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REGIONAL LABOR FORCE PARTICIPATION IN AUSTRIA

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FACTORS OF REGIONAL LABOR PARTICIPATION RATES

AN ECONOMETRIC STUDY FOR AUSTRIA

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1. Introduction

1.1. The general framework

This contribution is to be seen in the context of a larger regional labor market study of Austria. In order to understand some of the peculiarities of the analysis, it may be useful to outline the structure of the complete model briefly.

The approach to regional labor market modelling must be sensitive to the major problems perceived in the present and for the near future, so a few typical regional labor market problems in Austria could be a good starting point.

A study of unemployment rates on the county ("Bezirke") basis showed a fairly wide variation over the whole cross-section as well as over time. It seems that the economic development of the cities, compared to some rural areas, showed a much more favorable tendency (at least over the last decade). This fact is also reflected in the considerable income disparities (in terms of regional average income) that could be observed during this period.

The focus of the labor market project is hence the problem of regional disequilibria and disparities (see Rothschild 1977, pp. 54). Another interesting aspect is the apparent presence of a market segmentation by educational achievement. This is particularly relevant for the planning of capacity changes in the educational infrastructure. The 1971 census data, e.g., show that the increase of the skilled labor force, due to better schooling facilities in some rural areas, has led to higher unemployment within that qualification segment and/or the selective outmigration from these areas as there was no demand for highly trained labor in these regions. (Maier 1979).

Spatial mobility of people (segmented by qualification as just men tioned) and capital is another important factor to be considered explicitly in a labor market study, especially in a country like Austria, where population dynamics over space depend increasingly on migration rather than on demographic development.

(For further details see Geldner 1970; Buchegger 1972; Butschek 1974, 1975 und 1979; Jeglitsch 1978; Biffl 1978 und 1979; Keil und Schneidewind 1979; Graf 1979; Clement, Ahammer, Kaluza, 1980; Beirat für Wirtschafts-und Sozialfragen 1980.)

Let us next look at the structure of the labor market model to put the present paper into this context.

The model distinguishes between 4 types of regions, i.e. urban cores, urban rings, rural areas and peripheral areas, a classification which is also commonly used in the framework of regional policy in Austria (the 97 Austrian counties were classified using various techniques). For each type of region a model is constructed, the structure of which is basically always the same over all types of regions - the difference lies in the parameters. There is a labor supply component, consisting of several sub-models ("education", "labor force" and "supply"), as well as a demand component (sub-models ("investment" and "hiring & firing"). These components are linked by various feed-backs, the most prominent of which are the wages paid in the regional labor markets.

The regions are linked by "interactions" in the form of flows of production factors (capital & labor) as well as goods and services (sub-models "migration", "commuting" and "investment").

The model does not explicitly contain a monetary and financial sector, which is assumed to function perfectly over space. The following graph (figure 1.1) illustrates the structure of the model.

Let us next look at a very brief overview of the most essential relations of this model (see also Schubert 1979).

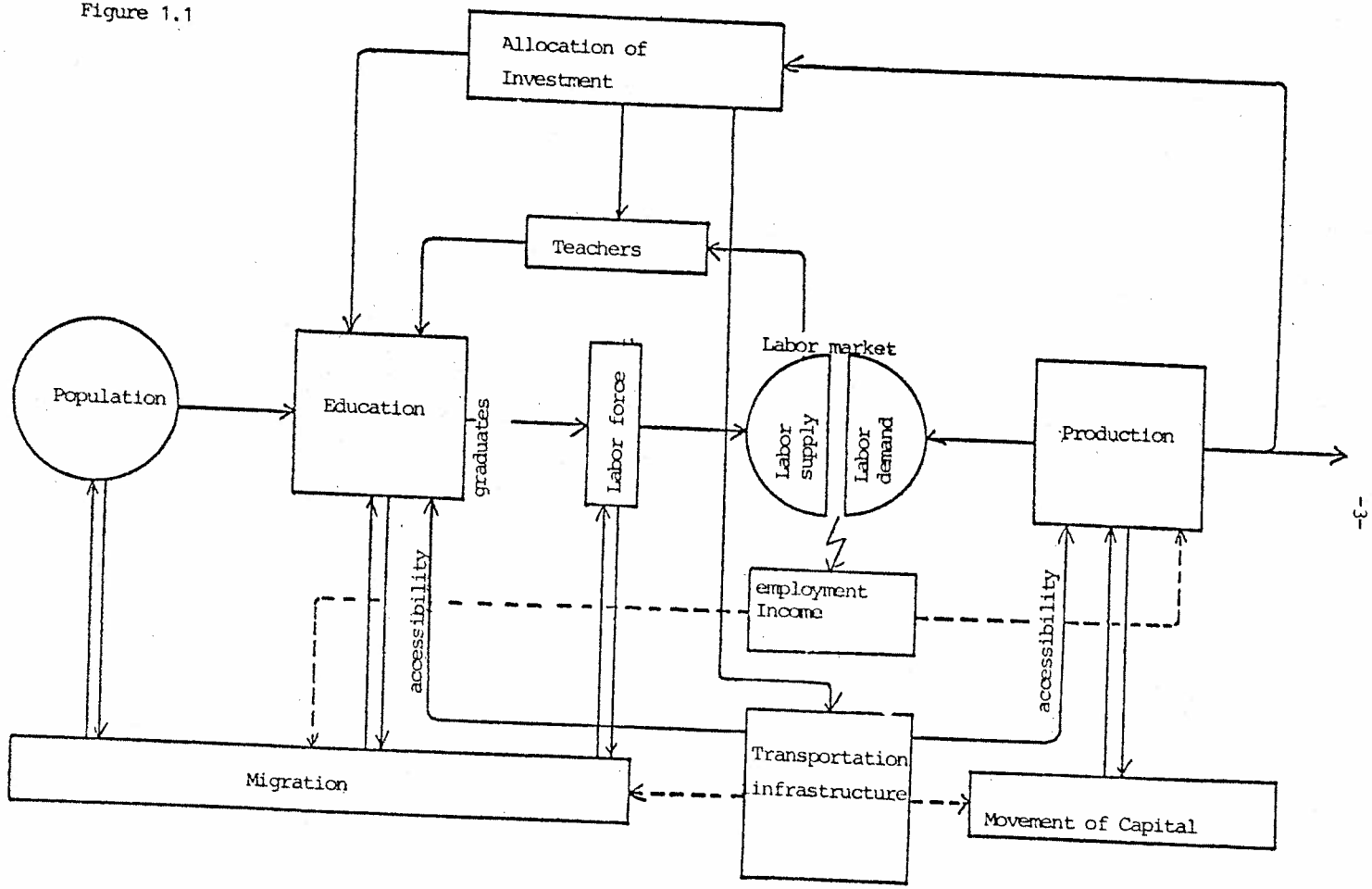
1.1.1. Labor supply

We distinguish 4 market segments, among which there are relatively closed barriers. These strata are distinguished by educational achievement ("University graduates", "high school-graduates", "skilled labor", "unskilled labor"). Mobility between these segments is only possible by re-entering the educational system.

The actual labor supply of qualification k in type of region i at time t ($^{k}S_{t}^{i}$) is a proportion $^{k}p_{t}^{i}$ ("labor force participation rate") of the potential labor force ($^{k}PS_{t}^{i}$) at location i, to which we have to add net commuting ($^{k}NC_{t}^{i}$). We assume, of course, that the participation rate of commuters is equal to 1.

$$^{k}S_{t}^{i} = {}^{k}p_{t}^{i} \cdot {}^{k}PS_{t}^{i} + {}^{k}NC_{t}^{i}$$

Figure 1.1


Allocation of Investment
Teachers
Population
Education
graduates
Labor force
Labor market
Labor supply
Labor demand
Production
employment Income
accessibility
accessibility
Migration
Transportation infrastructure
Movement of Capital

It is the variable ${}^{k}p^{i}_{t}$ which is the focus of this paper, particularly the factors behind its changes over time and space. Net commuting is determined in the above mentioned sub-model.

The potential labor supply ${}^{k}PS^{i}_{t}$ is a stock variable. The positive components of its change in each time period are the graduates of the appropriate type of school (${}^{k}G^{i}_{t}$) and the immigrants (${}^{k}IM^{i}_{t}$), the leakages are the emigrants (${}^{k}EM^{i}_{t}$) from the region, the deaths (${}^{k}D^{i}_{t}$) and the laborers retiring (${}^{k}R^{i}_{t}$).

$$ {}^{k}PS^{i}_{t} = {}^{k}PS^{i}_{t-1} + ({}^{k}G^{i}_{t} + {}^{k}IM^{i}_{t}) - ({}^{k}D^{i}_{t} + {}^{k}R^{i}_{t} + {}^{k}EM^{i}_{t}) $$

EM & IM are interaction variables between the regions (sub model ("Migration"); D and R are exogenous. G, the number of graduates is endogenous, its level is determined within the sub-model "Education" (for details, see Stoffl & Schubert 1977).

1.1.2 . Labor demand

The starting point of the regional labor demand function is a production function, the arguments of which are the 4 types of labor (by qualification) and investment derived simultaneously in the "Labor demand" sub-models. Intra regional and interregional investment is distinguished (Schubert 1979).

