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Saving and portfolio allocation before and after job loss

Abstract:
Using administrative panel data from Norway, we investigate the development of household labor income, financial wealth and asset holdings over a nine-year period surrounding job loss. Consistent with a simple theoretical model, the data show precautionary saving and a shift toward safer assets in the years leading up to unemployment, and depletion of savings during unemployment. This suggests that at least some households can foresee and prepare for upcoming unemployment, which indicates that private savings can complement publicly provided unemployment insurance.

Keywords: unemployment, precautionary saving, consumption smoothing, household portfolios, portfolio allocation, optimal unemployment insurance

JEL classification: D12, E21, E24, G11, J65

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Sammendrag

Ved hjelp av registerdata over alle mannlige lønnsmottakere som ble arbeidsledige i Norge fra 1999-2003, undersøker vi utviklingen i de rammede husholdningens arbeidsinntekt, finansielle formue og beholdning av verdipapirer over en niårsperiode rundt tidspunktet da mannen i husholdningen mistet jobben. I tråd med en enkel teoretisk modell viser den empiriske analysen økt sparing og en reallokering av finansporteføljen mot sikrere verdipapirer i årene forut for arbeidsledigheten, samt en reduksjon i beholdningen av finansielle midler etter at arbeidsledigheten inntraff. Resultatene indikerer at husholdningene kan forutse og forberede seg på framtidig arbeidsledighet. Privat sparing kan således, sammen med dagpengene, bidra til å dempe virkningene i konsumet som følge av arbeidsledigheten.

The financial crisis and the resulting recession have significantly increased the number of unemployed in most OECD economies, with associated increase in governments' spending on unemployment insurance (UI) benefits. The US spending on out-of-work income maintenance amounted in 2009 to 1% of GDP, a marked increase from 0.24 % in 2005 according to OECD data. The OECD average also amounted to 1% in 2009 (Adema et al. (2011)). With strained public finances and concerns about moral hazard – under which UI can prolong unemployment by "subsidizing" it – the question is whether insurance mechanisms other than UI can smooth consumption for those hit by unemployment. In this paper we investigate the extent to which workers in wealthy welfare states, such as Norway, are able to smooth consumption by foreseeing an upcoming unemployment spell and react to it by increasing their savings. In particular, we estimate the development of households' labor income, financial wealth and asset holdings four years before and after job displacement.

In the optimal UI literature, coined by Baily (1978) and further developed by e.g. Chetty (2006), the main substitute for publicly provided UI is private savings.[1] In the extreme case, unprepared "hand-to-mouth consumers" would have to reduce their consumption in line with the unemployment-induced reduction in their income, strengthening the case for UI. By contrast, households with sufficient savings might not need UI at all to maintain consumption levels.[2] Indeed, Browning and Crossley (2001) show that households in Canada, particularly those with insufficient prior wealth, have to cut their consumption during unemployment spells when UI benefits are cut. Bloemen and Stancanelli

[1] Relatedly, Crossley and Low (2011) show how the optimal UI replacement rate depends on, among other things, the cost of self-insurance.

[2] Note that the availability of alternative insurance mechanisms captures only the benefit side of the optimal UI framework. To determine whether the current level of UI is optimal, one also needs to know its moral hazard cost, as shown in Chetty (2008). This paper focuses on the benefits of UI; see Roed and Zhang (2003) for a paper addressing the costs for Norway.

(2005) present similar findings for food consumption in the UK.[3] Finally, results in Card et al. (2007) and Basten et al. (2011) provide further indication of liquidity constraints among unemployed in Austria and Norway, respectively.

Despite the theoretical recognition of private wealth as insurance against unemployment, there is limited evidence on the extent to which households are able to accumulate wealth before and decumulate it after job loss, chiefly because of the limited availability of adequate data. A notable exception is Gruber (2001) who uses the US Survey of Income and Program Participation (SIPP) to analyze prior holdings and wealth depletion during unemployment. He observes household wealth at two points in time, enabling him to take out household fixed effects in estimating wealth depletion during unemployment.[4] In addition to investigating wealth depletion during unemployment, we investigate the extent of additional saving and of portfolio reallocation in the years leading up to the unemployment spell. This has previously been addressed in the literature on precautionary saving, which recognizes that household saving may be motivated not only by the "life-cycle" purpose of smoothing consumption and preparing for retirement, but also by a desire for "precautionary" or "buffer-stock" saving at shorter horizons, to prepare for events such as unemployment (Deaton (1991) and Carroll (1997)).[5] Furthermore, some studies investigate the extent to which households' investment in risky assets is negatively affected by labor income risk (see e.g. Guiso et al. (1996) using survey data on Italian households, or Betermier et al. (2011) for a study of the portfolios of Swedish job and industry

[3]This is all the more striking in the light of arguments and findings in Browning and Crossley (2009), whereby households can first, with smaller effects on utility, cut spending on durables, and only thereafter need to cut food expenditures.

[4]Having only two points in time has the disadvantage that the depletion will be underestimated to the extent that some of it takes place before the first or after the second point of observation. While two observations per household do allow to control for household fixed effects in the *level* of wealth, they do not suffice to control for household trends in wealth over time. In this paper we are able to address these shortcomings through the use of a 13-year annual panel on households' income, wealth and asset holdings - for households experiencing and not experiencing an unemployment spell.

[5]For a summary of the different models of precautionary saving, see also Carroll (2001)

switchers).

The major challenge for such empirical studies is that job loss risk can be endogenous. Households that have chosen riskier jobs may in fact be less risk-averse than others and hence engage in less precautionary saving or be less cautious about holding risky assets at all times, biasing downward any estimates of the effect of unemployment risk on saving or portfolio reshuffling. The precautionary saving literature in particular has tried to address such endogeneity concerns by instrumenting unemployment risk with variables thought to influence this risk but not to otherwise affect saving (for examples, see Carroll et al. (2003), Fuchs-Schuendeln and Schuendeln (2005) or Barceló and Villanueva (2010)). In addition to the possible endogeneity of job loss risk, there is the problem that households' behavior will necessarily depend not on actual unemployment probabilities (which econometricians can predict with some measurement error and can then instrument), but rather on households' subjective expectations thereof. That is, households can prepare for upcoming unemployment only to the extent to which they are actually aware of it. In this paper we focus on cases of actual unemployment and test the hypothesis of no behavioral response against the joint hypothesis that households can to some extent foresee their job loss and are motivated and able to respond to it.[6]

This paper thus contributes to the literature in three ways. First, we investigate to what extent households prepare for an unemployment spell with additional saving in the years preceding the spell. Second, we examine to what extent they reallocate their savings toward safer and more liquid assets in the same period. Finally, we explore whether they draw on prior savings during

[6]Stephens Jr (2004), using the US Health and Retirement Study, finds households to have some sense of upcoming job losses and income drops, but whether this is also the case in Norway must of course still be tested, as the extent to which job losses are foreseeable for employees is likely to vary across national labor markets.

the unemployment spell. To do so, we employ a panel of annual administrative data from Norway in which we observe labor income, financial wealth and the holdings in different asset classes for each household for 13 consecutive calendar years, 1995-2007.[7] Based on these administrative data, we construct a sample comprising households where the man experiences his first unemployment spell in one of the years 1999-2003, and complement this with a placebo sample of comparable households that do not experience an unemployment spell in this period (similar to the approach in Jacobson et al. (1993)). The panel structure of our data allows us to control for any unobserved household characteristics that are time-invariant, as well as for any calendar-year fixed-effects that are household-invariant, such as the effects of being in different phases of the business cycle. In an attempt to explore some sources of selection bias, we also analyze a subsample of individuals whose job loss occurred as part of a mass layoff.

The remainder of this paper is structured as follows. Section I presents a theoretical model with predictions about how upcoming, current or recent unemployment should affect saving and portfolio choices. Section II explains our empirical strategy, Section III the data, and Section IV presents the main results. Section V concludes.

I. Theoretical Framework

To illustrate the role of saving and portfolio allocation in response to upcoming, current and recent job loss, we set up a simple but illustrative two-

[7] To strike a balance between tracing households for as many "relative years" around job loss (where the year of job loss is year 0) as possible, while also having enough observations for each relative year, using all households that experienced a job loss in 1999-2003 we estimate the coefficients of being in relative year -4 through +4.

period model in which households earn labor and capital income, get utility from consumption, and decide in one period how much to save for next-period consumption and how to invest their savings from one period to the next. These theoretical considerations are essentially a simplified version of those in some of the studies cited above (see e.g. Baily (1978), Carroll (2001), Chetty (2006), Bodie et al. (1992)). Detailed derivations are provided in the Appendix.

I.A. Wealth Depletion during Unemployment

We start by considering a household that is suffering unemployment and faces uncertainty about the next period's labor income. Unemployment benefits amount to y_l, which is the household's sole income in period 0.[8] In addition, the household has financial wealth holdings of w. Income y in the following period 1 is uncertain: with probability p_1 the household remains unemployed and thus income remains at the unemployment benefit level y_l, and with probability $(1-p_1)$ the household becomes reemployed and receives the higher income, y_h.[9]

The household derives utility from consumption (c) only, and the utility function $u(c)$ is assumed to be strictly increasing and concave in c. Let β denote the discount factor between the two periods, R the risk-free return on savings and s the saving rate. Then the household solves the following maximization problem:

$$\underset{s}{Max} \qquad u(c_0) + \beta E[u(c_1)], \tag{1}$$

[8] For the majority of households in Norway, this corresponds to 62.4% of the earnings in the previous year.

[9] To illustrate what we consider the main links between unemployment and saving behavior, we make two simplifying assumptions here. First, we take the risk of job loss as exogenous. Second, we assume that being unemployed is synonymous with receiving lower income, but does not affect utility through any other channel. In Section II (Empirical Strategy), we discuss how our analysis changes when some job losses are potentially endogenous.

subject to:

$$0 \leq s \leq 1 \tag{2}$$

$$c_0 = (w + y_l)(1 - s) \tag{3}$$

$$c_1 = y_1 + (w + y_l)sR \tag{4}$$

This maximization problem yields a simple Euler equation for savings, which tells us that – given an expectation p_1 for the probability of continued unemployment next period – the household will choose its rate of (dis-) saving such that its expectation of the marginal utility of consumption across both periods is equalized:

$$\frac{\delta EU}{\delta s} : u'(c_0) = R\beta \left[(1 - p_1)u'(c_1^E) + p_1 u'(c_1^U) \right], \tag{5}$$

where c_1^E and c_1^U denote consumption in period 1 in the case where the household is employed (E) and unemployed (U), respectively. As we show in the Appendix, differentiating this equation with respect to p_1 tells us that there will be less saving, or equivalently more depletion, the more likely the household expects to be back in a regular job next period.

