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When Might Unemployment Insurance Matter? Credit Constraints and the Cost of Saving.

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Abstract

Unemployment insurance is more valuable when self-insurance is more difficult. Self-insurance is more viable when the cost of borrowing and the cost of saving are low. The cost of savings depends on the timing of income and the timing of needs, as well as private and market discount rates. Heterogeneity in any of these factors translates into heterogeneity in the cost of saving and thus in the value of unemployment insurance. We develop a life-cycle model to illustrate these connections. We then provide empirical evidence on the extent of credit constraints and heterogeneity in the cost of saving among job losers. Among job losers, 25% do not have access to credit markets. Liquid assets that can be used to buffer employment shocks are lower for households with children (high needs). Among older households, those with illiquid pension wealth have less liquid wealth.

Keywords: unemployment benefit, savings, credit constraints, life-cycle, social insurance

JEL Classification: H53, D91

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1 Introduction

In most developed countries unemployment insurance is a large and important public program. Theoretically, such compulsory social insurance may solve an adverse selection problem which limits private unemployment insurance, but in common with private insurance, may induce moral hazard. Empirical research has documented that public unemployment insurance has consumption smoothing benefits but does distort the behaviour of workers and firms.[1]

From the point of view of an individual worker, the value of unemployment insurance will depend on how difficult it is to self-insurance. This in turn will depend on the cost of borrowing (credit market imperfections) and on the cost of (precautionary) saving. The cost of savings depends on the timing of income and the timing of needs, as well as private and market discount rates. Heterogeneity in any of these factors will translate into heterogeneity in the cost of saving. Market imperfections mean heterogeneity in the cost of saving passes through to heterogeneity in the value of unemployment insurance.

Recent studies of household wealth (Samwick, 1998) and consumption growth (Attanasio et al., 1999; Alan and Browning, 2003) provide empirical evidence of important heterogeneity in some of the determinants of the cost of saving. Our goal in this paper is to consider heterogeneity in access to credit markets after job loss and in the cost of saving prior to job loss.

We first construct a transparent (finite horizon) life-cycle consumption model, extending Bailey (1978). In our model, job loss is exogenous, the unemployed can invest in subsequent earnings capacity, insurance is partly from public unemployment insurance and partly from private savings, and we allow for the possibility of credit constraints. We use this model to illustrate the connections between credit market imperfections, the cost of saving and the effects of unemployment insurance.

Using this model as a guide, we then investigate empirically credit market access and holdings of liquid assets among job losers, using data from an unusual Canadian survey. The survey is of individuals who lost their jobs in particular windows in time and contains among other information, data on financial circumstances at the time of job loss and after job loss. To assess the importance of credit constraints, we have a unique combination of questions including subjective questions about

[1] On the distortions, see for example, Meyer (1990), Atkinson and Mickelwright, (1990), Anderson and Meyer (1993). On the consumption smoothing, see Hamermesh (1982), Gruber (1997), Browning and Crossley (2001), Bloemen and Stancanelli (2001), Sullivan (2002).

whether individuals are able to borrow and want to borrow, as well as objective questions on their success at obtaining credit since job loss. The latter are similar to those analyzed by Jappelli (1990) in a general population sample. We also have unique information on liquid assets held exactly at the time of job loss.

A quarter of job losers report that they could not borrow to raise current consumption. The incidence of credit constraints falls with age. With respect to liquid assets held at job loss we find striking heterogeneity. Almost half of job losers reported that their households had no such resources at the time of job loss. A quarter reported that their household had liquid savings of more than three months of usual household income. We further find that much of this variation can be understood in terms of life-cycle considerations. Liquid assets holdings are lower for households with children present (high needs). Among older households, those with illiquid pension wealth hold less liquid wealth with which they could smooth a temporary income loss.

In the next section we discuss our model. Section 3 outlines the implications of our model for asset accumulation, as well as more general implications. Section 4 describes the data. Section 5 presents our empirical analysis of credit constraints and financial circumstances and Section 6 concludes.

2 Life-Cycle Model

We develop a life-cycle model of consumption to illustrate how the effects of unemployment insurance depend on the cost of saving and the cost of borrowing. Potentially important benefits of unemployment insurance follow from enhanced consumption smoothing, and such benefits accrue to agents who are risk and fluctuation averse, and not otherwise fully insured.[2] Such agents will typically want to save and borrow. While models of intertemporal consumption and savings under uncertainty are plentiful, such models typically treat the income process as exogenous. Such an assumption ignores the potential moral hazard associated with unemployment insurance. On the other hand, the most common framework for thinking about the moral hazard induced by unemployment insurance is search models. In such models agents typically income maximize, and this is justified by assuming either linear utility (risk neutrality) or perfect insurance. Thus such models preclude

[2] In standard additive models, risk and fluctuation aversion are the same (the inverse of the intertemporal substitution elasticity). We note both here because below we will emphasize that unemployment insurance can smooth consumption both over states and over time.

the most obvious benefits of unemployment insurance. Our aim therefore is to build a framework for thinking about unemployment insurance which contrasts the moral hazard costs of unemployment insurance with the consumption smoothing benefits in the presence of credit market imperfections.

Bailey (1978) models the trade-off between consumption smoothing and moral hazard in a partial equilibrium framework. In Bailey's two period model, agents may lose their job between the first and second period. They then choose what portion of the second period to spend out of work. Crucially, utility depends only on total income in the second period: the fact that income may be low while unemployed is immaterial. This is consistent with the unemployed having complete access to credit markets. However, it is inconsistent with the common perception that the unemployed may be in temporarily difficult financial circumstances. Because of its transparency and useful insights, the Bailey model is still used to assess empirical estimates of the costs and benefits of unemployment insurance (see for example Gruber, 1997). Nevertheless, the restriction that the timing of income after job loss in unimportant is an important limitation. Our model might best be thought of as an extension of the Bailey framework. It develops that framework in two ways: first, we introduce role for credit constraints; second, we introduce a retirement savings motive. The latter allows us to vary the cost of holding assets for precautionary reasons. Our model is partial equilibrium but with a government budget constraint, like the Bailey model.[3]

There are a number of alternatives to the finite horizon life-cycle model we develop. Hansen and Imrohorglu (1992) model unemployment insurance in an infinite horizon, calibrated dynamic general equilibrium model. This is less suitable for our purposes of understanding the effects of heterogeneity in the cost of saving because with an infinite horizon, agents must be impatient in order to keep the problem bounded. In an infinite horizon, partial equilibrium model, Lentz (2003) varies the degree of impatience and illustrates that the value of unemployment insurance depends on the "cost of saving". The more impatient agents are, the more costly it is for them to hold a buffer stock of savings, and the more valuable social insurance becomes. However, the infinite

[3] We believe that for our purposes the general equilibrium feedback effects of savings by the unemployed onto the interest rate is unimportant: because wealth distributions are so highly skewed, it is reasonable to model users of unemployment insurance systems as price takers in capital markets (even in aggegrate).

A second potential general equilibrium effect is the effect of unemployment insurance on the vacancy posting behaviour of firms (firms' vacancy decisions do not take into account the positive externality on other firms of creating a "thicker" market). Similarly, we do not capture the negative externality of search on the probability of other people finding jobs. These general equilibrium and externality effects may be important but it is unlikely that there will be an important interaction with the costs and benefits we analyse in the current paper.

horizon framework precludes Lentz from considering patient agents and from explicitly introducing life-cycle considerations. Rendon (2003) carries out a similar exercise in a finite horizon, allowing for some life-cycle effects. His focus is on estimating structural parameters rather than on exploring heterogeneity due to life-cycle effects. Costain (1999) also works with a finite horizon model, but allowing for general equilibrium effects. His focus is on the value of unemployment insurance using a model calibrated to median wealth holdings and so he explicitly ignores the heterogeneity in the data. Further, like Rendon, he does not consider that heterogeneity in characteristics and in wealth may make the value of unemployment insurance very different for different individuals.[4] It is the effects of this heterogeneity across households that we illustrate in our model and then explore in our empirical analysis. In particular, we show the extent that the heterogeneity in asset holdings in the data can be explained by life-cycle considerations.

2.1 Assumptions and notation

Life has three stages: youth, middle-age and old age. We use subscripts to denote the life-stage and note that life-stages may be of different lengths. Agents are risk-averse and maximize expected utility. They begin the first stage (which lasts from 0 until T_1) with initial assets $A_0 (= 0)$. In this stage agents work for a wage, w_1, and consume continuously. Individuals pay two (proportional) taxes: a pension contribution (τ^r), and an unemployment insurance contribution (τ^u). If they choose to consume less than their net income, they accumulate assets. As in Bailey (1978), at the end of the first stage individuals face an exogenous probability (π) of job displacement. Where necessary, we use superscripts ^{d}(displaced) and ^{n}(not displaced) to denote states of the world.

In the second stage (from T_1 to T_2) agents consume (and save or possibly borrow). If they are not displaced at the end of the first period, they continue to earn the wage w_1. If agents are displaced at the end of the first period, they can return to work immediately at some wage which is strictly less than the wage in the job from which they were displaced ($w_2(I = 0) < w_1$). Alternatively, they may choose to invest for time $I \leq T_2 - T_1$. During this investment period they receive a benefit b. If $I < T_2 - T_1$ they return to work at $T_1 + I$, earning a wage $w_2(I)$ which is increasing in the duration

[4] Some recent papers focus on how the value of unemployment insurance depends on the nature of risk individuals actually face. For example, Rogerson and Schindler (2002) show in a life-cycle model that the welfare benefit of unemployment insurance depends on the persistence of earnings losses on unemployment. Low *et al.* (2004) distinguish employment risk from earnings risk and show that the lack of persistence in unemployment shocks means self-insurance is more feasible and public unemployment insurance less valuable.

of investment ($w_2(0) \leq w_2(I) \leq w_1$). Individuals pay taxes on unemployment benefits.

We can interpret investment in a number of alternative ways: first, investment may be search by the unemployed with longer search leading to a better match;[5] second, investment may be retraining by the unemployed with wages being higher the longer the training period; third, investment may merely be waiting for recall; finally, if we reinterpret unemployment benefit as a minimum payment to the worker, investment may be thought of as on-the-job training where workers receive a minimum payment during the training period, but a higher wage on completion. The presence of unemployment benefit may distort these investment decisions.

In the final stage of life (from T_2 to T_3), individuals are (exogenously) retired and collect a pension, which they consume. The size of their pension is determined solely by their contributions in the first two stages of life and contains no redistributive element. In retirement individuals pay no taxes. At the end of the third stage they die with terminal assets $A_3 = 0$. The amount of resources available for consumption in retirement is determined by pension wealth plus liquid asset holdings not consumed in earlier stages.

In a general intertemporal consumption model, an agent's patience (their inclination to save) will be determined by the interest rate, their discount factor, the time path of their needs, and the time path of their income. We assume that there is no discounting or rate of return ($\delta = r = 0$). We also abstract from explicitly modelling changes in needs. This gives us flat desired consumption paths. However, we can vary the impatience (again, defined as the inclination to save) of the agents in this model by varying the growth rate of income they face.

Savings motives are not additive: liquid assets held for precautionary reasons (smoothing consumption in the face of a temporary income loss) can be consumed in retirement if the negative shock is not realised. Equally, liquid assets held for retirement purposes may be partially used for precautionary reasons if unexpected shocks occur. This point is also emphasized by Dynan, Skinner and Zeldes (2002) who argue that precautionary savings and savings for a bequest motive cannot be distinguished. It is more costly for an impatient agent to accumulate precautionary balances as the marginal utility of current consumption is high (and similarly, resources that become available late in life - if the shock is not realized - have low value).

[5] It is possible that wages decline if unemployment is too long. In the current model, there is no uncertainty about job offer arrival, and so if there were no unemployment benefit, we would be able to ignore the part of the investment schedule which is declining.

In our model we alter the growth rate of income through (exogenous) changes to the pension system. With high withholding (large τ^r) agents face a rising income profile. Such agents would like to borrow, and saving is costly for such agents. With low withholding, agents face a falling income profile and wish to save. This is crucial because it will allow us to explore the value of unemployment insurance to agents for whom it is more or less costly to save.

Timing in the model is summarized in Figure 1 and notation in Table 1.

Table 1: Notation and Earnings

c_t :	consumption at time t	τ^r :	social security tax
A_s :	assets at end of stage s	τ^u :	unemployment insurance tax
w_s :	wage in stage s	b :	unemployment benefit (replacement ratio)
Y_s :	gross income for stage s		
E_s :	gross earnings for stage s	I :	duration of investment

	Gross Earnings	*Gross Income* (earnings + benefits)
Stage 1	$E_1 = w_1 T_1$	$Y_1 = E_1$
Stage 2 *(displaced)*	$E_2^d = (T_2 - T_1 - I) w_2(I)$	$Y_2^d = E_2 + bY_1 I$
Stage 2 *(notdisplaced)*	$E_2^n = (T_2 - T_1) w_1$	$Y_2^n = E_2^n$
Stage 3	$E_3 = 0.0$	$Y_3^i = \tau^r (Y_1 + Y_2^i)$

All income in stages 1 and 2 is subject to tax at a rate $t^r + t^u$.

