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Abstract

Denmark has drawn much attention for its active labor market policies, but is almost unique in offering a voluntary public unemployment insurance program requiring a significant premium payment. A safety net program--a less generous, means-tested social assistance plan—completes the system. The voluntary system emerged as one of many European "Ghent systems," essentially government subsidized trade union plans, but has since lost many key features of such plans. We assess system performance using a 10% sample of the Danish population drawn from administrative data. Coverage rates for the voluntary programs are surprisingly high, approximately 80 percent of the workforce, but the program has predictable selection effects, including adverse selection across risk classes and a substantial charity hazard (low coverage among those with generous treatment under the safety net program). The latter appears to explain the difficulty of shifting to a compulsory system; redistribution effects would be concentrated among the previously uninsured in the lowest decile of the income distribution, a problem in the Danish welfare state.

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Keywords: unemployment insurance, social assistance, unemployment.

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I. Introduction

Denmark has drawn much attention for its active labor market policies, but is quite unusual in one other insurance dimension. Its unemployment insurance system is voluntary and requires a significant premium payment. Voluntary public unemployment systems were widespread in the early years of public unemployment insurance programs, ILO (1955). Denmark and many other European countries initially adopted the Ghent system, essentially government subsidization of trade union plans. This approach had advantages, many of which eroded over time, and most countries converted to unified, compulsory systems, leaving only a handful of countries with voluntary systems, including Finland, Sweden, and more substantially Denmark. Using a 10% sample of the Danish population drawn from administrative data, we explore the function of this system in modern Denmark and seek answers to the question of why Denmark has maintained a voluntary unemployment system.[1]

Evidence from other voluntary insurance schemes suggests that it is difficult to induce widespread participation in such programs. This is partly a rational response to alternative public (free) programs, the charity hazard, but may also indicate widespread consumer myopia (or optimism bias). The well documented history of voluntary flood insurance in the U.S. is one example. After-the-event pressures to provide aid to flood victims induced the U.S. government to consider the failure of the private market for flood insurance.[2] [3] As a consequence, the federal government established the National Flood Insurance Program in 1968, offering communities strong incentives, including a program of

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[1] For broad overviews of recent trends in unemployment and labor market policies in Denmark, see Pedersen (1993), Pedersen and Smith (1995), Andersen, Jensen, and Risager (2000), Søndergaard (2000), and Andersen and Svarer (2007). For a discussion of the Swedish unemployment insurance system, see Bjorklund and Holmlund (1991); for recent reforms, Lindquist and Wadensjö (2007).

[2] Anderson (1974) provides an early policy review.

[3] As one private insurance association wrote, "Some years ago several companies seriously attempted to write specific flood insurance only to learn that there was a very limited market for such coverage, that the peak demand for flood insurance was immediately following a flood, and that property owners generally did not maintain their flood insurance in force after the lapse of several floodless years." American Insurance Association (1956, pp. 172-173).

heavily subsidized flood insurance on existing housing, to undertake appropriate flood risk surveys and land management reforms. The insurance program convincingly demonstrated that U.S. consumers would not voluntarily buy even heavily subsidized flood insurance:

> … there is evidence which suggests that many individuals will not purchase flood insurance voluntarily even if it is subsidized 90 percent by the federal government. It appears unlikely that prospective homeowners would purchase flood insurance at actuarial rates unless required to do so, particularly in view of the incentive to rely on disaster relief. Kunreuther (1973, p.23)

Browne and Hoyt (2000, p.293) report that, "In 1993 the greatest single flood event in the United States occurred…Of the $12 billion in damages, less than $1 billion was covered by federal flood insurance."[4]

Early evidence suggested considerable worker myopia when offered a voluntary unemployment insurance plan. William Franklin Willoughby for the U.S. Department of Labor reviewed early European unemployment insurance programs for possible adoption in the United States, Willoughby (1897). One was a voluntary program established in 1893 in Berne, Switzerland financed by a combination of membership dues, employer gifts and municipality contributions. In the first full year of operation, payouts exceeded member dues by a factor of seven to one, yet paid membership shrank in the second year, and the plan quickly failed.

The Danish system may not suffer from the same myopia concerns--the population is well educated and professionally counseled on government programs—but serious selection issues remain. Excluding special charges for ancillary programs which vary across UI-funds, premiums are identical for all workers despite large differences in unemployment risk, a pricing structure that encourages adverse selection. Charity hazard is also a problem. The Danish social safety net for unemployed workers without insurance is generous; means-tested social assistance is available to uninsured unemployed workers as well as UI benefit

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[4] In response to the limited demand for insurance, the government turned to compulsion, requiring that all structures financed by an institution with a federal government link, which includes most mortgage suppliers in the U.S., must require that the mortgagors purchase Federal insurance. This mandate has had surprisingly modest effects, perhaps because of limited efforts to enforce the mandate, GAO (1990).

exhaustees. The combined UI-fund/social assistance system is similar in some respects to the U.S. health insurance industry; an unemployed worker may be insured by a UI-fund, eligible for social assistance benefits, or simply uninsured (not a UI-fund member and ineligible for social assistance, perhaps because of high household income).

The paper proceeds as follows. In the next section we provide some background on the voluntary, union-based UI funds in Denmark. In Section III we provide a detailed description of unemployment insurance funds ("A-kasser" or UI-funds) and the social assistance safety net in Denmark, which leads to a formal model of the worker's decision to join an unemployment fund. We then turn to the data, considering the sensitivity of the UI-fund membership decision to economic incentives. The high UI-fund coverage rate in Denmark is transparent in aggregate data, as is its sensitivity to economic incentives, Section IV.

More precise estimation of selection effects requires multivariate analyses of micro data, and in Section V we introduce the principal data set, a 10 percent sample of the Danish population, drawn from IDA ("Integreret Database for Arbejdsmarkedsforskning" or integrated data base for labor market research) and the tax registry. We focus all analyses on the years 1994 and 1995. The year 1994 is the first year in which social assistance benefits were subject to the same income taxation rules as UI benefits. During the second half of the 1990s, a series of mandatory activation programs were imposed at different times on UI-fund beneficiaries and social assistance beneficiaries. During these two years (1994-1995), then, UI and SA benefits were taxed equivalently and were both subject to only modest activation (the passive period was 3 years).

We begin with a logit analysis of UI-fund membership status (Section VI). Obvious endogeneity problems arise because unemployment insurance status is likely to alter the worker's unemployment experience as well as the reverse. Because of the special nature of the UI benefit eligibility process (members are not immediately eligible for benefit), a first-difference approach commonly used to deal with unobserved heterogeneity (Chamberlain's conditional logit model) also addresses the endogeneity problem. The argument and

estimates are developed in Section VII. Section VIII then provides a number of robustness checks, using variants of the Chamberlain model. All models, including the initial levels logits, tell a consistent story; UI-fund membership is sensitive to the expected economic calculus—workers with low unemployment risk; those eligible for only modest UI benefits; and those who qualify for generous, means-tested alternatives are all less likely to join.

In Section IX, we return to the political economy question, why has Denmark clung to its voluntary UI system in the face of these apparent distortions? The answer appears to lie in the redistribution that would come with conversion to a compulsory system. Because of the charity hazard, low wage workers as well as high would be compelled to join the UI system, and indeed low wage workers would provide the larger share of additional government net revenues. Chapter X concludes.

II. The Danish Unemployment Support System: Background

At the turn of the 20th Century, unemployment insurance in Denmark was provided privately through already ubiquitous labor unions. It was natural for the government to encourage more generous unemployment support through subsidization of these funds, the Ghent sytem, which it did in 1907, Edling (2006, pp. 107-108). Union administration offered a variety of advantages, not least, relatively low incremental administrative costs. Unions could also require that union members join UI funds, which made the funds voluntary only in the collective sense. Moreover the union had obvious advantages monitoring its own members for slackness in job seeking. Alternative government support programs were rare, and "free-riding" on other social insurance programs, the charity hazard, uncommon.

Reforms over the next century eliminated many of these attractive features. Indeed Denmark is unusual, even among its Nordic neighbors. Norway adopted a voluntary program in 1906, a year before Denmark adopts its program, but converted to a compulsory system in 1938.[5] Unemployment insurance premiums in the Finnish and Swedish systems have historically been quite modest, essentially covering administrative costs. Sweden

[5] See Carroll (2005) for an extended discussion of the reasons why Norway transitioned to a compulsory system in 1938.

adopted a compulsory system during the early 1990s, but the decision was reversed a year later. It imposed a larger, risk differentiated fee in 2007, but experienced a sharp decline in membership, and has recently (January 1, 2014) restored the fees to about the same level as before 2007, although the fees remain somewhat more differentiated, Kjellberg (2014).

Within Denmark's voluntary system, much changed over the course of the 20th century. The government assumed responsibility for all benefit liabilities in the 1960s, so the union no longer had an economic incentive to monitor the unemployed worker's job search and offer acceptance strategies.[6] In 1988 the government made UI-fund nondiscrimination against nonunion workers an explicit precondition for state recognition and hence government subsidies (Direktoratet for Arbejdsløshedsforsikring, 1988); government subsidies could no longer be channeled disproportionately to union members, Carroll (2005). Although a hard proposition to test rigorously, the link with UI benefits is believed by many researchers to be a significant factor in the high degree of unionization in Denmark today.[7]

The long association of UI-fund and union membership raises some question of the worker's degree of choice in joining a fund. It remains legal for a union to require that members belong to its unemployment insurance fund, although this practice, once common, is now quite rare. Union membership is itself a voluntary decision in Denmark, and unions seem disinclined to impose ancillary requirements on members that might discourage workers from joining the union. Inquiries with unions and experts on unions uncovered only one national union with a compulsory UI-fund, the journalists union, apparently as a way of expressing solidarity with other workers. UI-fund membership requirements at the local union level are apparently also rare.

Social pressure to join a fund is possible, but difficult to document directly. The ratio of fund membership to union members seems to indicate the relative popularity of

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[6] "Insurance remained voluntary when the state, with the reform in 1967, granted full reimbursement of the funds' expenditure. Members now paid a fixed contribution…." Edling (2006, p.133).

[7] For a broad analysis of the union/UI fund nexus, see Neumann, Pedersen, and Westergård-Nielsen (1991), Lind (2009), and van Rie, Marx, and Horemans (2011). For Denmark, past and present, see Pedersen (1982) and Scheuer (2007) respectively.

unemployment funds in low skill unions. Among the five largest unions, the ratio is approximately 100% in SID and KAD (unskilled women),[8] 94% in FOA (public employees), 87% in HK (white collar) and 83% in Metal (skilled, metal industry).[9] Below we control for industry and occupation to allow for behavioral differences attributable to union social pressure.

