Anticipating Unemployment:

Savings Evidence from Denmark*

(Preliminary and Incomplete)

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August, 2013

Abstract

This paper studies the savings behavior of workers faced with costly job loss. Using Danish administrative data on income, savings, and employment from 1983 to 2010, I find cumulative earnings losses of more than $20,000 five years after a layoff. Income losses are smaller, around 13 percent of pre-layoff income, and there is no evidence of an expenditure loss. Under a number of specifications, the data reveal higher savings in the years before a mass layoff among displaced workers than those in the same firm who keep their job, consistent with worker foresight about the idiosyncratic probability of losing their job.

JEL Classification: J63, D91, E24
Keywords: Layoffs, Life Cycle Models and Saving, Unemployment

*I am grateful to Lori Beaman, David Burger, Steve Davis, Martin Eichenbaum, Trevor Gallen, Lorenz Kueng, Rasmus Lenz, Lee Lockwood, and Dale Mortensen for helpful comments and guidance. I am grateful to Søren Leth-Petersen for his detailed suggestions about imputed expenditure measures. Thank you to Henning Bunzel and LMDG, Department of Economics and Business, Aarhus University for access to the data. LMDG is a Dale T. Mortensen Visiting Niels Bohr professorship project sponsored by the Danish National Research Foundation. All mistakes are my own.

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1 Introduction

This paper studies the savings behavior of workers faced with costly job loss in the periods leading up to displacement. A lifecycle model of consumption and savings predicts consumption smoothing, so that expected future income shortfalls should be met with savings now. However, both models of unemployment and studies of the costs of job loss assume that unemployment is a sudden, unanticipated shock. If agents increase their savings before layoff events in step with increases in their idiosyncratic layoff probability, they plausibly possess information about their idiosyncratic probability of job loss. As I'll discuss below, private information about the probability of a layoff has important implications for how we model job loss over the life cycle.

This is not the first paper to study savings in response to increased layoff risk. However, many studies are limited to relying on demographic predictors of job loss risk, or to studying survey data with limited measures of consumer behavior. I use Danish micro data which include a catalog of worker-firm matches from 1995 to 2010, as well as individual income and savings histories from 1983 to 2010. These data invite an explicit test of both the income cost and consumption cost of job loss, as well as a test of whether workers save in anticipation of being laid off.

I find evidence that savings increase in the year before layoffs among those who are actually laid off relative to those not laid off. The savings effect is small, but in line with the average disposable income cost of job loss—only about $4,800 total (undiscounted) in five years after job loss. I find earnings losses consistent with a long literature on the high earnings cost of job loss in both the US and Europe (Davis and von Wachter (2011), Couch and Placzek (2010), Hijzen et al (2010)). I find no evidence of a consumption cost of job loss. Generous Danish unemployment benefits, the opportunity for self-employment, and precautionary savings may all affect the relative costs and benefits of being laid-off. None of these factors are captured in traditional, earnings-based measures of post-layoff welfare and unsurprisingly attenuate the costs of job loss.

Increased savings among those actually laid off signal that unemployment is a partially anticipated event. This anticipation has implications for how we model life-cycle income profiles and the degree to which workers can smooth consumption before large wage shocks. Adding private information about layoff probabilities, and the ability to save (and self-insure) to measures of optimal unemployment benefits will reduce the optimal level of benefits, as discussed in Lentz

(2009). This paper focuses on a description of the data on savings behavior in the time before a mass layoff and the heterogeneity in employee choices based on realized layoff status. I provide estimates of the costs of job loss in both earnings and disposable income. I also document some heterogeneity in the cost of job loss across income quartiles. I find evidence of increasing savings in the years before a layoff among workers who are actually laid off. This is consistent with a model in which workers have private information about their layoff probability, even within a firm and conditional on income.

The remainder of this paper proceeds as follows. Section II presents the literature on the costs of job loss and savings in anticipation of layoffs. Section III describes the data and institutional background, and Section IV discusses results. Section V concludes.