2. Labor force participation in Austria.

2.1. Basic problems and definitions

As outlined in the introduction, p, the labor force participation rate is a variable indicating the percentage of the residential, active population (15-65) ready to supply its services in the labor market. Contained in the labor supply statistics are hence all persons actually employed plus the unemployed actively looking for a job (the "employed" in the Austrian statistics also include the number of people active

in the military service).

The definitions of the participation rates vary considerably in the literature, often this rate is calculated as the ratio of employed and unemployed to the total residential population. We chose the above mentioned definition as it is the obvious one for the type of model we are working with, being based on the active population and its changes via demographic as well as educational factors. Needless to say that there can be considerable differences in the tendencies of these two alternative indicators (e.g. when considering the active population only there are often only small differences between participation in urban cores, often characterized by a top heavy age pyramid, and urban rings, with many childeren - there are often big differences when participation rates are based on the total residential population).

2.2. Can participation rates be considered constant?

Let us first look at a plot of total labor force participation rates (as defined above) over the 97 Austrian counties in 1971 (census data). (See figure 2.1).

We observe that the values vary between 58 and 74 percent, which in our opinion warrants an approach which considers these participation rates to be variables, rather than constants.

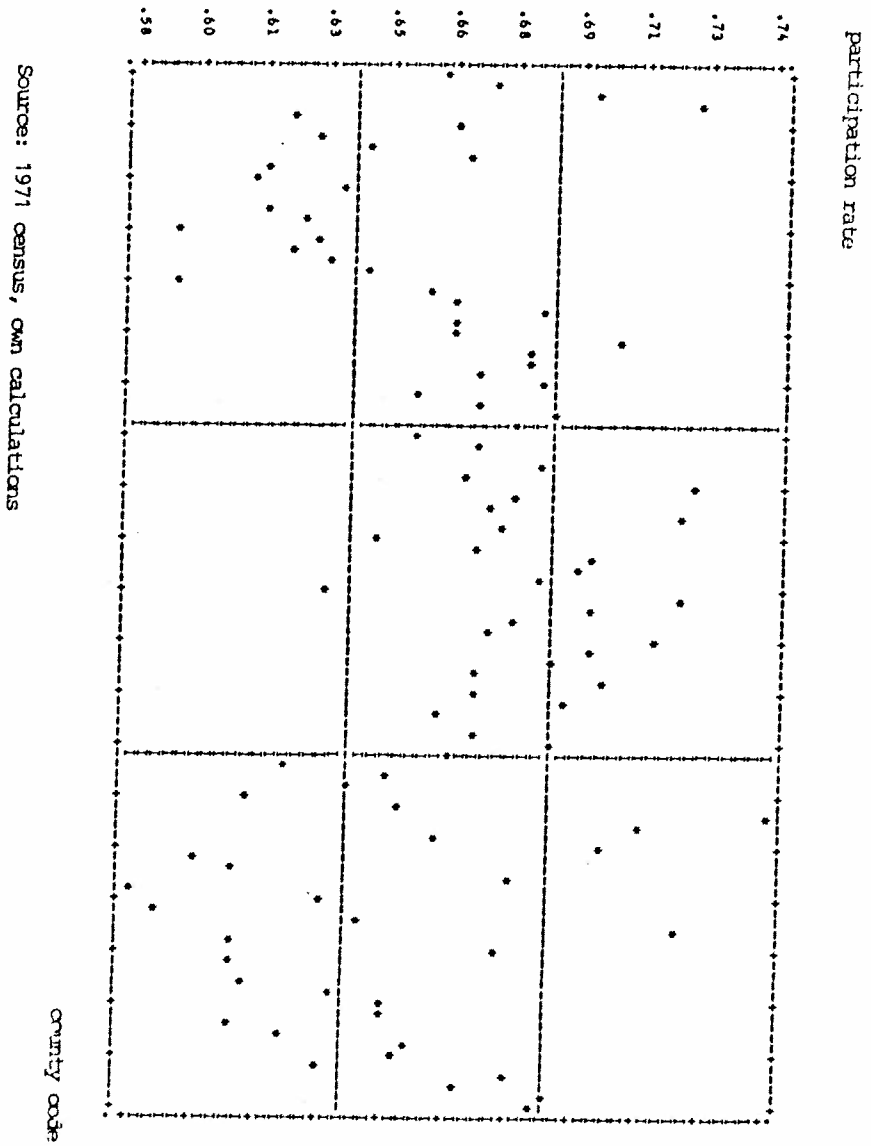
2.3 Labor force participation and market segmentation by qualification and type of region.

Let us now consider the justification for working with aggregated participation rates, an approach often encountered in quantitative analysis. The last row of the next table (2.1) shows the average participation rates disaggregated into 4 segments, classified by the highest educational level attained. There is a considerable difference to be observed between these classes. This evidence suggested to use 4 variables instead of one.

The same data material also reveals variations in the regional distribution of participation rates. The regional differences within a qualification group are admittedly smaller, but these differences may still be systematic. One of the most interesting questions we

Figure 2.1

Average participation rates for all 97 Austrian counties



Source: 1971 census, own calculations

asked ourselves in this study was, to what extent different behavioral and structural patterns in these types of regions account for the observed variations in the participation rates.

Table 2.1

AVERAGE PARTICIPATION RATES IN AUSTRIA 1971

(Deviation from National Average by Regional Classes)

(in percentage terms)

	UNIVERSITY GRADUATES	HIGH-SCHOOL GRADUATES	SKILLED WORKERS	UNSKILLED WORKERS	AUSTRIA TOTAL
CORE AREAS	90.95 (98.4)	65.71 (93.2)	78.56 (95.0)	53.93 (93.0)	64.90 (98.2)
URBAN RINGS	90.67 (98.1)	71.32 (101.2)	82.41 (99.6)	58.21 (100.4)	66.91 (101.2)
RURAL REGIONS	93.04 (100.6)	71.83 (101.9)	83.25 (100.6)	58.98 (100.2)	66.58 (100.7)
PERIPHERAL REGIONS	93.77 (101.4)	71.73 (101.1)	84.74 (102.4)	59.08 (101.9)	65.76 (99.5)
AUSTRIA TOTAL	92.44 (100.0)	70.50 (100.0)	82.72 (100.0)	57.98 (100.0)	66.10 (100.0)

Source: 1971 census, own calculations.

2.4. The influence of the age structure and sexual status

Many studies argue, that participation rates are age specific. The following table (2.2) presents an overview of age specific participation rates in Austria by sex and their variations over 60 years. (Butschek 1979). With the exception of the war time years, a remarkable stability in the male age specific rates can be observed. Another recent study on the situation in Austria (Clement, Ahammer, Kaluza 1980) stresses this point. Two graphs in this study make this point quite clear (Clement, et alii, op.cit., pp. 47 & 48) (Figures 2.2. & 2.3)

Figure 2.2.

Participation rate (male)

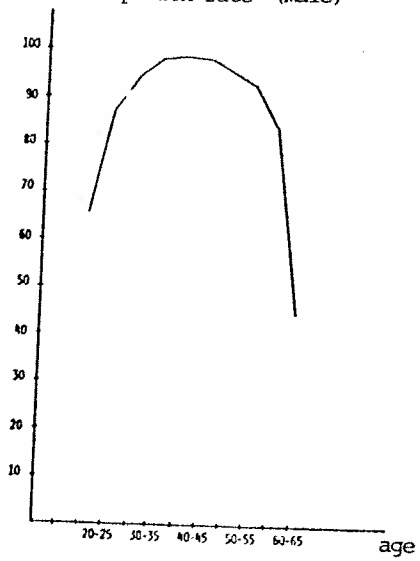


Figure 2.3.

Participation rate (female)

Both graphs demonstrate clearly, that besides age, sex plays a considerable role. It seems that average participation rates depend very much on the decisions of women concerning their supply of services in the labor market. This is also demonstrated on an international scale (Rothschild 1980) - showing considerable changes in female as compared to the male participation rates. (See table 2.3, Rothschild, op. cit.).

2.5. The task of an analytical study of labor force participation against the background of the empirical evidence.

A few other empirical phenomena could still be quoted, such as slightly higher average participation rates in the western part of Austria than the East, etc. (Buchegger 1972). The conclusion to be drawn from all this evidence seems to be that the assumption of constant participation rates over time and space seems hardly to hold, so that an analysis of the factors determining their levels is warranted.

Table 2.2

Age specific participation rates *

age groups in years	1910 male	1910 female	1910 total	1934 male	1934 female	1934 total	1951 male	1951 female	1951 total
14 - 18	–	–	–	79,3	93,9	86,5	72,8	60,4 *	66,7 **
18 - 30	–	–	–	98,9	84,5	91,6	94,1	65,4	78,9
30 - 50	96,6	50,8	73,5	91,3	35,1	61,3	97,1	45,4	68,6
50 - 60	91,8	50,3	70,3	80,8	26,9	51,8	89,4	39,8	62,0
60 - 65	–	–	–	58,1	–	–	69,9	–	–

	1961 male	1961 female	1961 total	1971 male	1971 female	1971 total
14 - 18	66,4	59,7	63,1	56,0***	50,1***	53,1***
18 - 30	91,3	70,8	81,2	89,2	64,5	77,0
30 - 50	97,4	53,6	73,1	97,5	52,2	74,0
50 - 60	90,5	43,8	64,8	87,8	41,5	61,0
60 - 65	66,0	–	–	44,9	–	–

Source: Austrian Central Statistical Office - censuses.
* labor force in % of population
** labor force without farmers' wives
*** 15 - 18 years.
(Taken from Butschek 1979)

Table 2.3

Changes in Female Participation Rates[a] 1965–1975 Changes in male Participation Rates[a] 1965–1975

	1965	1975	1965	1975
Austria	50.4[b]	48.0	88.6	84.4
Belgium	38.0	44.0		
Denmark	49.3	63.5		
Finland	63.1	65.6		
France	46.1[b]	50.3		
Germany	49.0	48.5		
Iceland	38.9	46.1[e]		
Ireland	35.2[d]	33.5		
Italy	31.1	29.9		
Norway	36.9	52.8		
Portugal	26.6	32.6		
Spain	28.9[e]	32.5		
Sweden	54.1	67.6		
United Kingdom	48.8	55.3		
U.S.A.	44.3	53.1		
Canada	36.0	47.1		

[a] Total female labour force as percentage of female population aged 15 to 64 years.
[b] 1968. [c] 1971. [d] 1966. [e] 1970.
Source: OECD, *Labour Force Statistics 1964–1975* (Paris 1977).