III. The UI-Fund Decision

There were 37 state-recognized funds in 1995--one fund for each trade, two funds for the self-employed and a general fund for both employers and employees (a Christian UI-fund). In general a worker was expected to join the fund of his trade, but fund differences were slight. All funds were regulated by the government and faced identical rules on fund membership procedures, including base membership fees, search and other eligibility requirements, and benefit levels and duration. Plans could and did differ in related services, including search counseling services, which were linked with fee differentials.

If the worker did not join a fund and became unemployed, she might still be eligible for social assistance. The social assistance program was a means-tested support system for the unemployed and for other socially stressed individuals, including those who were sick but not certified as fully disabled and those experiencing marital disruptions. An unemployed worker who did not belong to a UI-fund and was married to a well-paid, employed worker could expect to receive little social assistance.

Benefit differences in the two programs are fundamental to the UI-fund membership choice. Search requirements for eligibility in both programs were similar and quite modest in 1995. It was only necessary for a job loser to claim to look for work to qualify for benefits. Later reforms of social assistance paralleled those in the UI-fund, and imposed various activation requirements on SA beneficiaries less than 55 years of age, including (i)

[8] SID and KAD are now part of the union 3F.

[9] These statistics are from Danmarks Statistik (1999). Note that these figures may be somewhat misleading indicators of demand within the unions because there was a minimum size limit on funds, so that smaller unions must arrange to join funds operated by larger unions. We are indebted to Niels Blomgren-Hansen for the statistics and the caveat.

compulsory attendance at training programs prior to becoming benefit-eligible and (ii) documentation of search activities.

The insurance decision is a dichotomous one, join the fund or not, because the worker has no choice of extent of coverage, the parameters of which are set by the government. Formal multi-period models of (i) the decision to join a UI-fund by an uncovered worker and (ii) the decision to exit a UI-fund by a covered worker are derived in Appendix 1 (the two decisions are modestly asymmetric because of a delay in benefit eligibility following payment of the first premiums). By joining a voluntary UI-fund, then, the worker pays an annual premium in order to receive UI benefits instead of social assistance benefits. To a first approximation, these programs are substitutes and an opportunity cost of joining an unemployment insurance fund is the loss of social assistance payments

Formally, the i[th] worker must pay a fee f_i in every period to be a member of the UI-fund, and will receive a benefit payment B_{U_i} (in any period after the first) if she becomes unemployed, which occurs with probability θ_i.[10] The basic annual membership fee is set administratively at eight times the maximum daily UI benefit. In 1995 the fee was 3660 DKK ($654, 1995 USD) for employees and 4071 DKK ($727) for the self-employed.[11] This fee scheme makes the government's share of UI-fund expenditures dependent on the business cycle and implies that the funds are self-supporting when the average unemployment is approximately 3%, ignoring fund-related leave schemes and the early retirement supplement. Between 1975 and 1995 the average unemployment rate in Denmark was roughly 9%, so member fees covered only one third of direct fund benefit outlays, with the remainder covered by state subsidies and by compulsory contributions from employers.[12]

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[10] The benefit parameter would include any increments to early retirement benefits that result from UI-fund membership, appropriately discounted.

[11] At that time, recently self-employed individuals paid a higher fee, 9 times the maximum daily UF-benefits. The self-employment differential was eliminated in 1996. Part-time workers, those who work less than 31 hours per week, have both the fee and benefits reduced by one-third.

[12] Over the first decade of this century, the average unemployment rate was 4.3% with perhaps another percentage point added for unemployed workers in activation programs.

In the absence of paying a UI-fund fee, the unemployed worker may qualify for means-tested social assistance benefits, denoted by B_{SA_i}. Because it is a welfare program, SA has a family focus, with benefits varying with family composition. Especially before benefits were reformed in 1997, both an SA-unemployed worker and a nonworking spouse would be treated as unemployed; after that time each would have to be an active job seeker to receive unemployment benefits.

The worker will join a fund if $\Delta = E(U_i|UIfund = 1) - E(U_i|UIfund = 0) > 0$, where Δ is the i^{th} worker's lifetime net gain in expected utility of joining the UI-fund. It is easily demonstrated that, with an additively separable utility function in consumption and leisure and a dichotomous (zero-one) work choice, the expected value maximizing worker will reveal the following plausible qualitative behaviors:[13]

$$\frac{\partial \Delta}{\partial \theta} > 0, \frac{\partial \Delta}{\partial B_U} > 0, \frac{\partial \Delta}{\partial f} < 0, \text{ and } \frac{\partial \Delta}{\partial B_{SA}} < 0.$$

Not surprisingly, the attractiveness of UI-fund membership is increasing in both unemployment risk and UI-fund-benefits and decreasing in the fee and the generosity of social assistance benefits.

The delay in eligibility for UI-fund benefits is important in the analysis to follow. To be benefit-eligible (in 1995), the typical worker must be a member of the UI-fund (paid monthly dues) for one year and have worked for at least twenty-six weeks during the three years preceding the date of unemployment.[14] As a consequence, the worker's unemployment experience in his first year is not distorted by his UI-fund membership. Conversely, a member who stops paying dues becomes a nonmember (benefit ineligible) after two months (see below, Section VII). For full benefits, one must be involuntarily released; workers who voluntarily quit forfeit the first five weeks of benefits.

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[13] This preference structure implies equal consumption across states if insurance is complete and costless.

[14] If one joined a UI-fund as a student or military personnel, one could get UI benefits without ever having had paid work.

IV. UI-fund Membership: Aggregate Evidence

UI-fund membership in 1995 was surprisingly high--almost 80 percent of all labor force participants were members (contributed to a UI-fund)--but not an institutional constant. UI-fund membership increased by 10 percentage points between 1987 and 1995, before declining modestly between 1995 and 2001, Figure 1.[15] UI-fund membership rates are broadly consistent with adverse selection, rising and falling with the aggregate unemployment rate, although not symmetrically for reasons we discuss below.

<figure 1>

Cross-sectional statistics also suggest the importance of economic considerations in the membership decision. In Figure 2, we report 1995 UI-fund membership and unemployment rates by 1994 earnings deciles (Panel A) and by 1995 age (Panel B). Unemployment is high in the prior year's lower earnings deciles and is essentially nonexistent in the upper deciles. The high membership rates in the higher income deciles can be partly explained by a popular early retirement program, efterløn or post-employment wage, available only to UI-fund members. The low UI-fund membership rates in the low income deciles, despite relatively high unemployment risk, may be explained in part by access to means-tested social assistance.

<figure 2>

As in most industrialized countries, unemployment rates in Denmark peak among workers in their early 20s, falling more or less continuously through age 50 before climbing again, Figure 2B. With fixed premiums across individuals, one might conjecture that UI-fund membership would follow the same U-shaped pattern, first declining and then increasing with age. That is not the case; fund membership in this time period is remarkably flat throughout the bulk of the individual's active work life. The surprising constancy of UI-fund membership across age, Figure 2B, can only partly be explained by age variations in social

[15] Two measures of the aggregate unemployment rate, the official unemployment measure and the OECD standardized measure, are graphed in Figure 1. The OECD standardized measure is everywhere less than the official measure, which includes some individuals who are not actively looking for work.

assistance eligibility--safety net eligibility declines more or less continuously throughout the work life as marriage rates and spousal income grow, and assets accumulate.

Another explanation for the limited correlation of unemployment and UI-fund membership across age brackets is efterløn, an early retirement program, which in 1995 required twenty years of service in the 25 years prior to receipt, which can begin as early as age 60. This provides an incentive for all workers over 40 to belong to a fund. [16] Evidence of the strong efterløn effect can be found in a tightening of eligibility rules in 1992. The service requirement was was raised from 10 years to 20 years in that year, forcing those who intended to retire at 60 to belong to a Fund from age 40 on. The impact on the age profile of membership before (1990-1991) and after (1992-1995) the rule change is quite dramatic, Figure 3.

<figure 3>

V. The Data

Our primary data set is extracted from IDA (An Integrated Data Base for Labor Market Research) and the Income Tax Register, which are maintained by Statistics Denmark, the government statistical office.[17] The analysis centers on behavior in 1994-95; after all types of benefits became taxable and just before major workfare reforms were introduced. We focus on workers 18 to 34, for whom the UI-fund membership decision is a pure insurance decision, not affected by incentives to enroll in the early retirement scheme, 'efterløn'.

The value of using an administrative data set to examine unemployment fund membership is clear; an exact record of the individual's insurance status (UI-fund membership) is provided. The involvement of the government in many facets of Danish life means that the data set contains much more demographic and economic data than would be

[16] Somewhat younger if the worker does not expect to be continuously employed until retirement.

[17] The data was available for a fee that is considerable by U.S. government standards. The fee was expected to cover the cost of compiling and maintaining the data set as well as the marginal cost of providing it to the user. For commercial and privacy reasons the data can only be accessed at sites authorized by Statistics Denmark.

available in the administrative data of many countries. Not only do the data contain records of UI-fund membership and benefit receipt and social assistance receipt, it contains the usual demographics--sex, age, marital status; presence of children in the household, educational attainment—as well as labor force activity; earnings, income and wealth.

The key unemployment variable, the fraction of the year spent unemployed, is an administrative construct and may undercount laid off workers or others who do not contact public services because they believe they do not qualify for unemployment or social assistance benefits or other related services. Survey evidence of the extent of unreported unemployment is available, and suggests the numbers are relatively small. In 1995 approximately 13,000 individuals (0.45 percent of the labor force) were looking for work, but did not receive unemployment compensation nor were registered at the employment office ("AF-kontor") according to Denmarks Statistiks Labor Force Survey.[18] Conversely the unemployment category includes many individuals who are not unemployed in the usual sense of being available for work if offered.[19]

Unemployment benefits are constructed from program rules in 1995 (and 1993 and 1994 in the conditional logits). Cash benefits were uniform across plans, with benefits proportional at 90 percent of earnings up to a fairly low maximum, after which benefits remain flat just below 140,000 DK ($25,000):

$$B_{U\,i} = \min(0.9e_i - f, 136{,}709 - f)$$

where e_i denotes the *i*th individual's pre-unemployment earnings and f the UI-fund membership fee.[20] Benefits are a function of weekly earnings prior to unemployment, so we adjust reported annual earnings for weeks of employment to construct weekly earnings and then the benefit rate, which in turn is converted to an annual figure. Since 1994, SA

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[18] This information was provided by Danmarks Statistiks to the Ministery of Finance, Denmark (Personal Communication with Tranæs, 2002).

[19] Pedersen and Smith (1995) find that only some 60% of the individuals receiving unemployment compensation wanted a job *and* were actively searching for one. Statistics Denmark, Labor Force Survey, has arrived at comparable figures.

