Burkhauser (1980), Burkhauser and Quinn (1980), and Fields and Mitchell (1982) allow accrual of social security benefits to affect the retirement decision as well.

The one-period model also does not allow for the fact that both preferences and opportunities change with age. Other issues are ignored as well. First, it is assumed that the value of time in the labour market is independent of the age at which it is supplied. This is likely to be incorrect for at least two reasons. First, workers may experience exogenous changes in their productivity over the life cycle as a direct result of physical changes. Second, endogenous changes in productivity over the life cycle occur when individuals invest in human capital. If the value of market time varies over the life cycle, then it is preferable to work during some years rather than during others. This is true so long as the value of leisure is invariant with respect to when it is taken. But this brings up the second major difficulty with the simple model; the value of leisure may vary over time. What is necessary to induce retirement is that the value of leisure rises above the value of work. This does not require that old workers be less productive than young ones. It is a statement about the relative value of time. Moreover, as indicated before, in the context of social security, payments upon retirement are a function of earnings and years worked before retirement. The same is true of pension plans.

Somewhere between the two extremes of a full life-cycle model and a simple one-period model is the type of analysis performed by Hemming (1977) and by Fields and Mitchell (1984). The Fields and Mitchell model produces one of the more tractable empirical specifications, and estimation of the model yields sensible results. Other authors have incorporated additional factors to add realism to the analysis. Clark, Johnson and McDermed (1980) discuss the retirement decision in a family context. A final consideration is one of nonparameterized heterogeneity or, conveniently, differences in tastes for

retirement. Asch (1983) analyses the sorting effects of pensions on retirement decisions. Mitchell and Fields (1984) address the sorting issue as well and conclude that differences in retirement behaviour across individuals are in part due to differences in tastes. All of these models treat the compensation package as exogenous. The worker is offered a wage profile and is then allowed to choose the optimum work/leisure path. Another, more recent, strain of the literature recognizes that pensions and wages are linked by market forces. The exact nature of the compensation path may affect worker effort and under these circumstances, the worker's retirement may not be determined unilaterally by the worker. An extreme manifestation of this phenomenon is mandatory retirement.

A last approach to analyse the issues under study is the so-called option value model[7] as specified by Stock and Wise (1990). It is intended to capture an important empirical regularity, the likely irreversibility of the retirement decision. The model focuses on the opportunity cost of retiring or, equivalently, on the value of retaining the option to retire at a later date. It has two key aspects. The first is that a person will continue to work at any age if the option value of continuing work is greater than the value of immediate retirement. The second is that the individual re-evaluates this retirement decision as more information about future earnings becomes available with age. Retirement occurs when the value of continuing work falls below the value of retiring.

Most studies are concerned with the question to which extent the optimal retirement age depends on the value of the pension, and how this age varies with the features of the pension system. Some of these studies are Munnell (1974), Feldstein (1974), Boskin (1977), Pellechio (1978), Boskin and Hurd (1978), and Burtless and Hausman (1980) which all make use of the one-period model. The empirical literature on the relation of retirement to social security and private pensions yields inconsistent results, just like the theoretical literature does. For example, some studies find that social security wealth increases the propensity to retire (Boskin,1977, Boskin and Hurd, 1978, Gruber and Wise, 1998, Kapteyn and De Vos, 1998), while others find that the reverse is true (Pellechio, 1978,1981, Burkhauser, 1980, and Hurd and Boskin, 1981). Drawing inferences from these data is difficult, however, for two reasons. First, social security works on labour force behaviour in a number of ways. Perhaps the largest and most direct effect is via the earnings test, which taxes the labour market earnings of social security recipients according to some specified formula. This reduces the relative price of leisure in old age. Second, individuals who continue to work make social security contributions out of their earnings, which further reduces the value of work. Third, because of the redistributive nature of social security payments, there are non-neutral lifetime income effects of the social security system. These work differently on different individuals within a generation, but also affect one generation differently from another. Some may find that lifetime wealth is increased by the system, while others may find that it decreases. A second difficulty

7. This model is close in spirit to the stochastic dynamic programming model of Rust (1989) and to the transition-state model of Berkovec and Stern (1991).

encountered in attempting to estimate the impact of social security on retirement includes life-cycle labour supply and identification. There are two ways that one can generate differences in benefit eligibility across individuals. The first is from exogenous changes in the social security system. This is the kind of variation that is appropriate for estimating the effects of social security on retirement. The second is from the benefit formula itself. Social security benefits depend upon earnings and employment over the work life. Individuals with higher benefit entitlements tend to be those who worked more or had higher wages in the past. This is unlikely to be uncorrelated with retirement behaviour because of the ability to substitute leisure over the lifetime and also because of unobserved differences in preferences for leisure, which persist over the lifetime. There are many problems in what may appear to be a simple estimation problem. For example, social security and private pensions are linked in a mechanical way to the length of the work life so identification of the choice relationship separate from the technological one becomes quite difficult. There is agreement across studies that steeper age-pension profiles lead to delayed retirement. Put differently, for a given amount of pension wealth, sharper decreases in the actuarial value of retirement with continued work induce earlier retirement. There is evidence that supports the view that those with pensions leave the work force earlier. Quinn (1977), Gordon and Blinder (1980), Gustman and Steinmeier (1984) and Blundell and Johnson (1998) find that those with pensions are more likely to leave their jobs than those without pensions. Others (Reimers ,1977, Burkhauser and Quinn, 1980) find the opposite. Clark and Johnson (1980) find that males with pensions are more likely, but females with private pensions are less likely to retire than those without.

In recent years, there have been changes in retirement behaviour. There may be various reasons for the changes in retirement behaviour over time and differences across groups. The most important trend among older workers is the decline in age of retirement. Since there has been a simultaneous increase in the real income of the population, an obvious conjecture is that most of this reflects an income effect that induces workers to take more leisure. It should be noted though that the participation rates of older men were already declining before the period of the great expansion of government social security. However, this simple interpretation is not supported by the international cross-section.

Social policies: labour supply of women[8]

As mentioned above, labour supply is also influenced by other social policies. The most important of these are the policies with respect to labour supply of women. Of course, these policies are not of direct importance for the elderly, but may have a more indirect effect. Several studies indicate that women leave the labour market at childbirth and do not return afterwards. This can be due to reasons of skill obsolescence but also for other, social, reasons. Therefore, social policies that prevent women from leaving the labour market, or ease the combination of child-care and paid labour, will also increase labour supply of elderly women.

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8. This Section relies rather heavily on Rubery and Smith (1997).

Obviously, in a spatial sense, there exist differences in the organization of the family economy. These have implications for fertility rates and patterns, for the opportunities for individuals to find support outside the labour market, for the scope for the development of informal and even illegal activities as alternatives to wage work and for behaviour on the labour market. In this respect several regimes can be found within the European Union:

1. The countries in southern Europe stand out for their low fertility rates, low percentage of births outside marriage, low divorce rates and low shares of single person and lone parent families. In this respect Ireland follows much the same pattern as the Mediterranean countries;

2. The Nordic countries stand out for their relatively high fertility rates, shares of births outside marriage, divorce rates and shares of single person and one parent households;

3. The remaining Northern countries tend to be located between these relatively extreme positions, although individual countries may cross over with either the Mediterranean or the Northern patterns on individual indicators.

There are several impacts to be expected from changes in household structures. Thus single person households are likely to increase their commitment to work. It may also lead to problems of poverty for single retired persons, perhaps leading to an increase in labour supply among older workers. On the other hand, dual earner households may reinforce commitment, but also facilitate part-time work in some countries where women's contribution is not expected to be high.

State family policy can also be regarded as having a fundamental influence on the labour supply of women. In case of the Nordic countries the family and labour market policies are largely organized to facilitate the reconciliation of women's employment and parental responsibilities. Important policy elements which encourage the combination of work and family are the right to paid leave, subsidized day care, flexible working hours (including part-time work) and a progressive structure of taxes in combination with separate taxation of spouses. According to Rubery and Smith (1997) this Nordic model can be labelled as 'everyone a breadwinner', as all fit adults of working age are likely to be in work or looking for work. In their typology Austria, Germany and Luxemburg are considered as a strong male breadwinner model, designed around the presumption of a male breadwinner and a dependent wife. The taxation system tends to be household-based, so that the total tax is usually lower on married couples than on two single adults. This model is further characterized by limited state support with childcare and limited development of state services reducing overall demand for female wage labour. Belgium, France and the former East Germany can be seen as modified breadwinner countries as levels of service provision are higher, particularly for childcare. In the Mediterranean countries the family acts as breadwinner; the family provides many services which are provided

through the market elsewhere, due to the absence of a welfare state in many key areas such as child care. According to the Bulletin on Women and Employment (1996) this diversity in welfare and family systems may account in part for the uneven development towards a more gender-equal society.

3. Descriptive analyses

3.1 Introduction

In this Chapter a descriptive analysis of these same rates and their connection with the explanatory variables will be presented. In the previous Chapter a review of the economic literature concerning labour supply behaviour was presented. Several variables were uncovered as playing a role in explaining activity rates of the elderly, both on a theoretical and an empirical level. As was indicated, due to aggregation problems, it is not straightforward to generalize the relationships at an individual level to those on an aggregate level. However, it is assumed that factors that are of interest at the individual level will still be of importance at an aggregate level. Next to these factors, also some information related to the aggregation, i.e., demographic factors, has to be incorporated in the analyses. Still, in order to be able to conduct the quantitative analyses, the theoretical variables discussed in the previous Sections will have to be translated into empirical ones that are (close to) equal in content.

As far as the dependent variable is concerned, this is straightforward: the activity rate is simply defined as the labour force (both the employed and unemployed) as a percentage of the population of working age, where usually a partition into specific age- and gender-cohorts is made. All other factors will have to be incorporated in some aggregated form. This will be done as follows. As labour supply behaviour is so fundamentally different between men and women, the analysis will be conducted separately for both groups where appropriate. Also two age groups will be studied separately: both for men and women, the analyses will be presented for the age cohort 55-64 years of age and for the cohort 65-74 years of age.[9]

All other factors at the individual level will be aggregated in the analyses, and included as a multi-valued variable, indicating the percentage individuals in a certain region that have the given characteristic. In principle, the factors that were identified in the previous Chapter will be included: the labour supply factors are gender, age and educational level. The labour demand factors are incorporated by taking the employment characteristics: the professional status is used as well as the distinction between full-time and part-time. Not only individual characteristics are considered. Also, some proxies for the regional demographic structure of the population will be used as well as the degree of urbanisation. As a proxy for the employment structure (alternatively, the industrial structure) the extent of the service sector will be used.

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9. Although for some regions in Europe (especially the more agricultural oriented regions) the cohort 75-84 has also some importance, this cohort was left out of the analyses. The reasons for that is that reliable data on the age category 75-84 were not available for all countries, and the data available had too low variation to do any meaningful analyses.

Factors relating to the socio-economic and institutional differences between countries are incorporated by using a dummy-structure for e.g. the pension system. There are also some economic factors that should be included, but were not available on the regional level. The most important of these is the macroeconomic situation, which might be described by the rate of (regional) economic growth and the level of the real wage and the unemployment rate.

All data used in this Chapter and the next are taken from the Eurostat Labour Force Survey. As the data are needed on a regional level, the number of years that can be used is relatively restricted. The longest time series span a time period of 5 years, the shortest span a period of only two years. In Section 3.2 the activity rates will be discussed, both at the national level, and the regional differences. In Section 3.3 it is shown how the educational level - the most important explanatory variable with respect to labour supply - differs across the European Union. Section 3.4 highlights the most important explanatory variables relating to labour demand: demographic structure and sectoral composition of the economy. In this Section also some attention is paid to the incidence of part-time work and self-employment. In Section 3.5 some information is given on the socio-economic and institutional differences between the countries of the EU. Section 3.6 shows several bivariate correlations that are indicative of the extent to which economic and institutional factors influence national and regional activity rates. and the labour supply factors will be discussed.

3.2 Activity rates in the European Union

In Tables 3.1 and 3.2 below data are presented on male and female activity rates for four different age groups. It is easily seen that within age cohorts, male activity rates differ considerably between countries. For men aged 55-59, they range from 49.4% in Belgium to 83.9% in Sweden. For the age group 70-74 Belgium still has the lowest rate, while the highest participation is found in Portugal. It should be noted though that there exist not only differences between, but also within countries. This regional dispersion in activity rates is witnessed by the standard deviations ó. Generally speaking, the possibilities for regional dispersion increase with the number of regions within a country: in the United Kingdom, activity rates for men aged 60-64 e.g. range from 30.3% in the region of Tees Valley and Durham to 77.9% in North Eastern Scotland. On the other extreme, there is by definition no regional variation in Denmark and Luxemburg.

Taking a dynamic perspective, one observes that male activity rates are a declining function of age, i.e. successive age cohorts display lower rates. This holds at the general level of all EU-countries as well as for all countries taken separately. The overall decline in activity rates by age is quite substantial even though the rate by which this takes place differs between countries; thus, while the activity rate for men in Germany and Portugal is comparable for the age group 55-59 (74.2% and 72.3% respectively), the figures are highly divergent for men aged 60-64 (29.1% and 54.7% respectively). An observation that should be made when comparing the figures for the younger and the older cohort is that the ranking of the countries (i.e. ranking from the highest to the lowest activity

rate) is not equal for both age categories: in some countries the (relative) drop in activity rates is in some countries larger than in other countries.
Generally speaking, in Greece, Portugal and Ireland activity rates are structurally higher than in the other EU-countries.

Table 3.1
Male activity rates by age cohorts in the EU, 1997

	55-59	ó	60-64	ó	65-69	ó	70-74	ó
Belgium	49.4	7.0	19.5	5.5	4.3	2.3	1.4	1.1
Denmark	81.5	-	42.9	-	15.3	-	-	-
Germany	74.2	4.4	29.1	9.1	6.7	3.7	4.0	2.9
Greece	75.3	5.7	53.3	8.3	24.3	9.0	11.3	7.6
Spain	73.3	5.5	41.8	8.8	4.4	2.7	1.9	2.0
France	58.6	5.7	10.6	4.5	3.5	1.6	1.7	1.3
Ireland	72.1	5.7	52.9	6.9	27.7	8.9	17.9	7.2
Italy	55.7	11.0	30.6	6.4	10.6	2.8	4.9	2.3
Luxemburg	54.7	-	14.6	-	3.5	-	2.9	-
Netherlands	64.2	4.8	21.2	6.6	9.0	4.2	4.9	4.2
Austria	63.9	8.8	14.2	4.1	7.3	3.0	3.6	2.8
Portugal	72.3	6.5	54.7	7.7	31.6	14.1	18.4	14.1
Finland	65.4	21.6	18.3	11.2	7.5	5.5	2.9	3.6
Sweden	83.9	5.2	57.8	11.6	14.7	9.6	8.1	4.4
United Kingdom	74.4	9.0	51.8	10.4	14.3	6.7	6.7	3.9
Total	68.5	11.5	34.8	17.5	11.0	9.2	5.6	6.0

Source: Eurostat/ROA

At the EU-level activity rates of women are clearly below male activity rates: for the age groups 55-59 and 60-64 for example, the gender difference amounts to 26.7% and 17.6% respectively. This may obviously also be seen at the level of individual countries and it holds for almost all age cohorts; the only exception is Finland which has the same rates for men and women aged 55-59 and a higher rate for women in the age class 60-64. In some countries the difference is smaller: especially in Finland and Sweden the difference is small. In some of the southern European countries the gender difference is much larger: in Greece, Spain and Ireland the difference in activity rates is over 35 percentage points. This can be a result of a larger informal economy in these countries. The magnitude of the informal economy, however, can not be derived from the Eurostat figures. The pattern of high activity rates in the Nordic countries, which does not hold for the total population, seems to hold for the female population. For the rest the same remarks apply as for male activity rates; there is considerable between-country and within-country variation. Thus, for women aged 55-59 activity rates range from 17.6% in Luxemburg to 76.3% in Sweden. Furthermore, in Germany activity rates for women aged 55-59 range from 31.7% in the region of Saarland to 72.4% in East-Berlin.

Table 3.2
Female activity rates by age cohorts in the EU, 1997

	55-59	ó	60-64	ó	65-69	ó	70-74	ó
Belgium	23.4	6.1	5.0	1.8	1.5	1.5	0.9	0.8
Denmark	61.1	-	25.2	-	6.8	-	-	-
Germany	52.9	10.3	11.8	4.9	3.4	2.4	1.8	1.5
Greece	35.9	10.9	27.7	9.9	10.5	7.6	4.3	4.6
Spain	27.1	5.8	14.6	6.4	2.5	2.1	0.4	0.5
France	43.4	6.2	9.5	2.8	1.9	1.3	0.6	0.5
Ireland	28.5	4.5	17.1	3.4	6.5	3.1	3.2	1.4
Italy	28.5	6.0	8.2	2.1	2.9	1.4	1.2	0.9
Luxemburg	17.6	-	7.2	-	1.5	-	0.8	-
Netherlands	31.5	4.1	7.1	2.4	3.0	2.2	1.0	1.1
Austria	24.9	4.0	8.5	2.0	3.6	1.6	2.1	1.6
Portugal	44.9	16.4	29.0	13.5	15.8	13.5	8.7	11.0
Finland	65.4	17.9	30.5	34.4	1.1	1.4	0.5	1.2
Sweden	76.3	3.9	50.4	11.0	4.2	6.5	3.4	3.6
United Kingdom	52.6	7.3	27.2	8.3	8.1	3.5	2.9	2.0
Total	41.8	16.4	17.2	13.3	4.8	5.1	2.1	3.1

Source: Eurostat/ROA

Regional differences in activity rates can best be illustrated using so-called box-plots, in which the variation is indicated. In figures 3.1 and 3.2 the activity rates of men and women of the age cohort 55-64 years of age are shown. The smallest within-country variation in activity rates is observed in the Netherlands, where activity rates range from 39% to 53%. In Sweden the activity rates range from 61% to 82%. The regional activity rates in the UK range from 44% to 85%. The largest range is found in Finland, from 31% to 89%. On average, the range within the countries is about 25 percentage points. Part of the difference in the range is explained by the number and magnitude of the regions. The more regions there are given the size of the population, the larger the range can be. (Denmark and Luxemburg consist of one region, which reduces the range by definition to zero).

As illustrated in Figure 3.2, for the age cohort 55-64, the within-country variation of the female activity rates seems to be as large as that for men. There is however, a difference: for men, the interregional differences seem to be almost equal in all European countries, while for women, these differences in ranges are larger: in some countries very small ranges are observed. In Belgium, Ireland, the Netherlands and Austria the observed range is 10% or less (activity rates in Austria ranging from 13% to 21%). On the other hand, in some countries the range in female activity rates seems to be much larger than those observed for men. In Greece, Portugal and Finland, the observed range is over 30 percentage points. In Portugal the observed activity rates range from 18% to 63%, a range of 45 percentage points. In Finland the range is it is even 69 percentage points, but this seems to be a data-problem (one of the regions has a reported activity rate of 100%).