Proposition 1 $\frac{\delta s}{\delta p_1} > 0$. *The less likely an unemployed household expects to remain unemployed (with UI below the income of a regular job) in the next period, the more it will now deplete savings to cushion the temporarily lower labor income.*

I.B. Extra Saving before Unemployment

Given this motivation for spending additional resources during unemployment, we consider what a household would do upon realizing an increased risk of unemployment. The central intuition behind this consideration can be illustrated using the same kind of parsimonious two-period model with time set back one period. Now we consider behavior in the preunemployment *period -1*, in which income is at the higher level $y_{-1} = y_h$, given that the household expects to be unemployed and hence be earning only UI benefits $y_l < y_h$ in the following period 0. In this situation the same relationship of $\frac{\delta s_{-1}}{\delta p_0} > 0$ holds and can now be interpreted as precautionary saving:

Proposition 2 $\frac{\delta s_{-1}}{\delta p_0} > 0$. *If in period -1 the household realizes the risk of being unemployed in period 0, then the household will increase its saving rate* s_{-1}.

I.C. Portfolio Reallocation before Unemployment

When making its financial choices in response to unemployment risk, the household may also want to optimize the risk structure of its savings, given that asset classes other than the risk-free one are available. To illustrate the mechanism that might be at play here, we add to our illustrative model a second, risky asset yielding the uncertain return of R^r. With probability $(1 - q)$ this risky asset yields a high return, $R^r = R_h$; and with probability q a low return, $R^r = R_l$. To motivate risk-averse households to invest any fraction of their financial wealth in the risky asset, its expected return needs to exceed that of the safe asset: $E(R^r) > R^s$. As before, the household chooses its optimal saving rate from period -1 to 0, s_{-1}, to depend positively on the perceived probability of being unemployed next period, p_0. In addition to the previous case, the household now chooses which fraction α of its savings it wishes to invest in the risky asset. The optimization problem with two choice variables becomes:

$$\underset{s_{-1},\alpha}{Max} \qquad u(c_{-1}) + \beta E[u(c_0)], \tag{6}$$

subject to:

$$0 \leqslant s_{-1}, \alpha \leqslant 1 \tag{7}$$

$$c_{-1} = (y_{-1})(1 - s_{-1}) \tag{8}$$

$$E[c_0] = E[y_0] + s_{-1}y_{-1}(\alpha R^r + (1 - \alpha)R^s) \tag{9}$$

where $E[y_0]$ now depends on the perceived probability p_0 of being unemployed in period 0. For a given level of savings, an increase in the probability of unemployment in period 0 will lower the expected level of consumption in period 0. As the concave utility function is steeper at lower levels of consumption, any absolute variation in consumption at low levels will result in larger fluctuations in utility compared with the case when consumption is higher. Hence, a utility-maximizing household will shift from risky assets to safe assets to lower this dispersion accordingly. This can be shown formally from the two first order conditions of the maximization problem in Eq. (6):

Proposition 3 $\frac{\delta\alpha}{\delta p_0} < 0$. *An increase in the probability p_0 of being unemployed next period will induce the household to reduce the share of savings α that is invested in risky assets.*

To sum up, an increase in the perceived likelihood of experiencing unemployment induces households to save more, as well as to reshuffle toward less risky assets. We now explain our strategy for exploring these predictions empirically.

II. Empirical Strategy

Cross-sectional regressions of portfolio changes on employment changes using observational data will typically fail to identify the relationship of interest because households that experience unemployment will differ from those not experiencing unemployment. At the same time, there is the risk of confounding general changes in asset markets with developments because of job loss, seeing that the majority of job losses occur during economic downturns. Many previous studies could not solve these issues because they had access to cross-sectional data only. Gruber (2001), in his investigation of wealth depletion after job loss, was able to go a step further, by observing households in the SIPP once before and once after job loss. Although having two observations per household allows him to focus on wealth changes, he cannot compare changes in wealth before or after job loss with those that the same household experiences in normal times. Furthermore, to the extent to which households keep depleting wealth after his second point of observation, or have already started to rebuild some of their wealth, estimates of the full extent of dissaving will be biased downward.

Our panel, in which we observe households annually for 13 years, 1995-2007, gives us a distinct advantage, as we can trace our outcomes of interest for many years.[10] At the same time we can control for both household fixed effects and calendar-year fixed effects. Specifically, our empirical strategy is illustrated by

[10] Annual observations prevent us from analyzing developments that occur and are partly or fully reversed within a calendar year, so our estimates of saving and dissaving are still lower bounds. Nevertheless, they can be expected to be more accurate than estimates based on only two observations per household.

the following model estimated on a panel of households experiencing unemployment:

$$Y_{i,t} = \alpha_i + \beta(RY_{i,t}) + \gamma_t + \varepsilon_{it}, \tag{10}$$

where $Y_{i,t}$ denotes different outcome variables (e.g. saving; see Section III) for household i in calendar year t, α_i is a vector of household fixed effects , γ_t is a vector of calendar-year dummies, $RY_{i,t}$ is a vector of dummies for nine relative years around the year of job loss (the relative year zero is the year of job loss) and ε is an error term with mean zero. Because we use job losses from different calendar years, we are able to separately identify the calendar-year and the relative-year fixed effects. For each outcome variable of interest, we can thus estimate this equation and thereby obtain the respective variable's time path (given by the betas) for relative years before, during and after the year of job loss (see e.g. Jacobson et al. (1993)).[11] Moreover, controlling for age is potentially important to ensure that the counterfactual time paths without job loss are not biased by life-cycle-related changes over time. Following Jacobson et al. (1993), both calendar-year fixed effects and age effects are estimated using a larger sample also including individuals who do not become unemployed and who are thus randomly allocated an artificial job loss year. All the regressions are performed on this larger sample. [12]

This empirical strategy identifies the causal effect of an anticipated[13] unem-

[11]The "reference relative year" here is in effect a weighted average of the omitted relative years prior to or after the window of four years prior to and after the job loss. A household with job loss in 1999 will have omitted relative years 5 to 8, whereas a household with job loss in 2003 will have omitted relative years -8 to -5.

[12]Results from regressions on the smaller dataset (households experiencing unemployment only) are, however, very similar to those reported below.

[13]Some workers will be aware of the upcoming unemployment spell with certainty, others may only fear it with low probability. At the end of the current section, we elaborate on how this affects the interpretation of our results. In the next section we also define a placebo sample

ployment event on saving or portfolio reshuffling - or of an actual unemployment event on subsequent depletion of savings - if the timing of the event is uncorrelated with unobserved determinants of the outcome variable. Although unobservable differences in households that are time-invariant or aggregate calendar-year variation - both potential sources of bias in previous studies - are not a threat to our identification strategy, several legitimate concerns remain that our main identifying assumption does not hold. It is possible, for example, that there exist unobserved "third factors" (confounders) that cause both changes in saving behavior and in the employment situation. Individuals going through some kind of personal crisis might become less disciplined in their saving and investment behavior and might for the same underlying reasons lose their job soon after. If so, effect estimates of the upcoming unemployment would be biased downward. By contrast, households that recently managed to put an above-average amount of money on the side might be more eager to become unemployed (given that some individuals have some leeway on when or whether they are laid off), biasing the effect estimate upward. Indeed, we may even imagine that a worker could be saving *because* he is planning to make himself become unemployed, in which case, it is not the anticipation of (involuntary) unemployment that causes saving, but the saving that causes the unemployment.

We attempt to shed some light on the empirical relevance of such endogeneity issues by repeating our analyses for a subsample of households whose job loss occurs in association with a major plant downsizing event. As mass layoffs from bigger plants are unlikely to be influenced by any individual worker's health or intention to become unemployed, several individual-level endogeneity concerns

of households not suffering unemployment spells. Some workers in the placebo sample may still have expected to suffer unemployment, potentially resulting in, for example, precautionary saving. Given our random assignment of the imaginary displacement year for the placebo sample, and our control for household fixed effects, cf. below, expected unemployment spells in the placebo sample that do not occur should not seriously bias our main results.

are largely alleviated (Jacobson et al. (1993), Huttunen et al. (2011), Rege et al. (2009),Wachter et al. (2009)). Relying on job loss in association with mass layoffs will not, however, remove selection issues at the plant level. Workers selected into plants that undertake mass layoffs, may, for example, be less risk-averse than other workers, or they may hold different expectations about future employment opportunities. Therefore, although endogeneity concerns may be somewhat smaller for workers becoming unemployed in association with plant mass-layoffs, it is not clear whether effect estimates for such workers should be interpreted as less biased than effect estimates for all unemployed workers, or simply as indication that different types of workers are heterogeneously affected by (anticipated) unemployment events. It is also possible that the ability to foresee an upcoming unemployment spell differs for workers laid off in association with mass layoffs compared with other workers; cf. next paragraph.

Furthermore, it is worth highlighting again that we can expect households to prepare for unemployment only if they can see it coming, which in turn we do not observe. Stephens Jr (2004), using the US Health and Retirement Study, finds that households have some sense of upcoming job losses and income drops, but the strength of such expectations depend on the specifics of each national labor market. Thus our tests for behavioral responses to upcoming unemployment spells are essentially testing the joint hypothesis that households can *sense* the job loss and that they possess the financial ability to *respond* to the upcoming event by saving more.

III. Data

III.A. Data Sources

We use administrative data from Norwegian tax registers that cover the every Norwegian resident throughout the period 1995-2007. Three features make these data ideal for our purposes. First, register data are likely to be more reliable than survey data, an aspect that has previously been found to be of particular importance for data on income and financial wealth, as well as for data on unemployment spells, both of which are frequently recalled imperfectly or misreported.[14] Second, observing households in a panel format for a total of 13 years allows us to distinguish household and calendar year fixed effects from what happens in the different years around job loss. Finally, and importantly, we are able to merge information on employment status and labor income with information on household financial wealth, as well as – for the subsample analysis with those losing their job in the course of mass layoffs – with information on employment at the plant level.