[20] Benefits are also bounded by zero, which affects those workers with negative incomes in 1995.

benefits, like UI-fund benefits, have been subject to ordinary income taxation, although we do not adjust for taxes here.

The base fee *f* is essentially constant, varying only with part-time/full-time work and student status (there is a significant student discount), and for simplicity is simply subtracted from UI benefits. [21] UI-funds are free to offer ancillary services, such as job training and counseling, but must charge them fees in excess of those required for benefit eligibility. We exclude from our sample students, self-employed, people on leave or out of the labor force, and pensioners because of their distinctive circumstances, so that the fee varies only with UI-fund service-provision and part-time status.

We can also estimate the social assistance benefits for which the individual would be eligible if she were unemployed and *uninsured*. Welfare counselors are given a non-negligible degree of discretion in the Danish welfare system, so these estimates are not exact, but a similar degree of uncertainty is likely to exist in the mind of the decision-maker, who is after all speculating on her own social assistance eligibility. Unlike unemployment insurance, social assistance is means-tested. The system distinguishes in a modest way between other family income and wealth, and it is therefore necessary to partition into these components. Denote the i[th] individual's asset income by a_i, spouse earnings by e_i^S and family wealth by v_i. The social assistance benefits for which a worker would be eligible when unemployed has the following form:

$$B_{SA_i} = \max[0, S_i^* - a_i - e_i^{S*} - v_i^*]$$

where S_i^* is 80% of the maximum unemployment benefit if the family has children, and 60% if it does not, $e_i^{S*} = \max(0, e_i^S - S_i^*)$ and $v_i^* = \max(0, v_i - 10{,}000)$.[22]

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[21] A student can become a UI-fund member, even though ineligible for benefits while a student. Upon leaving full-time student status - having completed an education further than high school - the individual can then begin receiving unemployment benefits while looking for her first post-school job.

[22] In the empirical section below, we only include spousal income and wealth. Asset income will for houseowners tend to be negative due to interest paid on mortgage loans. However, since we do

VI. The Determinants of UI Fund Membership: Logit Estimates

In the next several sections, we undertake multivariate analyses of individual data in order to develop more precise estimates of the relationship between UI-fund membership and unemployment risk and the two potential benefits (UI-fund and social assistance). In Table 1, we define the variables used in the analysis, and in Table 2 we report their means and standard deviations.

<table 1>

<table 2>

We begin with a standard logit model of membership in a UI-fund:

$$F(x) = \frac{1}{1+e^{-(\beta_0+\beta_1 x)}},$$

where $F(x)$ denotes the cumulative distribution, x a vector of factors likely to influence UI-fund membership, and β_0 and β_1 the corresponding constant and coefficient vector. A convenient feature of the logit model is that the change in membership associated with variation in a covariate can be calculated as:

$$\frac{dF(x)}{dx} = F(x)[1 - F(x)]\beta_1.$$

Clearly the incremental change varies with the likelihood of UI-fund membership at x. We will generally evaluate the incremental change in UI membership associated with a change in a covariate at the mean membership level.

A number of potential covariates emerge from the UI-fund membership choice function derived above, including likelihood of unemployment, expected benefits from membership, and expected SA benefits if not covered. A variety of controls also come to mind, especially ones that might capture the individual's risk preference, including age, sex, marital status, presence of children, and wealth position.[23] We also allow for industry and

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not have the corresponding value of housing assets, we exclude asset income in the simulations of social assistance to avoid overstating who could potentially receive social assistance.

[23] See Harrison, Lau, and Rutstrom (2007) for experimental evidence on risk attitude among the Danes.

occupation dummies, because of the historical link between unemployment insurance and trade unions.

The logit level results are reported in Table 3. In Columns (1) and (2) we present the coefficients and robust standard errors respectively of a UI-fund membership model for 1995, excluding and including industry and occupation respectively. We are especially interested in three variables--the unemployment risk measure (U-YR) and two key "price" variables, potential unemployment benefits and potential social assistance benefits (if unemployed and not a UI-fund member). All three coefficients are of the expected sign and highly significant. Those with higher unemployment risk and higher unemployment benefit level are, ceteris paribus, more likely to be UI-fund members, while those with higher potential social assistance benefit are less, much as theory predicts. These results are robust to the introduction of industry and occupation controls.

<table 3>

The unemployment coefficients of 2.723 (Column 1) and 3.244 (Column 2) imply a 0.41 to 0.49 percentage point increase respectively in UI-fund membership for each percentage point increase in unemployment risk. Similar computations for UI-fund benefit levels suggest an increase of 4 percentage points for each additional 10,000 DKK in annual benefits, and a 1 percentage point *decrease* for each additional 10,000 DKK in social assistance. The large difference in absolute magnitudes of the two benefit effects—the coefficient on UI-fund benefits is 0.243, that on social assistance is -0.051 (Column 2)—is not predicted by the theory, which implies that the *differential* between the two should drive behavior, that is, that the two effects should be equal in absolute magnitude, but of opposite sign. The welfare stigma of social assistance may explain this difference. Alternatively it may be that social assistance benefits are measured with greater error; social workers have considerable discretion in the Danish system. In any case the broad conclusion is that the workers in our sample seem sensibly strategic in their UI-fund membership behavior.

We also obtain estimates for a wide range of controls, many of which can be interpreted as adjustments for unobserved heterogeneity in risk preferences. Controlling for

the price incentives to join a fund, those with higher wage income are less likely to join, suggesting reduced risk aversion with income, as are those with more wealth, although the wealth effect is small. The age splines suggest that there are systematic (positive) age effects through age 25, about 5 percentage points per year. Age effects disappear at that point (more precisely they decline modestly after age 25). Controlling for other factors, females, married workers, and those with children join funds disproportionately, which is broadly consistent with risk aversion expectations. The estimates suggest that females have a 10 percentage point greater propensity to be UI-fund members, ceteris paribus. Ceteris paribus, the highly educated are more likely to join than those at the lowest level of education attainment.[24] Those with only 12 years of formal schooling (ED4) are less likely to be members, those "skilled by vocational training" (ED5) more likely.

Since unemployment insurance historically has been linked to the unions, there may be considerable variation across industries and occupational status in who decides to join a UI-fund. We therefore allow for industry and occupation dummies in the UI-fund logit, which should capture differential union social pressures to join UI-funds, Table 3, Column 2. As already noted, the introduction of these covariates has only modest impact on other covariate estimates, but appears to have significant direct effects, with most industries having larger UI-fund membership representation than the base group, workers in agriculture. The positive differentials (relative to agriculture) in manufacturing, wholesale, and transportation are especially large.

There is an obvious endogeneity issue in the estimation of unemployment effects in a likelihood of UI-fund membership model. A long standing concern has been the possibility that UI coverage will increase the incidence of unemployment. That is not a problem for the two benefit measures, UI and SA, which are potential benefits drawn from administrative tables, but certainly can be for the unemployment measure (U-YR), the worker's own fraction-of-year unemployment experience. In Table 3, Columns 3 and 4, the models

[24] More detailed definitions of the education dummies are reported in Table 2A.

estimated in Columns 1 and 2 are reestimated using an estimated unemployment measure derived from the unemployment OLS regression reported in Appendix 2, Column 1. However, the identification of the expected effect would rely heavily on lagged unemployment experience, especially in the Column 4 model, which is clearly a concern. This concern led us to estimate conditional logit models that avoid the endogeneity problem in our application. See the next section. For all two-step models, we computed standard errors by bootstrapped standard errors with 400 replications.

Replacing the raw U-YR variable with expected U-YR has only modest effects on logit estimates. The estimated unemployment effects on membership is larger, but all other estimates are quite stable when expected unemployment is substituted into the estimation model; Column 4 versus Column 2. Using the estimated unemployment value the coefficient implies an increase of 0.87 percentage points for each one percent increase in unemployment expectation. That the estimated coefficient of U-YR is lower than the coefficient of expected U-YR is likely because many individuals with no realized unemployment will still have an expected positive unemployment risk, which they react to in their demand for unemployment insurance.

VII. UI-fund Membership Determinants: Chamberlain's Conditional Logit Model

It is unlikely that we have included all the individual factors that systematically determine either unemployment risk or UI-fund membership, which raises concerns about unobserved heterogeneity. In particular, the worker's attitudes towards risk and taste for work are only crudely proxied in our study. Moreover, the degree of risk aversion might influence not just the insurance decision, but also the unemployment risk measure, because risk averse individuals might partially "insure" themselves by their choices of education and occupation. Thus, we want to factor out individual specific fixed effects in the insurance decision estimations.

Chamberlain's conditional logit model is a natural estimating structure, Chamberlain (1980,1984), eliminating as it does unobserved heterogeneity (fixed) effects.[25] The model requires that the sample be limited to status changers only. In this case it is easily proven that the probability of joining a UI-fund if one does not currently belong, say (0,1), is in a sample of status changers:

$$Prob[(0,1)|(0,1)or\ (1,0)] = \frac{Prob(0,1)}{Prob(0,1) + Prob(1,0)} = \frac{1}{1 + e^{-\beta_1(x_1 - x_0)}}$$

The constant and any fixed effects disappear in this "first difference" form. As in the level logit:

$$\frac{dProb[(0,1)|(0,1)or\ (1,0)]}{dx} = G(x)[1 - G(x)]\beta_1,$$

with $G(x)$ the cumulative distribution function in the sample of UI status changers.

Using a sample of "status changers only" has an additional advantage of greatly reducing the moral hazard problem. As noted earlier, the worker must pay into the UI-fund for one year before becoming eligible for benefits. During the first year of membership, by design there is no search moral hazard problem (higher unemployment induced by unemployment insurance benefits) and therefore no endogeneity concern.[26]

The dependent variable in the conditional logit is a dummy equal to one if the individual moved from non-membership to membership in a UI-fund between November of 1994 and November of 1995 and zero if she moved from membership to non-membership. We report in Table 4 the estimates of Chamberlain's conditional logit model of UI-fund membership, which relies on changes in the covariates between 1994 and 1995. We are especially interested in three variables--the unemployment risk measure and two key "price" variables, potential unemployment benefits and potential social assistance benefits (if

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[25] Bjorklund (1985) provides an early application to unemployment models.

[26] This is precisely true of UI-fund joiners, who comprise 75 percent of the changers sample, Table 2, Panel B, but perhaps not UI-fund leavers. In the early 1990s as well as today funds were instructed to terminate UI fund membership after two months of nonpayment, although members have another month to restore membership with payment of a small penalty, (Bekendtgørelse No. 562 of July 5, 1993, Ch. 3-5, and Bekendtgørelse No. 723 of June 20, 2013, Ch. 5).

unemployed and not a UI-fund member). Estimates without and with industry and occupational change dummies are reported in Columns (1) and (2) respectively.

