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BY DONALD O. PARSONS / TORBEN TRANÆS / HELENE BIE LILLEØR



03:25

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KØBENHAVN 2003
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PREFACE

Voluntary public unemployment systems, once widespread, are now limited to a handful of countries, including Finland, Sweden, and in a more substantial way Denmark. A voluntary system has the positive feature of any user cost scheme, potentially more efficient targeting of services. This presumes rational behavior, an assumption long questioned for insurance of large loss/small probability events, as well as reasonable risk rating of premiums and the absence of worker access to alternative social programs. Using a 10 % sample of the Danish population drawn from administrative data, the voluntary Danish system is exploited to explore the nature of unemployment insurance demand. The aggregate take-up rate is surprisingly high, 80 % in 1995, but varies systematically with economic incentives. The political economy of the Danish system is also considered; calculations suggest that the net revenue gains to the U-funds from switching to a universal, compulsory system would be positive, but of rather modest proportions and with an unexpected twist – additional revenue would come disproportionately from low-wage workers.

Donald O. Parsons, Department of Economics, George Washington University, Torben Tranæs, Danish National Institute of Social Research, EPRU, and CESifo, and Helene Bie Lilleør, EPRU, University of Copenhagen have carried out this research. Funds for the research were provided in part by the project “The Welfare State: Threats, Problems, and Some Solutions” and EPRU. Parsons’ work is part of a project on the Foundations of Unemployment Insur-

ance being conducted at the Research Program in Labor and Social Insurance (Center for Economic Research, Economics Department, George Washington University). The comments and encouragement of participants at conferences on unemployment insurance at EPRU (University of Copenhagen), and the Center for Applied Microeconomics (University of Copenhagen), and at seminars at the Center for Economic Studies (U.S. Bureau of the Census), CESifo, George Washington University, and the University of Helsinki are gratefully acknowledged. We also wish to thank Niels Blomgren-Hansen and Niels Westergård-Nielsen for extended discussions on aspects of the Danish unemployment insurance system; Martin Browning, Mette Ejrnæs, Peter Jensen, Ann-Sofie Kolm, and Bent E. Sørensen for comments on earlier drafts; Tina Kyhl for consulting assistance on social assistance legislation and administration; and Duy Thanh Huynh for research assistance.

Copenhagen, December 2003

Jørgen Søndergaard

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SECTION I

INTRODUCTION

Voluntary public unemployment systems are now uncommon, but were widespread in the early years of public unemployment insurance programs, ILO (1955). Many European countries first intervened in unemployment insurance markets by subsidizing existing trade union programs, for the obvious administrative convenience and perhaps to encourage the growth of trade unions, Neumann, Pedersen, and Westergård-Nielsen (1991) and Western (1997). Over time the bulk of these countries converted to compulsory systems, leaving only a handful of countries with voluntary systems, including Finland, Sweden, and more substantially Denmark.¹ The ubiquity of subsidized, voluntary public unemployment insurance systems early in the 1900s and their persistence in the Nordic countries raise the possibility that such systems may in fact be efficient under some circumstances.

A voluntary system has the positive feature of any user cost scheme, potentially more efficient targeting of use – those who do not value the service need not take it up. The value of self-selection is, however, a function of (i) the rationality of consumers, (ii) the accuracy of individual risk assessment in premium setting, and (iii) the absence

1. Private premiums in the Finnish and Swedish systems are quite modest, essentially covering administrative costs. Sweden adopted a compulsory system during the early 1990s, but the decision was reversed a year later.

of “free-riding” on other social insurance programs. Clearly understanding selection into the program is critical to assessing the value of a voluntary system, because none of these can be comfortably assumed in this situation. At the same time an analysis of the Danish system affords us a large-scale experiment to assess the nature of unemployment insurance demand.

Using a 10 % sample of the Danish population drawn primarily from administrative data, we are able to estimate the worker’s demand for unemployment insurance. We find substantial economic rationality in the decision process. In this policy environment, which offers no risk adjustment of premiums, nonmembers are disproportionately those who face either low unemployment probabilities or alternative forms of public income support. The latter is somewhat related to the charity hazard discussed in Browne and Hoyt (2000). On the same data we can calculate the budget implications of making a transition to a compulsory system, computing the revenue gains that would result, while identifying the gainers and losers of such a policy change. The results provide a better understanding of why the voluntary system seems to be a political equilibrium in Denmark.

The paper proceeds in the following way. In the next section we consider the economics of voluntary public insurance, identifying what we believe to be the key issues in the voluntary/compulsory choice. We also review the sparse empirical evidence on the individual demand for social insurance schemes drawn from voluntary programs. In Section III we describe in detail the Danish unemployment insurance system, which is organized around unemployment insurance funds (“A-kasser” or U-funds). We develop a model of the worker’s decision to join an unemployment fund in Section IV; the decision requires consideration of the worker’s unemployment risk, unemployment fund attributes such as the required premium and expected benefits, and alternative income support programs for the uninsured unemployed, including social assistance. We introduce in Section V the principal data set used in this study, a 10 % sample of the Danish population, drawn from IDA (“Integret Database for Arbejdsmarkedsforskning” or integrated data base for labor market research) and the tax registry, before turning to the empirical analysis of the U-fund membership decision. We then present evidence of the sensitivity of the U-fund membership decision to economic

incentives, first in the aggregate data (Section VI) and then in the microdata, using a multivariate logit analysis of fund membership (Section VII). Because of concerns about unobserved heterogeneity, we report on tentative efforts to estimate a conditional logit model of the fund membership decision in Section VIII.² All models appear to tell a consistent story – although the U-fund take-up rate is surprisingly high, workers are sensitive to the usual economic calculus. In Section IX we consider the redistributive issue, which may hold the key to the political popularity of the voluntary system in Denmark; the data set is used to estimate the net revenue consequences across income classes of making the system universal and compulsory. We conclude in Section X with a few policy reflections.

2. Because of certain data limitations that we discuss at length in Section VIII, we are not able to estimate crucial first differences in some cases.

SECTION II

VOLUNTARY AND COMPULSORY UNEMPLOYMENT INSURANCE SYSTEMS

The private market failure argument for public provision of a good or service, in this case insurance, would suggest that the government provide the product at ‘cost’ and let consumers buy the product or not as they see fit.³ In the insurance case, this would require that the government price the product appropriate to the particular worker’s unemployment risk. User cost systems, of which a fee based voluntary system is obviously one, have the value that the good or service, in this case, an insurance service, is not provided to workers who do not value the service appropriately. Governments typically impose compulsory system universally at least within the range of the administratively feasible.⁴ Almost surely this is inefficient. Whether because of temperament, asset position, or family situation, there may be many workers who simply do not value earnings insurance.

The logic of mimicking the ideal market outcome assumes of course that market failure is the result of a supply problem, perhaps asymmetric information, and not a demand problem. Underpinning

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3. Clearly this argument implies that the government can do better than the private sector.
 4. Lower bounds on firm size in compulsory systems have been common in the U.S. Firm size limits on government compulsion no doubt reflect both the higher administrative costs of mandated programs in small firms and the administrative costs of enforcing the mandate.

government provision of many social insurance programs, however, is demand or consumer failure; that individuals do not voluntarily save and insure against future earnings contingencies as they would if they were better able to make the complex computations required to maximize well being.⁵ A second, mildly contradictory concern is that consumers (workers) are rational, which induces them to engage in “free riding” on other government safety net programs. If the government provides free consumption support programs for the least fortunate, the rational consumer will adjust his private affairs, including insurance purchases, accordingly. The safety net program implicitly taxes insurance benefits, reducing private insurance demand.

The U.S. flood insurance program provides an illustration of the difficulties faced by voluntary public insurance systems.⁶ After-the-event pressures to provide aid to flood victims induced the federal government to consider the failure of the private market for flood insurance. Two arguments for the absence of private flood insurance markets were especially compelling; that (i) hydrological data were not available to permit proper risk assessment of a structure, and (ii) consumers would not purchase the insurance at full price if flood insurance was available, presumably because of myopia and free rider strategies on other programs.⁷ Focusing on the first problem, the federal government established the National Flood Insurance Program (NFIP) in 1968. The government offered communities substantial incentives, including a program of heavily subsidized flood insurance on existing housing, to undertake appropriate flood risk surveys and land management reforms. The insurance program demonstrated, however, that U.S. consumers would not voluntarily buy even heavily

5. Diamond (1993) stresses this element in the justification for forced saving programs for retirement.

6. Anderson (1974) provides an early policy review.

7. “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. These companies also learned that with adverse selection and their inability to get a proper spread of risk they were obliged to charge rates proportionate to the exposure, which affected property owners, could not or would not pay, American Insurance Association (1955, pp. 172-173).

subsidized flood insurance. To cite one early and continuing contributor to this literature, Howard Kunreuther (1973, p.23):

... there is evidence which suggests that many individuals will not purchase flood insurance voluntarily even if it is subsidized 90 % by the federal government...

It appears unlikely that prospective homeowners would purchase flood insurance at actuarial rates unless they required to do so, particularly in view of the incentive to rely on disaster relief...

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". 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). Mortgage companies in many areas ignored the "requirement" when giving a loan, and more still did not monitor continuation of coverage, so that mortgagors let coverage lapse after the first year.

This experience echoes that of early unemployment insurance programs. William Franklin Willoughby for the U.S. Department of Labor reported on programs in two cantons in Switzerland before the turn of the last century, Willoughby (1897). A voluntary program was established in Berne in 1893, 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 in the second year paid membership shrank. In Saint Gall a compulsory plan was established in 1894 for all full-time workers with earnings below a ceiling level. Enrollments reached 4200 by the end of the first year, but only after 150 workers were convicted of neglecting to answer the summons to

enroll.⁸ “Administrators of the fund found it almost impossible to compel persons to become members or afterwards to pay their dues, even though they resorted to prosecution in a great many cases”. Willoughby (1897, p.842). The city council voted to suspend the fund in 1896; as Willoughby (1897, p.841) notes, “this suppression was accomplished on the motion and through the votes of representatives of the working classes in the council”. The absence of risk adjusted premiums made the program seem more like a redistributive program than an insurance program to many workers; “Though both factory and building-trades employees were required to be insured, practically all the persons aided belonged to the latter class” Willoughby (1987, 482).

In response to these early failures, a plan was under design in Basel that, although compulsory, channeled funds through a voluntary labor organization and also crudely risk-rated the premiums by occupation (there were three categories). In 1901 the town of Ghent, Belgium established a program of municipal subsidies to trade union unemployment funds that extended that effort by implicitly risk adjusting by the union’s industry and occupation, ILO (1955, p.15). The Danish system was established on a similar model in 1907, with the government subsidizing union unemployment clubs; coverage was aided by (1) “a higher proportion of workers in Denmark were members of trade unions at that time than in perhaps any other country of the world,” and (2) “members were required to contribute to the club...”⁹ ILO (1955, p.20)

Recent experience in the United Kingdom with voluntary private unemployment insurance of home mortgages suggests that voluntary unemployment insurance remains difficult to sell to workers, Pryce and Keoghan (2001) and Keoghan and Pryce (2001). A private

8. Worker contributions were 75 % of the first year benefit payouts, although the worker share was scheduled to decline in the second year (there were no payouts in the first six months of the program).

9. Although fund membership and union membership in Denmark are now practically as well as theoretically distinct, as late as 1982 Pedersen (1982, p.584) could write “the institutional arrangements were (and are) such that entering unemployment insurance normally meant simultaneous entry into a union”. We return to the issue of union compulsion below.

insurance product, Mortgage Payment Protection Insurance, exists to cover up to a year of mortgage payments (interest and capital) during an unemployment spell. Less than one in three mortgagors purchases this type of insurance despite government efforts to encourage this market. Analysis of take-up rates of the private insurance by Pryce and Keoghan (2001) revealed that take-up was modestly related to the premium charge and more substantially linked to unemployment probability – “a 10 per cent rise in the probability resulting in a 3 per cent increase in take-up,” (p.179) – raising adverse selection concerns. One unanswered question in their research was the extent of screening of bad risks by insurance sellers.

The Danish system may not suffer from the same myopia concerns.¹⁰ The population is well educated and professionally counseled on government programs. Charity hazard, however, is a problem; the social safety net for unemployed workers without U-fund coverage is substantial. At the same time distributional concerns are not the same as with, say, emergency flood relief; means testing insures that social assistance benefits are targeted on low-income workers, not on homeowners. Whether the government is concerned about the lack of U-fund revenues extracted from low-income workers is an issue that we will consider in Section IX.