Such a study, besides being rather interesting in its own right, could potentially be useful for labor market projections in which the assumption of constant participation rates could produce larger deficits of jobs in the forecasts. Needless to say that industrial, economic, social, etc. policy makers could find some useful pieces of information in the results of such a study (The present paper represents a first attempt of the authors in this direction).

Before we can proceed to formulate an analytical model which can be tested empirically, let us first review briefly the contributions economic theory has to make pertaining to the question of factors determining the supply of labor.

3. Factors determining the supply of labor - a brief theoretical overview.

The traditional neo-classical view of the individual's labor market behavior postulates a simple model of utility maximization which involves a trade-off between market goods (or, alternatively paid work-income) and leisure foregone (if the individual participates in the labor market). Hence, the point of departure for the basic neo-classical theory of labor supply is, that the indivual's supply is a function of the real wage rate obtainable in the market. If wages are taken as rewards per unit of effort, regardless of wether or not paid labor is involved, then an increase in the wate rate would have an income effect and a substitution effect on labor supplied. For someone already working the income effect will be negative, since the cost of leisure will have increased by the rise in the real wage rate. But since the higher wage will also have meant that the returns to additional work effort will have been increased, the negative income effect will be offset in all or part by a positive substitution effect. A priori therefore, the net effect of a change in the wage rate will be ambiguous. On the other hand, for an individual not participating in the labor market a rise in the wage rate can only have a positive effect on the probability of participation, since the income effect is irrelevant.

What limits the individual's supply of labor in traditional theory then, are the nonmonetary costs of time and effort involved in working. Thus, if effort can be translated into time equivalents, the marginal cost

to the individual of supplying labor is measured by the value to him of the alternative uses of time foregone. This foregone time has been considered "leisure", a desirable employment of time, while work - the cost of labor supply - is considered the leisure time sacrificed in order to earn a wage income. Wether an increase in the wage rate will lead to an increase or decrease in the individual worker's supply of work time (or alternatively, wether the labor-supply schedule is forward or backward sloping) has long been recognized as uncertain. The underlying basis for this uncertainty is usually explained with reference to the well known indifference curves, substitution and income effects, and all the familiar terms of modern value theory.

Nevertheless the standard version of labor supply theory combines the conclusions of Robbins and Marshall, with supply increasing and then decreasing with rising wages with the turning point dependent on the level of economic development and on the range of tests and acquaintance with market goods, being at a higher wage the more advanced the economy (see for example Friedman 1962, p. 204, Vetter 1961, pp. 580 and Finegan 1962, p. 230).

Within this theoretical framework the usual income-leisure analysis oversimplifies the relationship between individual labor supply and the wage rate. The primary shortcoming of the analysis lies in the strictly dichotomous relationship between the time spent in gainful employment and leisure or alternatively, the implication that all time not spent for the"pleasurable leisure" represents time spent in gainful employment. Furthermore, all time spent on the job represents leisure foregone. The failure to recognize that there exists a range of activities constituting neither gainful employment nor pleasurable leisure leads to an overstatement of the possibility of a negatively sloped labor-supply curve. The just mentioned second category of time, namely nonpleasurable leisure time, or, alternatively nonmarket working-time includes commuting-, consumption - and waiting time. In fact, work time might be more unpleasantly spent than nonmarket work time, but one can think of activities that are even more dissatisfying than labor time.

In this framework work is assumed to be onerous and is undertaken solely because it provides a source of income required to sustain the purchases of goods and services. Empirically this effect is hard to assess as data on this variable are difficult to come by.

3.1. Neoclassical model - some modifications

The standard neoclassical formulation of the individual's labor supply function (see e.g. Henderson and Quandt 1973) is derived as mentioned before from a simple model of choice between income (or real consumption) and leisure, where a utility function of these variables is maximized subject to linear budget and time constraints. Such models can be characterized as certainty models, because (i) there are no stochastic components in their formulation and (ii) they rely heavily on the competitive market assumption, whereby wages are perfectly flexible and adjust to clear any excess supply in the labor market.

In this view unemployment is assumed to be eliminated by a tatonnement process a la Walrás and all offers to work at the prevailing wage rate, w, are realized in actual employment. Thus, an individual's wage income, $w_i N_i$, is immediately calculable (in his budget constraint) once his labor offer, N_i (in hours), is determined. Clearly, once the competitive assumption is dropped, and unemployment is a possible individual status in labor market, the individual must reckon with the possibility that his wage income may be zero irrespective of his own labor offer. Summarizing, it is therefore warranted to propose a model of the individual's labor supply decision which also treats uncertainity as due to the existence of unemployment. It is our claim that the unemployment rate is a legitimate explanatory variable in the structural labor supply function. It is hypothesized here, (Malinvaud 1978, Gleave & Palmer 1979, Caravani & et al. 1980) that decisions concerning participation in the labor market depend not only on price (wage) information, but also on expected future labor market tensions.

In this context it is necessary to mention another basic weakness of the neoclassical view of labor supply concerning the individual's supposedly freely fixable "working time", N_i, which in real labor markets can hardly be realized by the individual - but is rather institutionally set. As Rothschild (1980) clearly points out, the more"realistic assumption (is) that one can only choose between a limited number of institutionally determined working time arrangements" (Rothschild 1980, pp. 248). His position in the theoretical analysis is an intermediate one between complete flexibility in the choice of working time - one stringent neoclassical basic assumption - and working time as a strictly given - yes-no-decision. (Such as Mincer's (1962) study). This approach reflects best the institutional situation in real markets. As Rothschild distinguishes

two typical alternatives, namely (i) "standard part-time work" and (ii) "jobs with regular opportunities for flexible over-time work" besides "standard time jobs" (full time). This makes it possible to capture the cumulative effects of overtime-work and the behavior of the so called "secondary labor force". Unfortunately there are no regional data available for empirically testing these hypotheses.

As our goal is finally to perform statistical tests and the Austrian census data provide us only with the number of people in the labor force, residential population, etc., we have to base an empirical analysis on the binary choice micro-approach. In macro-terms then we are counting the number of people having decided yes or no to arrive at the aggregate numbers.

3.2 A stochastic formulation of labor supply

As above mentioned, perfectly flexible wages and working time do not fully reflect real labor market situations. In reality unemployment, or, alternatively excess supply of labor is the general rule and wages, being set externally by collective bargaining agreements, do not fall in accordance with market forces to eliminate the excess supply. Hence in situations of excess supply not all offers to work at the going wage rate will be realized in actual employment. In particular, the above sketched standard neoclassical model fails to capture the effect of an individual's being unemployed. This failure is due to the implicit assumption that an individual's offer of labor services, N_i, determines his wage income, $w_i N_i$. It is also substantial evidence that labor force participation rates vary cyclically with the unemplayment rate (see e.g. Mincer 1966).

The purpose in this section is therefore to introduce the before mentioned modified neo-classical assumption into the standard model to accomodate these circumstances (see Hartley and Revankar 1973). Consider now a representative individual i who is part of the labor force but uncertain about his employment status in the forthcoming period. The employment status is denoted by means of the binary random variable s_i. Thus individual i is either

employed: $s_i = 1$

or

unemployed: $s_i = 0$.

Let further Un_i, $0 \leq Un_i \leq 1$ denote the probability that individual i find

himself unemployed in the forthcoming planning period. Therefore the probability of the individual's employment status, s_i, is given by

$$Pr(s_i = 1) = (1 - Un_i)$$

or

$$Pr(s_i = 0) = Un_i.$$

Further we shall assume that an individual's income arises from three sources: (i) wage income, $w_i N_i$, (if $s_i = 1$), (ii) unemployment compensation, u_i, (if $s_i = 0$) and (iii) nonwage income Y_i from all other sources (irrespective of his employment status). If by definition every individual in the labor force is willing to offer work, the anticipated total compensation in labor market to individual i in the forthcoming planning period is given by

$$c_i = (1 - s_i)\, u_i + s_i w_i N_i.$$

In the case of unemployment ($s_i = 0$) compensation, c_i, is equal u_i

$$c_i = u_i \qquad \text{(unemployment compensation)}$$

and in the case of employment ($s_i = 1$) compensation, c_i, is given by

$$c_i = w_i\, N_i \qquad \text{(individual's wage income)}$$

Finally, we shall make the two customary assumptions: (i) the individual's utiltiy, U_i, is derived from real consumption, C_i, and leisure, L_i, and (ii) the individual maximize his utility U_i with respect to his "decision variable" N_i. Thus determined the individual's optimal amount of labor services N_i to offer, the expected total compensation is given by

$$c_i = E(c_i | N_i) = Un_i\, u_i + (1 - Un_i)\, w_i\, N_i.$$

The budget constraint is therefore given by

$$p\, C_i = c_i + Y_i$$
$$= (1 - s_i)\, u_i + s_i\, w_i\, N_i + Y_i.$$

Depending on the employment status s_i the individual may face two different budget constraints. Either he is unemployed, then

$$p\, C_i = u_i + Y_i \qquad \text{(with } Pr(s_i = 0) = Un_i \text{)},$$

or, given offer to work, N_i, his budget constraint is

$$p\, C_i = w_i\, N_i + Y_i \qquad \text{(with } Pr(s_i = 1) = (1 - Un_i)\text{)}$$

Corresponding to the just mentioned budget constraints there are two different time constraints, namely

$$L_i = T$$

or

$$L_i = T - N_i$$

with: T available time (constant) L_i leisure

Note that both the budget and time constraints are stochastic in formulation so that C_i and L_i are random variables. Accordingly the individual's utility, U_i, is also an random variable.