<table 4>

The key estimates are quite robust to the inclusion or exclusion of industry and occupation change dummies across both unemployment measures, and we will focus the discussion on Table 4, Column 2. As in the level regressions, all three coefficients are of the expected sign and highly significant. Those with positive changes in unemployment experiences or potential unemployment benefits have higher UI-fund membership rates, while those with positive changes in potential social assistance benefits have lower rates, much as theory predicts. The unemployment risk coefficient roughly implies a 0.26 percentage point increase in UI-fund membership for each percentage point increase in unemployment risk.[27] Though still strongly significant, that is only one half the magnitude of effect found in the level regressions (0.49). The two estimates of benefit effects are virtually identical to those in the level regressions. Every 10,000 DKK increase in annual unemployment benefits is associated with UI-fund membership increase of 3.6 percentage points and every 10,000 DKK increase in annual social assistance benefits associated with a 0.56 percentage point decrease. The stark difference in absolute magnitudes of the two benefit effects, noted in the UI fund levels logits, remains.

We also obtain estimates for a wide range of controls. Ceteris paribus, UI-fund membership increases consistently with age, with spline estimates suggesting that incremental demand for membership with age decreasing only modestly over the 18-34 age interval. Each year through age 25 is associated with an increase in membership of 0.21 percentage points (at the mean membership rate); each additional year through age 30 0.12 percentage points; and through 34, 0.14 percentage points. Marriage and the addition of children also increase membership, though the effects are generally not significant. Estimates of industry and occupation change coefficients suggest some independent effects,

[27] The mean of the dependent variable, percent of joiners, is 0.750.

although often not consistent with expectations from average level differences in membership across industries. A shift into the reasonably well covered manufacturing or transportation sectors, for example, apparently induces a significant reduction in membership among UI-fund changers. Of course the number entering or leaving a specific industry or occupation is much smaller than the total sample of 4035 UI-fund changers, so sample size becomes an issue.

VIII. Robustness Checks

In general the logit level estimates and the conditional logit estimates tell much the same story. In this section we report on several additional robustness checks we undertook in the course of the study. All pivot around alternative specifications of unemployment in the conditional logit model. First the UI-fund conditional logit (Table 4, Column (2), shown in Table 5 as Column 1 for comparison purposes) is reestimated with the change in raw fraction-of-year unemployed (U-YR) replaced by the change in *expected* fraction-of-year unemployed, Table 5, Column 2. The latter is derived from the OLS unemployment regression discussed in the levels section, Appendix 2, Column 1. We then consider the same model employing a second unemployment measure and its expectation, the familiar point-in-time unemployment status measure, a dummy equal to one if the worker is unemployed in week 48, zero otherwise(Table 5, Columns 3 and 4 respectively).[28] The underlying unemployment expectation model for the status variable is derived from the unemployment status OLS reported in the Appendix 2, Column 2.

<table 5>

Replacing the raw ΔU-YR variable with expected change ΔE(U-YR) has no substantial impact on coefficient signs, magnitudes, or significance of key variables--with the exception of the unemployment change variable itself, which again is larger, essentially doubling the estimated membership effect. The estimated effect increases from 1.370 using

[28] There are obvious a priori reasons for preferring the fraction-of-year measure over the point-in-time measure, in this case in the 48th week of the year.

the raw change measure (Table 5, Column 1) to 2.666 using the change in expected unemployment, (Table 5, Column 2). The basic interpretation of effect is unchanged.

The familiar point-in-time unemployment status dummy (U) has only modest impact on coefficient estimates, whether entered in raw form or as an expectation, Table 5, Columns 3 and 4 respectively, again with the notable exception of the unemployment measure itself. The unemployment effect on UI membership is now smaller in magnitude using the unemployment status variable, with a coefficient of 0.515 when using the raw measure (Column 3) and 1.443 if using the expected measure (Column 4). Because realized U is zero for the vast majority of the observations, moving to expected U which will take non-zero values for most, has a significant impact on the size of the estimated unemployment effect on insurance take-up. However, there is little question that the effect is large in magnitude. As earlier, the magnitudes of the two benefit effects are essentially unchanged.

IX. The Political Economy of Voluntary Unemployment Insurance

Why Denmark has remained committed to a voluntary system with a substantial insurance premium remains to be explained. Although total coverage is surprisingly high, the empirical evidence suggests significant incentive distortions in the current program. A partial answer may be found in the distribution of net revenue effects (aggregate fees collected less benefits paid out) across income groups of a hypothetical transition to a universal compulsory UI system. In this section we undertake a simple simulation using our 10 percent Danish sample that provides some insight into the redistribution implied by a shift to a compulsory UI system, both in aggregate and by earnings decile. [29]

In the simulations, we assume no behavioral responses to the voluntary/compulsory regime change, a perspective that we suspect drives the political economy of this issue. That said, some long run adjustments are plausible should mandatory UI-fund membership

[29] The revenue estimates are adjusted upward by a factor of ten because we are using a ten percent sample.

be imposed. The most obvious concern is the withdrawal of workers from the labor force if workers are compelled to purchase earnings insurance that they do not value at (private) cost, with a corresponding reduction in program premium payments. This is likely to be a serious issue among low-wage workers who do not take up UI-fund membership because of the charity hazard. Although high-wage nonmembers would suffer utility losses from the regime change, the labor force withdrawal effect is likely be small and the impact on labor force participation slight for this group.

Ignoring these labor force effects, the transition to a universal compulsory UI-fund system will generate considerably greater fee payments. The gain in revenue will be the fee (3660 DKK per year in 1995) times the number of (previously) uninsured workers. Based on the number of insured Danish workers in 1995, this will generate 1.644 billion DKK in new revenue for the UI funds, Table 6, Column 2. A quick glimpse at the distribution *by income deciles* of additional fee payments gives a clue to a political problem. The distribution across income deciles the increased fee payment U-shaped is the reflection of UI-fund membership rates by decile, reported in Figure 2B, with the greatest increases at the lowest and highest deciles. It is the low income deciles that would provide the bulk of the increased fee revenue, more than a third of all additional fee revenues collected, Table 6, Column 2.

<table 6>

Of course the expanded UI-fund membership would also induce greater benefit payouts ceteris paribus, 2.242 billion DKK, Table 6, Columns 3. Workers in the lowest deciles will receive the greatest share of the additional UI benefits paid out to the previously uninsured. The lowest decile alone accounts for 0.95 billion DKK in additional expected benefits, about 43 percent of the total benefit increases.

If the planner's concern is only the health of the UI-funds, the aggregate net expected revenues (fees less expected benefit payouts) from compelling the uninsured to join the UI-fund can be constructed as R*:

$$R^* = \sum_{i=1}^{N} R_i^* = \sum_{i=1}^{N} (f_i - \theta_i B_{U_i})$$

where *N* is the number of uninsured (nonparticipants in the voluntary UI-fund), and the system parameters have their usual meaning. The measure is tabulated for our sample, in total and by income deciles in Table 6, Column 4.

In the absence of a charity hazard, it is reasonable to conjecture that the impact of imposing a mandatory system on all workers would increase expected net revenues. Adverse selection arguments would suggest that low risk workers would rationally respond to a fixed fee by differentially choosing not to join. As it happens, the total benefits expected to be paid out to the previously uninsured (2.242 B DKK) will exceed the total fees collected (1.644 B DKK) so that the net effect of forcing the uninsured worker into the UI-funds will require an infusion of funds, 598 M DKK (107 million $US), Table 6, Column 4. The net revenue *loss* of about 600 million DKK out of a total expenditure of about 25 billion DKK (4.46 billion $US) is about 2.4 percent of the budget.

Indeed compulsory insurance will generate positive net revenues in the upper income deciles (7 through 10); adverse selection is apparently significant in these deciles. The income decile breakdowns, however, point to the charity hazard as the primary reason for the adverse financial consequences. Negative net revenues to the system for Deciles 1 through 6 suggest that workers in this group will receive on average greater benefits than they would pay in fees. Indeed half of the total net revenue losses from universal adoption of UI membership would arise in the lowest decile (362 M DKK of the 598 M DKK loss).

The story is however incomplete. Government expenditures on social assistance must be considered in any reasonable algorithm. With compulsory UI, social assistance expenditures must fall; unemployed workers in the UI-fund are ineligible for social assistance payouts. Indeed, for a large number of the unemployed—those with no other resources and many children--at this time, benefits under social assistance exceeded those in the unemployment fund, providing additional “savings” in the transition.

If the planner’s concern includes the finances of both the UI-fund and the social assistance budget, the key revenue calculation is instead R**:

$$R^{**} = \sum_{i=1}^{N} [f_i - \theta(B_{U_i} - B_{SA_i})]$$

The aggregate public savings in this case would be large, 3.140 B DKK, Table 6, Column 5. Most savings would come from workers in the low income deciles. Indeed 72 percent of the SA savings are in the lowest decile, 85 percent in the bottom two deciles. Total government nest savings to the two programs together are significant. Not only are the uninsured required to pay premiums, expected net UI-fund payments are less than those under SA for a large number of the uninsured. The net effect is an increase in government net revenues of 2.542 B DKK, Table 6, Column 6.

Of course net revenue gains to the government are the same as net benefit losses to the uninsured workers forced into the UI program. That the net benefit losses are sharply focused on the lowest income workers is a special problem. More than 70 percent of the net benefit losses generated by the transition to a universal compulsory system will be borne by uninsured workers in the lowest decile, an uncomfortable fact in a welfare state.

X. Conclusion

An oddity of the Danish welfare state is its voluntary unemployment insurance program, which operates in combination with a less generous, means-tested social assistance program. Although a handful of other countries operate such voluntary programs, none charges substantial premiums. The Danish program provides both an opportunity to observe the operation of a voluntary system and also insight into why the voluntary system lingers in Denmark.

As in a number of European unemployment insurance systems, the Danish voluntary program emerged as a Ghent system, essentially government-subsidies for existing union plans. The problems that potentially beset voluntary plans—notably worker optimism bias and difficulties with premium setting, leading to adverse selection—were moderated in this structure. Unions often required that members joined the plan; union-based financing provided a natural form of underwriting—those in volatile industries naturally paid higher premiums. As union membership struggled, however, most dropped the UI requirement, at

least formally, and government reforms eliminated union-based financing, essentially eliminating any form of underwriting. The latter aggravated adverse selection incentives. The existence of a "free," means-tested social assistance program added the possibility of a charity hazard.

