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Entrepreneurial Moral Hazard in Income Insurance

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Entrepreneurial Moral Hazard in Income Insurance:

Empirical Evidence from a Large Administrative Sample

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July 2008

Abstract

We study risk behavior of Danish self-employed entrepreneurs, whose income risk may be driven by both exogenous factors and effort choice (moral hazard). Partial insurance is available through voluntary unemployment insurance (UI). Additional incentives to sign insurance contracts stem from a UI-embedded, government-subsidized early retirement (ER) program, giving benefits that are unrelated to business risk. Indeed, we argue that the self-employeds' incentives to insure themselves stem from the ER plan rather than from the UI cover. We show how to use a policy reform to identify moral hazard in observed transitions to unemployment when insurance is a choice variable. We use administrative (register) panel data covering 10% of the Danish population. We find that the insured are indeed more likely to transit into unemployment than the uninsured, once we properly instrument for the insurance choice.

Keywords: entrepreneurs, self-employment, early retirement, unemployment insurance, moral hazard, Denmark, panel data

JEL codes: C33, D12, D14, D91, J23, J26

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1 Introduction

How important is moral hazard for entrepreneurial ventures in the face of existing insurance mechanisms?

There is little empirical work addressing this important issue. The notion that moral hazard is at the heart of financial market imperfections that inhibit *start-up* of new or survival of existing firms and lead to an inefficiently low level of entrepreneurial activity, is widespread in the theoretical literature. The issue is typically addressed in the context of principal-agent relations, say, between an entrepreneur and a lender (Bergemann and Hege, 1998, Repullo and Suarez, 2000, Clementi and Hopenhayn, 2006).

Paulson *et al.* (2006) do provide empirical analysis based on cross-sectional household-level data from Thailand. They study the differential implications of financing constraints arising from limited liability and from moral hazard for entry into entrepreneurship. They find that moral hazard is the dominating of both sources.

In this paper, we complement the Thai evidence with longitudinal Danish micro data in the context of income insurance. Instead of studying selection into entrepreneurship, we identify ex-ante moral hazard that can manifest itself in the *exit* transition to bankruptcy when the entrepreneur is partially insured. For the vast majority of self-employed entrepreneurs in Denmark, not bankruptcy protection, but rather unemployment insurance (UI) provides the prime source of insurance against the risk of business failure. Is failure due to lack of effort?[1]

The exceptionally rich data we use are from a 10% random sample of the Danish residential population, and come in the shape of classical panel data (longitudinal individual observations at annual frequency), spanning 20 years. All information derives from government registers, most notably population registers and tax and benefit administration records. We shall focus our analysis on a sample of self-employed workers.[2]

[1] In relation to the labor economics literature, we are interested in the effect of insurance on the incidence of unemployment caused by reduced worker effort to avoid unemployment (see Mortensen (1990) for job-search theoretic modeling). Empirical evidence is lacking, however, presumably due to near-universal UI coverage of workers in most countries. Instead, the labor literature has focused on demand effects of UI on layoffs, an aspect we can ignore since all agents of interest are self-employed.

[2] Lacking firm characteristics (and measures of personality traits) in our data, we equate entrepreneurs with self-employed.

The main idea of this paper is straightforward to understand, once the institutional context has been sketched.

UI in Denmark is a large insurance program and of first-order importance for self-employed's income risk. Unlike in other countries, obtaining UI cover is at the discretion of the individual that can make a take-it-or-leave-it choice over an exogenously set insurance contract whose parameters do not vary in the population. Insurance is highly subsidized by the government, and applicants cannot be rejected. While these features absolve us from modeling contract characteristics, we may not be able to tell whether observed unemployment or bankruptcy propensities are due to adverse selection (the bad risks sign up for the contract) or moral hazard (lazy and insured entrepreneurs let themselves slip into unemployment). After all, both effort taking and risk propensities are (at least partially) unobservable.

While we can control for industry risk (or peer-group risk) to characterize unemployment risk classes, we need an instrument that captures variation in the demand for insurance without being correlated with unobserved factors in an equation measuring unemployment risk in order to identify moral hazard.

Such an instrumental variable is provided by an orthogonal incentive to join the UI system: insurees have the option to participate in an early retirement (ER) program (de-coupled from social security) which is not available for non-insured. Eligible participants can leave the labor force seven years before standard retirement age, but need to have signed up before a certain threshold age. As the ER option is unrelated to income risk, it will not affect effort taking directly. Since ER eligibility is directly linked to the insurance choice, we can use it as an instrument to identify the effect of effort taking on unemployment or bankruptcy risk. More precisely, we do not want to rely on actual (endogenous) use of the ER option, but rather on the change of the eligibility (age-based) rule itself. For this, we exploit a policy change that occurred half-way through our sample period: the threshold age was lowered drastically by 10 years.

To illustrate how this policy change affects insurance behavior, Figure 1 shows for the cohort of males born in 1945 UI insurance rates as a function of time. The policy change ('reform') leads to a discrete jump of enrollment between ages 47 and 48 by 11.5 percentage points. This is the exogenous variation in insurance demand that we shall exploit in this paper for identification of the moral hazard

effect.

Figure 1 about here

We find that if we insured a randomly chosen entrepreneur (using our instrumental variable), we would see him becoming unemployed subsequently with increased probability. In other words, we find strong evidence of effective moral hazard, which is in contrast with findings elsewhere in the recent empirical insurance literature that studies car liability insurance (Chiappori and Salanié, 2000, Abbring *et al.*, 2003). As these studies focus on compulsory insurance, selection issues are of no importance. While our institutional context applies to both self-employed and wage-employed alike, we shall demonstrate that the variation in incentives operates much stronger on the self-employed.[3]

Summarizing the contributions of the present paper, we provide first-time empirical evidence on the relevance of moral hazard for entrepreneurs within a "large insurance program". We provide a link between the risk of bankruptcy and incentives to insure that are unrelated to risk-reducing benefits of insurance, and show the identification of moral hazard through institutional design. We show empirically that the self-employed have a demand for insurance, and we take care of the endogeneity of insurance choice by exploiting exogenous variation in the sample that comes about by way of a policy change ('natural experiment'). We document that our findings survive various sensitivity checks. The theoretical model is very close to a standard insurance problem and yet encompasses all relevant features of the existing institutional setting. Our empirical estimating equations are directly implied by our theoretical approach. We comment extensively on the validity of our instrument.

The remainder of the paper proceeds as follows. In Section 2 we review briefly some of the related literature, Section 3 provides relevant details on the main institutional features of the Danish UI and ER system. Section 4 contains our insurance model and puts it in the institutional context. Section 5 gives a brief data introduction, specifies clearly how our instrumental variable is defined and provides descriptives and the intuition of where identification comes from in the data. Section 6 contains a brief review of estimation strategy, presents estimation results and comments on sensitivity checks. Section 7 concludes.

[3]Lentz (2008) uses a Danish sample of wage workers and finds in an estimated job search model with endogenous search intensity that the moral hazard effect (measured by increased unemployment duration) is limited.

2 Related Literature

We study entrepreneurial income risk as outcome for those that choose to be (partially) insured. How much of a bankruptcy probability can be attributed to a moral hazard effect? While the question has not been addressed before, related literatures exist that cover issues of entrepreneurial risk taking and risk attitudes, labor market transitions between self-employment and unemployment, and studies on entrepreneurial moral hazard.

Risk taking and the role of available insurance mechanisms have always been perceived to be important for entrepreneurial activity. Assuming that risks are exogenous, some authors have made important contributions by studying the implications of risk attitudes for selection into entrepreneurship. Kanbur (1979) and Kihlstrom and Laffont (1979) are two seminal papers that explore the comparative statics of a change in risk aversion. Their well-known results conform with intuition: risk averse individuals are likely to shun entrepreneurship, and increases in risk aversion decrease overall risk taking and hence productivity and growth.

These papers generated an empirical literature trying to establish whether the self-employed or entrepreneurs are indeed more tolerant to risk, typically with mixed results. Rosen and Willen (2002), for instance, suggest an indirect approach by comparing consumption levels and income variances between self-employed and wage employed. They conclude that differences in risk attitudes do not drive occupational choice.

A related, but different literature, assesses business risk by studying observable labor market transitions into and out of self-employment.

Evans and Leighton (1989) emphasize the need for using panel data and conduct a transition study using 12 longitudinal observations of the National Longitudinal Survey of Young Men. They document the duration dependence of self-employment. Bates (1990) studies entrepreneurial survival using the Census Bureau's 1982 Characteristics of Business Owners survey, which has measurements taken based on tax filer status in 1982, and is completed with retrospective survey information from 1986. Bates focuses on human capital effects on business survival until 1986, both direct and indirect (via raising external financial capital). Holmes and Schmitz (1996) use the same database to explain exit, focusing on

the difference between managerial tenure and business age. Lin *et al.* (2000) study entry and exit using Canadian micro panel data. While those papers use discrete choice models, others conduct duration-type analyses. Carrasco (1999) uses quarterly data from seven years of the Spanish Family Expenditure Survey (rotating panel) and estimates competing risk models. Her paper pays particular attention to the effect of previous spells of unemployment on self-employment duration. Taylor (1999) uses survey data from the British Household Panel Study and focuses on survival, distinguishing 'voluntary' from 'involuntary' (bankruptcy) exit. Martinez-Granado (2002) estimates multiple-state transition models on the same data, and focuses on unemployment as a driving force for entry. Aggregate unemployment appears to push the unemployed into self-employment, although previous unemployment experience is detrimental for entry.

Madrian's (1994) analysis of job-to-job mobility documents job-lock effects when transitions are associated with loss of employer-provided health insurance cover. Holtz-Eakin *et al.* (1996) extend this idea by looking specifically at transitions from wage-employment to self-employment, using richer data from two panel data sets. They find, unlike Madrian, no job-lock effect, a result that they attribute to unobservables such as low risk aversion of nascent entrepreneurs.

Moral hazard plays a prominent role in an active theoretical literature that studies incentive provision through contracts when the entrepreneur contracts with a financier or a worker.

Repullo and Suarez (2000) study the relationship between a liquidity-providing lender and an entrepreneur whose effort affects the lender's return. They determine endogenously which firms will rely on external market finance and which obtain monitored bank credit. Clementi and Hopenhayn (2006) draw out the implications for firm growth and survival when borrowing constraints are an endogenous feature of optimal lending contracts under entrepreneurial moral hazard. Bergemann and Hege (1998) study a related, dynamic moral hazard problem, where entrepreneur and lender learn about each other as uncertainty about the value of the project to be financed is resolved over time.

Chakraborty and Citanna (2005) and Newman (2007) study occupational self-selection where entrepreneurship is taken to be the riskier occupation and wealth is the important source of heterogeneity in the population. For instance, Newman assumes decreasing absolute risk aversion and studies the sorting mechanism when moral hazard is present. One of his central results is that for moral hazard effects to

be ameliorated in private contracting, the rich need to bear more risk than the poor and may therefore be driven out of entrepreneurship.

None of these theoretical papers provides evidence allowing to gauge the empirical importance of entrepreneurial moral hazard. Tests of moral hazard that can be envisaged with real-world data would typically be tests of residual moral hazard that remains after optimal contracts have set incentives for effort provision. Perhaps, therefore, it is not surprising that evidence is hard to find.

Paulson *et al.* (2006) are possibly the first authors that try to establish whether moral hazard can explain the positive wealth-entrepreneurship gradient that is observed in the data. Their evidence is based on a cross-section of non-urban households in two areas of Thailand. These households can choose to set up a non-farm business, in which case they are counted as entrepreneurs. The model explicitly distinguishes moral hazard from limited liability (non-negative wealth). Paulson *et al.* show that moral hazard is an important empirical phenomenon since its presence is consistent with much of the observed variation in the data.

The present paper provides complementary evidence, using an institutional channel that has not been looked at before in the context of the self-employed. As many other papers, we study labor market transitions. However, we propose to identify moral hazard in unemployment insurance, which constitutes the prime insurance mechanism for a self-employed entrepreneur who has to terminate his business.

Our simple strategy of detecting moral hazard is presumably helped by the fact that it is unlikely that the existing UI system optimally sets incentives for effort provision. However, since participation in the insurance scheme is voluntary, the propensity to insure oneself is arguably related to the riskiness of the entrepreneurial venture. This implies that we have to properly account for the endogeneity of insurance choice in order to be able to tell whether it is an effect of being insured per se that makes insured individuals more likely to transit into unemployment than non-insured.

To understand how we can do this, we now provide some details on the institutional frame.

3 Institutional Background

The vast majority of firms in Denmark are small, unincorporated businesses in sole proprietorship. 90% of all firms have less than 10 employees (in 1999). Self-employed entrepreneurs have two main formal income insurance mechanisms at their disposal: bankruptcy proceedings and unemployment insurance. There are two types of proceedings in which the bankruptcy law foresees: those extending to corporate liabilities, and those intended for personal liabilities including debt of unincorporated businesses. The latter protection was included in the bankruptcy reform act of 1984 in Denmark, making discharge of some part of debt possible for small firms but typically involving a repayment plan out of income for the remainder of nondischarged debt.

We argue, however, that bankruptcy proceedings are not of first-order importance for the majority of self-employed entrepreneurs. Unlike in the United States where insolvency is not a necessary condition for bankruptcy and debt discharge, filing for bankruptcy in Denmark is tied to being "hopelessly indebted and [...] the proceedings [being] warranted by the circumstances of the debtor" (Alexopoulos and Domowitz, 1998). Out-of-court settlements are subject to rules and discretionary negotiation outcomes. Thus, bankruptcy, insolvency, and debt restructuring will apply only in the minority of cases where a self-employed person terminates his business. In many cases, decreasing or nonpositive profits will be reason enough to close shop, without being insolvent.

Rather, unemployment insurance provides the main mechanism to partially insure against income losses. Denmark is one of the very few countries where unemployment insurance is voluntary[4] and where, quite uniquely, also the self-employed can insure themselves along with wage employed workers (Schoukens, 2000).

The insurance system is organized around about 35 private, industry/occupation-specific unemployment insurance (UI) funds. They cover a large majority of workers (Parsons *et al.*, 2003). There was historically a strong link between UI funds and trade unions, but UI fund membership is not conditional on union membership. A typical UI fund is a not-for-profit organization without selection restrictions for applicant members. UI funds finance UI benefits through membership fees, payroll taxes ('arbejds-

[4] Sweden and Finland are the only two other countries we know of

markedsbidrag') and government subsidies.[5] The benefit rule is simple: insured can receive up to 90% of previous earnings, subject to a ceiling and a floor. Ceiling and floor are typically fixed in nominal terms and only adjusted irregularly to nominal wage growth.[6] Figure 2 illustrates the benefit rule, where $\underline{w}$ corresponds to the floor and $\overline{w}$ to the ceiling.

Figure 2 about here

Benefit duration can be characterized as generous in international comparison: this used to be 36 months during the 1990s, but has been changed to include activation programs with mandatory participation that starts within 12 months of first registration; maximum duration of UI benefits from 1996 onwards is 60 months.

The premium, or fee, paid by individual workers can amount to around 10,000 DKK per year, depending on age and insurance status.[7]

Typically, UI fund members working full time will have to insure themselves as on full time basis, part time workers can choose full time or part time equivalence insurance. Individuals wishing to draw UI benefits will have to have been member of a UI fund for at least one year and be able to show that they have been working accordingly (typically half a year during the last 12 months preceding application). (Beskæftigelsesministeriet, 2001; website arbejdsdirektoratet; MISEP (1997)).

There are mainly two funds that focus on the self-employed, DANA and ASE. The funds are free (within legal limits) to determine regulation of benefit entitlements, although there tends to be close alignment. Self-employed's insurance status is restricted to always being full time. To illustrate, according to ASE[8] regulations, the self-employed and entrepreneurs can file for UI benefits in cases where all of the following conditions apply.

- the UI fund membership has lasted for at least 12 months

[5] Lentz (2008) reports that the average worker pays about 1/3 of the actual premium, the rest being subsidies.