Figure 3.1
Male activity rates in the European Union, age cohort 55-64, 1997

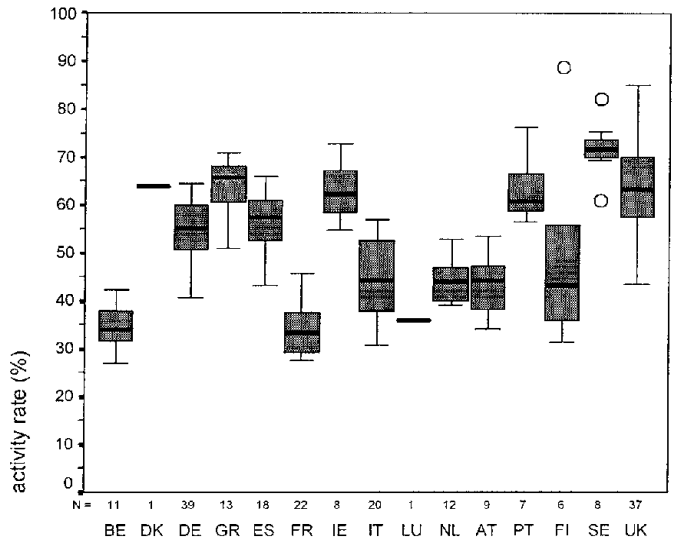
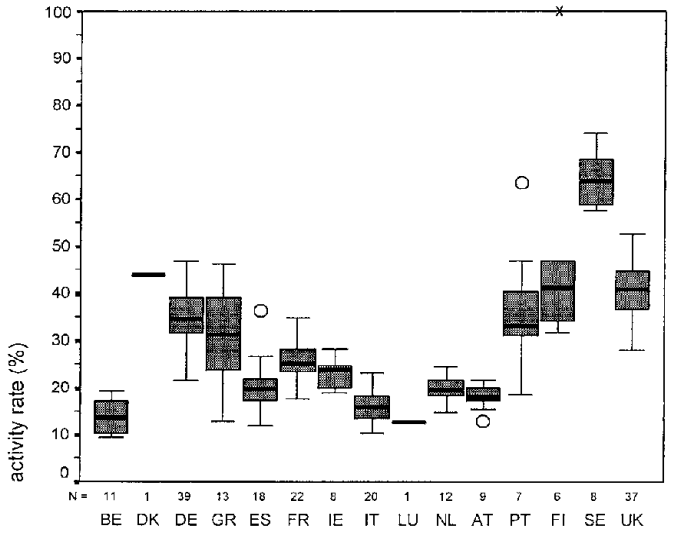


Figure 3.2
Female activity rates in the European Union, age cohort 55-64, 1997



In Figures 3.3 and 3.4 the variation in the activity rates for men and women in the age cohort of 65-74 is presented. When comparing Figure 3.3 to Figure 3.1, it seems as if the variation between countries is larger in Figure 3.3, also the range in activity rates between regions within countries seems to be larger. Both - of course - relative to the absolute value of the activity rate. For older men, the range is on average 15 percentage points, but the ranges differ considerably between countries: the largest ranges are found in Ireland (from 13% to 38%), Greece (from 8 to 38%) and in Portugal (16% to 56%). It seems as if the ranges in the Mediterranean countries are larger than those in the Nordic and Central European countries: the smallest ranges are found in Belgium and France (both ranging from 1% to 6%).

When turning to the variation in activity rates of women aged 65 to 74 as shown in Figure 3.4, it can be seen that in almost all countries the activity rates are very small. The relatively large drop in female activity rates occurs in almost all regions: the within country variation has almost vanished. The average magnitude of the range is about 9 percentage points. The smallest range is found in Finland (ranging from 0% to 2%), the largest is found in Portugal, where in one region an activity rate of 39% is found, while the lowest rate is 5%. It seems as if there might be some data-problems, because in some regions an activity rate of 0% is reported in the data. As can be seen in Figures 3.3 and 3.4, there are for some countries relatively large outliers. This can indicate some severe measurement problems. It should be questioned whether or not is useful to analyse the labour supply of elderly in the age cohort 65-74.

Figure 3.3
Male activity rates in the European Union, age cohort 65-74, 1997

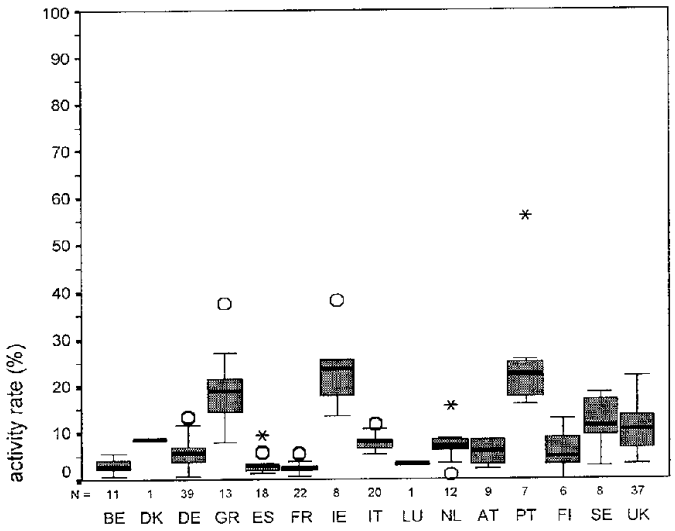
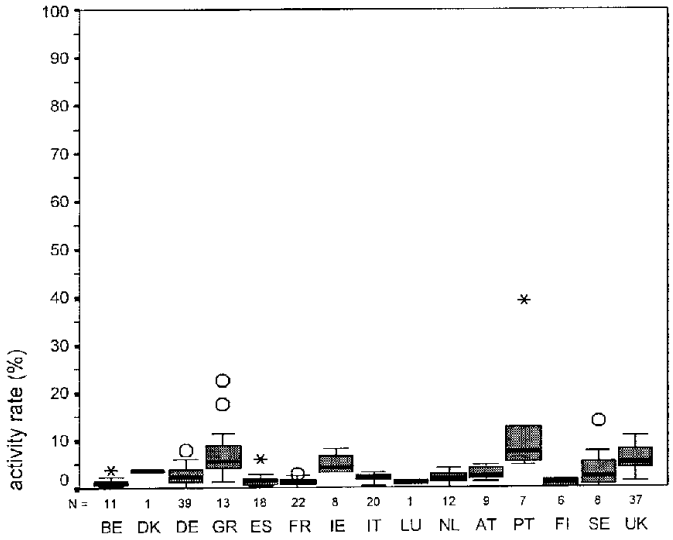


Figure 3.4
Female activity rates in the European Union, age cohort 65-74, 1997



3.3 Educational levels in the European Union

In the previous Section, the regional differences inactivity rates were presented. In this Section, information is given on the educational levels in the various countries of the EU, and the regional differences within those countries. From the economic theory as presented in Chapter 2, these differences are expected to explain (part of) the differences in activity rates between the regions.

The effects of the educational level are two-fold. First, a higher educational level implies that an individual has invested more in his human capital. In general, this implies that activity rates will be higher throughout the life-cycle. Second, most industries are evolving into the direction of more technological processes. This requires that workers are higher skilled. This implies that the demand for low skilled workers will diminish. This will also lead to lower activity rates for low educated workers. This last, demand-driven, effect, will not occur when the supply of higher educated workers is insufficient. Therefore, when the older workers are on average, not lower educated than the younger workers, this demand shift to higher educated workers will not affect the activity rates of the elderly. The same applies when the industries in the region does not require higher educated workers.

In this Section, it will be discussed how the educational levels differ between the countries, and to which extent there are regional differences in this level. This Section focusses on the educational level of the elderly. For reasons of measurement, educational level is divided into two levels: low educated (ISCED 1-3) and high educated (ISCED 4-7) In the Tables and Figures, only the percentage of individuals educated at ISCED level 1-3 are included; the percentages for ISCED level 4-7 are easily calculated since the two categories sum to 100%. As before, information on national levels will be summarized in tabular form, the regional variation in educational levels will be illustrated using box-plots. Table 3.3 shows the results for men. It turns out that on average the educational level of men decreases somewhat with age (obviously this argument only holds at a cohort level). Of all males aged 55-59 almost 80% is educated at ISCED 1-3, while for the older age groups this percentage is a little over 80%. This is in line with historical observations that the general educational level has steadily gone up during this century at least. The differences between countries are most marked for the age group 55-59 with percentages ranging from 51.3% in Sweden to 98.0% in Germany. Especially the percentages for this last country should maybe be taken with some care since they are surprisingly high. This may be due to how exactly the educational system is organized and how the different levels are defined. To a certain extent this holds for the other countries as well; educational systems are institutionalized in different manners and this may affect the results.

Table 3.3
Percentage of males aged 55-74 educated at ISCED level 1-3, 1997

	Age category			
	55-59	60-64	65-69	70-74
Belgium	59.0	65.4	72.2	73.3
Denmark	74.8	79.6	68.6	-
Germany	98.0	98.2	97.6	96.4
Greece	79.7	83.3	87.3	90.3
Spain	85.0	88.3	89.7	89.5
France	82.5	86.7	87.4	86.4
Ireland	73.5	78.6	82.7	84.3
Italy	80.0	86.2	87.1	87.8
Luxemburg	64.7	76.0	77.8	76.5
Netherlands	77.4	78.4	80.6	78.9
Austria	88.2	90.0	90.1	86.6
Portugal	93.5	93.1	93.3	94.3
Finland	83.0	86.7	90.6	86.9
Sweden	51.3	57.7	55.3	61.4
United Kingdom	64.0	70.6	63.2	74.9
Total	79.4	83.2	82.9	84.6

Source: Eurostat/ROA

In Table 3.4 the results for women are shown. It can be seen that on average the gender difference in educational levels is about 5%-points for all age cohorts. This may be rationalized by noting that in the past education was thought to be even less important for women than for men. This is, however, no longer the case, so for future generations this difference is expected to lessen. For women too the between-country differences

are largest for the age group 55-59 where percentages range from 48.2% in Sweden to 98.0% in Germany.

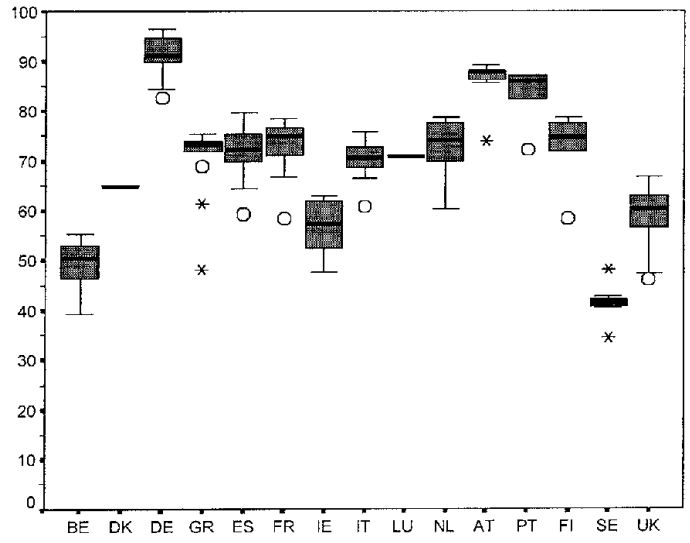
Table 3.4
Percentage of females aged 55-74 educated at ISCED level 1-3, 1997

	Age category			
	55-59	60-64	65-69	70-74
Belgium	65.3	75.5	79.7	84.5
Denmark	77.1	85.8	77.2	-
Germany	98.0	98.3	98.2	97.4
Greece	87.8	90.9	94.1	95.7
Spain	91.9	94.7	94.1	95.9
France	83.4	90.6	90.6	91.1
Ireland	67.7	74.4	78.7	84.1
Italy	87.7	91.1	92.5	93.5
Luxemburg	84.1	90.9	88.9	92.2
Netherlands	82.2	87.0	89.1	89.2
Austria	93.4	94.9	93.4	94.3
Portugal	92.1	93.7	96.8	97.2
Finland	87.0	91.1	93.5	92.2
Sweden	48.2	55.2	68.1	62.8
United Kingdom	79.6	78.0	74.2	72.0
Total	84.7	87.6	88.2	88.0

Source: Eurostat/ROA

Figure 3.5 shows the regional variation in the percentage of individuals educated at level ISCED 1-3. In this figure, no differentiation is made between age cohorts and gender here. It is easily seen that the regional dispersion is rather modest in most countries. It is largest in Ireland and the Netherlands. Within-country variation is found to be extremely low in Greece, Austria and Sweden.

Figure 3.5
Percentage inhabitants per region, educated at level ISCED 1-3, 1997



3.4 Demographic and economic structure of the regions

In this Section some factors related to the demographic and economic structure in the EU are discussed. From Chapter 2 is was known that these factors highly relate to labour demand. The demographic structure of the regions will to some extent limit employers in the individuals they can hire. When there live relatively few younger individuals, they have to hire older workers. At least, they will not replace older workers by younger workers. A higher percentage older individuals in a region will therefore -given demand - lead to higher activity rates of elderly. Also the economic structure of the region will influence the activity rates. The more flexible the economy is, (more part-time work) the higher activity rates of women and elderly will be. Also, the percentage workers in agriculture and services will influence activity rates. Agriculture is a sector with many self-employed and family workers. This will lead to higher activity rates of elderly. The more services there are in the economy, the lower activity rates will be, as these firms are expected to be highly computerised, and therefore hire young and high educated workers.

In this Section, it will be shown how the total population in each country is distributed both across age categories and across space. The economic structure is being described by the importance of the different economic sectors and the employment status, i.e. the extent of full- versus part-time work and of self-employment. For each of these descriptive statistics only 1997 data are used. Furthermore for reasons of clarity information will be presented at the level of national data, while indicating only particularities as far as the individual regions are concerned.

Table 3.5 depicts the distribution of population across age categories. At the EU-average the numbers suggest that the population structure is rather equilibrated in the sense that the youngest age cohort does not dominate the other two as is typical for most LDC's for example. Still there is some between-country variation: in Ireland for example the population is quite a bit younger than in other EU-countries. On the other hand, Germany, Greece and Finland have low scores for the youngest age cohort, but this is compensated for by higher than average scores for the intermediate (Finland) or the oldest age cohort (Germany and Greece). This picture becomes even more differentiated when within-country variation is allowed for. Thus, in the Irish region of Border the percentage of individuals aged 15-34 is as high as 47.4%. Finland and Germany have some very low scores for this age cohort: 26.8% in Etelä-Suomi and 29.7% in Saarland. The largest within-country variation is to be found in the United Kingdom though, where percentages for the youngest age cohort range from 28.8% in the Scottish region Highlands and Islands to 46.7 in Inner London.

Table 3.5
Demographic structure in the EU, 1997

	% 15-34	% 35-54	% 55-74
Belgium	36.7	37.0	26.3
Denmark	36.8	38.8	24.4
Germany	34.1	35.5	30.4
Greece	32.6	33.4	34.0
Spain	39.4	33.6	27.0
France	35.9	37.3	26.7
Ireland	43.3	35.7	21.0
Italy	39.0	33.5	27.5
Luxemburg	37.3	37.2	25.5
Netherlands	38.4	39.1	22.5
Austria	38.6	35.8	25.6
Portugal	36.2	33.8	30.0
Finland	33.2	41.4	25.4
Sweden	35.0	38.3	26.6
United Kingdom	36.9	37.4	25.7
Total	36.6	36.1	27.3

Source: Eurostat/ROA

The picture becomes even more differentiated if we allow for within-country variation. Thus, in the Irish region of Border the percentage of individuals aged 15-34 is as high as 47.4%. Finland and Germany have some very low scores for this age cohort: 26.8% in Etelä-Suomi and 29.7% in Saarland. Looking at figures 3.6 and 3.7, Portugal seems to be the EU-country with the largest regional variation for the youngest and oldest age cohorts[10].

10. Outliers are not taken into account when making this argument. Thus, in the UK for example, percentages for the youngest age cohort range from 28.8% in the Scottish region Highlands and Islands to 46.7 in Inner London

Figure 3.6
The percentage younger inhabitants (aged 15-34) per region, 1997

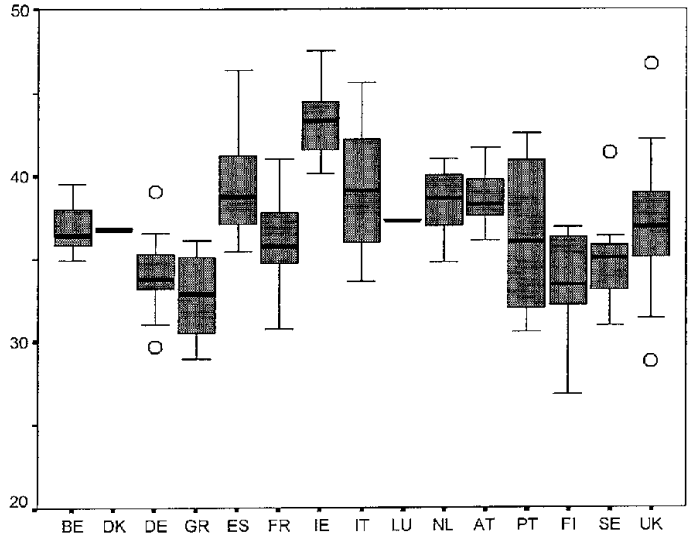
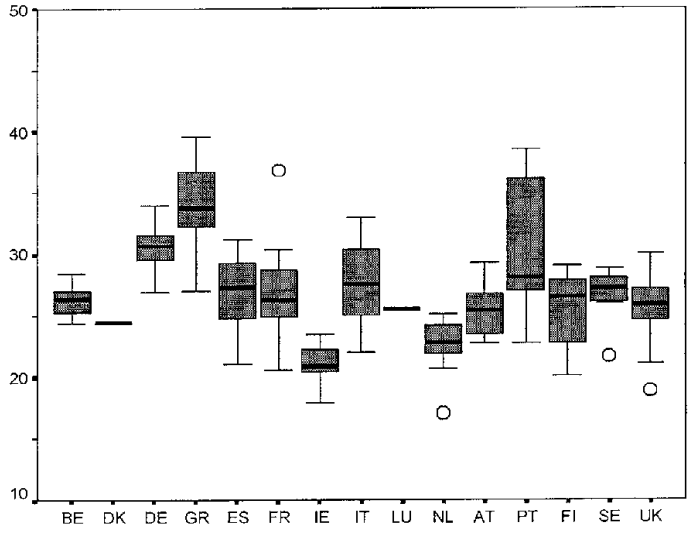


Figure 3.7
The percentage elderly (aged over 55) per region, 1997



In Table 3.6 below the distribution of population across space is illustrated, whereby the relevant variables are the percentages individuals of the total population living in densely, intermediately and thinly populated areas. Notice that the area to which is referred in this variable is smaller than the NUTS-II levels. Therefore, it is possible that there is variation in population density within the regions. On the aggregate level of the regions this implies that not all individuals in that given region are living in e.g. a densely populated area. There is a huge between-country variation, with the percentages living in densely populated area ranging from 14.3% in Sweden to 51.2% in the United Kingdom. For the percentages living in thinly populated area, the differences are even larger: 8.6% in the Netherlands and 81.2% in Ireland. That there exists a large within-country variation is only too obvious since any country contains regions that are predominantly densely or thinly populated, the former notably regions that contain the capital. Thus in Austria for example, in the region of Burgenland 0% of the population is living in a densely populated area, while for the bordering region of Vienna this percentage is as high as 100%. The same obviously holds for the agglomerations Brussels, Berlin, Hamburg, Greater Manchester and Inner and Outer London.