There are theoretical reasons to think that access to credit and the cost of borrowing may be limited and may vary across individuals.[6] We consider an extreme variation in the cost of borrowing, comparing cases where agents can borrow freely (subject only to the terminal asset condition) with cases where they face an exogenous borrowing limit $A_t \geq -\phi$. We provide direct empirical evidence on the extent of credit constraints among job losers in section 5.1.

[6] In asymetric information models, it may be better for lenders to better to ration credit than to raise interest rates because high interest rates may bring only high risk borrowers (Jaffee and Russel, 1976; Stiglitze and Weiss, 1981); In endogenous credit constraint models, lenders will lend only up to the point that default (and subsequent autarky) becomes attactive (Kehoe and Levinc, 1993; Kocherlakota,1996)

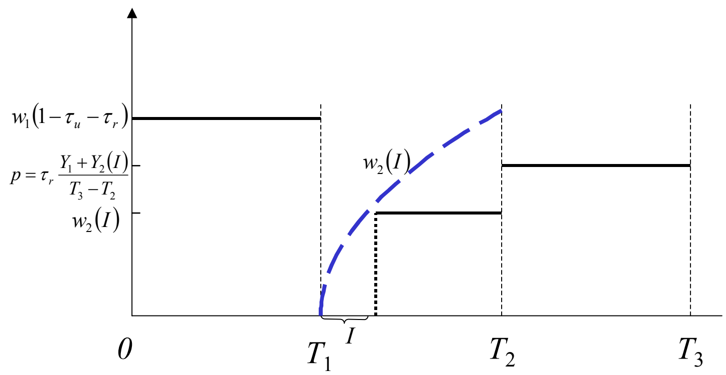


Figure 1: Time Path of Earnings

2.2 Individual Optimization Problem

We now lay out the individual optimization problem, taking b, τ^r, and τ^u as given. The individual maximises

$$V_1 = \max_{c_t, A_1} \int_0^{T_1} u(c_t)dt + \pi V_2^d(A_1) + (1-\pi)V_2^n(A_1) \tag{1}$$

subject to the budget constraint

$$\int_0^{T_1} c_t dt = -A_1 + Y_1 (1 - \tau^r - \tau^u)$$

and, if present, the credit constraint,

$$A_1 \geq -\phi.$$

The solution to this problem can be characterised by the Euler equation:

$$\frac{\partial V_1}{\partial A_1} = u'(c_1) - \pi \frac{\partial V_2^d}{\partial A_1} - (1-\pi)\frac{\partial V_2^n}{\partial A_1} + \mu_1 = 0 \tag{2}$$

$$\mu_1 \geq 0, \qquad A_1 \geq -\phi. \tag{3}$$

The presence of the credit constraint affects equation (2) in two possible ways: first, it may cause the Euler equation to be violated (ie. μ_1 is strictly positive); second, the constraint may bind in period 2 and so can affect behaviour in period 1 through either $\frac{\partial V_2^d}{\partial A_1}$ or $\frac{\partial V_2^n}{\partial A_1}$, even though $\mu_1 = 0$.[7]

[7] If there is no displacement, the constraint will only bind in period 2 if individuals are sufficiently impatient (if τ^r is sufficiently high).

In the absence of credit constraints, the solution is simple because the consumption path post-displacement can be separated from the timing of income: individuals displaced in the second stage choose investment simply to maximise income and, since there is no discounting, individuals choose consumption to be constant in any particular state. Once we know consumption post-displacement, we can then solve for assets held at the end of period 1 before displacement by using the envelope theorem to replace $\frac{\partial V_2^n}{\partial A_1}$ and $\frac{\partial V_2^d}{\partial A_1}$ in equation (2) by the marginal utility of consumption in each state.

The presence of credit constraints introduces an interaction between the investment decision and the consumption decision and so the choice of investment depends on the consumption level in the investment period. This means investment will depend on asset holdings, A_1. To solve the problem with the credit constraint, we have to solve simultaneously the asset allocation equation (2) and the optimal investment equation (19). In the remainder of this section, we solve for the optimal choices of consumption and investment at each stage.

Stage 3: In the third (retirement) stage of life, the value function is

$$V_3\left(A_2; I\right) = \max_{c_t} \int_{T_2}^{T_3} u(c_t)dt$$

Subject to:

$$\int_{T_2}^{T_3} c_t dt = A_2 + \tau^r (Y_1 + Y_2\left(I\right)) \tag{4}$$

where $I = -1$ indicates the individual was not displaced in period 2. Note that the borrowing constraint, if present, is irrelevant because the constraint that terminal assets are zero and the assumption that $\delta = 0$ mean consumption is spread evenly through the stage. Associating λ_3 with the budget constraint (4) and using the envelope theorem,

$$\frac{\partial V_3}{\partial A_2} = \lambda_3$$

$$\frac{\partial V_3}{\partial I} = \lambda_3 \cdot \tau^r \cdot \left(\frac{\partial E_2}{\partial I} + bY_1 \right)$$

These expressions are needed in solving for assets and investment in early stages.

Stage 2 (not displaced): In the second stage there are two cases: displaced (d) or not (n). If the agent is not displaced, her value function is

$$V_2^n(A_1) = \max_{c_t, A_2} \int_{T_1}^{T_2} u(c_t)dt + V_3(A_2; I = -1)$$

subject to

$$\int_{T_1}^{T_2} c_t dt = A_1 - A_2 + Y_2^n (1 - \tau^r - \tau^u) \tag{5}$$

As with stage 3, consumption will be constant within the stage. Associating the multiplier λ_{2n} with constraint (5) gives the Euler equation

$$\begin{aligned} \frac{\partial V_2^n}{\partial A_2} &: \qquad -\lambda_{2n} + \frac{\partial V_3}{\partial A_2} + \mu_{2n} = 0 \qquad (6) \\ \mu_{2n} &\geq 0, \qquad A_{2n} \geq -\phi. \end{aligned}$$

If there is no borrowing constraint, or the constraint is not binding, $\mu_{2n} = 0$ and consumption will be smooth between stages 2 and 3.

Stage 2 (displaced): No credit constraint We consider optimal choices after displacement first for the case with no credit constraint and in the next subsection for the case with credit constraints.

If the worker is displaced her value function is

$$V_2^d(A_1) = \max_{c_t, A_2, I} \int_{T_1}^{T_2} u(c_t)dt + V_3(A_2, Y_2(I))$$

subject to

$$\begin{aligned} \int_{T_1}^{T_2} c_t dt &= A_1 - A_2 + \left(bY_1 I + E_2^d(I)\right)(1 - \tau^r - \tau^u) \qquad (7) \\ 0 &\leq I \leq T_2 - T_1 \qquad (8) \end{aligned}$$

As before, consumption will be constant within the stage. Associating the multiplier λ_{2d} with constraint (7) gives the Euler equation

$$\frac{\partial V_2^d}{\partial A_2} : \qquad \frac{\partial V_3}{\partial A_2} - \lambda_{2d} = 0 \tag{9}$$

Since we know consumption in the final period, we can solve directly for consumption in period 2 and for λ_{2d}.

Turning to investment behaviour, the absence of a credit constraint means that the choice over I can be considered independently from the choice of A_2.. The choice of I will be the income maximising choice that solves[8]

$$\max_{I} \left[w_2 (I) (T_2 - T_1 - I) + bY_1 I \right] (1 - \tau^u),$$

which yields the first order condition

$$w_2' (I) (T_2 - T_1 - I) + bY_1 = w_2 (I) \tag{10}$$

The left hand side of equation (10) is the marginal benefit of investment and the right hand side is the marginal cost of investment, analogous to the partial equilibrium, linear utility model (Mortensen, 1986). The marginal benefit of investment includes unemployment benefit and the resulting increase in the future wage. The marginal cost is the (forgone) wage. The marginal benefit of investment is increased by the unemployment benefit paid and so a positive replacement rate induces inefficient (over) investment. This is the moral hazard which is typically cited as the "cost" of unemployment insurance and which is the subject of the large empirical literature discussed in the introduction.

Stage 2 (displaced): With credit constraint

The presence of the credit constraint means the timing of income within the second stage may matter. The length of investment and the path of consumption will be jointly determined rather than being separable decisions as in the absence of credit constraints. Therefore, it is useful to divide the stage into an earnings and an investment substage.

Earnings sub-stage

$$V_{2E}^d (A_{1+I}, I) = \max_{c_{tE}, A_2} \int_{T_1+I}^{T_2} u(c_{tE}) dt + V_3(A_2, Y_2(I))$$

subject to

$$\int_{T_1+I}^{T_2} c_t dt = A_1 - A_2 + E_2^d(I) (1 - \tau^r - \tau^u) \tag{11}$$

$$A_2 \geq -\phi \tag{12}$$

[8] Noting that the pension tax paid in stage 2 is returned in stage 3.

Associating the multiplier λ_{2E} with the first constraint and μ_{2E} with the second constraint,[9] gives first-order conditions:

$$\begin{aligned} \frac{\partial V_{2E}^d}{\partial A_2} &: \quad \frac{\partial V_3}{\partial A_2} - \lambda_{2E} + \mu_{2E} = 0 \qquad (13) \\ \mu_{2E} &\geq 0, \quad A_2 \geq -\phi \end{aligned}$$

Using the envelope theorem,

$$\begin{aligned} \frac{\partial V_{2E}^d\left(A_{1+I}, I\right)}{\partial A_{1+I}} &= \lambda_{2E} \\ \frac{\partial V_{2E}^d\left(A_{1+I}, I\right)}{\partial I} &= -u\left(c_{2E}\right) + \frac{\partial V_3}{\partial I} + \lambda_{2E}\left(\frac{\partial E_2^d}{\partial I}\left(1-\tau^r-\tau^u\right)+c_{2E}\right) \qquad (14) \end{aligned}$$

Investment sub-stage

$$V_{2I}^d\left(A_1\right) = \max_{c_{tI}, A_2, I} \int_{T_1}^{T_{1+I}} u(c_{tI})dt + V_{2E}^d(A_{1+I}, I) \qquad (15)$$

subject to

$$\begin{aligned} \int_{T_1}^{T_{1+I}} c_{tI}dt &= A_1 - A_{1+I} + bY_1 I\left(1-\tau^r-\tau^u\right) \qquad (16) \\ A_{1+I} &\geq -\phi \qquad (17) \end{aligned}$$

Associating the multiplier λ_{2I} with the first constraint and μ_{2I} with the second constraint, gives the first-order condition for savings:

$$\begin{aligned} \frac{\partial V_{2I}^d}{\partial A_{1+I}} &: \quad \frac{\partial V_{2E}^d}{\partial A_{1+I}} - \lambda_{2I} + \mu_{2I} + 0 \qquad (18) \\ \mu_{2I} &\geq 0, \quad A_{1+I} \geq -\phi \end{aligned}$$

Turning to investment behaviour, the size of the distortion induced by unemployment benefit is affected by the presence of credit constraints. The presence of this interaction between unemployment benefit and credit constraints is an important implication of our model.

In this case, we need to use the first-order condition from maximising equation (15) with respect to I.

[9] As before, consumption must be constant within each sub-stage because no new information arrives within each sub-stage and the interest rate equals the discount rate. This in turn means that if the constraint binds at all in a sub-stage, it must bind at the end of that sub-stage.

$$\frac{\partial V_{2I}^d}{\partial I} = 0 = \frac{\partial V_{2E}^d}{\partial I} + u(c_{2I}) + \lambda_{2I} b Y_1 (1-\tau^r-\tau^u) - \lambda_{2I} c_{2I}$$

Substituting in from equation (14) and rearranging,

$$\frac{\partial E_2^d}{\partial I}\left[\lambda_3\tau^r + \lambda_{2E}(1-\tau^r-\tau^u)\right] + bY_1\left[\lambda_{2I}(1-\tau^r-\tau^u)+\lambda_3\tau^r\right] = u(c_{2E}) - u(c_{2I}) + \lambda_{2I}c_{2I} - \lambda_{2E}c_{2E}.$$

Using the definition of E_2^d, this can be rearranged as:

$$w'(I)(T_2-T_1-I)\left[\lambda_3\tau^r + \lambda_{2E}(1-\tau^r-\tau^u)\right] + bY_1\left[\lambda_{2I}(1-\tau^r-\tau^u)+\lambda_3\tau^r\right]$$
$$= w(I)\left[\lambda_3\tau^r + \lambda_{2E}(1-\tau^r-\tau^u)\right] + \Psi \qquad (19)$$

where we define Ψ by

$$\Psi = \left[u(c_{2E}) - u(c_{2I})\right] - \left[\lambda_{2E}c_{2E} - \lambda_{2I}c_{2I}\right].$$

The left hand side of equation (19) is the marginal benefit of investment and the right hand side is the marginal cost of investment, analogous to condition (10). The marginal benefit of investment includes unemployment benefit and the resulting increase in the future wage. Here (and in contrast to condition 10) both are weighted by marginal utility terms which are share weighted averages of the marginal utilities in the stages in which the relevant resources will be realized. The first term in the marginal cost is the (forgone) wage, again valued at a share weighted average of the marginal utilities in the periods in which it is received (note that because of the mandatory pension contributions, a fraction of current earnings is received in retirement). The second term Ψ (which would not appear if utility were linear) is a utility cost term associated with the failure to smooth consumption between the investment and earnings substages of period 2 and which depends on risk aversion.[10] This term can be approximated as[11]

$$\Psi \approx \gamma \Delta c_{2E} u'(c_{2E}),$$

[10] If the credit constraint is not binding, utility and marginal utility are equalised across periods and so $\Psi = 0$.

