Discussion Papers No. 453, April 2006
Statistics Norway, Research Department

John K. Dagsvik, Tom Kornstad and
Terje Skjerpen

Analysis of the discouraged worker phenomenon
Evidence from micro data

Abstract:
In this paper we analyze labor force participation with particular reference to the discouraged worker effect. The theoretical point of departure is a simple model where the worker evaluates the expected utility of searching for work, and decides to participate in the labor market if the expected utility of the search exceeds the utility of not working. With suitable assumptions about unobserved and observed heterogeneity we derive an empirical model for the probability that the worker will be unemployed or employed as a function of the probability of getting a job, given that the worker searches for work. The model is estimated on Norwegian micro-data consisting of independent cross sections over 15 years. The results indicate that there is a substantial discouraged worker effect.

Keywords: Discouraged workers, Labor force participation, Random utility modelling

JEL classification: J21, J22, J64

Acknowledgement: We appreciate many constructive suggestions and remarks from Ådne Cappelen and technical assistance from Anne Skoglund. In addition, we acknowledge financial support from The Norwegian Research Council (Grant no. 156110/S20).

Address: John K. Dagsvik, Statistics Norway, Research Department. E-mail: john.dagsvik@ssb.no
Tom Kornstad, Statistics Norway, Research Department. E-mail: tom.kornstad@ssb.no
Terje Skjerpen, Statistics Norway, Research Department. E-mail: terje.skjerpen@ssb.no

Abstracts with downloadable Discussion Papers
in PDF are available on the Internet:
http://www.ssb.no
http://ideas.repec.org/s/ssb/dispap.html

For printed Discussion Papers contact:

Statistics Norway
Sales- and subscription service
NO-2225 Kongsvinger

Telephone: +47 62 88 55 00
Telefax: +47 62 88 55 95
E-mail: Salg-abonnement@ssb.no

1. Introduction

In many countries, it has been observed that the supply of labor seems to depend on business cycle fluctuations. That is, it is commonly believed that supply of labor is higher when the labor market is tight in contrast to the situation when the labor market is slack. One popular explanation for this is that during a recession workers become discouraged and give up searching for work. Economists view this as the result of workers believing that their chances of finding a job are so low that the implied monetary and psychological costs of searching yield a utility of searching that is lower than the utility of being out of the labor force (as perceived by the worker). A second source of business cycle variations in labor supply is variations in individual wage rates. Although the discouraged worker concept[1] has been around for a long time (Ehrenberg and Smith, 1988), there are surprisingly few empirical micro-based studies that address this issue within a structural framework.

The purpose of this paper is to analyze married women's decisions on labor force participation and employment in a way that explicitly accommodates the discouraged worker effect within a structural setting. Our point of departure is a simple search model that is used as a theoretical rationale to motivate the structure of the utility of looking for work. From this theoretical characterization, an empirical random utility model is developed and represented by the probabilities of not participating in the labor force, working or being unemployed. Our approach enables us to characterize these probabilities in terms of market wage rates, demographic factors, non-labor income (affecting the utility of not working), and the probability that a worker receives a job offer given that she searches for work. As a special case of our search-theoretic setup persons searching will accept the first job offer that arrives. This "decision rule" corresponds to the pronounced official policy of the regional government unemployment agencies in Norway. In these agencies, an employment "manager" decides to a large extent (at least in principle) which jobs are suitable for which type of worker and subsequently allocates vacant jobs to the unemployed workers she thinks are suitable. For other workers who organize their own search this schedule is too simplistic.

Micro studies that analyze the effect of unemployment on labor supply are Ham (1986), Blundell, Ham, and Meghir (1987, 1998), and Başlevent and Onaran (2003). There are however, some studies based on macro time series; see for example, Benati (2001), Darby, Hart, and Vecchi (2001), Otero et al. (1992), and Tachibanaki and Sakurai (1991). The paper that is closest in spirit to our work is Blundell, Ham and Meghir (1998) because they make use of explicit structural restrictions in their model, similarly to our approach. However, whereas they analyze labor force participation,

---

[1] According to Benati (2001), the discouraged worker concept was introduced by Long (1953, 1958).

employment, and hours of work, in this paper, we analyze only employment and labor force participation. Our analysis other aspects our analysis differs from theirs in other aspects as we impose weaker restrictions on our model and use a data set that covers 15 years, whereas their data set covers only four years. We also propose a particular version of Heckman's two-stage method for correcting for selectivity bias in the wage equation (cf. Heckman, 1979). Except for Dagsvik et al. (1988) and Dagsvik and Strøm (1994), this method does not seem to have been applied by others.

The empirical model is estimated on a sample of independent cross sections of married women in Norway, for each year from 1988 to 2002. The estimated model can be applied to predict the discouraged worker effect, given the wage rate, non-labor income and other explanatory variables. As regards the discouraged effect, we find that, on average, about 13.5 percent of the married women outside the labor force are discouraged.

The paper is organized as follows. In the next section the theoretical framework is developed and the general structure of the choice model is obtained. In Section 3, the empirical version of the model is specified and the estimation procedure is discussed. Section 4 contains a description of the data and we present the estimation results in Section 5. Section 6 reports the results, including selected elasticities for different populations groups as well as for the whole sample.

2. The model

In this section we develop a simple framework that subsequently will enable us to formulate an empirical model for individuals' assignment to states; "Out of the labor force" (state 0), "Unemployed" (state 1), and "Employed" (state 2). Let U_j denote the utility of being in state j, $j = 0, 2$. If the agent is out of the labor force she is viewed as being uncertain about her opportunities in the labor market and about the utility of arriving job offers. Job offers arrive according to a Poisson process with arrival intensity λ (possibly individual specific), which is assumed to be known by the individual. The corresponding search cost per unit of time is denoted c. Let V denote the utility of searching and assume that the agent is boundedly rational in the sense that she ignores discounting and is unable to account for the possibility of lay off. Then, applying the standard Bellman type of argument, cf. Lippman and McCall (1981), or Burdett et al. (1984),

$$V = \left(1 - \lambda\Delta t\right)\left(V - c\Delta t\right) + \lambda\Delta t\left(E\max\left(U_2, V\right) - c\Delta t\right) + o(\Delta t). \tag{2.1}$$

Equation (2.1) says that (in a stationary environment) the utility of searching for work is evaluated as follows.[2] When searching two things can happen in a small time interval of length Δt. With probability $1-\lambda\Delta t$ no job arrives within $(t, t+\Delta t)$ so that the expected utility in this case remains equal to V minus search cost $c\Delta t$. Otherwise, a job offer arrives with probability $\lambda\Delta t$, in which case expected utility equals $E\max(V, U_2) - c\Delta t$. After rearranging, dividing by Δt and letting Δt tend towards zero, we obtain:

$$V = E\max(V, U_2) - \frac{c}{\lambda}. \tag{2.2}$$

The expression in (2.2) is quite intuitive. First, recall that by assumption, a job offer arrives according to a Poisson process, which means that the interarrival times of job offers are independent and exponentially distributed with parameter λ. From this distribution, it follows that the expected interval between two job arrivals in this model is equal to $1/\lambda$. Consequently, c/λ is the expected search cost (or disutility) until a job arrives. Thus, V is equal to the expectation of the maximum of the utility of working and the utility of searching minus the expected cost of searching until a job arrives. Moreover, the exponential distribution has the lack of memory property. This means that, given some time after the last job arrival, the remaining time to the next arrival is independent of the time elapsed since the last arrival.

For the sake of empirical analysis, we shall modify the relation (2.2). Note that we can write:

$$\begin{aligned} E\max(V, U_2) &= VP(U_2 < V) + E(U_2 | U_2 > V)P(U_2 > V) \\ &= V(1 - P(U_2 > V)) + E(U_2 | U_2 > V)P(U_2 > V). \end{aligned} \tag{2.3}$$

When inserting (2.3) into (2.2) it follows that we can rewrite (2.2) as:

$$V = E(U_2 | U_2 > V) - \frac{c}{\lambda P(U_2 > V)}. \tag{2.4}$$

Equation (2.4) states that the utility of searching is equal to the expected value of working, given an acceptable job, minus the expected cost until an acceptable job arrives. When $P(U_2 > V) = 1$, (2.4) reduces to

---

[2] Recall that $o(\Delta t)$ is a small term in the sense that $o(\Delta t)/\Delta t$ approaches zero when Δt tends towards zero.

(2.5) $$V = EU_2 - \frac{c}{\lambda}.$$

This special case corresponds to a setting in which the agent will accept the first offer that arrives. As mentioned in the Introduction, this corresponds to the actual policy at public unemployment agencies, where the employment manager selects jobs considered as "suitable" for each unemployed worker. Normally, the unemployed worker cannot refuse a job offer viewed as suitable by the manager if she wishes to continue to receive unemployment benefits.