The analysis focuses on 1995, immediately prior to a series of major workfare innovations. Coverage rates were surprisingly high.[30] From the perspective of federal flood insurance in the United States, the 80 percent take-up rate of public unemployment insurance in Denmark is extraordinary. The reasons for this high take-up rate are less clear. The large public subsidy can only be part of the answer, flood insurance in the U.S. has also been highly subsidized. Three obvious possibilities come to mind: (i) extreme risk aversion among those in secure jobs, (ii) worker solidarity, and/or (iii) the tied-in early retirement scheme (efterløn). Participation rate studies for other types of insurance with less obvious social implications may provide additional insight into this motivational question.

Despite the high coverage rate, selection effects were large. Strong, positive membership responses to unemployment risk are evident in both the level logits and the conditional logits. In what we view as our best estimate of unemployment risk effects (Table 4, Column 2), we find that UI-fund membership rates increased by 0.26 percentage points for each percentage point increase in the fraction of year spent in unemployment.[31] Also consistent with simple theory, fund membership probabilities were responsive to UI-fund benefits (positive) and SA benefits (negative); social assistance benefits discourage UI-fund membership.[32] These results were robust across a variety of specifications.

Charity hazard may partly resolve the political economy mystery of why Denmark has not imposed a compulsory system. In aggregate, government expenditures would be

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30 Coverage rates have since fallen, perhaps because new ALMP requirements reduced the value of UI benefits.

31 This estimate is also broadly consistent with the decline in UI-fund membership between 1995 and 2001 of about 1.5 percentage points in response to a decrease in the insured worker unemployment of 7 percentage points.

32 The simple proposition that the two benefit responses should have equal absolute effects but of opposite sign was not confirmed; the SA benefit effect was smaller in absolute magnitude.

sharply reduced by a transition to a compulsory system, both because the government would be collecting a fee from all participants and because benefits under UI are less than under social assistance for a number of the unemployed (those with a large number of children and no other family income). Of course, positive government revenue effects imply negative transfers to the previously uninsured, with 72 percent coming from the uninsured in the lowest gross income decile; 85 percent from those in the lowest two deciles. This is an awkward transition to make in a welfare state such as Denmark.

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Table 1

Variable Definitions

UI-fund	A zero-one dummy, with one indicating the worker was a member of an unemployment fund.
U-YR	The fraction of the calendar year that the worker is unemployed.
U	A zero-one dummy, with one indicating the worker was unemployed in week 48.
BEN UI	The projected annual unemployment fund benefits the worker would qualify for if unemployed for one year (in 10,000 DKK).
BEN SA	The projected annual social assistance benefits the worker would qualify for if unemployed and without unemployment benefits for the calendar year (in 10,000 DKK).
EARNINGS	Gross annual earnings (in 10,000 DKK)
WEALTH	Physical asset wealth (in 10,000 DKK).
FEMALE	A zero-one dummy, with one indicating the worker is female.
AGE18-25 SP	Age in years for those 18 to 25, 25 for all others.
AGE26-30 SP	Zero if age less than 26, one to five for those age 26 to 30, five for all others.
AGE31-35 SP	Zero if age less than 31, one to five for those age 31 to 35, five for all others.
MARRIED	A zero-one dummy, with one indicating the worker is married.
CHILD0	A zero-one dummy, with one indicating the worker has no children living in the household.
CHILD1-3	A zero-one dummy, with one indicating the worker has one to three children living in the household.
CHILD4+	A zero-one dummy, with one indicating the worker has four or more children living in the household.
ED2	A zero-one dummy, with one indicating the worker's highest grade completed was 9 or primary education.
ED3	A zero-one dummy, with one indicating the worker's highest grade completed was 10 or 11 with very short vocational training.
ED4	A zero-one dummy, with one indicating the worker's highest grade completed was "gymnasium," (12 years).
ED5	A zero-one dummy, with one indicating the worker's highest grade completed was "skilled by vocational training."
ED6	A zero-one dummy, with one indicating the worker's highest grade completed was short term tertiary education.
ED7	A zero-one dummy, with one indicating the worker's highest grade completed was medium-term tertiary education.
ED8	A zero-one dummy, with one indicating the worker's highest grade completed was long-term tertiary education.

UNSK	A zero-one dummy, with one indication the worker's occupation is unskilled worker in week 48.
SKLD	A zero-one dummy, with one indication the worker's occupation is skilled worker in week 48.
CLER	A zero-one dummy, with one indication the worker's occupation is clerical in week 48.
MNGR	A zero-one dummy, with one indication the worker's occupation is manager in week 48.
DIR	A zero-one dummy, with one indication the worker's occupation is director in week 48.
OTHER	A zero-one dummy, with one indication the worker's occupation belongs to the residual group outside the main sample selection in 1995, i.e. she is either self-employed, on leave or pension, a student or out of the labor force in week 48 in 1993 or in 1994.
AGRIC	A zero-one dummy, with one indicating the worker's industry of employment is agriculture in week 48.
MANUF	A zero-one dummy, with one indicating the worker's industry of employment is manufacturing in week 48.
CONST	A zero-one dummy, with one indicating the worker's industry of employment is construction in week 48.
WHOLE	A zero-one dummy, with one indicating the worker's industry of employment is wholesale in week 48.
RETAIL	A zero-one dummy, with one indicating the worker's industry of employment is retail in week 48.
CATERING	A zero-one dummy, with one indicating the worker's industry of employment is catering in week 48.
TRANS	A zero-one dummy, with one indicating the worker's industry of employment is transport in week 48.
FINANCE	A zero-one dummy, with one indicating the worker's industry of employment is finance in week 48.
SERV-LOW	A zero-one dummy, with one indicating the worker's industry of employment is low skilled service in week 48.
SERV-HG	A zero-one dummy, with one indicating the worker's industry of employment is high skilled service in week 48.
PUBLIC	A zero-one dummy, with one indicating the worker's industry of employment is public sector in week 48.
UF/SA	A zero-one dummy, with one indicting receipt of either unemployment benefits or social assistance or both in the calendar year.

Table 2
Summary Statistics

Panel A: UI-fund Level Regressions, Workers Ages 18 to 34, 1995

Variable	Mean	Std. Dev.		Variable	Mean	Std. Dev.
UI-FUND	0.814	0.389		AGRIC 94		
U-YR	0.094	0.178		MANUF 94	0.238	0.426
U	0.084	0.167		CONST 94	0.077	0.267
BEN UI (10,000 DKK)	11.77	3.214		WHOLE 94	0.071	0.257
BEN SA (10,000 DKK)	4.174	4.145		RETAIL 94	0.074	0.262
EARNINGS (10,000 DKK)	17.94	9.350		CATERING 94	0.025	0.157
EARNINGS SQ (10,000 DKK)	409.35	512		TRANS 94	0.068	0.251
WEALTH (10,000 DKK)	-0.591	28.705		FINANCE 94	0.031	0.174
FEMALE	0.417	0.493		SERV-LOW 94	0.073	0.260
AGE18-25 SP	24.059	1.839		SERV-HG	0.041	0.198
AGE26-30 SP	2.686	2.196		PUBLIC	0.241	0.427
AGE31-35 SP	0.764	1.300		UNSK 94	0.390	
MARRIED	0.276	0.447		SKLD 94	0.174	0.174
CHILD0	0.621			CLER 94	0.285	0.285
CHILD1-3	0.375	0.484		MNGR 94	0.146	0.146
CHILD4+	0.004	0.062		DIR 94	0.001	0.001
ED2	0.151	0.358		OTHER 94	0.004	0.004
ED3	0.172	0.377				
ED4	0.053	0.225				
ED5	0.472	0.499				
ED6	0.049	0.216				
ED7	0.065	0.246				
ED8	0.039	0.193				
NO. OF OBSERVATIONS	86,080					

Source: Statistics Denmark. Note: All variables refer to 1995 unless otherwise noted.

Panel B: Summary Statistics, UI-fund Conditional Logit Model
Respondents Age 18 to 34, 1994 and 1995 [a]

	Means	Standard Deviations
ΔUI FUND	0.750	0.433
ΔU-YR	-0.035	0.222
ΔU-YR HAT	-0.030	0.117
ΔU	-0.032	0.372
ΔUHAT	-0.020	0.195
ΔBEN UI	1.727	3.832
ΔBEN SA	-0.424	3.631
ΔEARNINGS	2.975	5.727
ΔWEALTH	-0.743	8.939
ΔAGE18-25 SP	0.602	0.490
ΔAGE26-30 SP	0.249	0.432
ΔAGE31-35 SP	0.150	0.357
ΔMARRIED	0.022	0.187
ΔCHILD1-3	0.010	0.271
ΔCHILD4+	0.000	0.000
ΔMANUF	0.032	0.313
ΔWHOLE	0.011	0.168
ΔCONST	0.014	0.176
ΔRETAIL	0.009	0.255
ΔCATERING	0.002	0.184
ΔTRANS 94	0.012	0.185
ΔFINANCE	0.001	0.061
ΔSERV-LOW	0.009	0.220
ΔSERV-HIGH	0.008	0.145
ΔPUBLIC	0.017	0.385
ΔSKLD	0.006	0.168
ΔCLER	0.037	0.314
ΔMNGR	0.012	0.151
ΔDIR	0.000	0.000
ΔOTHER	-0.113	0.316

Source: Statistics Denmark. Sample size: 4035. The variables in the conditional logit model are all the difference between the 1994 and the 1995 value of the given variable, except for the dependent variable that takes the value 0 if the individual leave a U-fund and 1 of an individual enters a u-fund between 1994 and 1995 (all other individuals are excluded from the conditional logit model).