Households are identified as couples who are married or who live together with common children (data to identify unmarried but cohabiting couples without children are not available). We focus on cases of male unemployment, as this will have a more significant impact on the household's financial situation. It also makes the sample more homogeneous, as most men return to a job at some point, whereas many women who lose their job tend to remain out of the labor force. A household is defined as unemployed in a year if the man receives unemployment benefits. Throughout the analysis, income is defined as the man's

[14] For an example of the effects of misreporting in household surveys, see Meyer et al. (2009). For more information on the Norwegian administrative data see Røed and Raaum (2003), and on the wealth data in particular see e.g. Halvorsen (2011) and Fagereng et al. (2011).

labor-related income.[15]

We follow Gruber (2001) in focusing on the household's financial wealth and disregard real estate. Chetty and Szeidl (2007) argue that it is likely that fixed transaction costs will make it not worthwhile to liquidate a house to pay for an unemployment spell.[16] Household financial wealth and the holdings of different types of assets are used at the household level, i.e., we use the sum of the husband's and the wife's assets. This makes sense conceptually as we would expect most of our households to live on a shared budget. Furthermore, financial variables are more reliable at the household level: while the two spouses do report their wealth separately, they are jointly taxed and they do not have any incentive to ensure that the one who reports holding the wealth is the one who does in fact own it. The category of safe assets is defined to include bank deposits and bonds, whereas risky assets are defined to include direct and indirect (mutual fund) holdings of stocks.[17]

To identify the subset of households becoming unemployed in association with a mass layoff, we count the number of employees and define as mass layoff those cases in which the number of employees decreases by 50% or more from one calendar year to the next. As this would not have much meaning in the case of two-person plants or in plants that experience significant employment differences

[15] This includes wage income as well as work-related transfers, such as unemployment benefits, sickness benefits and parental leave benefits.

[16] We cannot observe real estate values reliably in our data sources. However, we have information on whether households enter or exit the status of homeowner. An analysis of this variable reveals that a few households in our sample go from being to not being homeowner before the unemployment spell. Moreover, there is some indication of a decline in gross debt in the years leading up to the unemployment spell. In an attempt to explore whether these small changes may affect our main results, we restricted our sample to the households that did not change homeowner status in the observation period. Our main results remained virtually identical in this sample.

[17] To ensure that our analyses of the impact of unemployment on labor income and wealth are not just driven by outliers in the far right tail of the distribution, we top-code both variables at the 99th percentile for each year. Furthermore, we consistently use 2004 as the omitted calendar year category, and convert NOK values into US dollars at 2004 exchange rates, with 1 USD corresponding to about NOK 6.7, so that all monetary variables are displayed in 2004 US dollars.

between any pair of years, we follow previous studies (see for instance Jacobson et al. (1993), Wachter et al. (2009), Huttunen et al. (2011), (Rege et al., 2009)) in imposing some additional requirements. First, we require that plants have employed at least 10 employees in one of the years 1999-2003. We also require that the plant has existed for at least four years and has not already experienced a mass lay-off in the above sense in one of the past three years. Finally, because it is rather common for Norwegian firms to move workers from one of its plants to another (Huttunen et al. (2011)), we compute this downsizing rate without counting employees who leave a plant merely to continue working at another plant of the same firm. In the summary statistics we also report the husband's highest educational achievement and industry. The latter follows the standard NACE classification system.[18]

III.B. Sample Definitions

Using the above data sources, our main sample is defined as follows. To exclude households still in full-time education or with access to early-retirement schemes, we require the man to be from 30 to 58 (inclusive) years old in the year of job loss. We also require that in the year before the job loss the man had sufficient income to be eligible for the publicly provided and universally utilized unemployment benefits.[19] Households with business income, whose unemployment benefits are calculated under different rules, are also excluded. Moreover, we require that households have not experienced any unemployment in the four years leading up to the unemployment spell. To ensure that our comparison

[18]See Eurostat (2011) for definitions. In cases where there are few observations within one industry, we merge industries to obtain adequately sized categories.

[19]This minimum income level necessary to be eligible is updated every year by the Norwegian Parliament in accordance with the general growth in prices and wages. The amount is low by Norwegian standards, and in practice employees with a nonminor position throughout a calendar year will meet the requirements. For 2010, for instance, the amount was about NOK 165,000, or USD 26,000. To ensure that the man's labor market attachment is not too loose, we impose a somewhat stronger restriction (equivalent to about NOK 220,000 in 2010). For more information on UI and these amounts; see www.nav.no/english.

of income and wealth across the different relative years is not biased by differences in the sample composition, we require our panel to be fully balanced both across the nine relative years and across the 13 calendar years. We also follow Chetty (2008) in excluding workers who return to the same plant after their unemployment spell, as these are likely to know already at the time of layoff that they will be able to return to their previous plant at a specific time. These requirements leave us with our main analytic sample, comprising two disjoint subsamples. The first subsample includes the households that were in fact unemployed at some point during 1999-2003. This subsample comprises 5,513 households or 71,669 household-year observations, and is labeled *Unemployed*. The second subsample includes the households that were never unemployed in our data sample, and it is labeled *Placebo*. They are randomly assigned an *artificial* year of job loss in the years 1999-2003 to match the other subsample of households that did lose their job in the data window. The union of these two subsamples constitutes our main analytic sample of 57,389 households or 746,057 household-year observations, and the regression results reported below are based on our main analytic sample. [20] In this dataset we can track all households for at least four years before and after the year of job loss.

In addition to the main analytic sample, we also split the *Unemployed* sample in two. The first is the subsample of 1,075 households losing their jobs in relation to a major plant downsizing (labeled *ML*), and the second is the remaining 4,438 (of the 5,513) whose job loss did not occur in association with a mass layoff (*NonML*).

III.C. Summary Statistics

Table I displays summary statistics for the *Unemployed* sample of households

[20] Results from regressions on *Unemployed* only, are very similar to those reported.

actually experiencing unemployment. As we consider men who are married or cohabiting with their spouse and common children, the mean age of the man is relatively high. Close to 35% of the household men have less than a high school education. We see that male labor income is more than twice as high as female income, in terms of both the mean and the median. We also note significant dispersions in financial wealth: whereas the mean holdings in the sample amount to more than USD 14,000, the median is about USD 4,500. We also see that the median household does not participate in risky asset markets.

[Table I about here]

In Table II we display summary statistics for our *Placebo* sample together with the *Unemployed* sample, the latter split into the *ML* and *NonML* subsamples. As might be expected, mass layoffs occur mainly in the manufacturing and construction sectors. Those affected are on average slightly older with annual income about USD 5,000 higher; otherwise, the samples are relatively similar, with average wealth differences being statistically but arguably not economically important. Nonetheless, the differences here need to be kept in mind below when we interpret the differences in the results for these two subsamples.

Those in the *Placebo* sample, by contrast, are on average about four years older and 4 percentage points more likely to have a college degree. Correspondingly they are more likely to be found in sectors such as education. Not surprisingly then their annual income is about USD 5,000 higher and their financial wealth almost USD 7,000 higher.[21]

[Table II about here]

[21]To explore whether the differences on observables between the *Placebo* sample and the *Unemployed* sample are affecting our main results, we did two things. First, we used matching on observables to create a smaller placebo sample (which was similar to our *Unemployed* sample on observables). Using this sample instead did not significantly change our main results. Second, we estimated results using the *Unemployed* sample only. Again, and as is evident from Figure 4, our main results remained unchanged in this subsample.

IV. Results

We now turn to our findings on households' inclination to save and shift assets toward less risky assets before an upcoming job loss, as well as the depletion of savings during unemployment. For our main results, we have estimated the model in Equation (10). Regression results are reported in Table III, and Figures 1, 2 and 3 plot the predicted paths of labor income, wealth and its components over time, obtained by adding to the estimate of the constant those of the respective relative-year coefficients. We are interested in the significance of the accumulation of wealth between our first observation in -4 and the last prelayoff observation in -1, in the changes in respectively safe and risky assets between the same pair of years, and finally in the significance of wealth decumulation between the last prelayoff year and the last point before households start to re-save, which for the average household turns out to be relative year 2.

We start our discussion with the results for labor-related income, the variable that is directly affected by job loss even without any active responses. From Fig. 1, we see that this income path is flat until relative year -1 (recall that our calendar-year fixed effects take out average income growth), but then the average household income drops significantly[22] from about USD 51,000 in the last year before job loss to USD 45,000 in the year of job loss.[23] Income then remains low in relative year +1 before it gradually starts increasing again, as more and more households move back into regular employment. By relative year +4 the difference has shrunk to about USD 1,000, which can be partly because of

[22] We refer to a difference with a p-value of less than 0.05 as statistically significant; see relevant Figures and Tables for details.

[23] The drop in relative year 0 here amounts to about 12%. Since we know that all of our households are eligible for UI benefits, which for most of them amount to 62.4% of prior income and thus imply an annualized drop of 37.6%, this tells us that the average household in this sample is unemployed for about one-third of its relative year 0.

some households still being unemployed and partly due to lower average income in the new job.[24]

[Fig. 1 about here]

Fig. 2 reports the predicted time path of financial wealth. We find that the average household starts out with financial wealth of about USD 34,500 in relative year -4 and increases this by more than USD 1,000 by the end of the last calendar year before job loss. As mentioned, this may be considered a conservative estimate because we only observe households per calendar year and we may therefore be mixing some additional saving and some dissaving within year 0 for households experiencing job loss within the calendar year. Furthermore, this is the average across all households, presumably including both households aware of an impending job loss that respond by saving more and households not aware of the upcoming job loss that are thus unable to take any measures to save before the job loss.[25] Despite these factors, however, we do find precautionary saving that is both statistically and economically significant, suggesting that the average household is aware of the upcoming job loss and does prepare for it.

Moreover, the subsequent wealth depletion of on average about USD 3,000 between relative years -1 and 2 is statistically significant, and also in line with our theoretical prediction. This depletion of savings does not seem very large, however, relative to the income shortfall of more than USD 6,000 in years 0

[24]This differs from the findings made for instance by Wachter et al. (2009), where workers displaced during the 1982 US recession are permanently worse off in terms of income. Presumably, this difference reflects the general strength of the Norwegian labor market with low unemployment rates during the period under consideration.

[25]Although the pattern of more saving before the job loss is as we expect, the financial wealth in -4 is not statistically significantly different from the wealth in -1. However, the buildup is not far from statistically significant, and it becomes clearly significant when we exclude the 5% richest households or when we exclude households that participate in the stock and bond markets. Those participating in the stock and bond markets, by contrast, respond more strongly in terms of reshuffling their portfolio structure, as we discuss below.

and 1, even when taking into account that about one-third of these income shortfalls may be cushioned by the tax system. Since by the time of job loss the average household would have enough resources for greater wealth depletion, this suggests that the average household can do the remaining adjustment along other margins, such as spousal labor supply (a slight increase in spousal labor income/supply is indeed found in complementary analyses not reported here), temporarily lower spending on durables (as in Browning and Crossley (2009)) or substituting some home production for market consumption.