Table 3.6
The distribution of the population over the regions, total population, 1997

	Percentage of the population living in an area where the population is:		
	dense %	intermediate %	thin %
Belgium	47.0	40.3	12.7
Denmark	33.4	27.8	38.8
Germany	44.1	34.1	21.8
Greece	45.7	15.5	38.8
Spain	46.8	18.2	35.0
France	32.7	17.5	49.9
Ireland	18.8	-	81.2
Italy	32.9	35.1	32.0
Luxemburg	29.7	47.2	23.1
Netherlands	47.3	44.1	8.6
Austria	30.5	25.0	44.4
Portugal	32.0	35.8	32.2
Finland	16.7	10.6	72.6
Sweden	14.3	10.1	75.6
United Kingdom	51.2	30.9	17.9
Total	39.8	27.2	33.1

* % dense, % intermediate and % thin represent the percentages of the total population living in densely, intermediately and thinly populated area respectively.
Source: Eurostat/ROA

While in the foregoing demographics were considered, in the following paragraphs the 'structure of the economy' will be discussed. This concerns both the industrial structure and the preponderant employment status. Table 3.7 presents data on the sectoral composition of the national economies and of the EU-total. At the aggregated level of all EU-countries, the service sector turns out to be by far the most important. As is well-

known the service sector has gone steadily upward since some decades at least, thereby driving down the extent of the agricultural sector in particular. This process has not progressed at the same rate in all countries. Thus in Ireland, Greece and Portugal the percentage of individuals working in the service sector is still well below the EU-average; at the same time the agricultural sector is quite extended, ranging as high as 28.1% in Greece. Noteworthy is the extent of the industrial sector in Germany, which reaches 34.6% and is thereby 6 percentage points higher than the EU-average. In addition to these differences, there is a large regional variation. As can be seen from Figure 3.8, in Greece for example, 43.1% of the population in the Peloponnisos region works in the agricultural sector, while this is only 1.0% in Attiki. On the other hand, in Germany, the extent of the industrial sector ranges from 22.3% in Hamburg to 43.8% in Stuttgart. Still, considerable variation in the extent of the industrial sector is not typical for Germany only. Within-country differences are even larger in Belgium and Italy. Figure 3.9 shows that Portugal and Greece have large variation in services; in these countries some regions are predominantly agricultural, while the capital region in particular has an extended service sector.

Table 3.7
Sectoral composition of the economy, total population, 1997

	Percentage of the working population working in : agriculture %	industry %	services %
Belgium	2.8	25.9	71.2
Denmark	3.7	26.2	70.0
Germany	3.2	34.6	62.2
Greece	28.1	20.8	51.1
Spain	9.1	28.9	62.0
France	6.1	27.6	66.3
Ireland	15.0	30.9	54.2
Italy	8.1	29.3	62.6
Luxemburg	2.3	23.3	74.4
Netherlands	4.4	24.0	71.6
Austria	6.6	30.6	62.8
Portugal	14.0	27.1	58.9
Finland	11.5	24.7	63.8
Sweden	3.7	26.3	70.1
United Kingdom	2.4	27.8	69.8
Total	7.1	28.6	64.3

Source: Eurostat/ROA

Figure 3.8
The percentage workers in the European regions in agricultural work, 1997

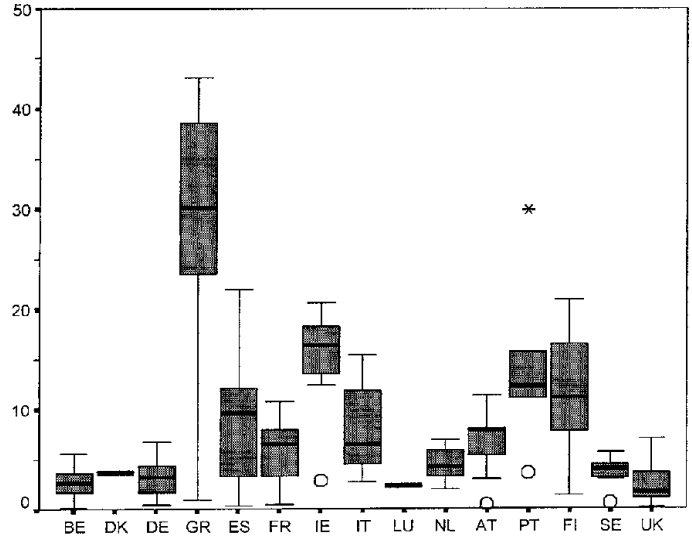
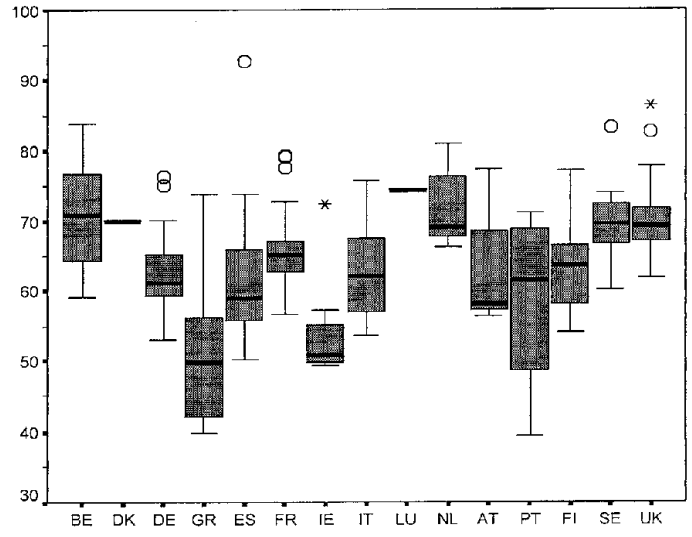


Figure 3.9
The percentage workers in the European regions in services, 1997



In Table 3.8 both the percentage of individuals in full-time work and the percentage of self-employed is shown for the European countries. Obviously full-time work is still the preponderant regime in the EU, although the numbers differ considerably when individual countries are compared. A full-time contract applies for 94.7% of the workers in Greece, while this percentage is only 61.5% in the Netherlands. The latter country may thereby be considered as having the most flexible economy as far as this one aspect is concerned. Greece also has the highest percentage of self-employed individuals, which may be understood by referring to Table 3.7 where it was shown that Greece has the largest agricultural sector in the EU. The lowest percentage of self-employed is to be found in Denmark and Luxemburg (8.3% and 8.5% respectively).

Table 3.8
Employment status of workers in the EU, total population, 1997

	Percentage of the working population working:	
	in full-time work %	as self-employed %
Belgium	84.9	15.0
Denmark	77.7	8.3
Germany	82.6	9.8
Greece	94.7	38.8
Spain	92.1	22.6
France	82.9	12.6
Ireland	87.9	22.7
Italy	93.1	25.6
Luxemburg	91.8	8.5
Netherlands	61.5	11.4
Austria	85.0	10.8
Portugal	90.5	25.0
Finland	88.7	16.9
Sweden	75.0	11.0
United Kingdom	74.5	12.8
Total	83.2	16.6

Source: Eurostat/ROA

Figure 3.10 illustrates the fact that the within-country variation in the percentage of the population working full-time is very restricted. This observation suggests that regulations concerning full- and part-time work apply to the national economy as a whole rather than to specific regions. Roughly the same can be said for the percentage of self-employed, although regional variation turns out to be somewhat larger here. In Figure 3.11 it is illustrated that in particular Portugal is characterized by considerable variation.

Figure 3.10
The percentage workers in full-time work in the European Regions, 1997

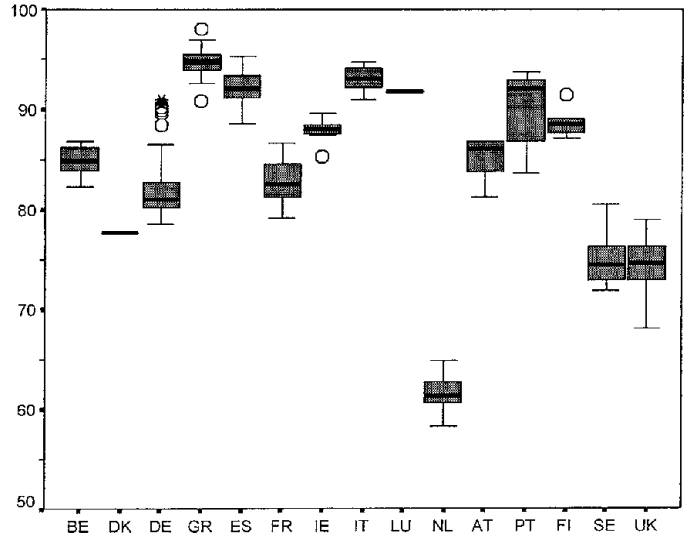
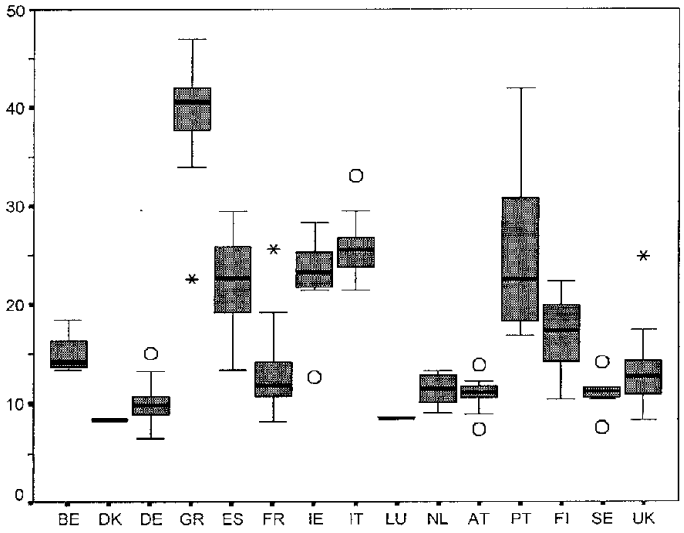


Figure 3.11
The percentage workers in self-employment in the European regions, 1997



3.5 The institutional environment

As described in the previous Chapter, there can be very substantial influences of the institutional system on the labour force activity rates of the elderly. The pension age is an example of this. Activity rates of individuals older than this age will generally be low, in particular when retirement is mandatory in nature. Table 3.9 presents information on national pension systems in the European Union. This information is mainly is based on DG V, Missoc (1999). It is easily seen that there are relatively large differences between EU-countries as far as pension systems are concerned. This is not true for (ordinary) male pension ages, that range from 60 years in France to 67 years in Denmark, although 65 years holds for most EU-countries. For women the range is somewhat larger, from 58 in Italy to 67 in Denmark. On the contrary, regulations concerning early, deferred and partial pensions differ substantially. These differences will not explain differences in the activity rates within countries though; at most differences between countries may thereby be explained.

In Table 3.9 only the national regulations are summarized. It is to be noted though that in almost all countries there are additional regulations, e.g. (binding or non-binding) collective agreements on an industry or sector level. For instance, in the Netherlands almost all collective agreements have early retirement schemes, which make early retirement around the age of 60 possible. However, these regulations differ between both countries and sectors.

Table 3.9
National pension systems for the EU countries

	Pension age		Early pension		Deferred	Partial
	men	women	men	women	pension	pension
Belgium	65	61	60	60	none	none
Denmark[a)]	67	67	50	50	3 years	60
Germany	65	65	63/60		possible	possible
Greece[b)]	65	60	57-60		none	none
Spain[c)]	65	65	60	60	possible	62
France	60	60	none		65	60
Ireland	65	65	none		none	none
Italy	63	58	54	54	65	none
Luxemburg	65	65	57/60		68	possible
Netherlands	65	65	none		none	none
Austria	65	60	60	55	unlimited	at early retirement
Portugal[d)]	65	64.5	60	60	none	none
Finland	65	65	60	60	unlimited	58-64
Sweden	65	65	61	61	70	61-64
United Kingdom	65	60	none		5 years	none

[a)] Early pension for social and/or health reasons
[b)] For individuals insured since 1993 equal at 65 for both men and women. The early pension age is highly dependent on the individual situation
[c)] Not for all workers, but only for those insured before 1967
[d)] Early pension for unemployed only
Source: MISSOC, 1999

3.6 Bivariate correlations

In this Section a number of bivariate analyses is presented. These are mainly bivariate correlations between the activity rate and several explanatory variables that are thought to be of importance. The correlations are calculated for all countries separately as well as for the EU as a whole, for both men and women. All correlations are computed using data at the lowest, regional, level.

In Table 3.10 the correlations are presented for the educational level, It turns out that there is a positive and significant correlation between the percentage of individuals educated at ISCED-level 4 or higher and the activity rate, which means that the higher educated tend to stay in the labour market for a longer time. This holds for both men and women, although the effect for women is somewhat stronger. It should be noticed, however, that although the correlation is positive at the EU-level, there are countries for which this correlation is zero or negative. Greece and Portugal have a negative correlation between the percentage high educated in the regions and the activity rates of elderly. Countries like Italy, Luxemburg and Finland there is no correlation at all. There seems to be clear pattern in these correlations, i.e., it is not possible to tell based on this Table that educational level has a different effect in the Northern than in the Southern countries of Europe.

Table 3.10
Bivariate correlations between activity rates and the percentage educated at ISCED 4 or higher, age cohort 55-64, 1992-1997[a)]

	% ISCED level 4-7	
	men	women
Belgium	0.85**	0.60**
Denmark	-0.21	-0.67
Germany	0.48**	0.18
Greece	-0.57**	-0.52**
Spain	0.23*	0.07
France	0.45**	0.35**
Ireland	-0.19	0.40*
Italy	0.02	0.11
Luxemburg	0.04	-0.37
Netherlands	0.11	0.65**
Austria	0.45*	0.20
Portugal	-0.40*	-0.19
Finland	-0.06	-0.08
Sweden	-0.10	-0.27
United Kingdom	0.54**	0.48**
Total	0.19**	0.33**

a) * indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

In the following Tables, the bivariate correlations for the demand factors are shown. First, the correlations of the demographic structure is shown. In Table 3.11 the results are shown for the percentage elderly in the regions correlated to the activity rates in those regions. It can be seen from this Table that when there are more people in the age category 55 years and older , the activity rate for the elderly increases. This may be caused by some kind of substitution effect, i.e. when there is a relative abundance of individuals aged 55-74, there is a relative shortage of individuals in other age cohorts, so employers are bound to hire relatively more senior workers. For this variable, it seems that although there are some differences in the magnitude of the correlation, for all countries the correlation is negative. The only exception is that for Greece, female activity rates are lowest in the regions where the lowest numbers of elderly live.

Table 3.11
Bivariate correlations between activity rates and the percentage elderly, age cohort 55-64, 1992-1997[a)]

	% aged 55-74	
	men	women
Belgium	-0.13	-0.25
Denmark	-0.67	0.04
Germany	-0.55**	-0.49**
Greece	0.35**	0.36**
Spain	-0.13	0.15
France	-0.18	-0.32**
Ireland	0.04	-0.25
Italy	-0.45**	0.34*
Luxemburg	0.04	-0.31
Netherlands	-0.09	-0.35**
Austria	-0.66**	-0.48*
Portugal	0.24	0.10
Finland	-0.26	-0.26
Sweden	-0.20	-0.12
United Kingdom	-0.28*	-0.16
Total	0.10**	0.13**

a) * indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

Table 3.12
Bivariate correlations between activity rates and the percentage individuals living in a densely populated area, age cohort 55-64, 1992-1997[a)]

	% dense	
	men	women
Belgium	0.43*	0.18
Denmark	0.01	0.76
Germany	0.06	0.18
Greece	-0.47**	-0.50**
Spain	0.09	0.09
France	0.32**	0.22*
Ireland	0.02	0.33*
Italy	-0.05	-0.31*
Luxemburg	0.02	-0.05
Netherlands	-0.01	0.41**
Austria	0.62**	0.11
Portugal	-0.26	0.19
Finland	0.15	0.04
Sweden	0.18	0.26
United Kingdom	-0.26*	-0.15
Total	0.02	-0.05

a) * indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

Finally, in Table 3.12 is illustrated whether or not there is any correlation between the spatial distribution of the population and the activity rates. As can be seen from this Table, there is only a very limited effect. There is an effect found for Greece, where highly populated regions have low activity rates of women. In France, the Netherlands and Austria the effect is positive: high populated area's have high activity rates of the elderly.

As indicated before, also the factors relating to the structure of the economy can influence the activity rates of the elderly. In the next three Tables these effects are illustrated. In Table 3.13 the bivariate correlations are shown of the percentage workers in services in the various regions and the activity rates of elderly in those regions. At the EU-level., the correlation between the percentage of individuals working in the service sector and the activity rate is significant for men only and is negative. This may also be due to substitution: as most work in the service sector is done by women, an extended service sector implies that there are relatively many women in the labour market, crowding out the older men (i.e. in a relative sense). Although this negative correlation at the EU-level, it can be seen in the Table that at the national level there are some countries for which this correlation is positive, both for the male as well as for the female activity rates. Both for Belgium, France, the Netherlands, Austria and the United Kingdom, activity rates are highest in the regions with a relatively large number of workers working in services.

Table 3.13

Bivariate correlations between activity rates and the percentage workers in services, men and women, age cohort 55-64, 1992-1997 [a)]

	% in services	
	men	women
Belgium	0.77**	0.77**
Denmark	-0.63	-0.14
Germany	0.02	0.19
Greece	-0.71**	-0.60**
Spain	0.21*	-0.19
France	0.36**	-0.45
Ireland	-0.13	0.29
Italy	0.23	-0.05
Luxemburg	0.03	-0.79
Netherlands	0.19	0.55**
Austria	0.39*	0.35
Portugal	-0.14	-0.38*
Finland	0.22	0.12
Sweden	-0.32	-0.03
United Kingdom	0.08	0.27*
Total	-0.22**	0.02

[a)]* indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

In Table 3.14 it is shown to which extent the number of full-time contracts correlates to the activity rates. It was expected that the lower this percentage, the higher the activity rates. From the Table however, it can be seen that this hypothesis is not fully supported by the data. The correlation of the percentage of workers in full-time jobs and the activity rates is significant for both men and women; it varies positively with the male activity rate and negatively with the female activity rate. This would suggest that men prefer full-time contracts, while women prefer part-time contracts. An other explanation would be that part-time contracts are possible for women only. In that case, men have the choice between full-time work and non-participation only. This will, in general, lead to a labour market exit that is earlier than would be the case when they could have worked part-time.

Table 3.14
Bivariate correlations between activity rates and the percentage of workers in full-time contracts, men and women, age cohort 55-64 [a)]

	% in full-time work	
	men	women
Belgium	0.04	-0.26
Denmark	-0.28	-0.81
Germany	-0.68**	0.14
Greece	-0.52**	-0.65**
Spain	-0.09	0.07
France	0.43**	-0.04
Ireland	-0.04	-0.50**
Italy	0.48**	0.26
Luxemburg	0.76	0.17
Netherlands	0.04	-0.16
Austria	-0.41*	-0.49**
Portugal	-0.60**	-0.78**
Finland	0.54*	0.50*
Sweden	0.04	0.21
United Kingdom	0.02	-0.13
Total	0.12**	-0.19**

a)* indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

Finally, also the number of workers in self-employment will be influencing the activity rates of the elderly. As can be read from Table 3.15, the correlation between this percentage and the activity rates is significant for both men and women, with the sign being the same as that for full-time work. In other words: more self-employment in a given region will increase male activity rates, but lower female activity rates. This can be explained by the fact that the owner of a firm is in most cases the man. This implies that he has to stay working in order to earn his income. On the other hand, when employment in a region is mostly self-employment, there are but little opportunities for non-self-employed to find a job. This may lower the activity rates for those people that are dependent on that kind of employment, i.e. mostly women. On the other hand, at the national level, almost all correlations are positive. This may indicate that there is a positive relation between the number of self-employed and activity rates for all countries, but that at the European level in countries with high self-employment rates female activity rates are low.