[6] The ceiling amounted to about 135,000 DKK p.a. in 1996, 173,000 DKK p.a. in 2006. 1000 DKK $\approx$ 134 Euro or 172 USD in May 2006. The floor amounts to 82% of the ceiling, and is essentially due to minimum wage regulation that applies for wage employed (thus, about 142.000 DKK p.a. in 2006).

[7] The fee covers both insurance premium, administration fee, and, as explained below, a contribution to the early retirement system, and may differ between UI funds.

[8] `www.ase.dk`

- the applicant has worked at least 52 weeks full-time during the past 3 years, and has run his business for at least three years
- the applicant enrolls with the public job centre form the first day of unemployment
- the applicant is willing to take on any job as a wage employee; the benefit recipient must perform active job search while receiving compensation
- the business is sold, liquidated, or leased (mutually irrevocable for a period of at least five years).

The self-employed may also temporarily suspend their business and register as unemployed upon experiencing an extraordinary event. In such cases, the event must be beyond control of the self-employed and excludes ordinary industry risk (idosyncratic exogenous shock). Incomes must have been critically exhausted.

The amount of the UI benefit is a function of an average of profits of the two best performing annual financial reports within the last five financial years during which the applicant was UI fund member. The parameters of that function are set centrally and are not at the discretion of the fund: the rate equals 90% of the average profit (excluding interests, including depreciations and labor market contribution), bracketed by a ceiling and a floor. The ceiling/floor correspond to that for workers,[9] and Figure 2 applies likewise. In the data, the vast majority (exceeding two in three) of self-employed would face potential benefits corresponding to the ceiling, and much of the rest (about one in five) would see potential benefits corresponding to the floor.

Certain limitations apply. For instance, the law stipulates that a period of deferral (suspension) of 3 weeks applies before any benefits can be drawn. The maximum duration of benefits equals 4 years. The unemployed will receive offers of activation from a government institution within the first 12 months of unemployment. This might be wage employment with a subsidized wage payment or further educational activities, also subsidized by the government.

Jobless persons not covered by UI fund benefits, including those who have exhausted the maximum benefit period, can receive social assistance. The social assistance depends on spousal income and indi-

[9] see footnote 6; for temporary suspensions, the benefit rate equals 80% of the ceiling.

vidual circumstances, but is for the vast majority considerably lower than the UI-benefit. Municipalities can, however, coerce recipients to work in public sector jobs.

The Danish old-age retirement pension is compulsory and foresees in retirement from age 67 onward. Integrated in the UI fund system, however, is an early retirement (ER) option open to UI fund members, allowing retirement at a reduced pension from age 60 onwards. The ER scheme was introduced in 1979, with an eye towards general labor market conditions at the time, and politically supported with the argument that it would bring relief to 'worn-out' blue-collar workers. Access to the ER system is possible irrespective of whether an individual is a wage earner or self-employed. The latter have to sell their business before they can claim benefits. UI fund members aged 60 and older used to qualify if they had been enrolled in the UI system for the last 10 years, typically leading to a spike in the enrollment hazard at age 50, both for wage earners and even more pronounced for self-employed workers.

Importantly, there is no additional premium associated with benefiting from the ER plan. In other words, ER can be had at zero marginal cost for the interested participant. ER benefits correspond to the UI benefits, as discussed earlier. However, once an individual has commenced his ER period, other labor market activities, and hence additional income generation possibilities, are precluded.

OECD (2006) illustrates the incentive effects of the ER system (and its current implementation) by showing that the 'implicit tax on continued work' from age 60 onward exceeded 50%. Due to these incentives and because of its generosity, ER became a very popular exit route from the labor force, but caused financial strain to the system and hampered productivity growth. The most important reform during the early 1990s concerned a policy shift in 1992 that required continued membership of at least 20 years before retirement, implying the latest age for joining a UI fund decreased to 40. Individuals aged between 40 and 50 in 1992 were required to join the UI fund in 1992 and stay members until 60 if they were to collect early retirement benefits. For reference, we shall denote members of the cohort unaffected by the 1992 reform as being subject to the 10-year-membership rule, while those who are falling entirely under the new regime as being subject to the 20-year rule. We shall show below that the empirically relevant variable for enrollment is the implied age threshold and not membership duration per se.

The ER system was substantially overhauled in 1999. We shall be looking at the situation in the

years before the 1999 reform.[10]

Summarizing, while unemployment insurance in principle is available to the self-employed, the system is tilted towards benefiting wage employees. Possibly for reasons of moral hazard, the self-employed face tight eligibility and membership rules. The real benefit of joining a UI fund for the self-employed therefore lies in access to early retirement provisions.

During the sample period other self-employment-relevant policy changes were introduced. From 1986 to 1993, a special subsidy scheme was available that was aimed at the unemployed to setting up their own business. Eligible persons could receive 50% of the maximum unemployment benefit as a start-up allowance for a period of up to 42 months (iværksætterydelsen). With the advent of the 1994 labor market policy reform, which launched an array of active labor market programs, the scheme was re-designed (etableringsydelse), with maximum subsidy duration of 30 months, before it finally expired at the end of 1997. A first look at our data does not suggest these measures to be of much relevance for the behavior of interest, however.

4 A Model of Unemployment Insurance Choice

We now turn to modeling the choice of insurance against unemployment. The model will deliver empirical equations that can be used to estimate individual unemployment risk, and will identify the moral hazard effect of insurance on experiencing unemployment.

The model is fairly standard and static, and incorporates the salient features of the Danish unemployment system, as detailed in Section 3. An individual has a take-it-or-leave-it choice in terms of UI.

The insurance contract offered by UI funds is a undifferentiated pooling contract: it specifies a single premium and a single benefit which do not depend on insuree characteristics. UI funds have no possibility of declining membership to an applicant. However, they receive substantial government

[10] Focus of the reform was in particular flexibility in terms of retirement age and possibilities to continue paid work while receiving ER benefits. The reform also removed the tight link between UI fund membership and ER eligibility by making ER eligibility depend on a special contribution to the ER system independent of UI fund membership dues. (Beskæftigelsesministeriet, 2001, 2005).

subsidies. Subsidies render the insurance premium paid by insurees actuarially 'unfair' in the sense that the premium paid falls short of the expected loss.

As a consequence, UI funds are not concerned about selection issues, and there is no pricing response when the pool of insurees changes quality over time. No effort is made at separating the population of insurees in the system by offering a menu of contracts. Given these characteristics, we need not model the contract or any other decisions of the insurer.

Let us consider a utility maximizing agent whose utility function u depends on current consumption, C, and leisure, l. Since the model is static, consumption equals income. We make minimal assumptions on u.

Let $u(C,l)$ be twice differentiable and concave in each of its arguments, $u_1(C,l) > 0$, $u_2(C,l) > 0$, $u_{12}(C,l) = u_{21}(C,l) \geq 0$, $u_{11}(C,l) < 0$ and $u_{22}(C,l) < 0$. Income, and hence consumption, is a random variable since it depends on the state of the world. We consider two states: the agent is active as a self-employed entrepreneur, E, or he is unemployed, U. To simplify the exposition we normalize leisure to zero in state E, $l^E = 0$, and to one if unemployed, $l^U = 1$. Following Chiu and Karni (1998), we instead introduce a parameter $\gamma \geq 0$ capturing intensity of preferences for leisure in the utility function, such that $u = u(C, \gamma l)$.

Denote the probability of unemployment by $\pi \in [0,1]$. The expected utility can then be written

$$\mathrm{E}(u(C)) = (1-\pi) \cdot u(C^E, 0) + \pi \cdot u(C^U, \gamma).$$

Unemployment risk is partially insurable by paying premium P. Let s indicate the insurance status ($s = 1$ if the agent is insured and 0 otherwise). If the agent is insured he receives unemployment benefits B when unemployed. Reflecting Danish institutions to first approximation, we assume B to be constant (i.e., independent of past earnings). If the agent is not insured he will receive social assistance (welfare), A, which is likewise constant. The difference between benefits and assistance is that benefit eligibility is tied to UI fund membership when a premium must be paid. Assistance is available without payment of premia (see Kim and Schlesinger (2005) for an adverse selection model with private insurers and a government-provided consumption floor).

Allowing for additional non-labor income, the agent's consumption possibilities depend on the fol-

lowing sources:

Y^E:	earnings (in state E)
Y^0:	non-labor market income (e.g., spousal or capital income)
B:	unemployment benefit (if insured)
A:	social assistance (if not insured)
P:	premium for being insured

Consumption in state E is conditional on insurance status s and equals

$$C^E = Y^E + Y^0 - P \cdot s$$

and consumption in state U,

$$C^U = Y^0 + A \cdot (1 - s) + (B - P) \cdot s$$

Furthermore, we assume that earnings net of the insurance premium exceed benefits net of premium, which in turn exceed social assistance,

$$Y^E - P > B - P > A. \tag{1}$$

This way, we avoid that social assistance, which an agent can collect without directly paying contributions, dominates incomes associated with participating in the labor market. For the purposes of this paper, we ignore feedbacks in a general equilibrium sense and those that run via the government budget constraint, and will therefore not model the financing of social assistance or the UI system.

Now, consider the possibility that the unemployment probability is partly chosen by the agent,

$$\pi = \pi(\theta, e).$$

We assume π depends on two factors: an exogenous individual risk component, θ, capturing both e.g. education-specific unemployment risk, but possibly also macro or industry risks, and secondly, effort $e \in [0; 1]$.[11] We assume $\pi(\theta, 0) = 1$, so that agents with strong preferences for leisure will purposely provide

[11] This is in line with the notation used in Chiu and Karni (1998). Essentially it makes deriving analytical results concerning moral hazard easier, a case we consider below.

no effort to make sure that they will be unemployed. We make the following additional assumptions on first and second derivatives of π: $\pi_e < 0$, $\pi_{ee} > 0$, $\pi_\theta > 0$ and $\pi_{\theta e} > 0$. These imply first order stochastic dominance of $\pi(\theta, e^a)$ compared to $\pi(\theta, e^b)$ for any two effort levels $e^a > e^b$. The assumption implies that the probability of unemployment is decreasing in effort, but increasing effort has decreasing returns. Higher exogenous risk leads to higher unemployment probability. And finally, for given increase of effort, the unemployment probability decreases more when exogenous risks decrease. Put differently, it is easier to prevent unemployment out of own effort when times are good, compare Figure 3.

Figure 3 about here

Effort is associated with utility costs (search or time cost, or cost of avoiding employment loss), denoted $f(e)$, with $f'(e) > 0$. Without loss of generality, we assume that $f(e) = \lambda e$, $\lambda > 0$.

The problem of the agent is to choose both insurance status s and effort e,

$$\max_{s=\{0,1\},e} E(u(C,e)) = \max_{s=\{0,1\},e} (1-\pi(\theta,e)) \cdot u(C^E,0) + \pi(\theta,e) \cdot u(C^U,\gamma) - \lambda e.$$

The budget constraint, given that we consider a single period with fixed UI system parameters, is directly incorporated into consumption. To solve the problem we compare the optimal effort provided in the two cases where the agent is or is not insured, and then determine whether utility is higher with or without insurance.

For reference, we define the following symbols:

$$\begin{aligned} a &= u(Y^0 + Y^E, 0) - u(Y^0 + Y^E - P, 0) > 0 \\ b &= u(Y^0 + Y^E - P, 0) - u(Y^0 + B - P, \gamma) \lesseqgtr 0 \qquad (2) \\ c &= u(Y^0 + B - P, \gamma) - u(Y^0 + A, \gamma) > 0 \\ d &= u(Y^0 + Y^E, 0) - u(Y^0 + A, \gamma) \equiv a + b + c \lesseqgtr 0 \qquad (3) \end{aligned}$$

Owing to our assumptions in (1), these magnitudes can be read off from Figure 4. Note that $d > b$. We also may want to interpret b and d as functions of various income, preference, and insurance parameters, and define for reference

$$b = b(Y^0, Y^E, B, P, \gamma) \qquad (4)$$

$$d = d(Y^0, Y^E, A, \gamma). \qquad (5)$$

Figure 4 about here

4.1 Choice of Effort

4.1.1 Agent is Insured

If the agent is insured, his problem is

$$\max_e E(u(C,e|s=1)) = \max_e (1-\pi(\theta,e)) \cdot u(Y^E + Y^0 - P, 0) + \pi(\theta,e) \cdot u(Y^0 + B - P, \gamma) - \lambda e$$

From the first order condition

$$-\pi_e(\theta,e) \cdot u(Y^E + Y^0 - P, 0) + \pi_e(\theta,e) \cdot u(Y^0 + B - P, \gamma) - \lambda = 0$$

we get

$$\pi_e(\theta,e) = -\frac{\lambda}{b} \tag{6}$$

where b has been defined in (2). From our assumptions that $\pi_e < 0$ and $\pi_{ee} > 0$ follows that, conditional on θ, there is a unique optimal effort when insured, $e^{\star I}(\theta)$. Unless we impose some sort of separability between θ and e, we will not be able to write $e^{\star I}$ as an explicit function, however.

In addition to interior solutions, depending on the specific functional form, there may be corner solutions, applying in the following two cases

$$e^{\star I} = \begin{cases} 0 & \text{if} \quad \lambda > -\pi_e(\theta,0) \cdot b \\ 1 & \text{if} \quad \lambda < -\pi_e(\theta,1) \cdot b. \end{cases}$$

From the expression above follows that if $b < 0$ (the agent prefers to be unemployed with benefits over working with earnings) then $e^{\star I} = 0$ and the agent will be unemployed. Assuming an interior solution we can sign the effects of various model parameters on effort:

$$e^{\star I} = e(\underset{-}{\theta}, \underset{\leq 0}{\lambda}, \underset{-}{\gamma}, \underset{+}{Y^E}, \underset{-}{Y^0}, \underset{-}{B}, \underset{+}{P}).$$

The sign on θ is determined by our assumption that $\pi_{e\theta} > 0$ (otherwise, reverse), and the sign on λ is negative if $b > 0$.

It is also possible to show that effort decreases to zero as the UI replacement rate approaches unity,

$$e^{\star I} \to 0 \quad \text{if} \quad Y^E \to B^+.$$

See the Appendix for details.

For reference, denote the expected utility at optimal effort when insured as

$$\mathrm{E}u^I = (1 - \pi(\theta, e^{\star I})) \cdot u(Y^E + Y^0 - P, 0) + \pi(\theta, e^{\star I}) \cdot u(B + Y^0 - P, \gamma) - \lambda e^{\star I} \tag{7}$$

4.1.2 Agent is Not Insured

If the agent is not insured the problem is

$$\max_e \mathrm{E}(u(C, e|s = 0)) = \max_e (1 - \pi(\theta, e)) \cdot u(Y^E + Y^0, 0) + \pi(\theta, e) \cdot u(Y^0 + A, \gamma) - \lambda e$$

solving the first order conditions

$$-\pi_e(\theta, e) \cdot u(Y^E + Y^0, 0) + \pi_e(\theta, e) \cdot u(Y^0 + A, \gamma) - \lambda = 0$$

yields

$$\pi_e(\theta, e) = -\frac{\lambda}{d}. \tag{8}$$

Again, besides an (implicit) interior solution for $e^{\star 0}$, there may be corner solutions characterized by

$$e^{\star 0} = \begin{cases} 0 & \text{if} \quad \lambda > -\pi_e(\theta, 0) \cdot d \\ 1 & \text{if} \quad \lambda < -\pi_e(\theta, 1) \cdot d. \end{cases}$$

Again, if $d < 0$ then $e^{\star 0} = 0$. The signs of the derivatives of effort with respect to model parameters are as follows

$$e^{\star 0} = e(\underset{-}{\theta}, \underset{\leq 0}{\lambda}, \underset{-}{\gamma}, \underset{+}{Y^E}, \underset{-}{A}, \underset{-}{Y^0}).$$

The sign on λ is negative if $d > 0$.