Table 3
Logit Estimates of Unemployment Fund Membership *Levels* (UI-fund)
Alternative Unemployment Measures, Respondents Age 18 to 34, 1995[a,b]

	(1)	(2)	(3)	(4)
UNEMP MEASURE	UYR	UYR	EXPECTED U-YR	EXPECTED U-YR
UNEMP	2.723***	3.244***	3.725***	5.767***
	(0.109)	(0.117)	(0.157)	(0.201)
BEN UI	0.262***	0.243***	0.251***	0.212***
	(0.013)	(0.013)	(0.008)	(0.008)
BEN SA	-0.050***	-0.051***	-0.052***	-0.055***
	(0.003)	(0.003)	(0.003)	(0.003)
EARNINGS	0.007	0.006	0.036***	0.082***
	(0.015)	(0.015)	(0.007)	(0.009)
EARNINGS SQ	-0.001**	-0.001**	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
WEALTH	-0.002**	-0.001**	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
FEMALE	0.636***	0.666***	0.700***	0.776***
	(0.029)	(0.032)	(0.027)	(0.029)
AGE18-25 SP	0.350***	0.361***	0.308***	0.276***
	(0.009)	(0.010)	(0.010)	(0.010)
AGE26-30 SP	-0.064***	-0.065***	-0.064***	-0.063***
	(0.010)	(0.010)	(0.010)	(0.010)
AGE31-35 SP	-0.016	-0.022*	-0.024*	-0.038***
	(0.013)	(0.013)	(0.013)	(0.013)
MARRIED	0.356***	0.356***	0.366***	0.381***
	(0.040)	(0.040)	(0.037)	(0.037)
CHILD1-3	0.222***	0.198***	0.231***	0.220***
	(0.037)	(0.038)	(0.038)	(0.038)
CHILD4+	-0.069	-0.057	-0.015	0.049
	(0.188)	(0.192)	(0.193)	(0.197)
EDU3	-0.097***	-0.120***	-0.080**	-0.088**
	(0.036)	(0.037)	(0.035)	(0.036)
EDU4	-0.666***	-0.668***	-0.659***	-0.677***
	(0.050)	(0.052)	(0.050)	(0.053)
EDU5	0.748***	0.678***	0.764***	0.685***
	(0.035)	(0.038)	(0.035)	(0.037)
EDU6	0.196***	-0.054	0.208***	-0.045
	(0.066)	(0.074)	(0.065)	(0.072)
EDU7	0.394***	0.193***	0.373***	0.155**
	(0.063)	(0.072)	(0.062)	(0.071)
EDU8	0.383***	0.310***	0.264***	0.105
	(0.073)	(0.081)	(0.074)	(0.083)

MANUF 94		1.329***		1.618***
		(0.056)		(0.057)
WHOLE 94		0.826***		1.088***
		(0.064)		(0.064)
CONST 94		0.568***		0.832***
		(0.069)		(0.073)
RETAIL 94		0.276***		0.629***
		(0.067)		(0.071)
CATERING 94		0.047		0.311***
		(0.083)		(0.085)
TRANS 94		0.699***		0.999***
		(0.069)		(0.071)
FINANCE 94		-0.175**		0.048
		(0.084)		(0.081)
SERV-LOW 94		0.323***		0.619***
		(0.064)		(0.071)
SERV-HIGH 94		0.453***		0.758***
		(0.078)		(0.081)
PUBLIC 94		0.552***		0.909***
		(0.057)		(0.062)
SKLD 94		0.088**		0.118***
		(0.035)		(0.032)
CLER 94		0.640***		0.679***
		(0.037)		(0.038)
MNGR 94		0.541***		0.487***
		(0.053)		(0.052)
DIR 94		-0.448		-0.813*
		(0.488)		(0.470)
OTHER 94		-1.100***		-1.752***
		(0.170)		(0.162)
CONSTANT	-10.113***	-11.009***	-9.565***	-10.277***
	(0.193)	(0.208)	(0.196)	(0.203)
Adjusted R2	0.298	0.321	0.291	0.318
Number of observations	68,080	68,080	68,080	68,080

[a] The dependent variable is one if member of UI fund in 1995, and zero otherwise. Robust standard errors in parentheses in Columns 1 and 2; Bootstrapped standard errors (400 replications) in parentheses in Columns 3 and 4.

[b] Unemployment expectation function used to create expected unemployment measure in Columns 3 and 4 is reported in Appendix Table 2.

Table 4
Conditional Logit Estimates of Unemployment Fund Membership (UI-fund)
Respondents Age 18 to 34, 1994 and 1995[a]

	(1)	(2)
UNEMP MEASURE	U-YR	U-YR
ΔUNEMP	1.364***	1.370***
	(0.234)	(0.239)
ΔBEN UI	0.195***	0.193***
	(0.020)	(0.020)
ΔBEN SA	-0.029***	-0.030***
	(0.011)	(0.011)
ΔEARNINGS	0.023**	0.028**
	(0.011)	(0.011)
ΔWEALTH	0.003	0.003
	(0.004)	(0.004)
ΔAGE18-25 SP	1.069***	1.127***
	(0.057)	(0.059)
ΔAGE26-30 SP	0.611***	0.649***
	(0.074)	(0.078)
ΔAGE31-35 SP	0.697***	0.733***
	(0.096)	(0.098)
ΔMARRIED	0.259	0.248
	(0.208)	(0.214)
ΔCHILD1-3	0.228	0.235
	(0.141)	(0.146)
ΔCHILD4+	(dropped)	(dropped)
ΔMANUF		-0.424***
		(0.165)
ΔWHOLE		-0.024
		(0.257)
ΔCONST		-0.139
		(0.242)
ΔRETAIL		0.418**
		(0.194)
ΔCATERING		0.630**
		(0.297)
ΔTRANS 94		-0.408*
		(0.212)
ΔFINANCE		-0.302
		(0.607)
ΔSERV-LOW		0.305
		(0.200)
ΔSERV-HIGH		0.250

		(0.278)
ΔPUBLIC		0.141
		(0.136)
ΔSKLD		-0.595**
		(0.273)
ΔCLER		-0.465***
		(0.144)
ΔMNGR		-0.537**
		(0.255)
ΔDIR		(dropped)
ΔOTHER		0.034
		(0.166)
Log-Likelihood	-2019.5457	-1991.4808
Observations	4,035	4,035

*** p<0.01, ** p<0.05, * p<0.1

[a] The dependent variable is one if join UI fund in 1995, and zero if leave fund in that year. Robust standard errors in parentheses.

Table 5

Conditional Logit Estimates of Unemployment Fund Membership (ΔUI-fund)
Alternative Unemployment Measures, Respondents Age 18 to 34, 1994 and 1995[a]

	(1)	(2)	(3)	(4)
UNEMP MEASURE	U-YR	EXPECTED U-YR[b]	U	EXPECTED U[b]
ΔUNEMP	1.370***	2.666***	0.515***	1.443***
	(0.239)	(0.476)	(0.141)	(0.262)
ΔBEN UI	0.193***	0.210***	0.221***	0.222***
	(0.020)	(0.021)	(0.019)	(0.020)
ΔBEN SSA	-0.030***	-0.029**	-0.030***	-0.029**
	(0.011)	(0.012)	(0.011)	(0.012)
ΔEARNINGS	0.028**	0.026**	0.004	0.012
	(0.011)	(0.011)	(0.010)	(0.010)
ΔWEALTH	0.003	0.003	0.003	0.004
	(0.004)	(0.004)	(0.004)	(0.004)
ΔAGE18-25 SP	1.127***	1.110***	1.119***	1.099***
	(0.059)	(0.060)	(0.058)	(0.060)
ΔAGE26-30 SP	0.649***	0.715***	0.645***	0.682***
	(0.078)	(0.079)	(0.078)	(0.079)
ΔAGE31-35 SP	0.733***	0.763***	0.737***	0.745***
	(0.098)	(0.100)	(0.098)	(0.100)
ΔMARRIED	0.248	0.248	0.250	0.256
	(0.214)	(0.217)	(0.210)	(0.219)
ΔCHILD1-3	0.235	0.234	0.211	0.239*
	(0.146)	(0.145)	(0.146)	(0.144)
ΔCHILD4+	(dropped)	(dropped)	(dropped)	(dropped)
ΔMANUF	-0.424***	-0.176	-0.695***	-0.787***
	(0.165)	(0.174)	(0.170)	(0.170)
ΔWHOLE	-0.024	0.285	-0.244	-0.326
	(0.257)	(0.290)	(0.263)	(0.278)
ΔCONST	-0.139	0.047	-0.428*	-0.560**
	(0.242)	(0.245)	(0.242)	(0.247)
ΔRETAIL	0.418**	0.669***	0.145	0.056
	(0.194)	(0.206)	(0.193)	(0.204)
ΔCATERING	0.630**	0.860***	0.360	0.271
	(0.297)	(0.313)	(0.290)	(0.310)
ΔTRANS 94	-0.408*	-0.173	-0.675***	-0.789***
	(0.212)	(0.231)	(0.217)	(0.221)
ΔFINANCE	-0.302	-0.165	-0.591	-0.739
	(0.607)	(0.787)	(0.650)	(0.773)
ΔSERV-LOW	0.305	0.501**	0.029	-0.083
	(0.200)	(0.219)	(0.205)	(0.223)

ΔSERV-HIGH	0.250	0.481	0.001	-0.112
	(0.278)	(0.306)	(0.284)	(0.299)
ΔPUBLIC	0.141	0.380***	-0.090	-0.199
	(0.136)	(0.147)	(0.143)	(0.142)
ΔSKLD	-0.595**	-0.492*	-0.606**	-0.581**
	(0.273)	(0.275)	(0.269)	(0.275)
ΔCLER	-0.465***	-0.422***	-0.481***	-0.479***
	(0.144)	(0.144)	(0.144)	(0.145)
ΔMNGR	-0.537**	-0.450*	-0.507**	-0.522**
	(0.255)	(0.261)	(0.257)	(0.257)
ΔDIR	(dropped)	(dropped)	(dropped)	(dropped)
ΔOTHER	0.034	0.340**	-0.151	-0.182
	(0.166)	(0.170)	(0.171)	(0.163)
OBERVATIONS	4,035	4,035	4,035	4,035
Log likelihood	-1991.4808	-1996.0614	-2004.6424	-1996.1846

*** p<0.01, ** p<0.05, * p<0.1

[a] The dependent variable is one if join UI fund in 1995, and zero if leave fund in that year. Robust standard errors are reported in parentheses in Columns 1 and 3, Bootstrapped standard errors in Columns 2 and 4.

[b] Estimating function for unemployment measures are reported in Appendix Table 2, Column 1.

Table 6

Net Expected Public Revenues Gains (Expected Benefits less Fees)
From Compulsory UI, in Total and by Gross Income Deciles
Denmark 1995 (In Mill. DKK)

Income Decile	Uninsured (10% Sample) *Number*	Added UI Fees	Added UI Benefits	Net Revenues R*	SA Savings	UI-fund/ SA Savings R**
	(1)	(2)	(3)	(4)	(5)	(6)
ALL	44,905	1644	2242	- 598	3140	2542
1	16054	588	950	- 362	2272	1910
2	5437	199	415	- 216	412	196
3	3447	126	239	- 113	160	47
4	2358	86	143	-57	81	24
5	1927	71	101	-30	56	26
6	1782	65	75	-10	35	25
7	1980	72	66	6	32	38
8	3877	142	105	37	29	66
9	3213	118	66	52	28	80
10	4830	177	82	95	33	128

Note: (5.6 DKK= $1 US in 1995). The raw numbers in the 10% sample are reported in Column 1, while the cost estimates have been expanded by a factor of ten to reflect population values. The alternative models are defined more completely in the text.