[11] Taking a first-order approximation to $u(c_{2E})$ around c_{2I} and substituting gives

$$\begin{aligned}\phi &= u'(c_{2I})c_{2E} - \lambda_{2E}c_{2E} \\ &= \left(u'(c_{2I}) - u'(c_{2E})\right)c_{2E}\end{aligned}$$

Taking an approximation for $u'(c_{2E})$ around c_{2I}

$$\begin{aligned}\phi &= -u''(c_{2E})(c_{2E}-c_{2I})c_{2E} \\ &= \left[-\frac{u''(c_{2E})}{u'(c_{2E})}c_{2e}\right](c_{2E}-c_{2I})u'(c_{2E})\end{aligned}$$

where γ is the coefficient of relative risk aversion which captures the degree of aversion to fluctuations in consumption. The presence of Ψ increases the marginal cost of investment because consumption is no longer smoothed over substages in a way that would not occur if there are no credit constraints. The size of this cost is increasing in the degree of fluctuation aversion. This reduces investment below investment when unconstrained. Investment when constrained may potentially fall below the level which would maximise earned income. In this case, increasing unemployment benefits can induce a more efficient level of search.

2.3 Government Budget Constraints

Unemployment benefit is financed in our model by the tax τ^u and we set τ^u to balance the government budget constraint. Ignoring the government budget constraint would mean increases in unemployment duration associated with more generous benefits do not introduce extra costs.

The budget constraint for the unemployment insurance system is:

$$\tau^u \left(w_1 T_1 + \pi w_2(I^*)((T_2 - T_1) - I^*) + (1-\pi) w_2(T_2 - T_1)\right) = \pi I^* bY \left(1 - \tau^u\right) \tag{20}$$

This implies that the budget is set to balance across individuals and there is redistribution from workers to the unemployed. Because there is no aggregate risk, we can alternatively say that the budget balances in expectation and so insurance is actuarially fair.

As discussed in section 2.1, budget balance in the pension system is imposed by each individual receiving the sum of their earlier contributions as retirement income: $Y_3 = \tau^r(Y_1 + Y_2(I))$. This implies that the pension system is forced saving, and contains no element of redistribution between individuals and no notion of insurance.

If there were only one government budget constraint, pension provision could contain an element of redistribution by providing "pension credits" for periods in unemployment. Similarly we do not consider redistribution across individuals who face different job loss risk, π, or different loss of potential earnings. Our focus is the on the non-redistributive aspects of unemployment insurance.

3 Implications of the Model

In this section, we outline implications of our model for individual saving behaviour. It is these implications which are the focus of our empirical evidence in subsequent sections. We also consider implications for consumption smoothing, investment and the marginal value of unemployment insurance. Implications of the model are demonstrated partly analytically and partly numerically.

For the numerical analysis we assume CRRA utility,

$$u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}$$

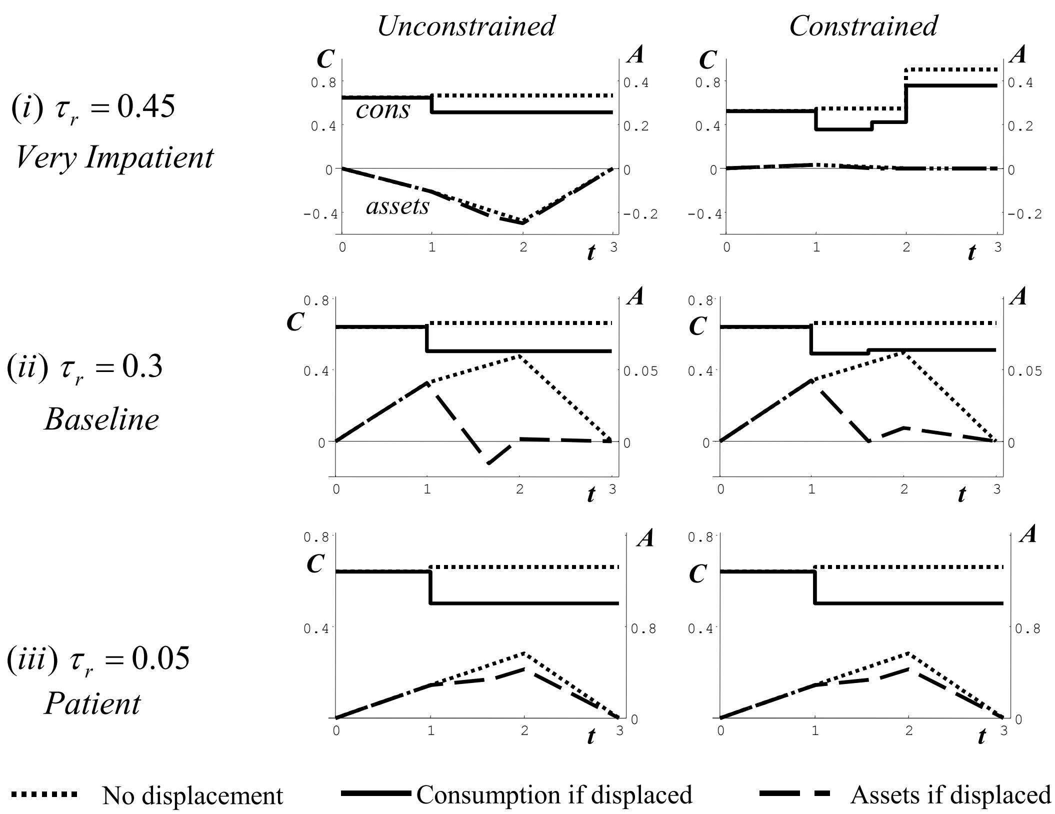
and a simple investment function, $w(I) = I^{\eta}$. In our baseline we set $\gamma = 1.5$ and $\eta = 0.5$. Each stage is assumed to be of length 1 and the wage rate in stage 1 is normalised to 1. We explore variation in replacement rates, variation in risk of layoff and timing of layoff and variation in the patience of agents. As noted above, the latter is controlled by the pension tax (τ^r) which controls the growth rate of expected income. With low τ^r agents anticipate low income in the future and save; with high τ^r agents anticipate high income in the future and would like to borrow. We interpret the variation in τ^r as variation in the cost of saving for precautionary reasons.

3.1 Precautionary Savings

Figure 2 displays the time paths of assets and consumption for simulations of our model with different parameter values. The left hand side panel present time paths for agents who can borrow; the right hand side panels present time paths for agents who cannot borrow. Moving from top to bottom the panels are differentiated by a decreasing cost of saving. In the top panels a very high value for pension withholdings is chosen which has the effect of making additional savings costly and agents very impatient (they would like to bring resources forward from the future.) In the bottom panels pension contributions are very low, the income profile is downward sloping, agents have a strong life-cyle (retirement) savings motive, and hence are patient. The middle panels present an intermediate case.

When agents are able to borrow, consumption is equalized across time (after the shock is realised) and the consumption path is independent of the timing of income. However, because time diversification is limited by the finiteness of life, consumption is not completely equalized across states. Patient agents (row *iii* in Figure 2) smooth by saving and their holdings of liquid assets increase with age until retirement, while impatient agents (row *i*) smooth by borrowing and their borrowing increases with age until retirement. This implies that as the cost of saving increases, individuals save less, and then borrow if the cost of saving becomes high enough.

Figure 2: **Asset and Consumption Paths**



The right hand column of Figure 2 shows that a similar results holds when individuals are unable to borrow: as the cost of saving increases, individuals save less, and then want to borrow if the cost of saving becomes high enough. Because patient agents have sufficient liquid wealth to smooth without borrowing, their time paths of consumption are unaffected by their inability to borrow (row *iii*). By contrast, impatient agents who cannot borrow cannot fully smooth consumption across time after job loss and consumption rises at reemployment (rows *i* and *ii*).

Figure 3 shows the extent of asset accumulation (A_1) for different replacement rates and for different costs of saving and borrowing. As with Figure 2, each row represents a different cost of saving, and in each graph we show the case where borrowing is unconstrained and the case where borrowing is constrained. The two columns represent different values of the probability of job loss.

Figure 3 reinforces that the extent of liquid asset holdings and the ability to self-insure depends on the cost of saving: greater forced retirement saving or greater impatience lead to lower liquid asset holdings. This result holds whether or not individuals are able to borrow. However, Figure 3 shows that the inability to borrow leads to greater asset holdings relative to the case where individuals are able to borrow. Further, row (*ii*) in Figure 3 shows that borrowing constraints can lead to greater asset holdings even if asset holdings are positive in the unconstrained case.

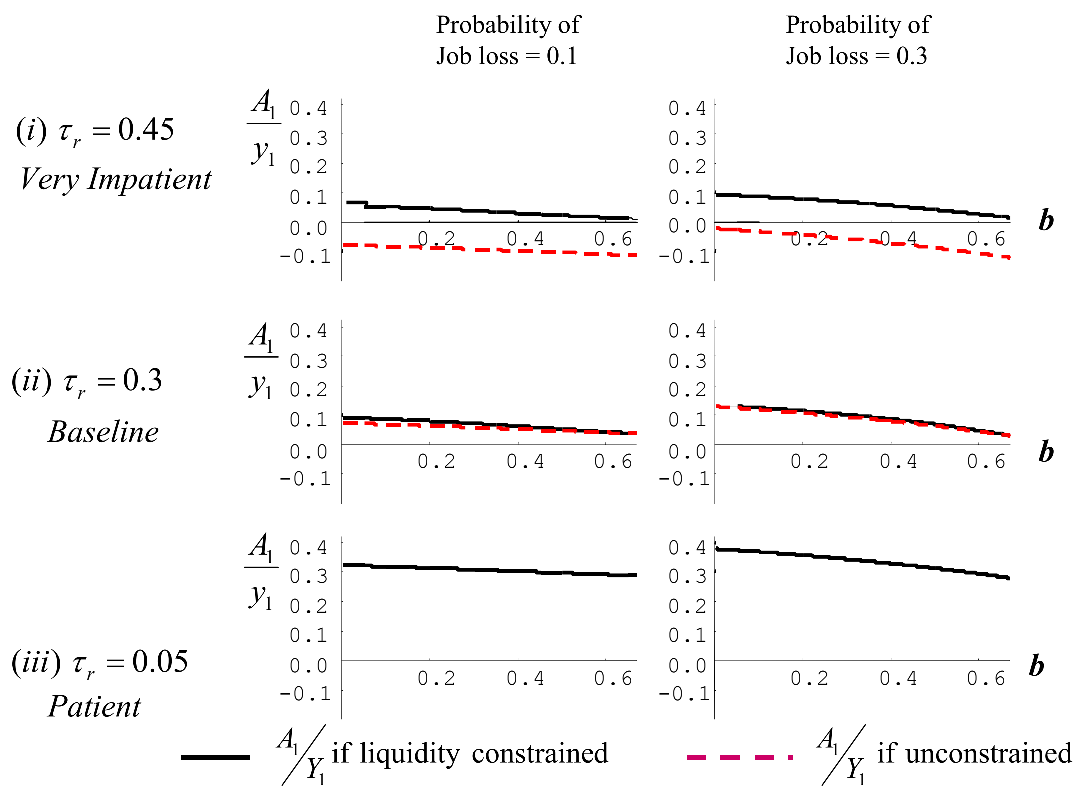
Asset accumulation in this model is for partly for precautionary reasons and partly to fund consumption in retirement. Assets not needed for precautionary reasons can instead be consumed in retirement. In this context, an increase in unemployment insurance will crowd out liquid asset holdings,[12] but the extent of the crowd-out will depend on the substitutability between asset motives: crowd-out is greater when liquid assets are not used for consumption in retirement (row *i* in Figure 3).