We shall refer to expected utility at optimal effort when not insured as

$$\mathrm{E}u^0 = (1 - \pi(\theta, e^{\star 0})) \cdot u(Y^E + Y^0, 0) + \pi(\theta, e^{\star 0}) \cdot u(A + Y^0, \gamma) - \lambda e^{\star 0}. \tag{9}$$

4.1.3 Moral Hazard

The effort undertaken by insured and uninsured agents can be compared due to our assumptions on derivatives of π and $d > b$. We find

$$e^{\star 0} \geq e^{\star I}. \tag{10}$$

In addition, if $\lambda < -\pi_e(\theta, 1) \cdot b$ both insured and uninsured will provide maximum effort, $e = 1$, and if $\lambda > -\pi_e(\theta, 0) \cdot d$ no-one will provide any effort, $e = 0$.[12] This behavioral effect (moral hazard) arises because of the cost of effort and the preference for leisure. If there is no cost of effort, $\lambda = 0$, and the preference for leisure is low such that $u(Y^0 + B - P, \gamma) < u(Y^0 + Y^E - P, 0)$ (i.e., $b > 0$) then there is no moral hazard problem, since in this case both insured and uninsured will provide maximum effort. On the other hand, if preferences for leisure are strong such that $u(Y^0 + A, \gamma) > u(Y^0 + Y^E, 0)$ (or, $d < 0$), then no-one will provide any effort, $e = 0$. Figure 5 illustrates the optimal effort as function of the marginal cost of effort, for the case that the relation between the two at an interior solution is linear.

Figure 5 about here

One can show several features associated with the moral hazard problem. We will say that the moral hazard problem becomes more pronounced if the difference between the effort provided by insured and non-insured, $e^{\star 0} - e^{\star I}$, increases. The problem of moral hazard decreases if A increases, if P increases or if B decreases.[13]

In general we can write the optimal effort as a function of insurance status, cost of effort and the various income sources:

$$e^\star = e(\underset{-}{\theta}, \underset{-}{s}, \underset{\leq 0}{\lambda}, \underset{-}{\gamma}, \underset{+}{Y^E}, \underset{-}{A}, \underset{-}{Y^0}, \underset{-}{B}, \underset{+}{P}).$$

Details of these derivatives are spelled out in the Appendix. Given optimal effort in the insured and non-insured state, we write

$$\pi^{\star 0} \equiv \pi(\theta, e^{\star 0}), \quad \text{and} \quad \pi^{\star I} \equiv \pi(\theta, e^{\star I}).$$

[12] This case arises if $d < 0$ meaning that the agent prefers drawing social assistance to working.

[13] This implies that the gain from being insured becomes smaller.

4.2 Choice of Insurance

4.2.1 Optimal insurance status

To find the optimal insurance status the agent compares the expected utilities (7) and (9), $\mathrm{E}u^I$ and $\mathrm{E}u^0$ Let $D = \mathrm{E}u^I - \mathrm{E}u^0$. The agent will choose to insure himself if $D > 0$. Using the notation introduced earlier, D can be written as

$$D = -a + (a + c) \cdot \pi^{\star 0} + b \cdot (\pi^{\star 0} - \pi^{\star I}) - \lambda(e^{\star I} - e^{\star 0}) \tag{11}$$

Notice that if there is no moral hazard problem (both insured and uninsured provide the same amount of effort) (11) reduces to $D = -a + (a + c) \cdot \pi(\theta, e^{\star})$.

4.2.2 Exogenous Risk

From (11) follows that agents with higher exogenous risk θ are more likely to insure themselves,

$$\frac{\partial D}{\partial \theta} = (a + c) \cdot \pi_\theta(\theta, e^{\star 0}) + \left[b \cdot \left(\pi_\theta(\theta, e^{\star 0}) - \pi_\theta(\theta, e^{\star I})\right)\right] \geq 0.$$

The derivative will be zero only if $d < 0$.

Under this assumption, and assuming continuity, there will be a "threshold level of risk" $\tilde{\theta}$ where an agent is just indifferent between being insured or not $D(\tilde{\theta}) = 0$. Absent further restrictions on functional form of π, an explicit expression for $\tilde{\theta}$ cannot be given.

Agents with a low risk of unemployment ($\theta < \tilde{\theta}$), will choose not to insure themselves against unemployment ($s = 0$) while agents with a high risk of unemployment will take out an insurance ($s = 1$). We label this 'adverse selection'. [14]

The problem of adverse selection exists independently of whether the moral hazard problem is present. To see this, notice that the "threshold risk" in the absence of moral hazard ($\pi^{\star 0} = \pi^{\star I}$) is determined by $\pi^{\star 0}(\tilde{\theta}, e) = \dfrac{a}{a + c}$. In this case, only high risk individuals choose to insure themselves.[15]

[14] We shall refer to the risk-insurance correlation as adverse selection, although our approach would go through if selection were advantageous (De Meza and Webb, 2001); we shall eventually be interested in isolating the effect of moral hazard.

[15] Likewise, adverse selection surfaces when agents with high preferences for leisure (such that $d < 0$) take up unemployment insurance. They also will provide no effort to be sure that they become unemployed. However, in this case there are both aspects of adverse selection and moral hazard.

To illustrate how the cost of effort affects the likelihood of insurance, Figure 6 shows the "threshold risk" as a function of marginal effort cost.

Figure 6 about here

4.2.3 Other Determinants

One can show that the insurance decision is affected by the individual risk, the cost of effort and the income sources

$$s = s(\underset{?}{\theta}, \underset{+}{\lambda}, \underset{+}{\gamma}, \underset{?}{Y^E}, \underset{-}{A}, \underset{?}{Y^0}, \underset{+}{B}, \underset{-}{P}).$$

We remark at this stage that the effect of earned and unearned income cannot be signed in general. This also holds true for the effect of exogenous risk. If $b > 0$, the effect will be positive (as mentioned above). For details, we refer to the Appendix.

4.3 Identification of adverse selection and moral hazard

The presence of adverse selection can be identified if the insurance status is observed and individual risk is partially observed. Partition the indvidual exogenous risk into two components, $\theta = \bar{\theta} + \varepsilon$, of which $\bar{\theta}$ is observed by the econometrician, and ε is only known to the agent. Insurance status as a function of parameters is then given by

$$s = s(\bar{\theta} + \varepsilon, \lambda, \gamma, Y^0, Y^E A, B, P).$$

Even if part of the individual risk is unobserved, a positive correlation between $\bar{\theta}$ and s indicates adverse selection.

The main problem is to identify moral hazard. The problem arises because both ε and effort e are only known to the agent. To illustrate the identification problem, consider the impact of insurance status on the risk of becoming unemployed. We assume that agents have rational expectations of the risk of unemployment, implying $\Pr(U) = \pi(\theta, e)$. Since effort is unobserved we can use the expression for optimal effort

$$\Pr(U) = \pi(\theta, e(s, \lambda, \gamma, Y^0, Y^E A, B, P)).$$

The effect of effort could be detected through the effect of insurance status. Unfortunately, this will not work unless we are able to fully control for the effect of individual risk, θ. Using the partitioning into $\bar{\theta}$ and ε, the model can be written as

$$\begin{aligned} \Pr(U) &= \pi(\bar{\theta}+\varepsilon, e(s,\lambda,\gamma,Y^0,Y^E A,B,P)) \\ s &= s(\bar{\theta}+\varepsilon,\lambda,\gamma,Y^0,Y^E,A,B,P) \end{aligned}$$

The model predicts that being insured increases the likelihood of becoming unemployed through its effect on effort. However, the positive impact is caused by both moral hazard and adverse selection. Moral hazard implies that insured agents provide less effort which increases π, while adverse selection implies individuals with a high ε are more likely to insure themselves but also have a higher risk of unemployment. Therefore, the effect of insurance status on subsequent unemployment does not disentangle the moral hazard problem from adverse selection.

To overcome this problem, we exploit the early retirement feature of the Danish unemployment insurance system: for some agents (at some ages) additional benefits R associated with the insurance are available, which we model as additively enhancing utility. The problem of the agent is then

$$\max_{s=\{0,1\},e} E(u(C,e)) = \max_{s=\{0,1\},e} (1-\pi(\theta,e))\cdot u(C^E,0) + \pi(\theta,e)\cdot u(C^U,\gamma) - \lambda e + sR.$$

Due to additivity, optimal effort conditional on insurance status is unaffected by the additional benefit. Optimal insurance status will, however, be affected positively. This implies that the problem is

$$\begin{aligned} \Pr(U) &= \pi(\bar{\theta}+\varepsilon, e(s,\lambda,\gamma,Y^0,Y^E A,B,P)) \\ s &= s(\bar{\theta}+\varepsilon,\lambda,\gamma,Y^0,Y^E A,B,P,R) \end{aligned} \tag{12}$$

By using the variation in insurance status caused by the additional benefit we can identify the effect of insurance status solely caused by the moral hazard problem. The identifying assumption is that the (value of) the retirement option is uncorrelated with the unobserved individual risk ε.

The empirical results presented below can be interpreted under this assumption. We shall devote some space below to discussing the validity of the instrument.

5 Data and Descriptives

5.1 Register Data

The CAM 10% Sample is based on a 10% random sample of the Danish population aged 16 and above from the Danish National Register. The data thus covers more than half a million individuals. Underlying the data are various administrative sources which are linked into a single large database. The data has been made available by Statistics Denmark to the Center for Applied Microeconometrics (CAM) at the University of Copenhagen. It is an 'all-purpose' sample with selected variables on demographics, incomes and benefits, savings, wealth, housing, and labor market status. Sampled individuals are followed over time, annually, from 1981 onwards. The sample is unbalanced in the sense that new qualifying residents (turning 16, or newly arrived immigrants) enter, whereas people leave due to death or emigration.

Due to its administrative nature, the data is very reliable in terms of measuring observable income reports and tax file status of individuals. In particular, any relevant fact that is related to receiving benefits is accurately observed, such as membership in a UI fund or labor market status. Labor market status is recorded in calendar week 48 of any given year. Individuals are classified self-employed according to their main economic activity in that particular week. Individuals are 'unemployed' when registered as such with a UI fund. Registration is not limited to UI fund members. It is a condition not only for receiving UI benefits, but also for social assistance benefits. The data will therefore even record those as unemployed that are not eligible for UI benefits.[16,17]

Empirically, as we do not have access to firm-level data, we cannot clearly distinguish in the data between self-employed workers and entrepreneurs in any economically meaningful sense, and will conduct the analysis on a sample of the former.

[16] We have no reason to presume that unemployed non-UI-fund-members may not register as being 'unemployed' and would be counted as 'out of the labor force' in the data. The transition rates from out of the labor force (in particular into employment) are the same for both UI fund members and non-members. If non-members actually had been unemployed we would expect them to a larger extent to return to employment.

[17] Further note that being registered as unemployed does not automatically imply receipt of benefits for UI fund members, but take-up rates are about 97%.

Due to its sheer size, the CAM 10% Sample covers a very large number of self-employed individuals and will hence reliably reflect population transitions in terms of labor market status and insurance membership. Sample size is important because of three reasons: (a) the level of self-employment in Denmark is rather low in cross-European comparison, (b) transitions are not frequently observed and are essential when using a fixed effect approach, and (c) as can be gleaned from the empirical literature on self-employment, there is substantial heterogeneity requiring large samples in order to reliably measure responses to policy variation and changes in characteristics.

As the Danish early retirement system underwent substantial reform in 1999, we base our analysis on data from 1981 through 1998. We further restrict the sample according a few observable variables. First, we only consider males in order not to have to discuss issues that typically arise in analyses of female labor force participation. Even more distinctly than elsewhere in Europe, self-employment appears to be a predominantly male activity in Denmark, not least because the alternative of wage employment offers decisive hours flexibility for female workers (see Carrasco and Ejrnæs, 2003). Second, we restrict attention to the age group of 25-59 year olds, since we are primarily interested in workers choosing UI fund membership and occupation before actually exiting into early retirement.[18]

We exclude students and individuals who are retired at the time of observation, as well as those who are out of the labor force in every year. We also require that any individuals should have at least one employment spell over the entire observation period. We also exclude any remaining observations of persons receiving public pensions in a given year.

We exclude workers in agriculture, fishery, and forrestry, as sectoral change strongly affected employment opportunities for these people. Moreover, there are likely behavioral differences between farmers and other self-employed persons that are not easily explained by observables.[19]

The remaining data still includes a number of people with observational gaps over time because they do not live in Denmark in a particular year, they are student or retired in any period. Removing those individuals as well leads to a final sample size of about 92,000 persons who are followed over an 18-year

[18]The data reveal that among those self-employed eligible for early retirement, the vast majority actually does use this route out of the labor force.

[19]We exclude all individuals that in the period 1981-1998 have been working either as wage earners or self-employed in the agricultural sector.

period, totalling 1.65m observations.[20]

5.2 Labor Market Status and Unemployment Insurance Status

We now provide some data description on the raw sample. Table 1 shows the distribution of labor market status over time. Overall, the sample grows with time, reflecting population growth and labor market expansion. Wage employment is the numerically strongest group with 83% on average, exhibiting a secular increase (from 81.4% to 86.6%). On average, 9% of all individuals in the sample are self-employed, with a strong negative time trend (10.3% in 1981 to 7.7% in 1998). Compared to other published statistics from Denmark the level is somewhat higher, owing to the fact that we only consider males aged 25-59, with self-employment being a predominantly male activity with strong age patterns. The unemployment rate exhibits typical cyclical patterns with a trough in 1986 and a peak in 1993, numbers closely matching other available statistics for prime-aged males. Around 2% of all sampled individuals are out of the labor force.[21, 22]

Table 1 about here

Figure 7 further breaks down self-employment (as percentage of the labor force) by time and year-of-birth cohort, for selected cohorts. Older cohorts appear to be more likely self-employed than younger ones (cohort effects, suggested by the 'vertical difference' between the various lines), while behavior also changes with age: the oldest cohorts appear to be leaving self-employment quicker, while the younger ones appear to become more likely self-employed as they grow older. Time effects (business cycle

[20] Further restricting the sample to Denmark-born residents is largely immaterial, as it turns out.

[21] Given our sample selection criteria, there is a small and heterogeneous group of people who are out of the labor force for reasons of long-term illness, labor market activation, but also for social reasons. Most of these receive either sickness benefits or social assistance.

[22] In addition to the labor market states mentioned, a tiny proportion of the sample is originally classified as 'on leave': members of an unemployment insurance fund may, as from 1994 on, go on a paid leave for a number of reasons (child care, education, and others). In order not to complicate further analysis by introducing an additional labor market state, we re-classify these people according to their state of origin. Leave schemes were relatively popular around the time of first introduction, but popularity decreased markedly within a few years.

patterns) are less clearly visible.

Figure 7 about here

Table 2 shows overall transition rates between labor market states, averaged over time. Of those being self-employed in one year, close to 90% are self-employed a year later. About 8% transit into wage employment, very few (between 1 and 2%) into unemployment or leave the labor market altogether. 95% of all wage earners in one year are wage earners a year later, less than 4% become unemployed, and a mere 1% transits from wage to self-employment.

Table 2 about here

Figure 8 displays the time-patterns of transition rates out of self-employment. The survival rate (north-west quadrant) is strongly pro-cyclical and mirrors (reverse image) the unemployment rate in the country over time. This may be ascribed to aggregate demand conditions changing over the cycle and affecting both workers and small business owners alike. The probability of exiting self-employment to wage employment (WE; north-east quadrant) increased until 1992, fell until 1996, and peaked again a year later. These changes are not very pronounced in terms of absolute levels, however. Exiting to unemployment (UE; south-west) is strongly cyclical and the time pattern mirrors the survival rate. Exit out of the labor force altogether (NE; south-east) does not display a clear pattern, but we do see occasional peaks in 1989 and 1997.