If $\bar{C}_i = (C_i|N_i)$ and $\bar{L}_i = E(L_i|N_i)$ denote the conditional expectations of C_i and L_i for given N_i, it follows that the optimal labor supply is determined as a solution to the problem:

$$\text{max!} \quad U_i(\bar{C}_i, \bar{L}_i)$$

s.t. the expected constraints

$$\bar{C}_i = 1/p \{Un_i\, u_i + (1 - Un_i)\, w_i\, N_i + Y_i\}$$

and

$$\bar{L}_i = T - (1 - Un_i)\, N_i$$

with: p price vector for market goods

The solution of the first-order conditions of the Lagrange-function for N_i yields the individual's supply function

$$N_i = N_i(w_i/p,\ u_i/p,\ Y_i/p,\ Un_i)$$

where N_i is homogenous of degree zero in p, w_i, u_i and Y_i.

Therefore the labor supply denpends on real wages, real unemployment compensation, real nonwage income and on the probability of being unemployed.

If leisure is a "normal good" it may be shown that, income effect being negative and small, the individual's labor supply varies directly with wages and the probability of unemployment and inversely with real nonwage income and real unemployment compensation (for a detailed analysis of the partials see Hartley and Revankar 1973).

Finally, in this context it should be mentioned that a particular individual's probability of being unemployed will typically vary, depending, inter alia, on his age, sex, marital status, education, etc.

As noted earlier, the focus of our study is the labor force participating rate, $^{k}p^{i}$, particularly the factors behind its changes over time and space. Applying the micro-approach of labor supply suggests a regional supply

function which relates $^{k}p^{i}$ to the aggregated regional counterparts of the explanatory variables in the last written equation. Taking into account the available data for Austria and being in harmony with microeconomic foundation the participating rate in our regional model depends on the wage rate, the nonwage rate, the total unemployment, the average age of potential labor force, the potential female labor force, the number of children and the capacity of (day)-nursery school and kindergarten.

4. A model of labor force participation.

4.1. Variables and basic hypotheses.

Theoretical considerations suggest 3 groups of variables as potential determining factors of labor force participation rates, i.e.

- economic variables (such as wage rates, nonwage rates and unemployment).
- demographic variables (such as the number of women in the local potential labor force, the age structure of the male and female local potential labor force, the number of children in the region).
- infrastructure & instruments (such as the capacity of (day)-nursery schools and kindergartens).

There are, of course, other variables that could (or should) be included on theoretical grounds (e.g. the employment vacancy rate, the average length of being unemployed, etc.). Partly, however, the empirical tests revealed insignificant influences of these variables (e.g. the job vacancies) or, there was no information available (e.g. for the average length of unemployment).

In general then we get the following model of the determination of labor force participation rates:

$$p = f(x_1, x_2, \ldots, x_{10})$$

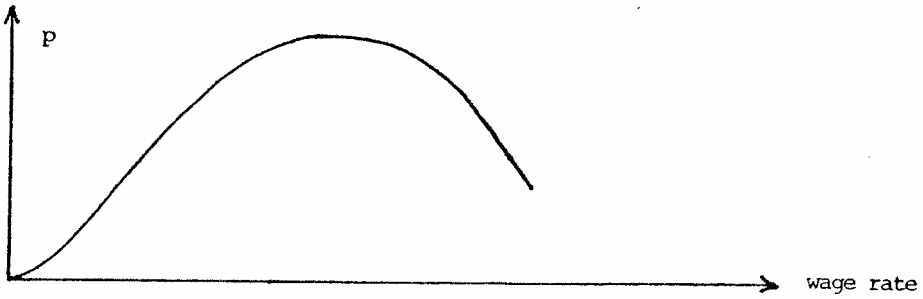
where:

economic -	x_1:	wage rate
	x_2:	nonwage rate
	x_3:	total unemployment 1971
	x_4:	total unemployment 1973
	x_5:	total unemployment 1975
demographic - infrastructural- factors	x_6:	average age of potential labor force (male)
	x_7:	average age of potential labor force (female)
	x_8:	potential female labor force
	x_9:	number of children (age: >0 to 15)
	x_{10}:	capacity of (day)-nursery school and kindergarten

What sensitivities to changes of these variables does theory make us expect?

Let us consider the economic variables to start with. The neoclassical theory of labor supply suggests the possibility of a "backward bending" supply curve (see section 3). If we use the labor force participation rate instead of the labor supply, we obtain the following graph: (4.1).

Figure 4.1.



This curve contains sections with a positive, zero and negative slope - $\frac{\partial p}{\partial x_1}$ could hence have any of these signs (in the econometric specification we hence used a parabola to be able to capture this effect).

In general we would expect a rise in non wage-income (x_2) to have a negative effect on the willingness to supply labor (i.e. $\frac{\partial p}{\partial x_2} < 0$).

Reactions to actual and anticipated unemployment can be very different. The inherent "discouraged-" and "added worker effects" contradict each other, making any sequence of signs possible.
One would expect, however, that if an unfavorable employment situation is feared for a larger period of time, that the discouragement effect should prevail (i.e. $\frac{\partial p}{\partial x_5} < 0$).

As outlined in 2 (see graph 2.2) participation rates of the male population seem to vary with age in a way resembling an upside down parabola again. As we use the average age in a region as an independent variable rather than working with age specific participation rates, the signs of $\frac{\partial p}{\partial x_6}$ as well as $\frac{\partial p}{\partial x_7}$ can change signs.

As female participation rates are in general lower than their male counterparts, we do expect $\frac{\partial p}{\partial x_8} < 0$.

One can generally argue that women of child bearing age (see graph 2.3) tend to stay away from the labor market as long as their children

are at least of pre-school age. In families with many children this effect could be reinforced - so we would suspect regions with a large share of children to exhibit a lower marginal propensity to supply (female) labor. There could be an opposite effect, however, families with many children are not seldom in need of extra income, so that if the father's income is not high enough (or in a macro sense: incomes are lower), mother has to work, too.

If there is sufficient capacity in (day)-nursery schools and kindergartens, one would expect women to have more opportunity to participate in the labor market. (i.e. $\frac{\partial p}{\partial x_{10}} > 0$). This need not be so, however. Especially in agricultural regions this could lure women back to the own small farm, which often provides a subsidiary income in rural areas (these women would drop out of the labor market if they had held a job before). Another effect, more expected in the social strata with higher education, could either lead to more leisure for women, making them sometimes devote their efforts towards social goals in their (usually small) communities, etc.

4.2 Econometric specification of the model

In this section a few number of facets of the theoretical structure of our modeling approach are explored. As we noted earlier Un_i denotes the probability that an individual i will find himself unemployed in the forthcoming planning period. In this context the employment status ist characterized by means of the binary random variable s_i with the probability density function given by

$$Pr(s_i = 0) = Un_i$$

wherein the probability Un_i must conform to the basic axiom of probability given by

$$0 \leq Un_i \leq 1 \qquad \text{for all i.}$$

This restriction has to hold also in the case of the aggregated regional counterpart, namely the regional participation rate p. Each functional formulation which leaves out the requirement of confirming the participating rate within the mentioned unit interval must be in error since predicted values of the dependent variable could fall outside of the unit interval, making it "awkward" to interpret predicted values as probability estimates.

To account for this problem, we use Theil's (1971) logit analysis -

a convenient estimation technique when the data come in the form of cross-tabulations. In the following brief overview of Theil's logit analysis p denotes the participating in the labor force, given the values of the explanatory variables, denoted by the x vector. The vector of logit coefficients to be estimated is denoted as β. The logit L owes is name to the relationship with the logistic function which is supposed for the present to be linear in the variables:

$$L = \ln\left(\frac{p}{1-p}\right) = x'\beta$$

In the logist function we may notice that p approaches 1 for large positive values of $x'\beta$; p approaches 0 for large negative values of $x'\beta$. A further characteristic of the logistic function is the symmetrical smoothing of the curve.