Comparing the two columns of Figure 2, a greater expectation of job loss leads to higher liquid asset holdings (or less borrowing). This holds whether or not individuals are able to borrow. This difference in expectation of job loss reflects heterogeneity in the income processes that individuals face. This heterogeneity will translate into different levels of holdings of liquid assets even if all individuals have the same cost of saving. A greater expectation of job loss also affects the extent of crowding out: a greater probability of job loss implies greater crowding out because more of the

[12] Engen and Gruber (2001) estimate the extent unemployment insurance crowds out precautionary saving.

holdings of liquid assets are for precautionary rather than retirement reasons.

Figure 3: **Asset Accumulation by Replacement Ratio**



In our framework, there is only one point in time where job loss may occur and in particular we assume there is no uninsured uncertainty after this point. We make this simplification to make clear the distinction between the effect of unemployment insurance in smoothing over states versus smoothing over time. In the presence of ongoing uncertainty, however, the distinction is less clear: uncertainty about future income increases the cost of borrowing because borrowing reduces the amount of non-committed income in future states. This makes borrowing constraints and ongoing uncertainty act in the same way to limit borrowing in the stage after the initial job loss (this analogy between borrowing constraints and uncertainty was first stressed by Deaton, 1991).

3.2 Further Implications

In the empirical sections 4 and 5 we focus on relating the implications for saving behaviour to the data. Our aim in this subsection, however, is to show the implications that the costs of saving and the inability to borrow have for consumption smoothing, investment and the marginal benefit of unemployment insurance.

Consumption Smoothing From the first-order conditions (2), (6) and (9) in Section 2.2, it is straightforward to see that in the absence of credit constraints, or if the constraints do not bind:

$$\begin{aligned}\lambda_{2I} &= \lambda_{2E} = \lambda_{2d} = \lambda_{3d} \\ \lambda_{2n} &= \lambda_{3n} \\ \lambda_1 &= \pi\lambda_{2d} + (1-\pi)\lambda_{2n}\end{aligned}$$

but

$$\lambda_{2n} = \lambda_{3n} \neq \lambda_{2d} = \lambda_{3d}$$

Marginal utility is smoothed over time (at least in expectation) but not over states. The finiteness of life means that households cannot perfectly self-insure even in the absence of credit constraints. Unemployment insurance has what we term an 'insurance benefit', in that it helps to smooth marginal utility across states. Unemployment insurance reduces $\lambda_{2d} - \lambda_{2n}$ which is the 'permanent shock' of job loss (See also Browning and Crossley, 2001). This is the benefit of unemployment insurance that operates in the Bailey model, and is similar to the benefit of progressive taxation which was discussed by Varian (1980): agents are taxed in good states (when income is high) and receive a benefit when income is low.

If credit constraints bind, then for equations (2), (6), (13) and (18):

$$\begin{aligned}\lambda_{2I} &= \lambda_{2E} + \mu_{2I} = \lambda_{3d} + \mu_{2I} + \mu_{2E} \\ \lambda_{2n} &= \lambda_{3n} + \mu_{2n} \\ \lambda_1 &= \pi\lambda_{2I} + (1-\pi)\lambda_{2n} + \mu_1\end{aligned}$$

Marginal utility is smoothed neither over states ($\lambda_{2d} \neq \lambda_{2n}$) nor over time after job loss ($\lambda_{2I} \neq \lambda_{2E}$). Credit constraints limit the time diversification of risk (Gollier, 2001). By reducing $\lambda_{2I} - \lambda_{2E} = \mu_I$ (or $\lambda_{2E} - \lambda_3 = \mu_E$) unemployment insurance can have another benefit (beyond the insurance benefit noted above): it helps to smooth consumption over time.

This consumption smoothing benefit of unemployment insurance is absent in the Bailey (1978) model because post-displacement, consumption is independent of labour market state. Thus calculations of optimal benefits that are based on this model (as in Gruber, 1997) implicitly assume that there are no credit constraints and that agents can fully time diversify employment risk. Full time-diversification of employment shocks across a finite life is nonetheless incomplete insurance, and so unemployment insurance raises welfare by pooling risk across individuals.

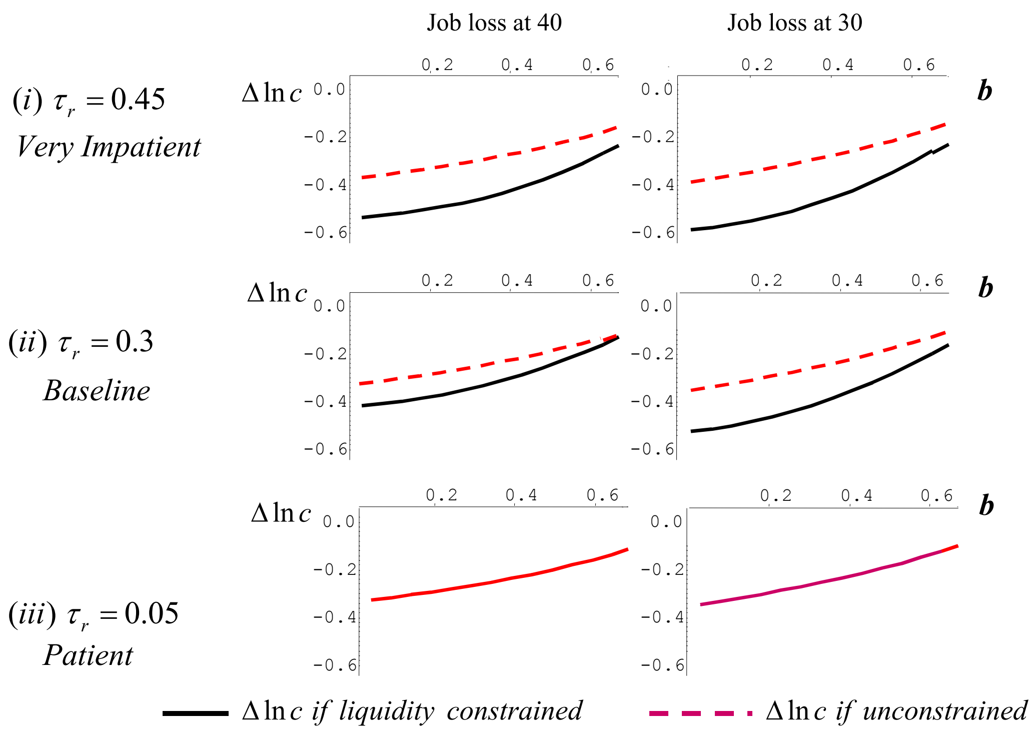
Gruber (1997) and Browning and Crossley (2001) both estimate regression equations of the form:

$$\Delta \ln c_t = X\beta + \alpha b + e$$

where legislative variation (across time, or time and jurisdictions) is used to estimate α. Gruber interprets his estimate of α as an estimate of the insurance benefits of unemployment insurance (and uses that estimate in optimal benefit calculations based on the Bailey model). In contrast, Browning and Crossley set out an explicit (Euler equation) framework in which α captures the effect on consumption growth of a binding credit constraint. In terms of the model presented here, Gruber interprets α as $\lambda_{2d} - \lambda_{2n}$, while Browning and Crossley interpret $\alpha = \lambda_{2I} - \lambda_{2E} = \mu_I$. If the data were generated by the model developed in the paper, both effects would be captured by a regression like that described above. This can be seen clearly in Figure 4, in which simulations of the model are used to generate plots of $\Delta \ln c_t$ against b for agents that differ by patience, risk aversion and access to credit markets. In all cases, consumption loss decreases as benefits increase, but among the impatient (row *i*) and intermediate agents (row *ii*) the relationship is steeper when borrowing is restricted. In other words, an increase in unemployment insurance leads to a larger reduction in consumption loss when saving and hence self-insurance is more costly. Self-insurance is also harder against job loss early in life and Figure 4 shows that consumption loss is therefore greater for job losses earlier in life.

Figure 4 illustrates that the effect is of b on $\Delta \ln C_t$ is heterogeneous across agents. Heterogeneity in consumption loss arises between individuals with different access to credit markets or with differences in the timing of job loss. Heterogeneity in the cost of saving (degree of impatience) only translates into heterogeneity in consumption loss for individuals with restricted borrowing. Browning and Crossley (2001) capture some of the heterogeneity in consumption loss. As just noted, and as predicted by the model developed here, they find different effects among households with and without liquid assets. Second, using quantile regressions they document considerable heterogeneity

Figure 4: **Consumption Loss by Replacement Rate**



in α even among agents with no liquid assets at job loss.[13] This evidence of heterogeneity can be used as evidence of borrowing constraints.

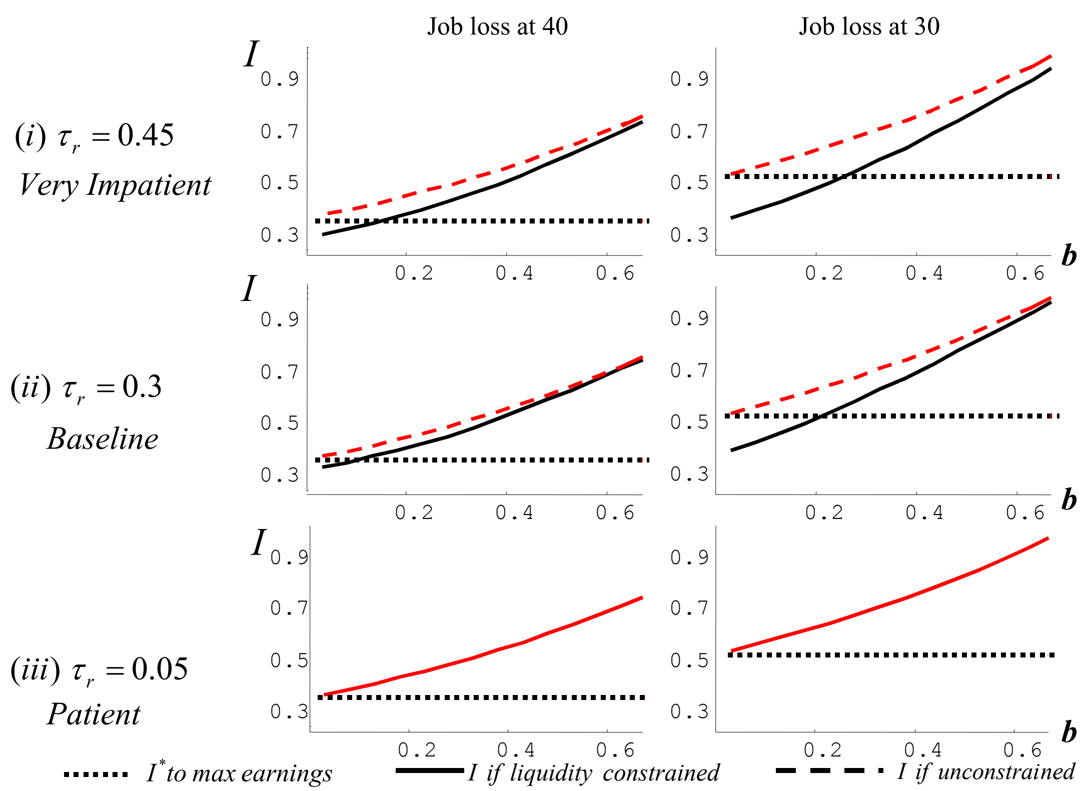
Investment Equation (19) in section 2.2 shows how the return to investment depends on the presence of borrowing constraints. This is illustrated by the simulations presented in Figure 5. Each panel plots the duration of investment against the replacement rates. The six panels each present a different parameterization of the model. They differ by the assumed patience of the agent and by the timing of job loss. In each panel, the solid line represents the case where the agent is credit constrained,[14] and the line comprised of long dashes represents the case where the agent can borrow freely. The optimal level of investment is indicated in each panel by the horizontal line of short dashes. Among the impatient agents and agents of intermediate patience, credit constraints lead to under-investment, and efficient search durations are induced by positive replacement rates. This is particularly the case when job loss happens earlier in life. As we saw in the preceding analysis of

[13] Of course, the apparent heterogeneity in α may, in part, be picking up the nonlinearity in the relationship that we observe in Figure 4 and which is not considered in the empirical literature.

[14] We use credit constrained and liquidity constrained interchangably.

consumption smoothing, the very patient agents are unaffected by credit constraints (because they have considerable liquid savings). As with consumption, heterogeneity in impatience only matters for search behaviour if individuals are credit constrained.

Figure 5: **Length of Investment by Replacement Rate**



Marginal Benefit of Unemployment Insurance We have shown that the cost of saving and the ability to borrow matter for understanding how individuals behaviour in response to unemployment insurance. This raises the issue of how the marginal benefit of unemployment insurance depends on the cost of saving and the ability to borrow.