Figure 1

UI-FUND MEMBERSHIP RATE OF LABOR FORCE PARTICIPANTS AND UNEMPLOYMENT RATES, DENMARK 1987-2001

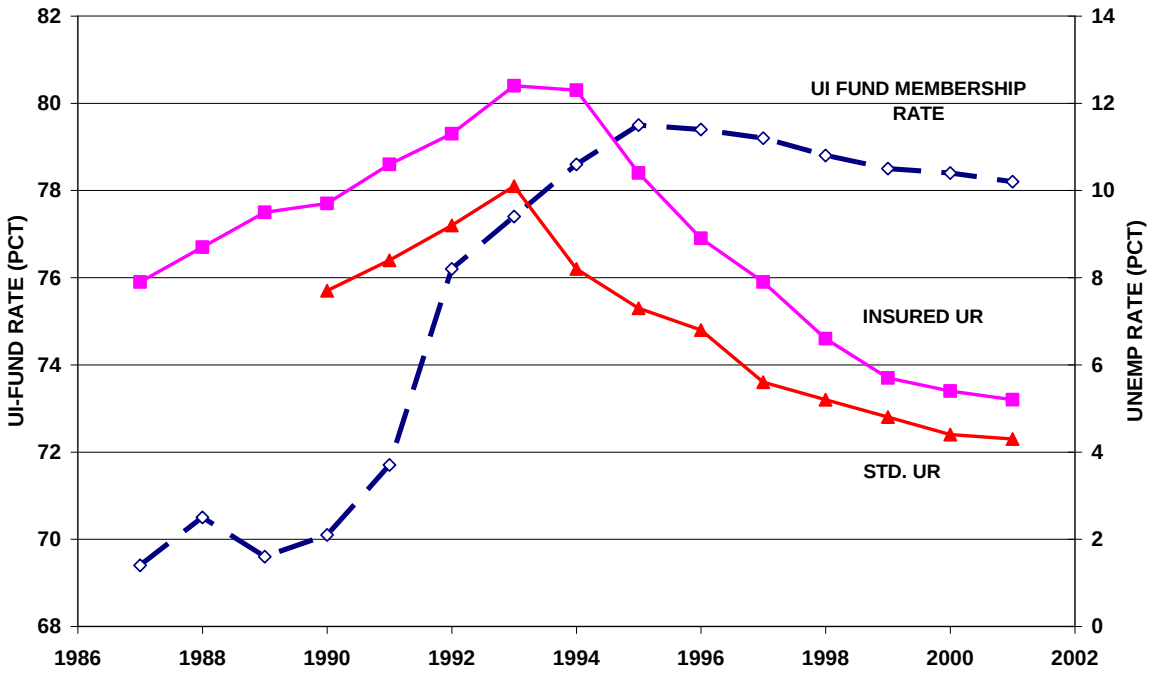
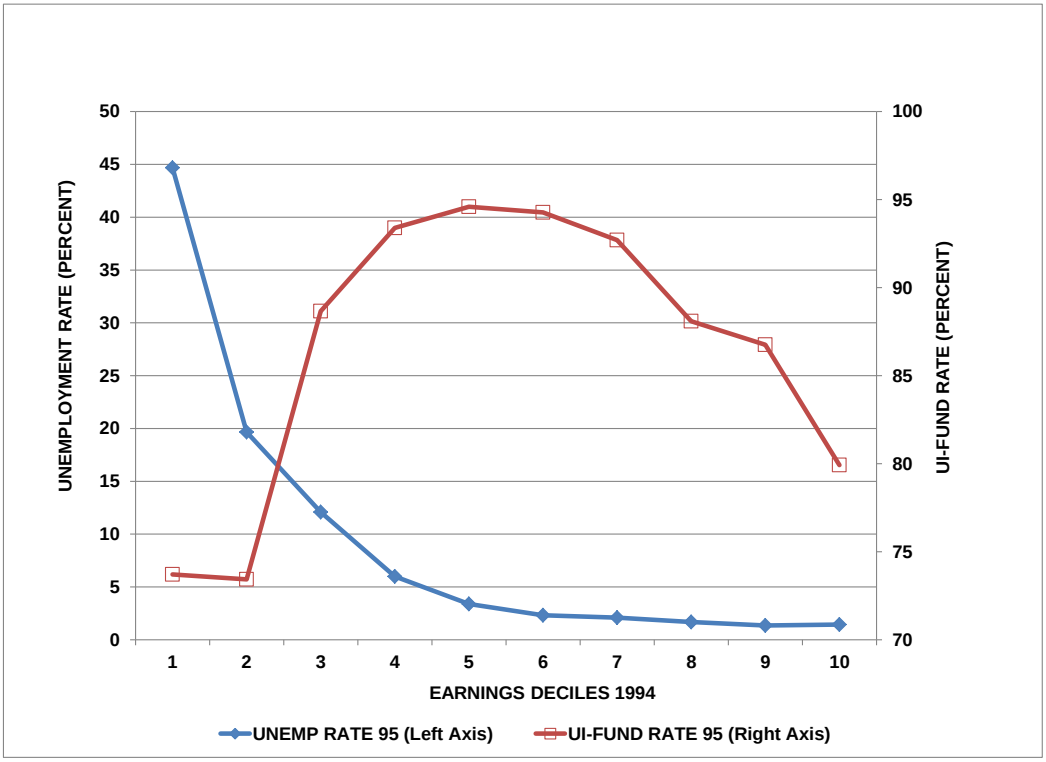


Figure 2

Unemployment Rate and UI-Fund Membership Rate 1995
By Income Deciles 1994 and Age 1995 Denmark

Panel A Income Deciles



Panel B: Age

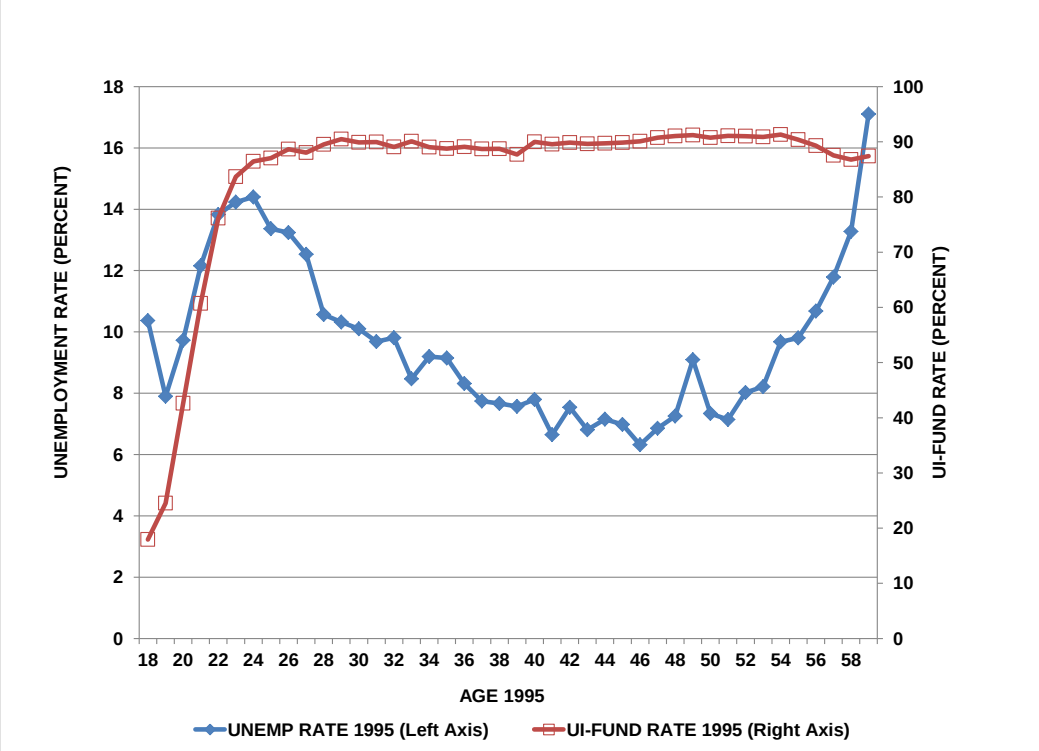
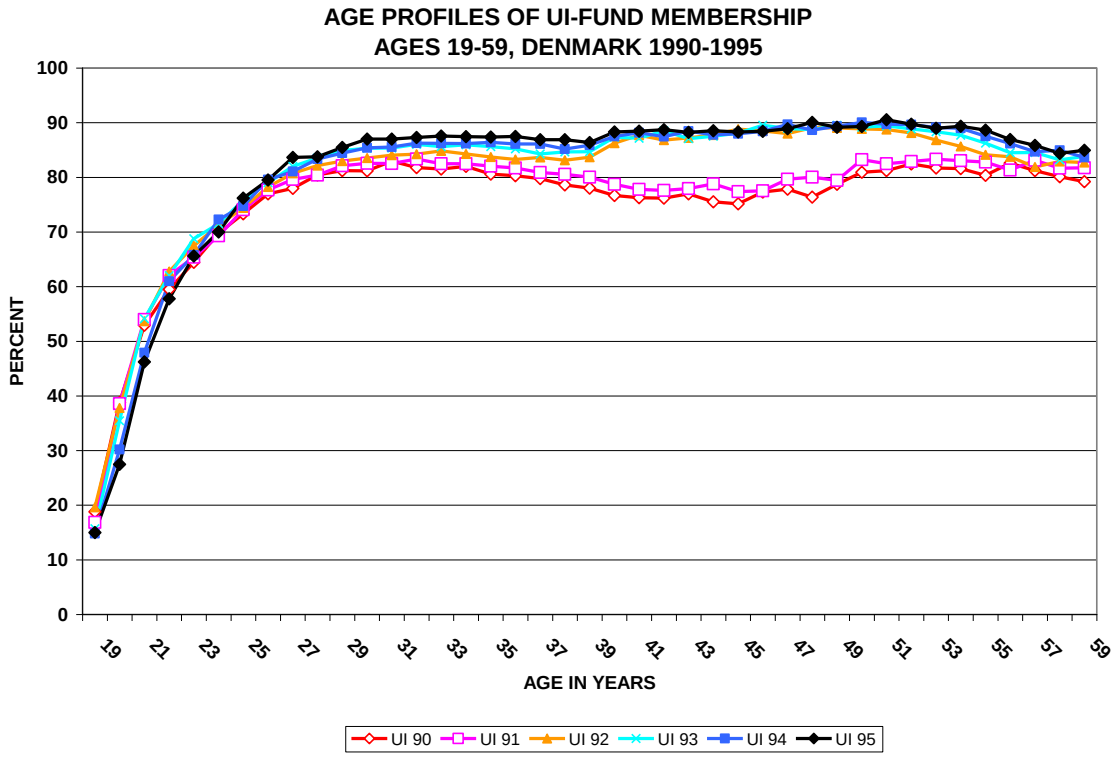


Figure 3


AGE PROFILES OF UI-FUND MEMBERSHIP
AGES 19-59, DENMARK 1990-1995
PERCENT
100
90
80
70
60
50
40
30
20
10
0
19
21
23
25
27
29
31
33
35
37
39
41
43
45
47
49
51
53
55
57
59
AGE IN YEARS
UI 90
UI 91
UI 92
UI 93
UI 94
UI 95

APPENDIX 1

THE DECISION TO BELONG TO A UI FUND[33]

An important dimension of the Danish system is its voluntarism--the worker can contribute to a UI-fund and expect to receive more generous benefits if unemployed. UI-fund membership is a modestly asymmetric decision because of a feature designed to avoid adverse selection--benefit eligibility comes only after a full year of membership in the fund. The loss of benefit eligibility following nonpayment of membership fees comes in less than a year, but not immediately, for obvious administrative reasons. A simple multiperiod expected utility model illustrates the entry and exit decision processes.