Thus p is related to x in a non-linear fashion, constrained to the unit interval, thereby facilitating interpretation of p as a probability estimate. A linear regression of the logit L on x estimates the logit coeffiecient β:

$$\frac{\partial L}{\partial x} = \beta$$

Changes in the probability p will be a function of the probability itself since p is non-linearly related to the x's via the logistic function. Specifically

$$\frac{\partial p}{\partial x} = \exp(L)/\{1+\exp(L)\}^2$$

Since

$$p = \exp(L)/\{1+\exp(L)\}$$

then

$$1-p = 1/\{1+\exp(L)\} \quad \text{and}$$

therefore

$$\frac{\partial p}{\partial x} = p(1-p)\beta$$

A simple extension of the last equation leads to the concept of elasticity-coefficient, a very informative parameter in labor policy.

4.3. Data and variables

In this section we attempt to give a brief overview about the data set used in the empirical analysis. There 4 basic data sources. Especially important are the 1971 census data ("Volkszählung 1971") which for the first time in Austria permitted the disaggregation of the labor force- and relevant population data by highest educational level attained and by county (p, x_6, x_7, x_8).

The unemployment figures (x_3, x_4, x_5) were obtained from the ministry for social affairs. Unfortunately neither the disaggregation by "qualification" nor by "region" are directly compatible with the census. There are 79 labor market districts in Austria as opposed to 97 counties (aggregating the 23 districts of Vienna into one region). Although most of these regional units coincide, it is the agglomerations, where often only one labor market office exists for core and ring together, that account for the reduced number. We attempted to "blow up" these 79 units to the original 97 by breaking up the unemployment (and vacany) figures, using the shares of the respective qualification in the regional labor force.

Another problem is to find the proper figure within the qualification segments in the unemployment (& vacancy) statistics. The data are collected on the basis of professional groups - within economic sectors. For most professions a direct correspondence to the education received could be found. It was, however, impossible to distinguish between high-school and university graduates, we hence had to use the same figures for both variables. Another notorious difficulty with official unemployment figures, especially at the higher qualification levels, is, that they contain only the number of registered unemployed. As is well known, there is some reluctance to register for unemployment benefits particularly on the side of the better educated. It seems warranted, hence, to judge the quality of the statistical tests, especially with regard to these variables, with a good dosis of caution.

The proper variables to use according to theoretical considerations, would be <u>expected</u> unemployment <u>rates.</u> Due to the lack of compatible data for the denominator (i.e. labor force) for other than the census year 1971, we used <u>actual</u> unemployment figures for 1973 and 1975. The parameters also contain a term containing the formation of expectations, then.

The wage rates, (x_1), in the form of hourly wages, were collected by the chamber of commerce, ("Industrie und Gewerbestatistik") again on a county basis. The qualification levels used are not quite the same as the ones in the census, but the adaptation shouldn't produce a large bias. What is more serious is the fact, that these wages (collected on an annual basis since 1971) are industrial wages only. It can only be hoped that they are representative enough for the other economic sectors also. (Note that p is aggregated over all sectors).

Nonwage income (x_2) was computed on a per capita basis, by substracting the total sum of wages from the 1971 GRP (gross regional product) for all 97 counties (Jeglitsch 1976).

The number of children in the residential population (x_9) and the kindergarten and day nursery school capacity figures (x_{10}) were taken from the 1971 census.

The variable in the numerator of the participation rates, the supply of labor, should be statistically available in terms of the total number of working hours/period supplied. Unhappily these data are not available, the closest approximation is the number of people offering their services in the labor market. In general this kind of indicator will be much more inelastic with respect to changes in the independent variables, particularly to wage rates (just consider the higher wages for working longer hours, etc.).

5. The results of the statistical tests

5.1. General observations

Before taking a look at the empirical results a few general remarks about the methodology applied should be made.

As we distinguish between 4 qualifications and 4 types of regions there is a total of 16 regressions to be performed. We added one regression for each qualification for all of Austria as a reference point. The sample sizes were 17 (urban cores), 19 (rings), 31 (rural) and 30 (peripherial regions) observations, the observational units being a cross section of a total of 97 counties. To ensure that $0 \leq p \leq 1$, the logit functional form was chosen. All estimates reported are simple OLS estimates, no maximum likelihood methods were tried.

The goodness of fit in regional cross-section analysis is usually not overwhelming, so R values are not sky-high. The same holds in general for the t-values of the coefficients. The relatively best results in both respects were obtained for the "skilled workers", the worst for the university graduates, the latter being probably due to the many biases in the data for the variables used (see preceding section).

Starting with the most general results, (see tables 5.1 - 5.4) reactions to changes in the independent variables over the qualifications are fairly heterogeneous. The variation over the types of regions is much less pronounced in general, although there are some quite sizeable differences to be observed.

Another interesting result is the generally low elasticity of response to changes in the determining variables, althouhg, one has to bear in mind, that a change of one percent in the wage rate is in another order of magnitude than a change of one percent of the participation rate (this usually corresponds to a fairly big number of workers!). (See tables 5.5 - 5.8).

The hourly wages used in this analysis did not fare too well in general. The upside-down parabola shape claimed in section 3 & 4 could only be verified for the skilled and unskilled workers at fairly acceptable levels of significance. The negative sign is obtained in 12 out of 20 cases (positive signs were, with one exception, always insignificant). It is the skilled and unskilled segments of the labor market who react strongest to changes in the wage rates (highest elasticities).

Table 5.1

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNIVERSITY GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	2.544 (1.61)	5.903 1.25	3.994 (1.17)	3.743 (1.15)	2.696 (0.90)
wage rate	0.290-E5 (0.43)	-0.621-E5 (-0.31)	-0.176-E4 (-0.77)	-0.272-E4 (-0.84)	0.832-E5 (0.88)
nonwage rate	-2.126 (-3.21)	-2.647 (-1.12)	-1.256 (-0.76)	-2.334 (-1.78)	-8.533 (-1.71)
total unempl. 1971	0.303-E2 (0.84)	0.747-E4 (1.75)	-0.302-E2 (-0.26)	-0.324-E3 (-0.10-E1	0.339-E2 (0.39)
total unempl. 1973	-2.126 (-3.21)	-0.116-E2 (-0.44)	0.299-E2 (0.56)	-0.106-E4 (-0.99-F3)	0.105-E1 (0.49)
total unempl. 1975	-0.191-E2 (-1.70)	-0.745-E3 (-0.39)	0.473-E2 (0.72)	-0.582-E2 (-0.83)	-0.[illegible]-E2 (-0.44)
av. age of pot. labour force (male)	0.165-E1 (0.49)	-0.287-E1 (-0.28)	-0.837-E1 (-1.03)	-0.550-E3 (-0.76-E2)	0.111-E1 (0.17)
av. age of pot. labour force (female)	-0.517-E2 (-0.27)	-0.293-E1 (-0.20)	0.612-E1 (1.07)	-0.885-02 (-0.74)	0.118-E1 (0.39)
ratio of pot. fem. l.f. to total pot. l.f.	-0.126-E3 (-0.39)	-0.811-E3 (-2.01)	-0.182-E2 (-1.66)	0.187-E2 (0.67)	0.715-E2 (0.46)
number of children	-0.137-E4 (2.04)	-0.144-E4 (-0.97)	-0.206-E4 (-1.12)	0.351-E5 (0.23)	-0.293-E4 (-0.70)
capacity of (day)-nursery school and kindergarten	0.113-E4 (0.19)	-0.109-E3 (-0.97)	0.250-E3 (1.21)	-0.204-E4 (-0.86-E1	0.174-E3 (0.94)
R	0.52	0.90	0.74	0.56	0.64
F	3.30	3.30	0.98	0.93	1.37
Sample Size	97	17	19	31	30

Table 5.2

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

HIGH-SCHOOL GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	-0.685 (-1.22)	-2.104 (-0.62)	2.033 (1.15)	0.754 (0.67)	-1.198 (-1.04)
wage rate	0.138-06 (0.10-E1)	0.117-E3 (0.64)	-0.873-E5 (-0.23)	0.509-E4 (1.43)	0.321-E5 (0.23)
nonwage rate	-0.934 (-2.34)	-0.750 (-0.25)	-0.121 (-0.11)	-0.906 (-1.45)	0.360) (0.37)
total unempl. 1971	0.190-E2 (1.21)	0.475-E2 (0.98)	-0.324-E2 (-0.69)	-0.304-E2 (-0.84)	-0.383-E2 (-1.01)
total unempl. 1973	0.177-E2 (1.46)	-0.128-E4 (-0.41-E2)	0.687-E3 (0.28)	0.791-E2 (1.68)	0.152-E1 (3.04)
total unempl. 1975	-0.223-E2 (-4.07)	-0.107-E2 (-0.55)	0.670-03 (0.26)	-0.212-E2 (-0.77)	-0.841-02 (-2.28)
av. age of pot. labour force (male)	0.507-E1 (3.13)	0.186 (3.10)	-0.882-02 (-0.15)	0.350-E1 (0.88)	0.140-E1 (0.48)
av. age of pot. labour force (female)	-0.992-E4 (-0.59-02)	-0.108 (-0.94)	-0.184-E1 (-0.28)	-0.312-E1 (-0.85)	0.470-E1 (2.28)
ratio of pot. fem. l.f. to total pot. l.f.	-0.960-E4 (-1.92)	-0.191-E3 (-1.21)	-0.116-E3 (-0.63)	-0.386-E3 (-1.28)	-0.815-E3 (-2.48)
number of children	-0.392-E5 (-1.16)	-0.669-E5 (-0.29)	-0.712-E5 (-0.75)	-0.157-E5 (-0.18)	0.[illegible]-04 (1.58)
capacity of (day)-nursery school and kindergarten	-0.402-E5 (-0.16-E1)	-0.734-E4 (-0.72)	0.190-E3 (2.10)	0.882-E4 (0.87)	-0.101-E3 (-2.03)
R	0.76	0.92	0.80	0.62	0.68
F	11.35	1.82	1.50	1.30	1.68
Sample Size	97	17	19	31	30