Figure 8 about here

Turning to UI fund membership, Figure 9 displays the percentage of UI fund members among those in the labor force by cohort and year. Again, we see a number of pronounced patterns in the data. The first panel relates to some of those cohorts that were subject to the rules before the policy change in 1992 (‘10 year membership rule’), the last panel relates to those who were clearly subject to the new regime (‘20 year rule’). The graph in the middle refers to some cohorts falling into the intermediary regime (compare Figure 1). People from the 10-year-rule join UI funds as they get older, the curve flattening out towards them reaching age 60. This pattern is unsurprising given the rules. Likewise, we observe a distinct time effect for the people from the intermediary group whose enrollment hazard peaks sharply in

1992, the year when the new rule came into force and provided the incentive to join in that particular year and stay member for reasons of ER eligibility. The enrollment rate after 1992 for this group exceeds that of the 10-year-rule group by 5 percentage points (87 v 82 percent) at even earlier ages, suggesting that the law change may have pushed additional people into joining the club (perhaps those who did not want to forfeit the option for ER eligibility). Finally, individuals from the 20-year-rule group also quickly (at early ages) reach an enrollment rate of close to 85%.

Figure 9 about here

There is a pronounced dip in enrollment, occurring between 1989 and 1992, across all cohorts from the late group. While we are not particularly concerned with explaining the underlying causes of the dip, its strong pattern does ask for comment. Some institutional changes between 1988 to 1989 in the UI legislation may provide a partial explanation, as it was no longer possible to work part-time and get an income supplement from the UI fund. A further investigation of the data also indicates that it is especially among the unemployed where UI fund membership falls (in 1988 71% of the unemployed were UI fund members, in 1989 only 60%). We have also looked at whether expiring UI benefit periods can explain the dip, but found that they do not.

Among the possible alternative explanations feature liquidity constraints: people may sign out of UI funds and save the premium to spend it on membership later when they really have to be member of the club for ER purposes. Against this speaks: (a) some are not the youngest anymore as we do see a dip also for older cohorts, (b) giving up unemployment insurance for intertemporal smoothing purposes seems not quite intuitive since risk exposure may increase when times get tougher, and (c) the timing: the onset is in 1989 and not in, say, the year before 1992.

Whatever the reason, though, the dip presumably has to do with unemployment insurance rather than with early retirement incentives, which is the more important aspect for our purposes. We shall include an extra time dummy in our regression analyses to take account of this dip. Since we shall be controlling for nonlinear age, time, and cohort effects in a flexible way (on which more below), our main estimates will not be influenced by this artifact in the data.

Table 3 splits the information in the graph out by labor market status (while suppressing the time/age

and cohort information). It shows that particularly the self-employed are far less likely to be member of a UI fund (except for those out of the labor force). Across all years and ages, 3 out of 5 self-employed are UI fund members, as opposed to 4 in 5 wage earners.

Table 3 about here

Interestingly, if we split the sample according to whether (33%) or not (67%) an individual would be eligible for early retirement benefits (according to the institutional rules), the percentage among the self-employed who are member of a UI fund changes from 73% (eligible) to 53% (not eligible), whereas there is no dramatic change for wage earners (from 84% to 81%). This suggests strongly that the ER incentive to sign up for UI fund membership works particularly strongly for the self-employed, and much less so for the wage employed.

Table 4 about here

It may also be instructive to have a look at UI fund entry rates, split by the years before and after the ER eligibility incentive is relevant. Numbers are in Table 4, where we condition on labor market status in the previous year ($t-1$). The Table shows that (both self-employed and wage) workers are about equally likely to join a UI fund while the deadline for signing up in order to be eligible for ER incentives is not imminent. Self-employed workers are only slightly more likely than wage earners to join a UI fund scheme. In the last year before the deadline, the self-employed have a clearly larger spike in the enrolment hazard than wage earners. The gap even widens after the deadline has passed (or has been missed).

In passing, we mention that exit rates from UI funds, while rather small in absolute levels, are twice as high for the self-employed compared to wage earners, for both the ones that are eligible (self-employed: 1.3%, wage earners: 0.7%) and the ones that are ineligible for early retirement (3.7% and 1.8%, respectively).

In conjunction with Table 3 this suggests two things: (a) there is an insurance motive to join the UI fund, resulting in a transition rate into UI funds of roughly 10% (across employment types and time—this motive is present both before and after the reform); (b) there is an additional incentive to join the UI fund stemming from the ER plan, resulting in an additional 20% transition. It is the ER incentive that

stimulates in particular the self-employed to join the club and not to leave it subsequently.

6 Estimates

6.1 Econometric Approach

We are interested in estimating the effect of unemployment insurance on becoming unemployed for a sample of self-employed individuals, taking into account the endogeneity of the insurance choice by using a policy change as instrument.

This can be most simply and transparently done using a logit regression estimating the probability of being unemployed in year t when the state of origin in $t-1$ is being self-employed. We consider the sub-sample of people who have been self-employed for at least three consecutive years, conforming with the institutional rules for drawing benefits.

Table 5 cross-tabulates the labor market status in year t (destination state) for the people in this sub-sample, distinguishing by whether or not they were UI fund members in year $t-1$. We see from the Table that those self-employed who are insured are clearly more likely to transit into unemployment than those who are uninsured.

Table 5 about here

Let U_{it} denote an individual i's observed binary labor market status at time t (t runs from 1 to T_i). $U=1$ indicates unemployment, $U=0$ indicates self-employment. x_{it} is a vector-valued regressor, containing the variables from our economic model, including insurance status. Let β be the slope coefficient of the relation between $U_{it}^{\star}$ and x_{it}, where $U^{\star}$ is a latent variable and can be interpreted as propensity to being unemployed. The latent variable model can then be written as

$$U_{it}^{\star} = x_{it}\beta + \eta_i + \nu_{it} \tag{13}$$

while we observe the 0/1 indicator

$$U_{it} = \mathbf{1}[U_{it}^{\star} > 0]$$

with $\mathbf{1}[A]$ the indicator function taking value 1 for the expression A being true. ν_{it} is an error term with logistic distribution, assumed independently and identically distributed between all i and t.

Having panel data, we can take individual fixed effects η_i into account in (13) and estimate a conditional logit (Andersen, 1970; Chamberlain 1980). Fixed effects estimators have the advantage of not restricting the correlation structure between the individual effect (unobserved heterogeneity) and any included regressor (observed heterogeneity). This also delivers some robustness against possible endogeneity of regressors. The logit is the only specification of the binary choice model that allows concentrating out the fixed effect from the likelihood contribution for unrestricted number of time-series observations, due to functional form: the estimator removes the fixed effect, by conditioning the likelihood contribution of observing an individual's given time series of labor market states (unemployed or not) on the number k_i of occurrences of being unemployed over time, $k_i = \sum_{t=1}^{T_i} U_{it}$. The latter serves as a sufficient statistic for the fixed effect. The conditional likelihood contribution for individual i can then be written as

$$\Pr\left(U_{i1}, \ldots, U_{it}, \ldots, U_{iT} \,|k_i\right) = \frac{\exp(\sum_t U_{it} x_{it}\beta)}{\sum_{\mathcal{D}} \exp(\sum_t d_{it} x_{it}\beta)}$$

where the denominator corresponds to the number of possibilities to have k times an observation of type U (d_{it} is a 0/1 variable corresponding to U_{it}, but represents one out of all possible permutations, set $\mathcal{D}$, to observe k_i times an occurrence of unemployment). The slope parameter is identified for the sub-sample of individuals that experience at least one transition. Other individuals will have a likelihood contribution of zero.

For purposes of interpretation, we may want to discuss the marginal effect of a change in a regressor variable on the underlying probability. Since we cannot obtain an estimate of the fixed effect, we can also not obtain the predicted probability of unemployment,

$$\Pr(U_{it} = 1) = \frac{\exp(x_{it}\beta + \eta_i)}{1 + \exp(x_{it}\beta + \eta_i)}.$$

Instead, we can assume that an individual experiences exactly one transition into unemployment,[23] which allows calculation of

$$\Pr(U_{it} = 1) = \frac{\exp(x_{it}\beta)}{\sum_t \exp(x_{it}\beta)}.$$

[23]For our data, this assumption is met: conditional on having at least one transition, the median number of transitions is 1, the mean is 1.02.

Evaluating the right-hand side of this expression at the sample mean of x, denote the resulting probability estimate by p. The marginal effect of variable ℓ obtains then simply as

$$\frac{\partial p}{\partial x_\ell} = \beta \times p \times (1-p).$$

The model can be extended to the multinomial case of J different exit routes (Chamberlain, 1980; Lee (2002) contains a detailed description). We then condition on the number of times that the individual has chosen outcome j, $j = 0, 1, \ldots, J-1$. Denote the 0/1 outcome variable by y_{jit} and equations of interest

$$y^\star_{jit} \quad = \quad x_{it}\beta_j + \eta_{ij} + \epsilon_{it}; \qquad y_{jit} = \mathbf{1}[y^\star_{jit} > 0]$$

where η_{ij} is a choice-specific individual fixed effect. Define counts over time for choosing option j accordingly as $k_{ji} = \sum_t y_{jit}$, with $\sum_j k_{ji} = T_i$. Then the probability to observe y, conditional on the counts k_j for individual i is given by

$$\Pr(y_i | k_{0i}, k_{1i}, \ldots, k_{J-1,i}) = \frac{\exp(\sum_t \sum_j y_{jit} x_{it}\beta_j)}{\sum_{\mathcal{D}} \exp(\sum_t d_{jit} x_{it}\beta_j)} \tag{14}$$

where the denominator corresponds to the number of possibilities to have k_j times an observation of type y_j.

While conceptually not more involved than the simpler conditional logit from above, the multinomial version is computationally burdensome, since the denominator involves a large number of permutations.[24] This is the reason why we mainly focus on the simpler, binomial version.

To take into account endogeneity of the insurance choice, we adopt a simple two-stage approach, in which we first predict the insurance choice from a number of regressors (including our policy instrument), and in the second stage apply the conditional logit estimator with the prediction as one of the regressors. In a linear model, this approach would correspond to the panel-data version of 2SLS.[25] We choose a linear fixed effects model for the first stage regression (linear probability model), due to its simplicity

[24] Consider the example $T_i = 15$, and $J = 4$ with an observed sequence of $(0,0,1,0,0,1,2,2,0,0,0,1,0,3,3)$, then $k_0 = 8$, $k_1 = 3$, $k_2 = 2$, $k_3 = 2$. There are a total of $C(15,8) \cdot C(7,3) \cdot C(4,2) \cdot C(2,2) = 1,351,350$ different choices leading to the same sequence of k's, with $C(a,b)$ denoting 'b out of a'. With $T_i = 15$, and $J = 4$, the maximum number of choices is $15,765,750$.

[25] Alternative approaches are possible. One is that of a regression-discontinuity design (RDD), to which our approach bears a

and encouraged by the fact that the predicted value of the insurance choice lies with up to 88% inside the $[0, 1]$ interval. We bootstrap the estimated marginal effects from the two-stage regression, resampling individuals.[26]

We present results from three specifications, distinguishing two different measures of exogenous risk (θ in terms of our model parameters from above). The first measure is based on observed, gender-specific unemployment probabilities in the data. It differentiates unemployment rates by educational level and is available at annual frequency for all sample years. The second measure is based on industry-specific bankruptcy rates, distinguishing in total five different industry classes. Figure 10 shows the various series over time. Agriculture is the one sector whose bankruptcy rates do not display cyclical variation. The underlying data, from Statistics Denmark, are available from 1984 onwards. The slightly shorter time-period, and the fact that not all self-employed can be classified into industries, implies a somewhat smaller sample.

Figure 10 about here

These two measures give rise to the first two specifications, indicated by roman numerals in the Tables to follow. The third specification is based on the second definition of risk, but excludes a number of regressors relating to income and wealth measurements. We can then document that possible measure-

close similarity. RDD would identify the insurance choice effect from the cross-sectional variation caused by the discontinuity in the age-based eligibility rule by comparing people below the threshold age with those above (see Van der Klaauw (2002) for exposition of theory and Lemieux and Milligan (2008) for an application using social assistance rules). Since in our case eligibility is not a simple age rule but differs across year of birth cohorts, and since we want to take into account the within-variation so as to be able to take into account unobserved heterogeneity by way of a fixed effect specification, we use the time-variation in eligibility for identification. We do take into account age as a direct covariate in the outcome equation and include it as a smooth polynomial function, as would be done in RDD.

[26] A related, but alternative approach is applied in Lee (1995). There, the model is written as a (triangular) two-equation system (structural form). In a first step, one estimates reduced-form equations for each endogenous variable. In a second step, the restrictions between structural form and reduced form parameters are imposed via Minimum Distance estimation. The approach has the drawback that in order to obtain the corrected variance-covariance matrix, the model estimates both reduced form equations on the same sample. Since in our context one equation is a conditional logit equation, however, we would estimate the insurance choice equation also on the sub-sample of individuals that experience at least one labor market transition. This, however, selects a sample that is not representative of the population facing an insurance choice.

ment and endogeneity problems in these excluded variables do not drive our results.

All results and conclusions drawn from the estimates are very similar across specifications. We shall in the sequel focus on discussing Specification III, and occasionally refer to the others.

6.2 Regression Results

We use a specification that closely mirrors the economic model set out above. The unemployment equation should therefore allow not only for insurance status (a lagged UI fund membership dummy), but also for observable risk (education-specific unemployment or industry-specific bankruptcy rates), and proxies for the cost of effort and the marginal value of leisure (taste shifters). Furthermore, we ought to control for unemployment benefits, own income and exogenous resources (such as spousal income and wealth).

Taste shifters included relate to marital status ("single"), having children of age 17 or younger living in the household, nonlinear functions in age, and the number of years of experience as wage-earner, which will pick up labor market attachment. We also control for whether a start-up allowances was received for persons entering self-employment from unemployment through active labor market programs.

Income from self-employment (surplus or profit of business) is included linearly, but we also use a dummy for whether it was negative. Income and wealth amounts are measured in constant 1981 million DKK.[27] The amount of unemployment benefits (in 1000 DKK) is included as an amount that the person would receive if transiting to unemployment. Model parameters such as the unemployment insurance premium do not vary in the cross-section and potential social assistance cannot be calculated since it depends on an assesment of the individual's needs; they are therefore not separately included.

The risk indicators included vary across broad groups (education, industry), and over time (business cycle), so they double as nonlinear time effects. Time effects that are unrelated to cyclical conditions, like those of structural economic change, will not be picked up, however. This is one of the reasons why we choose to exclude agriculture from the regression instead of dummying it out.

As indicated by the variable labels in the results tables, most variables have been lagged at least once or three times. These lags ought to make sure that the value we condition on is pre-determined for the choice under consideration, and not a current choice variable that is determined jointly with the outcome

[27] In 1981, 1000 DKK $\approx$ 140 USD (daily average; source: Federal Reserve).

variable of interest.

Conditioning on fixed effects ensures that all time-invariant characteristics and determinants, such as year of birth (cohort effects), education (not by definition fixed, but typically not varying for the vast majority of individuals in the sample), and preference (risk aversion, time preference) and technology (e.g., industry) parameters are taken care of. They are allowed to be arbitrarily correlated with the other observables in the regression.

Table 6 reports marginal effects based on fixed effects logit estimates for transitions from self-employment to unemployment, not accounting for endogeneity.

Table 6 about here

The probability that a self-employed person becomes unemployed instead of staying self-employed between years $t-1$ and t increases with 0.08 when he is insured via a UI fund in year $t-1$ compared to not being insured. The effect is significant at the 1% level, and does not vary between specifications. Higher risk exposure (unemployment or bankruptcy rate) pushes people into unemployment.

We find a highly significant, nonlinear but monotonically increasing age pattern. Exit to unemployment increases first at a decelerating and subsequently at an accelerating pace as people grow older. The age of one's spouse is also positively influencing transitions into unemployment, but the effect is very small in magnitude. Single entrepreneurs are more likely to experience a transition into unemployment.

Among the other significant controls that impact on the unemployment transition are labor market attachment (past experience as a wage earner) and whether the individual received a start-up allowance in order to leave unemployment. Both variables are negative with a marginal effect of comparable magnitude. Both may proxy for an individual's capacity to avoid unemployment.

Further demographics (children) and taste shifters (spouse's employment) appear not to matter. We have also tried to control as far as possible for health, since agents with bad health may have stronger preferences for leisure and thus be more inclined to make use of the unemployment or early retirement scheme. Our health measure is based on receipt of sickness benefits, to which working individuals (including the self-employed) are entitled when experiencing a longer spell of sickness (two weeks and above). While not a very precise health indicator, it will flag those with serious health problems. We find

that it increases the probability of unemployment, although the effect is not significant.