[Fig. 2 about here]

To pursue the predictions for portfolio reshuffling, we turn to Fig. 3, which plots separately the predicted time paths of risky assets (stocks and mutual funds) and safe assets (bonds and cash). The average household does significantly shift wealth from risky assets toward safe assets. As the household reaches the year of job loss we also note that it draws on both sources of assets. As we reach year +4, the levels of safe and risky assets are pretty much back at their -4 levels. Of course, one should note that the risky assets are held by a smaller share of the households, so the issue of reshuffling does not equally apply to each household in our sample. Nonetheless, these time patterns are in line with our theoretical predictions.[26]

[Fig. 3 about here]

In Section II we discussed how our household fixed effects take out un-

[26] Regressions on asset levels may be very sensitive to outliers, even after winsorizing at the 99th percentile. A possible alternative therefore is to use instead log asset holdings on the left-hand side, although this makes regressions more sensitive to households with very low initial holdings and for whom small dollar accumulations can therefore show up as huge relative changes in wealth. While we rely on levels for the results presented here, the corresponding log specifications confirm the same hypotheses, suggesting that our results are not driven by outliers at either the top or the bottom of the wealth distribution. The same applies when we use as dependent variables the first differences or their logs, although this reduces by one year the length of time for which we can make predictions.

observed time-invariant household characteristics, such as the degree of risk-aversion, and how our calendar-year fixed effects take out the impacts of, for instance, inflation and the business cycle. However, are these two sets of fixed effects sufficient? One way of getting an impression of this is to test whether the same time paths are flat for the *Placebo* sample of households who never experience unemployment and where the year of (artificial) job loss is randomly assigned. In Fig. 4 we plot the estimates for the RYs in Eq. (10) - as provided by the regression reported in Table III - for the *Placebo* sample and the *Unemployed* sample separately. Indeed, we find that for *Placebo* the predicted time paths are flat. This supports the validity of our specification.

[Fig. 4 about here]
[Table III about here]

In Section II we also discussed how we can get additional, suggestive evidence on the relevance of remaining individual-level selection issues, by focusing on the subsample of individuals affected by mass layoffs. Figures 5 through 8 display the predicted time paths of our outcome variables of interest separately for those affected by mass layoffs and the other unemployed, and the underlying coefficient estimates are given in Tables IV and V. We see that the time paths of income, risky and safe assets are all similar across the two subsamples. Looking at financial wealth, displayed in Fig. 6, wealth depletion during unemployment is also similar for both subsamples. Where the two subsamples differ somewhat is in terms of prior wealth accumulation, of which the ML subsample displays only very slight evidence. As discussed in Section II, it is not straightforward to interpret these differences in effect estimates for the households experiencing unemployment in and not in association with mass layoffs. On the one hand, we have seen that the households experiencing job loss in association with mass layoffs have substantially higher income and lower financial wealth throughout our data window, cf. Table II and Figures 5 and 6, which may indicate that the samples are different and that we therefore may expect effects of anticipated unemployment to be heterogeneous across the two samples. Moreover, there may be some weak indications that the *ML* households react to the upcoming job loss at a somewhat later stage than the *NonML* households, cf. Figures 6 and 7, which may indicate differences in the subjectively perceived likelihoods of unemployment. On the other hand, we might take the finding that most of the patterns for the *ML* households by and large line up with our theoretical predictions, as a sign that our main effect estimates are not seriously biased by selection on household characteristics. Nonetheless, we must caution that possible precautionary saving in the *nonML* subsample may be hidden by remaining unobserved sample heterogeneity, and recall that the *ML* sample is relatively small.

[Figs. 5-8 about here]
[Tables VI and V about here]

V. Conclusion

We have empirically investigated saving patterns and portfolio reshuffling toward safer assets before unemployment, as well as depletion of wealth after job loss. Consistent with the predictions of our simple theoretical model, we find, first, that the average household does deplete about USD 2,500 of financial wealth during an unemployment spell. More strikingly, almost all of this is made up for by additional saving in the three years before job loss as well as in years 3 and 4 after job loss. Furthermore, we also find evidence of portfolio reshuffling in the years before job loss. The latter two results suggest that the average household is indeed able to foresee the upcoming unemployment spell, and is then both able and willing to prepare for those rainy days.

These results have been obtained using an empirical strategy that allows us to trace the time paths of income, financial wealth and its components, while fully controlling for household and calendar-year fixed effects. Previous studies on wealth depletion, precautionary saving or household portfolios have not been able to include such controls because of due to lack of adequate panel data.

The presence of precautionary saving behavior indicates that at least some workers in our sample are able to foresee and prepare for the upcoming unemployment spell, which indicates that they are partly able to smooth consumption by drawing on their prior savings. While the estimated size of this wealth depletion may be thought to be relatively small compared with the drop in income associated with the job loss, its existence does nonetheless confirm that, to some extent, private savings can complement publicly provided unemployment insurance. At least four things should be noted, however.

First, the UI benefits in Norway are very generous by international standards: they typically replace more than 60% of earnings in the calendar year before job loss, and the tax rules ensure that the resulting posttax drop in income can be substantially smaller; at the same time most households are eligible to receive UI for up to 2 years, and some even for longer. Second, in our period of observation the Norwegian labor market is characterized by very low unemployment rates, implying relatively easy access to new employment for most of the job losers concerned. Both we and others have found income to recover more rapidly after job loss than is the case in many other countries, with correspondingly modest impacts on the reduction of private financial savings from efforts to smooth consumption through spells of unemployment. In line with this, the households in our sample tend to not end up with permanently lower holdings of financial wealth as a consequence of their unemployment spell, presumably because of the relatively generous UI system and the largely temporary nature of their unemployment spells. Third, the households in our sample do not only enjoy a generous welfare system, but they also hold substantial financial wealth at the outset. On average, they hold assets worth more than a fourth of their annual labor income. Finally, we need to caution that our findings are all based on sample averages and thus do not rule out the possibility that some of the poorest households suffer considerably during unemployment or do end up with permanently lower wealth afterward.

A Appendix: Analytical Solution of the Model

Complementing the parsimonious model in Section I this appendix provides the formal derivations behind our propositions.

In the maximization problem from Eq. (1) we replace c_1 with the two different states that consumption may take in period 1, depending on the employment status (Employed (E) or Unemployed (U)):

$$\underset{s}{Max} \qquad EU = u(c_0) + \beta[(1-p_1)u(c_1^E) + p_1 u(c_1^U)], \tag{11}$$

subject to:

$$0 \leqslant s \leqslant 1 \tag{12}$$

$$c_0 = (w + y_l)(1 - s) \tag{13}$$

$$c_1^U = y_l + s(w + y_l)R \tag{14}$$

$$c_1^E = y_h + s(w + y_l)R \tag{15}$$

The first order condition (FOC) for s then yields an Euler equation relating the marginal utility of consumption in period 0 to that in period 1.

$$\frac{\delta EU}{\delta s} : u'(c_0) = R\beta \left[(1-p_1)u'(c_1^E) + p_1 u'(c_1^U)\right] \tag{16}$$

Taking the total differential with respect to p_1 and assuming, for simplicity and without loss of generality, a return $R = 1$, gives:

$$\begin{aligned} & -u''(c_0)(w+y_l)\frac{\delta s}{\delta p_1} \\ & = \beta\left[-u'(c_1^E) + u'(c_1^U) + \left\{(1-p_1)u''(c_1^E)(w+y_l) + p_1 u''(c_1^U)(w+y_l)\right\}\frac{\delta s}{\delta p_1}\right] \end{aligned} \tag{17}$$

Hence,

$$\begin{aligned} & \frac{\delta s}{\delta p_1} \\ & = \frac{-u'(c_1^E) + u'(c_1^U)}{-u''(c)(w+y_l) - \beta\left\{(1-p_1)u''(c_1^E)(w+y_l) + p_1 u''(c_1^U)(w+y_l)\right\}} > 0 \end{aligned} \tag{18}$$

Both numerator and denominator are positive because of the concavity of the utility function ($u''(c) < 0$), and the saving rate is increasing in the probability of remaining unemployed. Hence we have proven Proposition 1.

Now we move the timing back one period, considering the household in period -1 before the job loss occurred. Rewriting the maximization problem from Eq. (6) by substituting for the four different consumption states that the household may face in the next period depending on high (H) vs. low (L) risky asset return and the employment (U or E) status, we get:

$$\begin{aligned} & \underset{s_{-1},\alpha}{Max} u((y_{-1}(1-s_{-1})) + \\ & \beta[(1-p_0)(1-q)u(c_1^{EH}) + (1-p_0)q \cdot u(c_1^{EL}) + p_0(1-q) \cdot u(c_1^{UH}) + p_0 q \cdot u(c_1^{UL})] \end{aligned} \tag{19}$$

subject to

$$0 \leqslant s, \alpha \leqslant 1 \tag{20}$$

where c_1^{EH} denotes consumption in period 1, given that the household is employed and risky asset returns turned out to be high. By contrast, c_1^{UL} denotes the other extreme case where the household is unemployed and risky asset returns turned out to be low.

The FOCs are:

$\frac{\delta EU}{\delta s_{-1}}$:

$$u'(y_{-1}(1-s_{-1})) = \beta \left\{ \begin{array}{c} (1-q)(\alpha R_h + (1-\alpha)R)[(1-p_0)\cdot u'(c_1^{EH}) + p_0 \cdot u'(c_1^{UH})] \\ +q(\alpha R_l + (1-\alpha)R)[(1-p_0)\cdot u'(c_1^{EL}) + p_0 \cdot u'(c_1^{UL})] \end{array} \right\} \tag{21}$$

$\frac{\delta EU}{\delta \alpha}$:

$$\frac{R_h - R}{R - R_l} = \frac{q}{1-q} \frac{(1-p_0)\cdot u'(c_1^{EL}) + p_0 \cdot u'(c_1^{UL})}{(1-p_0)\cdot u'(c_1^{EH}) + p_0 \cdot u'(c_1^{UH})} \tag{22}$$

For notational convenience, we define the following terms, where the subscripts for p and s are omitted:

$$\Omega_L(p, s, \alpha) = (1-p)\cdot u'(c_1^{EL}) + p \cdot u'(c_1^{UL}) \tag{23}$$

$$\Omega_H(p, s, \alpha) = (1-p)\cdot u'(c_1^{EH}) + p \cdot u'(c_1^{UH}) \tag{24}$$

$$R_H = (1-q)(\alpha R_h + (1-\alpha)R) \tag{25}$$

$$R_L = q(\alpha R_l + (1-\alpha)R) \tag{26}$$

$$C = \frac{R_h - R}{R - R_l}\frac{1-q}{q} \tag{27}$$

Then we can rewrite the FOCs into

$$\Omega_H \frac{R_h - R}{R - R_l}\frac{1-q}{q} = \Omega_L = \Omega_H \cdot C \tag{28}$$

and

$$u'(1-s) = \beta \left\{ R_H \cdot \Omega_H + R_L \cdot \Omega_L \right\} \tag{29}$$

Inserting into the other, and setting $\beta = 1$ and $y_{-1} = 1$, we get:

$$u'(1-s) = R_H \cdot \Omega_H + R_L \cdot \Omega_H \cdot C = \Omega_H \left[R_H \cdot + R_L \cdot C \right] = B \cdot \Omega_H$$

where $B = (1-q)\frac{R(R_h - R_l)}{R - R_l} > 0$.