2 Previous Research

Literature on the costs of job loss has focused on estimating the causal effect of a layoff on income. Since most variation in layoffs is not exogenous and plagued with selection problems, the literature has turned to studying the impact of layoffs by using only mass layoffs in which a large proportion of a firm is let go. Jacobson, LaLonde, and Sullivan (1993) pioneered this method, which compares earnings over time of workers who are laid off after a mass layoff to the earnings of workers who kept their jobs.

Davis and von Wachter (2011) use data from the Social Security Administration in order to investigate the long term effects of job loss. The authors estimate the effect of job loss using the following fixed-effects regression on earnings in years 1974-2008 for workers displaced in year y (1980-2005). The control group is workers not separating from their employers in that year or the two subsequent years. The model is estimated separately for each displacement year y.

$$e_{it}^y = \alpha_i + \gamma_t^y + \bar{e}_i^y \lambda_t^y + \beta^y X_{it} + \sum_{k=-6}^{20} \delta_k^y D_{it}^k + u_{it}^y$$

This regression gives fitted earnings $\hat{e}_{it}^y$ for individual i in calendar year t and displacement year y. X_{it} is a quadratic in age, $\bar{e}_i^y$ is the worker's average earnings in the five years before displacement, and D_{it}^k is a dummy that turns on k years after displacement for workers displaced in year y, $y+1$ and $y+2$.

The authors find that a worker displaced during a recession experiences a PDV earnings

loss of $\$112,095$ over 20 years, which is about three years of pre-displacement earnings, while a worker displaced in an expansion experiences a PDV earnings loss of $\$65,424$ over twenty years. The authors argue that selection bias is unlikely to drive their results because workers laid off from firms that have employment losses of more than 80 percent have comparable earnings losses to workers laid off from other firms. The authors also note that selection does not explain larger earnings losses for workers laid off during recessions, when a selection effect would be weaker.

Using information on earnings and employers from unemployment insurance records in Pennsylvania in the early 1980s and a comparable definition of job displacement, Jacobson, LaLonde, and Sullivan (1993) find average earnings losses of more than 50 percent. An update by von Wachter and Sullivan (2009) finds that even 10 years after the displacement, the loss persists.

The study of Pennsylvania in the early 1980s may not be the optimal displacement event for policy extrapolation, since this was a period of major industrial shifts in the Pennsylvanian labor market. Couch and Placzek (2010) examine job displacement using quarterly earnings data form unemployment insurance records in Connecticut in the early 1990s. Estimated losses are initially more than 30 percent of pre-displacement income and six years later, as much as 15 percent. Oreopoulos, Heisz, and von Wachter (2010) use Canadian administrative data to estimate the effect of entering the labor market in years of high vs. low aggregate unemployment by exploiting on regional variation over time. The authors find that earnings one year into the labor market are about 15 percent lower from a 5 percentage point increase in the initial unemployment rate. They find that this difference persists—earnings remain about 7.5 percent lower even after 10 years.

Browning and Crossley (2008) study expenditure changes using Canadian survey data. They depart from the literature by comparing consumption of workers who suffer a temporary layoff (with a known recall date) to the consumption of workers who suffered a permanent layoff. The authors find that workers with permanent layoffs experience an average consumption loss between 4 percent and 10 percent of pre-layoff consumption. The authors use propensity score matching in order to control for potentially large differences between workers who are temporarily laid off and workers who are permanently laid off. Notably, occupation, job tenure, and earnings are the only firm-level controls available to the authors.

Other studies document the health effects of job-loss. Black, Devereux and Salvanes (2012) study how job displacement in Norway affects cardiovascular health. They merge survey data

on health and health behaviors with register data on person and firm characteristics. They find that job displacement has a negative affect on health. Sullivan and von Wachter (2009) use the Pennsylvania data to study mortality. They find that even twenty years after displacement, the annual death hazard increases 10 percent to 15 percent. These numbers translate to a loss in life expectancy of $1.0 - 1.5$ years for a worker displaced at age forty.