Of course governments rarely follow the missing markets model literally; premium setting is often loosely tied to individual risk, and Denmark’s system, which we discuss at length in the next section, is no exception. Premiums are essentially the same for all workers, independent of unemployment risk, and the system is heavily subsidized out of general revenues. Membership fees cover only one-third of costs on average at the time of our sample (25 % taking into account that the membership fees is deductible). This reduces concerns about myopia or optimism bias, but at the same time compromises arguments that a voluntary system improves targeting of the system to those who would value it at full cost. An interesting social insurance design question, one that we do not answer here, is whether there is a subsidy rate that would optimally limit the myo-

10. And certainly is not affected by seller screening out of bad risks.

pia and free-riding distortions to a full cost voluntary system while maintaining some targeting efficiency.

Precisely because it suppresses individual choice, a universal, compulsory program does not suffer from the same selection problems. At the same time, that is its weakness; a potentially important advantage a voluntary system is that of targeting efficiency. Compulsion, properly targeted, permits governments to price their product without concern that they are distorting product purchase or consumption.¹¹ Instead governments must be concerned that they are properly targeting the compulsion. The efficiencies or even the financial implications of permitting voluntary participation are difficult to predict a priori, with selection potentially being a mix of rational, free-riding consumers with risk aversion of varying intensity and of myopic consumers who may poorly calculate their net advantage in hypothetical situations. That leads us to the empirical analysis of selection in a voluntary system.

11. It is for this reason that Barr (1988) rejects Beenstock's attempt to design an appropriate pricing scheme for unemployment insurance, Beenstock (1986). As long as all workers value unemployment insurance at the government's cost of providing it, universal compulsory insurance will not distort the worker's consumption behavior.

SECTION III

THE DANISH VOLUNTARY UNEMPLOYMENT INSURANCE SYSTEM

Voluntary public systems are now sufficiently rare that we will describe the Danish system in more detail in this section.¹² Danish unemployment funds (U-funds) are member-controlled, private funds. There are 39 state-recognized funds. In principle there is one fund for each trade, two funds for the self-employed and a general fund for both employers and employees (a Christian U-fund).¹³ Historically, the first state-recognized funds were union funds, formally independent of the union organization. In theory it was possible to join the fund without joining the respective union; although in practice this was hard and sometimes impossible. In the 1980s, the linkage between union membership and U-fund membership was broken in practice as well as theory.¹⁴

All funds are tightly regulated by the government and face identical rules on fund membership procedures, including base membership fees, search and other eligibility requirements, and benefit levels

12. For a careful discussion of the Swedish unemployment insurance system, see Bjorklund and Holmlund (1991). A broad overview of recent trends in unemployment and labor market policies in Denmark can be found in Westergaard-Nielsen (2001).

13. There is a minimum size limit on funds, so that smaller unions must arrange to join funds operated by larger unions.

14. In 1988 it was made an explicit precondition for state recognition and hence government subsidy that the U-funds not condition U-fund membership on trade union membership. (Direktoratet for Arbejdsløshedsforsikring, 1988).

and duration, although plans can and do differ in related services, including search counseling services, which are linked with fee differentials.¹⁵ Most individuals are eligible for only one fund, although there are exceptions. After January 1, 1994, the following individuals¹⁶ could join the fund linked to their occupation or education (or the Christian U-fund):

- (1) Employees;
- (2) The self employed;
- (3) Working/helping spouses to the self employed;
- (4) Individuals with occupational or further education of 18 month or more;
- (5) Individuals serving their military duty.

Before January 1, 1994, employees also needed at least 150 hours of employment during the past 10 weeks from the time they sign up in order to be accepted as members.

The yearly membership fee is set administratively at eight times the maximum daily UI benefit. In 1995 the fee was 3660 DKK (\$654) for employees and 4071 DKK (\$727) for the self-employed.¹⁷ This pricing scheme makes the government's share of U-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 ("efterløn"). 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. In the especially difficult year of 1992, when the rate of unemployment was 12 %, the fees covered only one-quarter of unemployment-related expenditures; including linked leave schemes and efterløn, the fees

15. Note that there is no longer an implicit risk adjustment in the use of union funds. The linkage between premiums and payouts, a crucial part of the early subsidy schemes, has been lost with the high public involvement in both financing and controlling the scheme.

16. Provided they were between 16-65 years of age and residents of Denmark.

17. 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.

covered only 1/6 of total expenditures, with the remainder covered by state subsidies and by compulsory contributions from employers. In 2001 when unemployment was close to 5 %, fees covered almost 75 % of the direct unemployment benefit outlays and 1/3 of total expenditures (including efterløn, leave schemes, etc.).

The typical worker must pay into the U-fund for one year and have worked for at least twenty-six weeks during the three years preceding the date of unemployment to be eligible for benefits in case of unemployment. If one joined a U fund under (4) or (5) above, one can get UI benefits without ever having had paid work. For full benefits, one must be involuntarily released; workers who voluntarily quit forfeit the first five weeks of benefits.

Benefits were 90 % of the unemployed worker's prior earnings up to a relatively low ceiling, 135,536 DKK (\$24,203) per year in 1994, and 136,709 DKK (\$24,412) per year in 1995. Benefit duration is extraordinary by U.S. standards. Until "reforms" in 1994, a covered unemployed worker was eligible for between 7 and 10 years of benefits depending on the amount of training and relief work accepted; in principle there was a workfare requirements of six months after every 2 1/2 years of unemployment. In practice the duration was open ended. In the period from which our data were drawn, 1994 and 1995, a covered, unemployed worker was eligible for benefits for seven years, but subject to workfare after four. The seven years could be extended for up to two more years by taking specific training options ("education leave").¹⁸

Long-term membership in a U-fund also provides substantial early retirement benefits through efterløn. Efterløn pays benefits equivalent to the worker's U-fund benefit for the first 2 1/2 years, after which it pays 82 % of the maximum U-fund benefit as a flat rate until the member turns 67, the "normal" retirement age for the pension system, *with no expectation of job search activity*. Eligibility requirements were substantial; you must have been a U-fund member for 20 out of the last 25 years at the time you wish to start

18. By 1999, benefit duration was at most 4 years, and you were subject to workfare after one year.

receiving efterløns benefits.¹⁹ For someone wishing to retire at 60 that means joining the U-fund no later than age 40. Efterløns is extremely popular and few fund members do not expect to receive some payments; among U-fund members between the ages of 60 and 66, approximately 2/3 were on efterløns in 1995.

The long association of UI and union membership raises some question of the worker's degree of choice in joining a fund or not.²⁰ For example, 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 U-fund, the journalists union, apparently as a way of expressing solidarity with other workers. U-fund membership requirements can be imposed at the local level, but such practices are apparently rare as well.

Social pressure to join a fund is also possible and difficult to document directly. One expert on the economics of union in Denmark, Steen Scheur, conjectures that such pressures are most plausible in manual skill unions (personal communication, April 14, 2001). Machael Valentin, writing on behalf of John Dahl, head of the largest Danish union, HK, representing white collar workers, reports that formal bylaws compelling fund membership may be found in "some sections of SID", the largest union of unskilled workers, and were previously common among skilled workers in the building trades (personal communication with Niels Blomgren-Hansen, April 6, 2001). However, Lars Brejnrod of the Economics Department of SID reports that "only a few thousands out of about 300,000 union members are not members of the associated unemployment fund," but that it is not compulsory, at least at the national levels, and seems to be the result of economic interest rather than social pressure or

19. If you become a U-fund member at the age of 43, for instance, you can get efterløns benefits only when you are between age 63 and 66.

20. Niels Blomgren-Hansen, to whom we are most grateful, provided much of the material in the next few sections.

norms, especially with the addition of efterløn. He also raises an issue that will arise again below, “It is true that public relief may be approximately as high as the unemployment benefit. However, you can only get relief if you are “in need”, that means that you don’t have means yourself and your spouse does not earn enough to support you” (personal communication with Niels Blomgren-Hansen, April 17, 2002). The ratio of fund membership to union members appears to bear out the relative popularity of unemployment funds in low skill unions. Among the five largest unions, the ratio is approximately 100 % in SID and KAD (unskilled women), 94 % in FOA (public employees), 87 % in HK, and 83 % in Metal (skilled, metal industry).²¹ In the sensitivity analysis section below, we will partition our primary logit model by industry to explore behavioral differences that might be attributable to union social pressure.

21. These statistics are from Danmarks Statistik (1999). Note that these figures may be somewhat misleading because some smaller unions do not have funds of their own, but instead join bigger ones. We are indebted to Niels Blomgren-Hansen for the statistics and the caveat.

SECTION IV

A MODEL OF THE DECISION TO JOIN AN UNEMPLOYMENT FUND

Consider the unemployment fund membership decision of an economically rational worker who places no special weight on the source of her income; that is, she is neither myopic nor sensitive to welfare stigma. The insurance decision is a dichotomous one, join the fund or not, because the individual has no choice of extent of coverage, the parameters of which are set by the government. Presumably the individual's algorithm for joining an unemployment fund is similar to that of any insurance purchase. Consider a one period model. The worker is assumed to have an additively separable utility function in consumption and leisure, to be risk averse in consumption, and to face a dichotomous (zero-one) work choice.²² The i^{th} worker's certainty utility function therefore can be represented by:

$$\begin{aligned} U &= u(C_i) && \text{if employed, and} \\ U &= u(C_i) + \ell, && \ell > 0, \text{ if unemployed,} \end{aligned}$$

where u is an increasing, concave function of own consumption (C_i), and ℓ is the utility of leisure. For simplicity the utility value of not working is assumed to be the same for all individuals, and sufficiently small that all individuals would choose to work if offered a job. She cannot find work of any kind in the unemployed state.

22. This preference structure implies equal consumption across states if insurance is complete and costless.

We assume that the probability of becoming unemployed varies across individuals and is denoted θ_i , and that the worker maximizes expected utility,

$$E(U_i) = (1 - \theta_i)U(C_{Ei}) + \theta_i[U(C_{Ui}) + \ell], \quad (1)$$

where the subscripts E and U denote activities in the employed and unemployed states respectively.

It remains to specify consumption in the two states, and how consumption varies across both unemployment and insurance fund membership. Assume that the worker has earnings of e_i when employed and earnings of zero when not, and has additional private income of A_i (capital income, spouse's earnings, etc.). If she chooses to join a U-fund, she must pay a fee of f_i , and receives benefits in the amount B_i if she finds herself unemployed; presumably $B_i > f_i$.

If the unemployed worker does not belong to a U-fund, she may be eligible for means-tested welfare benefits, or social assistance. The Danish social assistance program, although offering lower benefits to the unemployed than those given U-fund members, is generous by international standards. 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. Denote these means-tested social assistance benefits by $S(\gamma, A_i)$, where γ is a positive shift parameter and A denotes other family income. S is presumably a non-negative function of other family income, so that $S_1 > 0$ and $S_2 \leq 0$. *In the remainder of this section, we suppress the individual subscripts for notational simplicity.*

Consumption will vary across states and insurance fund status as follows:

If uninsured, consumption will be,

$$\{C_E, C_U\} = \{e + A, A + S(\gamma, A)\}. \quad (2a)$$

If insured (with insured status denoted by a superscripted asterisk),

$$\{C_E^*, C_U^*\} = \{e - f + A, B - f + A\}; \quad (2b)$$

Unlike private insurance, there is no requirement that the fund be self-financing and again that is emphatically not the case in the Danish unemployment insurance system.

The worker is assumed to be an expected utility maximizer, so that the decision to join an unemployment fund will involve a simple comparison of expected utilities in the two states. Define UF to be a binary variable equal to one if the worker is a member of an U-fund, zero if not. The membership decision rule can be expressed as: join the unemployment insurance fund if the net gain in utility (Δ) is nonnegative:

$$\Delta = \{E(U_i) \mid UF = 1\} - \{E(U_i) \mid UF = 0\} \geq 0 \quad (3)$$

The comparative statics of this simple model are straightforward:

$$\begin{aligned} \frac{\partial \Delta}{\partial \theta} &= -U(e - f + A) + U(B - f + A) + U(e + A) \\ &\quad - U(A + S(\gamma, A)) > 0; \end{aligned} \quad (4a)$$

$$\frac{\partial \Delta}{\partial B} = U'(B - f + A) > 0; \quad (4b)$$

$$\frac{\partial \Delta}{\partial f} = -(1 - \theta)U'(e - f + A) - \theta U'(B - f + A) < 0; \quad (4c)$$

$$\frac{\partial \Delta}{\partial e} = (1 - \theta)(U'(e - f + A) - U'(e + A)) > 0; \quad (4d)$$

$$\begin{aligned} \frac{\partial \Delta}{\partial A} &= (1 - \theta)U'(e - f + A) + \theta U'(B - f + A) - (1 - \theta)U'(e + A) \\ &\quad - \theta U'(A + S) S_2 > < 0. \end{aligned} \quad (4e)$$

$$\frac{\partial \Delta}{\partial \gamma} = -\theta U'(A + S) S_1 < 0. \quad (4f)$$

Not surprisingly the likelihood of U-fund membership is increasing in unemployment risk and U-fund-benefits and decreasing in the size of the fee. The likelihood of U-fund membership is also decreasing in the generosity of social assistance benefits; this is essentially

a charity hazard. The prior earnings effect is positive because the marginal utility cost of paying the fixed membership fee is decreasing in income. The asset effect is ambiguous without stronger assumptions on the curvature of the utility function.