In compact notation, the two FOCs are as follows:

$$u'(1-s) = B \cdot \Omega_H \tag{30}$$

$$\Omega_L = \Omega_H \cdot C \tag{31}$$

$$B \cdot \Omega_H(p, s, \alpha) - u'(1-s) = 0 \tag{32}$$

$$C \cdot \Omega_H(p, s, \alpha) - \Omega_L(p, s, \alpha) = 0 \tag{33}$$

Taking the total differential wrt. to p of the first:

$$B \cdot \left[\frac{\delta \Omega_H}{\delta p} + \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} + \frac{\delta \Omega_H}{\delta \alpha} \frac{\delta \alpha}{\delta p} \right] = -u''(1-s) \frac{\delta s}{\delta p} \tag{34}$$

This can be written as:

$$B \frac{\delta \Omega_H}{\delta \alpha} \frac{\delta \alpha}{\delta p} = -u''(1-s) \frac{\delta s}{\delta p} - B \frac{\delta \Omega_H}{\delta p} - B \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} \tag{35}$$

The total differential of the second FOC is as follows:

$$C \cdot \left[\frac{\delta \Omega_H}{\delta p} + \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} + \frac{\delta \Omega_H}{\delta \alpha} \frac{\delta \alpha}{\delta p} \right] = \frac{\delta \Omega_L}{\delta p} + \frac{\delta \Omega_L}{\delta s} \frac{\delta s}{\delta p} + \frac{\delta \Omega_L}{\delta \alpha} \frac{\delta \alpha}{\delta p} \tag{36}$$

Solving for $\frac{\delta \alpha}{\delta p}$:

$$\frac{\delta \alpha}{\delta p} = \frac{C \frac{\delta \Omega_H}{\delta p} + C \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} - \frac{\delta \Omega_L}{\delta p} - \frac{\delta \Omega_L}{\delta s} \frac{\delta s}{\delta p}}{\left(\frac{\delta \Omega_L}{\delta \alpha} - C \frac{\delta \Omega_H}{\delta \alpha} \right)} \tag{37}$$

and inserting $\frac{\delta \alpha}{\delta p}$, the first FOC gives:

$$\begin{aligned} & B \frac{\delta \Omega_H}{\delta \alpha} \left(\frac{C \frac{\delta \Omega_H}{\delta p} + C \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} - \frac{\delta \Omega_L}{\delta p} - \frac{\delta \Omega_L}{\delta s} \frac{\delta s}{\delta p}}{\left(\frac{\delta \Omega_L}{\delta \alpha} - C \frac{\delta \Omega_H}{\delta \alpha} \right)} \right) \\ & = -u''(1-s) \frac{\delta s}{\delta p} - B \frac{\delta \Omega_H}{\delta p} - B \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} \end{aligned} \tag{38}$$

Multiplying both sides by $\left(\frac{\delta \Omega_L}{\delta \alpha} - C \frac{\delta \Omega_H}{\delta \alpha} \right)$ and rearranging gives:

$$\begin{aligned} & B \frac{\delta \Omega_H}{\delta \alpha} \left(C \frac{\delta \Omega_H}{\delta p} + C \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} - \frac{\delta \Omega_L}{\delta p} - \frac{\delta \Omega_L}{\delta s} \frac{\delta s}{\delta p} \right) \\ & = \left(-u''(1-s) \frac{\delta s}{\delta p} - B \frac{\delta \Omega_H}{\delta p} - B \frac{\delta \Omega_H}{\delta s} \frac{\delta s}{\delta p} \right) \left(\left(\frac{\delta \Omega_L}{\delta \alpha} - C \frac{\delta \Omega_H}{\delta \alpha} \right) \right) \end{aligned} \tag{39}$$

We can now solve for $\frac{\delta s}{\delta p}$:

$$\frac{\delta s}{\delta p}=\frac{B\left(\frac{\delta\Omega_L}{\delta p}\frac{\delta\Omega_H}{\delta\alpha}-\frac{\delta\Omega_H}{\delta p}\frac{\delta\Omega_L}{\delta\alpha}\right)}{u''(1-s)\left(\frac{\delta\Omega_L}{\delta\alpha}-C\frac{\delta\Omega_H}{\delta\alpha}\right)+B\left(\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta\alpha}-\frac{\delta\Omega_H}{\delta\alpha}\frac{\delta\Omega_L}{\delta s}\right)}>0 \tag{40}$$

We can verify that $\frac{\delta\Omega_L}{\delta p}$, $\frac{\delta\Omega_H}{\delta p}$, $\frac{\delta\Omega_L}{\delta\alpha}$, B , $C>0$ and $\frac{\delta\Omega_H}{\delta\alpha}$, $u''(1-s)$, $\frac{\delta\Omega_H}{\delta s}$, $\frac{\delta\Omega_L}{\delta s}<0$, given $R_h>R_s>R_l$. Hence, both numerator and denominator are negative and $\frac{\delta s}{\delta p}>0$, which proves Proposition 2.

A higher probability of low income in the second period increases the saving rate out of period-one income and solving this for the first FOC for $\frac{\delta s}{\delta p}$ we obtain:

$$B\cdot\left[\frac{\delta\Omega_H}{\delta p}+\frac{\delta\Omega_H}{\delta s}\frac{\delta s}{\delta p}+\frac{\delta\Omega_H}{\delta\alpha}\frac{\delta\alpha}{\delta p}\right]=-u''(1-s)\frac{\delta s}{\delta p} \tag{41}$$

$$\frac{\delta s}{\delta p}=\frac{B\cdot\left[\frac{\delta\Omega_H}{\delta p}+\frac{\delta\Omega_H}{\delta\alpha}\frac{\delta\alpha}{\delta p}\right]}{\left(-u''(1-s)-B\frac{\delta\Omega_H}{\delta s}\right)}$$

and rearranging the other FOC we obtain:

$$\left(C\frac{\delta\Omega_H}{\delta s}-\frac{\delta\Omega_L}{\delta s}\right)\frac{\delta s}{\delta p}=\frac{\delta\Omega_L}{\delta p}-C\frac{\delta\Omega_H}{\delta p}+\left(\frac{\delta\Omega_L}{\delta\alpha}-C\frac{\delta\Omega_H}{\delta\alpha}\right)\frac{\delta\alpha}{\delta p} \tag{42}$$

Substituting the first FOC and multiplying by $\left(-u''(1-s)-B\frac{\delta\Omega_H}{\delta s}\right)$ we obtain:

$$\begin{aligned}&\left(C\frac{\delta\Omega_H}{\delta s}-\frac{\delta\Omega_L}{\delta s}\right)\left(B\cdot\frac{\delta\Omega_H}{\delta p}+B\frac{\delta\Omega_H}{\delta\alpha}\frac{\delta\alpha}{\delta p}\right)\\&=\left[\frac{\delta\Omega_L}{\delta p}-C\frac{\delta\Omega_H}{\delta p}+\left(\frac{\delta\Omega_L}{\delta\alpha}-C\frac{\delta\Omega_H}{\delta\alpha}\right)\frac{\delta\alpha}{\delta p}\right]\left(-u''(1-s)-B\frac{\delta\Omega_H}{\delta s}\right)\end{aligned} \tag{43}$$

Rearranging terms gives:

$$B\left(\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta p}\right)+u''(1-s)\left(\frac{\delta\Omega_L}{\delta p}-C\frac{\delta\Omega_H}{\delta p}\right)$$
$$=\frac{\delta\alpha}{\delta p}\left[u''(1-s)\left(C\frac{\delta\Omega_H}{\delta\alpha}-\frac{\delta\Omega_L}{\delta\alpha}\right)+B\left(\frac{\delta\Omega_L}{\delta s}\frac{\delta\Omega_H}{\delta\alpha}-\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta\alpha}\right)\right] \quad (44)$$

Hence,

$$\frac{B\left(\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta p}-\frac{\delta\Omega_H}{\delta p}\frac{\delta\Omega_L}{\delta s}\right)+u''(1-s)\left(\frac{\delta\Omega_L}{\delta p}-C\frac{\delta\Omega_H}{\delta p}\right)}{\left[\underbrace{u''(1-s)\left(C\frac{\delta\Omega_H}{\delta\alpha}-\frac{\delta\Omega_L}{\delta\alpha}\right)}_{+}+B\underbrace{\left(\frac{\delta\Omega_L}{\delta s}\frac{\delta\Omega_H}{\delta\alpha}-\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta\alpha}\right)}_{+}\right]}=\frac{\delta\alpha}{\delta p} \quad (45)$$

At the optimum we know that $\frac{\delta\Omega_L}{\delta p}=C\frac{\delta\Omega_H}{\delta p}$, and we are left to evaluate $\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta p}-\frac{\delta\Omega_H}{\delta p}\frac{\delta\Omega_L}{\delta s}$,

Inserting into the expression we have:

$$\frac{\delta\Omega_H}{\delta s}\frac{\delta\Omega_L}{\delta p}-\frac{\delta\Omega_H}{\delta p}\frac{\delta\Omega_L}{\delta s} \quad (46)$$
$$=\left[(1-p)\cdot u''(c_1^{EH})+p\cdot u''(c_1^{UH})\right]\cdot(\alpha R_h+(1-\alpha)R)\cdot\left[u'(c_1^{UL})-u'(c_1^{EL})\right]-$$
$$\left[(1-p)\cdot u''(c_1^{EL})+p\cdot u''(c_1^{UL})\right]\cdot(\alpha R_l+(1-\alpha)R)\cdot\left[u'(c_1^{UH})-u'(c_1^{EH})\right]$$

We see that both parts of the expression are negative,

$u'(c_1^{UL})-u'(c_1^{EL})>u'(c_1^{UH})-u'(c_1^{EH})$, because of the concavity of the utility function, and the way the consumption states are built up. $(\alpha R_h+(1-\alpha)R)>(\alpha R_l+(1-\alpha)R)$ by definition. Further $0>(1-p)\cdot u''(c_1^{EH})+p\cdot u''(c_1^{UH})>(1-p)\cdot u''(c_1^{EL})+p\cdot u''(c_1^{UL})$.

Hence, we have shown that $\frac{\delta \alpha}{\delta p} < 0$, which is Proposition 3. The higher the risk of low income in the next period, the smaller the share of risky financial assets.

References

Adema, W., P. Fron, and M. Ladaique, "Is the European Welfare State Really More Expensive?," *OECD Social, Employment and Migration Working Papers*, 2011, (124).

Baily, M.N., "Some aspects of optimal unemployment insurance," *Journal of Public Economics*, 1978, *10* (3), 379–402.