The relatively recent availability of job loss expectations data from surveys have opened a new door for the study of worker displacement. In a notable example, Stephens (2004) documents a strong correlation between subjective job loss expectations and the realized displacement. Studying food expenditures in the Health and Retirement Survey, the author finds evidence of a large fall in food expenditures following a layoff, but little evidence of different consumption paths among households with different job loss expectations. Hurst (2008) later notes the difficulty of using food consumption as a proxy for actual consumption when studying changes in employment status, as a great deal of food purchases are incidental expenses of working. Hurst relies on evidence from the US that consumption in non-food and non-work related categories doesn't fall after retirement, and food intake remains constant (only expenditure falls) upon retirement.

Klemm (2012) utilizes the German Socio-Economic Panel to look at the link between job insecurity and savings. He finds that households reporting to be "worried" about their financial situation increase their savings rate by about 0.3 percentage points relative to households "somewhat worried" about their financial situation. This is the only gradient of the level of subjective income risk along which the authors find evidence of increased savings correlated with increased risk. Carroll et al (2003) use regression-based measure of unemployment risk, by first regressing unemployment in the CPS on a number of (non time varying) demographic and industry level controls. Using this, they generate predicted unemployment probabilities in the Survey of Consumer Finances to look for evidence of precautionary savings. They find that increased unemployment risk boosts savings of middle-income households (but not relatively low-income households). This study relies on variation in unemployment risk correlated with choice of residence as an instrument. As noted by the authors, the instrument would not be valid if households who chose to reside in relatively more volatile economic regions also had high levels of risk tolerance.

It is also possible to infer anticipation of future income shocks from current changes in con-

sumption. Nalewaik (2006) uses survey data to document a correlation between households' consumption growth and subsequent realizations of their income growth. Guvenen and Smith (2010) use similar data and find that the amount of uninsurable lifetime income risk that households face is substantially smaller than what is assumed in most macroeconomic models. These studies suggest that households have sophisticated knowledge the long run growth rate of their future income, and suggest that even major income shocks (such as layoffs) may be anticipated by workers.

I will study displacement events in Denmark, where the costs of job loss are far lower than in the United States. Nonetheless, I find evidence of higher savings by workers who are eventually laid off in the years immediately preceding a mass-layoff event. These results caution against the interpretation of differences in earnings following a displacement as causal—workers seem to be able to self-identify as relatively more or less likely to be laid off, even conditional on a number of controls.

3 Data

3.1 Institutional Background

This paper focuses on the effects of mass layoffs in Denmark between 1998 and 2008. Unlike many European countries, Denmark has a flexible labor market with low firing costs. Workers are heavily insured against resulting unemployment. Unemployment insurance is purchased voluntarily by workers, but about 90 percent of the population is covered. In particular, workers with at least 52 weeks of work within the last three years who have purchased unemployment insurance for the past year are able to receive benefits. Unemployment benefits are up to 90 percent of the member's previous work income, limited to no more than (approximately) $700 per week (OECD, 2009). The structure of unemployment benefits has changed over my sample period. In the beginning of the period, workers could claim unemployment benefits for five years. This fell to four years and recently fell again to two years.

Mass layoffs in Denmark are governed by the Collective Dismissals Act. Firms with more than 100 employees who layoff more than 50 percent of their staff are required to give eight weeks notice to workers who will be dismissed. For mass layoffs of fewer than 50 percent of workers, thirty days notice are required (Hasselbalch, 2010). These institutional details are important

considerations when investigating the costs of job loss both because they imply that most workers are well protected from large drops in disposable income when they become unemployed, and also because workers in sufficiently large firms will have a reasonable chance to search for work before losing their earnings due to a mass layoff. I nonetheless find evidence of costly job loss to which workers respond pre-layoff.

3.2 Description of the data

To study the cost of job loss, I will be using Danish firm-employee matched data from 1995 to 2010, as well as data on the income and savings histories of Danes from 1983 to 2010. This is commonly referred to as the Integrated Database for Labor Market Research (IDA). The IDA is a yearly, longitudinal data set covering all persons of age 15-70 in Denmark from 1980 to the present. The data set includes information on the age, sex, nationality, education, relatives, and residence of each tax-filer. In addition, the data set contains information on the employment history of each worker and their employment status and wages. The individual-year level observations contain the unique establishment ID of workers, making it possible to track worker movements across firms. Unfortunately, the IDA does not give information on the industry of establishments and has no characteristics of corresponding firms.