Comparing between Specifications I and II shows closely comparable marginal effects for all variables included.

This also holds for Specification III which excludes a number of income and wealth related variables, even though some of them are significant in the other two specifications. Income from self-employment, for instance, increases the probability of transiting into unemployment. It is possible that the variable is picking up a positive risk/return correlation in entrepreneurial ventures: those in risky businesses may not only be more likely to experience unemployment, but at the same time receive a market premium for taking on this risk.

Higher wealth, on the other hand, is associated with a lower probability to become unemployed, the effect is significant in Specification II. This accords with findings in the literature on wealth positively influencing self-employment survival.

The level of unemployment benefits one would be entitled to if experiencing unemployment, is not increasing unemployment probababilities. There is, however, not much variation in this variable in the sample (recall Figure 2).

While our economic model suggests to control for these income and wealth related effects, it is not a priori clear to what extent they are exogenous. Yet, in all cases we find them to be very small in magnitude. Leaving them out does not affect any of the other estimated marginal effects.

Since people can choose to join the UI fund, possibly because they anticipate exit from self-employment (be it due to looming business failure or otherwise), we next instrument using measures of the eligibility rule for the early retirement system and a year dummy for 1988 (the year preceding the 'dip', see Figure 9). Without the reform, eligibility would mainly be a non-linear age effect, which we already control for. More precisely, ER eligibility is a dummy variable equal to one if (a) year of birth is later than 1951 and age is equal to or larger than 40, for any of the sample years; (b) year of birth is earlier than 1942 and age is older than 50 years, for any of the sample years; (c) year of birth is in between 1942 and 1951, and calendar year is 1992 or later. So, we have variation over both time and age (or cohort), which is not collinear with either time or age (cohort). Note, that speaking of ER eligibility does not imply that a person with the dummy variable equal to 1 is actually entitled to ER benefits when retiring at age 60,

since that depends on the actual choice made to join the UI fund and to stay member for 10 or 20 years (or in between for people of the transition cohorts). However, not joining the UI fund means not being eligible (even though ER eligibility may equal one). In order to capture the change in the ER eligibility as defined here for a given individual, we include the variable twice: measured at $t-1$ and at $t-2$.

Results are shown in Tables 7 (first stage) and 8 (second stage). We control in either stage for the other regressors already discussed above.

Table 7 and 8 about here

The first stage results clearly indicate that the early retirement incentive is a strong positive predictor for a self-employed person to join the UI fund in the same year. While being eligible to receive ER benefits in the future, measured at time $t-2$, reduces the probability to become UI fund member by 3 percentage points, the ER eligibility at $t-1$ increases this probability by 12-14 percentage points. The difference between being eligible in years $t-2$ and $t-1$ drives enrollment behavior: those that change to become "at risk" for ER eligibility actually sign up as UI fund members with a net difference of 10 percentage points (compared to those whose ER eligibility status does not change).

Many of the other predictors are significant as well. Higher observable risk (be it measured as the unemployment or the bankruptcy rate) increases the demand for insurance. This can be seen as empirical evidence of the adverse selection effect discussed in the modeling section.

Income from self-employment slightly decreases the likelihood to insure oneself. Given the very partial insurance that can be obtained via the UI system, it is perhaps not surprising. It is a little less intuitive why a higher benefit level leads to lower UI fund enrollment, but the effect is very small in magnitude. Having had a negative income from self-employment, however, clearly increases the probability to sign up for insurance, even though the effect is limited to about 2 percentage points.

Those who had a longer experience as a wage earner are less likely to enroll in an UI fund, which is possibly due to these people insuring themselves against adverse shocks by way of increased labor market flexibility. On the other hand, those who received support at start-up three years earlier have a 5% higher probability to be member of the UI system.

The nonlinear age pattern is very clearly determined, and varies distinctly differently from our main

instruments. Insurance membership is u-shaped in age with a minimum at age 34. Age of the spouse is not important, even though significant.

Spousal income and wealth are not important, neither is our health (sickness) indicator. We find, perhaps not according with intuition, that those whose spouse does not work are less likely to be insured.

The within-R^2 (OLS goodness of fit measure corresponding to mean-differenced data) of our first stage regression is with 18% relatively high.We find that the simple linear prediction of the regressors lies mostly within the [0,1] interval. In particular in Specification I, the value is close to 88% (75% in the other two specifications).

Using the prediction in the second stage yields the results in Table 8. All regressors except UI fund membership exert a very similar influence on the response variable as in the uninstrumented regression of Table 6, across all three specifications. We abstain from a detailed discussion.

The predicted UI fund membership variable now has a much larger marginal effect than in the uninstrumented regression. The marginal effect implies that an entrepreneur's probability to transit into unemployment increases with being insured by 0.40-0.45. This is a truly large effect.

The result is consistent with the notion of moral hazard (self-employed who join the UI fund are more likely to experience unemployment afterwards). One clear driving force behind the UI fund enrollment decision for the self-employed is the ER incentive, our main instrument. So if we were to make a randomly chosen self-employed person member of a UI fund (instead of letting him choose), we would see him becoming unemployed subsequently with substantially increased probability.

We wish to remark, though, that the results for the marginal effect differ somewhat in terms of significance levels from those of the associated coefficient. The latter is always significant at a level of 10% or lower, but not at the 5% or 1% level. This will be due to the nonlinearity of the model. The coefficient (which is a little less straightforward to interpret) also increases after instrumentation.

We have also estimated random effects models, and see a rather different picture: the coefficient for the uninstrumented model is larger compared to the fixed effects specification, while the coefficient for the instrumented version is smaller. In either case, instrumentation leads to a higher coefficient.

Two results call for further discussion. First, the uninstrumented model yields smaller marginal effects for membership of a UI fund than the instrumented model. This result is not exactly in line

with the adverse selction story, where one would expect the uninstrumented regression to capture the combined effect of enrolling in a UI fund and having a business that may face difficult times (and whose predisposition is not captured by lagged profits, for instance). A possible explanation could be that individuals are heterogenous with respect to risk tolerance. If individuals who are more risk tolerant are both more exposed to failure in particular when the general level of risk is high (because they take more chances) and less likely to insure themselves, this could lead to the observed pattern. The second result is the size of the marginal effect of UI fund membership in the instrumented version. The estimated marginal effect is very large although it is not very precisely determined. However, when interpreting this causal effect one should keep in mind that this is the average effect on the treated, which in our context means those who join the UI fund (very few exit the UI fund). Furthermore, the fixed effects estimates are based on a sample of individuals who experience unemployment.[28] This means that the marginal effect is identified from self-employed individuals who are more exposed to risk of unemployment and probably also more risk tolerant (because they chose not to be member from the beginning) than the "average self-employed" in Denmark. Therefore, we believe that this estimate of the marginal effect is an upper bound of the population average, but that it also provides evidence that moral hazard is empirically relevant for certain segments of the self-employed population.

6.3 Instrument Validity

There are two conditions that a good instrument has to fulfil. First, it needs to be correlated with the instrumented variable. Figure 1 and the first stage estimation (see Table 7) clearly show that this is the case. Second, there must be no correlation between the error in the outcome equation and the instrument. Following Angrist *et al.* (1996), the IV assumptions can be rephrased from a potential-outcomes perspective by putting the emphasis on a valid exclusion restriction and a monotonicity assumption. These imply that there is no direct effect on the outcome from the instrument, except through 'treatment' (insurance), and that there are no 'defiers'.

The latter means in our application that there is no-one who would be insured if being ER-ineligible but not if being ER eligible. We can reasonably rule out such behavior since ER benefits can be had

[28] The sample used for the fixed effects estimation contains less than 10% of the original sample of self-employed.

at zero marginal cost for the insuree, and hence becoming eligible will not drive individuals out of insurance.

Recall that our theoretical model motivates the identification of moral hazard from a static perspective and invokes the assumption that the early retirement option enhances utility additively. While the model captures important aspects of reality, it may not be consistent with life cycle generalizations were we to allow for agents saving and dissaving (or borrowing).

Such a dynamic extension is beyond the scope of the current paper, as we do not estimate parameters of a structural model. Wealth effects that run via the intertemporal budget constraint are unlikely to be ruled out, however. Recent papers have illustrated how savings and wealth can have an impact on labor supply and search decisions, labor market transitions, and interact with insurance (Lentz (2008), French and Jones (2008), and Chetty (2008)).

If such wealth effects were important, the exclusion restriction could be violated by an eligible person who, due to the policy change, decides to stay uninsured and instead starts providing effort in order to increase saving. That is, there would be a direct effect of changed eligibility status on effort taking that is independent of the moral hazard effect that we try to isolate. Indeed, this would be the case if the present value of premium paid by the insuree (in the possibly far away future) were sufficiently high to make a noticeable difference in terms of life cycle wealth. We have two arguments against this: first, the high subsidization rate of the premium (both before and after the reform, see footnote 5 and surrounding text); and second, the fact that insurance rates at higher ages do not drop for the affected cohorts (rather, they increase, see Figure 9). The only possible remaining issue we can think of concerns those that are undecided whether ER is a good thing for them in the far future, and who both 'join the club' *and* provide higher effort for the case that they discover at some later stage that they will not exercise the ER option. We think this is unlikely: the same people would then overlook the fact that they can keep earning money after age 60, presumably at a level higher than the ER-replacement rate.

Our estimates show that wealth effects in the unemployment transition equation are not very strong. Likewise, potential UI benefits do not have a noticeable impact. Further life-cycle relevant components of wealth will be controlled for by the fixed effect. The evidence found in the data makes no case against validity of the instrument. Further institutional rules (in particular concerning the old-age social security

(retirement) system) suggest that any remaining savings effect due to the ER reform will be quite limited if not nil.

6.4 Sensitivity Analyses

Several sensitivity checks have been performed, without us presenting detailed results in Tables. Benchmark for comparison is the parsimonious Specification III from the previous tables.

(a) We have conditioned the sample on just being self-employed in year $t-1$ as opposed to in the previous three years. The sample (consisting of those making a transition) increases from 951 individuals to 1368. We find a somewhat smaller marginal effect of UI fund membership on the transition to unemployment, of 0.33. Magnitudes of marginal effects for other variables only differ occasionally. None of our main conclusions is affected.

(b) We have conditioned the sample not only on being self-employed in the previous three years, but also on not being a member of a UI fund in years $t-3$ and $t-2$. We then study the impact of joining the UI fund in between years $t-2$ and year $t-1$ on the transition to unemployment between years $t-1$ and t. The sample decreases from 951 individuals to a mere 120. The marginal effect of being insured on the transition to unemployment is with 0.41 little affected, however, compared to the baseline.

(c) A number of further checks have been performed using somewhat simpler models (not accounting for fixed effects). For instance, we have redefined as self-employed those that have at least 50% of their earnings (from self-employment or wage employment) from their own business. This hardly makes a difference to our estimates. Our findings are also robust to redefining unemployment as the fraction of time per year spent in registered unemployment.

(d) We have estimated a 2SLS panel data linear probability model for both fixed and random effects, which has the computational advantage of not needing to rely on bootstrapped marginal effects. A Hausman specification test then rejects the random effects model in favor of the fixed effects specification. Also in this specification we find that the instrumented model yields larger marginal effects of UI fund membership than the uninstrumented model. However, we prefer the proposed two-way set-up since the proportion of '1's in the second stage–dependent variable (unemployment in t) is rather low, rendering a linear probability model presumably misspecified.

(e) Lastly, we also estimated fixed-effects multinomial models on the data, where we allow for individuals to leave self-employment via two other routes, wage employment and exit from the labor force altogether. Table 9 displays coefficient estimates.[29]

Table 9 about here

The sample increases roughly 4.5-fold due to individuals that choose the alternative routes. The specification in Table 9 differs by one regressor (having received start-up support for nascent entrepreneurs in year $t-3$) from that of the other Tables due to multicollinearity problems with one of the additional regimes.

While numerically different from the marginal effects presented in the other Tables, we find the coefficient estimates for transitions from self-employment to unemployment to be quite close between the standard binomial and the multinomial model. This suggests that our binary estimates in the other Tables do not fall prey to selection (sample composition) issues (in principle, the group that may transit into wage employment or unemployment, or out of the labor force, may be very different from the one that transits into unemployment only).

It is therefore interesting to note that we do not find a self-employed person that is predicted to be UI fund member to be significantly less likely to transit into wage employment, but instead to be significantly less likely to exit out of the labor force altogether. We interpret this as being consistent with the moral hazard story told above: once insured (and having controlled for exogenous risk variation), self-employed entrepreneurs will be more likely to let themselves slip into unemployment by way of reduced effort provision or reduced cautionary behavior, but their labor market attachment as such (working in any sector or being unemployed) does increase.

[29] The Table displays uncorrected standard errors. Estimation of marginal effects with associated bootstrapped standard errors was computationally not feasible for this model, since a single run takes about 18 hours to converge. The interpretation given in the sequel rests on the assumptions that the sign of the coefficient is indicative of the sign of a marginal effect, and that a correction of standard errors is not necessary.

7 Conclusions

In this paper we are concerned with empirically identifying the effect of entrepreneurial moral hazard in the context of a large income insurance program. The literature to date has been concerned with incentive effects of entrepreneurs mainly in theoretical settings where two parties to a transaction, one of whom an entrepreneur, settle on an optimal contract that is designed to mitigate the effects of moral hazard. Instead, the problem we are looking at is conceptually very simple: entrepreneurs have a take-it-or-leave it choice of signing a pre-specified insurance contract. There is no apriori reason to presume that this contract is designed optimally, since its parameters are fixed for the entire population.

The insurable risk is that of income loss due to, say, exogenous shocks, that may lead to permanently low profits or, in the limit, bankruptcy. The insurance mechanism we consider is unemployment insurance which is available for small business owners in Denmark. Indeed, for the vast majority of them, unemployment insurance is the prime mechanism to partially insure against income loss. Specific to Denmark are a couple of insititutional features that we take into account and exploit. First, insurance is voluntary, which opens up possibilities of adverse selection. This implies that if unemployment risk depends on both (heterogeneous) chance and choice of effort, both of which are unobservable to outsiders, one cannot be sure which of these drives the decision to insure. Insurance is endogenous to the risk and effort characteristics of the entrepreneur.

We identify the effect of moral hazard by considering incentives to join the pool of insured people that are orthogonal to the insurance coverage per se. This is where the second feature of the Danish institutional frame comes into play: insurees have the option of participating in an early retirement (ER) scheme, not available to non-insurees. Eligibility for the ER scheme is basically tied to the age of the insuree. Controlling for age anyway, our identification comes from variation of the ER eligibility conditions over time. A policy reform, enacted halfway through our sample period, changed the incentives to join UI for ER purposes differentially for individuals of different ages.

Our data strongly suggest that ER incentives pull the self-employed into the UI funds: at the point in time when a person becomes “at risk” in terms of eligibility, we see that enrollment for UI funds increases. Purging UI membership from this choice, a strong additional effect of insurance on the transition

into unemployment remains.

Essentially, this leads us to conclude that moral hazard is an important empirical phenomenon among self-employed despite the threat of having to supply effort in terms of schooling participation and search for wage jobs once unemployed, so as to stay eligible for UI benefits. Our results, are in this respect at variance with the findings of Rosholm and Svarer (2004) for workers. The results also differ from findings in the empirical literature that studies liability insurance for car drivers and does not find (residual) moral hazard to be important (Chiappori and Salanié (2000), Abbring *et al.* (2003)). It is conceivable, that private car insurers optimally respond to moral hazard incentives by choosing contract parameters that limit moral hazard. The Danish unemployment insurance system is by no means fine tuned to do so.