Table 5.3

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

SKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	4.132 (7.40)	5.381 (1.94)	3.917 (2.34)	6.409 (5.18)	1.456 (1.10)
wage rate	-0.237-E3 (-5.18)	-0.312-E3 (-1.51)	-0.744-E4 (-0.97)	-0.218-E3 (-2.42)	-0.101-E3 (-0.67)
nonwage rate	-1.139 (-2.91)	-0.806 (-0.36)	0.219-E1 (0.48-E1)	-0.745 (-1.26)	-1.050 (-0.53)
total unempl. 1971	0.491-E3 (1.30)	0.194-E2 (1.70)	0.173-E2 (2.89)	-0.144-E3 (-0.13)	-0.454-E3 (-0.44)
total unempl. 1973	0.407-E3 (0.97)	-0.113-E2 (-1.22)	-0.197-E2 (-2.38)	0.637-E3 (0.65)	0.860-E3 (0.94)
total unempl. 1975	-0.415-E3 (-2.59)	0.132-E3 (0.32)	0.233-E3 (0.55)	0.312-E3 (0.48)	-0.120-E3 (-0.25)
av. age of pot. labour force (male)	0.428-E2 (0.20)	-0.619-E1 (-0.85)	-0.230-E1 (-0.62)	-0.575-E1 (-1.17)	0.119 (2.37)
av. age of pot. labour force (female)	-0.612-E1 (-3.61)	-0.240-E1 (-0.33)	-0.365-E1 (-0.84)	-0.616-E1 (-2.00)	-0.112 (-2.42)
ratio of pot. fem. l.f. to total pot. l.f.	-0.649-E5 (-1.00)	-0.310-E4 (-2.07)	-0.792-E4 (-2.11)	-0.665-E4 (-1.71)	-0.121-E3 (-1.14)
number of children	-0.241-05 (-0.65)	-0.290-E5 (-0.26)	0.477-E5 (0.47)	-0.193-E5 (-0.21)	0.183-E4 (1.01)
capacity of (day)-nursery school and kindergarten	0.172-E4 (1.03)	0.252-E4 (0.63)	0.109-E3 (2.12)	0.916-E4 (1.05)	-0.402-E4 (-0.54)
R	0.87	0.90	0.96	0.92	0.85
F	28.52	2.87	10.50	12.38	5.00
Sample Size	97	17	19	31	30

Table 5.4

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNSKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	1.446 (1.29)	5.789 (5.57)	5.182 (0.70)	2.076 (0.49)	-0.105 (-0.37-E1)
wage rate	-0.301-E3 (-2.48)	0.743-E4 (0.29)	0.130-E3 (0.30)	-0.383-E3 (-1.47)	-0.327-E3 (-1.61)
nonwage rate	-1.729 (-3.23)	-3.563 (-1.85)	-0.701 (-0.49)	-0.524 (-0.51)	-3.526 (-2.33)
total unempl. 1971	-0.347-E2 (-1.92)	0.102-E2 (0.39)	-0.170-E2 (-0.33)	0.511-E2 (0.94)	-0.123-E1 (-1.79)
total unempl. 1973	0.301-E2 (1.35)	0.507-E2 (1.55)	0.260-E2 (0.43)	0.348-E2 (0.57)	0.598-E2 (0.59)
total unempl. 1975	0.356-E3 (0.45)	0.486-E3 (0.37)	0.387-E3 (0.11)	0.280-E3 (0.95-E1)	-0.157-E4 (-0.94-E2)
av. age of pot. labour force (male)	-0.135-E1 (-0.43)	-0.122 (-1.63)	-0.236-E1 (-0.14)	0.438-E1 (0.73)	-0.115 (-1.26)
av. age of pot. labour force (female)	-0.188-E2 (-0.71-E1)	-0.872-E2 (-0.14)	-0.950-E1 (-1.02)	-0.793-E1 (-1.07)	0.139 (1.87)
ratio of pot. fem. l.f. to total pot. l.f.	0.211-E4 (1.27)	-0.351-E4 (-1.85)	0.479-E4 (0.60)	0.249-E4 (0.34)	0.197-E4 (0.421)
number of children	-0.129-E4 (-0.36)	0.189-E5 (0.19)	-0.544-E4 (-0.89)	-0.119-E4 (-0.20)	0.378-E3 (0.98-E1)
capacity of (day)-nursery school and kindergarten	-0.662-E5 (-0.20)	0.135-E3 (2.09)	0.132-E4 (0.16)	-0.332-E3 (-1.67)	-0.104-E3 (-1.28)
R	0.62	0.95	0.56	0.80	0.84
F	5.55	5.85	0.37	3.61	4.87
Sample Size	97	17	19	31	30

Table 5.5

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNIVERSITY GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	.0034	-.0086	-.0255	-.0211	.0085
x_2	-.0107	-.0638	-.0172	-.0259	-.0685
x_3	.0167	.1845	-.0144	-.0007	.0061
x_4	.0006	-.0350	.0149	-.0000	.0123
x_5	-.0109	-.0183	.0242	-.0124	-.0118
x_6	.0550	-.1141	-.3424	-.0017	.0308
x_7	-.0159	-.1087	.2311	-.0252	.0298
x_8	-.0226	-.0938	-.0216	.0073	.0146
x_9	-.0195	-.0435	-.0370	.0037	-.0253
x_{10}	.0010	-.0220	.0297	-.0012	.0078
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate
x_2 : nonwage rate
x_3 : total unemployment 1971
x_4 : total unemployment 1973
x_5 : total unemployment 1975
x_6 : average age of potential labour force (male)
x_7 : average age of potential labour force (female)
x_8 : potential female labour force
x_9 : number of children (age: >0 to 15)
x_{10} : capacity of (day)-nursery school and kindergarten

*) the calasticities of the wage rates have to be multiplied by two!

Table 5.8

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNSKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1*)	-.1297	.0400	.0582	-.1568	-.1263
x_2	-.1209	-.4383	-.0431	-.0343	-.1858
x_3	-.0869	.0830	-.0405	.0615	-.1312
x_4	.0512	.2791	.0462	.0283	.0384
x_5	.0108	.0377	.0110	.0039	-.0002
x_6	-.2095	-2.0324	-.3633	.7683	-1.7637
x_7	-.0319	-.1654	-1.6106	-1.3142	2.2729
x_8	.1529	-.5521	.3391	.1363	.0958
x_9	-.1018	.0291	-.4381	-.0748	.0213
x_{10}	-.0032	.1147	.0176	-.1183	-.0305
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate
x_2 : nonwage rate
x_3 : total unemployment 1971
x_4 : total unemployment 1973
x_5 : total unemployment 1975
x_6 : average age of potential labour force (male)
x_7 : average age of potential labour force (female)
x_8 : potential female labour force
x_9 : number of children (age: >0 to 15)
x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!

Table 5.6

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

HIGH-SCHOOL GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	.0002	.1901	-.0119	.0610	.0039
x_2	-.0458	-.0687	-.0051	-.0407	.0180
x_3	.0408	.4886	-.0473	-.0253	-.0199
x_4	.0374	-.0012	.0105	.0620	.0819
x_5	-.0897	-.1015	.0106	-.0182	-.0577
x_6	.5378	2.2999	-.0916	.3605	.1494
x_7	-.0010	-1.3558	-.1874	-.3138	.4660
x_8	-.0368	-.3260	-.0281	-.0484	-.0841
x_9	-.0217	-.0761	-.0394	-.0065	.0711
x_{10}	-.0001	-.0560	.0693	.0216	-.0208
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate
x_2 : nonwage rate
x_3 : total unemployment 1971
x_4 : total unemployment 1973
x_5 : total unemployment 1975
x_6 : average age of potential labour force (male)
x_7 : average age of potential labour force (female)
x_8 : potential female labour force
x_9 : number of children (age: >0 to 15)
x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!

Table 5.7

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

SKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	-.0716	-.1366	-.0248	-.0642	-.0228
x_2	-.0328	-.0461	.0006	-.0199	-.0206
x_3	.0198	.2513	.0586	-.0036	-.0093
x_4	.0133	-.1093	-.0577	.0139	.0154
x_5	-.0186	.0174	.0087	.0084	-.0035
x_6	.0276	-.5163	-.1514	-.3576	.6606
x_7	-.3659	-.1904	-.2218	-.3562	-.5703
x_8	-.0067	-.1342	-.0681	-.0304	-.0366
x_9	-.0078	-.0208	.0162	-.0050	.0365
x_{10}	.0034	.0120	.0244	.0133	-.0044
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate
x_2 : nonwage rate
x_3 : total unemployment 1971
x_4 : total unemployment 1973
x_5 : total unemployment 1975
x_6 : average age of potential labour force (male)
x_7 : average age of potential labour force (female)
x_8 : potential female labor force
x_9 : number of children (age: >0 to 15)
x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!

Non wage income generally fares very well, particularly in the rural & peripheral areas, where agriculture on the owner operated small farm still "competes" with dependent work in the labor market. This effect is particularly pronounced for skilled and unskilled workers, many of whom shift between part time work on the farm and in the labor market.