Let

$$\lambda^* = \lambda P\left(U_2 > V \middle| V > U_0\right), \quad E\left(U_2 \middle| U_2 > V\right) = v_2 + \varepsilon_2,$$

and $U_0 = v_0 + \varepsilon_0$, where v_0 and v_2 are systematic terms that depend on observed individual characteristics whereas ε_0 and ε_2 are random error terms that are supposed to account for the effect of unobservables. From (2.4) and the assumptions above, it now follows that the individual will decide to search for work (participate in the labor market) if:

(2.6) $$v_2 - v_0 - \frac{c}{\lambda^*} > \varepsilon_0 - \varepsilon_2,$$

where $\left(\varepsilon_0 - \varepsilon_2\right)/\sigma$ has cdf $G(x)$, where G is assumed to be known and σ is a positive scale parameter, such that σ^2 is proportional to the variance of $\varepsilon_0 - \varepsilon_2$. Hence, the probability of searching equals:

(2.7) $$P\left(V > U_0\right) = G\left(\left(v_2 - v_0 - \frac{c}{\lambda^*}\right)\Big/\sigma\right).$$

As c is positive, this model implies a positive relationship between the probability of being in the labor force and the arrival rate λ^* of acceptable jobs. In the concrete econometric specification to be discussed in the next section, v_2 will depend on the wage rate whereas v_0 depends on demographic variables and non-labor income.[3] Let q be the probability that the individual has a job offer and that this job offer is acceptable, given that the individual is unemployed (searching for work). Then, the probability that the individual is working, P_2, equals

(2.8) $$P_2 = P\left(V > U_0\right)q = q\,G\left(\left(v_2 - v_0 - \frac{c}{\lambda^*}\right)\Big/\sigma\right).$$

---

[3] In a standard life cycle setting, v_0 will depend on some measure of permanent or lifetime income (through the marginal utility of wealth).

Similarly, the probability of being unemployed, P_1, equals

(2.9)
$$P_1 = P(V > U_0)(1-q) = (1-q)G\left(\left(v_2 - v_0 - \frac{c}{\lambda^*}\right)\Big/\sigma\right).$$

Consequently, it follows that the unemployment rate satisfies:

(2.10)
$$1-q = \frac{P_1}{P},$$

where $P = P_1 + P_2$ is the probability of labor force participation. The formulae in (2.8) and (2.9) are true only if the arrival and value of the job offers are independent of the error term in the utility of working. Before we turn to the issue of empirically specifying the model, we need to establish the link between the arrival rate of acceptable jobs, λ^*, and the probability that an acceptable job is available, q. To this end, note first that the functional dependence between λ^* and q is such that $\lambda^* = \infty$ corresponds to q = 1 and $\lambda^* = 0$ corresponds to q = 0. As a first-order Taylor approximation we can therefore write:

(2.11)
$$\frac{1}{\lambda^*} = (\frac{1}{q} - 1)k\,,$$

where k is a positive constant. Thus, in the empirical specification below, we shall substitute λ^* by the expression given in (2.11).

3. Empirical specification

3.1. Specification of the state probabilities

We shall now discuss the empirical specification and estimation of the model above. From (2.6) and (2.7), we note that when the structural terms v_0 and v_2 are linear in parameters the parameter σ cannot be identified and it can therefore with no loss of generality be normalized to one, provided that σ is independent of time. We start with the specification of the expected utility of working, given that the job is acceptable. It is assumed that the individuals know with perfect certainty the wage rate they will get in the market, but that they may be uncertain with respect to other attributes of the job. We assume that the utility

$$\tilde{U}_{i2t} \equiv E\left(U_{i2t} \middle| U_{i2t} > V_{it}\right)$$

has the structure

$$(3.1) \qquad \tilde{U}_{i2t} = \theta \log W_{it} + \varepsilon^{*}_{i2t},$$

where W_{it} is the real wage rate of individual i in period t and ε^{*}_{i2t} is a random error term that is possibly correlated with the individual's wage rate. (We shall see in a moment that this specification is consistent with the assumption made above that $\tilde{U}_2 = v_2 + \varepsilon_2$.) Furthermore, assume that:

$$(3.2) \qquad \log W_{it} = \beta_{0t} + X_{it}\beta + \eta_{it},$$

where X_{it} is a vector that includes length of schooling, experience and experience squared. Note that we allow the intercept in the wage equation to depend on time.[4]

From (3.1) and (3.2), it follows that:

$$(3.3) \qquad \tilde{U}_{i2t} = \theta\left(\beta_{0t} + X_{it}\beta\right) + \varepsilon_{i2t} = v_{i2t} + \varepsilon_{i2t},$$

where $\varepsilon_{i2t} = \varepsilon^{*}_{i2t} + \theta\eta_{it}$ and $v_{i2t} = \theta(\beta_{0t} + X_{it}\beta)$. Note that, if η_{it} and ε^{*}_{i2t} are correlated this represents no problem. What is important, however, is that ε_{i2t} is not correlated with X_{it}. As regards the systematic part of the utility of not working we assume that $v_{i0t} = -Z_{it}\gamma$, where Z_{it} is a vector of variables consisting of one, age, age squared, the logarithm of non-labor income, and the number of children in the household. Finally, assume that the probability of getting a job given that the woman searches, is given by:

$$(3.4) \qquad q_{it} = \frac{1}{1 + \exp\left(B_{it}\delta\right)},$$

where B_{it} is a vector consisting of the number of children, length of schooling, experience, experience squared, and time dummies. The variable "non-labor income" is not included in B_{it}, which ensures identification of the model. The specification in (3.4) represents a reduced form version. This is sufficient for the purpose of this paper, where the role of the specification in (3.4) is as an instrument variable that enables us to identify the model empirically.[5] From the assumptions and analysis above, we find that the probability of person i being unemployed or employed can be expressed as:

---

[4] We have experimented with an alternative specification with a constant intercept and aggregate unemployment rate, or alternatively, *q*, as an additional regressor. The regressors are supposed to represent the effect of the business cycle. However, as this specification produced unreasonable results (wrong signs), it was abandoned. The main reason for these unreasonable effects may be that the timespan covered by the data was too short.

[5] Note that in the most general case, *q* may depend on preferences. Therefore, one could argue that the B-vector should contain the same variables as in the wage equation and the utility of not working. If so, this implies that identification is sensitive to the functional form of *q*.

(3.5) $$P_{i1t} = \frac{\exp(B_{it}\delta)}{1+\exp(B_{it}\delta)} G\{\theta(\beta_{0t} + X_{it}\beta) + Z_{it}\gamma - c\exp(B_{it}\delta)\},$$

and

(3.6) $$P_{i2t} = \frac{1}{1+\exp(B_{it}\delta)} G\{\theta(\beta_{0t} + X_{it}\beta) + Z_{it}\gamma - c\exp(B_{it}\delta)\},$$

respectively, where the constant *k* is absorbed in the parameter *c*.

We shall next discuss the distributional properties of the error terms ε_0 and ε_2 and the structure of the wage equation of the chosen job. To this end we need the following lemma.

Lemma 1

Assume that $U_j = v_j + \varepsilon_j$, $j = 0,2$, *where* ε_0 *and* ε_2 *are random variables with joint cdf*

(3.7) $$P\left(\varepsilon_0 \le x_0, \varepsilon_2 \le x_2 \middle| v_j, j = 0,2\right) = \exp\left(-\left(e^{-x_0/\mu} + e^{-x_2/\mu}\right)^{\mu}\right),$$

and $\mu^2 = 1 - corr(\varepsilon_0, \varepsilon_2)$, $\mu \in (0,1]$. *Then*:

(3.8) $$P(U_2 > U_0) = \frac{1}{1+\exp\left((v_0 - v_2)/\mu\right)},$$

and:

(3.9) $$P\left(\varepsilon_2 \le x \middle| U_2 > U_0\right) = P\left(\max(U_0, U_2) \le x + v_2\right) = \exp\left(-\left(1 + e^{(v_0 - v_2)/\mu}\right)^{\mu} e^{-x}\right).$$

The first part of Lemma 1, (3.8), is well known; see for example McFadden (1984). The second part, (3.9), can be found in Strauss (1979) or alternatively in Dubin (1985). For the readers' convenience, the proof is given in Appendix C.

In the empirical application below, we assume that the error terms $(\varepsilon_{i0t}, \varepsilon_{i2t})$ are bivariate extreme value distributed with cdf as in (3.7). Then, it follows from (3.8) that the cdf *G* is a logistic distribution:

(3.10) $$G(x) = \frac{1}{1+\exp(-x/\mu)}.$$

From (3.8) in Lemma 1, we note that the logit model is consistent with utility maximization where the error terms are bivariate extreme value distributed, regardless of the degree of correlation between the error terms.

3.2. Correction for selectivity bias

We shall now discuss a particular version of Heckman's two-stage method, similarly to Heckman (1979). To this end, we need to calculate $E\left(\eta_{it} \middle| \varepsilon_{i2t}\right)$ (given that the individual works). We assume that:

$$\eta_{it} = \rho\left(\varepsilon_{i2t} - 0.5772\right) + \eta_{it}^{*}, \tag{3.11}$$

where η_{it}^{*} is a zero mean random variable that is independent of ε_{i2t} and ε_{i0t}, and ρ is an unknown parameter. The reason why we have subtracted 0.5772 (Euler's constant) from the error term is because $E\varepsilon_{i2t} = 0.5772$. If all three random variables that enter (3.11) were jointly normally distributed a representation like (3.11) would always be true. However, in our case one of the variables, ε_{i2t}, is not normally distributed so therefore (3.11) represents an approximation to the true relation. Before we proceed further, we need the following result. Consider the joint distribution of the error term ε_{i2t} and the event that individual *i* is working. We have:

$$P\left(\varepsilon_{i2t} < x, \text{individual } i \text{ works}\right) = P\left(\varepsilon_{i2t} < x, V_{it} > U_{i0t}\right) q_{it} = P\left(\varepsilon_{i2t} < x, \tilde{U}_{i2t} > U_{i0t} + c\left(\frac{1}{q_{it}} - 1\right)\right) q_{it}.$$

From this relation, it follows that:

$$P\left(\varepsilon_{i2t} < x \middle| \text{individual } i \text{ works}\right) = P\left(\varepsilon_{i2t} < x \middle| \tilde{U}_{i2t} > U_{i0t} + c\left(\frac{1}{q_{it}} - 1\right)\right). \tag{3.12}$$