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A Model

This appendix supplies a few core derivatives whose signs are discussed in the text. It may be useful to partition the set of parameters into the following:

- exogenous risk, θ
- cost of effort, λ
- preference, income, and insurance parameters,

$$M = \{Y^0, Y^E, A, B, P, \gamma, \} \tag{A.1}$$

A.1 Derivatives of Effort

The derivatives of optimal effort with respect to some parameter can be calculated, assuming an interior solution, by relying on implicit differentiation. We may distinguish between effort when insured ($e^{\star I}$) and uninsured ($e^{\star 0}$).

A.1.1 Exogenous Risk

$$\frac{\mathrm{d}e^{\star I}}{\mathrm{d}\theta} = -\frac{\pi_{e\theta}}{\pi_{ee}} = \frac{\mathrm{d}e^{\star 0}}{\mathrm{d}\theta} < 0$$

which is independent of whether the agent is insured or not. The sign follows from the assumption $\pi_{e\theta} > 0$.

A.1.2 Cost of Effort

$$\frac{\mathrm{d}e^{\star I}}{\mathrm{d}\lambda} = -\frac{1}{\pi_{ee}} \cdot \frac{1}{b} \leq 0 \qquad \text{and} \qquad \frac{\mathrm{d}e^{\star 0}}{\mathrm{d}\lambda} = -\frac{1}{\pi_{ee}} \cdot \frac{1}{d} \leq 0.$$

For $b > 0$ and $d > 0$, respectively, effort decreases with effort cost. For $b < 0$ and $d < 0$, respectively, effort will not react to effort cost since optimal effort is already zero.

A.1.3 Preference, Income, and Insurance Parameters

Let $\mu \in M$ where M is defined in (A.1). Then,

$$\begin{aligned} \frac{\mathrm{d}e^{\star I}}{\mathrm{d}\mu} &= \frac{1}{\pi_{ee}} \cdot \frac{\lambda}{[b(\cdot)]^2} \cdot b_\mu \\ \frac{\mathrm{d}e^{\star 0}}{\mathrm{d}\mu} &= \frac{1}{\pi_{ee}} \cdot \frac{\lambda}{[d(\cdot)]^2} \cdot d_\mu \end{aligned}$$

Where $b(\cdot)$ and $d(\cdot)$ are defined through (4) and (5). The sign of these derivatives equals the sign of b_μ and d_μ, respectively, since $\pi_{ee} > 0$ by assumption.

Derivatives at a corner solution are zero.

Earnings

$$\frac{\partial b}{\partial Y^E} = u_1(Y^0 + Y^E - P, 0) > 0$$

and

$$\frac{\partial d}{\partial Y^E} = u_1(Y^0 + Y^E, 0) > 0.$$

Insured or not, labor income increases effort.

Nonlabor Income Analogously, we find

$$\frac{\partial b}{\partial Y^0} = \overbrace{[u_1(Y^0 + Y^E - P, 0) - u_1(Y^0 + B - P, \gamma)]}^{\kappa_1} < 0$$

and

$$\frac{\partial d}{\partial Y^0} = \underbrace{[u_1(Y^0 + Y^E, 0) - u_1(Y^0 + A, \gamma)]}_{\kappa_0} < 0$$

both follow from the concavity of the utility function and from our assumptions on the relative sizes of income components: effort decreases with sufficient fall-back resources, irrespective of insurance status.

Social Assistance

$$\frac{\partial b}{\partial A} = 0 \quad \text{and} \quad \frac{\partial d}{\partial A} = -u_1(Y^0 + A, \gamma) < 0$$

Increasing the outside option is irrelevant for those that are insured, but decreases effort for those that are not.

UI Benefits

$$\frac{\partial b}{\partial B} = -u_1(Y^0 + B - P, \gamma) < 0 \quad \text{and} \quad \frac{\partial d}{\partial B} = 0$$

Increasing UI benefits is detrimental for effort for those that are insured and does not affect those that are not.

UI Premium

$$\frac{\partial b}{\partial P} = u_1(Y^0 + B - P, \gamma) - u_1(Y^0 + Y^E - P, 0) > 0 \quad \text{and} \quad \frac{\partial d}{\partial P} = 0.$$

Higher premiums encourage provision of effort, whereas they are irrelevant for behavior of uninsured people.

Preferences for Leisure

$$\frac{\partial b}{\partial \gamma} = -u_2(Y^0 + B - P, \gamma) < 0 \quad \text{and} \quad \frac{\partial d}{\partial \gamma} = -u_2(Y^0 + A, \gamma) < 0.$$

A.2 Insurance

In this section, we study how insurance choice depends on variation in various parameters.

A.2.1 Exogenous Risk

From (11) follows

$$\frac{\partial D}{\partial \theta} = (a+c)\cdot \pi_\theta(\theta, e^{\star 0}) + \left[b\cdot\left(\pi_\theta(\theta, e^{\star 0}) - \pi_\theta(\theta, e^{\star I})\right)\right] \geq 0.$$

If $b<0$ and $d<0$ then $e^{\star I} = e^{\star 0} = 0$ and $\pi(\theta, e^{\star I}) = \pi(\theta, e^{\star 0}) = 1$. It then follows that $\pi_\theta(\theta, 0) = 0$. The expression above reduces to $\partial D/\partial\theta = 0$. In the case where $b<0$ and $d>0$ we have $e^{\star I} = 0$ and $\pi(\theta, e^{\star I}) = 1$. It then follows that $\pi_\theta(\theta, 0) = 0$.

$$\begin{aligned}\frac{\partial D}{\partial \theta} &= (a+c)\cdot \pi_\theta(\theta, e^{\star 0}) + \left[b\cdot\left(\pi_\theta(\theta, e^{\star 0})\right)\right] \\ &= (a+b+c)\cdot \pi_\theta(\theta, e^{\star 0}) \\ &= d\cdot \pi_\theta(\theta, e^{\star 0}) > 0.\end{aligned}$$

A.2.2 Cost of Effort

$$\frac{\partial D}{\partial \lambda} = -(e^{\star I} - e^{\star 0}) > 0$$

due to (10).

A.2.3 Preference, Income, and Insurance Parameters

For $\mu \in M$ (see (A.1)),

$$\frac{\partial D}{\partial \mu} = a_\mu(\pi^{\star 0} - 1) + c_\mu \cdot \pi^{\star 0} + b_\mu \cdot \underbrace{(\pi^{\star 0} - \pi^{\star I})}_{\leq 0}$$

Earnings The derivative is

$$\frac{\partial D}{\partial Y^E} = (1-\pi^{\star I})\cdot u_1(Y^0 + Y^E - P, 0) - (1-\pi^{\star 0})\cdot u_1(Y^0 + Y^E, 0)$$

which we rewrite slightly as

$$\frac{\partial D}{\partial Y^E} = (1-\pi^{\star I})\cdot \alpha_1 - (1-\pi^{\star 0})\cdot \alpha_0 \tag{A.2}$$

where we have introduced the symbols $\alpha_1 \equiv u_1(Y^E + Y^0 - P, 0)$ and $\alpha_0 = u_1(Y^E + Y^0, 0)$. Note that $\alpha_1 \geq \alpha_0$ (due to concavity). It is apparent that the derivative is not easily signed since we know from (10) and $\pi_e < 0$ that $\pi^{\star 0} \leq \pi^{\star I}$. That means that the association of a large α_1 with a small probability may or may not weigh up against the association of a relatively smaller α_0 with a larger weight.

We can rewrite (A.2) as

$$\frac{\partial D}{\partial Y^E} = \underbrace{(1-\pi^{\star 0})\cdot[\alpha_1-\alpha_0]}_{>0} + \underbrace{[\pi^{\star 0}-\pi^{\star I}]\cdot\alpha_1}_{\leq 0}$$

In the (near) absence of an insurance effect on effort ('moral hazard'), $\pi^{\star I} \approx \pi^{\star 0}$, the derivative is positive and richer people (in terms of own income) are more likely to insure themselves.

There is a second aspect of interest. This concerns behavior when UI benefits get large relative to earnings. In particular, effort taking will be diminished, and instead taking out insurance becomes more likely.

If $Y^E \to B^+$ and $e^{\star I} \to 0$, and hence

$$\begin{aligned} D &\to u(B+Y^0-P,\gamma) - (1-\pi^{\star 0})\cdot u(B+Y^0,0) - \pi^{\star 0}\cdot u(A+Y^0,\gamma) + \lambda e^{\star 0} \\ &\geq u(B+Y^0-P,\gamma) - (1-\pi^{\star 0})\cdot u(B+Y^0,\gamma) - \pi^{\star 0}\cdot u(A+Y^0,\gamma) + \lambda e^{\star 0} \end{aligned}$$

By using Jensen's inequality we get that

$$\begin{aligned} u(B+Y^0-P,\gamma) - (1-\pi^{\star 0})\cdot u(B+Y^0,\gamma) - \pi^{\star 0}\cdot u(A+Y^0,\gamma) + \lambda e^{\star 0} &\geq \\ u(B+Y^0-P,\gamma) - u((1-\pi^{\star 0})(B+Y^0) + \pi^{\star 0}(A+Y^0),\gamma) + \lambda e^{\star 0} &= \\ u(B+Y^0-P,\gamma) - u(B+Y^0-\pi^{\star 0}(B-A),\gamma) + \lambda e^{\star 0} \end{aligned}$$

The last expression is positive if $P < \pi(\theta, e^{\star 0})\cdot(B-A)$.This means that if the premium is small then agents with an income $Y^E \to B^+$ will chose to insure themselves.[30]

Nonlabor Income

$$\begin{aligned} \frac{\partial D}{\partial Y^0} &= \Big((1-\pi^{\star I})\cdot u_1(Y^0+Y^E-P,0) + \pi^{\star I}\cdot u_1(Y^0+B-P,\gamma)\Big) - \\ &\quad \Big((1-\pi^{\star 0})\cdot u_1(Y^0+Y^E,0) + \pi^{\star 0}\cdot u_1(Y^0+A,\gamma)\Big) \end{aligned}$$

Rewriting leaves

$$\frac{\partial D}{\partial Y^0} = \underbrace{[\alpha_1-\alpha_0]}_{<0} + \underbrace{\pi^{\star 0}\cdot\kappa_0}_{<0} - \underbrace{\pi^{\star I}\cdot\kappa_1}_{<0}$$

where α_1, α_0, κ_1 and κ_0 have been defined before. Again, the derivative cannot be signed in general. If we assume no moral hazard, then

$$\frac{\partial D}{\partial Y^0} \approx \underbrace{[\alpha_1-\alpha_0]}_{<0} + \underbrace{\pi^{\star 0}\cdot(\kappa_0-\kappa_1)}_{<0} < 0$$

That is, income other than earnings decreases insurance demand.

[30] If the UI premium is actuarially fair then $P = \pi(\theta, e^{\star 0})\cdot(B-A)$. In Denmark, the premium is instead heavily subsidized by the government.

Social Assistance

$$\frac{\partial D}{\partial A} = -\pi^{\star 0} \cdot u_1(Y^0 + A, \gamma) < 0.$$

UI Benefits

$$\frac{\partial D}{\partial B} = \pi^{\star I} \cdot u_1(Y^0 + B - P, \gamma) > 0.$$

UI Premium

$$\frac{\partial D}{\partial P} = -(1 - \pi^{\star I}) \cdot u_1(Y^0 + Y^E - P, 0) - \pi^{\star I} \cdot u_1(Y^0 + B - P, \gamma) < 0.$$

Preferences for Leisure

$$\frac{\partial D}{\partial \gamma} = \pi^{\star I} \cdot u_2(Y^0 + B - P, \gamma) - \pi^{\star 0} \cdot u_2(Y^0 + A, \gamma) > 0$$

B Figures and Tables

Figure 1: UI Choice and Change of ER Eligibility (cohort born 1945)