The "added work" effect seems to be strongest for the lower skill levels again, possibly with the exception of workers in the peripheral areas (very low t-values though), who seem to be discouraged easier and withdraw from the labor market (back to the farm?).

In the group of demographic variables the average age of the active population seems to be the most influential variable in terms of elasticities, although many coefficients are not significantly different from 0. It seems, that the specification used did not optimally take the shape of graph 2. into account, which points in the direction of flat spots and turning point.

The number of children also seems to have a considerable influence (in terms of elasticities again), the signs being predominantly negative.

Kindergartens, pre-schools etc., exhibit the strongest impact in the urban ring areas, where in 1971, in the middle of the "suburbanization" phase (v.d. Berg et alii, 1980), most of the young couples with younger children had become residents; the influence there is positive.

Most of the parameters with a negative sign are insignificant, with the exception of the "unskilled" labor market segment in rural & peripheral areas, where mothers might use the extra time gained to work in the small owner operated farms, which can no longer be taken care of be the men.

5.2. Differences across the types of regions

Going into a little more detail now concerning regional differences in labor supply behavior, let us proceed by variables.

- wages: (The squares of which are used in the regressions - wages elasticities have hence to be doubled in tables 5.5. - 5.8). The most flexible reactions to changes in the wages occur in the ring - and rural areas in the labor market for university graduates, elasticities and parameters are very similar (both negative). As far as the high school graduates are concerned, the most significant parameter was encountered in the regression for the rural regions, the highest elasticity in the urban cores.

t-values for both qualifications are generally low. Reactions seem fairly heterogenous over the types of regions. It is again in the urban cores where labor supply is the most flexible with respect to wage changes. Elasticities in 1971 for all other types of regions are within the same order of magnitude, but considerably smaller than in urban areas. The size of the labor market appears to have a considerable effect on the flexibility of labor supply in the "skilled" group.

The reverse holds for the unskilled workers, the highest elasticities can be found in the periphery and in the rural regions (also the t-values are much better in these types of regions). Agriculture and partly tourism may,as mentioned,provide alternatives to participation in the labor market.

- non wage income: The strongest influence can be found in the urban and the peripheral areas. It seems that non-wage incomes are more available in these types of regions than in the others (in the former probably more in terms of capital in the latter agricultural income).

  In the higher two segments elasticities in urban areas are practically the same, there seems to be a fairly uniform reaction of university graduates to changes over all types of regions.

  Elasticities appear to be higher in the group of the unskilled, the strongest effect occurs in the urban areas.

- unemployment: Significances on these variables are fairly low, so conclusions are extremely tentative. The strongest and most significant impact of higher unemployment seems to be by university graduates in the urban core areas (the same holds for the high-school graduates). For the skilled workers the strongest impact can be observed in the urban rings. In the unskilled workers segment, the biggest effects occur in the rural & peripheral areas.

- average age: The highest t-values can be found in the rings for the university graduates, and in the rural and peripheral areas for the two lower qualification levels. Elasticities are generally fairly high - thus corroborating the thesis of "age-specific" participation rates.

- female labor force: A high share of women in the potential labor force generally means lower overall participation rates. The most striking exception to this rule can be found in the peripheral regions, particularly for the unskilled workers, who seem to be women to a larger extent. In general, elasticities are higher for lower qualification levels, the highest one is found in urban core areas.
- number of children: Elasticities generally do not show a very wide variation over qualifications nor over types of regions. The strongest effects of rising family size can be expected in the urban rings (signs are mostly negative).
- capacity of kindergartens & day nursery schools: Most of the signs are positive, so there seems to be an influence of social and infra-structural policy on the labor supply. Elasticities do differ over qualifications and types of regions, but the variations are not very wide. As was to be expected, the strongest effects occur in the urban ring areas.

In conclusion one could say, that there do seem to be differences across regions in labor supply behavior. When problems of regional unemployment are considered, large biases may partly be produced in supply forecasts by using nationally uniform participation rates. This point has to be emphasized even more for different qualification levels.

For further analyses of this type, some additional information could be useful. To be able to assess the "unvertainty" aspects better than we have, information on the average length of unemployment seems mandatory. The authors also fear, that the question of age structure has to be dealt with in more detail , different functional forms could produce better results. The results on the reaction to changes in wage rates for the two higher qualification levels are not very satisfactory, yet. It may be that the average, industrial wages used are only a very bad approximation to the average wages paid, as many people in these qualification classes work in the service sector.

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Table 5.1

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNIVERSITY GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	2.544 (1.61)	5.903 1.25	3.994 (1.17)	3.743 (1.15)	2.696 (0.90)
wage rate	0.290-E5 (0.43)	-0.621-E5 (-0.31)	-0.176-E4 (-0.77)	-0.212-E4 (-0.84)	0.832-E5 (0.88)
nonwage rate	-2.126 (-3.21)	-2.641 (-1.12)	-1.256 (-0.76)	-2.334 (-1.78)	-8.533 (-1.71)
total unempl. 1971	0.303-E2 (0.84)	0.747-E4 (1.75)	-0.302-E2 (-0.26)	-0.324-E3 (-0.40-E1	0.539-E2 (0.39)
total unempl. 1973	-2.126 (-3.21)	-0.146-E2 (-0.44)	0.299-E2 (0.56)	-0.106-E4 (-0.99-E3)	0.105-E1 (0.49)
total unempl. 1975	-0.191-E2 (-1.70)	-0.745-E3 (-0.39)	0.473-E2 (0.72)	-0.582-E2 (-0.83)	-0.790-E2 (-0.44)
av. age of pot. labour force (male)	0.165-E1 (0.49)	-0.287-E1 (-0.28)	-0.837-E1 (-1.03)	-0.550-E3 (-0.76-E2)	0.111-E1 (0.17)
av. age of pot. labour force (female)	-0.517-E2 (-0.27)	-0.293-E1 (-0.20)	0.612-E1 (1.07)	-0.885-02 (-0.24)	0.118-E1 (0.39)
ratio of pot. fem. l.f. to total pot. l.f.	-0.126-E3 (-0.39)	-0.811-E3 (-2.01)	-0.182-E2 (-1.66)	0.187-E2 (0.67)	0.715-E2 (0.46)
number of children	-0.137-E4 (2.04)	-0.144-E4 (-0.97)	-0.206-E4 (-1.12)	0.351-E5 (0.23)	-0.295-E4 (-0.70)
capacity of (day)-nursery school and kindergarten	0.113-E4 (0.19)	-0.109-E3 (-0.97)	0.250-E3 (1.21)	-0.204-E4 (-0.86-E1	0.174-E3 (0.94)
R	0.52	0.90	0.74	0.56	0.64
F	3.30	3.30	0.98	0.93	1.37
Sample Size	97	17	19	31	30

Table 5.2

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

HIGH-SCHOOL GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	-0.685 (-1.22)	-2.104 (-0.62)	2.033 (1.15)	0.754 (0.67)	-1.198 (-1.04)
wage rate	0.138-06 (0.10-E1)	0.117-E3 (0.64)	-0.873-E5 (-0.23)	0.509-E4 (1.43)	0.321-E5 (0.23)
nonwage rate	-0.934 (-2.34)	-0.750 (-0.25)	-0.121 (-0.13)	-0.906 (-1.45)	0.380) (0.37)
total unempl. 1971	0.190-E2 (1.21)	0.475-E2 (0.98)	-0.324-E2 (-0.69)	-0.304-E2 (-0.84)	-0.383-E2 (-1.01)
total unempl. 1973	0.177-E2 (1.46)	-0.128-E4 (-0.41-E2)	0.687-E3 (o.28)	0.791-E2 (1.68)	0.152-E1 (3.04)
total unempl. 1975	-0.223-E2 (-4.07)	-0.109-E2 (-0.56)	0.670-03 (0.26)	-0.212-E2 (-0.77)	-0.841-E2 (-2.28)
av. age of pot. labour force (male)	0.507-E1 (3.13)	0.186 (3.10)	-0.882-02 (-0.15)	0.356-E1 (o.88)	0.146-E1 (0.48)
av. age of pot. labour force (female)	-0.992-E4 (-0.59-E2)	-0.108 (-0.94)	-0.184-E1 (-0.28)	-0.312-E1 (-0.85)	0.470-E1 (2.28)
ratio of pot. fem. l.f. to total pot. l.f.	-0.960-E4 (-1.92)	-0.191-E3 (-1.21)	-0.116-E3 (-0.63)	-0.386-E3 (-1.28)	-0.815-E3 (-2.48)
number of children	-0.392-E5 (-1.16)	-0.665-E5 (-0.29)	-0.712-E5 (-0.75)	-0.151-E5 (-0.18)	0.180-04 (1.88)
capacity of (day)-nursery school and kindergarten	-0.402-E6 (-0.16-E1)	-0.734-E4 (-0.72)	0.190-E3 (2.10)	0.882-E4 (o.87)	-0•101-E3 (-2.03)
R	0.76	0.92	0.80	0.62	0.68
F	11.95	3.82	1.50	1.30	1.68
Sample Size	97	17	19	31	30