The marginal benefit of unemployment insurance derives from providing smoothing over states and smoothing over time. The marginal cost of unemployment insurance is the higher taxes that must be paid. We can calculate $\frac{\partial V_1}{\partial b}$ from equation (1), using the government budget constraint (20) to substitute in the effect on the tax rate:[15]

$$\frac{\partial V_1}{\partial b} = \pi Y_1 \left(1 - \tau^r\right) I^* \left[\lambda_2^d - \frac{Y_1 \lambda_1 + \pi E_2^d \lambda_2^d + (1 - \pi) Y_{2n} \lambda_2^n}{Y_1 \lambda_1 + \pi E_2^d + (1 - \pi) Y_{2n}} \right]$$

The first term in the square brackets is the marginal benefit of the unemployment insurance, the second term is the implied increase in the tax rate which imposes a cost. We are particularly interested in how the net benefit varies with τ^r and with the imposition of the borrowing constraint. Since I^* changes with these factors, we plot the values for $\frac{\partial V_1}{\partial b}$ in Figure 6.

If individuals are unconstrained, then the value of unemployment insurance stems only from smoothing over states. Increases in impatience do not affect the value of unemployment insurance because individuals are able to reallocate resources across their lifetime to satisfy their impatience. This implies that the marginal benefit of unemployment insurance will be independent of the cost of saving. Figure 6 confirms that the cost of saving (τ^r) does not affect the marginal value of unemployment insurance. The marginal value of unemployment insurance is higher for younger job losers because they have had less time to save and self-insure.

When there are credit constraints, marginal benefit at $b = 0$ is highest for the most impatient agents: extra income in the investment phase has a high marginal utility (λ_{2d}). As benefits increase the marginal benefit of unemployment insurance declines, with the rate of decline being greater the greater the impatience. This faster decline is due to changes in the marginal benefit of smoothing over time: if agents are more impatient then the cost of having to pay taxes early in life is greater. This means that the marginal benefit of unemployment insurance is not necessarily higher when credit constrained despite the additional value of smoothing over time.[16] The key point to stress from Figure 6 is the heterogeneity in the marginal benefit of saving.

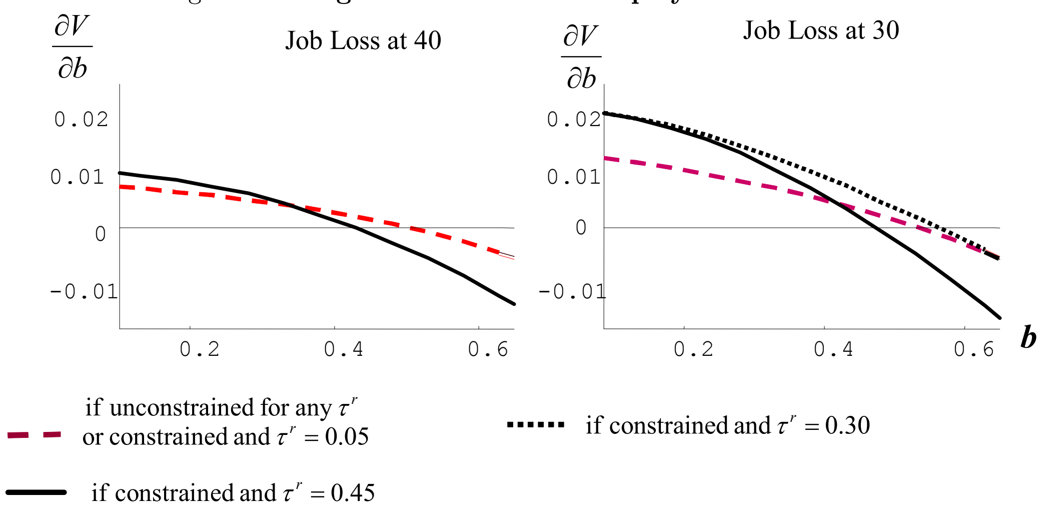
The analysis just presented has illustrated that the value of unemployment insurance depends on the cost of saving - a point also emphasized by Lentz (2003). In our model, unemployment insurance has more value for agents who have made substantial pension contribution, and hence do not wish to save; it has less value for agents who are privately saving for retirement and hence have a buffer stock.

[15]

$$\frac{\partial \tau}{\partial b} = \frac{\pi Y_1 \left(1 - \tau^r\right) I}{Y_1 \lambda_1 + \pi E_2^d + (1 - \pi) Y_{2n}}$$

[16] This implies that the optimal replacement ratio may be higher or lower in the presence of credit constraints.

Figure 6: **Marginal Benefit of Unemployment Insurance**



A final implication in considering the value of unemployment insurance is that for some parameterisations (for example with $\tau^r = 0.3$) credit constraints can *raise* welfare. The reason for this surprising result is that the displaced agent does not internalize the negative externality that her search behaviour has through the government budget constraint. That is, in this model, the absence of credit markets leave the government less constrained by moral hazard, and able to offer more insurance. Another way to think about this is that in a second best world, the ability to control borrowing would give the government a second instrument.[17] This result is analogous to Diamond and Mirrlees (1979).

4 Data, Sample and Institutional Setting

4.1 The 1995 Canadian Out of Employment Panel

The empirical analysis in this paper is based on the 1995 Canadian Out of Employment Panel (COEP). The Canadian Out of Employment Panels are a series of surveys commissioned by Human Resources Development Canada for the purposes of evaluating a number of legislative changes to the Canadian unemployment insurance system that occurred during the 1990s. In Canada, the end of a job is marked by the employer submitting a Record of Employment (ROE) to the government. The flows of such forms within certain time windows formed the sampling frames for these surveys.

[17] Note that if we think of a population of ex ante homogeneous agents, the expected utility criteria amounts to a Utilitarian social welfare funtion. We could overturn this result (for the same parameter values) with a non-Utilitarian social welfare function which placed more weight on the less fortunate (job losers).

Data from the 1995 survey is publicly available[18], and contain the detailed questions on the ability and desire to borrow which are central to the empirical work reported in this paper. The respondents in the 1995 survey lost their jobs in the first half of 1995, and were interviewed twice, in the 3rd and fifth quarters after job loss. Thus the respondents were first interviewed in the last quarter of 1995 and first quarter of 1996. Information was collected pertaining to their circumstances at the interview date and retrospectively about their circumstances prior to the end of the relevant job, and over the intervening period. Information was collected about work, training, and job search, about household composition, consumption, income and finances, and about benefit receipt.

4.2 Sample

There were 7818 respondents to the 1995 COEP. The COEP samples job separations of various types, including quits, dismissals, separations due to illness, and temporary and permanent layoffs. In the selection of a sample for analysis, we discarded 18 respondents who did not report a separation reason. We also discarded 464 individuals who, although they lost a job, reported continuing employment in a second job. Next, we deleted from the sample 665 respondents who reported that they quit to take another job. These individuals have little or no unemployment and are outside the scope of our interest. Finally we deleted 1091 individuals age 25 or younger and 474 individuals over age 55, to focus on prime age workers.

Of the remaining 5015 observations, we focussed on those 2922 who lived in a nuclear family (alone, with a spouse, or spouse and children) and were the primary earner in their households. The job loss of primary earners is of particular interest. Moreover, previous experience with this data suggests the quality of the survey responses on household finances is lower among respondents in other family types (for example, living with their parents or with unrelated adults). Of these 2922 respondents, 1659 were employed at the time of the first interview (in the third quarter after job loss). The other 1263 were not working at the time of interview, though some of these had spells of employment between the initial job loss and the interview. The multivariate analyses reported in the paper are based on slightly smaller samples, due to the inevitable item non-response in a large and comprehensive survey.

[18] The survey was conducted by the Special Surveys Division of Statistics Canada, and further details are available at:
http://www.statcan.ca/english/IPS/Data/72M0001XCB.htm.

4.3 The income shock of job loss

One way to think about the environment from which our respondents are drawn is to consider the income shock associated with job loss. We have information on the change in monthly, take-home household income between the month just prior to the job separation and the month prior to the interview (in the third quarter after job loss). The mean percentage change for respondents out of work at the interview is - 22% (median -20%). A quarter of out-of-work respondents report income losses in excess of 39%. The modest size of the average income shock associated with non-employment (a complete loss of earnings) reflects several factors. The unemployment insurance system in Canada is fairly generous, with statutory replacement rates over 50% and benefits lasting up to a year. Moreover, because the Canadian income tax system is progressive, the actual (after-tax) replacement rate is often higher than the statutory rate. Against that, insurable earnings are capped, and workers losing jobs with earnings above the maximum insurable earnings will have an effective replacement rate below the statutory rate. Both eligibility for benefits and the duration of benefits depend on the extent of recent employment. However, Canada also has a second tier of income support: a means-tested social assistance program that would be available to those who are ineligible for benefits, or whose benefits expire. Finally, while we focus on the primary earners, these workers live in households, and many of those households have other earners. Quite mechanically, if a worker provides 50% of household income prior to job loss, and faces a 60% actual replacement rate, then the job loss represents a shock to personal income of – 40% but to household income it is a shock of -20%.

5 Empirical Analysis

5.1 Are Job Losers Credit Constrained?

The model we developed in the first half of this paper illustrates that the effect and value of unemployment insurance will depend on whether job losers can access credit markets. If job losers are credit constrained they will be limited in their ability to time diversify risk, and unemployment insurance can have a consumption smoothing benefit. Moreover, in the absence of unemployment insurance benefits, credit-constrained job losers may under-invest in search; benefits can induce a more efficient level of investment. Finally, we can demonstrate cases in which credit market failures can actually raise welfare (by mediating moral hazard and hence making it possible to for the government to offer more insurance.)

There is a substantial literature which attempts to establish the incidence of credit constraints in general populations.[19] It is reasonable to think that recent job losers may be more likely to be credit-constrained than the general population. Casual empiricism suggests that employment status is a key criteria considered by lenders. Moreover, investments in future earnings (either human capital or job match) are not collateralisable.

Two kinds of studies have shed some light on the incidence and importance of credit constraints among the unemployed. First are studies that (in the spirit of Zeldes' early work on the full population) compare the behaviour of agents who had different levels of liquid assets at job loss (those that without liquid assets being more likely to be constrained). The Browning and Crossley (2001) study, described in Section 3.2, examines consumption growth. Sullivan (2002) performs a similar exercise for food consumption growth using the PSID. Effectively, these papers are looking for the excess consumption growth associated Euler equation violations. Browning and Crossley (2003) focus on durable replacement and Chapman, Crossley and Kim (2003) investigate training and retraining choices. All of these papers document significant differences between household with and without liquid assets. A second group of studies documents the assets holdings of job losers and their borrowing and dis-saving behaviour. These papers include Gruber (2001), Sullivan (2002) and Bloemen and Stancanelli (2001).

All such studies have two important limitations. First, asset levels are not allocated randomly. In the model presented in this paper it is the patient agents who hold assets at job loss, and the behaviour of such agents can differ in some ways from that of impatient agents even if there are no restrictions on borrowing. Second, credit constraints can affect behaviour and welfare even if they never actually bind. In our model this is apparent in behaviour in the first stage: for our baseline level of impatience, savings and consumption behaviour in the first stage is affected by the ability to borrow even though the constraint does not bind. This impact on behaviour occurs because of the possibility of the constraint binding in the next stage. More generally, the possibility of a

[19] This literature includes (i) early "excess sensitivity" (Euler equation) studies, including Zeldes (1989) who examined consumption growth in samples divided by liquid asset levels; (ii) studies that use direct survey questions about the credit applications and borrowing, such as Jappelli (1990); and (iii) most recently, Gross and Souleles' (2003) work on credit card behaviour.

borrowing constraint binding in the future can affect behaviour in an earlier period (as first shown by Deaton, 1991). Thus, if agents are forward looking, studies that test for Euler equation violations (observations of the constraint actually binding) will not capture the full extent and impact of limited access to credit.

In this paper, we take a different, complimentary, and more direct approach. We report the responses of recent job losers to direct survey questions about their option to borrow and the desire to borrow. In particular, the 1995 Canadian Out of Panel asked recent job losers two sets of questions about their ability to borrow. They were asked subjective questions as follows:

- *If you needed it, COULD you borrow money from a friend, family, or a financial institution in order to increase your household expenditures?*

If the answer to this question was negative, the respondent was then asked:

- *Suppose you COULD borrow money from one of these sources at 11% interest per year, to be paid back starting in one year. WOULD you borrow money to increase your weekly spending on household expenses?*

A question similar to the first of these was previously posed to low income households in Chicago, as reported by Mayer and Jencks (1989). We take the answers to the first question as informative about access to credit. If a respondent says "no" to the first question and "yes" to the second, we take them to be reporting that they are constrained (in the sense that their Euler equation does not hold with equality.)

Second, respondents were asked a series of questions about credit applications and the outcomes of those applications, similar to the (U.S.) Survey of Consumer Finance questions studied by Jappelli (1990). These questions were as follows:

- *At any time since your job ended on [date of job loss] did you or any member of your household apply for a loan at a bank or financial institution, or for credit with any credit company?* (Applied)

- *Were any of your requests for credit or a loan turned down*? (Declined)

- *Were you, or any member of your household, given as much credit as you applied for?* (Not Full Amount)

- *Were you later able to obtain the full amount you requested by reapplying to the same institution or by applying elsewhere?* (Got Later)

- *Was there any time since [date of job loss] that you or any member of your household thought of applying for credit at a particular place, but changed your mind because you thought you might be turned down?* (Discouraged)

Respondents who reported applying for credit were also asked what type of credit they applied for.