Table 3.15
Bivariate correlations between activity rates and the percentage workers in self-employment, men and women, age cohort 55-64 [a)]

	% self-employed	
	men	women
Belgium	0.60**	0.40
Denmark	0.33	0.77
Germany	0.75**	0.24*
Greece	0.64**	0.64**
Spain	-0.19	0.30**
France	0.08	-0.29**
Ireland	0.41**	-0.16
Italy	0.23	0.56**
Luxemburg	-0.07	0.54
Netherlands	-0.04	-0.19
Austria	-0.46*	0.02
Portugal	0.39*	0.42*
Finland	0.06	0.22
Sweden	0.40	0.48*
United Kingdom	0.36**	0.40**
Total	0.37**	-0.08**

[a)] * indicates significance at the 5% level, ** at the 1% level.
Source: Eurostat/ROA

When interpreting the bivariate correlations, it should be realized that these might lead to misleading conclusions. When two explanatory variables are highly correlated, and only one is influencing the level of the activity rates, both bivariate correlations will be significant. An example is the effect of the educational level and age. When older workers are on average lower educated, and lower educated have lower activity rates, the bivariate correlation between age and activity rate will also be negative. Therefore, it is better to use multivariate analyses to study the effect of explanatory factors. These analyses are done in Chapter 4.

4. Explanatory analyses

4.1 Introduction

In the previous Chapter it has been shown to which extent differences in activity rates correlate with differences in the explanatory variables. In this Chapter a more technical approach is used. Using the data as presented in the previous Section a number of multivariate regressions will be run to explain activity rates in the European Union. The results of these regressions will be used to predict activity rates. By using various levels of pooling, it can be computed which factors contribute most to the observed variance of activity rates.

4.2 The importance of regional differences in labour supply

When explaining regional differences, it should be realized that differences between regions in different countries do have two components: the differences between the countries, and the deviations of both regions from their national mean. When explaining the differences between regions, this level-structure should be recognized. The literature presents a model for this type of clustered data, called multi-level model. The standard example in the (sociological) literature is when explaining student scores. As students are part of a class, classes are within a school, the observed variance of student scores is composed of three parts: between-school variance, between-class variance and between-students variance. This structure is known as multilevel models (See e.g. Raudenbush and Bryk, 1986, Bryk and Raudenbush, 1992, or Goldstein, 1997). Due to the structure of the multilevel model it is possible to pool the data. This means that more data are available, and hence the statistical reliability of the estimations will improve.

This structure of several levels can also be applied to variables that are measured at a regional level. The data for the activity rates are available on a regional (NUTS-II) level. This implies that the observed data can be "clustered" in groups. The lowest level is given by the repeated observations in the various years for the various regions. The second level is the regional level, the third level is given by the national level. In principle it is possible to define a fourth level by groups of countries. This implies that there are explanatory variables that differ per year and per region, those that are fixed across years, but differ between regions, and those that are fixed within countries. Examples of the first are given by e.g. the educational level of the population in a given region, examples of the factors that are equal within countries are given by e.g. the structure of the pension systems.

Not only the explanatory variables show a nested structure, also the structure of the variance does. The variance at the lowest level is a function of a number of components: the variance at the individual level, the 'within-region' variance, the between region-variance, etc. This

implies that the variance-matrix of the problem has a very specific structure. The basic multilevel model has fixed coefficients, together with the variance structure as mentioned above. Given the structure of the error-term, a three-level regression model can be written as:

$$y_{ijk} = \hat{a}'Z_{ijk} + \mathring{a}_{ijk} \tag{11}$$

with:

$$\mathring{a}_{ijk} = u_i + v_j + e_k \tag{12}$$

In Equation (12) the three error components are indicated by *u, v,* and *e*. The three subscripts refer to the three levels in the model. Each of the three error-components is assumed to be distributed normally, with zero mean and a given variance. The covariance between the various units at each level is assumed to be zero. This implies that the variance-covariance matrix of the composite error-term åhas a block-diagonal structure (See also Goldstein, 1997). Due to the structure of the model, the relative magnitude of the three error-components can be computed, which makes it possible to determine which variance-component is most important.

As Goldberg shows, not only the variance can differ between the level-1 units. Also the beta's can differ between level-1 units. The easiest example is to have â as a random coefficient. In that case the regression coefficients can differ between the level-1 units randomly, as if they were drawn from a normal distribution: $\hat{a} \sim n(\bar{\hat{a}}, ó_{\hat{a}})$. A more sophisticated model results from â taken as a function of level-2 variables: $\hat{a} = \hat{a}_0 + \tilde{a}'Z + ç_{\hat{a}}$. Using that specification, it is possible to have the regression coefficients vary systematically between the level-1 units. The easiest model that can be used in this specification is a dummy-structure, which lets â have equal variance between level-1 units, but different intercepts.

Using the basic multi-level model, it is possible to decompose the total variance of activity rates into three components. To do so, activity rates for the various regions are 'explained' by a model consisting of a constant, and three error terms: one at the national level, one at the regional level, and one at the year-level:

$$p_{yrc} = \hat{a} + v_c + u_{rc} + e_{yrc} \tag{13}$$

The three error terms have variances $ó_v^2$, $ó_u^2$ and $ó_e^2$, respectively. The relative magnitude of these three components, is an indication for the relative importance of regional and national differences in labour supply.

In the previous Chapter it has been shown that the activity rates differ greatly between men and women, but also between the age category 55-64 and 65-74. Therefore, in Table 4.1 the estimations of the variance decomposition are shown for four subgroups: two age categories and two sexes. The estimated â is the average activity rate over all regions and years (which is 1993-1997 for most countries), while the three estimated variances are the variance of the national deviations from the overall average, the regional deviations from the national average, and the yearly deviations from the regional average, respectively. It should be noted that due to differences in population size in the regions, the average activity rate in a country is not equal to the average of the regional activity rates. It should also be noted that the number of regions within a country can influence the results with respect tot the interregional variance component: this component is expected to be lower, the lower the number of regions is for a given population size.

Table 4.1
Estimation results of the basic variance model explaining activity rates

	aged 55-64		aged 65-74	
	men	women	men	women
â	52.37	28.93	9.98	3.77
	(16.5)	(8.1)	(5.4)	(5.2)
$ó_v^2$	143.28	187.02	50.85	7.39
	(2.6)	(2.7)	(2.7)	(2.6)
$ó_u^2$	38.17	28.43	19.76	9.87
	(8.9)	(8.6)	(18.4)	(18.4)
$ó_e^2$	12.28	12.23	-	-
	(15.5)	(15.5)	-	-
-2LogL	4252.9	4203.4	4101.6	3602.5
Number of obs.	693	693	693	693

t-values in parentheses
Source: ROA

In Table 4.1 it can be seen that the average activity rate of the age group 55 - 64 in the countries of the EU differs between men and women. For men the average activity rate is 52 percent, while for women it is 29 percent. The activity rates have a large variance. When decomposing this variance into the three components described above, it can be seen that the variance of the differences between countries is very large in comparison to the other two variance components. This is especially so for the activity rates of the age cohort 55-64 years. For the male activity rates, the variance of the differences between countries is 143, while the variance between the regions within a country is only 38. The variance within the regions between years is even lower: 12. For the female activity rates, the results are comparable. The variance of the differences between the countries is 187, the variance of the regional differences within countries is 28, while the variance of the between year differences is 12. For the age cohort 65-74 the results are slightly different. The variation in activity rates of individuals older than 65 is much lower than that of those aged 55-64. As a result of this, the variation between years is extremely

low, which made it impossible to estimate a three level model. Therefore, in Table 4.1 the results for a two level model are shown. It can be seen that for this age cohort, both the level of the activity rates and the variation are much lower. Again, for male activity rates, the variation between countries is much higher than the between-region variation. For female activity rates, the between-country and the within-country variation are about equal, the latter being somewhat larger.

This simple decomposition shows that when explaining regional differences in activity rates, these differences should be explained mainly from national differences when the regions belong to different countries. The variation that remains when controlled for national differences is much lower, and this variance has to be explained by regional differences.

For the results in Tables 4.1 it should be noted again that for some countries only a small time series is available. For some countries the time series start only in 1995. This implies that the between year variation is (for some regions) based on two observations only. In the next Chapter, the variance will be explained by several factors, which makes it possible to decompose the variance components into several parts, and thereby show the relative importance of the explanatory factors.

4.3 Regression results, a pooled model

In this Section, the results of a pooled regression will be shown. Due tot the fact that men and women, and two age categories, are studied separately, there are four sets of estimated parameters to be shown. All regressions are run based on the lowest regional level. Due to this, countries with relatively few regions will have less influence on the results than those consisting of a large number of regions. Using the estimated parameters, it can be investigated how much of the observed variance is explained, and at which level the unexplained variance remains.

The first thing to notice is that the variable to be explained is the labour force activity rate. This rate is between zero and one (or zero and hundred, depending on the scale). When a linear model is estimated, it is possible to have the predicted activity rates outside this range. Therefore, a transformation is used, which allows the transformed activity rate to be outside this range, but forces the predicted activity rates between zero and one. A transformation commonly used is a logit transformation:

$$y = \ln\left(\frac{p}{1-p}\right) \tag{14}$$

with p the observed activity rate, and y the transformed rate. The variable y is unbounded, while p is bounded. Now, using this specification, a linear model can be estimated for y. This model can be used to compute predictions for y, that can be transformed to predictions for p using the inverse transformation:

$$\hat{p} = \frac{\exp(\hat{y})}{1 + \exp(\hat{y})} \tag{15}$$

When explaining activity rates, two strategies can be followed, depending on the definition of the variables used. The first one, also used by Ward and Dale (1992), is to divide the total population within a region in a number of subgroups, and specify a linear model for the level of participation for these subgroups:

$$y_{ij} = \hat{a}_0 + \sum_k \hat{a}_{ijk} x_{ijk} \tag{16}$$

In this specification the activity rate of individuals within region *i* and belonging to sub-group *j* is explained by the relevant explanatory variables. The explanatory variables x_{ijk} are mainly dummies indicating to which group a given activity rate refers. In this model, it is possible to relate differences in activity rates between individuals of given characteristics within certain regions to differences in these characteristics. The estimated parameters can thus be interpreted as the deviation from the mean activity rate. Therefore, this specification is useful in examining the difference in activity rates between e.g., men and women, or between high and low educated individuals. However, it is not possible to compute the total activity rate in a given region. This total activity rate depends not only on the activity rates within certain groups, but also on the magnitude of these groups. Thus the fact that high educated individuals have higher activity rates than low educated, does not give information on regional activity rates, as long as the number of high and low educated within these regions is not known. Therefore a slightly different specification is used, in which not the activity rates of the various types within a region are to be explained, but the "overall" activity rate in the region. In that case the model becomes:

$$y_i = \hat{a}_0 + \sum_k \hat{a}_{ik} x_{ik} \tag{17}$$

In this case the activity rate of the region is explained by using explanatory variables on a regional (or higher) level. In this specification the explanatory variables x_{ik} are, e.g., average age, educational level or economic growth in a given region. This specification is useful to relate activity rates to general characteristics of a region(educational level, industrial structure etc). Also, this specification is easily used for future predictions, since it does not need to predict the number of individuals in certain groups, it only needs the general trends of the explanatory variables. The disadvantage of the second specification is that it is very difficult to translate the estimated parameters into micro-economic behaviour, which is more easily done using the first specification.

As the main objective of this study is to explain existing differences in labour force activity rates between regions, the second specification will be used. However, from the empirical

literature it is known that men and women have different characteristics and labour supply behaviour (Grift, 1998, Vlasblom, 1998). In that case, estimating one model will obscure the underlying relationships. Therefore, for both men and women separate participation models will be estimated.

The first regression is one in which all data are pooled over countries, regions and years. In Table 4.2 the results of this regression are shown. Due to the transformation used, the coefficients are not directly interpretable in terms of activity rates. However, positive coefficients correspond to higher activity rates. In this regression no random-coefficient structure is used. For all four groups it can be seen that both the Nordic and the Mediterranean countries have higher activity rates. For the first age cohort the effect is larger for women, while for the second age cohort the effect is larger for men. For the Mediterranean countries only the estimated coefficient for the males is significant. For the other groups, there is no significant difference compared with the other European countries. The higher activity rates for those countries is explained by the other relevant factors included in the regression.

There is an important effect of the pension system on the activity rates. The higher the pension age, the higher the activity rates are. This effect is strongest for the male age category 55-64. There is also an effect of a deferred pension: the possibility to defer pension increases the activity rates of elderly. The effects of the other two features of the pension system are not as expected: the possibility of an early pension lowers the activity rates of males younger than 65, and increases activity rates of males older than 65. Especially this higher activity rates of older men is not as expected. Perhaps this has to do with the fact that when some individuals leave the labour market relatively young, this opens possibilities for some of the elderly to stay in the labour market longer. The possibility of a partial pension lowers the activity rates. This is quite counterintuitive, because a partial pension was meant to increase the activity rates of the elderly. On the other hand, as indicated in Table 3.9, the partial pension can be used before the legal pension age. In this respect, it is somewhat comparable to the early retirement: it increases the 'distance' to the labour market for the elderly, and therefore lowers the activity rates. For all estimated effects of the pension system, it should be recognized that these factors do not differ between regions and years within a country. Therefore, there is relatively low variation, and the significance of some of the estimated effects can be attributed to one or two countries, especially when these countries have a large number of regions. (e.g., the significant effect of pension age is mainly due to observations on France).

Some effects can be found of the demographic structure of the regions: the larger the percentage of younger people (younger than 35) in a region, the lower the activity rates of the age cohort 55-64. This seems to suggest that younger workers drive the elderly out of the labour market. On the other hand, both the percentage of younger individuals and the percentage of elderly (older than 55), increases the activity rates of the oldest age cohort (65-74). The positive effect of the percentage younger individuals in a region

an the activity rate of elderly is not explained straightforwardly. The effect of the number of elderly should perhaps be explained by the fact that when the majority of the people in a region is relatively old, workers have to be found in this older age cohort.

There is some effect of the educational level in a region on the activity rates, although this effect is only found for two groups under study. The educational level is included twice: the educational level of the cohort under study, and the effect of the educational level of the (regional) population in total. The higher the number of low educated individuals in a cohort, the lower the activity rates, and the higher the number of people with a university degree, the higher the activity rates. The educational level of the total population has almost no effect: the higher the number of low educated, the higher the activity rates of elderly. The explanation for this is that when the population as a total is relatively low educated, the older generation is 'less handicapped' by their own low educational level, and thus able to stay longer in the labour market.

The structure of the economy has also a relatively small effect on the activity rates: the percentage of non self-employed has no effect on activity rates, also the percentage of workers in services does not explain differences in activity rates. There is, however, a strong positive correlation between the number of workers in agriculture and the activity rates. Agricultural workers seem to increase the activity rates of elderly. The number of part-time workers does increase the activity rates of elder men. The explanation for this can be two-fold: the first is that when people can work in part-time, they are able to stay longer in the labour market. The other is that when younger people start working part-time, the work can or has to be done by elder workers. Unfortunately, the available information on wages, incomes and GDP is not in the same NUTS-classification as the other data are. Therefore, this information could not be included into the analyses.[11]

11. This holds mainly for the UK, where the NUTS-classification in the LFS is based on the NUTS-92 classification, while in the New Cronos database the NUTS-95 classification is used.

Table 4.2
Regression results for the activity rates, pooled observations

Age cohort	55-64				65-74			
	men		women		men		women	
Constant	-0.310	(0.43)	1.367	(1.42)	-4.037**	(2.92)	-6.417**	(3.56)
Nordic	0.198*	(2.06)	0.570**	(4.71)	0.634**	(3.54)	0.036	(0.16)
Mediterranean	0.433**	(5.45)	-0.102	(0.94)	0.251	(1.71)	-0.234	(1.26)
Pension age[a)]	0.189**	(12.88)	0.075**	(5.49)	-0.017	(0.63)	0.097**	(2.75)
Early pension	-0.248**	(3.26)	-0.060	(0.93)	0.352*	(2.44)	0.186	(1.00)
Deferred pension	0.427**	(7.80)	0.861**	(11.24)	0.214*	(2.06)	0.591**	(4.34)
Partial pension	-0.123*	(1.97)	-0.532**	(7.46)	-1.021**	(8.97)	-0.836**	(5.68)
% younger	-1.242	(1.25)	-4.940**	(4.18)	2.348	(1.25)	5.866*	(2.38)
% older	1.051	(1.05)	-0.604	(0.51)	4.189*	(2.23)	5.112*	(2.07)
low educated	-0.472	(1.16)	-3.139**	(6.26)	-1.677**	(4.00)	-0.913	(1.91)
univ. degree	0.614	(1.08)	-1.061	(1.33)	2.607**	(3.39)	0.529	(0.45)
low educated (r)	-0.356	(1.04)	1.461**	(3.73)	1.027**	(2.59)	0.193	(0.41)
univ. degree (r)	0.744	(0.91)	-0.064	(0.09)	0.215	(0.19)	-0.003	(0.00)
% non-self employed	0.745	(1.71)	0.923	(1.64)	-0.478	(0.59)	-0.266	(0.25)
% agricultural workers	2.665**	(4.97)	4.003**	(6.27)	2.863**	(2.85)	3.617**	(2.75)
% workers in services	0.232	(0.90)	0.284	(0.97)	-0.738	(1.53)	-0.544	(0.89)
% workers in part-time	0.470	(1.35)	-0.006	(0.01)	2.993**	(4.60)	0.471	(0.56)
$\bar{R}^2$	0.56		0.51		0.49		0.25	
Number of observations	693		693		693		693	

[a)] The pension age is measured as deviation from 65.
Absolute t-values in parentheses
Source: ROA

When looking at the fit of the four models, it can be seen that for the younger age cohort, the model explains about 50% of the variance in activity rates between the regions. The fit for the older cohort is lower, especially for the activity rates of older women, for which only a quarter of total variance is explained. It is interesting to see that for males aged 55-64 and women aged 65-74 years of age, only the factors that do not differ between regions (apart from the effect of the demographic structure and the number of workers in agriculture) contribute to the explanation for this variance. This implies that for these two groups, the model as presented in Table 4.2 does not - or to a very small extent - explain differences between regions in a given country. This can also be seen in Table 4.3, where the three-level variance decomposition is presented for the predicted activity rates.

Using the estimated model, the activity rates can be predicted. In Table 4.3 the observed and predicted activity rates are presented. This table is again based on a multi-level decomposition of the variance of the predicted activity rates. It can therefore be compared to Table 4.1 in which the decomposition of the observed activity rates is presented. A few remarks can be made based on this table. The first one is that total variance explained is much lower than the observed variance. This was already noted before. As can be seen from the decomposition, the variance explained is mainly at the national level. This implies that the model is able to explain a relatively large part of the differences between countries with respect to the average activity rates. When looking at the regional and yearly variance component in Table 4.3, it can be seen that these two are much lower than the observed variance. For the model explaining male activity rates for the youngest cohort, predicted variance between regions is even that low that it could not be estimated. Therefore, it should be concluded that this model does not count for the large amount of regional variance, although all variables used are at the regional level.