From Lemma 1 it follows that:

$$\begin{aligned} P\left(\varepsilon_{i2t} < x \middle| \tilde{U}_{i2t} > U_{i0t} + c\left(\frac{1}{q_{it}} - 1\right)\right) &= P\left(\max\left(\tilde{U}_{i2t}, U_{i0t} + c\left(\frac{1}{q_{it}} - 1\right)\right) < x + v_{i2t}\right) \\ &= \exp\left(-\left(1 + e^{(v_{i0t} + c/q_{it} - c - v_{i2t})/\mu}\right)^{\mu} e^{-x}\right). \end{aligned} \tag{3.13}$$

Recall that the expectation of the type III extreme value distribution $\exp\left(-e^{b-x}\right)$ equals $b + 0.5772$. Consequently, it follows from (3.13) that:

$$(3.14)\qquad \begin{aligned} &E\left(\varepsilon_{i2t}\,\middle|\,\tilde{U}_{i2t} > U_{i0t} + c\left(\frac{1}{q_{it}} - 1\right)\right) \\ &= \mu \log\big(1 + \exp\left(\left(v_{i0t} - v_{i2t} + c/q_{it} - c\right)/\mu\right)\big) + 0.5772 = -\mu \log P_{it} + 5.772, \end{aligned}$$

where we recall that P_{it} is the probability of being in the labor force. As a result of (3.14) and assumption (3.11), we obtain:

$$(3.15)\qquad E\left(\eta_{it} \mid \text{individual } i \text{ works}\right) = -\rho\mu \log P_{it}.$$

From (3.15) we realize that, similarly to Heckman's two-stage regression method (cf. Heckman, 1979), one can correct for selectivity bias by including an estimate of $\log P_{it}$ as an additional regressor in the wage equation.

Consider finally the conditional variance of η_{it} given that the individual i works. Note that it follows from (3.14) that the variance of the conditional distribution of ε_{i2t}, given that individual i works, is equal to the unconditional variance (which is equal to $\pi^2/6$). Moreover, since η^*_{it} is independent of the error terms of the decision rule that governs the labor force participation entrance, we obtain that:

$$(3.16)\qquad \begin{aligned} \operatorname{Var}\left(\eta_{it} \,\middle|\, \text{individual } i \text{ works}\right) &= \rho^2 \operatorname{Var}\left(\varepsilon_{i2t} \,\middle|\, \text{individual } i \text{ works}\right) + \operatorname{Var}\left(\eta^*_{it} \,\middle|\, \text{individual } i \text{ works}\right) \\ &= \rho^2 \operatorname{Var}\varepsilon_{i2t} + \operatorname{Var}\eta^*_{it} = \operatorname{Var}\eta_{it}. \end{aligned}$$

Hence, we have demonstrated that the variance of the error term in the wage equation is not affected by selection.

The method for controlling for selectivity described above has been applied previously by Dagsvik et al. (1988) and Dagsvik and Strøm (1994). From (3.8) and (3.15), we note that one can set $\mu = 1$, because this represents no restriction on the empirical model.

4. Data

The data are obtained by merging the Labor Force Survey 1988–2002, and three different register data sets— the Tax Register for personal tax payers 1988–1992, the Tax Return Register 1993–2002, and the National Education database—with additional information about incomes, family composition, children, and education.[6]

---

[6] This is possible owing to a system with unique personal identification numbers for every Norwegian citizen.

The Labor Force Survey collected by Statistics Norway is a representative sample of the Norwegian population. It allows a classification of the population into categories based on whether they are employed, unemployed or persons not in the labor force. These definitions are in accordance with recommendations given by the International Labor Organization (ILO). The classification is based on answers to a broad range of questions. Here, we note only that persons are asked about their attachment to the labor market during a particular week and that, for a person to be defined as unemployed, she must not be employed in the survey week, she must have been seeking work actively during the preceding four weeks, and she must wish to return to work within the next two weeks.

Information about actual and formal working times in a worker's main as well as second job, and background variables such as demographic characteristics, family members and occupation are also included in the Labor Force Survey. Conditional on labor market participation, respondents are asked whether they consider themselves as self-employed or as an employee. Based on this information, we have excluded self-employed persons from the empirical analysis. Working time is measured as formal hours of work on an annual basis in both the main as well as in a possible second job. If this information is missing and the respondent is participating in the labor market, information about actual working time is used. The actual sample we use is a subset of the Labor Force Survey and consists of independent cross sections for all the years from 1988 (second quarter) to 2002 (fourth quarter), where each person is observed in one quarter in one year only. The observation period (a quarter) for a given person is drawn randomly from the periods the person is present in the Labor Force Survey. Unfortunately, the Tax Register for personal taxpayers (which is an income register with selected income variables) does not include very detailed information about different types of incomes. Salaries corresponding to actual labor incomes as well as a stipulated measure of labor incomes for self-employed persons are observed, but for other types of income as capital income, the information is based on a net income concept with practically no limitations on deductions of interest expenditures (as long as net income is nonnegative). As interest deductions vary systematically with age, and we want consistency in our definition of non-labor income over time, (net) capital incomes are ignored in our measure of non-labor income. Thus, non-labor income include the salaries of the husband as well as stipulated labor incomes for selfemployed husband. Nominal hourly wages are measured as labor incomes divided by (formal) annual working time, defined above. The nominal hourly wage and non-labor income variables are converted to constant prices by using the official Norwegian consumer price index with 1998 as the base year. The number of children includes all children aged less than 19 years. It would be preferable to have a more detailed classification of children by age, but the data do not contain sufficient information about the age of the children.

Education is measured in years of schooling, and experience is defined as age minus length of schooling minus seven.

The sample is further reduced by including only married or cohabiting females aged 25 and 60 years.[7] The motivation for the age restriction is that education is an important activity for women under 25 years of age, and for those older than 60 years, early retirement is rather frequent. Single women are excluded because the model specifications exclude the possibility that they can stay outside the labor market when they have no permanent income. In line with this reasoning, women with zero non-labor income are also excluded from the sample. Moreover, females with non-labor income higher than one million NOK are also excluded, as are females earning particularly low or high hourly wage rates. This leaves us with a final sample for all years of 46,969 used in the estimation of the model. The average annual proportion of women outside the labor force is 13.1 percent, the average unemployment rate is 2.1 percent, and the average participation rate is 84.7 percent. Table A1 in Appendix A gives detailed summary statistics of the sample with respect to labor market states. Two characteristics are evident: There has been a trend increase in female labor market participation over the period and the unemployment share shows some business cycle fluctuations over the years covered in the sample. In Table A2 in Appendix A, we report the number of observations in each year and summary statistics on an annual basis for the variables used in our econometric analysis. In Table 1 below, we report, as an example, the segment of Table A2 corresponding to 1995.

Table 1. Summary statistics of selected variables, 1995

Variable	Mean	Std. dev.	Minimum	Maximum	No. of obs.
Wage rate NOK	117.72	42.22	39.72	455.85	3,231
Non-labor income NOK	197,740	93,309	149.72	644,538	4,042
Age	40.92	9.17	25	60	4,042
Education	11.9	2.58	6	20	4,042
Number of children	1.3	1.12	0	8	4,042

---

[7] To simplify the verbal exposition, we refer to both these types of females as married in the rest of the paper.

5. Estimation and empirical results

5.1. A multistage estimation procedure

For simplicity we have estimated the model in five stages. The procedure is as follows: In the first stage we estimate a reduced form probability of getting a job given search, by the maximum likelihood method based on (3.4). In the second stage, we estimate the wage equation (3.2) by OLS. In the third stage, we estimate the probabilities (3.5) and (3.6) by maximum likelihood, conditional on the estimated q from stage one and the estimated wage equation from stage two. That is, the predicted wage is inserted into the structural model as an explanatory variable. Based on the results from the third stage, an estimate of $\log P_{it}$ is computed and used as an additional regressor in the wage equation in the fourth stage to correct for potential selectivity bias. In the fifth and last stage, we reestimate the probabilities given by (3.5) and (3.6) conditional on the estimate of q from stage one and the predicted wage obtained in stage four. Results for the two final estimation stages are reported on the right hand side of Table 2 and in the middle column of Table 3, whereas the results from estimation stages 2 and 3 are given on the left hand side of Table 2 and in the first column of Table 3, respectively. In Table B1 in Appendix B, we report the estimates of the parameters of q from stage 1; cf. (3.4). Having obtained estimates of the parameters of q, one can predict the probability of getting work for each individual, also including those who are outside the work force.

From Table 2, we observe that the sample selection variable has a negative effect and is significant, and we observe that the timespecific intercepts are affected by selection, whereas the coefficients associated with schooling and the experience variables change little when selection and estimation uncertainty are accounted for. All the estimates in Table 3 related to the maintained model have the a priori expected sign and are significant.