Table 5.3

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

SKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	4.132 (7.40)	5.381 (1.94)	3.917 (2.84)	6.409 (5.18)	1.456 (1.10)
wage rate	-0.237-E3 (-5.18)	-0.312-E3 (-1.51)	-0.744-E4 (-0.97)	-0.218-E3 (-2.42)	-0.101-E3 (-0.67)
nonwage rate	-1.139 (-2.93)	-0.806 (-0.36)	0.219-E1 (0.48-E1)	-0.745 (-1.26)	-1.050 (-0.53)
total unempl. 1971	0.491-E3 (1.30)	0.194-E2 (1.70)	0.173-E2 (2.89)	-0.144-E3 (-0.13)	-0.454-E3 (-0.44)
total unempl. 1973	0.407-E3 (0.97)	-0.113-E2 (-1.22)	-0.197-E2 (-2.38)	0.637-E3 (0.65)	0.860-E3 (0.94)
total unempl. 1975	-0.415-E3 (-2.59)	0.132-E3 (0.32)	0.233-E3 (0.55)	0.312-E3 (0.48)	-0.120-E3 (-0.25)
av. age of pot. labour force (male)	0.428-E2 (0.20)	-0.619-E1 (-0.85)	-0.230-E1 (-0.62)	-0.575-E1 (-1.17)	0.119 (2.37)
av. age of pot. labour force (female)	-0.612-E1 (-3.61)	-0.240-E1 (-0.33)	-0.365-E1 (-0.84)	-0.616-E1 (-2.00)	-0.112 (-2.42)
ratio of pot. fem. l.f. to total pot. l.f.	-0.649-E5 (-1.00)	-0.310-E4 (-2.07)	-0.792-E4 (-2.13)	-0.665-E4 (-1.71)	-0.121-E3 (-1.16)
number of children	-0.241-05 (-0.66)	-0.290-E5 (-0.26)	0.477-E5 (0.47)	-0.193-E5 (-0.21)	0.183-E4 (1.01)
capacity of (day)-nursery school and kindergarten	0.172-E4 (1.03)	0.252-E4 (0.63)	0.109-E3 (2.12)	0.916-E4 (1.05)	-0.402-E4 (-0.54)
R	0.87	0.90	0.96	0.92	0.85
F	28.52	2.87	10.50	12.38	5.00
Sample Size	97	17	19	31	30

Table 5.4

LOGIT COEFFICIENTS β (= ∂L/∂X) FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

UNSKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
Constant	1.446 (1.29)	5.789 (5.57)	5.182 (0.70)	2.076 (0.49)	-0.105 (-0.37-E1)
wage rate	-0.301-E3 (-2.48)	0.743-E4 (0.28)	0.130-E3 (0.30)	-0.383-E3 (-1.47)	-0.327-E3 (-1.61)
nonwage rate	-1.729 (-3.23)	-3.563 (-1.85)	-0.701 (-0.49)	-0.524 (-0.51)	-3.526 (-2.33)
total unempl. 1971	-0.347-E2 (-1.92)	0.102-E2 (0.39)	-0.170-E2 (-0.33)	0.511-E2 (0.94)	-0.123-E1 (-1.79)
total unempl. 1973	0.301-E2 (1.35)	0.507-E2 (1.55)	0.260-E2 (0.43)	0.348-E2 (0.57)	0.598-E2 (0.59
total unempl. 1975	0.396-E3 (0.45)	0.480-E3 (0.37)	0.387-E3 (0.11)	0.280-E3 (0.95-E1)	-0.157-E4 (-0.94-E2)
av. age of pot. labour force (male)	-0.135-E1 (-0.43)	-0.122 (-1.63)	-0.236-E1 (-0.14)	0.508-E1 (0.73)	-0.115 (-1.26)
av. age of pot. labour force (female)	-0.188-E2 (-0.71-E1)	-0.872-E2 (-0.14)	-0.950-E1 (-1.02)	-0.793-E1 (-1.07)	0.139 (1.87)
ratio of pot. fem. l.f. to total pot. l.f.	0.211-E4 (1.27)	-0.351-E4 (-1.85)	0.479-E4 (0.60)	0.249-E4 (0.34)	0.197-E4 (0.42)
number of children	-0.129-E4 (-0.96)	0.189-E5 (0.19)	-0.544-E4 (-0.89)	-0.119-E4 (-0.20)	0.378-E5 (0.98-E1)
capacity of (day)-nursery school and kindergarten	-0.662-E5 (-0.20)	0.135-E3 (2.09)	0.132-E4 (0.16)	-0.332-E3 (-1.67)	-0.104-E3 (-1.28)
R	0.62	0.95	0.56	0.80	0.84
F	5.55	5.85	0.37	3.61	4.87
Sample Size	97	17	19	31	30

Table 5.5

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION BY REGIONAL CLASSES AND QUALIFICATIONS

UNIVERSITY GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	.0034	-.0086	-.0255	-.0211	.0085
x_2	-.0107	-.0638	-.0172	-.0259	-.0685
x_3	.0167	.1845	-.0144	-.0007	.0061
x_4	.0006	-.0350	.0149	-.0000	.0123
x_5	-.0109	-.0183	.0242	-.0124	-.0118
x_6	.0550	-.1141	-.3424	-.0017	.0308
x_7	-.0159	-.1087	.2311	-.0252	.0298
x_8	-.0026	-.0938	-.0216	.0073	.0146
x_9	-.0195	-.0435	-.0370	.0037	-.0253
x_{10}	.0010	-.0220	.0297	-.0012	.0078
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate

x_2 : nonwage rate

x_3 : total unemployment 1971

x_4 : total unemployment 1973

x_5 : total unemployment 1975

x_6 : average age of potential labour force (male)

x_7 : average age of potential labour force (female)

x_8 : potential female labour force

x_9 : number of children (age: >0 to 15)

x_{10} : capacity of (day)-nursery school and kindergarten

*) the ealasticities of the wage rates have to be multiplied by two!

Table 5.6

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION BY REGIONAL CLASSES AND QUALIFICATIONS

HIGH-SCHOOL GRADUATES

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	.0002	.1901	-.0119	.0610	.0039
x_2	-.0458	-.0687	-.0051	-.0407	.0140
x_3	.0408	.4446	-.0473	-.0253	-.0199
x_4	.0374	-.0012	.0105	.0620	.0819
x_5	-.0497	-.1015	.0106	-.0182	-.0577
x_6	.5374	2.2999	-.0916	.3605	.1494
x_7	-.0010	-1.3558	-.1874	-.3138	.4660
x_8	-.0366	-.3260	-.0281	-.0484	-.0841
x_9	-.0217	-.0761	-.0394	-.0065	.0711
x_{10}	-.0001	-.0560	.0693	.0216	-.0208
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate

x_2 : nonwage rate

x_3 : total unemployment 1971

x_4 : total unemployment 1973

x_5 : total unemployment 1975

x_6 : average age of potential labour force (male)

x_7 : average age of potential labour force (female)

x_8 : potential female labour force

x_9 : number of children (age: >0 to 15)

x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!

Table 5.7

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION
BY REGIONAL CLASSES AND QUALIFICATIONS

SKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1 *)	-.0716	-.1366	-.0248	-.0642	-.0228
x_2	-.0328	-.0461	.0006	-.0199	-.0206
x_3	.0198	.2513	.0586	-.0036	-.0093
x_4	.0133	-.1093	-.0577	.0139	.0154
x_5	-.0186	.0174	.0087	.0084	-.0035
x_6	.0276	-.5163	-.1514	-.3576	.6606
x_7	-.3659	-.1904	-.2218	-.3562	-.5703
x_8	-.0067	-.1342	-.0681	-.0304	-.0366
x_9	-.0078	-.0208	.0162	-.0050	.0385
x_{10}	.0034	.0120	.0244	.0133	-.0044
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate

x_2 : nonwage rate

x_3 : total unemployment 1971

x_4 : total unemployment 1973

x_5 : total unemployment 1975

x_6 : average age of potential labour force (male)

x_7 : average age of potential labour force (female)

x_8 : potential female labor force

x_9 : number of children (age: >0 to 15)

x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!

Table 5.8

ELASTICITY COEFFICIENTS FOR LABOR PARTICIPATION BY REGIONAL CLASSES AND QUALIFICATIONS

UNSKILLED WORKERS

INDEPENDENT VARIABLE	AUSTRIA TOTAL	CORE AREAS	URBAN RINGS	RURAL REGIONS	PERIPHERAL REGIONS
x_1*)	-.1297	.0400	.0582	-.1568	-.1263
x_2	-.1209	-.4383	-.0431	-.0343	-.1858
x_3	-.0869	.0830	-.0405	.0615	-.1312
x_4	.0512	.2791	.0462	.0283	.0384
x_5	.0108	.0377	.0110	.0039	-.0002
x_6	-.2095	-2.0324	-.3633	.7683	-1.7637
x_7	-.0319	-.1654	-1.6106	-1.3142	2.2729
x_8	.1529	-.5521	.3391	.1363	.0958
x_9	-.1018	.0291	-.4381	-.0748	.0213
x_{10}	-.0032	.1147	.0176	-.1183	-.0305
Sample Size	97	17	19	31	30

Variables:

x_1 : wage rate

x_2 : nonwage rate

x_3 : total unemployment 1971

x_4 : total unemployment 1973

x_5 : total unemployment 1975

x_6 : average age of potential labour force (male)

x_7 : average age of potential labour force (female)

x_8 : potential female labour force

x_9 : number of children (age: >0 to 15)

x_{10} : capacity of (day)-nursery school and kindergarten

*) the elasticities for the wage rates have to be multiplied by two!