Table 4.3
Estimation results of the variance decomposition of predicted activity rates

	aged 55-64		aged 65-74	
	men	women	men	women
â	53.95	29.59	8.56	2.71
	(21.1)	(10.1)	(5.9)	(7.9)
$ó_v^2$	97.83	126.75	31.32	1.72
	(2.8)	(2.7)	(2.7)	(2.7)
$ó_u^2$	-	15.43	7.69	1.09
		(9.1)	(18.4)	(18.5)
$ó_e^2$	-	3.78	-	-
		(15.5)		

t-values in parentheses
Source: ROA

The observation that at the regional level the unexplained variance is large, can be due to the fact that the correlations between the various factors and the activity rates are

not equal for all countries. In the previous Chapter it was shown that the bivariate correlations between the factors differ over a relatively wide range. Therefore, the estimated coefficients in Table 4.2 give information on the correlation between the average level of activity rates and the average levels of the explanatory factors, but ignore the fact that these correlations differ at a lower - national, or even regional - level. For instance, it may be the case that countries with a low level of education have low activity rates, and countries with high educational level have high activity rates, but on the other hand, within those countries, differences in educational level does not induce differences in activity rates. To account for this, variation in estimated coefficients should be allowed for.

4.4 Regression results, separate national models

In the previous Section, it was shown that a pooled model does not explain the observed variance of activity rates between regions very well. A possible explanation for this is that the behaviour in the various countries does differ. As the behaviour is 'summarized' in the parameters of the model, differences in behaviour between countries, should be reflected in different parameters in the various countries.

The preferred way to do so from a technical viewpoint, would be using the multi-level approach discussed before, in combination with a random-coefficients model. This random-coefficient approach allows for the assumption that the effects of the factors that determine labour force participation may differ between regions. The regression coefficients are assumed to differ randomly between regions, but have a common mean and a given variance. For a more complete review concerning the interpretation of these random coefficient models , see a.o. Borghans and Heijke (1994), Wieling and Borghans (1995) or Marey and Borghans (1998). Thus, the approach assumes on the one hand that the dynamics in the various regions (e.g. the regions of a particular EU-Member State) show similarities to some extent, but on the other hand also allows for regional differences. The similarities between certain types of regions can be regarded as a general structure underlying the labour market mechanisms. This general structure explains the relevant parameters as a function of characteristics of the region concerned, such as the Member State concerned, population density, sector structure, etc. However, the actual parameters in a specific region may differ from this general structure. For these deviations a national and a regional level can be distinguished.

The estimation of the random coefficient models can thus be seen as a 'weighted compromise' between the need for estimations of region-specific developments, and the reliability of the general structure of the developments. The more reliable the estimates of the developments in a particular region, the more weight is given to this regional estimate of the parameter. The less reliable these specific estimates are and the better the general structure explains the developments in all separate regions, the more weight will be given to these 'average' mechanisms. The results of this analysis make it is possible to draw

conclusions with respect to the underlying determinants of the observed patterns of participation within the regions, but also with respect to the causes for the differences between regions. In addition, it will be possible to distinguish between the effects of national and regional influences.

However, when estimating such a model the variation seemed to be that large that convergence was difficult. Therefore, the model is estimated separately for each country. The total results of this can be found in the appendix. In Tables 4.4 to 4.7 it is indicated whether the explanatory factors have a positive, a negative, or no effect at all. Notice that all factors that do not differ within countries are not incorporated in the regression. The combined effect is 'summarized' in the constant term.

In Table 4.4 the regression results for male activity rates, for the age cohort 55-64 are presented. Due to the small samples, many of the estimated effects are not significant. It can be seen that the significant effects are not of the same sign in the various countries. Almost all factors do have a positive correlation with activity rates in some countries, and negative correlations in other countries. It is, however, difficult to suggest some kind of clustering based on these differences in effects. The demographic structure has no effect in some countries, the percentage of younger and older people has a positive effect on the activity rates for two of the Mediterranean countries (Greece and Italy), and a negative effect in two of the Central European countries (France and the United Kingdom). There is no clear pattern in the effect of the educational level: these effects seem to be completely country-specific: the only pattern seems to be that in countries having high activity rates the educational structure is of less importance explaining the regional differences. In Ireland, Sweden and the United Kingdom only one of the factors is significant. The same applies - to some extent - to the countries with the lowest activity rates. For Belgium and Italy almost no effect of the educational level can be found.

The effect of the structure of the economy is different as well in the various countries: only the effect of the percentage employees has a negative effect on the activity rates of the cohort 55-64 in all countries. The percentage of individuals working in the agricultural sector has only an effect in Spain (negative) and in Finland (positive). The effect of the percentage workers in services and the percentage workers in part-time work have different effects in all countries .

In Table 4.5 the same information can be found for the female activity rates for the age cohort 55-64. In this table it can be seen that the estimated effects are more or less of the same direction in al countries. Again, the effect of the demographic structure seems to be unimportant for most of the European countries, and the same applies for the educational level within the countries. There is more effect of the structure of the economy: the percentage non-self-employed, the percentage workers in agriculture, and - to a lesser extent - also the percentage workers in services and workers in part-time do all have a positive effect on activity rates.

In Table 4.6 and 4.7 the results are shown for the age cohort 65-74 years of age. For both men and women, it can be seen that both differences in the demographic structure and in the educational level do not contribute much to explaining differences in regional differences in activity rates. There is however, some effect of the structure of the economy on the activity rates, although there are some countries (e.g. The Netherlands, Belgium and Austria) in which these factors do not explain the differences.

Overall, it seems as if the regional differences in activity rates are explained only to a limited extend by differences in the demographic structure, differences in the educational level and differences in the structure of the economy. Part of this conclusion is to be attributed to the relative short time series used for some countries, or to the relative low number of regions within a country. On the other hand, when comparing the results in Table 4.2 to those in the subsequent tables, it can be concluded that the differences in the activity rates between countries do correlate with the differences in the factors between countries. In other words, both the activity rates and the explanatory factors have much larger between-country variation than between- region variation. This can be seen from the figures presented before, in which average activity rates and variation are illustrated. In general, the countries with lowest variation do have the lowest number of relevant explanatory factors.

The total fit of the models as presented in Tables 4.4 to 4.7 is far better than the fit of the model presented in Table 4.2: the R^2 is 0.90, 0.90, 0.81 and 0.69 respectively. Still the fit is best for the age-cohort 55-64 and for men, but now also the fit for the model explaining activity rates of older women is fairly good. This indicates that a considerable amount of interregional variance in activity rates should be attributed to different behaviour in the various countries.

Table 4.4
Summary of the regression results for the activity rates, males , 55-64 years of age

Country	BE	DK	DE	GR	ES	FR	EI	IT	LU	NL	AU	PT	FI	SE	UK
demographic structure															
% younger	0	-	1	1	0	-1	1	1	-	0	0	0	0	1	-1
% older	0	-	0	1	0	-1	0	1	-	0	0	0	0	0	-1
educational level															
% low educated	0	-	-1	1	0	1	0	0	-	0	0	-1	1	0	-1
% univ. degree	0	-	0	1	1	1	1	0	-	1	-1	0	1	0	0
% low educ. (r)	-1	-	0	-1	1	0	0	0	-	0	1	1	0	1	0
% univ. degree (r)	0	-	1	0	0	0	0	1	-	-1	1	0	0	0	0
strucutre of the economy															
% employed	0	-	-1	-1	-1	-1	0	-1	-	0	0	-1	0	0	-1
% in agriculture	0	-	0	0	-1	0	0	0	-	0	0	0	1	0	0
% in services	0	-	-1	0	0	-1	0	0	-	1	0	1	0	0	0
% in part-time	0	-	1	0	0	-1	0	0	-	0	0	1	0	-1	0

For Denmark and Luxemburg, the number of observations was too low to estimate a multivariate regression model
Source: ROA

Table 4.5
Summary of the regression results for the activity rates, females , 55-64 years of age

Country	BE	DK	DE	GR	ES	FR	EI	IT	LU	NL	AU	PT	FI	SE	UK
demographic structure															
% younger	1	-	0	1	1	0	0	0	-	0	0	0	1	0	1
% older	0	-	0	0	1	0	0	0	-	0	0	0	0	0	1
educational level															
% low educated	-1	-	1	1	1	0	1	0	-	1	0	0	0	0	1
% univ. degree	1	-	0	0	0	1	0	0	-	0	0	1	0	0	1
% low educated (r)	0	-	1	0	0	0	0	1	-	0	1	0	0	0	0
% univ. degree (r)	0	-	1	0	0	1	0	0	-	0	1	0	0	0	0
strucutre of the economy															
% employed	0	-	0	0	0	1	0	1	-	0	1	1	1	1	1
% in agriculture	0	-	0	1	1	1	0	0	-	0	0	1	1	0	0
% in services	1	-	0	1	0	1	0	0	-	0	0	0	0	0	0
% in part-time	1	-	0	1	0	0	1	0	-	0	0	1	0	0	0

For Denmark and Luxemburg, the number of observations was too low to estimate a multivariate regression model
Source: ROA

CONTENTS

Table 4.6
Summary of the regression results for the activity rates, males , 65-74 years of age

Country	BE	DK	DE	GR	ES	FR	EI	IT	LU	NL	AU	PT	FI	SE	UK
demographic structure															
% younger	1	-	0	0	0	0	0	0	-	0	1	0	0	0	1
% older	0	-	1	0	0	0	0	0	-	1	0	0	0	0	1
educational level															
% low educated	0	-	0	0	0	1	1	0	-	0	0	0	1	0	1
% univ. degree	0	-	1	0	0	0	0	0	-	0	0	0	0	0	0
% low educated (r)	0	-	1	0	1	0	0	0	-	0	0	0	0	0	1
% univ. degree (r)	0	-	1	0	1	0	0	0	-	0	0	0	0	0	0
strucutre of the economy															
% employed	0	-	1	1	0	0	0	0	-	0	0	0	0	0	0
% in agriculture	0	-	0	0	1	1	1	0	-	0	0	1	1	0	0
% in services	0	-	1	1	1	1	0	1	-	0	0	0	1	0	0
% in part-time	1	-	1	1	1	1	0	1	-	0	0	1	1	0	0

For Denmark and Luxemburg, the number of observations was too low to estimate a multivariate regression model
Source: ROA

Table 4.7
Summary of the regression results for the activity rates, females , 65-74 years of age

Country	BE	DK	DE	GR	ES	FR	EI	IT	LU	NL	AU	PT	FI	SE	UK
demographic structure															
% younger	0	-	0	1	0	0	0	0	-	0	0	1	0	0	0
% older	0	-	0	1	0	0	0	0	-	1	0	1	1	0	0
educational level															
% low educated	0	-	0	0	0	1	0	0	-	0	0	0	0	0	1
% univ. degree	0	-	0	0	0	0	0	0	-	1	1	1	0	0	0
% low educated (r)	0	-	0	0	0	0	1	0	-	0	0	0	0	0	1
% univ. degree(r)	0	-	0	0	0	0	0	0	-	0	0	0	1	0	0
strucutre of the economy															
% employed	-1	-	1	0	1	1	1	1	-	0	0	1	0	0	0
% in agriculture	0	-	1	0	0	1	1	1	-	0	0	1	1	1	0
% in services	0	-	1	1	1	1	0	0	-	0	0	1	1	0	1
% in part-time	0	-	1	1	1	1	1	0	-	1	0	1	1	0	0

For Denmark and Luxemburg, the number of observations was too low to estimate a multivariate regression model
Source: ROA

Again, to illustrate the amount of variation explained, in Table 4.8 the multi-level variance decomposition can be found. The first thing to note is that the common mean is closer to the observed value than when using the pooled model. This is partly a result of the larger number of parameters in the model, and partly a result of the non-linear transformation used in the model. The second thing to note is that the explained variance has increased substantially. When comparing Table 4.8 to Table 4.1, it can be seen that for all four groups the predicted between-country variance is now about equal to the observed variance. As all countries do now have a country-specific constant term, this was to be expected. Due to the fact that the other parameters are now fitted to the within-country (i.e., the between-region) variation, the explained part of the between-region variation is much larger than in the model presented in Table 4.2.

This argument, that the explained part of the variance at a given level increases when the model is fitted explicitly to this level translates to the lowest level. In other words, when time series would have been long enough to estimate the model for each region separately, the explained variance at the between-region level would equal the observed variance.
Unfortunately, time series available were too short to make acceptable inferences for the separate regions. Using the multi-level approach and allowing for random coefficients, such as was explained in Section 4.2 also resulted in estimation problems due to the relatively large number of regions as well as the relatively low number of years.

Even though the fit of the model is now quite acceptable, still a considerable amount of the between-region and the within-region (i.e., between-time) variance is not explained by the model. Part of this variance can originate from differences in behaviour between regions, but the time series available are too short to estimate the model for each region separately. The other part will stem from factors that are not incorporatedin the model, and are perhaps also due to purely random influences. One of the factors that could be of interest, is perhaps the activity rate in the past. Due to habit formation, regions with high activity rates in the past, will tend to have higher present activity rates. However, due to the fact that time series are not long enough, habit formation and persistence could not be incorporated into the model. The only way this can be done using the current setup of the model, is using past activity rates on a national level. However, these do not show variation between regions within a country, and can therefore not be used to explain differences in activity rates between regions within countries. As the model is estimated separately for each country, the effect of habit formation is country-specific, and therefore, the effect is "part of the estimated constant term".

Table 4.8

Estimation results of the variance decomposition of predicted activity rates

	aged 55-64		aged 65-74	
	men	women	men	women
â	52.39	28.74	9.74	3.53
	(16.4)	(8.0)	(5.2)	(5.0)
$ó_v^2$	146.86	188.68	51.08	7.08
	(2.6)	(2.7)	(2.7)	(2.6)
$ó_u^2$	27.62	18.45	15.89	6.87
	(9.0)	(8.7)	(21.1)	(18.4)
$ó_e^2$	7.42	7.02	-	-
	(15.5)	(15.5)		

t-values in parentheses

Source: ROA

CONTENTS

5. Explaining the differences in activity rates

5.1 Introduction

In the previous Chapter, a number of regressions was performed. These regressions can be used to illustrate the effects of changes in the explanatory factors on the predicted activity rates. The estimation results in the previous Chapter suggest that differences in behaviour in the European countries contribute significantly to differences in activity rates between countries and regions. The variance decompositions presented in Tables 4.3 and 4.8 also indicate which part of the variance is explained. However, this is only part of the information. It is very difficult to tell on the basis of these regressions which factors do contribute most to regional differences in activity rates. This can be seen easily, by recognizing that these differences stem from two sources. The first source is the magnitude of the estimated parameters, the second one is the existing variance in explanatory factors. In other words, if the explanatory factors do not differ between regions, this factor can not explain differences in activity rates between regions, no matter how large the estimated parameter is. On the other hand, when the variance in explanatory factors is large, a small parameter is enough to make this factor an influential one.

The estimated parameters of the models indicate to which extent the labour force activity rates of elderly vary with the explanatory factors. This, however, is not enough to indicate which factors are most important to explain existing regional differences. The differences between the regions are caused by either differences in individual behaviour, or by differences in characteristics between the individuals. When it is assumed that the estimated parameters reflect behaviour, the results of the (linear) model can be used to decompose the differences in the labour force activity rates. Oaxaca (1973) has shown how to perform such a decomposition, in which existing differences in labour supply can be attributed to differences in both behaviour and characteristics. Vlasblom (1998) has generalized this decomposition into a decomposition where three sources of differences are present: behaviour, characteristics and institutions. The decomposition strategy has a disadvantage though: in the decomposition the activity rate in one region is compared to the activity rate in another region. In the analyses a large number of regions is distinguished: 212 regions at NUTS-II level. This makes a total of about 22.000 separate decompositions (=0.5*212*211). Therefore, in this Chapter a different method will be used to illustrate the effect of the various explanatory factors.

5.2 Differences between countries

A shown in the previous Chapters, part of the differences in activity rates between regions can be attributed to differences between countries. In this Section, an indication will be given which part of the regional differences can be explained by differences between countries. It was already shown in Chapter 4 by how much the explained variance of

the model increased when variation in behaviour is allowed for. In this Section, therefore, the emphasis is on the differences in explanatory factors between the countries.
Given estimated behaviour it will be shown how differences in activity rates between countries depend on the actual values of explanatory factors in those specific countries. This will be done as follows: average values for the explanatory factors are computed, both at the European and the national level. First, activity rates are computed for all countries, when all factors are set at the European average. Next, the three groups of explanatory factors (demographic structure, economic structure and educational level) are set subsequently at their national average. This will lead to changes in the predicted activity rates. These changes are to be attributed to the deviation from the European mean of that specific explanatory factor. Note that only between country-variation is taken into account in this way. The results of these computations can be found in Tables 5.1 to 5.4.

Table 5.1
Decomposition of the differences in activity rates between countries, male activity rates, 55-64.

Country	All factors at EU-mean	Factors at national mean			Observed
		demogr.	demogr. education	demogr education econ.	
Belgium	21.0	20.2	31.9	34.3	34.5
Denmark	40.1	63.4	64.7	64.7	64.7
Germany	67.3	64.4	60.1	54.7	54.6
Greece	48.1	48.9	43.5	64.2	64.0
Spain	54.6	56.7	54.1	56.3	56.2
France	41.1	41.7	38.6	34.6	34.8
Ireland	51.6	55.6	62.5	64.8	64.7
Italy	40.4	49.4	39.4	44.2	44.3
Luxemburg	40.8	66.7	35.7	35.7	35.7
Netherlands	45.3	44.5	44.9	42.8	42.8
Austria	19.0	19.5	47.4	43.9	44.0
Portugal	74.1	73.3	77.9	64.9	64.8
Finland	37.2	48.3	48.1	45.1	44.6
Sweden	96.7	96.0	90.4	72.2	72.0
United Kingdom	76.3	79.6	76.5	63.8	63.3

Source: ROA

In Table 5.1 the decomposition is shown for male activity rates. In the first column, predicted activity rates are shown when all explanatory factors are set at the European mean. It can be seen that there is a broad range of predicted activity rates, from 19% in Austria to 97% in Sweden. These differences are to be explained by differences in behaviour and work-attitude in the various countries. Also factors as habit formation play a role in these differences. The differences in activity rates that are attributable to differences in explanatory factors can be read from the rows of the Table. As an example, take Belgium. When the demographic factors are set at the Belgian value, predicted activity rates decline a little, when next the educational factors are set at the Belgian value activity rates increase by over 10 percentage points. Setting the economic factors on the Belgian value does not increase the predicted activity rate very much. Thus, it can be concluded that the difference between the observed rate of 35% and the predicted rate of 21% is mainly

attributable to the fact that the educational factors in Belgium differ from the European mean. Thus, labour supply behaviour of Belgian men induces the activity rate to be below the European average, while the fact that the educational level differs from the European average decreases this difference.