One Dynamic Consideration. Were there no fixed entry and exit costs, the fund membership decision would be a series of single period optimizing decisions as in (3). For example the *risk-neutral* worker in period t would join a U-fund if and only if the expected value of fund benefits in that period exceeds social assistance payments by more than the fund fee:

$$\theta_t(B_t - S_t) - f_t \geq 0.$$

The Danish U-fund has investment elements that make the decision a multi-period one. First, it is necessary for fund members to pay into the system for one year (as well as work for at least 26 weeks) before qualifying for unemployment benefits. A short run reduction in membership returns, even a large one, will not necessarily cause a worker to leave the fund, because the worker must purchase a year's membership just to become eligible again. The back loaded efterløøn payment provides another form of long term return to membership. The worker must consider not only current insurance coverage but also access to this early retirement scheme when making her U-fund decision.

To illustrate the impact of the one-year waiting period on the U-fund decision, consider first the case in which the unemployment probability increases monotonically with age ($\theta' \geq 0$) while all other factors $\{B, S, f\}$ remain constant. The worker, if she enters the fund, will never exit. Denote the length of the work life by T and the year of first payment into the fund (entry) by t_c . The *risk neutral* worker will join the fund in the first time period in which:

$$\theta_{t_c+1}(B_{t_c+1} - S_{t_c+1}) - f_{t_c+1} \geq 0, \text{ and } \sum_{t=t_c+1}^T \delta^{t-t_c} [\theta_t(B - S) - f] \geq 0.$$

The net return must be nonnegative in the first protection year and the discounted annual net returns to fund membership must equal or exceed the membership fee – the one-year fee payment.

Conversely consider the case in which the unemployment probability decreases monotonically with age ($\theta' \leq 0$). In this case it is transparent that the worker, if she ever joins the fund, will do so in the first period. The decision rule for the risk-neutral worker is to join in the first period if and only if:

$$\sum_{t=2}^{\tau} \delta^{t-1} [\theta_t(B - S) - f] - f \geq 0.$$

where τ is the date of exit from the system (the last period in the system). Exit will occur in the first period in which:

$$\theta_t(B - S) - f < 0,$$

the fee exceeds expected U-fund benefits in excess of social assistance. A fortiori, the discounted value of all future expected net returns is negative at this point, although it may be negative at an earlier stage as well – a negative expected present value of net returns is a sufficient, but not necessary condition for exit with monotonically declining net returns.

The entry and exit algorithms become more complex if, as appears to be the case in the current application, net returns to membership vary nonmonotonically over the work life. The investment aspect of fund membership, especially the back-loaded benefits of *efterløn*, could explain why U-fund membership remains attractive in the middle years of stable jobs and growing wealth (we return to this issue in Section VI).

SECTION 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 Danish Statistics, the government statistical office.²³ Administrative data from a variety of government sources was compiled for a 10 % sample of the Danish population between the age of 18 and 65 in 1993.²⁴ The value of using an administrative data set to examine unemployment fund membership is clear; an exact record of the individual's insurance status (U-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 available in U.S. administrative data. Not only does the data set contain records of U-fund membership and benefit utilization, and social assistance records, it contains the usual demographics, i.e. sex, age, marital status; presence of children in the household, educational attainment, labor force activities; and earnings, income and wealth.

23. The data is available for a fee that is substantial by U.S. government standards. The fee is 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 official Danish Statistics sites.

24. Although the focus of the analysis is calendar year 1995, to accommodate lagged variables and analyses of behavioral change, the sample was drawn in 1993 and sample members then followed for two years.

We require measures of unemployment risk rather than actual unemployment in two distinct exercises, (i) in the estimation of individual U-fund decisions (Section VI-VIII), and (ii) in the calculation of the expected revenue gain from imposing universal membership in Denmark (Section IX). The first requires a subjective measure, what the worker thinks her unemployment probability is, the second an objective one. However, we have no direct measures of the subjective probability of unemployment and therefore make no distinction between the two concepts, assuming instead that the worker's subjective estimate of her unemployment risk is her objective probability. We construct an estimate of this objective probability from a logit model of unemployment probability (the precise form of this model is reported in detail in Section VII).

The key unemployment variable, unemployed all of week 48, the fourth week in November, is not the usual survey response, but is an administrative construct and may undercount laid off workers 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: approximately 13,000 individuals or 0.45 % of the labor force were looking for work in 1995, but did not receive unemployment compensation nor were registered at the employment office ("AF-kontor") according to Danmarks Statistik's Labor Force Survey.²⁵ Conversely the unemployment category includes many individuals who are not unemployed in the usual sense of being available for work if offered.²⁶

Several other variables are constructed. Benefits under the unemployment fund are institutional datum and are constructed from program rules. In 1995, the focal year of the analysis, cash benefits were uniform across plans, with benefits rising at a fixed proportion

25. Danmarks Statistik provided this information to the Ministry of Finance, Denmark (Personal Communication with Tranæs, 2002).

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

of earnings, about 90 % up to a fairly low maximum, after which benefits remain flat just below 140,000 DK (\$25,000):

$$B_i = \min(0.9e_i, 136,709),$$

and e_i of course denotes pre-unemployment earnings.²⁷ Benefits are a function of weekly earnings prior to unemployment, so we adjust reported annual earnings for weeks of unemployment to construct weekly earnings and then the benefit rate; which in turn is converted to an annual figure. Since 1994 these benefits have been taxed, as have social assistance benefits, although we do not adjust for taxes here.

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 social assistance eligibility. Unlike unemployment insurance, social assistance is means-tested. The system distinguishes in a modest way between asset income and other family earnings, and it is therefore necessary to partition A_i into these components. Denote asset income and other family earnings by α_i and family wealth by v_i , $A_i = \alpha_i + v_i$. The social assistance benefits for which a married worker would be eligible when unemployed has the following form:

$$S_i = \max [0, S_i^* - a_i - v_i^*]$$

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

The cost of joining an unemployment insurance plan f is theoretically straightforward, simply the plan's fee schedule. The fee varies with part-time/full-time work status, student status (there is a

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

significant student discount), and with the specific plan you join.²⁸ U-funds are free to offer ancillary services, such as job training and counseling, but must pay for them out of fees in excess of those for benefits. We exclude from our sample students and pensioners because of their quite distinct circumstances, so that the fee varies only with U-fund service-provision and part-time status, which is potentially correlated with other omitted decision factors. We view the impact of fees on U-fund membership as not identifiable in our data, and exclude the fee variable.

28. A student can become a U-fund member, even though ineligible for benefits while a student. Upon leaving full-time student status, the individual can then begin receiving unemployment benefits while looking for her first post-school job.

SECTION VI

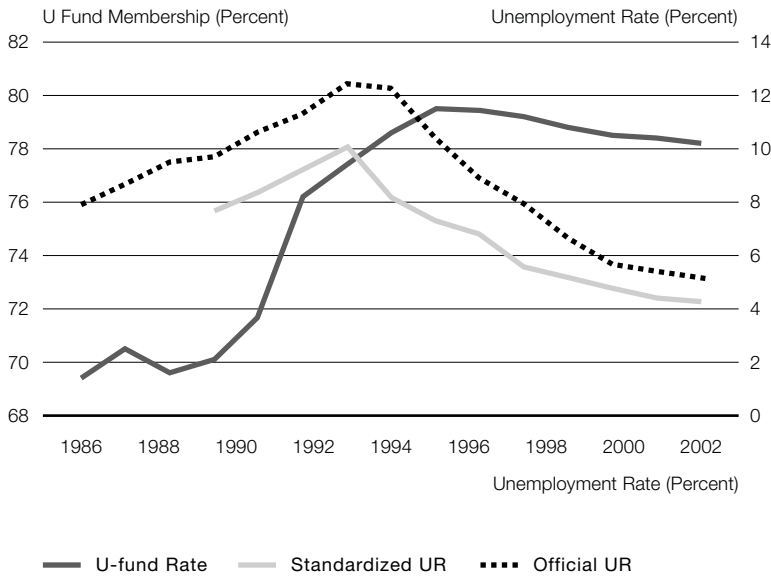
UNEMPLOYMENT FUND MEMBERSHIP IN DENMARK: SOME AGGREGATE EVIDENCE

The aggregate data reveal much about the nature of the U-fund system and the sensitivity of UI fund membership to economic incentives. The time trend in U-fund membership is graphed in Figure 1 for the 1987-2001 period, along with two measures of the aggregate unemployment rate, the official measure and the OECD standardized measure. The standardized measure is everywhere less than the official measure, which apparently includes some individuals not looking for work.

Membership in an unemployment fund approached 80 % in 1995, a figure that seems exceptionally high in light of the U.S. experience with flood insurance and the U.K. experience with unemployment insurance for mortgagors. The U-fund membership decision is not an institutional constant, however. The U-fund membership rate increased by 10 percentage points between 1987 and 1995, before declining modestly between 1995 and 2001. This flow and ebb in membership rates correspond broadly with the increase and subsequent decline in the aggregate unemployment rate, although the membership increase in the first interval is much larger and enduring than the decline that follows. As we shall see below, the large increase in the early 1990s is reasonably attributed to the extension of eligibility requirements for fund-linked early retirement supplements (efterløn) from 10 years of fund membership to 20 years.

Figure 1

Unemployment Fund Membership and Official and Standardized Unemployment Rates, Denmark 1987-2001



Aggregate statistics from our primary data set also suggest the importance of economic considerations in the membership decision. Presumably a high risk of unemployment and a low likelihood of safety net payments each encourage U-fund membership. In Figure 2, we report *income* profiles by deciles for two key economic incentives for U-fund membership, (i) the worker’s unemployment experience, whether the worker was unemployed all of week 48, (Panel A) and (ii) hypothetical social assistance eligibility if the worker was unemployed *and not a U-fund member* (Panel B). We also report the likelihood the worker is a member of a U-fund (Panel C).

Unemployment is high in the lower half of the income distribution, especially in the third through fifth deciles, and is essentially nonexistent in the upper deciles. The counterfactual, social assistance eligibility if without earnings, decreases unsurprisingly by income decile, reflecting as it does asset income and wealth, partly explaining the relatively low popularity of U-funds at the very low end of the income distribution despite high unemployment risk. Less easily explained is the high membership rate in the higher income deciles.

Figure 2a

Unemployment Rate (46th Week) by Income Decile, Denmark 1995

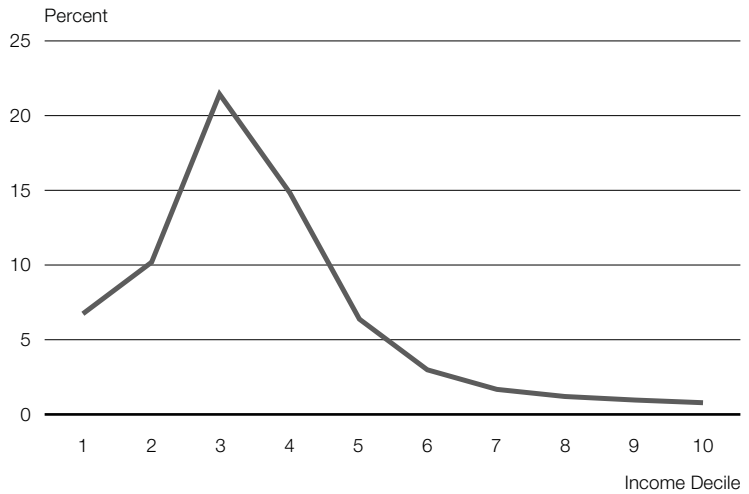


Figure 2b

Hypothetical Social Assistance Eligibility by Income Decile, Denmark 1995

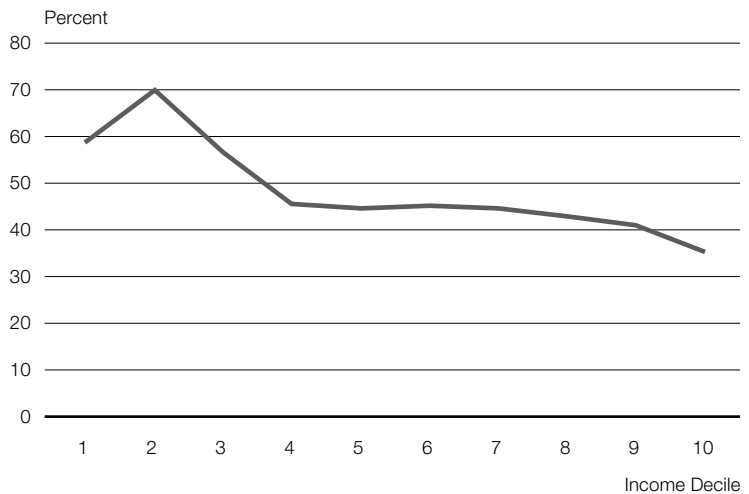
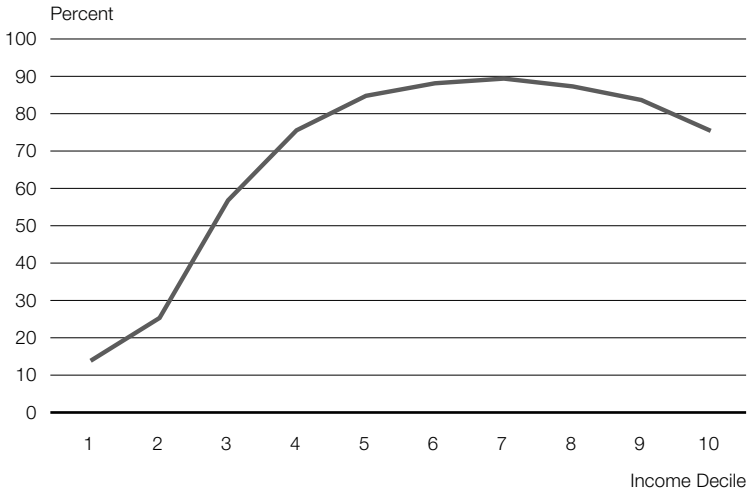