Responses to the "subjective" questions are summarized in Table 2. Among respondents not working at the time of interview, more than 30 percent report that they could not borrow. The corresponding number for those back in employment is almost 10 percentage points lower. Overall, about a quarter of recent job losers report no access to credit. Of those who report that they are unable to borrow, only a fraction (13 percent among those not working) report that they would borrow if they could. Thus, only a small fraction of the sample report being "constrained" in the sense of an Euler equation violation. However, uncertainty about future employment and the possibility that credit constraints may bind in the future may be dampening the desire to borrow.

Table 3 summarizes our sample's responses to the "Jappelli" questions. About a quarter of recent job losers applied for some kind of credit before the 1st interview (6 to 9 months later). Of those, about a quarter were constrained in the sense that their application was declined or they did not get the full amount, and were not later able to get the full amount. Thus about 6 percent of the full sample are constrained by this definition. Following Jappelli, we also consider a broader definition of constrained that includes those who did not apply because they anticipated that an application would not be successful (the discouraged). These are about 8 percent of the sample, so that about 14 percent of the sample are constrained by this broader definition.

Table 4 reports the type of credit our respondents applied for. Personal loans, car loans and credit cards were the most common. Although the respondents could list up to 3 different kinds of credit, more than 90% listed only one type. Thus we can also calculate rough rejection rates by type of credit. These were much higher for unsecured debt (credit cards and consolidation loans) than for secured debt (car loans and mortgages).

Table 2: Credit Market Access and Credit Constrained

	Currently unable to borrow	*Currently Constrained* (of those who are unable to borrow)	(of sample)	*Observations*
Not Employed	31.2%	13.1%	4.0%	1263
Employed	23.0 %	14.4 %	3.3%	1659
Total	26.5 %	13.8%	3.6%	2922

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job).

Table 3: Proportions Refused Credit or Discouraged from Applying

	Applied for credit	*Declined*	*Not Full Amount*	*Got Later*†	*Constrained (A)*	*Discouraged*	*Constrained (B)*
	(1)	(2)	(3)	(4)	(2) + (3) − (4)	(5)	(A) +(5)
Base	sample	(1)	(1) − (2)	(2) + (3)	(1) (sample)	non-applicants (sample)	sample
Not Employed	21.7	30.1	6.4	4.3	32.8 (7.1)	13.3 (10.4)	17.4
Employed	26.5	21.2	3.5	18.1	19.5 (5.2)	9.4 (6.9)	12.0
Total	24.4	24.6	4.5	11.6	24.6 (6.0)	11.1 (8.4)	14.3

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job).
†There are a large number of missing values to this question. We treat these as a negative response. This is the only question to which there is significant non-response.

Figure 7 illustrates the age patterns in our measures of credit access and credit constrained. The age profiles are estimated by locally weighted (or local linear) regression. The top panel is based on the "subjective" questions. The fraction that report that they could not borrow falls with age among the employed. Among the unemployed it falls initially and then rises again late in working life. The fraction that are constrained (can't borrow and would) falls with age for both the employed and unemployed.

The lower panel of Figure 7 compares the measure of binding constraints based on the "subjec-

Table 4: Types of Credit Applied For and Outcome

Type of Credit	*Applied* % of applicants for any credit	*Unsuccessful* % of applicants
Mortgage	9.30	17.7
Car Loan	20.69	16.7
Equity Loan	0.30	0.0
Business Loan	4.35	13.8
Credit Card	9.45	41.3
Store Account	3.30	27.3
Line of Credit	6.45	18.6
Personal Loan	34.03	24.2
Consolidation Loan	5.70	57.9
Other	6.45	16.3

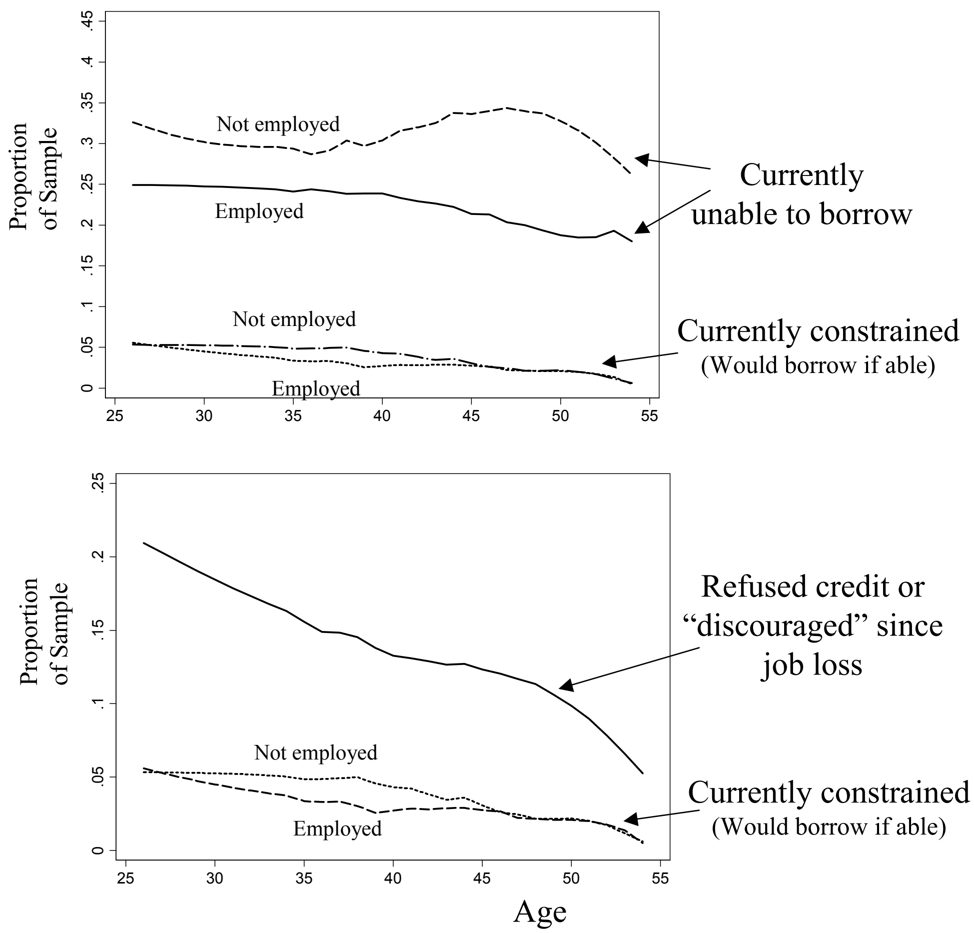
Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job). Unsuccessful means application declined or the applicant was not awarded full amount and the applicant did not subsequently receive the loan. These calculations do not include the 1% of applicatins for whom the type of credit was not specified; and the numbers do not include the 6% of applicants who applied for multiple sources of credit.)

tive" questions with the measure based on the "Jappelli" questions (the broad measure including the discouraged). It is important to note that the former refer to at the time of the interview, while the latter refer to any time since the job loss. Quite naturally then, the "Jappelli" questions suggest a greater incidence of binding constraints at all ages. However, both measures of binding constraints decline noticeably with age.

To examine the correlates of the responses to these questions in a multivariate setting, we estimated a series of probit models. Predictor variables which we considered include characteristics of the respondent (gender, age, education, marital status, visible minority status) and her household (the presence of children); characteristics of the job separation (separation type, whether the job loss was expected, and whether recall was expected) and financial circumstance of the household (whether they owned their home, had a mortgage, had liquid assets, had debt.) The results are presented in Tables 5 through 7.

Table 5 presents empirical (probit) models of the response to the "could borrow" question. We have coded a negative response as a 1, so that these are models of the probability of a respondent reporting that she is unable to borrow. This question refers to the point in time of the interview. We have split the sample into those respondents who were not employed at the interview date (on

Figure 7: **Credit Status by Age**



the left) and those that were (on the right). For each sub-sample, we estimate a basic model and an extended model. We report marginal effects (calculated from the underlying probit coefficients) and the standard errors of those marginal effects. Age is measured in decades and specified as a linear spline with a knot at 45 years of age.

Starting with the sparser specification, we see that, regardless of employment status, men are less likely to be unable to borrow. Relative to the omitted group (less than a high school education), high school graduates and especially university and college graduates report greater access to credit. Married respondents with are also less likely to be unable to borrow. These effects are economically large as well as statistically significant. For example, among the non-employed, those with a university or college education have a probability of reporting that they are unable to borrow which is 14 *percentage points* lower than the base group (recall that the 31% of the unemployed report that they are unable to borrow). Inability to borrow is more commonly reported by those with visible minority status and less often reported by as respondent age past 45 years of age. However, these effects are only statistically significant in the employed group.

Turning to the extended specification, we see that some of the demographic effects noted above become weaker, but that the financial circumstances of the households are strong predictors of their ability to borrow. If a respondent's household owned their homw, the household is much less likely to report being unable to borrow. This effect is substantially reduced if the household also has a mortgage. Finally, holding liquid assets is a good predictor of being able to borrow.

The main lesson we draw from these results is that the "subjective" responses about ability to borrow correlate in sensible ways with characteristics of the respondents and their households. This strengthens our belief that the apparent heterogeneity in access to credit is real.

In Tables 6 and 7 we turn from issue of whether a household could borrow to the issue of whether they face (or have faced) a *binding* constraint. Table 6 examines the correlates of the measure based on the subjective questions. Here a respondent is coded 1 if they report that they are unable to borrow *and* would like to (and 0 otherwise). The format of the Table follows Table 5: the sample is divided on the basis of employment at the interview date, and for each sample we estimate both a basic empirical model and a richer specification. All of the models are probit models and we report marginal effects and their standard errors.

Relative to those that reported they could not borrow, a smaller fraction of the sample reported that they were actually constrained, and here we find fewer significant predictors. However, education remains important, and home ownership for those out of work.

Table 7 examines correlates of the measure of "constrained" which is based on the "Jappelli" questions (the broad measure, including "discouraged"). Since these questions refer to the entire period since the initial job loss, we pool those who are currently working with those that are not. In other respects, we follow the previous two tables: we estimated two probit models, a sparse specification and a richer empirical model, and report marginal effects and their standard errors.

Once again the education effects are quite strong. Binding credit constraints are more often experienced by visible minorities, and less often by married respondents. Home ownership and holding liquid assets reduces the probability of a binding credit constraint. Pre-existing unsecured debt raises that probability.

To summarize then, two types of questions in the COEP survey document that not all job losers have access to credit, and that a smaller fraction experience a binding credit constraint. While the data are self-reports, the responses seem coherent in light of the responses to other questions about household finances. The circumstances of job losers are heterogeneous: many indicate that they could borrow to raise current consumption. This heterogeneity can be related to observable characteristics. The data indicate that young workers, less educated workers and visible minorities are more likely to be unable to borrow, and to experience a binding credit constraint.

5.2 Liquid Assets at Job Loss

Taken literally, our model suggests that the effects of unemployment insurance depend on the liquidity of retirement savings (and thus that there is an important complementarity in the design of unemployment insurance and public pension systems.) However, as previously discussed, the mandatory pension system in our model is really just a convenient way to vary the cost of savings, and we intend it to be a metaphor for all variation in the cost of savings. There is good empirical evidence based on the distribution of wealth (Samwick, 1998) and on consumption growth rates (Alan and Browning, 2003) to support the idea that there is considerable heterogeneity in rates of time preference. Attanasio, Banks, Meghir and Weber (1999) demonstrate that changing needs (children) can also vary the costs of savings. An important implication of the model is that heterogeneity in

Table 5: Unable to Borrow (Probit)

	Not Employed		Employed	
Male	**-0.064** (.037)	-0.056 (.040)	**-0.048** (.029)	-0.047 (.030)
Age	0.020 (.030)	**0.078** (.033)	-0.006 (.023)	0.024 (.024)
Age45	-0.093 (.095)	-0.161 (.101)	**-0.159** (.081)	**-0.182** (.084)
High school	**-0.060** (.035)	-0.060 (.037)	**-0.073** (.027)	**-0.056** (.028)
University or College	**-0.135** (.038)	**-0.127** (.041)	**-0.072** (.029)	-0.047 (.032)
Spouse Present	**-0.126** (.039)	-0.031 (.042)	**-0.073** (.032)	-0.030 (.033)
Visible Minority	0.055 (.039)	**0.072** (.042)	**0.114** (.033)	**0.099** (.034)
Children present **	0.021 (.037)	0.027 (.039)	-0.005 (.027)	0.00 (.028)
Quit		-0.108 (.064)		-0.008 (.060)
Fired		-0.002 (.094)		0.095 (.101)
Ill		0.027 (.076)		**-0.117** (.042)
Expect job to end		-0.004 (.035)		-0.005 (.026)
Used UI in past 2 years		**-0.074** (.038)		0.005 (.027)
Strong Expectation of recall		-0.016 (.053)		-0.009 (.028)
Ownhome		**-0.278** (.052)		**-0.162** (.045)
Mortgage		**0.120** (.051)		**0.068** (.041)
Household had liquid assets		**-0.10** (.034)		**-0.10** (.025)
Household had other debt		0.026 (.034)		0.029 (.025)
Number of obserations	912		1245	
	$R^2 = 0.027$.	$R^2 = 0.072$.	$R^2 = 0.030$.	$R^2 = 0.030$.
	Mean = 0.31%		Mean = 0.23%	

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job).
Marginal effects (standard error of marginal effect). Dependent variable = 1 if the respondent self reports that they could not borrow if needed, and = 0 otherwise. Question is asked at the first interview (in the 3 quarter after job end). See text for more details. Omitted categories are: less than high school education, layoff, no expectation of recall. Marginal effects are calculated for the change in a dummy variable from zero to one, at the means of all other variables. Numbers in bold indicate that the underlying parameter is statistical significant at a 10% level.