Analogously, for all other countries it can be computed whether behaviour or characteristics result in activity rates below or above the European average. For Denmark, behaviour implies an activity rate below the average, while the demographics result in an activity rate above the European average. Germany, Portugal, Sweden and the United Kingdom would be far above the European average activity rate if only differences in labour supply behaviour would be considered, but due to the structure of the economy, the activity rates are lower than expected based on the 'average European structure', resulting in actual activity rates that are still above the average, but not as far as indicated in the first column. In a way, Greece also belongs to this group, although at the EU-average Greece is slightly below the average activity rates. France and the Netherlands are below the European average, due to behaviour, and even farther below due to the fact that the economic structure induces individuals to lower their labour market participation. Ireland is above the European level due to behaviour and even further above due to its educational structure: a higher educational results in a higher activity rate, and Ireland is slightly above the European average. Luxemburg would have a relatively high activity rate of males aged 55-64, if only the demographic structure would differ from the European mean, but as also educational levels differ, the actual activity rate is not far below the value computed at the European average. Austria would have very low activity rates when all explanatory factors were set at the European average; i.e. due to behaviour the activity rate would be low. However, due to the fact that the educational level is different from the European level, Austrian activity rates are only slightly below the European average. This more or less also holds for Finland, but for this country it is the demographic structure that has the largest influence on activity rates. The patterns for Spain and Italy are not very clear: some factors result in higher activity rates, some in lower, while the predicted rates at the European average do not differ very much from those actually observed.

It is almost impossible to summarize the results: for all countries the interaction between behaviour and characteristics differ. There is no clear subdivision in countries where either demographics, education or economic structure has the largest influence. Also, there is no clear difference in results when looking at the three groups of countries: Nordic, Central European and Mediterranean countries. The only clear pattern emerges when comparing the observed levels of activity rates to those computed when all factors are set at the Europan average. It can then be seen that about half of the countries are below that level and half of them above. Most of the Mediterranean countries are above the predicted level, most of the Continental countries are below that level. It should therefore be concluded, that although some studies indicate that it is possible to cluster European countries based on characteristics, it seems as if this clustering does not hold when looking at estimated labour supply behaviour.

The patterns become even more obscured when looking at the predicted activity rates of females aged 55-64. For some countries the patterns in Table 5.2 are the same as shown in Table 5.1: This holds for Denmark, Austria, Portugal, Finland and Sweden. However, for other countries the results are exactly opposite: Belgian activity rates are below the European activity rate due to behaviour, and due to differences in the educational level, the female activity rates are even lower.

Table 5.2
Decomposition of the differences in activity rates between countries, female activity rates, 55-64.

Country	All factors at EU-mean	Factors at national mean			Observed
		demogr.	demogr. education	demogr education econ.	
Belgium	25.6	24.2	18.3	13.3	13.8
Denmark	9.6	58.9	42.7	42.7	42.7
Germany	24.8	24.3	38.5	33.7	33.9
Greece	43.7	39.8	34.0	29.5	30.7
Spain	29.9	25.3	17.7	19.0	19.5
France	28.7	28.9	23.9	25.1	25.4
Ireland	26.7	23.0	25.7	20.7	20.9
Italy	9.8	10.4	12.6	15.5	15.8
Luxemburg	36.5	12.6	12.7	12.7	12.7
Netherlands	11.9	12.9	14.1	18.0	18.3
Austria	14.9	15.9	34.4	18.0	18.2
Portugal	65.0	63.2	66.3	33.7	34.5
Finland	23.5	36.3	34.6	40.3	40.5
Sweden	91.4	89.2	90.3	65.5	65.3
United Kingdom	29.4	32.1	35.3	40.1	40.2

Source: ROA

Comparing Tables 5.1 and 5.2, it seems that for the differences between male activity rates in the European countries educational factors are not extremely important. For the differences of female activity rates however, the differences in educational levels between the countries (and the way women react to educational level) seem to be an important aspect. This implies that when explaining differences in female activity rates between countries (and thus, between regions in different countries) the educational level is an important aspect. For both male and female activity rates, the structure of the economy is an important aspect. Differences in the demographic structure of the countries has only a limited effect on differences in activity rates.

The results of the decomposition of the differences in activity rates for the cohort aged 65-74 seem to be a little unstable. In Tables 5.3 and 5.4 the results are shown. Due to the non-linear transformations used, the column with all factors set at the national average and the column actually observed do not show the same number. When looking at the patterns in the tables, it can be seen that both for male and female activity rates, the differences in behaviour between countries induce activity rates to be further away from the European average than actually is the case. When looking at the factor that has largest influence, it seems as if the educational level and the economic structure are the most important. In most countries, the actual educational level seems to reduce male activity rates, when compared to the European educational level. The economic structure is the

most important factor for explaining national differences in the activity rates of elder women. In almost all countries the economic structure, and the way women react to that seem to reduce activity rates.

Table 5.3
Decomposition of the differences in activity rates between countries, male activity rates, 65-74.

Country	All factors at EU-mean	Factors at national mean			Observed
		demogr.	demogr. education	demogr education econ.	
Belgium	77.0	72.4	5.1	2.7	3.0
Denmark	0.1	7.6	8.8	8.8	9.4
Germany	61.2	57.5	16.7	4.6	5.6
Greece	18.3	14.6	12.0	18.7	19.8
Spain	10.0	9.5	6.9	3.5	3.9
France	4.4	4.5	3.8	3.0	3.4
Ireland	9.9	14.6	16.2	22.9	23.6
Italy	19.2	18.7	12.3	7.7	7.8
Luxemburg	17.7	5.2	3.1	3.1	3.1
Netherlands	60.9	35.7	19.7	6.4	7.7
Austria	7.2	8.0	5.7	6.7	7.2
Portugal	30.9	30.7	23.0	25.1	25.8
Finland	47.0	39.3	35.9	3.2	5.6
Sweden	2.2	3.1	11.4	11.6	12.5
United Kingdom	11.3	13.7	24.6	9.7	10.7

Source: ROA

Table 5.4
Decomposition of the differences in activity rates between countries, male activity rates, 65-74.

Country	All factors at EU-mean	Factors at national mean			Observed
		demogr.	demogr. education	demogr education econ.	
Belgium	0.3	0.3	2.3	1.0	1.3
Denmark	0.1	2.7	3.2	3.2	3.5
Germany	17.5	12.9	7.0	2.0	2.6
Greece	17.2	16.3	23.4	6.4	8.2
Spain	2.0	2.6	2.2	1.6	2.2
France	0.7	0.7	0.7	1.1	1.4
Ireland	14.6	23.6	10.5	4.2	4.4
Italy	2.2	2.5	1.7	2.0	2.1
Luxemburg	70.1	1.8	1.7	1.7	1.9
Netherlands	99.4	97.9	81.3	1.1	1.6
Austria	2.3	2.6	5.5	3.0	3.2
Portugal	25.1	20.8	32.7	9.4	11.4
Finland	12.3	28.8	30.1	1.1	1.9
Sweden	79.2	78.4	95.7	2.8	4.9
United Kingdom	9.4	9.9	5.3	4.9	5.4

Source: ROA

5.3 Explaining the differences in activity rates between regions

In the previous Section, some decompositions were shown to explain the differences in activity rates between countries. In principle, these computations can also be done for the predicted activity rates in the various regions: in that case it would be most interesting to compute activity rates for all explanatory factors set at the national mean, and next to the actual value for that specific region. The problem is then to present those values, because there is a total of 212 regions. Therefore, the following method has been chosen. Not actual values of the predicted activity rates are presented, but the within-country variance of the unexplained part. In other words: when all factors are set at their national average, the variance of the unexplained part is at its maximum. Allowing for more variation in the explanatory factors will increase the explained variance and thus reduce the unexplained part of the variance. The factor that reduces the unexplained part most, is the most important to explain the regional differences in activity rates in that specific country. As will be seen from the Tables, allowing for regional variance in explanatory factors will for some countries increase the unexplained part of the activity rates. In those cases it is difficult to interpret the results unambiguously, because these results are possibly a result of correlated explanatory factors. It should be noted that for these computations the data for all available years have been used. Therefore, the variance reported is the between-region and the between-years variance. This latter component is relatively small, and therefore ignored.

In Table 5.5 the results can be found for the male activity rates for the age cohort 55-64. It can be seen that when all factors are set at the national average, the within-country (i.e., the between region) variation is not explained. In the second column, the remaining variance is shown, when only the demographic factors are set at the regional values. Thus, the differences between the first two columns represent the part of the total variance of the regional differences that can be attributed to differences in the demographic structure between the regions in a country. These demographic factors are of minor importance: only for Denmark, Italy and the United Kingdom the variation in demographic structure explains most of the regional differences.[12] For two countries, Belgium and Sweden, the differences between the regions are smaller than to be expected on the basis of the demographic variation between the regions. The differences in educational levels within the countries do not have a large effect either. Only for three countries, Belgium, Austria and Sweden, it seems to be the major explanatory factor. For all other countries, the differences between the regions with respect to the economic structure are the most important factor. Differences in activity rates correlate within the rate of part-time work, the sectoral composition of regional employment and the number of self-employed in those regions.

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12. Due to the fact that for Denmark and Luxemburg no model could be estimated, the results in this and the next tables for these two countries are not useful in determining the effects of the explanatory factors.

It should be noted from a comparison of the first and the last column in the table, that for some countries only a relatively small part of the total regional variance is explained by the model: for Spain and the Netherlands, the remaining variance is still over 80% of total variance. On the other hand , for countries such as Germany, Italy and Finland, the remaining variance is about 30% of total variance. It should therefore be concluded that in the context of the current model the economic structure does explain most of the predicted differences, but predicted differences are relatively small compared to actual differences.

Table 5.5
Variances of the predicted regional activity rates, male activity rates, 55-64.

Country	All factors at national mean	Factors at regional values		
		demogr.	demogr. education	demogr education econ.
Belgium	4.95	5.38	2.79	1.46
Denmark	2.25	1.58	-	-
Germany	6.90	6.02	5.34	3.40
Greece	6.58	6.40	7.72	2.91
Spain	6.12	6.03	5.82	5.18
France	5.39	5.10	4.68	3.43
Ireland	4.67	4.24	4.54	2.55
Italy	7.54	4.08	2.67	2.15
Luxemburg	1.79	9.71	-	-
Netherlands	4.56	4.60	4.50	3.83
Austria	6.06	5.62	3.65	3.04
Portugal	5.14	5.98	5.20	2.66
Finland	13.21	11.47	9.19	4.33
Sweden	4.77	5.87	3.77	2.07
United Kingdom	9.28	7.86	6.90	6.06

Source: ROA

In Table 5.6 the differences between the female activity rates are studied. Demographic factors are now of no importance at all. This was already concluded in Table 4.4, where relatively few significant effects of the demographic structure on activity rates are reported. It should be noted however, that for the computations in the current Tables, also the non-significant effects were used, resulting in relatively large effects of factors, which do not have significant parameters. The effect of the educational level is only present for Germany, perhaps due to the differences between the former Eastern and Western part of the country. In all other countries the effect of the economic structure is largest. As was the case for men aged 55-64, the sectoral composition, the incidence of part-time work, and the number of self-employed explain most of the differences between regions. Again, it should be noted that the explained differences are relatively small compared to the actual differences.

When turning to the activity rates of the age cohort 65-74, explained differences are even smaller than for the age cohort 55-64. Apparently, the model is too general to explain the differences. Perhaps, these differences should be explained by more specific - individual

- factors, such as habit formation, social differences between regions etc. The explained part of the differences is mainly attributable to, again, economic factors. For men, the educational differences are of importance for Sweden, while for women, they are of almost no importance. The demographic differences between regions are of importance to explain differences in male activity rates in the United Kingdom.

Table 5.6
Variances of the predicted regional activity rates, female activity rates, 55-64.

Country	All factors at national mean	Factors at regional values		
		demogr.	demogr. education	demogr education econ.
Belgium	3.91	3.92	2.79	1.20
Denmark	3.09	12.93	2.09	2.09
Germany	5.26	5.24	3.59	3.33
Greece	10.28	11.31	10.43	4.55
Spain	5.75	5.75	6.23	4.10
France	4.28	4.66	4.03	2.57
Ireland	3.07	3.51	3.01	2.14
Italy	3.34	2.99	2.79	2.25
Luxemburg	1.56	1.18	1.07	1.07
Netherlands	3.69	3.54	2.80	2.77
Austria	2.91	2.70	4.96	1.70
Portugal	10.60	11.14	10.00	3.66
Finland	10.90	7.53	8.26	3.07
Sweden	5.95	6.14	5.73	4.01
United Kingdom	6.34	5.81	5.19	4.58

Source: ROA

Table 5.7
Variances of the predicted regional activity rates, male activity rates, 65-74.

Country	All factors at national mean	Factors at regional values		
		demogr.	demogr. education	demogr education econ.
Belgium	1.40	1.51	1.18	0.67
Denmark	4.47	2.97	1.77	1.77
Germany	3.05	2.87	3.26	1.57
Greece	7.68	8.70	9.15	4.28
Spain	2.31	2.32	2.43	1.69
France	1.86	1.79	1.68	1.10
Ireland	6.60	8.12	6.42	2.46
Italy	1.80	1.80	2.21	1.33
Luxemburg	0.51	0.65	0.21	0.21
Netherlands	3.66	4.19	4.17	3.82
Austria	2.58	2.27	2.34	2.01
Portugal	9.36	9.51	10.68	2.79
Finland	3.31	3.12	3.87	1.80
Sweden	4.37	4.30	3.74	3.35
United Kingdom	4.60	3.94	3.81	3.53

Source: ROA

Table 5.8
Variances of the predicted regional activity rates, female activity rates, 65-74.

Country	All factors at national mean	Factors at regional values		
		demogr.	demogr. education	demogr education econ.
Belgium	0.82	0.83	0.80	0.63
Denmark	2.02	1.64	1.31	1.31
Germany	1.60	1.51	1.45	0.93
Greece	6.19	6.39	5.93	3.34
Spain	2.12	2.14	2.21	1.60
France	0.71	0.77	0.89	0.66
Ireland	1.38	1.58	1.66	0.79
Italy	0.79	1.03	0.95	0.65
Luxemburg	0.83	0.20	0.19	0.19
Netherlands	1.19	1.24	1.59	1.08
Austria	1.27	1.22	1.40	0.97
Portugal	8.66	8.74	8.69	2.22
Finland	1.39	4.71	6.63	1.02
Sweden	3.97	7.71	8.92	4.23
United Kingdom	2.27	2.21	2.08	1.62

Source: ROA

The preceding Tables suggested that the differences in regional economic structure explain most of the differences in activity rates. However, in the model a number of factors related to the economic structure are incorporated. Therefore, in the following Tables, the same variance decomposition will be used, to see which of these factors is the most important. There are four factors of interest in the model: the percentage non self-employed, the percentage working in agriculture, the percentage workers in services and the percentage workers working in part-time work.

In Table 5.9 the effect of the various economic factors is illustrated. Note that in these tables the first and the last column are the same as the third and fourth column in the Tables before. It can be seen that again there is relatively little pattern in the Table. From Table 5.4, it was seen for which countries the economic factors are of most importance. For these eight countries, there is not one specific factor that explains the major part of the observed variation in activity rates between regions. The percentage of self-employed is important for Germany, Greece, France and Ireland, the percentage workers in agriculture is most important for Spain and Finland, while the percentage workers in services is most important for the Netherlands, and the percentage workers in part-time is most important for Portugal and Sweden. For these four 'groups' of countries, there is no clear division.

In Table 5.10 the explained variance is shown for female activity rates for the same age-cohort. Again, there is no clear pattern. From Table 5.6 the countries for which the economic factors are most important can be read. For those countries, there is - as for the male activity rates - not one factor that can explain most of the differences between the regions. For Belgium and Portugal the number of part-time workers is most important, for Greece,

Spain, Italy, Austria, Sweden and the United Kingdom it is the percentage of self-employed. For France, Ireland and Finland it is the percentage workers in agricultural work.

For both male and female activity rates it seems that the percentage workers in agriculture and the percentage self-employed are of importance in explaining the regional differences in activity rates. The percentage workers in agriculture was already identified as an important factor when explaining differences between countries, as can be seen from the highly significant parameters in Table 4.2. The percentage self-employed however, does not explain differences between counties, but seems to be important when explaining differences within countries.

The variance decomposition for Finland gives a result that is somewhat different from the other results: allowing for regional differences in the number of self-employed does increase the unexplained variance, while allowing for regional differences in the number of self-employed decreases the unexplained variance by about the same amount. This is probably a result of a relatively high correlation between both factors.

Table 5.9
Variances of the predicted regional activity rates, male activity rates, 55-64.

Country	All econ. factors at national mean	Economic factors at regional values %self-empl.	% agric.	% serv.	%part-time
Belgium	2.79	2.72	2.35	1.66	1.46
Denmark	-	-	-	-	-
Germany	5.34	4.45	4.45	4.02	3.40
Greece	7.72	3.19	3.32	3.03	2.91
Spain	5.82	6.65	5.29	5.19	5.18
France	4.68	4.20	3.99	3.95	3.43
Ireland	4.54	2.60	2.68	2.55	2.55
Italy	2.67	2.48	2.15	2.15	2.15
Luxemburg	-	-	-	-	-
Netherlands	4.50	4.56	4.47	3.87	3.83
Austria	3.65	4.30	3.07	3.07	3.04
Portugal	5.20	5.54	5.23	5.89	2.66
Finland	9.19	12.84	7.23	7.43	4.33
Sweden	3.77	3.56	3.05	3.99	2.07
United Kingdom	6.90	6.38	6.33	6.09	6.06

Source: ROA

Table 5.10
Variances of the predicted regional activity rates, female activity rates, 55-64.

Country	All econ. factors at national mean	Economic factors at regional values %self-empl.	% agric.	% serv.	%part-time
Belgium	2.79	2.82	2.47	2.01	1.20
Denmark	-	-	-	-	-
Germany	3.59	3.50	3.51	3.34	3.33
Greece	10.43	8.05	6.87	6.21	4.55
Spain	6.23	5.14	4.14	4.10	4.10
France	4.03	5.06	2.79	2.57	2.57
Ireland	3.01	3.75	3.03	2.80	2.14
Italy	2.79	2.25	2.25	2.25	2.25
Luxemburg	-	-	-	-	-
Netherlands	2.80	2.78	2.79	2.78	2.77
Austria	4.96	2.09	2.21	1.73	1.70
Portugal	10.00	10.18	11.91	11.91	3.66
Finland	8.26	15.15	4.69	4.52	3.07
Sweden	5.73	4.37	4.52	4.49	4.01
United Kingdom	5.19	4.88	4.86	4.85	4.58

Source: ROA

In Tables 5.11 and 5.12 the decompositions are shown for the oldest age cohort. From Tables 5.7 and 5.8 it was seen that for this age cohort the economic factors were the most important when explaining regional differences. When looking in detail at those economic factors, there is no pattern. For male activity rates the percentage workers in agriculture and the percentage workers in services is most important, while for female activity rates the percentage self-employed and the percentage workers in agriculture are the most important factors. It is interesting to see that in all countries the incidence of part-time work does not influence differences in activity rates of those aged over 65. Probably this is a result of the fact that part-time work is only for those in employment, while the elderly are mostly out of regular employment. This can also be concluded from the fact that the factors that are important are the factors that concern the workers not in regular employment.

Table 5.11
Variances of the predicted regional activity rates, male activity rates, 65-74.

Country	All econ. factors at national mean	Economic factors at regional values %self-empl.	% agric.	% serv.	%part-time
Belgium	1.18	1.15	1.07	1.03	0.67
Denmark	-	-	-	-	-
Germany	3.26	2.67	2.48	1.78	1.57
Greece	9.15	5.57	5.65	5.41	4.28
Spain	2.43	2.64	1.90	1.83	1.69
France	1.68	1.81	1.19	1.18	1.10
Ireland	6.42	5.46	2.97	2.47	2.46
Italy	2.21	2.09	1.96	1.48	1.33
Luxemburg	-	-	-	-	-
Netherlands	4.17	3.93	4.08	3.85	3.82
Austria	2.34	2.47	2.42	2.18	2.01
Portugal	10.68	9.40	3.67	3.38	2.79
Finland	3.87	3.10	11.90	3.58	1.80
Sweden	3.74	3.91	3.83	4.73	3.35
United Kingdom	3.81	3.76	3.68	3.67	3.53

Source: ROA

Table 5.12
Variances of the predicted regional activity rates, female activity rates, 65-74.