The IDA data set can be merged with employer registers available from 1995 onward to create the FIDA. This firm and worker matched data describes the work history of each person living in Denmark of working age in covered industries, supplementing the IDA by providing information about industry and firm of establishments in the IDA.[1] The matching of worker and firm is based on employment status in the last week of November of each year, giving one observation per worker aged 15-70 per year that includes employee demographics (age, sex, education, etc.) and basic firm characteristics, such as ownership structure, size, and industry indicators in covered industries from 1995 to the present (Bunzel, 2008).

In addition, the data can be merged with tax registers which contain information on the house value, bank account balances, bond holdings, stock holdings, deeds, bank debt, mortgage debt, and income (including taxes and transfers) of each Dane from 1981 to 2010. Following Browning and Leth-Petersen (2003), expenditures can be reliably constructed from this income data along with data on asset holdings. Denmark had a wealth tax from 1981 to 1996, so all

[1]The covered industries *exclude* agriculture, public services, and parts of the financial sector.

tax payers were required to report variables such as cash in the bank and bond holdings at the end of each year (even households with no substantial asset income). This data is also reported voluntarily to tax authorities from 1997 onward, though it is not used for tax purposes. In principle, it is possible to construct a measure of household expenditure using data on income and changes in wealth.[2]

The sample consists of all persons employed for at least three years in a firm that experiences mass layoffs. As in Davis and von Wachter (2011), the criteria for a mass-layoff event in year y are that: the employer had 50+ employees in year $y-2$, employment contracts by 30-99 percent from year $y-2$ to year y, employment in year $y-2$ is less than 130 percent of employment in $y-3$, and employment in year $y+1$ is less than 90 percent of employment in year $y-2$. A worker in the sample is considered laid off in year y if in year $y-1$ he was working at a firm with mass-layoffs in year y, but was no longer at that firm in year y. In addition, I require that the firm have one mass layoff event in the period 1995-2010, rather than include companies shrinking by 30 percent each year for many years—previous research (for example, Davis et. al. 2012) has shown that the separations from these companies likely include a great number of quits.

This paper will discuss the savings differences pre-layoff between workers in the same firm. I find that those who are displaced save more pre-displacement, compared to their co-workers. It is reasonable to expect divergent savings behavior in these groups if there is a cost of job loss within this segment of the population. Thus, my method of calculating the cost of job loss

[2]The specific expenditure imputation suggested by Browning and Leth-Petersen (2003) and used in this paper is the accounting identity $c_t = y_t - \Delta W_t$ where c_t is the imputed level of expenditure, y_t is disposable income (including taxes and transfers) in year t, ΔW_t is the change in total wealth from the previous year. This definition abstracts from changes in the value of assets (like changes in house prices or changes in the value of stock market holdings), which would show up as a change in wealth but not necessarily impact consumption. Browning and Leth-Petersen include the value of housing in their asset calculation, but exclude the value of stock market holdings. This gives

$$\begin{aligned}\Delta W_t = \Delta\text{Home Value} + \Delta\text{Bank account} + \Delta\text{Bonds} + \Delta\text{Deeds} \\ - \Delta\text{Bank debt} - \Delta\text{Mortgage debt} - \Delta\text{Other Debt}\end{aligned}$$

Browning and Leth-Petersen (2003) compare the results of their imputation with data drawn from the Danish Family Expenditure Survey (DES) for 1994-1996. The DES is a survey which asks a sample of families to keep diaries of their total expenditure on goods and services. These survey responses can be linked with the measure of expenditure imputed from administrative data on income and wealth. The authors find that for middle ranges of the income distribution, the imputation is quite successful in capturing relative consumption levels. Browning and Leth-Petersen remove housing capital gains from their imputation by considering only non-movers and eliminating changes in housing wealth from their considerations. The decision to move, however, is a non-negligible part of a worker's response to being laid off. Both definitions of wealth (including and excluding changes in home value) are considered in this paper and the results are qualitatively unchanged whether or not this variable is included.

differs from the calculation used in the previous literature because it only considers workers who experience layoffs—laid off workers are compared only to their co-workers, not also to workers from companies with no mass layoff events[3]. In order to get a clean comparison of savings between those laid off and those not laid off, I exclude firms with repeat mass layoffs from the sample.