Figure 2c

Unemployment Fund Membership By Income Decile, Denmark 1995



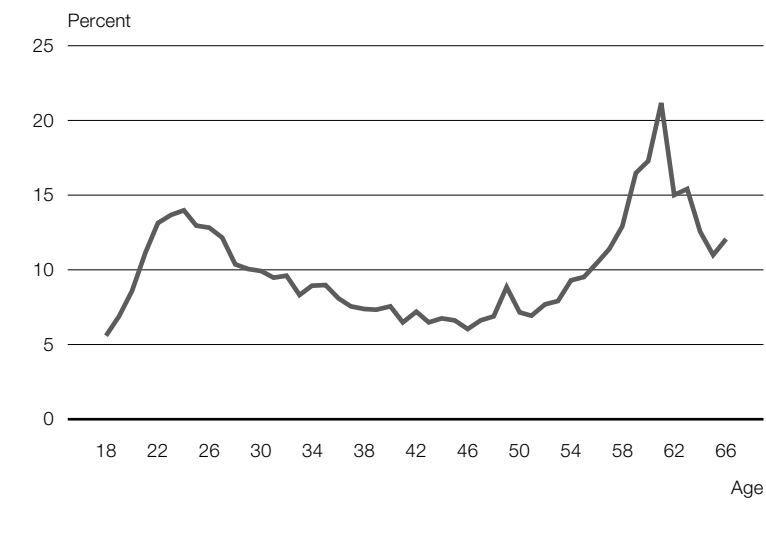
For these individuals unemployment is an extraordinarily uncommon event, although social assistance benefits are less likely. Of course without some bounds on risk aversion, any degree of insurance purchasing can be rationalized. Solidarity or social pressure, especially within unions, may also explain some of this phenomenon, an issue we return to below.

In Figure 3, we report *age* profiles for the same three series: unemployment rates (Panel A), social assistance eligibility rates (if unemployed) (Panel B), and U-fund rates (Panel C). As one might expect, unemployment rates peak among workers in their early 20s, falling more or less continuously through age 50 before climbing again. Intuitively one might conjecture that U-fund membership would follow the same pattern, first declining and then increasing with age. That does not appear to be the case, Figure 3 Panel C. Fund membership is remarkably flat throughout the bulk of the individual's active work life. This surprising constancy of U-fund membership across age can only partly be explained by age variations in safety net eligibility. Safety net eligibility declines more or continuously throughout the work life, presumably as assets accumulate and the incomes of spouses grow, which would, *ceteris paribus*, imply

an increase in rational membership rates among workers in their 50s – unemployment exposure increases and safety net eligibility declines.²⁹

The absence of the expected decline in U-Fund membership in mid-life would seem somewhat inconsistent with expectations. Intuition would suggest that U-fund membership follow unemployment risk across ages, with the greatest demand in the early and late years in the labor force, but there is little evidence of this effect in the age profiles. A major complicating factor, however, is *efterløn*, the early retirement supplement, which for those working in 1995 required twenty years of service in the 25 years prior to receipt. This provides an additional incentive for all workers over 40 to belong to a fund. Moreover, because of the investment aspect of the unemployment insurance component of fund returns – under ordinary circumstances one must pay in for one year before becoming eligible for benefits, workers who belonged to a fund when young may not have an incentive to withdraw for the few years prior to the *efterløn* pay-in period.

Figure 3a
Unemployment Rate by Age (Week 46), Denmark 1995



29. Of course asset ownership also increases in this period, reducing not only safety net eligibility, but also insurance demand.

Figure 3b

Hypothetical Social Assistance Eligibility if Unemployed (Zero Earnings), Denmark 1995

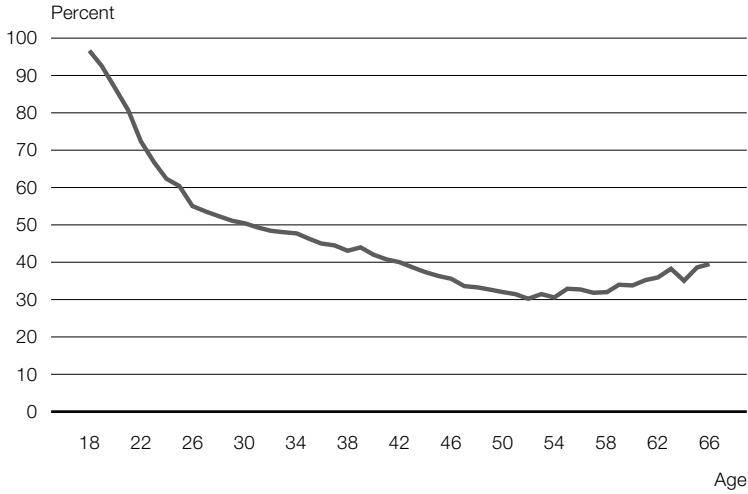


Figure 3c

Unemployment Fund Membership Rate by Age, Denmark 1995

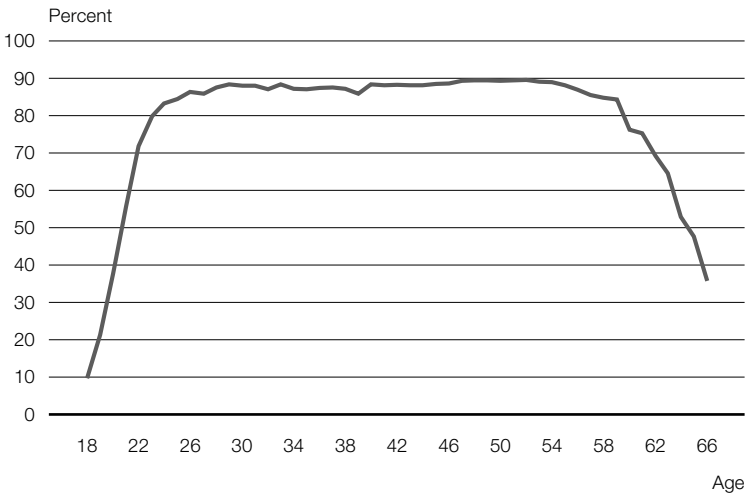


Figure 4a

Unemployment Fund Membership Rate by Age, Denmark 1991 and 1992

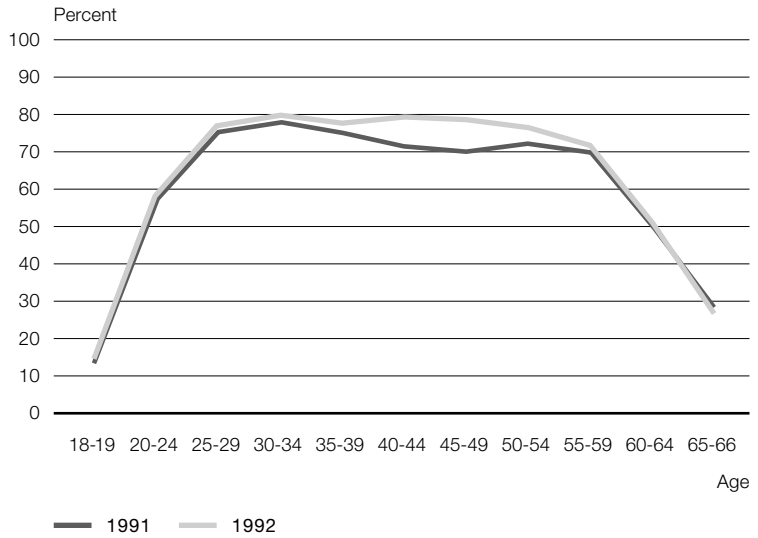


Figure 4b

Unemployment Fund Membership Rate by Age, Denmark 1987-1991

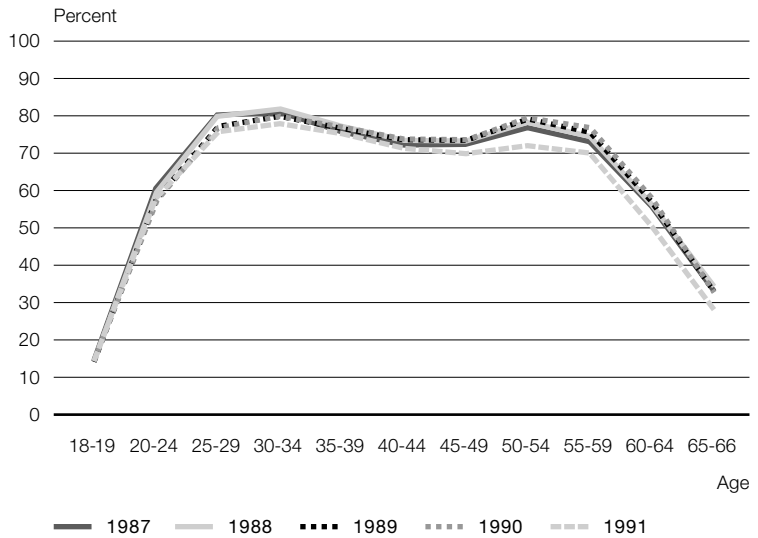
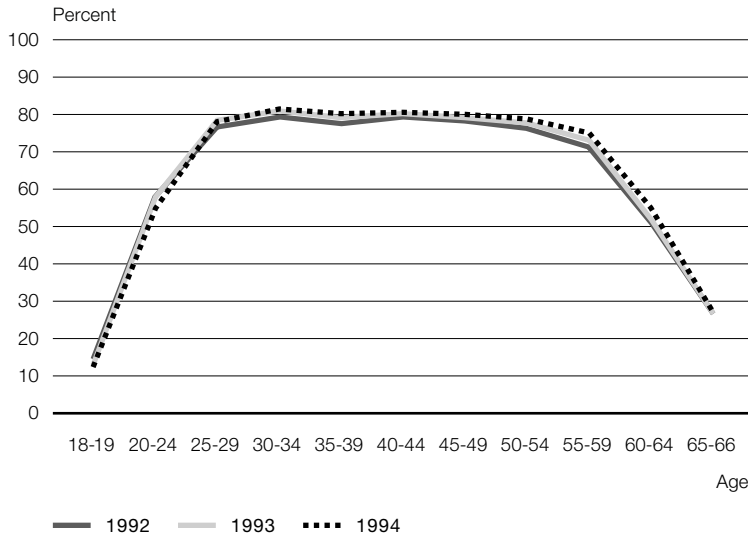


Figure 4c

Unemployment Fund Membership Rate by Age, Denmark 1992-1994



There is powerful evidence of the efterløn effect on the membership decision. As noted earlier, the rules governing eligibility for efterløn eligibility changed substantially. As noted above, in 1992 the program definition of long time member was extended from ten to twenty years. The reform implied that if you were not a member of a U-fund by March 31, 1992, you would need to have been a member of a U-fund for 20 years out of the last 25 years *at the time you wish to start receiving efterløn benefits*.³⁰ Under the assumption that efterløn is an attractive addition to U-fund membership, one would predict potentially large effects on the U-fund membership in the age 40 to 50 bracket and indeed that is exactly what we observe, Figure 4A. In one year U-fund membership increased by 10 percentage points for workers in their forties, while remaining stable for almost all other age brackets. The size of this shift can be compared to the stability of the age profile of U-fund membership in the years before (Figure 4B) and after (Figure 4C). Clearly workers in their 40s are quite sensitive to the economic returns to fund membership.³¹

30. If you become a U-fund member at the age of 43, for instance, you can get efterløn-benefits only when you are between age 63 and 66.