Country	All econ. factors at national mean	Economic factors at regional values %self-empl.	% agric.	% serv.	%part-time
Belgium	0.80	0.69	0.69	0.69	0.63
Denmark	-	-	-	-	-
Germany	1.45	1.05	1.14	0.95	0.93
Greece	5.93	5.46	5.46	5.09	3.34
Spain	2.21	1.53	1.55	1.60	1.60
France	0.89	2.11	0.68	0.66	0.66
Ireland	1.66	3.03	1.23	1.23	0.79
Italy	0.95	1.10	0.70	0.68	0.65
Luxemburg	-	-	-	-	-
Netherlands	1.59	1.45	1.44	1.34	1.08
Austria	1.40	1.13	1.02	0.98	0.97
Portugal	8.69	7.20	10.20	7.91	2.22
Finland	6.63	6.18	28.21	2.73	1.02
Sweden	8.92	8.75	5.77	4.10	4.23
United Kingdom	2.08	1.86	1.89	1.67	1.62

Source: ROA

6. Summary and conclusions

6.1 Summary of the analyses

In this study, a descriptive analysis is given of the existing differences between the European regions with respect to activity rates of the elderly. In Chapter 2, a review of the existing labour supply literature was shown, in which was set out the main ideas over labour supply, and the models that are used to study labour supply. Economic theory usually describes individual behaviour assuming that individuals try to maximize their well-being. This well-being is known in the economic literature as utility. Individual preferences can thus be described by a so-called utility function which allows to compute be the value of a given package of consumption goods. Individuals choose a package of consumption goods which maximizes the value of this utility function. Total utility depends not only on the commodities consumed, but also on individual preferences, which can be seen as the individual's "tastes". These preferences will depend on individual characteristics, such as age, gender, marital status, level of education and social class. Not only characteristics do influence labour supply. Also individual and social habits do so. The reasons for this are multiple. The first one is that changes in labour supply may take time. The other reason is that both individuals or social groups get used to a given pattern of labour supply. Habit formation implies that labour supply will in general be higher in those regions where labour supply used to be high.

The above represents basically the supply side of the market, i.e. the participation decision. Still, whether or not an individual really does participate clearly depends on the demand side as well. Demand side factors will be of importance because they have effect on the probability of someone finding a job. This probability is related to developments in job creation which in turn depend on the rate of economic growth. This follows from a 1994 study from the European Commission where it was found that over the past thirty years the fluctuations in the numbers in employment coincided with variations in the rate of growth of GDP. If the arrival rate of job offers or the likely wage attached to those offers is expected to be low, some workers, notably the older unemployed, will find continued job search to be unattractive and will drop out of the labour force.

Activity rates will also be influenced in several ways by institutional factors. On the one hand, institutional factors will influence individual decisions by putting direct restrictions on their behaviour. On the other hand, institutional factors will influence individual behaviour because of indirect restrictions. Examples of the direct restrictions are social security systems, which restrict labour supply of individuals receiving benefits. Also the pension systems can pose restrictions by imposing a compulsory pension age. Direct restrictions can also result from the absence of institutions that make paid work possible (e.g. child care facilities for working women). Indirect restrictions can result from e.g. the taxation system, which can result in very low real wages, or from the social acceptance of elderly being in paid work. With respect to labour supply of the elderly, at least two institutional

factors are of importance. The first one is the pension system that is in effect in the various countries. The second one, which is of less importance, are the social policies that influence labour supply of (mainly married) women. Due to habit formation, social policies aimed at younger women, will in time, influence labour supply of the elderly. As institutions differ by country or even by region differences in these institutions can be an important cause of regional differences in labour force participation.

Based on the notions set forth in Chapter 2, a number of relevant explanatory factors were chosen, and the existing differences in activity rates between the regions of the European Union were shown, and related to the differences in the explanatory factors. The result of these analyses can be found in Chapter 3. When analysing activity rates in the regions of the European Union, it showed up that there are considerable differences, both between countries, as well as between regions. For men aged 55-59, male activity rates range from 49.4% in Belgium to 83.9% in Sweden. For the age group 70-74 Belgium still has the lowest rate, while the highest participation is found in Portugal. Activity rates of women are below male activity rates: for the age groups 55-59 and 60-64 for example, the gender difference amounts to 26.7% and 17.6% respectively. For the age cohort 55-64, female activity rates range from 14% in Belgium to 64% in Sweden. For Finland there seems to be no clear difference between men and women: the activity rates for men and women aged 55-59 are equal and the rate for women in the age class 60-64 is higher than activity rate of men in the same age cohort.

The range of the activity rates between regions within a country are almost as large as the differences between countries. The smallest range is observed in the Netherlands, where activity rates range from 39% to 53%, in Sweden the activity rates range from 61% to 82%. The regional activity rates in the UK range from 44% to 85%. The largest range is found in Finland, from 31% to 89%. On average, the range within the countries is about 25 percentage points. For women, the within country range seems to be as large as for the men. There is however, a difference: for men, the interregional differences seem to be almost equal in all European countries, while for the women, these differences in ranges are larger: in some countries very small ranges are observed.

Activity rates of the older cohort are below the rates of the younger cohorts. This holds at the general level of all EU-countries as well as for all countries taken separately. The overall decline in activity rates by age is quite substantial even though the rate by which this takes place differs between countries; thus, while the activity rate for men in Germany and Portugal is comparable for the age group 55-59 (74.2% and 72.3% respectively), the figures are highly divergent for men aged 60-64 (29.1% and 54.7% respectively). This results in the observation that when comparing the figures for the younger and the older cohort is that the ranking of the countries (i.e. ranking from the highest to the lowest activity rate) is not equal for both age categories: in some countries the (relative) drop in activity rates is in some countries larger than in other countries.

As a first illustration, in Chapter 3 also a number of bivariate correlations is shown. These correlations are computed at the national level, i.e., the reflect the differences between regions, but not those between countries. Therefore, there are no correlations computed for pension age and activity rates. It turns out that there is a positive and significant correlation between the percentage of individuals educated at ISCED level 4-7 and the activity rate, which means that the higher educated tend to stay in the labour market for a longer time. This holds for both men and women, although the effect for women is somewhat stronger. There is also an significant correlation between the percentage of elderly in a region and the activity rates of elderly: when there are more elderly, the activity rate of people aged 55 and older is higher. This may be caused by a substitution effect, i.e. when there is a relative abundance of individuals aged 55-74, there is a relative shortage of individuals in other age cohorts, so employers are bound to hire relatively more senior workers. The spatial distribution of the population seems to play an insignificant role in explaining differences in activity rates. The correlation between the percentage of individuals working in the service sector and the activity rates is significant when male activity rates are concerned. The larger the relative magnitude of the service sector, the lower the male activity rates. This may also be due to substitution: as most work in the service sector is done by women, an extended service sector implies that there are relatively many women in the labour market, driving the older men out (i.e. in a relative sense). In regions where there are relatively many workers in a full-time job, male activity rates are relatively high, and female activity rates relatively low. This would suggest that men prefer full-time contracts, while women prefer part-time contracts. An other explanation would be that part-time contracts are possible for women only. In that case, men have the choice between full-time work and non-participation only. This will, in general, lead to a labour market exit that is earlier than would be the case when they could have worked part-time. Finally, the correlation between the percentage workers in self-employment and the activity rates is significant for both men and women, with the sign being the same as that for full-time work. In other words: more self-employment in a given region will increase male activity rates, but lower female activity rates. This can be explained by the fact that when employment in a region is mostly self-employment, there are but little opportunities for non-self-employed to find a job. This may lower the activity rates for those people that are dependent on that kind of employment, i.e. mostly women.

When interpreting the bivariate correlations, it should be realized that these might lead to misleading conclusions. When two explanatory variables are highly correlated, and only one is influencing the level of the activity rates, both bivariate correlations will be significant. An example is the effect of the educational level and age. When older workers are on average lower educated, and lower educated have lower activity rates, the bivariate correlation between age and activity rate will also be negative. Therefore, it is better to use multivariate analyses to study the effect of explanatory factors. These analyses are done in Chapter 4.

In Chapter 4 a number of multivariate regressions are presented. As the outcomes of the regressions is intended to explain regional differences in activity rates, first a

decomposition of the total variances of the activity rates is presented. When explaining regional differences, it should be realized that differences between regions in different countries do have two components: the differences between the countries, and the deviations of both regions from their national mean. When explaining the differences between regions, this level-structure should be recognized. The literature presents a model for this type of clustered data, called multi-level model. The data for the activity rates are given on a regional (NUTS-II) level. This implies that the observed data can be "clustered" in groups. The lowest level is given by the repeated observations in the various years for the various regions. The second level is the regional level, the third level is given by the national level. Using this structure the total variance of activity rates can be decomposed in a between-country variance, a within-country (=between-region) variance and a within-region (=between year) variance.

From the analyses it follows that the variance of the differences between countries is very large in comparison to the other two variance components. This is especially so for the activity rates of the age cohort 55-64 years. For the male activity rates, the variance of the differences between countries is bout four times as large as the variance between the regions within a country. The variance within the regions between years is only one third of the between-region variance. For the female activity rates, the results are comparable. For the age cohort 65-74 the results are slightly different. The variation in activity rates of individuals older than 65 is much lower than that of those aged 55-64. As a result of this, the variation between years is extremely low, which made it impossible to estimate a three level model. As both the level and the variance of the activity rates of the population aged 65 and older are very low, it is questionable whether or not is useful to analyse labour supply of this and older cohorts.

This simple decomposition shows that when explaining regional differences in activity rates, these differences should be explained mainly from national differences when the regions belong to different countries. The variation that remains when controlled for national differences is much lower, and this variance has to be explained by regional differences. The multi-variate regression in which regional activity rates are explained showed that both the Nordic and the Mediterranean countries have higher activity rates. There is also an important effect of the pension system on the activity rates. The higher the pension age, the higher the activity rates are. This effect is strongest for the male age category 55-64. There is also an effect of a deferred pension: the possibility to defer pension increases the activity rates of elderly. The effects of the other two features of the pension system are not as expected: the possibility of an early pension lowers the activity rates of males younger than 65, and increases it of males older than 65. Especially this higher activity rates of older men is not as expected. Perhaps this has to do with the fact that the fact that some people leave the labour market relatively young, this opens possibilities for some of the elderly to stay in the labour market longer. The possibility of a partial pension lowers the activity rates. This should be explained by the fact that the partial pension can be used before the legal pension age. Therefore, it is comparable to the early retirement: it increases the 'distance' to the labour market for the elderly, and therefore

lowers the activity rates. Some effects can be found of the demographic structure of the regions: the larger the percentage of younger people (younger than 35) in a region, the lower the activity rates of the age cohort 55-64. This seems to suggest that younger workers drive the elderly from the labour market. On the other hand, both the percentage of younger individuals and the percentage of elderly (older than 55), increases the activity rates of the oldest age cohort (65-74).

There is some effect of the educational level in a region and the activity rates, although this effect is only found for two groups under study. The educational level is included twice: the educational level of the cohort under study, and the effect of the educational level of the (regional) population in total. The higher the number of low educated individuals in a cohort, the lower the activity rates, and the higher the number of people with a university degree, the higher the activity rates. The educational level of the total population has almost no effect: the higher the number of low educated, the higher the activity rates of elderly. The explanation for this is that as the older generations are relatively low educated. When the population as a total is relatively low educated, the older generation is 'less handicapped' by their own low educational level, and thus able to stay longer in the labour market.

The structure of the economy has also a relatively small effect on the activity rates: the percentage of non self-employed has no effect on activity rates, also the percentage workers in services does not explain differences in activity rates. There is, however, a strong positive correlation between the number of workers in agriculture and the activity rates. Agricultural workers seem to increase the activity rates of elderly. The number of part-time workers does increase the activity rates of elder men. Unfortunately, the available information on wages, incomes and GDP is not in the same NUTS-classification as the other data are. Therefore, this information could not be included into the analyses.

Using the model estimated, the activity rates can be predicted. It turns out that the total variance of activity rates explained is much lower that the variance observed, the variance explained is mainly at the national level. This implies that the model is able to explain a relatively large part of the differences between countries with respect to the average activity rates. Therefore, it is concluded that a large part of the differences between countries stems from differences in labour supply behaviour in the countries. To allow for such differences, separate regressions are run for each country. It then turns out that behaviour indeed differs between countries. Almost all factors have positive correlations with activity rates in some countries, and negative correlations in other countries. It is, however, difficult to suggest some kind of clustering based on these differences in effects. The demographic structure has no effect in some countries, the percentage of younger and older people has a [positive effect on the activity rates for two of the Mediterranean countries (Greece and Italy), and a negative effect in two of the Central European countries (France and the United Kingdom). There is no clear pattern in the effect of the educational level: these effects seem to be completely country specific: the only pattern seems to be that in countries having high activity rates the educational structure is of less importance explaining the

regional differences: In Ireland, Sweden and the United Kingdom only one of the factors is significant. The same applies - to some extent - to the countries with the lowest activity rates, for Belgium and Italy almost no effect of the educational level can be found.

The effect of the structure of the economy is also not the same in the various countries: only the effect of the percentage employees has in all counties a negative effect on the activity rates of the cohort 55-64. The percentage workers in agriculture has only an effect in Spain (negative) and in Finland (positive). The effect of the percentage workers in services and the percentage workers in part-time work have different effects in all countries.

When predicted activity rates are analysed, it shows up that the second model, that allows for behavioural differences between countries does explain a far larger part of the interregional differences. Based on the regression results, it is concluded that part of the differences in activity rates between the countries are to be attributed to differences in behaviour, and part of the differences in characteristics. In Chapter 5, it is illustrated which explanatory factors do explain most of the between-country and the between-region differences.

When activity rates are predicted when all explanatory factors are set at the European mean, there is a broad range of predicted activity rates, from 19% in Austria to 97% in Sweden. These differences are to be explained by differences in behaviour and work-attitude in the various countries. Also factors as habit formation do play a role in these differences. The differences in activity rates that are attributable to differences in explanatory factors are deducted from predicted activity rates when subsequently all explanatory factors are set at the national average. It is almost impossible to summarize the results of this analysis: for all countries the interaction between behaviour and characteristics differ. There is no clear subdivision in countries where either demographics or education or economic structure has the largest influence. Also, there is no clear difference in results when looking at the three groups of countries: Nordic, Central European and Mediterranean countries. The only clear pattern is that comparing in this table the observed levels of activity rates to those computed when all factors are set at the European average, it can be seen that about half of the countries are below that level and half of them above. Most of the Mediterranean countries are above the predicted level, most of the Nordic and Continental countries are above that level. It should therefore be concluded, that although some studies indicate that it is possible to cluster European countries based on characteristics, it seems as if this clustering do not hold when looking at estimated labour supply behaviour.

The same analysis can be repeated for the within-country differences. Now it is computed how the within-country variance of predicted activity rates increases when the various factors are set at the regional values in stead of the national average. It seems as if the demographic factors are of minor importance: only for Denmark, Italy and the United Kingdom the variation in demographic structure between the regions explains most of

the regional differences. The differences in the educational levels within the countries do also not have a large effect. Only for three countries, Belgium, Austria and Sweden, it seems to be the major explanatory factor. For all other countries, the differences between the regions with respect to the economic structure are the most important factor. Differences in activity rates correlate within the rate of part-time work, the sectoral composition of employment in the regions and the number of self-employed in those regions.

As these differences in the economic structure seem to be the most important, a further analysis is done, to determine which of these factors is the most important. There are four factors of interest in the model: the percentage non self-employed, the percentage working in agriculture, the percentage workers in services and the percentage workers working in part-time work. For the countries for which the economic variables where of most important, there is not one factor that is of most importance. For these eight countries, the percentage of self-employed is important for Germany, Greece, France and Ireland, the percentage workers in agriculture is most important for Spain, and Finland, the percentage workers in services is most important for the Netherlands, and the percentage workers in part-time is most important for Portugal and Sweden. For these four 'groups' of countries, there is no clear division. It is not true that the countries having the largest absolute number or the largest variance in those factors have those factors as the most important factor explaining regional differences. For the differences in female activity rates, the results are comparable: There is not - as for the male activity rates - one factor that can explain most of the differences between the regions. For Belgium and Portugal the number of part-time workers is most important, for Greece, Spain, Italy, Austria, Sweden and the United Kingdom it is the percentage of self-employed. For France, Ireland and Finland it is the percentage workers in agricultural work.

For both the male and the female activity rates it seems that the percentage workers in agriculture and the percentage self-employed are of importance in explaining the regional differences in activity rates. The percentage workers in agriculture was already identified as important factors when explaining differences between countries. The percentage self-employed however, does not explain differences between counties, but seems to be important when explaining differences within countries.

6.2 Suggestions for further research

In this report a number of analyses is performed to determine what causes the regional differences in activity rates between the regions of the European Union. Based on the analyses in this report, a number of suggestions for further research can be given:

As illustrated in Chapter 2, most of labour supply and demand theories start from the individual employee or employer. Causal relationships are therefore derived at the individual level. In many cases, it is difficult to aggregate those micro-arguments to macro-data. Therefore, it is difficult to make use of the most recent economic theories and econometric

methods to analyse regional labour supply. One of the suggestions therefore, is to make better use of the fact that the European Labour Force Survey consist of micro-data. It is e.g., possible to estimate behavioural models on micro-data, and use the results of these models to estimate changes in labour force participation at an aggregate level.

The second suggestion, which is particularly important when predictions of future activity rates are to be made, is to construct longer time series. Due to the fact that the NUTS-II classification has been changed a few times during the recent years, it is difficult to construct time-series. As is illustrated in this report, the correlations between activity rates and the explanatory factors differ between the level that is observed: It is possible that in a given country regions with high educational levels have high activity rates, and regions with low educational levels have low activity rates, resulting in a positive correlation. However, it might be the case that in both the 'high' and the 'low educated' regions labour supply does not react to changes in the educational level. In that case, using the between region correlation to construct predictions might lead to misleading results. It is therefore of great importance to allow for dynamic aspects in the empirical models. These, however, can not be realized when only few years of observations are available.

Related to this suggestion is an other remark concerning the data. Due to frequent changes in the regional classifications, it appeared that it is difficult to match data from various sources to each other. For instance, data on wages and GDP available from the regional databases of Eurostat, used a NUTS-II classification different from the one used in the LFS. For some countries this is no problem because classifications are stable through time, for other countries, especially the United Kingdom, this results in severe data-problems. Due to these problems, a number of relevant variables could not be included in the present analyses. Especially the omission of the GDP-variables might decrease the usefulness of the outcomes.

When the two above mentioned suggestions can be realized, it will be better possible to use the proposed estimation techniques. For the present stud, it seemed as if too short time series, and a lack in variation in those series made it difficult to use the multi-level estimation techniques. Therefore, it was not possible to cluster regions based on estimated behaviour. Using longer time-series will make this kind of clustering possible.