Table 1 provides summary statistics of the sample (taken in the year before a layoff). The average worker is over forty years old, male, and attended technical school (so has 14 years of education). Their income is 232,799 2008 DKK, which translates to approximately forty thousand dollars. Most people own homes worth on average 578,960 DKK (about one hundred thousand dollars). There are about sixteen hundred firms which had mass layoffs between 1997 and 2009. Though these firms lost 30-99 percent of their total workforce in the year of the layoff, on average this included just more than 30 percent strongly attached workers (workers who had worked at that firm for at least three years before the layoff).

Table 1: Summary statistics of persons experiencing major layoffs

	mean	median	standard deviation	observations
Age	41.60	42	12.17	156035
Male	0.62	1	0.49	156035
Yrs. Education	13.27	14	2.48	156035
Income (yr. pre-layoff)	232799.4	221043.4	205532.7	156035
Bank account (yr. pre-layoff)	68043.16	20164.34	294112	156035
House value (yr. pre-layoff)	578959.7	436434	1773297	156035
Year of layoff	2003	2003	2.70	1664
Proportion firm laid off	0.30	0.24	0.20	1664

The characteristics of the laid off differ from their more fortunate counterparts. Those who are laid off are on average younger, more often female, slightly less educated, and earning less in the year prior to the mass layoff. They also have lower savings, less money in the stock market, and own a smaller amount of housing. Table 2 below describes these differences. All values are in 2008 DKK.

[3]The costs are similar to those obtained using the control group of Davis and von Wachter (2011).

Table 2: Summary statistics by displacement status

	Laid Off	Not Laid Off
Age	39.18	42.73
	(13.57)	(11.26)
Male	0.58	0.64
	(0.49)	(0.48)
Yrs. Education	13.18	13.30
	(2.45)	(2.49)
Income (yr. pre-layoff)	212704	242243
	(195802)	(209285)
Bank account (yr. pre-layoff)	63570	70145
	(231033)	(319464)
House value (yr. pre-layoff)	479106	625890
	(1195663)	(1985883)
N	49888	106147

Note: Standard deviation in parentheses

Table 3 describes the distribution of mass layoffs by industry. Durable goods manufacturing and wholesale and retail trade have the largest number of firms with layoffs between 1997 and 2009. Together, they make up about 45 percent of the total layoffs in the data.

Table 3: Distribution of layoffs by industry

Industry Type	Frequency	Percent	Cumulative
Construction	161	13.88	13.88
Durable goods manufacturing	293	25.26	39.14
FIRE	10	0.86	40.00
Leisure and hospitality	80	6.90	46.90
Mining, quarrying, and gas extraction	2	0.17	47.07
Nondurable goods manufacturing	139	11.98	59.05
Professional and technical services	177	15.26	74.31
Transportation and utilities	75	6.47	80.78
Wholesale and retail trade	223	19.22	100.00

The next section provides results on savings behavior before layoffs. The cost of a layoff is computed using three measures: earnings, total disposable income, and expenditure. Earnings are the measure by which previous papers (Jacobson, LaLonde, and Sullivan (1993), Davis and von Wachter (2011)) have studied the cost of job loss. However, disposable income, which includes unemployment benefits, as well as taxes and transfers, may be a variable more relevant to the study of household behavior, especially in a country like Denmark with generous welfare provisions. Household utility, of course, depends on consumption. Here, expenditure—as close as the data get to a measure of consumption—is imputed using the difference between income and change in wealth using data on workers who have at least three years of tenure at a firm with mass layoffs, where mass layoffs are defined following Davis and von Wachter (2011)[4].