The Model

A. The Decision to Join a UI-fund

An "'uncovered," expected utility maximizing worker with an infinite horizon is employed in the initial period ($i = 0$), and considers joining a UI fund in that period. All economic conditions are stable (constant) over time, including the probability of job displacement in any period, and the resulting job loss is permanent. Coverage under the UI fund becomes effective in the period (year) following the payment of the first premiums ($i = 1$). In the absence of UI-fund coverage, the displaced worker is eligible for social assistance benefits, which are generally less than UI-fund benefits.

The worker's intra-period utility function is assumed to be additively separable in consumption and leisure:

$$U = u(C) + v(L)$$

with the consumption (C) utility element an increasing, strongly concave function and the leisure (L) utility function increasing and weakly concave. Leisure is fixed for the employed $(\bar{L})$ and unemployed $(\bar{\bar{L}})$, with $\bar{L} < \bar{\bar{L}}$. The worker can, through the UI-fund, reallocate

[33] See Multiperiod Decision Model v2 for more detailed derivations, and additional material

resources across states, but can neither borrow nor lend across time, and will therefore consume all current income net of insurance premiums as it accrues.

Notation

e earnings per period if employed
f the UI-fund premium per period, $0 < f < e$
θ the likelihood of job displacement in any period, $0 < \theta < 1$
b the (subjective) time rate of discount, $0 < b < 1$
β the time discount factor $\beta = \frac{1}{1+b}$ or $b = \frac{1-\beta}{\beta}$.
B_U UI fund benefits if unemployed
B_{SA} Social assistance benefits if unemployed

What is the joining decision rule and how does it vary with economic conditions?

If the worker joins the UI-fund, expected utility is:

$$EU(JOIN) = [u(e-f) + v(\bar{L})][1 + \sum_{i=1}^{\infty} \beta^i (1-\theta)^i]$$

$$+[u(B_U) + v(\bar{\bar{L}})] \sum_{i=1}^{\infty} \{\beta^i (1-\theta)^{i-1} \theta \sum_{j=i}^{\infty} \beta^{j-i}\}$$

If the worker does not join

$$EU(NOT\ JOIN) = [u(e) - v(\bar{L})][1 + \sum_{i=1}^{\infty} \beta^i (1-\theta)^i]$$

$$+[u(B_{SA}) - v(\bar{\bar{L}})] \sum_{i=1}^{\infty} \{\beta^i (1-\theta)^{i-1} \theta \sum_{j=i}^{\infty} \beta^{j-i}\}$$

Decision Rule: Join if:

$$\Delta_U = EU(JOIN) - EU(NOT\ JOIN) \geq 0$$

or

$$\Delta_U = [u(e-f) - u(e)][1 + \sum_{i=1}^{N} \beta^i (1-\theta)^i]$$

$$+[u(B_U) - u(B_{SA})] \sum_{i=1}^{N} \{\beta^i (1-\theta)^{i-1} \theta \sum_{j=i}^{N} \beta^{j-i}\} \geq 0$$

The infinite horizon assumption permits simplification of this decision rule:

$$\sum_{i=1}^{\infty} \beta^i (1-\theta)^i = \frac{\beta(1-\theta)}{1-\beta(1-\theta)} = \frac{\frac{1}{1+b}(1-\theta)}{1-\frac{1}{1+b}(1-\theta)} = \frac{(1-\theta)}{1+b-(1-\theta)}$$

$$= \frac{1-\theta}{b+\theta}$$

$\sum_{j=i}^{\infty} \beta^{j-i} = 1 + \frac{1}{b} = \frac{1+b}{b}$, with $0 < b < 1$.

Therefore

$$\Delta_U = [u(e-f) - u(e)]$$
$$+ \frac{1-\theta}{b+\theta}\{u(e-f) - u(e) + \frac{\theta}{1-\theta}\frac{1+b}{b}[u(B_U) - u(B_{SA})]\}$$
$$= [\frac{1+b}{b+\theta}][u(e-f) - u(e)]$$
$$+ \frac{\theta}{b+\theta}\frac{1+b}{b}[u(B_U) - u(B_{SA})]$$

Comparative Statics

$$\frac{d\Delta_U}{df} = -[\frac{1+b}{b+\theta}]u'(e-f) < 0 \quad \text{(A1)}$$

$$\frac{d\Delta_U}{de} = [\frac{1+b}{b+\theta}][u'(e-f) - u'(e)] > 0, \quad \text{(A2)}$$

$$\frac{d\Delta_U}{dB_U} = [\frac{\theta}{b+\theta}\frac{1+b}{b}]u'(B_U) > 0 \quad \text{(A3)}$$

$$\frac{d\Delta_U}{dB_{SA}} = -[\frac{\theta}{b+\theta}\frac{1+b}{b}]u'(B_{SA}) < 0 \quad \text{(A4)}$$

As for the layoff probability,

$$\frac{d\Delta_U}{d\theta} = \left[-\frac{1+b}{(b+\theta)^2}\right][u(e-f) - u(e)]$$
$$+ [\frac{1}{b+\theta} - \frac{\theta}{(b+\theta)^2}]\frac{1+b}{b}[u(B_U) - u(B_{SA})]$$

$$= -\left[\frac{1+b}{(b+\theta)^2}\right][u(e-f)-u(e)]$$

$$+\left[\frac{1+b}{(b+\theta)^2}\right][u(B_U)-u(B_{SA})]>0. \quad \text{(A5)}$$

An increase in the displacement rate increases the value of joining the fund both because the employment interval during which premiums are paid is reduced (recall $u(e-f)-u(e)<0$) and the unemployment interval during which extra benefits are received increases.

B. The Decision to Leave a UI-fund

Consider a worker who is currently a UI-fund member and eligible for benefits. Under constant conditions, we would not expect any change in behavior in the infinite life case; the worker decided it was appropriate to join a fund in some prior period, and he will continue in each period. Even if the worker realizes that there will be a drop in displacement rates in an upcoming period, the decline would have to be very large to justify dropping out of the program and then reapplying in the next, because the worker would face the standard one period delay in benefit eligibility. Essentially a current member gets coverage for two periods for a single payment in this scenario, because of the “restart” penalty.

APPENDIX 2

UNEMPLOYMENT REGRESSION MODEL ESTIMATES 1995[a]

	(1)	**(2)**
DEPENDENT VARIABLE:	**U-YR 95**	**U 95**
FEMALE	-0.026***	-0.026***
	(0.001)	(0.002)
AGE18-25 SP	0.016***	0.020***
	(0.000)	(0.001)
AGE26-30 SP	0.001***	-0.001*
	(0.000)	(0.001)
AGE31-35 SP	0.004***	0.005***
	(0.000)	(0.001)
MARRIED	-0.002	-0.003
	(0.001)	(0.002)
CHILD1-3	-0.010***	-0.015***
	(0.001)	(0.002)
CHILD4+	-0.028***	-0.043***
	(0.008)	(0.014)
PART-TIME 95	-0.085***	-0.168***
	(0.004)	(0.005)
EDU2	-0.040***	-0.020***
	(0.004)	(0.005)
EDU3	-0.050***	-0.032***
	(0.003)	(0.005)
EDU4	-0.031***	-0.007
	(0.004)	(0.006)
EDU5	-0.038***	-0.024***
	(0.003)	(0.004)
EDU6	-0.039***	-0.029***
	(0.004)	(0.005)
EDU7	-0.029***	-0.022***
	(0.003)	(0.004)
EDU8	(dropped)	(dropped)
SKLD 94	-0.013***	-0.014***
	(0.002)	(0.003)
CLER 94	-0.008***	-0.008***
	(0.001)	(0.002)
MNGR 94	0.015***	0.010***
	(0.002)	(0.003)
DIR 94	0.066***	0.057**

	(0.022)	(0.027)
MANUF 94	-0.053***	-0.167***
	(0.003)	(0.006)
WHOLE 94	-0.044***	-0.175***
	(0.003)	(0.006)
CONST 94	-0.049***	-0.169***
	(0.004)	(0.006)
RETAIL 94	-0.066***	-0.183***
	(0.004)	(0.006)
CATERING 94	-0.037***	-0.158***
	(0.005)	(0.009)
TRANS 94	-0.049***	-0.166***
	(0.004)	(0.006)
FINANCE 94	-0.031***	-0.144***
	(0.004)	(0.006)
SERV-LOW 94	-0.051***	-0.173***
	(0.004)	(0.006)
SERV-HIGH 94	-0.056***	-0.174***
	(0.004)	(0.007)
PUBLIC 94	-0.062***	-0.174***
	(0.003)	(0.006)
BEN UI 1995 (10,000 DKK)	0.007***	-0.004**
	(0.001)	(0.002)
BEN SA1995 (10,000 DKK)	0.001***	0.001***
	(0.000)	(0.000)
EARNINGS AND BENEFITS (10,000DKK)	-0.020***	-0.019***
	(0.002)	(0.002)
EARNINGS AND BENEFITS SQ (10,000DKK)	0*.000***	0.000***
	(0.000)	(0.000)
WEALTH (10,000DKK)	-0.000***	-0.000***
	(0.000)	(0.000)
U-YR94	0.205***	0.124***
	(0.006)	(0.009)
U94	0.197***	0.079***
	(0.005)	(0.008)
UF/SA94	0.013***	0.010***
	(0.001)	(0.002)
CONSTANT	-0.041***	0.095***
	(0.010)	(0.018)

Adjusted R^2	0.655	0.361
Number of observations	68,080	68,080

*** p<0.01, ** p<0.05, * p<0.1

[a] Robust standard errors in parentheses.