The last suggestion that can be made, is that the present research did not focus on prediction making. Econometric literature does suggest that the model having the best fit, does not always lead to the best predictions. In the report only the fit of the models was analysed. It might be the case that factors that do contribute most to the explanation of the observed variance, do so due to outliers and influential observations. In that case, this factor does not necessarily contribute to good predictions. Before using the results of the present research for purposes of predictions, some attention should be paid to these effects.

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Appendix: Estimation results

In this appendix, the estimation results of the regressions at country level are presented. The results are summarized in Tables 4.4 to 4.7, and presented here in full detail. The results are presented in 15 tables, while each of the four groups under study will be presented in one table.

Table A.1
Estimation results for Belgium

	55 - 64		65-74	
	Men	Women	Men	Women
constant	0.956	9.063	20.220	10.448
	(0.21)	(2.01)	(1.92)	(0.47)
% younger	0.035	0.068	0.247	0.163
	(0.68)	(1.45)	(1.99)	(0.71)
% younger	0.052	0.067	0.192	0.165
	(0.75)	(1.13)	(1.41)	(0.60)
% low educated	0.007	0.026	0.060	0.018
	(0.34)	(1.31)	(1.43)	(0.20)
% univ. degree	0.016	0.311	0.077	0.214
	(0.19)	(1.20)	(0.28)	(0.22)
% low educated (r)	0.020	0.002	0.055	0.024
	(0.87)	(0.07)	(1.13)	(0.36)
% univ. degree (r)	0.021	0.071	0.539	0.089
	(0.11)	(0.29)	(1.21)	(0.14)
% employed	0.024	0.019	0.043	0.191
	(0.71)	(0.56)	(0.59)	(2.12)
% in agriculture	0.024	0.086	0.069	0.002
	(0.47)	(1.16)	(0.44)	(0.01)
% in services	0.011	0.021	0.014	0.003
	(0.74)	(1.67)	(0.48)	(0.10)
% in part-time work	0.027	0.090	0.174	0.106
	(0.66)	(1.80)	(1.65)	(0.85)

Source: ROA

Table A.2
Estimation results for Denmark

	55 - 64		65-74	
	Men	Women	Men	Women
constant	7.115	34.106	14.564	14.925
	(0.40)	(0.34)	(0.35)	(0.26)
% younger	0.063	0.717	0.592	0.411
	(0.38)	(0.38)	(1.30)	(0.71)
% younger	0.334	0.942	1.506	1.246
	(0.56)	(0.35)	(1.05)	(0.63)
% low educated	0.010	0.184	0.032	0.041
	(0.22)	(0.45)	(1.19)	(1.05)

Source: ROA

Table A.3
Estimation results for Germany

	55 - 64		65-74	
	Men	Women	Men	Women
constant	2.139	0.696	25.102	18.482
	(0.55)	(0.17)	(2.93)	(1.45)
% younger	0.065	0.031	0.069	0.094
	(2.25)	(0.96)	(0.95)	(0.93)
% younger	0.023	0.023	0.121	0.024
	(0.78)	(0.70)	(1.70)	(0.25)
% low educated	0.033	0.051	0.029	0.056
	(1.35)	(1.47)	(0.76)	(0.65)
% univ. degree	0.012	0.018	0.060	0.031
	(1.14)	(0.82)	(2.80)	(0.34)
% low educated (r)	0.013	0.051	0.078	0.012
	(0.66)	(2.56)	(1.91)	(0.21)
% univ. degree (r)	0.053	0.100	0.100	0.011
	(2.07)	(4.18)	(1.79)	(0.17)
% employed	0.031	0.021	0.123	0.186
	(1.64)	(1.04)	(2.85)	(3.08)
% in agriculture	0.013	0.002	0.035	0.105
	(0.56)	(0.09)	(0.62)	(1.41)
% in services	0.014	0.008	0.037	0.034
	(2.00)	(1.08)	(2.24)	(1.53)
% in part-time work	0.023	0.004	0.082	0.057
	(1.80)	(0.27)	(2.56)	(1.34)

Source: ROA

Table A.4
Estimation results for Greece

	55 - 64		65-74	
	Men	Women	Men	Women
constant	2.200	8.632	0.148	24.792
	(0.67)	(2.19)	(0.02)	(1.49)
% younger	0.044	0.064	0.016	0.208
	(1.54)	(1.98)	(0.24)	(1.95)
% younger	0.033	0.014	0.053	0.120
	(1.36)	(0.52)	(0.94)	(1.30)
% low educated	0.040	0.048	0.006	0.067
	(2.35)	(1.97)	(0.14)	(0.66)
% univ. degree	0.087	0.154	0.031	0.170
	(2.51)	(1.84)	(0.31)	(0.44)
% low educated (r)	0.031	0.012	0.007	0.017
	(1.49)	(0.52)	(0.16)	(0.31)
% univ. degree (r)	0.048	0.029	0.025	0.131
	(0.91)	(0.49)	(0.22)	(0.90)
% employed	0.034	0.019	0.051	0.028
	(2.52)	(1.17)	(1.56)	(0.58)
% in agriculture	0.002	0.028	0.007	0.024
	(0.16)	(2.34)	(0.29)	(0.73)
% in services	0.007	0.022	0.020	0.046
	(0.92)	(2.91)	(1.36)	(2.06)
% in part-time work	0.021	0.108	0.101	0.224
	(1.03)	(4.76)	(2.17)	(3.51)

Source: ROA

Table A.5
Estimation results for Spain

	55 - 64		65-74	
	Men	Women	Men	Women
constant	1.611	11.742	1.716	1.306
	(1.12)	(5.87)	(0.55)	(0.16)
% younger	0.030	0.071	0.025	0.099
	(1.77)	(3.82)	(0.58)	(1.77)
% younger	0.011	0.079	0.016	0.047
	(0.67)	(4.39)	(0.38)	(0.86)
% low educated	0.000	0.063	0.008	0.011
	(0.02)	(3.07)	(0.33)	(0.14)
% univ. degree	0.062	0.007	0.055	0.031
	(2.59)	(0.22)	(1.25)	(0.31)
% low educated (r)	0.033	0.015	0.052	0.049
	(3.16)	(1.39)	(2.22)	(1.58)
% univ. degree (r)	0.034	0.049	0.097	0.041
	(1.37)	(2.01)	(1.96)	(0.60)
% employed	0.030	0.019	0.023	0.121
	(3.06)	(1.98)	(1.10)	(4.22)
% in agriculture	0.030	0.027	0.079	0.007
	(3.52)	(3.15)	(4.17)	(0.27)
% in services	0.004	0.007	0.017	0.040
	(1.08)	(1.79)	(1.81)	(3.56)
% in part-time work	0.006	0.003	0.075	0.101
	(0.56)	(0.23)	(2.77)	(2.70)

Source: ROA

Table A.6
Estimation results for France

	55 - 64		65-74	
	Men	Women	Men	Women
constant	4.748	5.512	6.843	9.281
	(2.51)	(2.57)	(1.50)	(1.32)
% younger	0.025	0.011	0.023	0.015
	(1.67)	(0.69)	(0.65)	(0.30)
% younger	0.042	0.006	0.007	0.064
	(2.80)	(0.33)	(0.18)	(1.24)
% low educated	0.017	0.005	0.054	0.090
	(1.76)	(0.45)	(2.28)	(2.16)
% univ. degree	0.039	0.062	0.010	0.136
	(2.34)	(1.75)	(0.30)	(1.27)
% low educated (r)	0.018	0.018	0.041	0.060
	(1.15)	(1.00)	(1.07)	(1.14)
% univ. degree (r)	0.005	0.090	0.041	0.016
	(0.15)	(2.68)	(0.50)	(0.15)
% employed	0.029	0.039	0.009	0.196
	(3.18)	(3.90)	(0.39)	(6.49)
% in agriculture	0.012	0.060	0.086	0.234
	(1.02)	(4.56)	(3.00)	(5.89)
% in services	0.008	0.010	0.022	0.028
	(1.49)	(1.64)	(1.61)	(1.53)

% in part-time work	0.038	0.000	0.071	0.047
	(4.19)	(0.05)	(3.24)	(1.53)

Source: ROA

Table A.7
Estimation results for Ireland

	55 - 64		65-74	
	Men	Women	Men	Women
constant	5.183	8.843	0.707	17.955
	(1.02)	(1.36)	(0.06)	(0.94)
% younger	0.129	0.078	0.053	0.091
	(1.76)	(0.80)	(0.30)	(0.33)
% younger	0.104	0.117	0.134	0.202
	(0.95)	(0.84)	(0.49)	(0.48)
% low educated	0.009	0.030	0.033	0.023
	(0.57)	(1.99)	(0.78)	(0.34)
% univ. degree	0.010	0.004	0.001	0.001
	(1.79)	(0.81)	(0.09)	(0.11)
% low educated (r)	0.000	0.001	0.015	0.049
	(0.01)	(0.05)	(0.38)	(0.89)
% univ. degree (r)	0.008	0.005	0.003	0.015
	(0.66)	(0.38)	(0.13)	(0.42)
% employed	0.027	0.030	0.011	0.170
	(0.78)	(0.81)	(0.14)	(1.43)
% in agriculture	0.008	0.033	0.074	0.146
	(0.17)	(0.63)	(0.67)	(0.93)
% in services	0.004	0.007	0.022	0.001
	(0.24)	(0.34)	(0.48)	(0.02)
% in part-time work	0.007	0.075	0.011	0.147
	(0.20)	(1.96)	(0.15)	(1.37)

Source: ROA

Table A.8
Estimation results for Italy

	55 - 64		65-74	
	Men	Women	Men	Women
constant	11.543	1.121	0.020	3.390
	(2.72)	(0.21)	(0.00)	(0.21)
% younger	0.188	0.030	0.016	0.080
	(3.62)	(0.54)	(0.13)	(0.45)
% younger	0.143	0.047	0.020	0.018
	(2.83)	(0.85)	(0.17)	(0.11)
% low educated	0.008	0.009	0.017	0.015
	(0.45)	(0.32)	(0.41)	(0.19)
% univ. degree	0.023	0.055	0.031	0.150
	(0.69)	(0.75)	(0.36)	(0.64)
% low educated (r)	0.002	0.048	0.019	0.034
	(0.09)	(1.82)	(0.35)	(0.44)
% univ. degree (r)	0.123	0.019	0.113	0.214
	(1.49)	(0.24)	(0.50)	(0.71)
% employed	0.022	0.037	0.013	0.101
	(1.49)	(2.30)	(0.38)	(2.16)
% in agriculture	0.012	0.005	0.028	0.111
	(0.60)	(0.21)	(0.54)	(1.51)

% in services	0.000	0.001	0.028	0.022
	(0.04)	(0.18)	(1.93)	(1.04)
% in part-time work	0.000	0.007	0.070	0.087
	(0.01)	(0.19)	(0.91)	(0.81)

Source: ROA

Table A.9
Estimation results for Luxemburg

	55 - 64		65-74	
	Men	Women	Men	Women
constant	68.226	51.131	25.286	172.580
	(0.62)	(0.85)	(0.16)	(0.61)
% younger	1.504	0.650	0.046	2.459
	(0.64)	(0.83)	(0.03)	(0.72)
% younger	0.920	0.850	0.654	3.044
	(0.57)	(0.66)	(0.20)	(0.55)
% low educated	0.154	0.037	0.091	0.012
	(0.61)	(0.40)	(0.60)	(0.06)

Source: ROA

Table A.10
Estimation results for Netherlands

	55 - 64		65-74	
	Men	Women	Men	Women
constant	1.066	0.259	0.245	0.165
	(0.34)	(0.08)	(0.03)	(0.02)
% younger	0.008	0.008	0.070	0.135
	(0.38)	(0.35)	(1.46)	(2.01)
% younger	0.011	0.025	0.252	0.315
	(0.39)	(0.82)	(3.96)	(3.50)
% low educated	0.012	0.032	0.009	0.036
	(1.42)	(2.45)	(0.54)	(1.07)
% univ. degree	0.066	0.003	0.052	0.375
	(3.69)	(0.08)	(1.49)	(2.88)
% low educated (r)	0.010	0.006	0.006	0.008
	(0.43)	(0.21)	(0.10)	(0.10)
% univ. degree (r)	0.094	0.027	0.198	0.387
	(1.71)	(0.47)	(1.55)	(2.43)
% employed	0.008	0.021	0.105	0.142
	(0.41)	(0.99)	(2.31)	(2.23)
% in agriculture	0.007	0.009	0.048	0.004
	(0.22)	(0.25)	(0.61)	(0.03)
% in services	0.017	0.005	0.033	0.017
	(1.96)	(0.49)	(1.50)	(0.56)
% in part-time work	0.009	0.005	0.014	0.211
	(0.74)	(0.38)	(0.45)	(4.90)

Source: ROA

Table A.11
Estimation results for Austria

	55 - 64		65-74	
	Men	Women	Men	Women
constant	6.406	7.922	27.624	7.202
	(0.43)	(0.66)	(0.93)	(0.19)
% younger	0.015	0.077	0.406	0.207
	(0.14)	(0.78)	(1.62)	(0.72)
% younger	0.003	0.111	0.332	0.125
	(0.03)	(1.00)	(1.40)	(0.43)
% low educated	0.040	0.012	0.048	0.092
	(1.07)	(0.31)	(0.59)	(0.78)
% univ. degree	0.060	0.005	0.014	0.116
	(1.89)	(0.18)	(0.24)	(1.31)
% low educated (r)	0.125	0.095	0.028	0.098
	(1.42)	(1.24)	(0.16)	(0.42)
% univ. degree (r)	0.186	0.178	0.110	0.148
	(1.79)	(1.67)	(0.48)	(0.48)
% employed	0.027	0.130	0.060	0.084
	(0.32)	(1.57)	(0.32)	(0.34)
% in agriculture	0.033	0.030	0.066	0.033
	(0.53)	(0.48)	(0.49)	(0.19)
% in services	0.001	0.012	0.023	0.009
	(0.03)	(0.61)	(0.48)	(0.15)
% in part-time work	0.011	0.012	0.070	0.025
	(0.34)	(0.32)	(0.80)	(0.23)

Source: ROA

Table A.12
Estimation results for Portugal

	55 - 64		65-74	
	Men	Women	Men	Women
constant	3.995	1.671	1.707	15.409
	(0.77)	(0.37)	(0.18)	(0.92)
% younger	0.015	0.032	0.010	0.130
	(0.35)	(0.68)	(0.09)	(1.05)
% younger	0.030	0.053	0.010	0.153
	(0.93)	(1.57)	(0.11)	(1.64)
% low educated	0.063	0.026	0.014	0.051
	(1.56)	(0.73)	(0.24)	(0.29)
% univ. degree	0.018	0.159	0.034	0.255
	(0.34)	(2.06)	(0.27)	(0.75)
% low educated (r)	0.051	0.012	0.018	0.011
	(1.45)	(0.29)	(0.18)	(0.08)
% univ. degree (r)	0.034	0.053	0.052	0.025
	(0.35)	(0.55)	(0.26)	(0.09)
% employed	0.022	0.050	0.012	0.040
	(1.47)	(2.92)	(0.35)	(0.84)
% in agriculture	0.017	0.067	0.054	0.069
	(1.07)	(3.89)	(1.53)	(1.39)
% in services	0.014	0.000	0.004	0.035
	(1.90)	(0.00)	(0.21)	(1.49)
% in part-time work	0.083	0.174	0.030	0.213
	(4.53)	(8.05)	(0.76)	(3.86)

Source: ROA

Table A.13
Estimation results for Finland

	55 - 64		65-74	
	Men	Women	Men	Women
constant	12.392	2.280	11.573	16.456
	(2.14)	(0.36)	(0.81)	(0.75)
% younger	0.133	0.139	0.040	0.004
	(2.35)	(2.65)	(0.32)	(0.02)
% younger	0.005	0.071	0.082	0.477
	(0.10)	(1.10)	(0.70)	(2.53)
% low educated	0.104	0.006	0.053	0.021
	(3.22)	(0.23)	(1.65)	(0.71)
% univ. degree	0.101	0.036	0.065	0.169
	(2.88)	(0.55)	(1.02)	(0.91)
% low educated (r)	0.026	0.071	0.105	0.434
	(0.53)	(1.37)	(0.87)	(2.13)
% univ. degree (r)	0.184	0.016	0.003	1.036
	(1.98)	(0.15)	(0.01)	(2.77)
% employed	0.059	0.086	0.133	0.018
	(1.47)	(2.21)	(1.39)	(0.14)
% in agriculture	0.096	0.123	0.243	0.318
	(2.90)	(3.51)	(2.45)	(2.43)
% in services	0.009	0.013	0.110	0.328
	(0.47)	(0.44)	(2.33)	(3.79)
% in part-time work	0.113	0.063	0.429	0.653
	(1.57)	(1.15)	(3.03)	(2.96)

Source: ROA

Table A.14
Estimation results for Sweden

	55 - 64		65-74	
	Men	Women	Men	Women
constant	0.776	2.979	12.640	1.784
	(0.18)	(0.65)	(1.27)	(0.13)
% younger	0.096	0.098	0.129	0.085
	(1.78)	(1.61)	(1.00)	(0.38)
% younger	0.006	0.060	0.165	0.381
	(0.08)	(0.69)	(0.84)	(1.22)
% low educated	0.008	0.007	0.014	0.058
	(0.67)	(0.79)	(1.06)	(2.08)
% univ. degree	0.013	0.019	0.046	0.005
	(0.41)	(0.74)	(1.50)	(0.06)
% low educated (r)	0.022	0.009	0.032	0.007
	(1.40)	(0.50)	(1.05)	(0.13)
% univ. degree (r)	0.037	0.015	0.022	0.111
	(1.12)	(0.71)	(0.53)	(1.33)
% employed	0.015	0.078	0.091	0.193
	(0.60)	(2.78)	(1.46)	(1.89)
% in agriculture	0.074	0.092	0.021	1.393
	(0.94)	(1.03)	(0.12)	(5.57)
% in services	0.022	0.001	0.029	0.225
	(1.14)	(0.03)	(0.78)	(4.04)

% in part-time work	0.061	0.035	0.083	0.110
	(2.07)	(1.04)	(1.33)	(1.01)

Source: ROA

Table A.15
Estimation results for United Kingdom

	55 - 64		65-74	
	Men	Women	Men	Women
constant	13.169	6.633	11.388	0.083
	(8.06)	(3.62)	(2.86)	(0.02)
% younger	0.070	0.047	0.091	0.032
	(3.88)	(2.43)	(2.17)	(0.55)
% younger	0.128	0.084	0.142	0.039
	(5.96)	(3.84)	(2.98)	(0.59)
% low educated	0.023	0.018	0.007	0.008
	(4.65)	(2.58)	(1.87)	(2.11)
% univ. degree	0.045	0.116	0.019	0.013
	(1.02)	(2.10)	(0.90)	(0.39)
% low educated (r)	0.010	0.001	0.027	0.027
	(1.56)	(0.20)	(2.22)	(1.58)
% univ. degree (r)	0.041	0.064	0.019	0.126
	(0.71)	(1.14)	(0.16)	(0.75)
% employed	0.038	0.027	0.026	0.031
	(3.19)	(2.10)	(0.93)	(0.80)
% in agriculture	0.014	0.029	0.051	0.039
	(0.72)	(1.34)	(1.11)	(0.62)
% in services	0.017	0.002	0.015	0.031
	(2.47)	(0.24)	(0.95)	(1.38)
% in part-time work	0.011	0.026	0.048	0.025
	(0.66)	(1.58)	(1.34)	(0.53)

Source: ROA