4 Results

4.1 The cost of job loss in Denmark

Following Jacobson, LaLonde, and Sullivan (1993), studies of the cost of job loss have relied on studying samples of workers who experience mass layoffs. These studies compare the earnings of workers who are displaced in these mass layoffs to the earnings of their more fortunate co-workers who keep their jobs, as well as a sample of the population never exposed to layoffs. The difference between the earnings of displaced workers and workers who keep there jobs is interpreted as the cost of job loss. As discussed in the previous section, the comparison of interest in this paper is the difference in earnings between displaced and non-displaced workers from firms with mass layoffs. Following Davis and von Wachter (2011), this procedure is implemented by running the regression:

$$e_{it} = \alpha_i + \gamma_t + \sum_{k=-17}^{12} \nu_k Y_{it}^k + \bar{e}_i \lambda_t + \beta X_{it} + \sum_{k=-18}^{12} \delta_k D_{it}^k + u_{it} \tag{1}$$

where e_{it} are the earnings of worker i in year t, X_{it} is a quadratic in age, $\bar{e}_i$ is the worker's average earnings in the five years before displacement, Y_{it}^k is a dummy for number of years after a mass layoff event, and D_{it}^k is a dummy that turns on k years after displacement for workers who experience layoffs[5]. The coefficients δ_k give the difference between income of workers who

[4]Excluding firms with more than one layoff event in the data, as described previously

[5]I run the regression using all of the data available, so that k runs from -18 to 12, however I only study the five year window before and after displacement to avoid small sample sizes drawn from only a year or two of data

are displaced relative to those who are not. Figure 1 below plots the coefficients δ_k and 95 percent confidence interval from this regression.