Table 2. Estimates of the parameters in the wage equation in stages 2 and 4

Explanatory variable	Stage 2		Stage 4	
	Estimate	t-value	Estimate	t-value
Length of schooling	0.0418	61.33	0.0400	46.10
Experience	0.0167	23.49	0.0156	19.90
Experience squared	-0.0003	-17.65	-0.0002	-15.15
Dummy for 1988	3.9007	275.28	3.9495	200.05
Dummy for 1989	3.8974	282.78	3.9478	199.65
Dummy for 1999	3.9260	284.77	3.9744	205.10
Dummy for 1991	3.9688	287.05	4.0156	210.27
Dummy for 1992	3.9641	286.07	4.0107	210.09
Dummy for 1993	3.9732	289.23	4.0199	211.36
Dummy for 1994	3.9883	290.84	4.0337	215.09
Dummy for 1995	3.9925	288.91	4.0386	213.16
Dummy for 1996	4.0019	285.65	4.0470	214.04
Dummy for 1997	4.0196	280.53	4.0641	213.66
Dummy for 1998	4.0456	276.38	4.0884	215.85
Dummy for 1999	4.0678	277.09	4.1102	217.43
Dummy for 2000	4.0705	277.43	4.1128	217.73
Dummy for 2001	4.0710	275.42	4.1136	215.98
Dummy for 2002	4.1340	293.12	4.1757	227.72
Selection, −logP			-0.0642	3.5537
No. of observations	37,914		37,914	
Std. error of regression			0.299	
R^2			0.150	

Using McFadden's ρ^2 as a measure of goodness of fit (cf. McFadden, 1984), estimated to 0.68, we conclude that the model fits the data rather well. In the last column of Table 3, we report, for comparative reasons, the results of a constrained model in which it is assumed a priori that the discouraged worker effect does not enter the model. Apart from a significant loss of explanatory power, the most striking feature is the higher coefficient associated with age and the logarithm of the wage rate. From Table 4, we note that we are able to explain the trend in the labor force participation rates without introducing a trend in the specification of the utility of not working.

Table 3. Maximum likelihood estimates from stages 3 and 5[a]

Para-meter	Parameter attached to	Stage 3	Stage 5	
		With DW[b]-effect	With DW-effect	Without DW-effect
θ	Predicted log real wage	4.9384 (29.07)	5.1422 (29.05)	5.7696 (39.35)
γ_1	Intercept	-22.9973 (-26.62)	-24.1019 (-26.82)	-27.9472 (-42.51)
γ_2	Age	0.2360 (15.89)	0.2405 (16.10)	0.2727 (19.55)
γ_3	Age squared	-0.0034 (-19.23)	-0.0034 (-19.53)	-0.0037 (-22.33)
γ_4	log(non-labor real income)	-0.0917 (-5.57)	-0.0916 (-5.56)	-0.0895 (-5.45)
γ_5	Number of children	-0.5037 (-31.46)	-0.5033 (-31.44)	-0.5295 (-34.04)
c	Discouraged worker effect	4.9411 (5.88)	4.9640 (5.91)	0[c]
Number of observations		46,969	46,969	46,969
Log-likelihood value		-21,505	-21,544	-21,523
McFaddens ρ^2			0.68	

[a] t-values are provided in parentheses. [b] DW stands for 'Discouraged worker'. [c] A priori restriction.

Table 4. Empirical participation rates and mean predicted participation rates

Period	Observed participation rate	Observed unemployment rate	Mean of predicted participation rates		
			Maintained model	$q = 1$	No wage trend[a]
1988	0.8056	0.0177	0.8012	0.8207	0.8012
1989	0.8176	0.0265	0.7923	0.8223	0.7936
1990	0.8283	0.0233	0.8187	0.8427	0.8006
1991	0.8370	0.0278	0.8453	0.8707	0.7999
1992	0.8484	0.0238	0.8479	0.8687	0.8064
1993	0.8448	0.0278	0.8496	0.8743	0.8018
1994	0.8636	0.0236	0.8641	0.8832	0.8099
1995	0.8662	0.0285	0.8657	0.8889	0.8087
1996	0.8777	0.0235	0.8766	0.8940	0.8168
1997	0.8952	0.0218	0.8836	0.8988	0.8144
1998	0.9061	0.0136	0.9041	0.9121	0.8280
1999	0.8991	0.0128	0.9125	0.9193	0.8271
2000	0.9112	0.0146	0.9144	0.9221	0.8292
2001	0.9155	0.0159	0.9177	0.9256	0.8334
2002	0.9141	0.0176	0.9351	0.9423	0.8272
1988-2002	0.8647		0.8647	0.8830	0.8114

[a] This column corresponds to the case where the estimates are initially taken from the maintained model, but where the estimates of the dummy variables in the wage equation for 1989–2002 are all replaced by the estimated value of the dummy variable for 1988.

5.2. Discouraged worker effects and quasi-elasticities

In Table 4 we compare, on an annual basis, the mean of the predicted labor market participation probabilities and the corresponding empirical labor market participation shares (cf. the second and the third column, respectively). Our parsimonious model does rather well in picking up the positive trend in female labor market participation over the years covered by the sample. The mean of the absolute value of the deviations taken over the fifteen years from 1988-2002 is about 0.007. The largest deviations, 0.025 and 0.021, are found for 1989 and 2002, respectively. To assess the magnitude of the discouraged worker effect we have in the fourth column of Table 4 calculated the mean of the predicted labor market participation probabilities in a hypothetical situation when the perceived conditional probability of obtaining employment, given search efforts, is assumed to equal one for all women in the sample (presented in the fourth column of Table 4). This "reference" case corresponds to an ideal situation in which the agent perceives with perfect certainty that she will get a job if she decides to search. Although this case will never occur in practice, it is useful in this context to illustrate the upper bound on labor supply. As seen from the last row of the table, the global predicted mean increases by about 0.018, which implies that about 13.5 percent of those outside the labor force are discouraged. Note that there is a substantial drop in the discouraged worker effect from 1997 on, which corresponds to a similar decrease in the unemployment rate from 1997. A much larger effect would occur if unemployment were higher and labor force participation lower. If, for example, the unemployment rate were 8 percent and labor force participation 80 percent, then the participation rate would increase to about 86 percent if unemployment vanished, which consequently implies that 30 percent of workers are discouraged. If however the unemployment rate were 8 percent and the participation rate 70 percent, the corresponding increase in the participation rate would be about 8 percentage points and the fraction discouraged would be 26.6 percent. By comparing these results with those obtained in Blundell, Ham, and Meghir (1998) we find the following: In their sample, about 64 percent of the women are in the labor force and the average unemployment rate is 6.7 percent. Given the estimate of *c* in our model, this would correspond (using our model) to an increase of the labor force from 64 percent to about 72 percent, which means that the fraction of discouraged workers would be about 22.2 percent. The corresponding fraction of discouraged workers found by Blundell, Ham, and Meghir (1998) is about 10 percent (compared with the effect in our case of 13.5 percent). However, one must be cautious when interpreting these results because the specification and identification criteria used in Blundell, Ham, and Meghir (1988) differ from ours. In the last column of Table 4, we have simulated labor supply behavior in the counterfactual case with wage rates generated by the wage equation of 1988. As a consequence, the increase in labor force participation from 1988 to 2002 reduces to about 2.7 percent (compared with the actual increase of about 13.5 percent). Most of this modest increase in labor force participation is due to increasing education levels and reduced unemployment in the sample.

Next, consider elasticities. Elasticities are characterized by being invariant to the arbitrary choice of units of measurement in both variables. In this section, we calculate a different type of elasticities. We have chosen to use socalled quasi-elasticities, (see Cramer, 2001, p. 8). The motivation for this is that "probability" is already a relative concept and its scale is not arbitrary. The individual quasi-wage and quasi-non-labor-income elasticities are given by:

$$(6.1) \qquad \frac{\partial P_{it}}{\partial \log EW_{it}} = \theta\left(1 - P_{it}\right) P_{it},$$

and:

(6.2) $$\frac{\partial P_{it}}{\partial Z_{i4t}} = \gamma_4 \left(1 - P_{it}\right) P_{it},$$

where Z_{i4t} is the logarithm of non-labor income. These elasticities yield the change in the probability of participation in the labor force resulting from an increase in the wage rate and non-labor income, respectively. The quasi-elasticity with respect to the unemployment rate[8], $1 - q_{it}$, is given by:

(6.3) $$\frac{\partial P_{it}}{\partial \left(1 - q_{it}\right)} = -c \left(1 - P_{it}\right) P_{it} \frac{1}{q_{it}^2}.$$

In Table 5, we report for each year in the sample the annual mean of the quasi-wage, the quasi-non-labor-income-and the quasi-unemployment elasticities. Let us for instance consider the mean elasticities in 1990 and 2000. In 1990 the mean quasi-elasticities for wage, non-labor income and unemployment are 0.70, –0.013 and –0.73, respectively, whereas the corresponding figures for 2000 are 0.38, –0.0053 and –0.31. From Table 4, we note that the mean predicted labor force participation rates are 0.82 in 1990 and 0.91 in 2000. If we counterfactually assume a 5 percent universally higher real wage rate in 1990, the mean predicted participation rate would have increased to 0.855. Correspondingly, a 10 percent universal increase in non-labor income would have lowered the mean predicted participation rate by 0.001. Finally, if all the predicted perceived unemployment rates had been increased by 0.05, the mean predicted labor participation probability would have decreased to 0.7835. If we make the same type of calculations for 2000, the changes in the mean predicted participation probabilities in the three counterfactual situations would have been about 0.02, –0.0005 and –0.016, respectively. Because of a positive trend in female labor participation over the timespan, there is a negative trend in the mean quasi-wage elasticity over time. The mean quasi-non-labor-income elasticity is rather small in magnitude. The quasi-unemployment elasticity, which picks up the discouraged worker effect, shows business cycle variations over time. Ceteris paribus, the quasi-unemployment elasticity will be higher the higher is the perceived probability of being unemployed given search efforts.

---

[8] As both P and 1–q are probabilities and hence dimensionless, we find it consistent with Cramer's intuition to label the derivative in (6.3) as a quasi-elasticity.