31. Less obvious to us is the reason for the decline in U-fund membership between 1990 and 1991 for all workers over 40.

SECTION VII

U-FUND MEMBERSHIP: A MULTIVARIATE LOGIT ANALYSIS

The aggregate data suggest that Danish workers, in deciding whether to insure themselves against unemployment losses, are sensitive to the expected economic factors, including unemployment levels, access to social assistance, and the presence of tie-in programs such as *efterløn*. In this section we report on a multivariate analysis of individual data to provide more precise estimates of these effects. In Table 1A, we define the variables used in the analysis, in Table 1B we report on the corresponding means and standard deviations of the variables.

A potentially important complication is that individual unemployment experiences may not be independent of U-fund membership. The usual moral hazard concerns arise – insured workers are more likely to “choose” unemployment if laid off. That concern requires that we undertake a two stage process: in the first step we estimate the worker’s probability of being unemployed, using that model to estimate the expected unemployment risk, which is then embedded in the second step, estimation of the insurance decision. The unemployment risk measure used as a regressor in the second stage is an imputed variable and thus measured with sampling error. We use a procedure proposed by Murphy and Topel (1985) to correct all standard errors in the second stage. The procedure is quite general and has the standard instrumental variable method as a special case (see Murphy and Topel, 1985).

Table 1: Panel A
Variable Definitions.

U	A zero-one dummy, with one indicating the worker was unemployed all of week 48 (4 th week of November).
U-fund	A zero-one dummy, with one indicating the worker was a member of an unemployment fund.
θ^{\wedge}	The probability a worker is unemployed all of week 48, derived from the unemployment logit reported in Table 2, column 3.
B	The projected annual unemployment fund benefits the worker would qualify for if unemployed for one year (in 10,000 DKK).
S	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).
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.
AGE36-40 SP	Zero if age less than 36, one to five for those age 36 to 40, five for all others.
AGE41-50 SP	Zero if age less than 41, one to ten for those age 41 to 50, five for all others.
AGE51-60 SP	Zero if age less than 51, one to ten for those age 51 to 60, five for all others.
AGE61-66 SP	Zero if age less than 61, one to six for those age 61 to 66.
ED1	A zero-one dummy, with one indicating the worker's highest grade completed was 7.
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.
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.

SE	A zero-one dummy, with one indication the worker's occupation is self-employed in week 48.
LEAVE	A zero-one dummy, with one indication the worker's occupation is "on leave in week 48."
STUD	A zero-one dummy, with one indication the worker's occupation is student.
PEN	A zero-one dummy, with one indication the worker's occupation is "on pension in week 48."
OLF	A zero-one dummy, with one indication the worker's occupation is "on pension" or out of the labor force in week 48.
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.
U-YR	The fraction of the year unemployed.
UF/SA	A zero-one dummy, with one indicating receipt of either unemployment benefits or social assistance or both in the calendar year.
GROSSINC	Gross annual income (in 10,000 DKK).
WEALTH	Physical asset wealth (in 10,000 DKK).
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.
PART-TIME	A zero-one dummy, with one indicating the worker worked less than 30 hours at his job or was insured part-time and unemployed in the survey week.

Table 1: Panel B

Summary Statistics For Unemployment And U-fund Logits, 1995.

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
U	0.092	0.289	MANUF 94	0.186597	0.389588
U-fund	0.834	0.372	WHOLE 94	0.055134	0.228242
$\hat{\theta}$	0.092	0.178	CONST 94	0.053994	0.226007
FEMALE	0.454703	0.497945	RETAIL 94	0.04727	0.212217
AGE18-25 SP	24.56723	1.346462	CATERING 94	0.016314	0.126679
AGE26-30 SP	4.048787	1.826346	TRANS 94	0.061427	0.240113
AGE31-35 SP	3.356326	2.228995	FINANCE 94	0.030693	0.172485
AGE36-40 SP	2.698218	2.386	SERV-LOW 94	0.056128	0.23017
AGE41-50 SP	3.451506	4.273387	SERV-HIGH 94	0.035701	0.185544
AGE51-60 SP	1.068683	2.572314	PUBLIC 94	0.300824	0.458617
AGE61-66 SP	0.069959	0.5083	U-YR 94	0.099895	0.236988
ED2	0.097269	0.296324	U 94	0.078939	0.269645
ED3	0.110177	0.313111	UF/SA 94	0.348217	0.476406
ED4	0.039438	0.194635	B	11.68272	3.464545
ED5	0.412877	0.492352	S	3.581108	4.278343
ED6	0.067725	0.251273	GROSSINC 94	19.71557	14.09665
ED7	0.095662	0.294127	WEALTH 94	8.520886	102.1688
ED8	0.05112	0.220244	GROSSINC	20.89638	14.08703
SKLD 94	0.122945	0.328375	WEALTH	9.272337	105.0801
CLER 94	0.231801	0.421984	MARRIED	0.523167	0.499464
MNGR 94	0.239783	0.426952	CHILD1-3	0.386778	0.487013
DIR 94	0.005839	0.07619	CHILD4+	0.006706	0.081616
SE 94	0.008127	0.089785	PART-TIME	0.0723104	0.2590017
LEAVE 94	0.020732	0.142484			
STUD 94	0.007033	0.083568			
PEN 94	0.001594	0.039889			
OLF 94	0.020495	0.141688			
Number of Observations				220,245	

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

(a) The unemployment risk measure

We construct the worker's unemployment risk from a multivariate logit model of survey week unemployment status in 1995:

$$\theta = F(\tau_0 + \tau_1 Z)$$

where θ , in our analysis, is the probability of layoff in the 48th week. The Z vector plausibly includes a variety of demographic variables (age, sex, etc.) and occupational and industrial characteristics; we use lagged values of occupation of employment because no measure of the occupation of currently unemployed workers is given.³² Thus, we estimate an unemployment risk expectation for the year 1995 based on the occupational and industrial characteristics at the end of 1994. F is assumed to be a cumulative logistic function.

Estimates of the logit model of the probability of unemployment status in the survey week are reported in Table 2. Not surprisingly, education and training lead to lower levels of unemployment. Similarly highly skilled workers and managers have low unemployment rates. Agricultural workers, the base group, have high unemployment relative to other industries, including construction, which might be explained by the date of the measurement, the forty-eighth week (fourth week of November). Controlling for economic incentives and structural issues, the likelihood of unemployment increases sharply with age for those in their 50s and beyond.

Personal histories are important as well. Past unemployment experience and receipt of public funds, whether unemployment benefits or social assistance (UF/SA), are powerful predictors of unemployment in 1995. Because we are interested in constructing an instrument for the probability of unemployment in the U-fund membership model, we also include all variables that are hypothesized to appear in that model. This includes additional price and wealth variables, such as expected unemployment benefits for U-fund members and those on social assistance. The price variables are significant; unemployment risk is lower among workers who can expect high U-fund payouts, and high among those who can expect high social assistance payments.

32. Indeed our measure of unemployment is derived from these occupational categories.

Table 2

Logit Estimates Of Unemployment In Week 48, 1995.

	Coefficient	Standard Error
FEMALE	0.062054***	0.021755
AGE18-25 SP	0.090812***	0.009857
AGE26-30 SP	-0.03203***	0.009887
AGE31-35 SP	0.030682**	0.010567
AGE36-40 SP	-0.01579**	0.01052
AGE41-50 SP	0.031516***	0.005162
AGE51-60 SP	0.073874***	0.005479
AGE61-66 SP	-0.08436***	0.021091
ED1		
ED2	-0.04724	0.036581
ED3	-0.11834***	0.037315
ED4	-0.11936***	0.052478
ED5	-0.25908***	0.030396
ED6	-0.52116***	0.054708
ED7	-0.7546***	0.058512
ED8	-0.53961***	0.066675
UNSK 94		
SKLD 94	-0.11122**	0.040883
CLER 94	0.059651	0.033324
MNGR 94	-0.36946***	0.046018
DIR 94	0.021169	0.172562
SE 94	1.317768***	0.073031
LEAVE 94	0.615996***	0.053122
STUD 94	0.654139***	0.090984
PEN 94	-1.99157***	0.462169
OLF 94	0.653906***	0.061045
AGRIC 94		
MANUF 94	0.080713	0.051048
WHOLE 94	0.15944***	0.063247
CONST 94	0.146523**	0.068971
RETAIL 94	0.277918***	0.06317
CATERING 94	0.560924***	0.075303
TRANS 94	0.055727	0.066337
FINANCE 94	0.493186***	0.09212
SERV-LOW 94	0.136389**	0.063847

SERV-HIGH 94	-0.02738	0.083265
PUBLIC 94	0.199231***	0.048457
MARRIED	-0.11651***	0.0254
CHILDO		
CHILD1-3	-0.27942***	0.02556
CHILD4+	-0.16427	0.107064
U-YR 94	1.164328***	0.045384
U 94	1.340853***	0.051951
UF/SA 94	1.205595***	0.026798
B	-0.21329***	0.002542
S	0.022773***	0.002536
GROSSINC94	-0.00852***	0.001481
WEALTH94	-0.0004**	0.000287
PART-TIME	-2.11693***	0.050587
CONSTANT	-3.24917***	0.228038
Log Likelihood	-40179.92	
Pseudo-R ²	0.406	

Data Source: Danish Statistics. The dependent variable is U95. The sample size is 220,245. The dependent variable is U95. The base group is males, single with no children, only basic education, working in the agricultural sector as unskilled labor.

The impact of past income and wealth is more modest. We construct our estimates of the worker's perception of unemployment risk using these estimates, that is, we use the estimated relation to predict an unemployment risk measure $\hat{\theta}$.

(b) The U-fund Membership Decision

The basic decision algorithm is described by the equation set (2a), (2b), and Inequality (3). If we approximate the expected utility differential Δ by the linear index I and further assume that the decision to join the unemployment insurance plan is subject to a decision error ε , the decision to join the fund can be represented as:

Join an unemployment fund if:

$$\Delta = I - \varepsilon \geq 0, \text{ or } I \geq \varepsilon$$

where again I denotes a linear approximation to the net expected utility returns to fund membership, which could of course be negative, and ε is a random variable with mean zero. The probability of joining the unemployment insurance pool is then:

$$P(UF=1) = G(I)$$

where G is assumed to be the cumulative logistic function. This is a standard logit model, with the indicator function I of the form:

$$I = \alpha_0 + \alpha_1 \theta + \alpha_2 f + \alpha_3 B + \alpha_4 S + \alpha_5 e + \alpha_6 A + \alpha_7 X$$

where the X vector denotes various controls. The X vector presumably includes all observables correlated with risk aversion and other unobserved decision factors; one might expect the curvature of the utility function or risk aversion to be a function of age, marital status, number of children in the family, educational level, and other family income (A), including asset income and spouses earnings. One might speculate that risk aversion falls as family income rises, so that these enter negatively for this reason, making own earnings and other family income ambiguous. To summarize, the theoretical arguments suggest that: $\alpha_1, \alpha_3 > 0$ and $\alpha_2, \alpha_4 < 0$, with α_5, α_6 ambiguous.

The unemployment membership fund decision was then estimated using logit techniques and the results are reported in Table 3. In Columns (1) and (2) we present the coefficients and standard errors respectively of a U-fund membership model for 1995 with industry and occupation excluded. In this model, industry and occupation come into the process solely through their effects on the individual's expected unemployment experience, providing additional identifying restrictions in the estimation. We are especially interested in three variables – the unemployment risk measure and the two key “price” variables, potential unemployment benefits and potential social assistance benefits (if unemployed and not a U-fund member). All three variables are of the expected sign and highly significant, with unemployment risk and the unemployment benefit level increasing the U-fund membership probability and the potential social assistance benefit reducing it as theory predicts.