Figure 1: The earnings cost of job loss

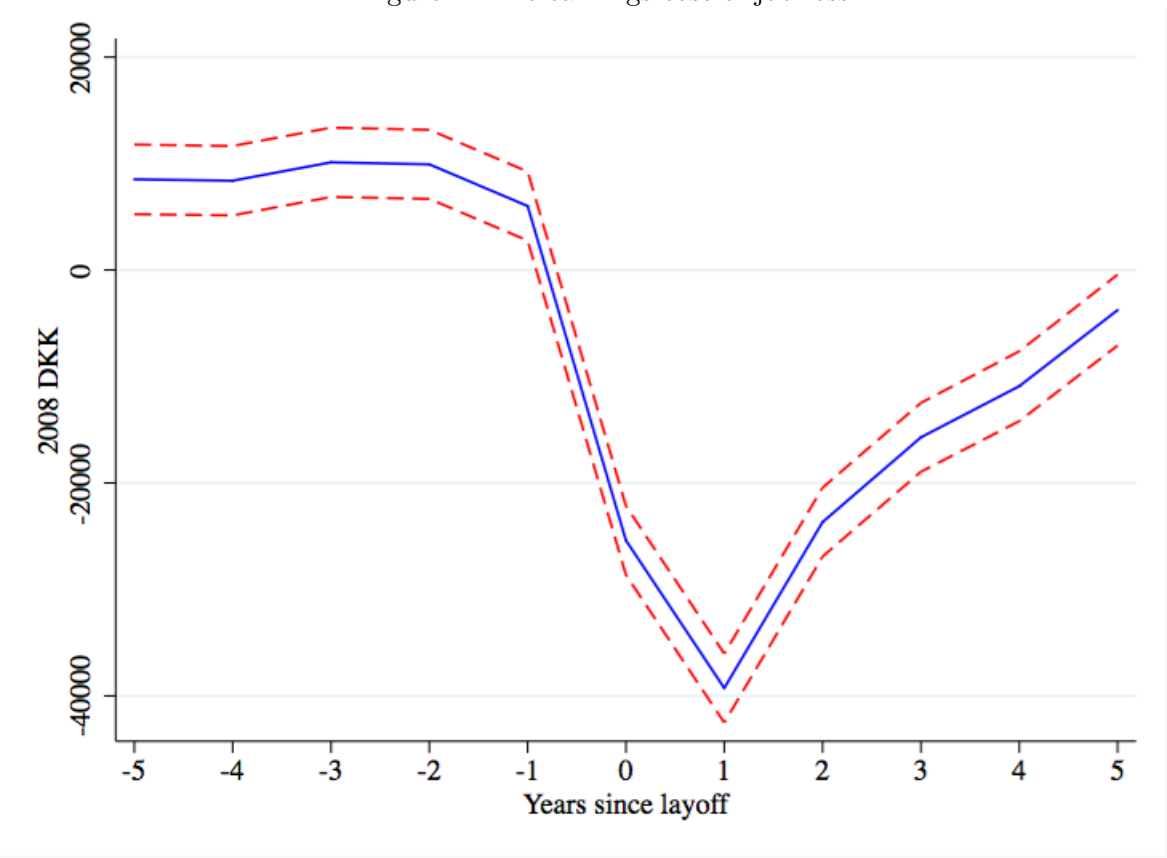

Figure 2: *

Figure 1: This figure plots the difference over time in earnings for workers who a laid off compared to co-workers who are not laid off in companies experiencing mass layoffs. The red lines give 95 percent confidence intervals for these earnings losses. The losses and standard errors are calculated from a regression of earnings on person and time fixed effects, average earnings five years before displacement, a quadratic in age, and year-post-layoff fixed effects for laid off and non-laid off workers. The difference in these year-post-layoff fixed effects are interpreted as the earnings losses of laid off workers.

In the first year after displacement, workers who are laid off have approximately 40,000 DKK lower earnings than those not laid off. This translates to an earnings cost of displacement of about $6,900. By four years after displacement, the losses fall to 10,000 DKK, or about $1,700. The gap in earnings between displaced and non-displaced workers persists through five years

after the layoff event. This suggests an initial cost of job loss (in the first year after displacement) of about 70 percent of what Davis and von Wachter report during NBER expansions in the US. However, these costs persist for decades after displacement in the US. This is not the case in Denmark. Nonetheless, the large initial cost (and relatively large cumulative cost—over $20,000) suggest that job loss is an adverse event for Danish workers[6].

Following Davis and von Wachter's method, which uses workers who never experienced mass layoffs as a part of the control group[7], I find that the earnings costs of job loss are similarly persistent and only slightly smaller. In this broad sample, earnings losses are a little more than 31,000DKK (approximately $5,300). The cumulative cost after five years is just less than $20,000. Thus, the losses when comparing co-workers within mass layoff firms are similar to those obtained when including a sample of workers who do not lose their jobs or experience mass layoffs in the control group.

Unemployment benefits in Denmark are generous, while taxes are high. For this reason, before concluding that the cost of job loss is large, it is worth studying disposable income of laid off workers. Gruber (1997) discusses the importance of unemployment benefits for consumption smoothing post-job loss in the US, finding that unemployment insurance reduces the fall in consumption following job loss to one third of what it otherwise would have been. The larger benefits in Denmark make it even more important to study the income costs of job loss, rather than focusing only on earnings. The Danish data allow calculation of disposable income (including taxes and transfers). Replacing earnings in regression (1) with disposable income, I plot the time path of the difference between disposable income of those laid off and those not laid off (δ_k)in Figure 2 below. Disposable income falls by about 10,000 DKK, which translates to about $1,700. After 5 years, the cumulative income loss is about $\$4,800$ USD.

There is some variation in income loss based on location in the income distribution (pre-layoff). Figure 3 gives the cost of job loss (in disposable income terms) for different quartiles

[6]Consistant with Stevens (1997), workers who are displaced during mass layoffs have more earnings variation and more job-status changes (including movements into and out of unemployment) than those who aren't laid off, even conditional on a number of controls. The difference in job changes increases over time.

[7]Following the method outlined in Davis and von Wachter (2011), I add to the control group a 5 percent sample of males under age fifty who work in industries with mass layoffs who have at least three years of tenure before year y and must not separate from their firm in year y, $y+1$, or $y+2$. These are compared to the universe of male workers under age 50 experiencing mass layoffs in year y, $y+1$, or $y+2$.