Table 5. Mean quasi-elasticities

Year	Quasi-wage elasticity	Quasi-non-labor-income elasticity	Quasi-unemployment elasticity
1988	0.7637	-0.0136	-0.7785
1989	0.7781	-0.0139	-0.8161
1990	0.7044	-0.0125	-0.7319
1991	0.6227	-0.0111	-0.6574
1992	0.6175	-0.0110	-0.6416
1993	0.6101	-0.0109	-0.6439
1994	0.5624	-0.0100	-0.5850
1995	0.5554	-0.0099	-0.5883
1996	0.5217	-0.0093	-0.5422
1997	0.4972	-0.0089	-0.5133
1998	0.4240	-0.0076	-0.4265
1999	0.3920	-0.0070	-0.3928
2000	0.3825	-0.0068	-0.3857
2001	0.3736	-0.0067	-0.3780
2002	0.3003	-0.0053	-0.3057

6.2. Quasi-elasticities for different population groups

One advantage of using micro-data in structural analysis is that it allows the researcher to assess the importance of population heterogeneity when marginal effects from changes in exogenous variables are considered. In Table 6, we report quasi-elasticities related to the (real) wage, real non-labor income and unemployment for different groups of women. The groups differ with respect to combinations of age, length of schooling, number of children, and non-labor income. The non-labor income levels are given in constant 1998 prices. Among women aged 35 years, we distinguish between groups with zero, one, and three children, whereas, for women aged 55 years, we consider groups with zero and and one child. In the sixth column of Table 6, we report the predicted probability q of getting employment, given labor force participation, within the specific population group considered. In the seventh column of Table 6, we report the predicted probability of labor market participation for the respective population groups. As seen from formulae (6.1) to (6.3), the levels of the probabilities have major impacts on the quasi-elasticities. Specifically, an increase in the probability of labor market participation implies a decrease in the absolute value of the quasi-elasticities.

Table 6. Probability of employment, probability of labor supply, quasi-wage elasticity, quasi-non-labor-income elasticity and quasi-unemployment elasticity for different population groups[a]

Population group	Length of schooling	Age	No. of children	Non-labor income[b]	Probability of getting a job, given search	Probability of labor force participation	Quasi-wage elasticity	Quasi-non-labor income elasticity	Quasi-unemployment elasticity
1	14	35	0	1	0.9898	0.9933	0.0343	-0.0006	-0.0338
2	14	35	1	1	0.9885	0.9889	0.0565	-0.0010	-0.0559
3	14	35	3	1	0.9852	0.9697	0.1513	-0.0027	-0.1504
4	14	35	0	167,000	0.9898	0.9801	0.1003	-0.0018	-0.0988
5	14	35	1	167,000	0.9885	0.9673	0.1627	-0.0029	-0.1608
6	14	35	3	167,000	0.9852	0.9140	0.4042	-0.0072	-0.4020
7	14	35	0	300,000	0.9898	0.9790	0.1056	-0.0019	-0.1041
8	14	35	1	300,000	0.9885	0.9655	0.1711	-0.0030	-0.1690
9	14	35	3	300,000	0.9852	0.9097	0.4225	-0.0075	-0.4202
10	14	35	0	600,000	0.9898	0.9777	0.1122	-0.0020	-0.1106
11	14	35	1	600,000	0.9885	0.9634	0.1815	-0.0032	-0.1793
12	14	35	3	600,000	0.9852	0.9043	0.4449	-0.0079	-0.4425
13	18	35	0	1	0.9954	0.9965	0.0180	-0.0003	-0.0175
14	18	35	1	1	0.9948	0.9942	0.0297	-0.0005	-0.0290
15	18	35	3	1	0.9933	0.9841	0.0803	-0.0014	-0.0786
16	18	35	0	167,000	0.9954	0.9895	0.0534	-0.0010	-0.0520
17	18	35	1	167,000	0.9948	0.9827	0.0874	-0.0016	-0.0852
18	18	35	3	167,000	0.9933	0.9537	0.2269	-0.0040	-0.2220
19	18	35	0	300,000	0.9954	0.9889	0.0563	-0.0010	-0.0548
20	18	35	1	300,000	0.9948	0.9818	0.0920	-0.0016	-0.0898
21	18	35	3	300,000	0.9933	0.9513	0.2382	-0.0042	-0.2331
22	18	35	0	600,000	0.9954	0.9882	0.0599	-0.0011	-0.0583
23	18	35	1	600,000	0.9948	0.9806	0.0978	-0.0017	-0.0954
24	18	35	3	600,000	0.9933	0.9483	0.2522	-0.0045	-0.2468
25	14	55	0	1	0.9961	0.9840	0.0811	-0.0014	-0.0789
26	14	55	1	1	0.9956	0.9737	0.1317	-0.0023	-0.1283
27	14	55	0	167,000	0.9961	0.9533	0.2290	-0.0041	-0.2228
28	14	55	1	167,000	0.9956	0.9248	0.3575	-0.0064	-0.3481
29	14	55	0	300,000	0.9961	0.9508	0.2404	-0.0043	-0.2339
30	14	55	1	300,000	0.9956	0.9210	0.3741	-0.0067	-0.3643
31	14	55	0	600,000	0.9961	0.9478	0.2545	-0.0045	-0.2476
32	14	55	1	600,000	0.9956	0.9163	0.3945	-0.0070	-0.3842
33	18	55	0	1	0.9986	0.9930	0.0359	-0.0006	-0.0348
34	18	55	1	1	0.9985	0.9884	0.0589	-0.0010	-0.0571
35	18	55	0	167,000	0.9986	0.9791	0.1050	-0.0019	-0.1017
36	18	55	1	167,000	0.9985	0.9659	0.1692	-0.0030	-0.1639
37	18	55	0	300,000	0.9986	0.9780	0.1106	-0.0020	-0.1070
38	18	55	1	300,000	0.9985	0.9641	0.1779	-0.0032	-0.1723
39	18	55	0	600,000	0.9986	0.9766	0.1175	-0.0021	-0.1137
40	18	55	1	600,000	0.9985	0.9619	0.1887	-0.0034	-0.1827

[a] Calculations refer to 2000. The probability of being employed when offering work is taken as the arithmetic mean over the four quarters in 2000.

[b] In constant 1998 prices.

As an example, let us consider population group 8, consisting of women aged 35 in 2000, with 14 years of education, non-labor income equal to 300,000 NOK, and one child. For this group the predicted probability of participating in the labor market is 0.9655. The quasi-wage elasticity is 0.17, which means that a one percent increase in the real wage increases the probability of labor market participation to 0.9672. Correspondingly, a 10 percent increase in non-labor income yields a decrease in the probability equal to 0.0003. Hence, the response in labor supply to an increase in non-labor income is rather modest. The quasi-unemployment elasticity is about –0.17. That is, an increase in the unemployment rate from 0.012 to 0.062 leads to a decrease in the probability of labor market participation from 0.966 to 0.957.

If we compare group 8 with some of the other groups, we can illustrate the significance of partial changes in demographic variables. Group 9 differs from group 8 in that the women have three children instead of one. The predicted probability of labor market participation drops to 0.9097. As a consequence of this, the three quasi-elasticities are larger in absolute value for group 9 than for group 8. Note that this effect works through two channels. More children decrease the probability of getting a job, conditional on search effort, but also increase the reservation wage.

Next let us compare population group 8 with group 21. The difference between these two groups is that the women in the latter have four more years of schooling. Higher education yields a higher expected real wage, which increases the probability of labor market participation from 0.9655 to 0.9818. Accordingly, the absolute values of the quasi-elasticities are smaller for this highly educated group.

Finally, let us look at the effect of age. The difference between group 8 and group 30 is that the women in the latter one are twenty years older, 55 years against 35 for those in group 8. The effect of age operates in two opposing ways in this case. Higher age goes along with more experience, which leads to a higher expected real wage, which accordingly stimulates labor market participation. However, this effect is clearly dominated by the effect that increasing age increases the utility of not working (see Table 3). The total effect is that the predicted probability of labor market participation decreases from 0.9655 to 0.9210.

7. Conclusions

In this paper we have proposed a simple search-theoretic framework for rationalizing the discouraged worker effect, namely that labor force participation depends negatively on unemployment. Based on this framework, we have specified a static empirical model for the probability that a person is out of the labor force, unemployed, or employed in a given period. Subsequently, we have estimated the model by means of a sample of independent cross sections for married women in Norway, covering the years from 1988 to 2002.

The estimation results show that the model explains the data very well without introducing time dummies for the utility of not working. For example, the mean quasi-wage elasticity in for example 2000 is somewhat lower than 0.40. The income effect is found to be very small. The effect of discouraged worker behavior can be summarized in two ways. First, if, for example the perceived unemployment rates in 2000 increases by 0.01, the mean probability of married women being in the labor force decreases by about 0.004 percentage points. Second, relative to a situation with no unemployment, the average fraction of women outside the labor force who are discouraged is about 13.5 percent.

References

Başlevent, C. and Ö. Onaran (2003): Are married women in Turkey more likely to become added or discouraged workers? *Labour*, **17**, 439–458.

Benati, L. (2001): Some empirical evidence on the 'discouraged worker' effect. *Economics Letters*, **70**, 387–395.

Blundell, R., J. Ham, and C. Meghir (1987): Unemployment and female labour supply. *Economic Journal*, **97**, 44–64.

Blundell, R., J. Ham, and C. Meghir (1998): Unemployment, discouraged workers and female labour supply. *Research in Economics*, **52**, 103–131.

Burdett, K., N. Kiefer, D. T. Mortensen, and G. Neumann (1984): Earnings, unemployment and the allocation of time over time. *Review of Economic Studies,* **51**, 559–578.