Barceló, C. and E. Villanueva, *The response of household wealth to the risk of losing the job: evidence from differences in firing costs*, Documentos de Trabajo, 2010.

Basten, C., A. Fagereng, and K. Telle, "Liquidity Constraints and Unemployment Duration: Quasi-Experimental Evidence from Norway.," *EUI Mimeo*, 2011.

Betermier, S., T. Jansson, C.A. Parlour, and J. Walden, "Hedging Labor Income Risk," *forthcoming, Journal of Financial Economics*, 2011.

Bloemen, H.G. and E.G.F. Stancanelli, "Financial wealth, consumption smoothing and income shocks arising from job loss," *Economica*, 2005, *72* (287), 431–452.

Bodie, Z., R. C Merton, and W. F Samuelson, "Labor supply flexibility and portfolio choice in a life cycle model," *Journal of economic dynamics and control*, 1992, *16* (3-4), 427–449.

Browning, M. and T. F Crossley, "Unemployment insurance benefit levels and consumption changes," *Journal of Public Economics*, 2001, *80* (1), 1–23.

_ **and T.F. Crossley**, "Shocks, stocks, and socks: Smoothing consumption over a temporary income loss," *Journal of the European Economic Association*, 2009, *7* (6), 1169–1192.

Card, D., R. Chetty, and A. Weber, "Cash-On-Hand and Competing Models of Intertemporal Behavior: New Evidence from the Labor Market," *Quarterly Journal of Economics*, 2007, *122* (4), 1511–1560.

Carroll, C. D, "Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis," *Quarterly Journal of Economics*, 1997, *112* (1), 1–55.

_ , "A theory of the consumption function, with and without liquidity constraints," *Journal of Economic Perspectives*, 2001, *15* (3), 23–45.

Carroll, C.D., K.E. Dynan, and S.D. Krane, "Unemployment risk and precautionary wealth: Evidence from households' balance sheets," *Review of Economics and Statistics*, 2003, *85* (3), 586–604.

Chetty, R., "A general formula for the optimal level of social insurance," *Journal of Public Economics*, 2006, *90* (10-11), 1879–1901.

—, "Moral hazard versus liquidity and optimal unemployment insurance," *Journal of political Economy*, 2008, *116* (2), 173–234.

— **and A. Szeidl**, "Consumption Commitments and Risk Preferences," *The Quarterly Journal of Economics*, 2007, *122* (2), 831–877.

Crossley, T. and H. Low, "Borrowing constraints, the cost of precautionary saving and unemployment insurance," *forthcoming, International Tax and Public Finance*, 2011, pp. 1–30.

Deaton, A., "Saving and liquidity constraints," *Econometrica: Journal of the Econometric Society*, 1991, *59* (5), 1221–1248.

Eurostat, "Glossary:Statistical classification of economic activities in the European Community (NACE)," *Statistics Explained (11/3)*, 2011.

Fagereng, A., C. Gottlieb, and L. Guiso, "Asset Market Participation and Portfolio Choice over the Life-Cycle," *EUI Mimeo*, 2011.

Fuchs-Schuendeln, N. and M. Schuendeln, "Precautionary Savings and Self-Selection: Evidence from the German Reunification "Experiment"," *Technology*, 2005, *1085.*

Gruber, J., "The wealth of the unemployed," *Industrial and Labor Relations Review*, 2001, *55* (1), 79–94.

Guiso, L., T. Jappelli, and D. Terlizzese, "Income risk, borrowing constraints, and portfolio choice," *The American Economic Review*, 1996, pp. 158–172.

Halvorsen, E, "Datadokumentasjon - registerdata til anvendte mikroanalyser i 510," Statistics Norway Mimeo 2011.

Huttunen, K., J. Moen, and K. G Salvanes, "How destructive is creative destruction? Effects of job loss on job mobility, withdrawal and income," *Journal of the European Economic Association*, 2011, *9* (5).

Jacobson, L. S, R. J LaLonde, and D. G Sullivan, "Earnings losses of displaced workers," *The American Economic Review*, 1993, *83* (4), 685–709.

Jr, M. Stephens, "Job loss expectations, realizations, and household consumption behavior," *Review of Economics and Statistics*, 2004, *86* (1), 253–269.

Meyer, B. D, W. K.C Mok, and J. X Sullivan, "The Under-Reporting of Transfers in Household Surveys: Its Nature and Consequences," *NBER Working Paper*, 2009.

Rege, M., K. Telle, and M. Votruba, "The effect of plant downsizing on disability pension utilization," *Journal of the European Economic Association*, 2009, *7* (4), 754–785.

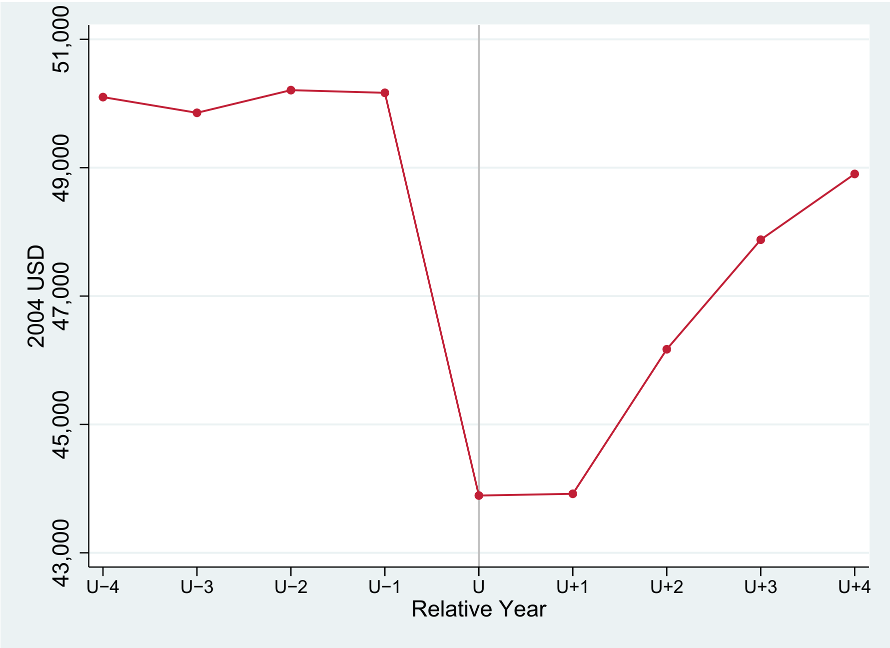
Røed, K. and O. Raaum, "Administrative registers–Unexplored reservoirs of Scientific Knowledge?," *The Economic Journal*, 2003, *113* (488), F258–F281.

Roed, K. and T. Zhang, "Does Unemployment Compensation Affect Unemployment Duration?," *The Economic Journal*, 2003, *113* (484), 190–206.

Wachter, T. Von, J. Song, and J. Manchester, "Long-Term Earnings Losses due to Job Separation During the 1982 Recession: An Analysis Using Longitudinal Administrative Data from 1974 to 2004," *Columbia University Department of Economics Discussion Paper Series*, 2009.

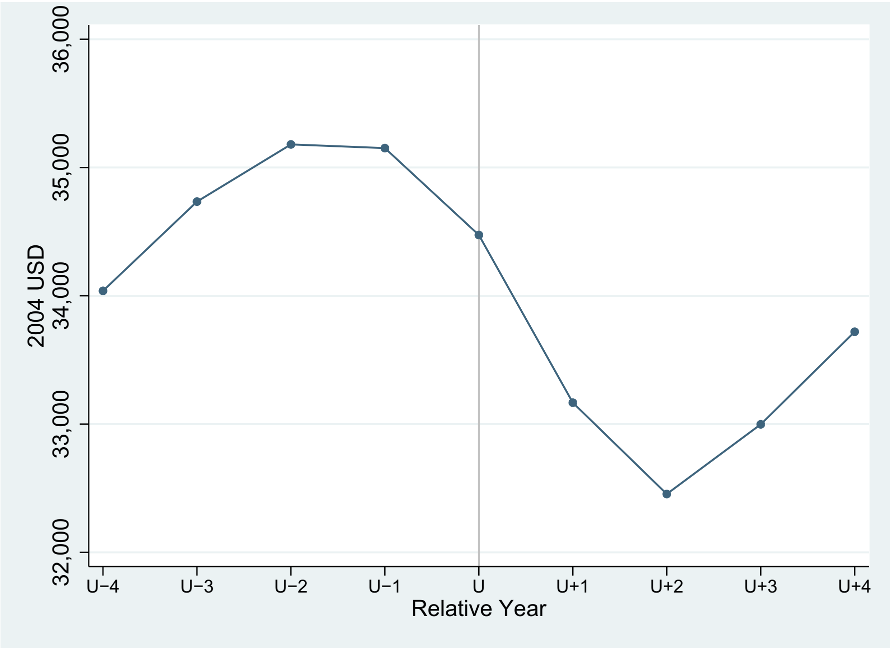
B Figures and Tables

Figure 1: **Labor Income around Unemployment**



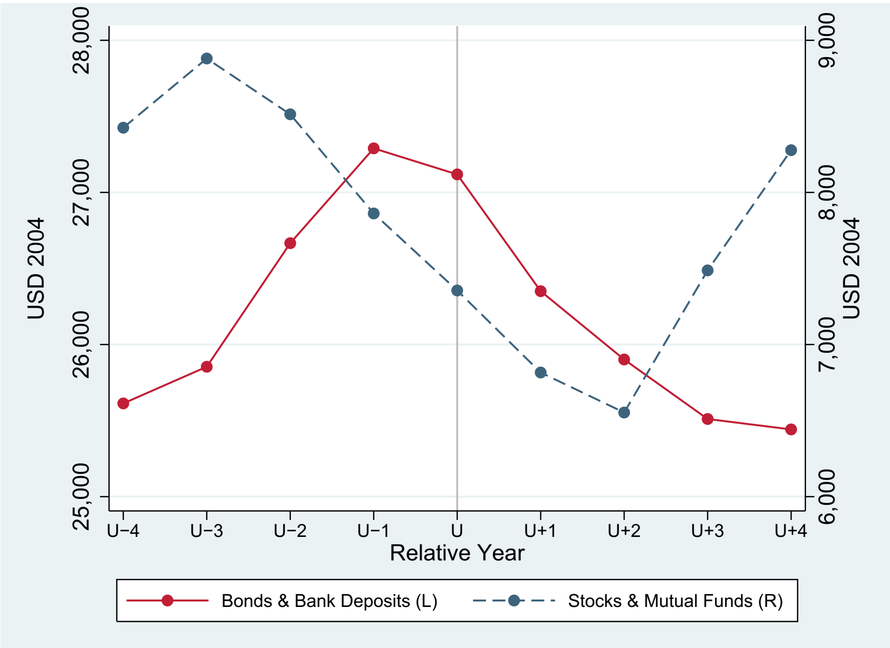
Note: The graph shows the predicted time path of household financial wealth from four years before to four years after the year of job loss, based on the estimates reported in Table III.