Table 3

Logit Estimates Of Unemployment Fund Membership 1995

Variable	Model 1		Model 2	
	Coefficient (1)	Std. Error (2)	Coefficient (3)	Std. Error (4)
θ^{\wedge}	2.594243***	0.06429	3.845259***	0.074934
B	0.279975***	0.00359	0.312545***	0.003972
S	-0.04522***	0.00187	-0.0439***	0.001942
GROSSINC	-0.02659***	0.000611	-0.02802***	0.000647
WEALTH	-0.00037***	0.000089	-0.00039***	9.33E-05
FEMALE	0.66949***	.01574015	0.781186***	0.017024
CHILDO				
CHILD1-3	0.14878***	.01848531	0.116941***	0.019047
CHILD4+	-0.16831**	.07849333	-0.19418**	0.082455
MARRIED	0.240546***	.01887382	0.250253***	0.019465
Age18-25 SP	0.321181***	.00732899	0.305019***	0.007814
Age26-30 SP	0.013901*	.00794063	0.01615**	0.008318
Age31-35 SP	-0.02408***	.00782443	-0.02281***	0.008108
Age36-40 SP	0.013167*	.00716846	0.020675***	0.007382
Age41-50 SP	0.032111***	.0035263	0.032414***	0.003612
Age51-60 SP	-0.06321***	.00394188	-0.06585***	0.004033
Age61-66 SP	-0.23621***	.01249516	-0.22382***	0.012816
ED1				
ED2	-0.14077***	.03015247	-0.19264***	0.031626
ED3	-0.2332***	.0292469	-0.2876***	0.030713
ED4	-0.72793***	.03567602	-0.66069***	0.037895
ED5	0.51691***	.02430515	0.377743***	0.026282
ED6	-0.08978***	.03337736	-0.10964***	0.036347
ED7	-0.29054***	.0294539	-0.19999***	0.034042
ED8	-0.19239***	.03478706	-0.04136***	0.038965
UNSKLD 94				
SKLD 94			0.528514***	0.029622
CLERICAL 94			0.239094***	0.021923
MANAGER 94			0.069257***	0.024987
DIRECTOR 94			-0.11098	0.07964
94			-0.42055***	0.070608
94			2.072799***	0.087222
AGRIC 94				

MANUF 94			1.305716***	0.030955
CONST 94			0.86827***	0.040939
WHOLE 94			0.721987***	0.038887
RETAIL 94			0.614465***	0.039176
CATERING 94			0.097785**	0.055549
TRANS 94			0.407894***	0.035225
FINANCE 94			0.387412***	0.046474
SERV-L 94			0.528653***	0.0368
SERV-H 94			0.723818***	0.043745
PUBLIC 94			0.4211***	0.027231
PART-TIME	-1.04454***	.02837495	-0.73833***	0.030243
CONSTANT	-9.22885***	.16275027	-10.0482***	0.174938
<hr/>				
Log likelihood		-74798		-72623
LR χ^2		48540		52892
P-value of χ^2		0.0000		0.0000
Pseudo-R ²		0.2450		0.2669

Source: Danish Statistics. The dependent variable is UF95. The sample size is 220,245. The base group is single males with no children, only basic education, and (for model (2)) is working in agriculture as an unskilled laborer. A coefficient is significant at level 0.01 when marked by ***, at level 0.05 when marked by **, and at level 0.10 when marked by *. The standard errors are Murphy-Topel corrected.

The unemployment risk coefficient roughly implies a 0.36 percentage point increase in U-fund membership for each addition percentage point of unemployment risk.³³ Because a much larger share of workers belong to U-funds than are unemployed, this translates into a relatively low elasticity, about 0.04 at the point of means. Similar computations at the point of means for the benefits elasticities suggest (i) a U-fund benefit elasticity of 0.54, and (ii) a social assistance benefit elasticity of -0.03. The large difference in absolute magnitudes of the two benefit effects – the coefficient on U-fund benefits is 0.280, that on social assistance is -0.045 – is somewhat anomalous; theory would suggest that it is the differential between the two that would drive behavior, that is, that the two effects should be equal in absolute magnitude, but of opposite sign. Perhaps stigma exists toward social assistance receipt, even in the welfare state. Alternatively it may be that benefits, perhaps social assistance benefits,

33. The linear approximation to the logit model can be obtained by multiplying the logit coefficient by $P^*(1-P)$, where P denotes the probability of being a fund member, or in this case $0.834 \cdot 0.166 = 0.138$.

are poorly measured.³⁴ In any case the broad conclusion is that the workers in our sample seem sensibly strategic in their U-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 incentives to join a fund, those with higher gross income are less likely to join, suggesting reduced risk aversion with income; at the point of means, the income elasticity of membership is -0.09 . Wealth also reduces membership *ceteris paribus*, although the wealth effect appears to be relatively small. Controlling for other factors, females, married workers, and those with children join funds disproportionately, which is broadly consistent with risk aversion expectations. Despite their low membership rate, the very young (18-25) apply for membership beyond expectations, while the old (61-66) are disproportionately less likely to be members. Surprisingly, there appears to be little efterløn effect in the age splines; the independent effect of age varies little over the middle years. *Ceteris paribus*, the highly educated are only marginally more likely to join than those at the lowest level of education attainment, with those with only 12 years and no further vocational education or schooling being least likely to be members, and those with 12 years of schooling and vocational training being substantially more likely to be members.

To explore the sensitivity of model estimates to our identifying restrictions for the unemployment risk instrument, we estimate a second model with the industry and occupation dummies appearing directly in the U-fund logit as well as in the unemployment probability instrument (as before). These industry and occupation dummies could, for example, capture union social pressures to join the U-fund, an issue we will return to below. The results are reported in Table 3, Columns 3 and 4.

The estimated unemployment risk coefficient increases in magnitude in this model by about 30 %; the linear approximation at the mean

34. Benefits are constructed as the annual benefits for which a worker would be eligible if she were without earnings for the entire year.

membership probability suggests an increase in unemployment fund membership of 0.53 percentage points for each 1 % increase in unemployment expectation, with a corresponding increase in the elasticity estimate. The two benefit coefficients are essentially unchanged with the addition of the industry and occupation covariates directly in the U-fund model. A worker in the base industry, agriculture, apparently has the lowest intrinsic likelihood of joining a U-fund controlling for measurable economic incentives, with catering and the low-service sector not far behind. *Ceteris paribus* fund membership is highest in manufacturing, perhaps reflecting the origins of U-funds and unions, although less “traditional” union sectors, i.e. the high-service sector, also has an unusually high propensity to join a U-fund.

Industrial sector does appear to affect the worker’s membership decision, controlling for unemployment risk and benefit structure. To explore that issue further, we partitioned the sample into broad industrial sectors and reestimated the U-fund membership logit separately for each group. The sectors are:

- IND1: Agriculture, Construction, Manufacturing (1-3)
- IND2: Wholesale and Retail, Catering,
Low Skilled Service (4-7,9)
- IND3: High Skilled Service, Finance (8,10)
- IND4: Public Sector (11-14)

The results for the key unemployment risk and two benefit variables are reported in Table 4. The results are quite robust across sectors. Although the model estimates differ significantly across sectors in these very large samples, they are not substantial in magnitude, with the expected unemployment probability coefficient in the range 3.232 to 5.466, the U-fund benefit coefficient 0.293 to 0.420, and the social assistance benefit coefficient -0.049 to -0.033 .

Given the potential importance of *efterløn*, the membership decision may also be age dependent. Although we see little evidence of an *efterløn* effect in the simple age splines, age could affect the whole U-fund demand structure, not just the constant. We therefore partitioned the sample by age and reran the model separately on the age groups 18-34, 35-49, and 50-66. The results are reported in Table 5.

Table 4

Logit Results by Industry Sector, Unemployment Fund Membership Selected Coefficients, 1995.

	IND1	IND2	IND3	IND4
UF 95	[0.870]	[0.795]	[0.837]	[0.830]
θ^A	5.466 (0.245) [0.060]	3.2320 (0.176) [0.059]	4.803 (0.581) [0.069]	3.383 (0.189) [0.054]
B	0.420 (0.009) [12.460]	0.293 (0.008) [11.975]	0.338 (0.018) [12.460]	0.310 (0.007) [12.006]
S	-0.047 (0.004) [3.669]	-0.044 (0.004) [3.768]	-0.049 (0.007) [2.816]	-0.033 (0.003) [4.238]
Pseudo-R ²	0.357	0.281	0.221	0.232
Sample Size	59,398	52,848	14,847	68,857

Source: Danish Statistics. Standard error of estimates are reported in parentheses, variable means in brackets. []

IND1: Agriculture, Construction, Manufacturing (1-3)

IND2: Wholesale and Retail, Catering, Low Skilled Service (4-7,9)

IND3: High Skilled Service, Finance (8,10)

IND4: Public Sector (11-14)

All the key variables have strongly significant coefficients of the expected sign. Unemployment risk and the generosity of the U-fund and social assistance influence the U-fund decision in strong and predictable ways that are stable across age. The magnitudes of the coefficients do vary across age brackets, with the membership decisions of the young and the old especially sensitive to unemployment risk. Nonetheless the qualitative structure of the findings remains robust for the three age groupings. Two exceptions are education level and the presence of children in the household, which affect the insurance decision very differently for young workers and old. For young workers, high education levels are correlated with recent entry into the labor market; for older workers, this consideration is no longer relevant. Concerning children, older people are less likely to be financial responsible for their children and it is not obvious what coefficient signs to expect on the children dummies a priori.

Table 5

Logit Results By Age Group, Unemployment Fund Membership, 1995.

Variable	Age Intervals					
	18-34		35-49		50-65	
	Coefficient	Std.Error	Coefficient	Std.Error	Coefficient	Std.Error
$\hat{\theta}$	2.612***	0.110	1.263***	0.115	4.922***	0.174
B	0.296***	0.0062	0.229***	0.0065	0.351***	0.0098
S	-0.060***	0.0029	-0.037***	0.0030	-0.020***	0.0056
GROSSINC	-0.037***	0.0017	-0.028***	0.0009	-0.018***	0.0014
WEALTH	-0.001**	0.0004	-0.000	0.0001	-0.0004***	0.0001
FEMALE	0.512***	0.0247	0.704***	0.0266	0.554***	0.0493
CHILD0						
CHILD1-3	0.274***	0.033	0.087***	0.026	-0.195***	0.050
CHILD4+	-0.151	0.155	-0.127	0.092	-0.595	0.569
MARRIED	0.461***	0.036	0.278***	0.029	0.089*	0.049
Age18-25 SP	0.296***	0.008				
Age26-30 SP	-0.014	0.009				
Age31-35 SP	-0.015	0.012				
Age36-40 SP			0.022***	0.008		
Age41-50 SP			0.026***	0.005		
Age51-60 SP					-0.093***	0.005
Age61-66 SP					-0.226***	0.013
ED1						
ED2	0.366***	0.065	0.163***	0.051	-0.033	0.081
ED3	0.351***	0.065	0.048	0.049	-0.596***	0.074
ED4	-0.089	0.070	-0.452***	0.063	-0.762***	0.111
ED5	1.230***	0.064	0.516***	0.038	0.296***	0.040
ED6	0.943***	0.081	-0.191***	0.048	-0.309***	0.065
ED7	1.033***	0.079	-0.286***	0.044	-0.787***	0.048
ED8	1.060***	0.085	-0.074	0.052	-0.920***	0.065
PART-TIME	-1.856***	0.056	-1.150***	0.049	-0.237***	0.063
CONSTANT	-9.156***	0.185	-0.649***	0.102	-1.694***	0.141
Sample Size		84,318		86,738		49,189
Log likelihood		-29,621		-27,709		-16,347
LR χ^2		30,116		7,904		9,410
P-value of χ^2		0.000		0.000		0.000
Pseudo-R ²		0.337		0.125		0.223

Source: Danish Statistics.

SECTION VIII

THE U-FUND MEMBERSHIP DECISION: CONDITIONAL LOGIT ESTIMATES

It is unlikely that we have included all the factors that systematically determine either unemployment risk or U-fund membership, which raises concerns about unobserved heterogeneity in both the unemployment and the U-fund models. In particular, the worker's attitudes towards risk and taste for work are crucial and yet unobservable. Moreover, the degree of risk aversion might influence not just the insurance decision, but also influence 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 both steps, the unemployment risk and the insurance decision estimations. Fortunately we could obtain data for 1993, so that we can estimate a "fixed effects" model of U-fund membership (the 1995 model uses 1994 and 1995 data, so the 1994 model requires 1993 and 1994 data).

Chamberlain's conditional logit model is a natural estimating structure, Chamberlain (1980, 1984).³⁵ The model requires that the sample be limited to status changers only. The dependent variable in the conditional logit is a dummy equal to one if the individual moved from non-membership to membership in a U-fund between November of 1994 and November of 1995 and zero if she moved from membership to nonmembership. The probability that an

35 Bjorklund (1985) provides an early application to unemployment models.

individual makes a transition from membership to nonmembership or the reverse is driven by changes in the values of the covariates, so fixed effects (and any time-invariant covariates) are eliminated from the analysis, permitting unbiased estimation of the remaining variables.