Cramer, J.S. (2001): *An Introduction to the Logit Model for Economists*. 2nd edition. London: Timberlake Consultants Ltd.

Dagsvik, J. K., F. Laisney, S. Strøm and J. Østervold (1988): Female labour supply and the tax benefit system in France. *Annales d'Economie et de Statistique*, **11**, 5–40.

Dagsvik, J. K. and S. Strøm (1994): Sectoral Labor Supply, Choice Restrictions and Functional Form. Discussion Papers no. 388. Oslo: Statistics Norway.

Darby, J., R.A. Hart, and M. Vecchi (2001): Labour force participation and the business cycle: a comparative analysis of France, Japan, Sweden, and the United States. *Japan and the World Economy*, **13**, 113–133.

Dubin, J.A. (1985): *Consumer Durable Choice and the Demand for Electricity*. Amsterdam: North-Holland.

Ehrenberg, R., and R. Smith (1988): *Modern Labor Economics: Theory and Public Policy*. 3rd edition. London: Scott, Foreman, and Co.

Ham, J. (1986): On the interpretation of unemployment in empirical labor supply analysis. In R.W. Blundell and I. Walker (Eds.), *Unemployment, Search and Labour Supply*. Cambridge: Cambridge University Press.

Heckman, J.J. (1979): Sample selection bias as a specification error. *Econometrica*, **47**, 153–161.

Lippman, S. A., and J. J. McCall (1981): The Economics of uncertainty: selected topics and probabilistic methods. In K.J. Arrow and M.D. Intriligator (Eds.), *Handbook of Mathematical Economics,* Vol. I, Ch. 6. Amsterdam: North Holland.

Long, C. (1953): Impact of effective demand on the labor supply. *American Economic Review, Papers and Proceedings,* **43**, 458–467.

Long, C. (1958): *The Labor Force under Changing Income and Employment*. Princeton, NJ: Princeton University Press.

McFadden, D. (1984): Econometric analysis of qualitative response models. In Z. Grililches and M.D. Intriligator (Eds.), *Handbook of Econometrics*, Vol. I, Ch. 24. New York: Elsevier Science Publishers BV.

Otero, J.M., G. Martin, F. Trujillo, and A. Fernández (1992): Population, labour force and unemployment in Andalusia: prospects for 1993. *International Journal of Forecasting*, **7**, 483–492.

Strauss, D. (1979): Some results on random utility models. *Journal of Mathematical Psychology*, **17**, 35–51.

Tachibanaki, T. and K. Sakurai (1991): Labour supply and unemployment in Japan. *European Economic Review*, **35**, 1575–1587.

Summary statistics

Table A1. Share of total number of persons in different labor market states

Year	Outside the labor force	Unemployed	Employed
1988	0.1944	0.0177	0.7879
1989	0.1824	0.0265	0.7911
1990	0.1717	0.0233	0.8050
1991	0.1630	0.0278	0.8092
1992	0.1516	0.0238	0.8246
1993	0.1552	0.0278	0.8170
1994	0.1364	0.0236	0.8400
1995	0.1338	0.0285	0.8377
1996	0.1223	0.0235	0.8542
1997	0.1048	0.0218	0.8734
1998	0.0939	0.0136	0.8924
1999	0.1009	0.0128	0.8863
2000	0.0888	0.0146	0.8966
2001	0.0845	0.0159	0.8997
2002	0.0859	0.0176	0.8965

Table A2. Summary statistics of selected variables

Year	Statistic	Real wage rate	Real non-labor income	Age	Education	No. of children
1988	Mean	103.57	182,637	41.05	11.06	1.25
	Std. dev.	32.76	78,829	9.40	2.25	1.10
	Min	35.23	89.67	25	6	0
	Max	265.20	503,700	60	20	6
	No. of obs.	1,912	2,546	2,546	2,546	2,546
1989	Mean	104.34	180,958	40.54	11.12	1.23
	Std. dev.	36.64	78,755	9.40	2.32	1.09
	Min	34.01	261.43	25	6	0
	Max	319.60	528,782	60	20	5
	No. of obs.	2,490	3,322	3,322	3,322	3,322
1990	Mean	107.85	186,827	41.08	11.35	1.26
	Std. dev.	36.08	80,852	9.28	2.45	1.12
	Min	34.08	251.70	25	6	0
	Max	369.33	556,812	60	20	8
	No. of obs.	2,775	3,610	3,610	3,610	3,610
1991	Mean	112.82	185,513	41.33	11.38	1.26
	Std. dev.	37.45	82,609	9.04	2.44	1.13
	Min	38.66	81.74	25	6	0
	Max	342.78	566,791	60	20	7
	No. of obs.	2,849	3,706	3,706	3,706	3,706
1992	Mean	112.65	190,400	41.68	11.47	1.25
	Std. dev.	38.18	90,463	9.13	2.47	1.14
	Min	38.79	157.49	25	6	0
	Max	339.00	591,414	60	20	10
	No. of obs.	2,822	3,575	3,575	3,575	3,575
1993	Mean	113.82	189,391	40.71	11.59	1.31
	Std. dev.	39.38	90,535	9.22	2.43	1.12
	Min	40.07	231.20	25	6	0
	Max	401.01	604,604	60	20	10
	No. of obs.	3,050	3,891	3,891	3,891	3,891
1994	Mean	115.44	192,056	40.91	11.71	1.27
	Std. dev.	36.98	89,305	9.33	2.49	1.13
	Min	39.36	75.90	25	6	0
	Max	306.84	636,107	60	20	9
	No. of obs.	3,257	4,076	4,076	4,076	4,076
1995	Mean	117.72	197,740	40.92	11.9	1.3
	Std. dev.	42.22	93,309	9.17	2.58	1.12
	Min	39.72	149.72	25	6	0
	Max	455.85	644,538	60	20	8
	No. of obs.	3,231	4,042	4,042	4,042	4,042

Table A2 (cont.)

Year	Statistic	Real wage rate	Real non-labor income	Age	Education	No. of children
	Mean	118.54	202,795	41.21	12.03	1.28
	Std. dev.	38.45	93,971	9.25	2.57	1.13
1996	Min	35.23	89.67	25	6	0
	Max	397.96	665,277	60	20	13
	No. of obs	2,790	3,402	3,402	3,402	3,402
	Mean	121.21	205,714	41.06	12	1.34
	Std. dev.	43.76	98,978	9.30	2.57	1.15
1997	Min	30.44	359.86	25	6	0
	Max	480.00	706,931	60	20	10
	No. of obs.	2,136	2,528	2,528	2,528	2,528
	Mean	124.65	217,358	41.45	12.19	1.29
	Std. dev.	41.25	106,777	9.47	2.58	1.17
1998	Min	42.39	1,390	25	6	0
	Max	386.5	789,376	60	20	8
	No. of obs.	1,834	2,129	2,129	2,129	2,129
	Mean	127.58	218,130	41.79	12.23	1.30
	Std. dev.	41.77	107,471	9.50	2.65	1.17
1999	Min	40.19	410.60	25	6	0
	Max	361.86	826,739	60	20	10
	No. of obs.	1,812	2,111	2,111	2,111	2,111
	Mean	129.03	224,037	41.62	12.25	1.29
	Std. dev.	46.99	110,072	9.27	2.63	1.17
2000	Min	36.97	728.99	25	6	0
	Max	499.5	861,205	60	20	10
	No. of obs.	1,842	2,128	2,128	2,128	2,128
	Mean	129.7	232,037	42.25	12.44	1.26
	Std. dev.	44.08	114,674	9.30	2.62	1.14
2001	Min	36.96	772.56	25	6	0
	Max	446.36	896,490	60	20	6
	No. of obs.	1,862	2,143	2,143	2,143	2,143
	Mean	138.08	237,799	42.32	12.45	1.3
	Std. dev.	46.53	119,857	9.50	2.57	1.15
2002	Min	53.64	191.09	25	6	0
	Max	434.54	978,439	60	20	9
	No. of obs.	3,252	3,760	3,760	3,760	3,760

Results from estimation stage 1

Table B1. Estimates of the probability of getting a job, conditional on search efforts

Explanatory variable	Interpretation of explanatory variable	Estimate	t-value
B_1	Education	0.2856	16.04
B_2	Experience	0.1245	7.92
B_3	Experience squared	-0.0016	-4.53
B_4	Number of children	-0.1264	-3.54
B_5	Dummy for 1988Q2	-0.5936	-1.44
B_6	Dummy for 1988Q3	-1.1451	-3.05
B_7	Dummy for 1988Q4	-1.0093	-2.58
B_8	Dummy for 1989Q1	-1.4241	-4.05
B_9	Dummy for 1989Q2	-1.2053	-3.30
B_{10}	Dummy for 1989Q3	-1.3030	-3.57
B_{11}	Dummy for 1989Q4	-1.3419	-3.68
B_{12}	Dummy for 1990Q1	-1.5171	-4.29
B_{13}	Dummy for 1990Q2	-1.3437	-3.76
B_{14}	Dummy for 1990Q3	-0.9810	-2.57
B_{15}	Dummy for 1990Q4	-1.0511	-2.74
B_{16}	Dummy for 1991Q1	-1.4109	-4.00
B_{17}	Dummy for 1991Q2	-1.1207	-2.98
B_{18}	Dummy for 1991Q3	-1.7066	-4.93
B_{19}	Dummy for 1991Q4	-1.4767	-4.14
B_{20}	Dummy for 1992Q1	-1.6498	-4.67
B_{21}	Dummy for 1992Q2	-1.2383	-3.32
B_{22}	Dummy for 1992Q3	-1.1062	-2.95
B_{23}	Dummy for 1992Q4	-1.1301	-2.98
B_{24}	Dummy for 1993Q1	-1.5438	-4.39
B_{25}	Dummy for 1993Q2	-1.4032	-3.97
B_{26}	Dummy for 1993Q3	-1.5273	-4.37
B_{27}	Dummy for 1993Q4	-1.2223	-3.39
B_{28}	Dummy for 1994Q1	-0.9488	-2.51
B_{29}	Dummy for 1994Q2	-1.5177	-4.36
B_{30}	Dummy for 1994Q3	-1.4672	-4.19
B_{31}	Dummy for 1994Q4	-0.9807	-2.59
B_{32}	Dummy for 1995Q1	-1.5798	-4.53
B_{33}	Dummy for 1995Q2	-1.6665	-4.80
B_{34}	Dummy for 1995Q3	-1.6799	-4.85

Table B1 (cont.)