Figure 2: **Financial Wealth around Unemployment**



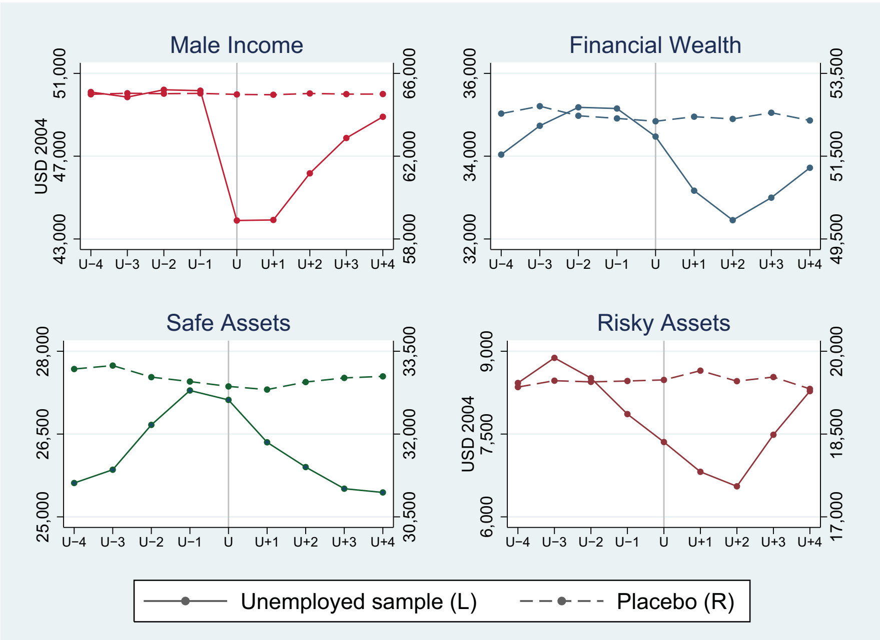
Note: The graph shows the predicted time path of household financial wealth from four years before to four years after the year of job loss, based on the estimates reported in Table III.

Figure 3: **Safe and Risky Assets around Unemployment**



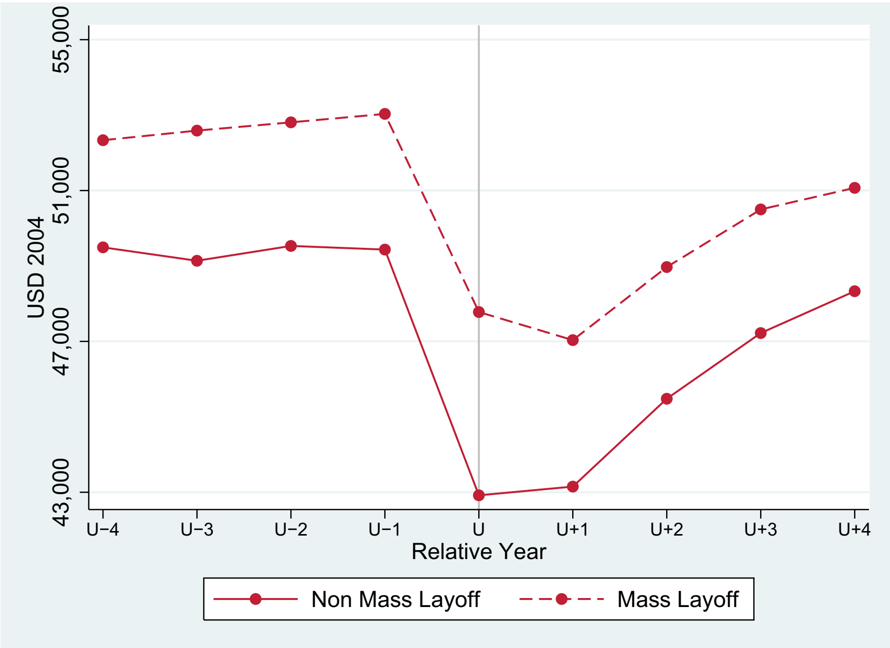
Note: The graph shows the predicted time paths of the holdings of safe assets (bonds and deposits) and risky assets (stocks and mutual funds) from four years before to four years after the year of job loss, based on the estimates reported in Table III.

Figure 4: **Unemployed vs. Placebo**



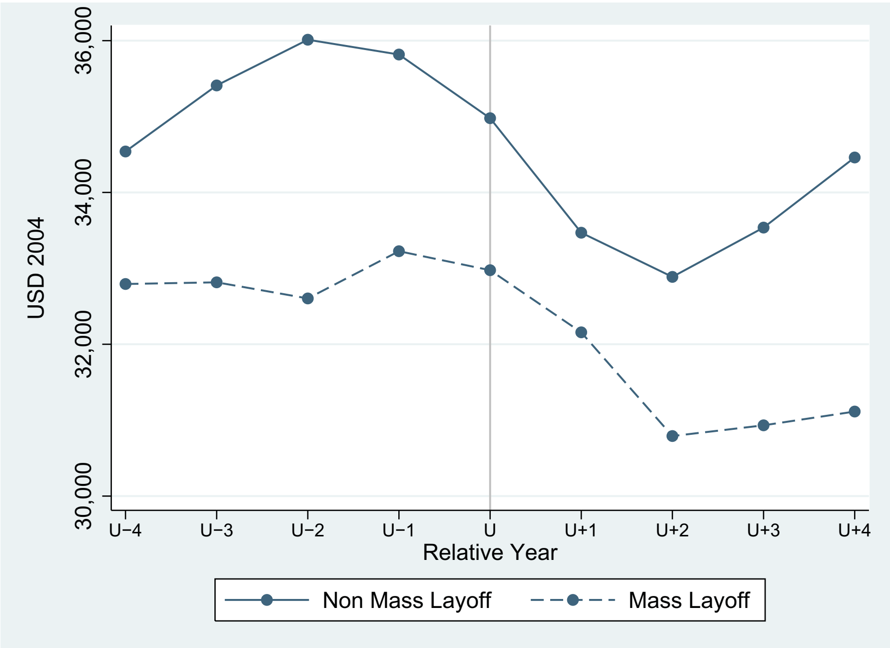
Note: The figure displays the predicted time paths of male income, household financial wealth, safe assets, and risky assets for households in the Placebo and the Unemployed subsamples in the years around job loss. Results from the four underlying regressions are reported in Table III. As those in the affected sample have on average lower income and lower wealth, we use different vertical intercepts, but the scaling is the same. The main point in this graph is that for households in the Placebo sample the time paths of all variables of interest are basically flat, confirming the validity of our fixed-effects methodology.

Figure 5: **Labor Income Paths: Mass Layoff vs. Non Mass Layoff**



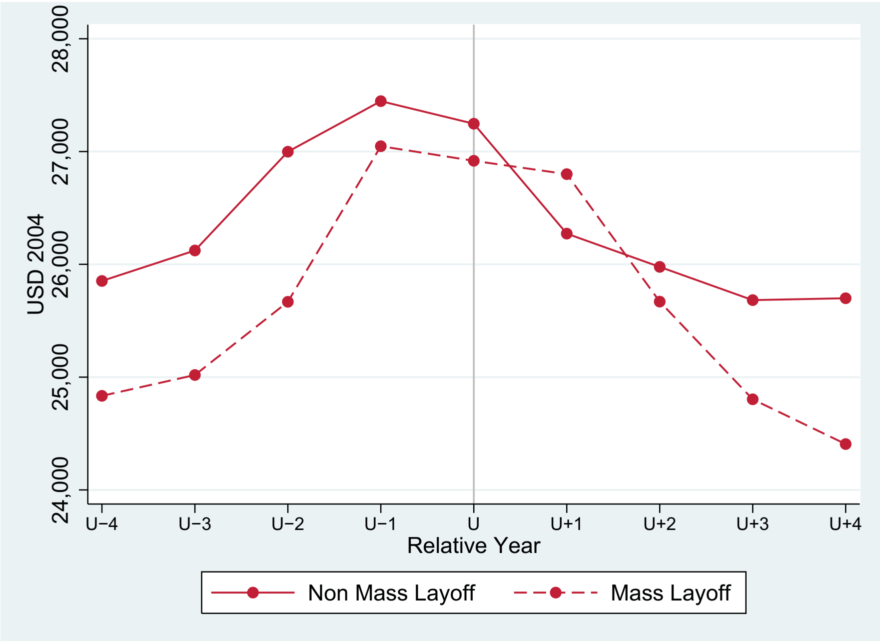
Note: The graph shows the predicted time paths of labor income of the household male from four years before to four years after the year of job loss, based on the estimates reported in Table IV – separately for those losing their jobs in the course of mass layoffs (ML) and for the other job losers (NonML).

Figure 6: **Financial Wealth Paths: Mass Layoff vs. Non Mass Layoff**



Note: The graph shows the predicted time paths of household financial wealth from four years before to four years after the year of job loss, based on the estimates reported in Table IV – separately for those losing their jobs in the course of mass layoffs (ML) and for the other job losers (NonML).

Figure 7: **Safe Asset Holdings: Mass Layoff vs. Non Mass Layoff**



Note: The graph shows the predicted time paths of the holdings of safe assets from four years before to four years after the year of job loss, based on the estimates reported in Table V – separately for those losing their jobs in the course of mass layoffs (ML) and for the other job losers (NonML).

Figure 8: **Risky Asset Holdings: Mass Layoff vs. Non Mass Layoff**

Note: The graph shows the predicted time paths of the holdings of risky assets from four years before to four years after the year of job loss, based on the estimates reported in Table V – separately for those losing their jobs in the course of mass layoffs (ML) and for the other job losers (NonML).

Table I: Summary Statistics Main Sample

	Mean	Std Dev	Median
Demographics:			
Age Husband	40.72	5.488	41
Job loss year	2001	1.464	2001
Share Low Education	0.37		
Share High School Education	0.39		
Share College Education	0.24		
Income (2004 USD):			
Male Income	55,196	28,762	53,325
Female Income	25,092	20,394	26,930
Household Income	80,288	39,070	81,928
Asset Holdings (2004 USD):			
Risky Assets	7,424	31,469	0
Safe Assets	13,820	24,103	5,556
Financial Wealth	21,245	43,638	6,858
Industry decomposition:			
Manufacturing	0.32		
Construction	0.09		
Wholesale retail	0.17		
Transport / communication	0.07		
Real estate.	0.10		
Education	0.03		

Note: Based on the Unemployed sample of 5,513 households four years prior to the year of job loss (cf. Section III.B.), all occurring in the period 1999-2003. Where applicable, values are in 2004 USD. Minor industry categories are omitted from the table. Shares of educational achievements are calculated with about 1% of sample missing an observation for this variable.