Limiting the sample to U-fund changers dramatically reduces the size of our sample. The sample size problem is made more severe when combined with the evidence that model parameters vary with age, so that it is appropriate to partition the sample by age. The limited number of insurance status changers arises no doubt in part because of the investment aspect of U-fund membership that one must belong to a U-fund for one year before becoming eligible for benefits upon entering unemployment. This investment consideration has the effect of limiting U-fund exits, though not entries, and we would expect only a small number of exits from U-fund status in any year. When people eventually leave the labor force they do it as U-fund members.

Because of these considerations we limit our conditional analysis to the young. In particular we estimate the conditional logit on a sample of workers between the ages of 18 and 34, a group dominated by entry into U-funds. This age group, although only 38 % of our total sample, captures 73 % of all U-fund status changers. This age group is also likely to be unaffected by efterløns considerations.

The logic of the fixed effects analysis of U-fund decisions applies as well to the worker's unemployment experience – the parameter estimates may be affected by unobservables in that relationship, ones that are perhaps more or less constant from one year to the next for a given individual (like risk aversion, presumably). As a result we undertook a conditional logit analysis of the probability of being unemployed in the 48th week, and use that model to construct the estimated change in unemployment risk necessary for the estimation of the conditional U-fund logit. The details of the unemployment estimation and the parameter estimates of the resulting model are reported in the Appendix.

Table 6

Level and Conditional Logit Estimates Of Unemployment Fund Membership.
Workers Age 18 to 34, 1994 and 1995.

Variable	Model 1		Model 2	
	Levels Logit 1995		Conditional Logit 1994-1995	
	Coefficient (1)	Std.Error. (2)	Coefficient (3)	Std.Error (4)
θ^i	2.612***	0.110	0.792***	0.195
B	0.296***	0.0062	0.125***	0.016
S	-0.060***	0.0029	-0.032**	0.013
GROSSINC	-0.037***	0.0017	0.0212**	0.009
WEALTH	-0.001**	0.0004	0.0013	0.004
FEMALE	0.512***	0.0247		
CHILD1-3	0.274***	0.033	0.339*	0.179
CHILD4+	-0.151	0.155	-1.056	1.537
MARRIED	0.461***	0.036	0.145	0.223
AGE18-25 SP	0.296***	0.008	0.373*	0.198
AGE26-30 SP	-0.014	0.009	-0.031	0.193
AGE31-35 SP	-0.015	0.012	0.0158	0.206
ED2	0.366***	0.065	-0.211	0.909
ED3	0.351***	0.065	-0.572	0.8261
ED4	-0.089	0.070	-1.051	0.843
ED5	1.230***	0.064	2.753***	0.823
ED6	0.943***	0.081	2.491**	1.002
ED7	1.033***	0.079	3.361***	1.220
ED8	1.060***	0.085	4.674***	1.362652
PART-TIME	-1.856***	0.056	-2.284***	0.164
Sample Size	84,318		5463	
Log likelihood	-29,605		-1869	
LR χ^2	30148			
P-value of χ^2	0.0000			
Pseudo-R ²	0.337			

Data Source: Danish Statistics. The dependent variable is UF in Model 1 and dUF in Model 2, where dUF is a dummy variable equal to one if the worker entered a U-fund and a zero if she exited a U-fund. All independent variables in Model 2 are first differences. For the construction of $\Delta\theta$, the change in unemployment risk, see the Appendix. A coefficient is significant at level 0.01 when marked by ***; at level 0.05 when marked by **; and at level 0.10 when marked by *. The standard errors have been Murphy-Topel adjusted for the presence of an instrument.

We report in Table 6 the estimates of two models, a levels logit of U-fund membership in 1995 and a conditional U-fund logit model, which relies entirely on changes in the covariates between 1994 and 1995. The levels logit, whose coefficient and standard error estimates are reported in Columns (1) and (2), was estimated on the same sample to provide a comparison for the conditional logits; the level estimates are consistent in structure with those reported earlier.

More interesting are the conditional logit estimates reported in Table 6, Columns (3) and (4). If fixed effects have not biased the level estimates, the conditional logit estimates should parallel the level parameter estimates, although it is important to note that there is likely to be substantial sampling variation. The levels model is based on 84,318 observations, the conditional logit on only 5,463. The pattern of signs replicates those in the level regressions, although the conditional logit estimates would suggest that unobserved fixed effects seriously bias downwards the positive effects of high levels of education on U-fund membership *ceteris paribus*.

Of special interest to us, the three incentive variable coefficients in the conditional logit replicate the sign pattern of the level regression. Greater unemployment risk significantly increases the likelihood of U-fund membership, as do more generous unemployment benefits, while more generous social assistance benefits reduce the likelihood.³⁶ The absolute magnitudes of the effects are sharply lower than the level estimates, however – by 67 %, 56 %, and 45 % for unemployment risk, unemployment benefits, and social assistance benefits respectively. We are unsure which set of estimates is superior; the conditional estimates are theoretically preferred if “fixed” effects are the only problem with model specification, but these estimates are not as robust as the level estimates based on more than 10 time as

36. Recall from Figure 1 that between 1994 and 1995 aggregate unemployment and UI-fund membership moved in opposite directions.

many observations. Tests suggest that both models produce consistent estimators.³⁷ Qualitatively both models signal that workers are sensitive to economic incentives in deciding to join a U-fund.

37. Using a Hausman (1978) test of the conditional model against the corresponding unconditional model (i.e., the levels model pooled over 1994 and 1995) we cannot reject the null hypothesis of homogeneity (no unobserved heterogeneity): Let ML indicate maximum likelihood and CML conditional ML, Var is the estimated covariance matrix computed for the maximum likelihood estimator β . The test is then based on the chi-squared statistics $(\beta_{\text{CML}} - \beta_{\text{ML}})'(\text{Var}[\text{CML}] - \text{Var}[\text{ML}])^{-1}(\beta_{\text{CML}} - \beta_{\text{ML}})$, which needs to be large to cast doubt on the hypothesis of homogeneity (the degree of freedom is equal to the number of regressors), and we get a negative number (interpreted as zero). Under the null hypothesis of homogeneity, the conditional estimator is still consistent; it is just not efficient. So our test indicates that both the unconditional and the conditional estimators are consistent. Had we rejected the null hypothesis for the alternative that would have suggested that only the conditional estimators are consistent (and efficient, then); the unconditional estimators would have been inconsistent.

SECTION IX

THE POLITICAL ECONOMY OF VOLUNTARY UI IN DENMARK: THE REVENUE GAINS FROM COMPULSION

The high take-up rate of U-fund membership and the appearance of adverse selection at the margins would both argue for conversion to a compulsory system. Finland and Sweden have programs that are more voluntary in form than spirit, each with subsidy rates of about 95 %. Indeed the Swedes briefly converted to a compulsory system in the early 1990s, although canceling that decision within a year. In this section we use our 10 % Danish sample to estimate the revenue gains that would result from instituting a universal, compulsory insurance system on Danish workers; in the process we identify the first-order gainers and losers of such a transition, and identify a major reason the voluntary program remains politically popular.³⁸

An unemployment insurance planner may or may not include the implications of a program rule change on the budgets of related programs, most obviously social assistance. We feel it is appropriate to consider these related savings and costs, but will compute the fiscal consequences of shifting from a voluntary system to a compulsory one under two assumptions: (i) that the policy planner calculates the consequences for the unemployment funds alone, a nonintegrated

38. We do not consider second order effects, including most prominently the possibility that low wage workers forced to pay into the U-fund may instead choose not to work at all.

computation, and (ii) that she considers the consequences for both the unemployment fund and social assistance, an integrated computation.

This distinct is an important one in the Danish system, because, under current Danish administrative rules, eligibility for unemployment insurance preempts eligibility for social assistance, at least as a matter of right. Under this rule, net revenue gains from compulsion in an integrated approach may be very large indeed, as a modest UI benefit may preempt a more substantial SA benefit. That is not a problem in the current voluntary system because rational workers will not join U-funds if they expect to receive greater benefits under social assistance. In a compulsory system the number of such perverse cases is likely to multiply. Indeed it is likely that low-wage workers, disadvantaged in this way, will be protected by placing a floor on unemployment benefit levels that insures that the individual's unemployment benefits do not fall below the social assistance benefits for which the individual was previously eligible. When considering the integrated model, we will calculate the revenue gains from compulsion under the current system and under a program in which unemployment benefits are automatically raised to cover SA benefits foregone plus the fund membership fee the worker is required to pay under the compulsory system.³⁹

We assume no behavioral responses to the voluntary/compulsory regime change. The most obvious concern would be the withdrawal of workers from the labor force if compelled to consume earnings insurance that they do not value at cost. This is likely to be a special problem among low-wage workers who did not take up U-fund membership because of the presence of a social assistance alternative, but only if workers are made financially worse off by the regime shift. In the integrated system in which low-wage workers are guaranteed net U-fund payments no lower than their current potential social assistance payments, this is not a problem. Although high-wage workers compelled to join a U-fund would suffer utility losses from

39. The "fee" in a compulsory system is essentially a form of payroll tax. For simplicity, we will assume the membership fee remains in place in a compulsory system, although that is only a question of terminology.

the regime change, the utility effect would likely be small and the impact on labor force participation slight.

Consider then the impact of universal compulsion on U-fund finances only. The calculation of the revenue gain is a simple one: for each individual in our sample who is not currently (1995) a U-fund member, we subtract the expected annual benefit payouts from the fee the individual is required to pay, and then sum across all nonmembers:

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

where:

- R^* : The aggregate U-fund revenue gain from universal compulsion;
and
- N : Nonparticipants in the voluntary U-fund.

Theory would suggest that R_i^* is a positive number for all nonparticipants in the unemployment fund; that is that fees should exceed expected payouts. This need not be the case if nonmembers are myopic, or if they economically rational, and currently rely social assistance that is more generous than net unemployment benefits.

The revenue gain calculations under compulsion are reported in Column 1 of Table 7 for the total sample and for various demographic subgroups, adjusted upward by a factor of 10 to account for the fact that we are using a 10 % sample. The net gains to the U-fund system are in fact negative, although not large. The U-fund system would pay out more in benefits than it collected in fees with compulsion. The net revenue loss in 1995 is about 600 million DKK (\$107 million) out of a total expenditure of about 25 billion DKK (\$4.46 billion), or about 2.4 % of the budget. The revenue losses are evenly split across gender. The education breakdowns and perhaps more clearly the income decile breakdowns in Table 8, Column 1 point to the social assistance system as the primary reason for the adverse financial consequences of making the system compulsory. Many workers who would find the U-fund financially attractive in expectation do not join, presumably because of the charity hazard.

Table 7

Potential Revenue Gains Of Compulsory U-Fund Membership: Denmark 1995 (In Mill. DKK).

	Number of Nonmember (10 % Sample)	U-fund Savings R*	U-fund/SA Savings R**	U-fund/Limited SA Savings R***
		(1)	(2)	(3)
TOTAL	43,905	- 598	2542	576
MALE	22,717	- 303	1452	410
FEMALE	21,188	- 296	1090	167
PRIMARY ED	21,392	- 551	1463	246
SECONDARY	11,646	- 144	406	113
SHORT TERT.	2,622	29	68	50
MEDIUM TERT.	4,456	81	122	102
LONG TERT.	2,959	45	81	62

Note: (5.6 DKK= \$1 US in 1995) The raw numbers in the 10 % sample are reported in Column 3, while the cost estimates have been expanded by a factor of ten to reflect population values. The alternative models of the revenue gain from compulsion are defined in the text.

Table 8

Potential Revenue Gains Of Compulsory UI By Population Gross Income Deciles Denmark 1995 (In Mill. DKK).

Income Decile	Max Gross Inc. (in DKK)	Nonmembers Of a U-fund (10 % Sample)	U-fund Savings R*	U-fund/SA Savings R**	U-fund/ Limited SA Savings R***
			(1)	(2)	(3)
1	117,352	16054	- 362	1910	202
2	145,105	5437	- 216	196	13
3	167,960	3447	- 113	47	7
4	188,147	2358	-57	24	12
5	206,461	1927	-30	26	18
6	225,410	1782	-10	25	22
7	248,290	1980	6	38	35
8	279,412	3877	37	66	64
9	341,592	3213	52	80	78
10	7,053,389	4830	95	128	126

Note: (5.6 DKK= \$1 US in 1995) The raw numbers in the 10 % sample are reported in Column 3, while the cost estimates have been expanded by a factor of ten to reflect population values. The alternative models of the revenue gain from compulsion are defined in the text.

Forcing all workers with a primary education into the U-fund system would impose a net drain on the U-funds of approximately one half a billion Danish crowns! Forcing all workers with some tertiary (post-secondary) education into the system would yield positive revenue, but only about 150 million Danish crowns (\$27 million). If it was possible to limit compulsion to the top four deciles of the income distribution, the gains would be only 200 million DKK (\$36 million), less than 1 % of program expenditures.