Explanatory variable	Interpretation of explanatory variable	Estimate	t-value
B_{35}	Dummy for 1995Q4	-0.9786	-2.57
B_{36}	Dummy for 1996Q1	-1.4986	-4.17
B_{37}	Dummy for 1996Q2	-1.6920	-4.73
B_{38}	Dummy for 1996Q3	-1.1437	-2.91
B_{39}	Dummy for 1996Q4	-0.7266	-1.71
B_{40}	Dummy for 1997Q1	-1.2334	-3.20
B_{41}	Dummy for 1997Q2	-1.2531	-3.17
B_{42}	Dummy for 1997Q3	-1.5541	-3.99
B_{43}	Dummy for 1997Q4	-0.4425	-0.87
B_{44}	Dummy for 1998Q1	-0.8836	-1.96
B_{45}	Dummy for 1998Q2	-1.0746	-2.37
B_{46}	Dummy for 1998Q3	-0.9581	-2.12
B_{47}	Dummy for 1998Q4	0.4828	0.63
B_{48}	Dummy for 1999Q1	-1.0131	-2.24
B_{49}	Dummy for 1999Q2	-0.6364	-1.25
B_{50}	Dummy for 1999Q3	-0.2314	-0.40
B_{51}	Dummy for 1999Q4	-0.8321	-1.78
B_{52}	Dummy for 2000Q1	-0.6729	-1.39
B_{53}	Dummy for 2000Q2	-0.4059	-0.75
B_{54}	Dummy for 2000Q3	-1.1729	-2.66
B_{55}	Dummy for 2000Q4	-0.9879	-2.19
B_{56}	Dummy for 2001Q1	0.0247	0.04
B_{57}	Dummy for 2001Q2	-0.7728	-1.51
B_{58}	Dummy for 2001Q3	-1.0713	-2.36
B_{59}	Dummy for 2001Q4	-1.5135	-3.81
B_{60}	Dummy for 2002Q1	-0.3846	-0.75
B_{61}	Dummy for 2002Q2	-0.9406	-2.19
B_{62}	Dummy for 2002Q3	-1.3120	-3.50
B_{63}	Dummy for 2002Q4	-1.2701	-3.53
Number of observations		40,614	
Log-likelihood value		-4,584	

Appendix C

Proof of Lemma 1:

Under the distributional assumption in (3.8), it follows that:

(C.1)

$$P\left(U_2 \in \left(x, x+dx\right), U_0 \le y\right)$$

$$= \exp\left(-\left\{\exp\left((v_2 - x)/\mu\right) + \exp\left((v_0 - y)/\mu\right)\right\}^{\mu}\right)\left\{\exp\left((v_0 - x)/\mu\right) + \exp\left((v_2 - y)/\mu\right)\right\}^{\mu-1}\exp\left((v_2 - x)/\mu\right)dx.$$

Hence,

(C.2)

$$P\left(U_2 > U_0\right) = \int_{-\infty}^{\infty} P\left(U_2 \in \left(x, x+dx\right), U_0 \le x\right)$$

$$= \int_{-\infty}^{\infty} \exp\left(-\left\{\exp\left((v_0 - x)/\mu\right) + \exp\left((v_2 - x)/\mu\right)\right\}^{\mu}\right)\left\{\exp\left((v_0 - x)/\mu\right) + \exp\left((v_2 - x)/\mu\right)\right\}^{\mu-1}\exp\left((v_2 - x)/\mu\right)dx$$

$$= \left\{e^{v_0/\mu} + e^{v_2/\mu}\right\}^{\mu-1} e^{v_2/\mu} \int_{-\infty}^{\infty} \exp\left(-e^{-x}\left\{e^{v_0/\mu} + e^{v_2/\mu}\right\}^{\mu}\right)e^{-x}dx = \frac{\exp\left(v_2/\mu\right)}{\exp\left(v_2/\mu\right) + \exp\left(v_0/\mu\right)},$$

which proves (3.8). To prove (3.9), note that it follows from (C.1) that:

$$\begin{aligned} &P\left(\max\left(U_0, U_2\right) \in \left(x, x+dx\right), U_2 > U_0\right) = P\left(U_2 \in \left(x, x+dx\right), x > U_0\right) \\ &= \exp\left(-e^{-x}\left\{\exp\left(v_0/\mu\right) + \exp\left(v_2/\mu\right)\right\}^{\mu}\right)\left\{\exp\left(v_0/\mu\right) + \exp\left(v_2/\mu\right)\right\}^{\mu-1} e^{-x}\exp\left(v_2/\mu\right)dx. \end{aligned} \tag{C.3}$$

Furthermore, we have:

$$P\left(\max\left(U_0, U_2\right) \le x\right) = P\left(U_0 \le x, U_2 \le x\right) = \exp\left(-e^{-x}\left\{\exp\left(v_0/\mu\right) + \exp\left(v_2/\mu\right)\right\}^{\mu}\right),$$

which yields:

(C.4)

$$P\left(\max\left(U_0, U_2\right) \in \left(x, x+dx\right)\right) = \exp\left(-e^{-x}\left\{\exp\left(v_0/\mu\right) + \exp\left(v_2/\mu\right)\right\}^{\mu}\right)e^{-x}\left\{\exp\left(v_0/\mu\right) + \exp\left(v_2/\mu\right)\right\}^{\mu} dx.$$

By combining (C.2), (C.3), and (C.4) we obtain that:

$$P\left(\max\left(U_0,U_2\right)\in\left(x,x+dx\right)\middle|U_0>U_2\right)=\frac{P\left(\max\left(U_0,U_2\right)\in\left(x,x+dx\right),U_0>U_2\right)}{P\left(U_0>U_2\right)}$$

$$=\exp\left(-e^{-x}\left\{\exp\left(v_0/\mu\right)+\exp\left(v_2/\mu\right)\right\}^{\mu}\right)e^{-x}\left\{\exp\left(v_0/\mu\right)+\exp\left(v_2/\mu\right)\right\}^{\mu}dx \tag{C.5}$$

$$=P\left(\max\left(U_0,U_2\right)\in\left(x,x+dx\right)\right).$$

Consequently, we obtain:

$$P\left(\varepsilon_2\le x\middle|U_2>U_0\right)=P\left(U_2\le x+v_2\middle|U_2>U_0\right)$$

$$=P\left(\max\left(U_0,U_2\right)\le x+v_2\middle|U_2>U_0\right)=P\left(\max\left(U_0,U_2\right)\le x+v_2\right)$$

$$=\exp\left(-\left\{\exp((-x)/\mu)+\exp\left(\left(v_0-v_2-x\right)/\mu\right)\right\}^{\mu}\right)=\exp\left(-\exp\left(-x\right)\left\{1+\exp\left(\left(v_0-v_2\right)/\mu\right)\right\}^{\mu}\right),$$

which completes the proof.

Q.E.D.

Recent publications in the series Discussion Papers

361 E. Halvorsen (2003): Financial Deregulation and Household Saving. The Norwegian Experience Revisited

362 E. Røed Larsen (2003): Are Rich Countries Immune to the Resource Curse? Evidence from Norway's Management of Its Oil Riches

363 E. Røed Larsen and Dag Einar Sommervoll (2003): Rising Inequality of Housing? Evidence from Segmented Housing Price Indices

364 R. Bjørnstad and T. Skjerpen (2003): Technology, Trade and Inequality

365 A. Raknerud, D. Rønningen and T. Skjerpen (2003): A method for improved capital measurement by combining accounts and firm investment data

366 B.J. Holtsmark and K.H. Alfsen (2004): PPP-correction of the IPCC emission scenarios - does it matter?

367 R. Aaberge, U. Colombino, E. Holmøy, B. Strøm and T. Wennemo (2004): Population ageing and fiscal sustainability: An integrated micro-macro analysis of required tax changes

368 E. Røed Larsen (2004): Does the CPI Mirror Costs.of.Living? Engel’s Law Suggests Not in Norway

369 T. Skjerpen (2004): The dynamic factor model revisited: the identification problem remains

370 J.K. Dagsvik and A.L. Mathiassen (2004): Agricultural Production with Uncertain Water Supply

371 M. Greaker (2004): Industrial Competitiveness and Diffusion of New Pollution Abatement Technology – a new look at the Porter-hypothesis

372 G. Børnes Ringlund, K.E. Rosendahl and T. Skjerpen (2004): Does oilrig activity react to oil price changes? An empirical investigation

373 G. Liu (2004) Estimating Energy Demand Elasticities for OECD Countries. A Dynamic Panel Data Approach

374 K. Telle and J. Larsson (2004): Do environmental regulations hamper productivity growth? How accounting for improvements of firms’ environmental performance can change the conclusion