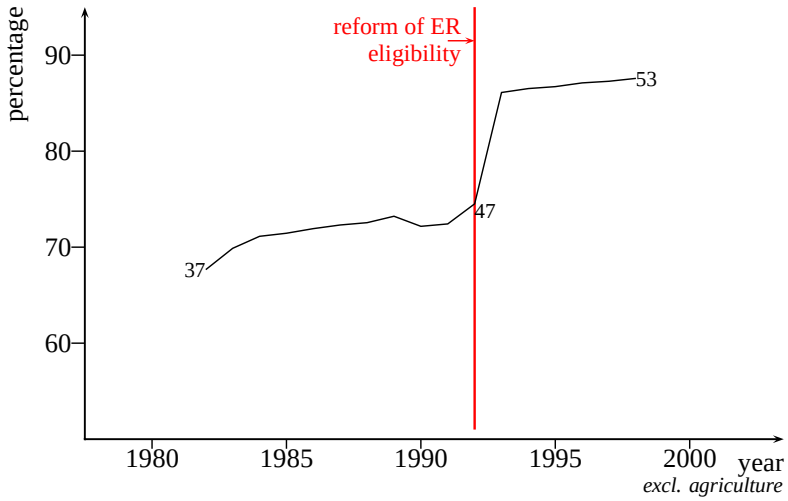


Figure 2: UI Benefit Rule

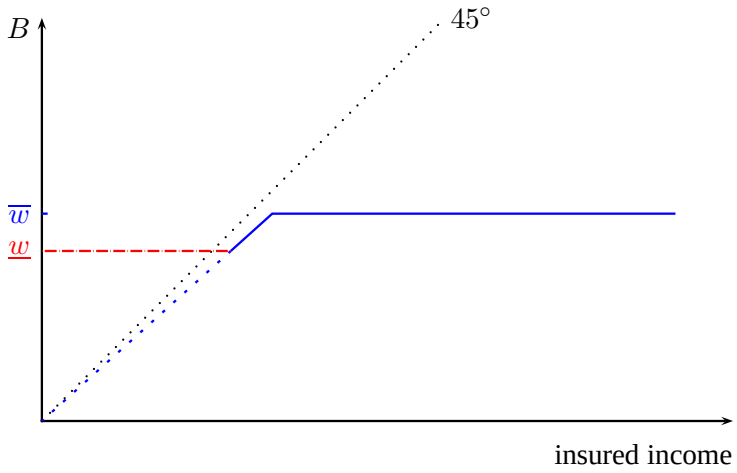


Figure 3: Probability of Unemployment

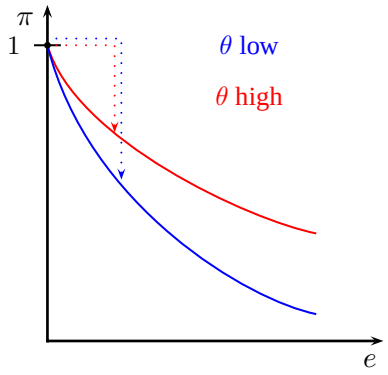


Figure 4: Utility of Consumption

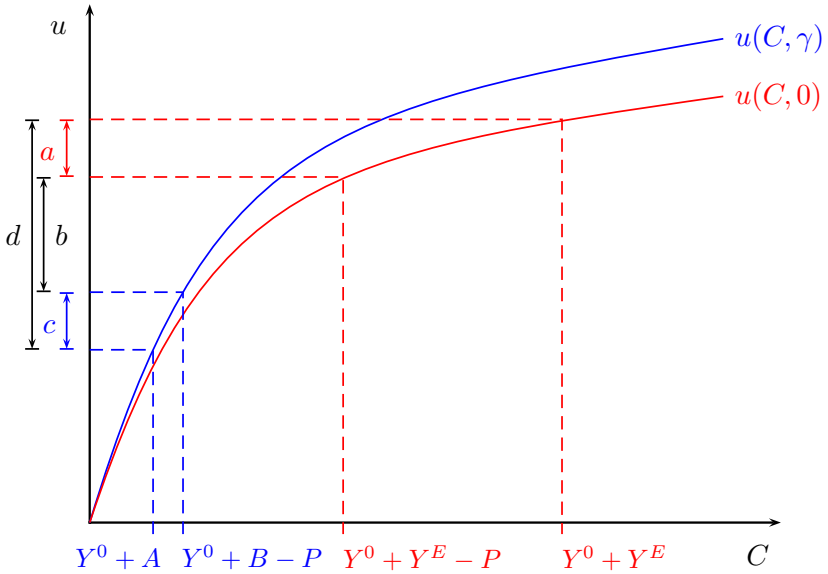


Figure 5: Effort and Cost of Effort

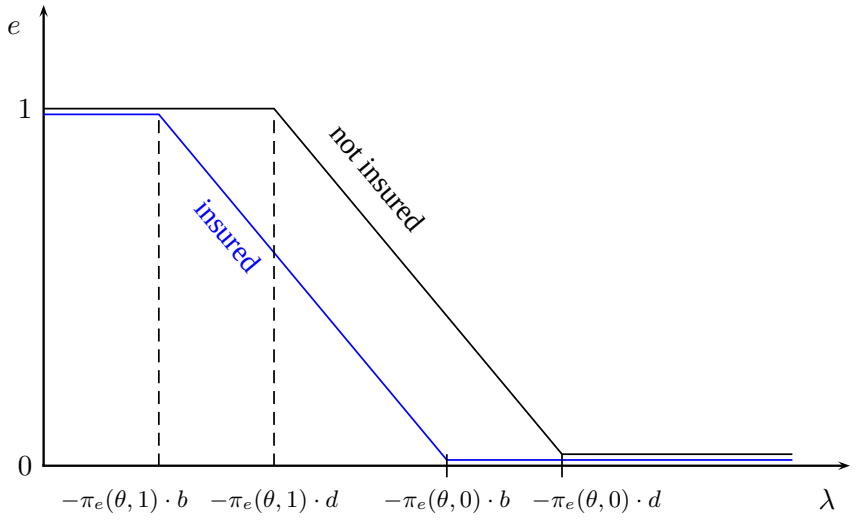


Figure 6: Insurance and Cost of Effort

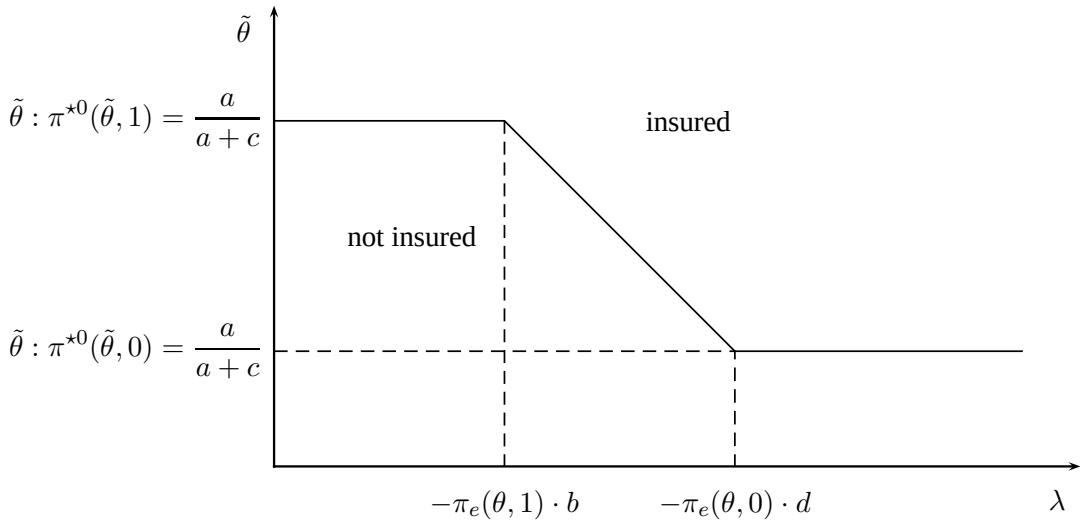
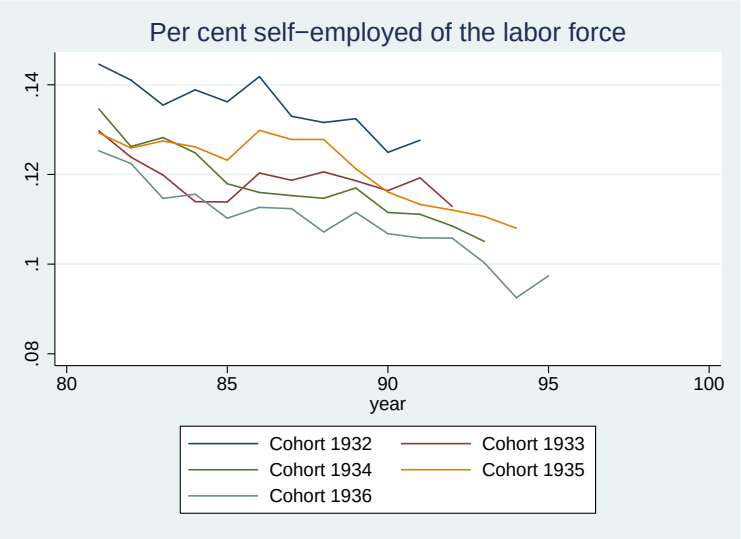
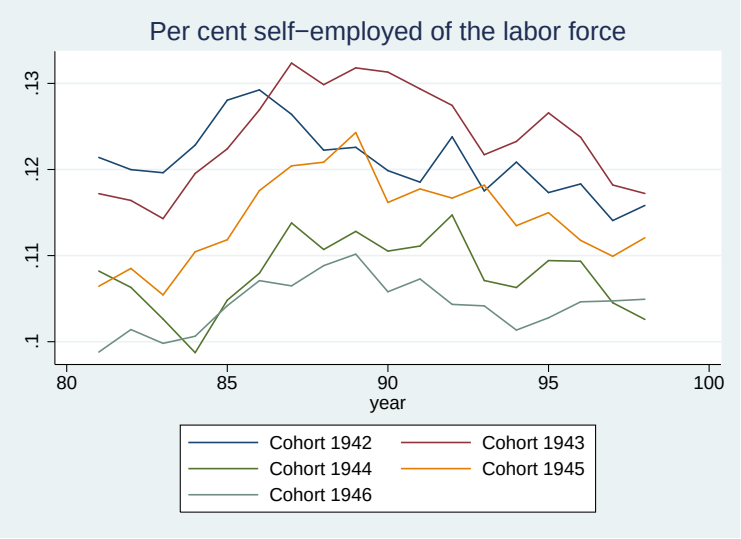


Figure 7: Self-employment by year-of-birth cohort and year in percent of labor force





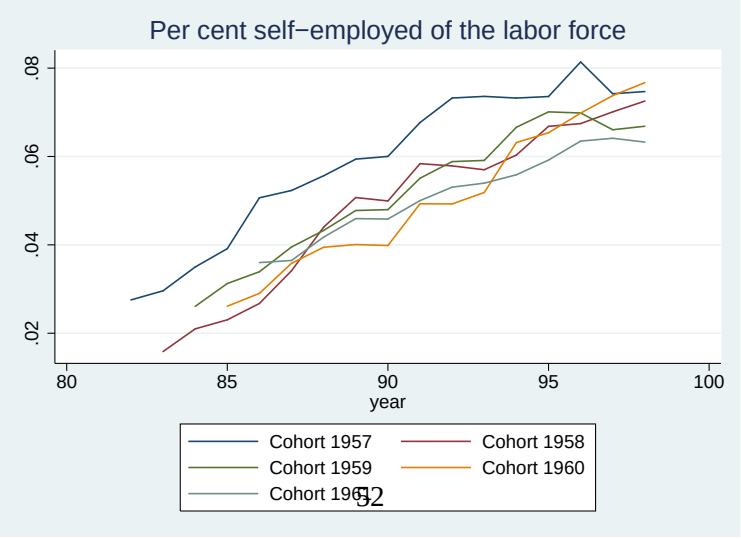


Figure 8: Survival in and Exit from Self-Employment

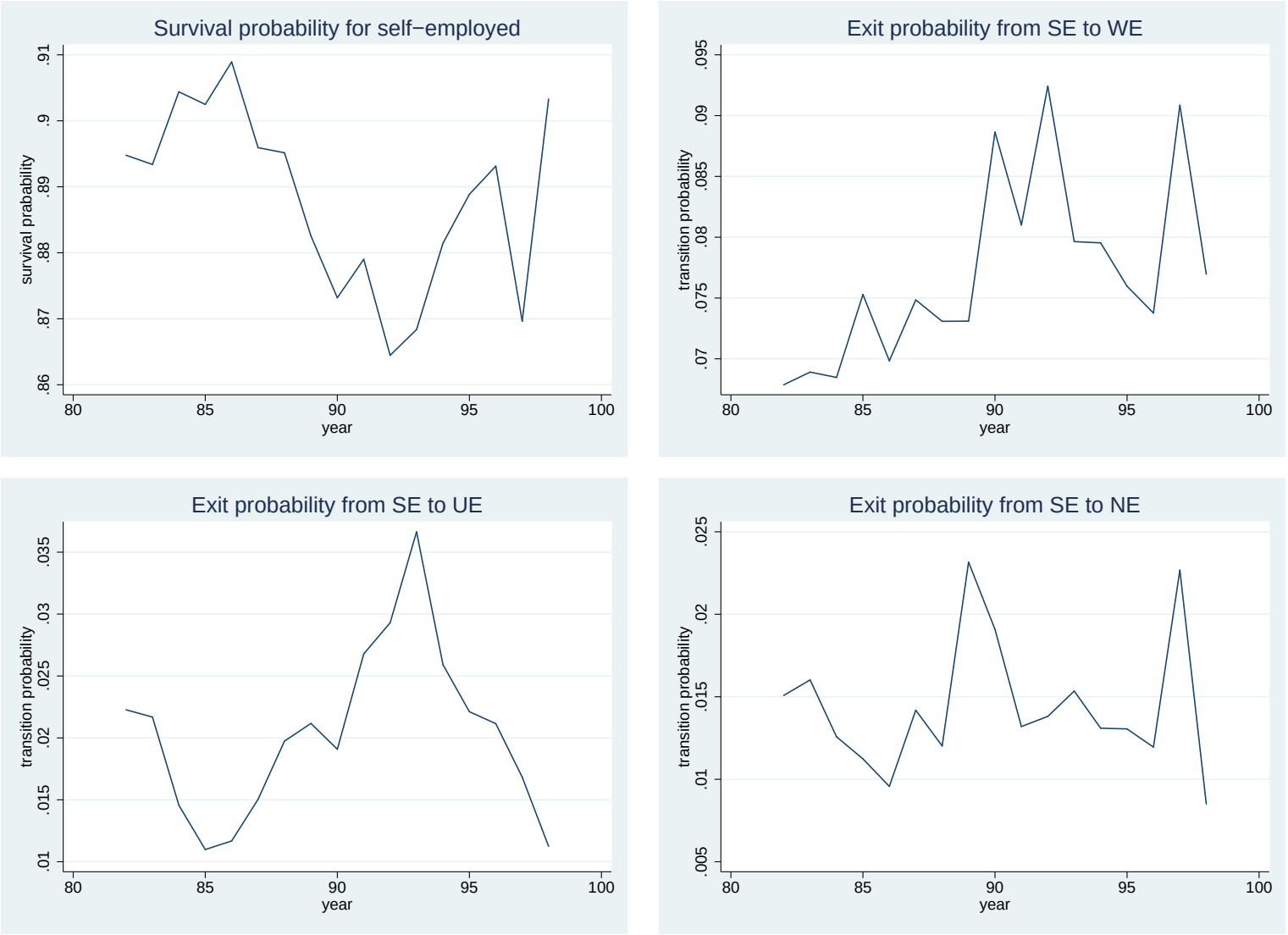
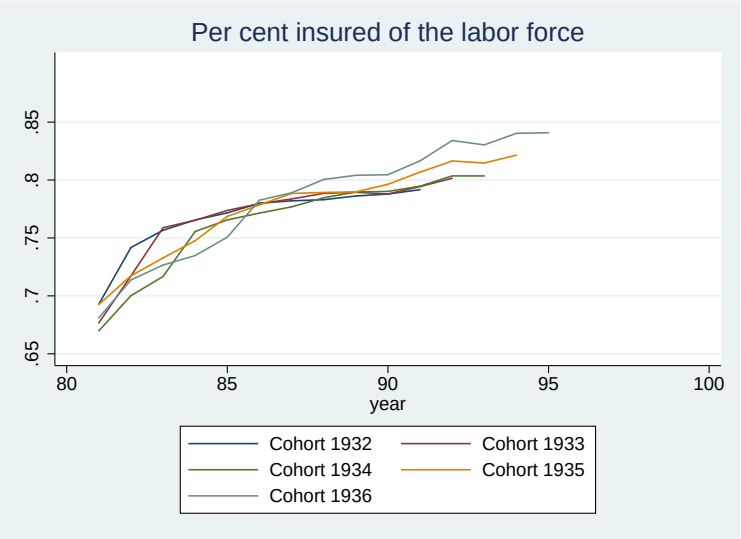
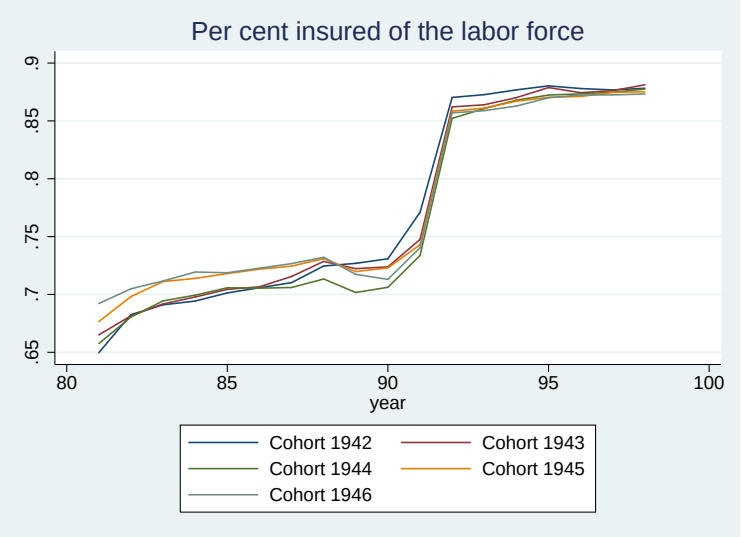