The fact that U-fund members are currently not eligible for social assistance benefits provides an additional potential government revenue gain from compulsion if we include social assistance savings. It is possible to calculate these savings in a manner similar to that of the last section: the aggregate (U-fund plus social assistance) revenue gain from the transition to a universal, compulsory system can be computed as:

$$R^{**} = \sum_I^N [f_i - \theta(B_I - S_i)]$$

where again S_i denotes the social assistance payment for which the i^{th} uncovered worker is eligible if he or she became unemployed. The preemption of social assistance payments surely contributes positively to the government's revenue gains from the introduction of compulsion. The results of this computation, in aggregate and by demographic group are reported in Table 7, Column 2, and by income decile in Table 8, Column 2. A shift to compulsory U-fund membership would result in government savings to the combined U-fund and social assistance programs of 2.5 billion Danish crowns (\$446 million), approximately 10 % of U-fund expenditures in 1995.

Any program change whose primary financial gain comes from social assistance savings is likely to have troubling distributional effects and this is clear from the demographic breakdowns in Tables 7 and 8. About 60 % of the projected cost saving comes from primary education workers, Table 7, Column 2. More than 80 % of the program revenue gain from compulsion would be extracted from the lowest 30 % of the gross income distribution, Table 8, Column 2.

These revenue gains are probably illusory to the extent that they reduce the economic well-being of low-wage workers, particularly those who suffer unemployment. A more meaningful calculation is the revenue gains to compulsion that arise when the economic well-being of social assistance beneficiaries is protected. Within the context of the U-fund, this is equivalent to assuming that unemployment fund benefits cannot be less than the social assistance benefits for which the unemployed worker is currently (1995) eligible plus the membership fee. Denote by R^{***} the aggregate revenue gain when the economic well being of current social assistance eligibles is protected, so that

$$R^{***} = \sum_I^N [f_i + \theta S_i - \theta \max\{0, (B_i, S_i + f_i)\}]$$

With this benefit protection, the total government saving in the two programs is about one quarter of the combined saving without that protection, or 576 million DKK (\$103 million), about 2.3 % of total U-fund expenditures in 1995, Table 7, Column 3.⁴⁰ Almost all these savings are generated from social assistance eligibles who do not become unemployed, yet now must pay the U-fund membership fee. The distributional consequences are self-evident. Even with the social assistance benefit protection, almost 40 % of the revenue gain comes from workers with basic education, Table 7, Column 3, and 35 % from the lowest three deciles of the earnings distribution, Table 8, Column 3. The unfavorable redistributive aspect may explain why Sweden's experiment in the early 1990s with compulsion was reversed after only a year.

40. We have ignored possible adverse effects on low-wage workers' labor supply induced by a reduction in the wage income and SA-benefits differential. The complete system, with voluntary membership and relatively high SA-benefits in fact functions like an "earned income tax credit" which is then removed in our third experiment.

SECTION X

CONCLUSION

By what is perhaps an historical accident, the Danish unemployment insurance system, having grown out of trade union programs, is voluntary although heavily subsidized. This permits us to assess empirically the unemployment insurance demand functions that are crucial to the assessment of alternative public systems. Voluntary programs with user fees induce workers who seriously demand this insurance to reveal themselves. This selection gain over universal compulsion increases with the extent of the working population that is not interested in purchasing unemployment insurance. Of course the selection gain requires that the selection be efficient, a requirement that need not hold if (i) workers are myopic or individually rational in a way that subverts selection, or (ii) system prices do not reflect “market” values. Perhaps of the greatest concern to program administrators are that low risk workers have an obvious incentive to avoid the system because of the absence of risk rating of premiums. Free-riding on other social insurance programs also involves selection that is not socially efficient.

Viewed from the perspective of the small take-up rates of federal flood insurance in the United States and of private unemployment mortgage insurance in the United Kingdom, the 80 % take-up rate of public unemployment insurance in Denmark is extraordinary. The reason for this high take-up rate is less clear. The substantial 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, so that the secure are willing to subsidize the insecure, and/or (iii) the tied-in early retirement scheme (efterløn). Perhaps studies of participation rates for other types of insurance with less obvious social implications will provide an answer to that deeper motivational question.

The analysis does indicate that the workers who choose to opt out of the system have good economic reasons for doing so. The fixed unemployment fund fee and fixed benefits for most workers leads to the hypothesis that fund membership should be sensitive to unemployment expectations, a hypothesis that the data strongly confirm.⁴¹ For those workers below the benefit ceiling, there is a second hypothesis, that those with high replacement rates should join unemployment funds. This hypothesis is also confirmed when we control for a countervailing force among low-wage workers, the impact of the social assistance program. The charity hazard is high in the Danish unemployment insurance system.

The high voluntary participation rate and the substantial adverse selection in the participation decision both argue for a compulsory public system (or better risk rating of individual workers). What then can explain the political support in Denmark for such a system? One natural place to start is to identify the gainers and losers from converting the system to a universal compulsory one. The projected revenue gains from a transition to a compulsory system are modest but not inconsequential. We estimate that the net gain to the unemployment funds (fees collected less expected benefit disbursements) would be on the order of 2.5 billion DKK (\$446 million) if the implicit savings from the preempted social assistance payments were included as revenue gains. More interesting is the identity of the losers. A significant share of the increased revenue, about one

41. These significant adverse selection estimates of the voluntary public system cannot be carried over to private insurance systems. The total absence of risk rating in premium setting makes the adverse selection losses especially severe, so it is hard to assess the extent of adverse selection under optimal underwriting. On the other hand it is difficult to conceive of a voluntary public system that incorporates severe risk rating, and it is easy to imagine that the adverse selection losses would be much grander were the subsidization rate any less extravagant.

half, comes from low skilled workers. If we assume that unemployment benefits are adjusted upward so that social assistance eligibles are made no worse off by the transition to a compulsory system, the redistribution is less stark, but the net revenue gains shrink by 60 %. Given that any revenue gain from such a transition is disproportionately derived from the unskilled, it may not be accidental that voluntary systems remain in place in welfare states with a high universal safety net.

APPENDIX

Estimation of a Flexible Form Conditional Logit Model of Unemployment Risk

The Chamberlain conditional logit model proposes the estimation of a logit model on status changers only; essentially a difference model results in which the dependent variable is a dummy indicating a positive status shift, in this case, moving from unemployment to employment, and the independent variables are changes in the time-varying covariates. There were 10,797 usable unemployment status changer observations in our sample between 1994 and 1995.⁴²

While the parameters of the U-fund membership decision are quite plausibly stable across years – assuming of course no major change in eligibility rules – the same is not true of the unemployment model. The locus of unemployment activity across occupation, industry, education, and gender, for example, can easily vary across years. We therefore estimate a more flexible form of the conditional logit in which the covariate and its lag are estimated unconstrained. We

42. We were also forced to exclude all observations in which there was a status change in unemployment between 1993 and 1994 because these observations (7,359) perfectly predict status change between 1994 and 1995. One cannot both enter unemployment between 1993 and 1994 and between 1994 and 1995, having already entered in 1995. These estimates therefore should literally be interpreted as descriptive of unemployment change behaviors among workers who did not change unemployment status between 1993 and 1994.

appreciate the mild inconsistency of the assumptions that (i) the parameters of the unemployment model may change, but that the “fixed effects” constants do not. The resulting estimates should be viewed only as an approximation.

Because the data are generated from administrative annual accounting, we cannot estimate the coefficients of all variables unconstrained. In particular industry and occupation refer specifically to labor force status in week 48 and are not available for individuals unemployed at that time (equivalently, in this data unemployment is considered an industry/occupation: either an individual is unemployed, employed, or out of the labor force and if you are unemployed at the week of counting you cannot hold job and thus no occupation or industry is recorded). It is possible, however, to estimate the remaining covariates flexibly, and we do that for all covariates except the upper bound age dummy (there is no higher category into which initial members of this category can transit).

We estimated the (partially) flexible form model of the conditional unemployment logit, and report the resulting coefficients and standard errors in the Appendix Table, Columns 1-2. The coefficient cells reflect the corresponding estimates for the (1995,1994) pairs if the variable is estimated flexibly.

A likelihood ratio test rejects the hypothesis that the restriction imposed in the simplest first difference model – that the coefficients of the time-varying variables and of their lagged values are of equal absolute size and of opposite sign – are valid. Among the covariates that break the current/lagged value constraints of being of the same magnitude but opposite sign, the lagged unemployment experience variables stand out. The lagged fraction of the year unemployed (unadjusted for weeks in the labor force, a variable we do not have) has a strong negative effect on unemployment experience (the coefficient is -6.7907). The twice-lagged value of this coefficient is estimated to be -3.205, not +6.7907, and significant different from zero. This may indicate that our one period lag structure in the levels model is too constraining.

This model is used to estimate the unemployment status change variable required for the estimation of the conditional logit of the U-fund decision.

Appendix Table 1

Flexible Form Conditional Logit Estimates Of Unemployment Risk, 1994-1995

	Coefficients	Stand.Errors
	1995, 1994 (1)	1995,1994 (2)
AGE18-25 SP	-0.7663, 0.8157	1.2400, 1.2295
AGE26-30 SP	-0.9702, 0.9882	1.1837, 1.1713
AGE31-35 SP	-0.9040, 1.0654	1.1157, 1.0992
AGE36-40 SP	-1.3128, 1.2087	1.0310, 0.0125
AGE41-50 SP	-1.1544, 1.2187	0.9500, 0.9435
AGE51-60 SP	-1.2159, 1.1974	0.8562, 0.8422
AGE61-66 SP	-0.11638	0.3054
ED2	1.5090, -1.3563	0.8865, 0.8865
ED3	0.3114, -0.2236	0.4903, 0.4932
ED4	-0.0540, 0.0832	0.8525, 0.8772
ED5	1.9915, -1.9863	1.2584, 1.2549
ED6	1.6290, -1.5543	1.2154, 1.2357
ED7	1.9315, -1.5008	3.4757, 3.4823
ED8	3.8700, -3.1747	7.6846, 7.6840
dSKLD 94	0.345718	0.355762
dCLER 94	-0.27569	0.240786
dMNGR 94	-0.0333	0.337697
DDIR 94	-1.10388	4.893742
DSE 94	-0.47058	0.487034
dLEAVE 94		
dSTUD 94	-1.29579	0.647727
dPEN 94		
dOLF 94	-0.59858	0.352789
dMANUF 94	0.587109	0.340709
dWHOLE 94	0.737425	0.408014
dCONST 94	0.277678	0.443727
dRETAIL 94	-0.13764	0.462695
dCATERING 94	0.438636	0.483382
dTRANS 94	-0.12845	0.421056
dFINANCE 94	0.79897	0.780482
dSERV-LOW 94	0.074244	0.402365
dSERV-HIGH 94	0.080265	0.563715
dPUBLIC 94	-0.13967	0.316323

MARRIED	-0.0406, 0.0223	0.2370, 0.2411
CHILD1-3	-0.2404, 0.0152	0.2276, 0.2270
CHILD4+	1.0638, -1.4920	0.9373, 1.0149
U-YR 94	-6.7907, -3.205	0.2494, 0.2143
U 94		
UF/SA 94	-0.3281, -1.9831	0.3343, 0.2755
B	-0.2270, 0.0308	0.0132, 0.0132
S	0.0025, 0.0033	0.0163, 0.0179
GROSSINC94	0.0304, -0.0098	0.0119, 0.0089
WEALTH94	0.0069, -0.0031	0.0036, 0.0036
PART-TIME	-2.8444, 2.0646	0.3682, 0.3755
CONSTANT	8.506857	2.224454
<hr/>		
Log Likelihood		-1611
LR χ^2		10328
P-value of χ^2		0.0000
Pseudo-R ²		0.762
Number of observations		10,797
<hr/>		

Data Source: Danish Statistics. The sample size is. The dependent variable is DUF95; differences are denoted by the D operator and refer to 1995-1994 differentials unless denoted by 94, which indicates 1994-1993 differentials. The base group is male, single with no children, and only basic education.

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VOLUNTARY PUBLIC UNEMPLOYMENT INSURANCE

Voluntary public unemployment systems, once widespread, are now limited to a handful of countries, including Finland, Sweden, and in a more substantial way Denmark.

This analysis indicates that the workers who choose to opt out of the system have good economic reasons for doing so. The fixed unemployment fund fee and fixed benefits for most workers leads to the hypothesis that fund membership should be sensitive to unemployment expectations, a hypothesis that the data strongly confirm. For those workers below the benefit ceiling, there is a second hypothesis, that those with high replacement rates should join unemployment funds. This hypothesis is also confirmed when we control for a countervailing force among low-wage workers, the impact of the social assistance program. The charity hazard is high in the Danish unemployment insurance system.