375 K.R. Wangen (2004): Some Fundamental Problems in Becker, Grossman and Murphy's Implementation of Rational Addiction Theory

376 B.J. Holtsmark and K.H. Alfsen (2004): Implementation of the Kyoto Protocol without Russian participation

377 E. Røed Larsen (2004): Escaping the Resource Curse and the Dutch Disease? When and Why Norway Caught up with and Forged ahead of Its Neughbors

378 L. Andreassen (2004): Mortality, fertility and old age care in a two-sex growth model

379 E. Lund Sagen and F. R. Aune (2004): The Future European Natural Gas Market - are lower gas prices attainable?

380 A. Langørgen and D. Rønningen (2004): Local government preferences, individual needs, and the allocation of social assistance

381 K. Telle (2004): Effects of inspections on plants' regulatory and environmental performance - evidence from Norwegian manufacturing industries

382 T. A. Galloway (2004): To What Extent Is a Transition into Employment Associated with an Exit from Poverty

383 J. F. Bjørnstad and E.Ytterstad (2004): Two-Stage Sampling from a Prediction Point of View

384 A. Bruvoll and T. Fæhn (2004): Transboundary environmental policy effects: Markets and emission leakages

385 P.V. Hansen and L. Lindholt (2004): The market power of OPEC 1973-2001

386 N. Keilman and D. Q. Pham (2004): Empirical errors and predicted errors in fertility, mortality and migration forecasts in the European Economic Area

387 G. H. Bjertnæs and T. Fæhn (2004): Energy Taxation in a Small, Open Economy: Efficiency Gains under Political Restraints

388 J.K. Dagsvik and S. Strøm (2004): Sectoral Labor Supply, Choice Restrictions and Functional Form

389 B. Halvorsen (2004): Effects of norms, warm-glow and time use on household recycling

390 I. Aslaksen and T. Synnestvedt (2004): Are the Dixit-Pindyck and the Arrow-Fisher-Henry-Hanemann Option Values Equivalent?

391 G. H. Bjønnes, D. Rime and H. O.Aa. Solheim (2004): Liquidity provision in the overnight foreign exchange market

392 T. Åvitsland and J. Aasness (2004): Combining CGE and microsimulation models: Effects on equality of VAT reforms

393 M. Greaker and Eirik. Sagen (2004): Explaining experience curves for LNG liquefaction costs: Competition matter more than learning

394 K. Telle, I. Aslaksen and T. Synnestvedt (2004): "It pays to be green" - a premature conclusion?

395 T. Harding, H. O. Aa. Solheim and A. Benedictow (2004). House ownership and taxes

396 E. Holmøy and B. Strøm (2004): The Social Cost of Government Spending in an Economy with Large Tax Distortions: A CGE Decomposition for Norway

397 T. Hægeland, O. Raaum and K.G. Salvanes (2004): Pupil achievement, school resources and family background

398 I. Aslaksen, B. Natvig and I. Nordal (2004): Environmental risk and the precautionary principle: “Late lessons from early warnings” applied to genetically modified plants

399 J. Møen (2004): When subsidized R&D-firms fail, do they still stimulate growth? Tracing knowledge by following employees across firms

400 B. Halvorsen and Runa Nesbakken (2004): Accounting for differences in choice opportunities in analyses of energy expenditure data

401 T.J. Klette and A. Raknerud (2004): Heterogeneity, productivity and selection: An empirical study of Norwegian manufacturing firms

402 R. Aaberge (2005): Asymptotic Distribution Theory of Empirical Rank-dependent Measures of Inequality

403 F.R. Aune, S. Kverndokk, L. Lindholt and K.E. Rosendahl (2005): Profitability of different instruments in international climate policies

404 Z. Jia (2005): Labor Supply of Retiring Couples and Heterogeneity in Household Decision-Making Structure

405 Z. Jia (2005): Retirement Behavior of Working Couples in Norway. A Dynamic Programming Approch

406 Z. Jia (2005): Spousal Influence on Early Retirement Behavior

407 P. Frenger (2005): The elasticity of substitution of superlative price indices

408 M. Mogstad, A. Langørgen and R. Aaberge (2005): Region-specific versus Country-specific Poverty Lines in Analysis of Poverty

409 J.K. Dagsvik (2005) Choice under Uncertainty and Bounded Rationality

410 T. Fæhn, A.G. Gómez-Plana and S. Kverndokk (2005): Can a carbon permit system reduce Spanish unemployment?

411 J. Larsson and K. Telle (2005): Consequences of the IPPC-directive's BAT requirements for abatement costs and emissions

412 R. Aaberge, S. Bjerve and K. Doksum (2005): Modeling Concentration and Dispersion in Multiple Regression

413 E. Holmøy and K.M. Heide (2005): Is Norway immune to Dutch Disease? CGE Estimates of Sustainable Wage Growth and De-industrialisation

414 K.R. Wangen (2005): An Expenditure Based Estimate of Britain's Black Economy Revisited

415 A. Mathiassen (2005): A Statistical Model for Simple, Fast and Reliable Measurement of Poverty

416 F.R. Aune, S. Glomsrød, L. Lindholt and K.E. Rosendahl: Are high oil prices profitable for OPEC in the long run?

417 D. Fredriksen, K.M. Heide, E. Holmøy and I.F. Solli (2005): Macroeconomic effects of proposed pension reforms in Norway

418 D. Fredriksen and N.M. Stølen (2005): Effects of demographic development, labour supply and pension reforms on the future pension burden

419 A. Alstadsæter, A-S. Kolm and B. Larsen (2005): Tax Effects on Unemployment and the Choice of Educational Type

420 E. Biørn (2005): Constructing Panel Data Estimators by Aggregation: A General Moment Estimator and a Suggested Synthesis

421 J. Bjørnstad (2005): Non-Bayesian Multiple Imputation

422 H. Hungnes (2005): Identifying Structural Breaks in Cointegrated VAR Models

423 H. C. Bjørnland and H. Hungnes (2005): The commodity currency puzzle

424 F. Carlsen, B. Langset and J. Rattsø (2005): The relationship between firm mobility and tax level: Empirical evidence of fiscal competition between local governments

425 T. Harding and J. Rattsø (2005): The barrier model of productivity growth: South Africa

426 E. Holmøy (2005): The Anatomy of Electricity Demand: A CGE Decomposition for Norway

427 T.K.M. Beatty, E. Røed Larsen and D.E. Sommervoll (2005): Measuring the Price of Housing Consumption for Owners in the CPI

428 E. Røed Larsen (2005): Distributional Effects of Environmental Taxes on Transportation: Evidence from Engel Curves in the United States

429 P. Boug, Å. Cappelen and T. Eika (2005): Exchange Rate Rass-through in a Small Open Economy: The Importance of the Distribution Sector

430 K. Gabrielsen, T. Bye and F.R. Aune (2005): Climate change- lower electricity prices and increasing demand. An application to the Nordic Countries

431 J.K. Dagsvik, S. Strøm and Z. Jia: Utility of Income as a Random Function: Behavioral Characterization and Empirical Evidence

432 G.H. Bjertnæs (2005): Avioding Adverse Employment Effects from Energy Taxation: What does it cost?

433. T. Bye and E. Hope (2005): Deregulation of electricity markets—The Norwegian experience

434 P.J. Lambert and T.O. Thoresen (2005): Base independence in the analysis of tax policy effects: with an application to Norway 1992-2004

435 M. Rege, K. Telle and M. Votruba (2005): The Effect of Plant Downsizing on Disability Pension Utilization

436 J. Hovi and B. Holtsmark (2005): Cap-and-Trade or Carbon Taxes? The Effects of Non-Compliance and the Feasibility of Enforcement

437 R. Aaberge, S. Bjerve and K. Doksum (2005): Decomposition of Rank-Dependent Measures of Inequality by Subgroups

438 B. Holtsmark (2005): Global per capita CO_2 emissions - stable in the long run?

439 E. Halvorsen and T.O. Thoresen (2005): The relationship between altruism and equal sharing. Evidence from inter vivos transfer behavior

440 L-C. Zhang and I. Thomsen (2005): A prediction approach to sampling design

441 Ø.A. Nilsen, A. Raknerud, M. Rybalka and T. Skjerpen (2005): Lumpy Investments, Factor Adjustments and Productivity

442 R. Golombek and A. Raknerud (2005): Exit Dynamics with Adjustment Costs

443 G. Liu, T. Skjerpen, A. Rygh Swensen and K. Telle (2006): Unit Roots, Polynomial Transformations and the Environmental Kuznets Curve

444 G. Liu (2006): A Behavioral Model of Work-trip Mode Choice in Shanghai

445 E. Lund Sagen and M. Tsygankova (2006): Russian Natural Gas Exports to Europe. Effects of Russian gas market reforms and the rising market power of Gazprom

446 T. Ericson (2006): Households' self-selection of a dynamic electricity tariff

447 G. Liu (2006): A causality analysis on GDP and air emissions in Norway

448 M. Greaker and K.E. Rosendahl (2006): Strategic Climate Policy in Small, Open Economies

449 R. Aaberge, U. Colombino and T. Wennemo (2006): Evaluating Alternative Representation of the Choice Sets in Models of Labour Supply

450 T. Kornstad and T.O. Thoresen (2006): Effects of Family Policy Reforms in Norway. Results from a Joint Labor Supply and Child Care Choice Microsimulation Analysis

451 P. Frenger (2006): The substitution bias of the consumer price index

452 B. Halvorsen (2006): When can micro properties be used to predict aggregate demand?

453 J.K. Dagsvik, T. Korntad and T. Skjerpen (2006): Analysis of the disgouraged worker phenomenon. Evidence from micro data