Table 6: Would Borrow if Able (Probit)

	Not Employed		Employed	
Male	0.002 (.014)	0.001 (.001)	-0.004 (.011)	0.001 (.009)
Age	-0.016 (.012)	0.000 (.012)	-0.011 (.009)	-0.003 (.008)
Age45	-0.009 (.044)	-0.003 (.005)	-0.038 (.038)	-0.029 (.034)
High school	**-0.023** (.013)	-0.001 (.001)	**-0.024** (.010)	**-0.016** (.009)
University or College	**-0.028** (.013)	-0.002 (.001)	**-0.029** (.008)	**-0.021** (.008)
Spouse Present	**-0.036**(.019)	-0.001 (.042)	-0.021 (.014)	-0.007 (.011)
Visible Minority	0.033 (.019)	0.003 (.002)	0.025 (.015)	0.017 (.013)
Children present **	0.016 (.015)	0.002 (.002)	0.005 (.010)	0.006 (.009)
Quit		0.001 (.004)		-0.002 (.019)
Fired		-0.007 (.010)		0.029 (.044)
Ill		**0.014** (.012)		-0.005 (.017)
Expected job to end		-0.001 (.002)		0.001 (.009)
Used UI in past 2 years		0.002 (.001)		0.005 (.027)
Strong Expectation of recall		-0.002 (.001)		0.004 (.010)
Ownhome		**-0.696** (.044)		-0.051 (.026)
Mortgage		**0.570** (.044)		0.014 (.019)
Household had liquid assets		-0.002 (.001)		-0.014 (.009)
Household had other debt		0.002 (.001)		**0.018** (.008)
Number of obserations	912		1245	
	$R^2 = 0.023.$	$R^2 = 0.162.$	$R^2 = 0.063.$	$R^2 = 0.118.$
	Mean = 0.040%		Mean = 0.033%	

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job).
Marginal effects (standard error of marginal effect). Dependent variable = 1 if the respondent self reports that they would borrow if they were able to, and = 0 otherwise. Question is asked at the first interview (in the 3 quarter after job end). See text for more details. Omitted categories are: less than high school education, layoff, no expectation of recall. Marginal effects are calculated for the change in a dummy variable from zero to one, at the means of all other variables. Numbers in bold indicate that the underlying parameter is statistical significant at a 10% level.

Table 7: Credit Application Rejected or Discouraged (Probit)

Male	-0.011 (.018)	-0.001 (.017)
Age	**-0.043** (.014)	-0.014 (.014)
Age45	-0.064 (.052)	-0.050 (.051)
High school	-0.019 (.017)	-0.006 (.017)
University or College	**-0.060** (.018)	**-0.044** (.018)
Spouse Present	**-0.084** (.021)	**-0.039** (.020)
Visible Minority	**0.059** (.021)	**0.058** (.020)
Children present **	0.003 (.017)	0.012 (.017)
Quit		0.010 (.037)
Fired		0.083 (.059)
Ill		0.062 (.041)
Expected job to end		0.006 (.016)
Used UI in past 2 years		0.016 (.016)
Strong Expectation of recall		-0.023 (.017)
Ownhome		**-0.123** (.028)
Mortgage ??..		0.020 (.025)
Household had liquid assets		**-0.037** (.015)
Household had other debt		**0.089** (.014)
Number of obserations	2157	2038
	$R^2 = 0.040.$	$R^2 = 0.093.$
	Mean = 0.15%	

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job).
Marginal effects (standard error of marginal effect). Dependent variable = 1 if the respondent self reports that they have had an application for crdedit declined or that they were discouraged from applying at any time since job loss, and = 0 otherwise. Question is asked at the first interview (in the 3 quarter after job end). See text for more details. Omitted categories are: less than high school education, layoff, no expectation of recall. Marginal effects are calculated for the change in a dummy variable from zero to one, at the means of all other variables. Numbers in bold indicate that the underlying parameter is statistical significant at a 10% level.

the cost of savings will be manifest in liquid asset holdings at job loss.

The COEP data collects information about liquid assets with the following questions:

- *Do you or someone in your household have any assets that YOU could draw on if it was really necessary? For example, money in the bank, savings bonds or RRSPs that are cashable, or insurance policies, etc. Please do not include fixed assets such as house, cars, boats, etc.*

- *Roughly how much do you have available in such assets?*

The respondent is then asked how these quantities have changed since the date of the job loss. This was followed by similar questions about debt:

- *Apart from cars or mortgage, do you and your household have any other debts? Please think of all sources such as loans and credit cards.*

- *Roughly how much debt apart from cars or mortgage do you have?*

Again the level at interview and the change since job loss were collected, allowing us to calculate the level at job loss.

Figure 8 presents the empirical cumulative distributions of liquid assets (top left), unsecured debt (top right) and net position (assets - debt, bottom left). All refer to the time of job loss, and are measured in months of usual household income. The first point to note is that almost half of job losers reported that their households had no such resources at the time of job loss. This number is not incongruent with other evidence. Using the Canadian Survey of Financial Security (a cross- sectional and representative survey of Canadian households), Morissette (2002) finds that only about two thirds of those households that experienced some unemployment in the previous year reported some financial wealth. However, financial wealth in that study is a broader concept than our measure, and includes real assets such as boats and cars.

The second striking feature of Figure 8 is the heterogeneity in liquid assets at job loss. A quarter of our sample reported that their household had liquid savings of more than three months of usual household income. Similar heterogeneity was reported and emphasized by Gruber (2001).

The empirical cumulative distributions debt and for net positions have similar features: many zeros and striking heterogeneity.

The bottom right panel of Figure 8 shows, by age, the fraction of our sample having (at job loss) (i) liquid assets amounting to at least one month of usual household income, (ii) unsecured debt of at least one month of usual household income, (iii) both, (iv) neither. The fraction having only debt falls with age, while the fraction having only assets rises. Interestingly, at all ages a nontrivial fraction hold both liquid assets and unsecured debt.

The next step in our analysis is to consider the extent to which the observed heterogeneity in liquid assets can be understood in terms of life-cycle considerations. As we have emphasized above, holding liquid wealth is more costly if current income is low, or future income is expected to be high. One important determinant of the timing of income is retirement provisions. All Canadian workers participate in a public pension scheme (either the Canada Pension Plan or the Quebec Pension Plan). However, this is only one component of retirement provision in Canada. Workers have, of course, their own savings, and in addition many Canadians participate in (registered) pension plans through their employer. These pension plans are a form of illiquid wealth. All else equal, it is more costly for workers with such plans to hold a buffer of liquid assets, because contributions to thse plans mean that their current disposable income is lower, and the payout of the plan means that resources that they arrive at retirement with will have lower marginal value. In our sample, 38% of report being covered by an employer administered pension in the job that ended.[20] A second life-cycle consideration is that it is more costly to hold a buffer of liquid assets when needs are high (the current marginal utility of income of is high.) Needs are high when children are present in the household. As Attanasio et al. (1999) emphasize, demographic effects in intertemporal allocation operate very much like variations in private discount rates.[21]

Figure 9 presents age profiles of financial circumstances for workers losing jobs with and without an employer sponsored pension (top panels) and with and without children present in the home (bottom panels). The left hand panels present liquid assets at job loss (measured in months of usual household income) while the right hand panel present net position (liquid assets - unsecured debt,

[20] Using data from a cross-sectionally representative survey (the Survey of Labour and Income Dynamics), Morissette and Drolet (2001) give the following estimates of pension coverage among paid workers in 1995: men aged 25-34, 45%; men, 35-54, 67%; women, 25-34, 43%; women, 35-54, 54%. Given that the COEP samples from the flow of job separations, it oversamples younger and less educated workers (and less desirable jobs). Interestingly, Morissette and Drolet note that pension coverage fell from 1984 to 1997 (except for older women) but that contributions to RRSPs (liquid individual retirement accounts) rose substantially over the same period.

[21] A common formulation is of the intertemporal objection function with demographics is:
$\max E \sum B^t e^{Z_t A} u(c_t)$
where B is the discount rate and Z_t, is a set of demographics variables (Attanasio et al., 1999).

again measured in months of usual households income).

In the top panel of Figure 9 we see that the for those without employer sponsored pensions, liquid assets rise rapidly after age 45, presumably as these households accumulate household savings. This is not true of workers with employer sponsored pensions, so that after age 45 a difference in liquid asset holidngs opens up between the two groups.In the bottom panels we see that at every age, households with children currently present (and thus with high current needs) hold smaller stocks of liquid wealth.

Another obvious implication is a life-cycle framework is that households that anticipate a job-loss should reduce consumption and increase savings. Our data include information on whether the job loss was expected. Figure 10 illustrates that, at least among older workers, those who expected the job loss had a larger buffer of liquid assets. There does not appear, however, to be any difference in net positions. With all of this analysis it should be borne in mind that we are making cross sectional comparisons.

Table 8 reports an attempt to model the effects described in Figures 9 and 10 simultaneously, while controlling for other characteristics of the household. The distribution of liquid assets holdings in our data (again, measured as months of usual household income) has two important characteristics: (i) a great many zeros, and (ii) the positives are very skewed.[22] Our multivariate analysis is therefore based on a "two-part" model in which the probability of positive holdings is modelled with a probit, and the quantity of holdings (conditional on positive holdings) is modelled with a log-linear regression.[23] We specify both components of the empirical model to include the same conditioning variables. These include a gender dummy, a spline in age (with knot at 45), dummies for highschool and college education, a dummy for spouse present, and a dummy for (self-reported) visible minority status. To capture the effects noted in Figures 9 and 10, we include a dummy for children present and a dummy for expecting the end of the job. We also interact the intercept and age profile with a dummy for having an occupational pension in the job that was lost.

We find no significant gender effects. There age profile is statistically significant in the quantity (months) of liquid assets (conditional on postive) but not in the probability of having positive assets.

[22] The latter, for example, means that the normality assumption of a Tobit model is certainly violated.

[23] The two-part model differs from the usual (Heckman) sample selection model in that the former assumes that $E[Y|X, Y > 0]$ is linear while the latter assumes that $E[Y/X]$ is linear. (The two-part model of course implies that $E[Y/X]$ is non-linear.)

Education has significant effects on both the probability of having liquid assets and in quantity of assets conditional on positive. Respondents with spouse present are more likely to have positive assets, and respondents who self-report visible minority status are both less likely to have positive assets and have lower assets conditional on having any at all.

The presence of children significantly reduces both the probability of having a buffer of liquid assets and the quantity of assets conditional on positive. In this multivariate framework, expectation of job loss appears to increase the size of liquid asset holdings conditional on having such a buffer, but has no effect on the probability of having a buffer. Finally, the pension-age interactions are jointly significant in the in the probit (for any assets) but not in the log-linear regression.

Table 8: Liquid Asset Holdings at Job Loss

	Probit $A > 0$	*Regression* *Log* $A \mid A > 0$
Male	0.000 (.026)	0.005 (.092)
Age	0.033 (.036)	0.374 (.118)
Age45	-0.027 (.107)	-0.156 (.352)
High school	0.109 (.025)	0.296 (.095)
University or College	0.180 (.028)	0.391 (.108)
Spouse Present	0.085 (.028)	0.088 (.099)
Visible Minority	-0.072 (.028)	-0.230 (.103)
Children present	-0.096 (.025)	-0.260 (.09)
No Pension†	-0.091 (.055)	0.086 (.194)
No Pension * Age†	-0.030 (.044)	-0.056 (.153)
No Pension * Age45†	0.155 (.136)	0.322 (.463)
Expected job to end	-0.015 (.023)	0.177 (.081)
Number of observations	2105	1187

Self-reports, 1995 COEP, 1st Interview (3rd quarter after separation from a job)
† Test of joint significance of the pension variables: For probit, $\chi^2(3) = 26.38$,($Prob > \chi^2$) < 0.001 For regression, test of joint significance of the pension variables: $F(3, 1174) = 0.30$,$Prob > F = 0.828$. Numbers in bold indicate that the underlying parameter is individually statistical significant at a 5% level. For probit, estimates are marginal effects (standard error of marginal effect). For the discrete variables, marginal effects are calculated for the change in a dummy variable from zero to one, at the means of all other variables. For the age variables, age is measured in decades.