Table II: Summary Statistics for the Subsamples of Employees Displaced in Association with Mass Layoffs (ML), Displaced Not in Association with Mass Layoffs (NonML) and Never Displaced (Placebo)

	1. NonML (N=4,438)			2. ML (N=1,075)			3. Placebo (N=51,876)				
	Mean	Std Dev	Median	Mean	Std Dev	Median	Mean	Std Dev	Median	T(1-2)	T(1-3)
Demographics:											
Age Husband	40.56	5.51	41	41.37	5.33	42	44.69	5.01	45	-4.42	-48.22
Job loss year	2001	1.48	2001	2001	1.35	2002	2001	1.41	2001	-7.39	0.22
Share Low Educ.	0.37			0.35			0.35				
Share High School	0.38			0.45			0.36				
Share College Educ.	0.25			0.20			0.29				
Income (2004 USD):											
Male Income	54,206	29,911	52,657	59,285	22,995	55,192	65,390	22,816	59,499	-6,10	-24,31
Female Income	24,607	20,656	26,358	27,096	19,159	29,578	29,126	19,310	31,351	-3.76	-14.06
Household Income	78,812	40,444	80,672	86,381	32,100	86,718	94,516	30,373	91,826	-6.57	-25.26
Asset Holdings (2004 USD):											
Risky Assets	7,790	31,908	0	5,919	29,557	0	14,118	46,126	0	1.83	-12.17
Safe Assets	13,705	24,447	5,305	14,299	22,637	6,598	20,745	31,968	9,779	-0.76	-17.92
Financial Wealth	21,495	44,541	6,586	20,218	39,701	7,995	34,862	62,737	13,310	0.92	-18.49
Industry decomposition:											
Manufacturing	0.29			0.44			0.31				
Construction	0.08			0.15			0.10				
Wholesale / retail	0.19			0.12			0.16				
Transport /com.	0.08			0.07			0.05				
Real estate.	0.11			0.08			0.07				
Education	0.03			0.02			0.08				

Note: Based on the Placebo sample (51,876 households) and the Unemployed sample (5,513 households), where the latter is split into the NonML (4,438 households) and ML (1,075 households) subsamples (cf. Section III.B.). The summary statistics are calculated for the households four years prior to job loss. The two subcolumns on the right indicate the T-values for testing the difference in means between the samples. Minor industry categories are omitted from the table. Shares of educational achievements are calculated with about 1% of sample missing an observation for this variable.

Table III: Main Regression Results

	Male Inc	Fin Wealth	Safe Assets	Risky Assets
U-4	-463.3	1,426.2	682.4	743.8
	(215.9)**	(465.3)***	(306.7)**	(304.8)**
U-3	-707.8	2,122.1	923.4	1,198.8
	(288.0)**	(607.9)***	(412.2)**	(403.3)***
U-2	-354.6	2,567.8	1,735.8	831.9
	(348.1)	(707.9)***	(504.4)***	(470.3)*
U-1	-396.2	2,539.2	2,359.2	180.0
	(400.8)	(811.5)***	(592.4)***	(540.5)
U	-6,670.6	1,861.8	2,188.1	-326.3
	(434.8)***	(893.8)**	(648.3)***	(600.1)
U+1	-6,643.6	554.9	1,420.4	-865.5
	(425.5)***	(902.8)	(647.6)**	(618.2)
U+2	-4,391.9	-157.4	971.3	-1,128.7
	(395.2)***	(843.1)	(597.4)	(563.8)**
U+3	-2,684.9	385.8	580.1	-194.3
	(351.4)***	(801.4)	(567.8)	(548.1)
U+4	-1,660.5	1,107.5	511.5	596.1
	(287.5)***	(755.0)	(512.9)	(527.7)
Constant	50,562.9	32,612.0	24,930.4	7,681.6
	(416.3)***	(908.2)***	(640.6)***	(538.9)***
Observations:				
Unique Households	57,389	57,389	57,389	57,389
Household*Year	746,057	746,057	746,057	746,057

Note: The table displays the estimates for the relative-year dummies (U denotes year of job loss) of the four dependent variables from OLS regressions on our main samples (union of Unemployed and Placebo, cf. Section III.B.) of 57,389 households in total. Regressions include household and calendar-year fixed effects, as well as a fourth-order polynomial in age, but these estimates are not reported in the table. The regressions also include relative-year fixed effects interacted with a dummy indicating that the household belongs to the Placebo sample, but these estimates are not reported in the table (they are, however, plotted in Fig. 4). Values are in 2004 USD and clustered standard errors (on household) are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values from F-tests for equality between coefficients of different relative years: Male Income: p(U-1=U)=0.000, p(U=U+4)=0.000, p(U-1=U+4)=0.000. Financial Wealth: p(U-4=U-1)=0.057, p(U-1=U+2)=0.000, p(U+2=U+4)=0.029. Safe Assets: p(U-3=U-1)=0.000, p(U-1=U+2)=0.001. Risky Assets: p(U-3=U-1)=0.012, p(U-1=U+2)=0.000.

Table IV: Regression Results for Displacement and Mass Layoffs: Income and Financial Wealth

	Male Income		Financial Wealth	
	NonML	ML	NonML	ML
U-4	-609.3	659.0	2,243.0	-4,053.5
	(247.4)**	(482.8)	(541.6)***	(1,002.5)***
U-3	-965.5	1,269.6	3,113.3	-4,901.8
	(329.6)***	(646.5)**	(706.0)***	(1,366.2)***
U-2	-572.0	1,095.3	3,715.4	-5,715.9
	(397.6)	(793.8)	(806.2)***	(1,735.6)***
U-1	-668.9	1,415.8	3,520.6	-4,899.2
	(457.2)	(926.7)	(917.3)***	(2,020.5)**
U	-7,184.4	2,678.2	2,681.9	-4,310.4
	(495.6)***	(1,014.5)***	(1,005.6)***	(2,270.7)*
U+1	-6,953.7	1,703.1	1,172.8	-3,619.9
	(486.0)***	(989.3)*	(1,020.0)	(2,252.5)
U+2	-4,624.0	1,309.8	591.1	-4,404.3
	(454.0)***	(906.2)	(951.9)	(2,144.7)**
U+3	-2,882.6	1,097.2	1,240.6	-4,912.5
	(404.0)***	(813.9)	(904.5)	(2,049.1)**
U+4	-1,772.7	559.1	2,164.0	-5,654.7
	(331.4)***	(658.5)	(868.9)**	(1,770.5)***
Constant	50,102.4	2,181.8	32,296.6	2,307.7
	(468.3)***	(996.6)**	(1,007.0)***	(2,348.9)
Observations:				
Unique Households	57,389		57,389	
Household*Year	746,057		746,057	

Note: The table displays the estimates for the relative-year dummies (U denotes year of job loss) of the given dependent variables from OLS regressions on our main sample (union of Unemployed and Placebo, cf. Section III.B.), but the relative-year dummies are interacted with the dummy for household belonging to the ML subsample (in addition to the interactions of the Placebo sample dummies as in Table III). Dummies for the Placebo sample (including interactions with relative years), together with calendar-year fixed effects and a fourth-order polynomial in age are included in the regressions but not reported in the table. Values are in 2004 USD, and clustered standard errors (on household) reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values from F-tests for equality between coefficients of different relative years: Male Income NonML: p(U-1=U)=0.000, p(U=U+4)=0.000, p(U-1=U+4)=0.003. Male Income ML: p(U-1=U)=0.000, p(U=U+4)=0.000, p(U-1=U+4)=0.005. Financial Wealth NonML: p(U-4=U-1)=0.048, p(U-1=U+2)=0.000, p(U+2=U+4)=0.018. Financial Wealth ML: p(U-4=U-1)=0.752, p(U-1=U+2)=0.030, p(U+2=U+4)=0.784.

Table V: Regression Results for Displacement and Mass Layoffs: Safe And Risky Assets

	Safe Assets		Risky Assets	
	NonML	ML	NonML	ML
U-4	1,079.5	-1,985.7	1,163.4	-2,067.7
	(350.4)***	(707.9)***	(354.0)***	(678.7)***
U-3	1,349.9	-2,071.3	1,763.4	-2,830.4
	(470.5)***	(969.1)**	(472.1)***	(904.6)***
U-2	2,225.4	-2,297.8	1,490.1	-3,418.0
	(572.4)***	(1,219.4)*	(531.4)***	(1,220.6)***
U-1	2,673.8	-1,366.7	846.8	-3,532.5
	(669.1)***	(1,453.7)	(605.3)	(1,445.8)**
U	2,473.7	-1,295.9	208.1	-3,014.5
	(735.7)***	(1,569.1)	(669.8)	(1,614.1)*
U+1	1,499.4	-439.9	-326.6	-3,179.9
	(732.7)**	(1,574.7)	(698.7)	(1,595.8)**
U+2	1,204.5	-1,275.5	-613.4	-3,128.8
	(680.9)*	(1,441.0)	(637.3)	(1,489.1)**
U+3	909.8	-1,846.6	330.8	-3,065.9
	(643.2)	(1,403.0)	(627.7)	(1,392.4)**
U+4	926.5	-2,260.3	1,237.5	-3394.4
	(582.2)	(1,244.5)*	(619.7)**	(1,169.3)***
Constant	24,772.9	967.3	7,523.7	1,340.4
	(714.8)***	(1,593.0)	(579.2)***	(1,593.2)
Observations:				
Unique Households	57,389		57,389	
Household*Year	746,057		746,057	

Note: The table displays the estimates for the relative-year dummies (U denotes year of job loss) of the given dependent variables from OLS regressions on our main sample (union of Unemployed and Placebo, cf. Section III.B.), but the relative-year dummies are interacted with dummy for household belonging to the ML subsample (in addition to the Placebo sample dummy as in Table III). Dummies for the Placebo sample (including interactions with relative years), together with calendar-year fixed effects and a fourth-order polynomial in age are included in the regression but not reported in the table. Values are in 2004 USD, and clustered standard errors (on household) reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. P-values from F-tests for equality between coefficients of different relative years: Safe Assets NonML: p(U-4=U-1)=0.000, p(U-1=U+2)=0.001. Safe Assets ML: p(U-4=U-1)=0.021, p(U-1=U+2)=0.131. Risky Assets NonML: p(U-3=U-1)=0.051, p(U-1=U+2)=0.001. Risky Assets ML: p(U-3=U-1)=0.034, p(U-1=U+2)=0.157.