Figure 9: UI Membership as Percentage of Labor Force





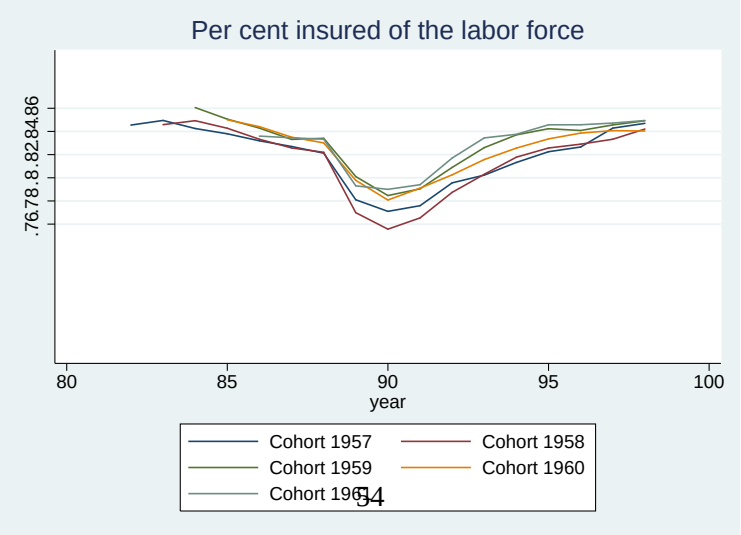


Figure 10: Bankruptcy Rates by Industry

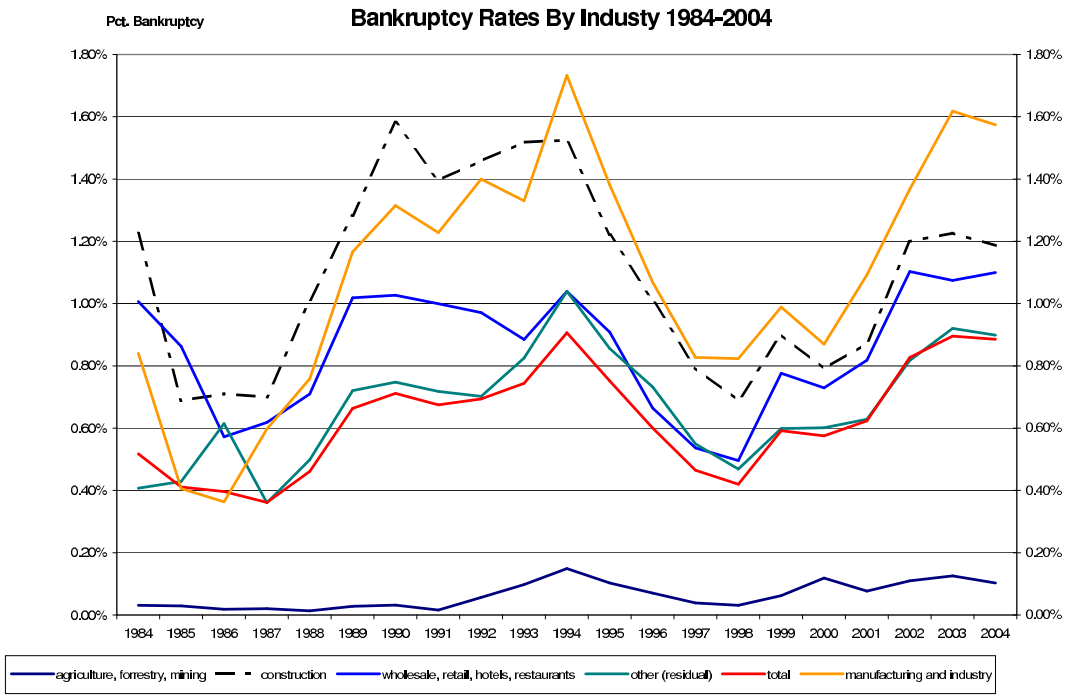


Table 1: Labor Market Status Over Time

year	self-employed	wage earner	unemployed	out of LF	Total
1981	10.26	81.40	6.79	1.55	87,452
1982	9.79	81.16	7.23	1.82	88,553
1983	9.32	81.30	7.54	1.84	89,141
1984	9.22	82.81	6.20	1.77	89,616
1985	9.22	84.61	4.56	1.62	90,079
1986	9.35	84.81	4.25	1.59	90,487
1987	9.27	84.44	4.42	1.86	90,835
1988	9.10	82.69	6.29	1.91	91,248
1989	8.96	82.77	5.92	2.35	91,697
1990	8.57	82.19	6.65	2.60	92,321
1991	8.62	81.30	7.73	2.35	93,249
1992	8.35	80.86	8.39	2.41	93,985
1993	8.05	80.42	9.23	2.29	94,314
1994	7.98	82.30	7.51	2.21	94,463
1995	8.01	83.65	5.94	2.39	93,811
1996	7.98	84.44	5.02	2.56	93,760
1997	7.70	85.52	4.19	2.59	93,598
1998	7.70	86.57	3.19	2.53	92,963

Note: row percentages, totals are frequencies. LF: labor force. *Source:* CAM 10% Sample, males 25-59, and further restrictions (see text).

Table 2: Overall Transition Rates between Labor Market States

labor market status year $t-1$	labor market status, year t				
	self-employed	wage earner	unemployed	out of LF	Total
self-employed	88.84	7.69	2.03	1.44	132,312
wage earner	0.95	94.84	3.49	0.72	1,257,120
unemployed	2.66	47.04	42.81	7.49	93,623
out of LF	6.68	27.75	14.43	51.15	28,370

Note: row percentages, totals are frequencies. LF: labor force. *Source:* CAM 10% Sample, males 25-59, and further restrictions (see text).

Table 3: Overall Unemployment Insurance Status by Labor Market Status

	labor market status			
UI fund membership	self-employed	wage earner	unemployed	out of labor force
total sample				
no	38.97	18.16	12.13	67.86
yes	61.03	81.84	87.87	32.14
total	144,222	1,370,194	101,958	35,198
thereof:				
ER eligible			32.7%	
no	27.29	15.82		
yes	72.71	84.18		
ER not eligible			67.3%	
no	46.99	19.25		
yes	53.01	80.75		

Note: column percentages, totals are frequencies.
Source: CAM 10% Sample, males 25-59, and further restrictions (see text).

Table 4: Joining UI Fund by Labor Market Status and Force of ER Incentive

UI fund entry between $t-1$ and t	labor market status, year $t-1$			
	self-employed	wage earner	unemployed	out of LF
all years before ER eligibility				
no	90.50	91.40	85.97	89.71
yes	9.50	8.60	14.03	10.29
last year to sign up in order to be ER-eligible				
no	69.96	71.73	89.25	90.08
yes	30.04	28.27	10.75	9.92
years after eligibility incentive (no ER gain from joining)				
no	88.83	91.20	91.95	94.43
yes	11.17	8.80	8.05	5.57

Note: column percentages. LF: labor force.
Source: CAM 10% Sample, males 25-59, and further restrictions (see text), and not UI-fund member in $t-1$.

Table 5: Effect of Joining UI Fund on Transition Rates from Self-employment

UI fund membership year $t-1$	labor market status, year t			
	self-employed	wage earner	unemployed	out of LF
no	92.02	5.31	0.64	2.02
yes	92.40	5.33	2.03	0.24

Note: row percentages. LF: labor force.
Source: CAM 10% Sample, males 25-59, and further restrictions (see text), selfemployed in years $t-1$, $t-2$ and $t-3$.

Table 6: Transitions from Self-employment to Unemployment (Fixed Effects Logit)

variable	Specification I marg. effect	Specification I std. error	Specification II marg. effect	Specification II std. error	Specification III marg. effect	Specification III std. error
UI fund member, $t-1$	0.0832	0.030**	0.0810	0.033*	0.0784	0.033*
educ.-specific unemployment rate, $t-1$	2.2379	0.450**				
industry-spec. bankruptcy rate, $t-1$			11.2449	3.621**	12.1653	3.491**
income from self-employment, $t-3$ [mDKK]	0.2493	0.091**	0.3911	0.134**		
had negative income from SE, $t-3$	0.0177	0.034	0.0485	0.042		
UI benefit level, $t-1$ [kDKK]	−0.0003	0.001	0.0020	0.002		
wealth, $t-1$ [mDKK]	−0.0050	0.020	−0.0664	0.029*		
total income spouse, $t-1$ [kDKK]	−0.0004	0.000	−0.0004	0.000		
experience [years] as wage earner, $t-3$	−0.4514	0.179*	−0.5246	0.251*	−0.5369	0.253*
SE start-up support, $t-3$	−0.4031	0.088**	−0.4188	0.115**	−0.4203	0.125**
age/10	11.9626	3.018**	15.0225	3.708**	15.4047	3.642**
age squared/100	−2.7021	0.660**	−3.3157	0.821**	−3.3850	0.809**
age cubed/1000	0.2145	0.048**	0.2580	0.060**	0.2618	0.060**
age spouse, $t-1$	0.0064	0.003*	0.0075	0.004*	0.0073	0.004*
spouse does not work, $t-1$	0.0293	0.020	0.0365	0.026	0.0441	0.024
receipt sickness benefits, $t-1$	0.1161	0.093	0.1695	0.147	0.1442	0.133
marital status: single, $t-1$	0.2729	0.122*	0.3234	0.147*	0.3435	0.144*
children age ≤ 17 living at home, $t-1$	−0.0301	0.028	−0.0618	0.034	−0.0634	0.033
Log likelihood:	−967.35		−730.78		−740.68	
Pseudo R^2:	0.4772		0.5248		0.5183	
Number of observations:	6773		5556		5556	
number of individuals:	1106		951		951	

Source: CAM 10% Sample, males 25-59, and further restrictions (see text), selfemployed in previous three years. Asterisks indicate significance levels: ** 1% or less, * 5% or less.

Table 7: Unemployment Insurance Choice (Fixed Effects Regression), 1st Stage of Two-Stage Model

	Specification I		Specification II		Specification III	
variable	coeff.	std.err.	coeff.	std.err.	coeff.	std.err.
educ.-specific unemployment rate, $t-1$	0.6025	0.066**				
industry-spec. bankruptcy rate, $t-1$			1.3689	0.392**	1.2699	0.386**
income from self-employment, $t-3$ [mDKK]	−0.0115	0.008	−0.0163	0.008*		
had negative income from SE, $t-3$	0.0236	0.007**	0.0224	0.008**		
UI benefit level, $t-1$ [kDKK]	−0.0017	0.000**	−0.0007	0.000*		
wealth, $t-1$ [mDKK]	0.0013	0.002	−0.0004	0.002		
total income spouse, $t-1$ [kDKK]	0.0000	0.000	0.0000	0.000		
experience [years] as wage earner, $t-3$	−0.0221	0.006**	−0.0308	0.007**	−0.0299	0.007**
SE start-up support, $t-3$	0.0491	0.011**	0.0540	0.011**	0.0562	0.011**
age/10	−3.3082	0.154**	−3.1497	0.167**	−3.1804	0.167**
age squared/100	0.7574	0.035**	0.7213	0.037**	0.7273	0.037**
age cubed/1000	−0.0534	0.003**	−0.0509	0.003**	−0.0512	0.003**
age spouse, $t-1$	0.0013	0.000**	0.0010	0.000*	0.0010	0.000
spouse does not work, $t-1$	−0.0241	0.005**	−0.0228	0.005**	−0.0219	0.005**
receipt sickness benefits, $t-1$	0.0414	0.023	0.0450	0.025	0.0467	0.025
marital status: single, $t-1$	0.0169	0.019	0.0093	0.021	0.0116	0.020
children age ≤ 17 living at home, $t-1$	−0.0128	0.004**	−0.0146	0.004**	−0.0146	0.004**
eligibility early retirement, $t-1$	0.1235	0.005**	0.1386	0.005**	0.1385	0.005**
eligibility early retirement, $t-2$	−0.0303	0.004**	−0.0311	0.005**	−0.0309	0.005**
year 1988	0.0162	0.004**	0.0082	0.004*	0.0093	0.004*
σ_η	0.5049		0.5247		0.5225	
σ_ϵ	0.2531		0.2491		0.2491	
R^2 within:	0.1837		0.1756		0.1753	
R^2 total:	0.0100		0.0045		0.0050	
%-age prediction $\in [0,1]$	87.84		75.26		75.41	
F-test regressors ($p-$value)	0.0000		0.0000		0.0000	
Number of observations:	83328		74171		74171	
number of individuals:	12879		11987		11987	

Source: CAM 10% Sample, males 25-59, and further restrictions (see text), selfemployed in previous three years. Asterisks indicate significance levels: ** 1% or less, * 5% or less. Specification includes intercept. σ_η: standard-deviation fixed effect, σ_ϵ: standard-deviation idiosyncratic error.

Table 8: Transitions from Self-employment to Unemployment (Fixed Effects Logit), Two-Stage Model, 2nd Stage

	Specification I		Specification II		Specification III	
variable	marg. effect	std. error	marg. effect	std. error	marg. effect	std. error
predicted UI fund member, $t-1$	0.4004	0.169*	0.4576	0.177**	0.4756	0.175**
educ.-specific unemployment rate, $t-1$	1.9122	0.485**				
industry-spec. bankruptcy rate, $t-1$			10.4504	3.417**	11.3917	3.295**
income from self-employment, $t-3$ [mDKK]	0.2522	0.086**	0.3969	0.125**		
had negative income from SE, $t-3$	0.0111	0.033	0.0391	0.041		
UI benefit level, $t-1$ [kDKK]	0.0004	0.001	0.0023	0.002		
wealth, $t-1$ [mDKK]	−0.0053	0.019	−0.0643	0.027*		
total income spouse, $t-1$ [kDKK]	−0.0004	0.000	−0.0004	0.000		
experience [years] as wage earner, $t-3$	−0.4385	0.168**	−0.5072	0.233*	−0.5188	0.237*
SE start-up support, $t-3$	−0.4232	0.087**	−0.4466	0.113**	−0.4502	0.121**
age/10	13.9625	3.006**	17.4765	3.601**	17.9956	3.518**
age squared/100	−3.1555	0.657**	−3.8743	0.797**	−3.9748	0.780**
age cubed/1000	0.2465	0.047**	0.2976	0.058**	0.3036	0.057**
age spouse, $t-1$	0.0059	0.003*	0.0070	0.004*	0.0067	0.003
spouse does not work, $t-1$	0.0387	0.020*	0.0500	0.025*	0.0577	0.023*
receipt sickness benefits, $t-1$	0.0973	0.090	0.1480	0.141	0.1211	0.127
marital status: single, $t-1$	0.2681	0.117*	0.3204	0.143*	0.3340	0.139*
children age ≤ 17 living at home, $t-1$	−0.0267	0.027	−0.0576	0.033	−0.0592	0.032
Log likelihood:	−969.73		−731.52		−741.09	
Pseudo R^2:	0.4709		0.5243		0.5181	
Number of observations:	6773		5556		5556	
number of individuals:	1106		951		951	

Source: CAM 10% Sample, males 25-59, and further restrictions (see text), selfemployed in previous three years. Asterisks indicate significance levels: ** 1% or less, * 5% or less. Standard errors based on 100 bootstrap replications.

Table 9: Transitions from Self-employment to Other Destinations (Fixed Effects Multinomial Logit), Specification II

	binary FE logit		multinomial FE logit					
	to unemployment		to unemployment		to wage employment		out of labor force	
variable	coeff.	std.err.	coeff.	std.err.	coeff.	std.err.	coeff.	std.err
predicted UI fund member, $t-1$	3.3774	1.697*	3.0576	1.620	−1.1427	0.979	−5.5528	2.048**
educ.-specific unemployment rate, $t-1$								
industry-spec. bankruptcy rate, $t-1$	77.1279	25.233**	76.0443	24.033**	36.4919	14.153**	13.8499	24.441
income from self-employment, $t-3$ [mDKK]	2.9294	0.965**	3.1729	0.939**	−0.0238	0.197	2.2673	0.629**
had negative income from SE, $t-3$	0.2889	0.323	0.2154	0.310	9.1499	0.162	0.4130	0.415
UI benefit level, $t-1$ [kDKK]	0.0167	0.012	0.0108	0.012	−0.0264	0.007**	0.0045	0.013
wealth, $t-1$ [mDKK]	−0.4746	0.239*	−0.6497	0.222**	0.0272	0.029	0.0453	0.114
total income spouse, $t-1$ [kDKK]	−0.0027	0.002	−0.0035	0.002	−0.0006	0.001	0.0009	0.002
experience [years] as wage earner, $t-3$	−3.7435	0.469**	−3.9462	0.475**	−8.8480	0.317**	−1.1287	0.348**
SE start-up support, $t-3$	−3.2963	0.486**						
age/10	12.8981	1.893**	11.8438	1.842**	4.3609	0.991**	1.0018	1.455
age squared/100	−0.2859	0.042**	−0.2643	0.041**	−0.0607	0.022**	−0.0167	0.033
age cubed/1000	0.0022	0.000**	0.0020	0.000**	0.0004	0.000*	0.0001	0.000
age spouse, $t-1$	0.0518	0.025*	0.0430	0.024	0.0184	0.017	0.0500	0.025*
spouse does not work, $t-1$	0.3689	0.244	0.4043	0.231	0.1487	0.142	0.1942	0.262
receipt sickness benefits, $t-1$	1.0920	0.695	0.7597	0.638	0.3771	0.367	1.2997	0.728
marital status: never married, $t-1$	2.3646	0.997*	1.9924	0.955*	0.7275	0.636	2.7874	1.072**
children age ≤ 17 living at home, $t-1$	−0.4249	0.277	−0.3731	0.262	0.0697	0.145	−0.3168	0.256
Log likelihood:			−3790.30					
Number of observations:	5556		24202					
number of individuals:	951		4479					

Source: CAM 10% Sample, males 25-59, and further restrictions (see text), selfemployed in previous three years. Asterisks indicate significance levels: ** 1% or less, * 5% or less. Column 'binary FE logit' displays coefficients corresponding to the marginal effects in Table 8