Figure 8: **Distribution of Assets and Debt**

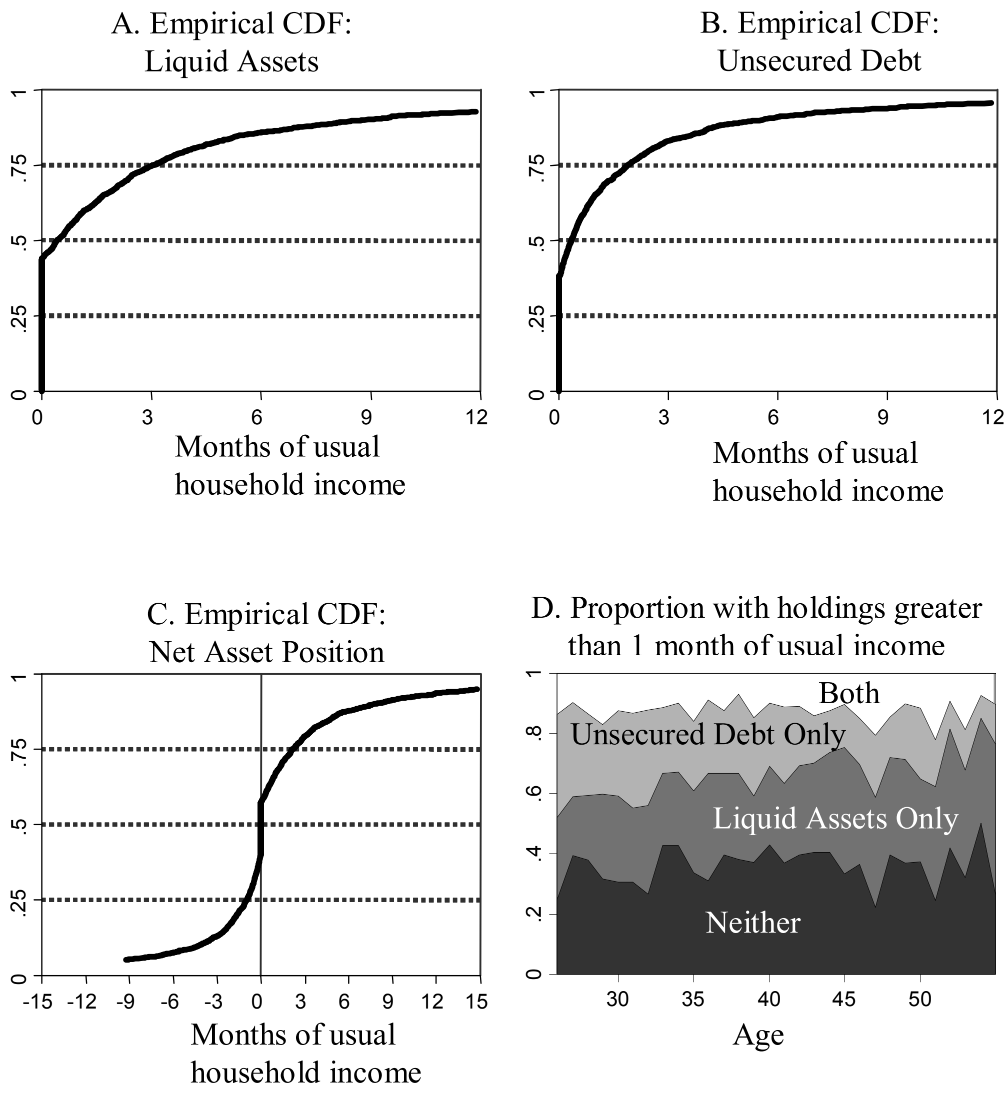


Figure 9: **Asset Holdings, conditional on Pensions and Children**

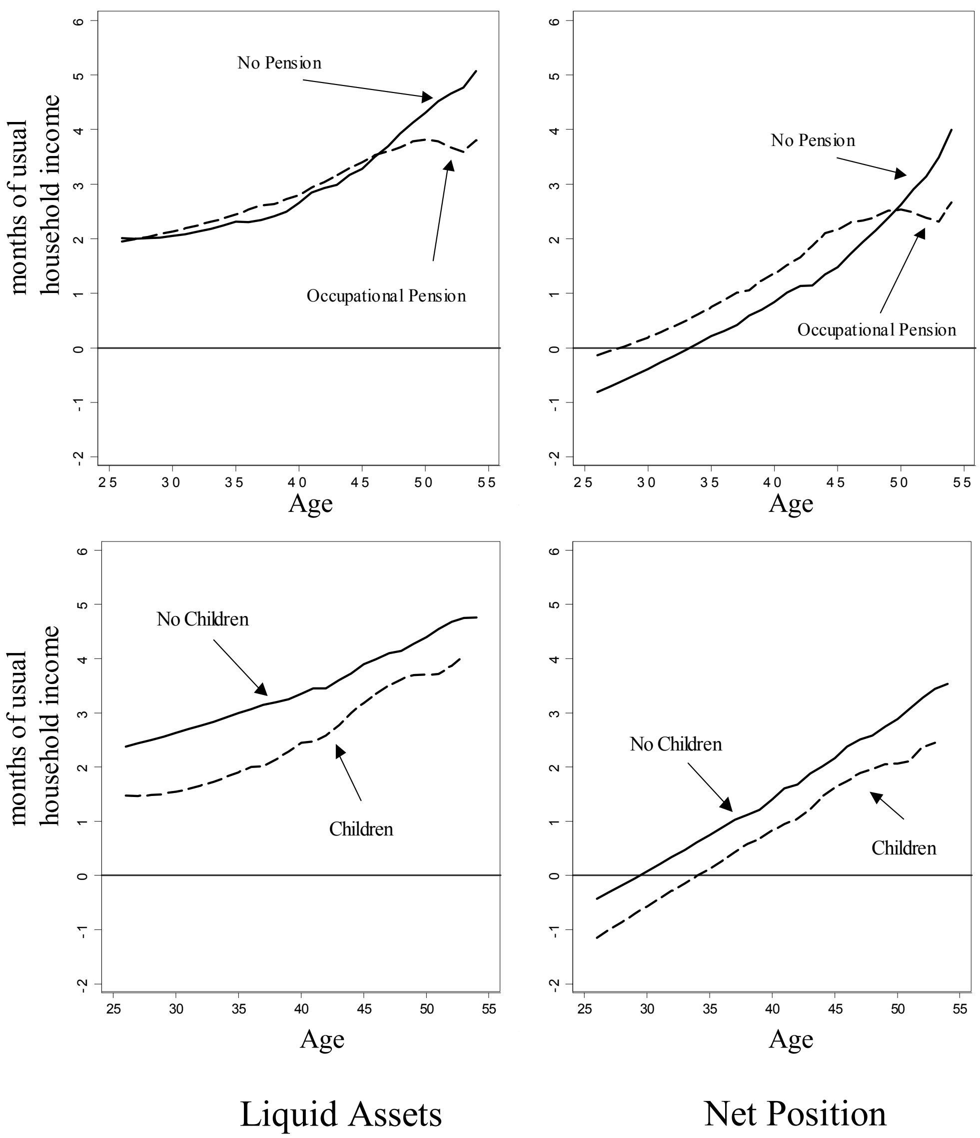
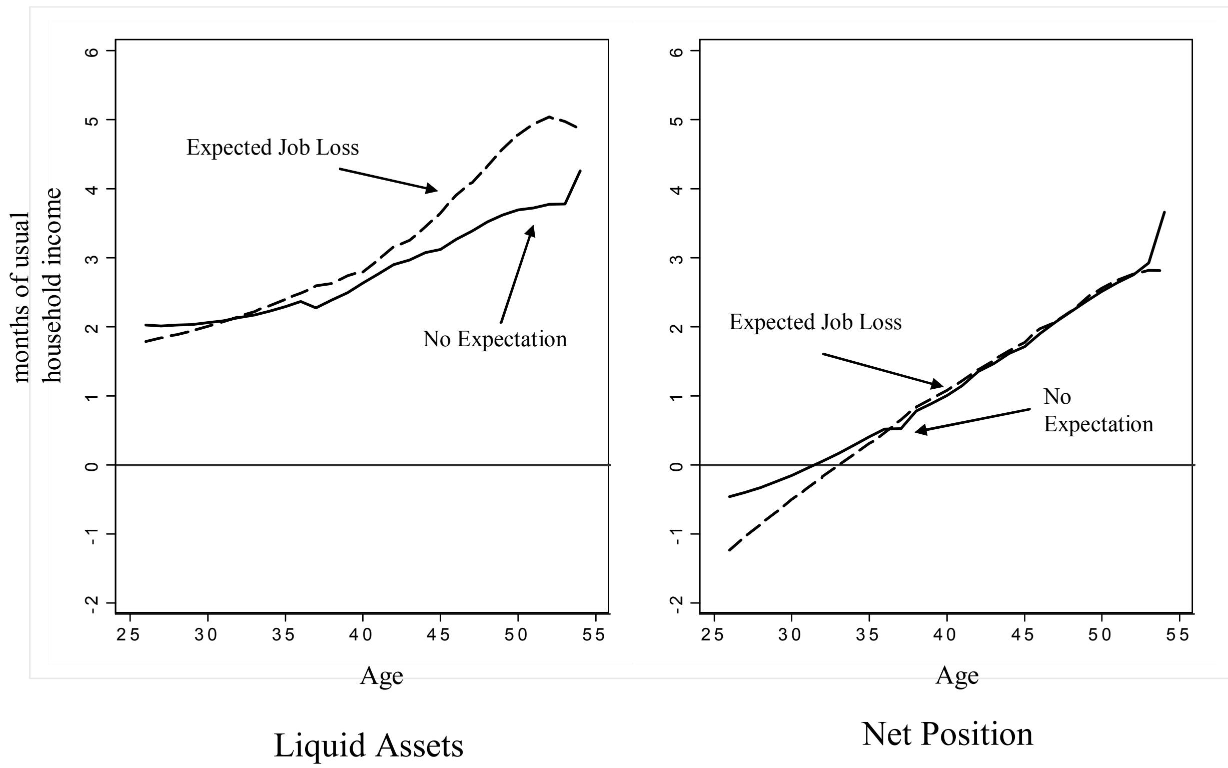


Figure 10: **Asset Holdings, conditional on Expectation of Job Loss**



6 Conclusions

In this paper, we have emphasized a series of related ideas. Unemployment insurance is more valuable when self-insurance is more difficult. Self-insurance is more viable when the cost of borrowing and the cost of saving are low. The cost of savings depends on the timing of income and the timing of needs, as well as private and market discount rates. Heterogeneity in any of these factors translates into heterogeneity in the cost of saving and thus in the value of unemployment insurance.

We developed a life-cycle model to illustrate these connections. Then, using the model as a guide, we examined empirical evidence on the extent of credit constraints and heterogeneity in the cost of saving among job losers.

We found that among out of work job losers, 25% do not have access to credit markets. A smaller fraction report being "constrained" in the sense that they would borrow if they could. However, the possibility that credit constraints may bind in the future may be dampening the desire to borrow. We also find that there is substantial variation in buffer stock holdings at job loss. Life-cycle circumstances that alter the costs of savings explain some of this variation. For example, holdings of liquid assets that can be used to buffer employment shocks rise with age; are lower for households with children (high needs); and are lower for households with (illiquid) pension wealth.

Our data contain workers for whom unemployment insurance likely has little value. Because circumstances or other savings motives makes it easy for them to hold a buffer of liquid assets, or because they have good access to credit markets, self-insurance is a reasonable option. For other workers, this is not the case. A key implication of our analysis is that models that ignore such heterogeneity may provide an incomplete guide to policy.

A life-cycle approach such as ours also suggests other important policy implications. For example, an obvious implication is that the design of public pensions and public unemployment insurance systems are interdependent. To the extent that public pensions mean that workers retirements savings are unavailable to smooth a temporary income (either directly or as collateral) they may make unemployment insurance more valuable. A second insight is that differential benefits by family type (for example, higher benefits to families with children) may be desirable on insurance grounds alone (with out reference to redistributional goals). This is because the cost of self-insurance, and hence the value of unemployment insurance, may differ across family types. Of course, this needs to be balanced against differences across family types in the extent of moral hazard.

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