Figure 3: Disposable income cost of job loss

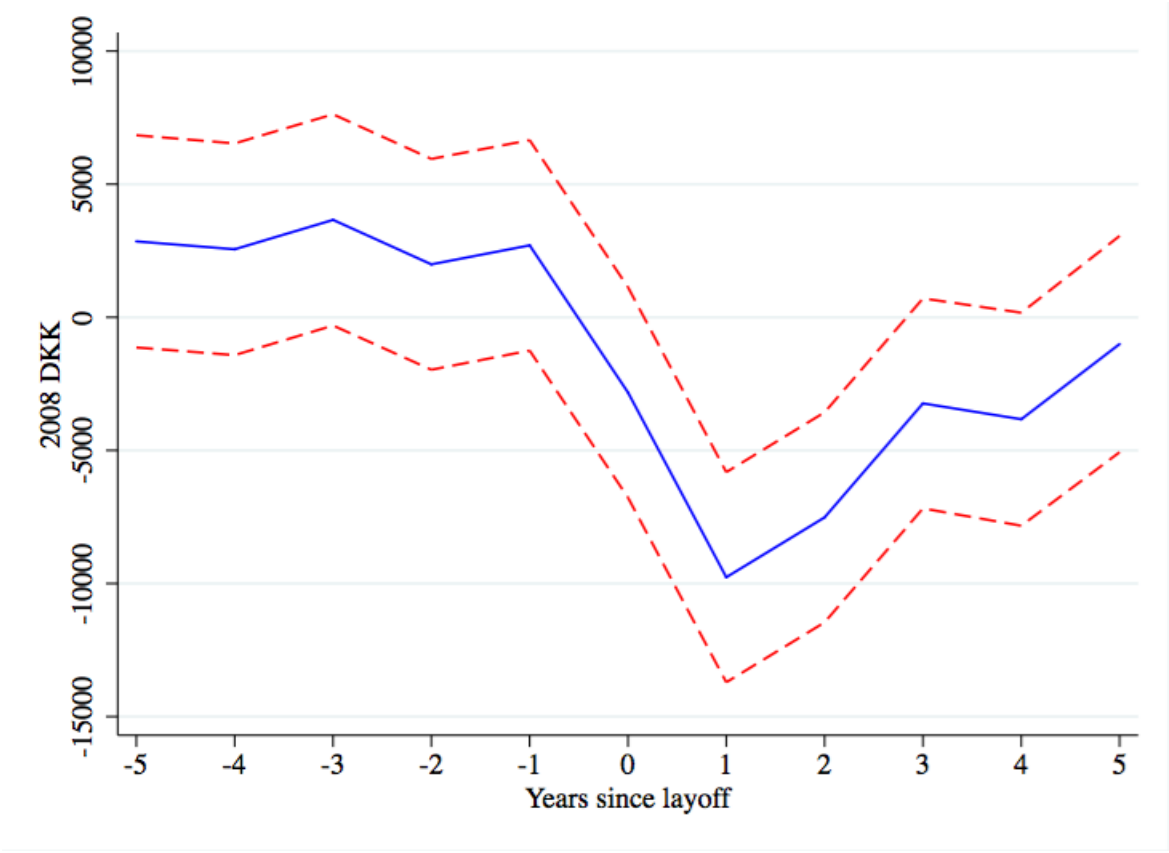

Figure 4: *

Figure 2: This figure plots the difference over time in disposable income (including taxes and transfers) for workers who a laid off compared to co-workers who are not laid off in companies experiencing mass layoffs. The red lines give 95 percent confidence intervals for these income losses. The losses and standard errors are calculated from a regression of earnings on person and time fixed effects, average earnings five years before displacement, a quadratic in age, and year-post-layoff fixed effects for laid off and non-laid off workers. The difference in these year-post-layoff fixed effects are interpreted as the income losses of laid off workers.

of the income distribution. This figure plots δ_k from regression (1) using disposable income as the outcome measure, where the regression is run separately for each quartile of the income distribution. Workers are binned into quartiles based on their real disposable income in the year before a mass layoff. The income cost of job loss is larger and more persistent for workers at the top of the income distribution. However, this is also the noisiest bin—the differences in income pre-layoff are not significant, while the differences post-layoff are significant at the five percent level, except in years 3 and 5. The cumulative income cost of job loss for the top quartile is almost $9,000 after 5 years.

Figure 5: Cost of job loss by pre-layoff income quartile

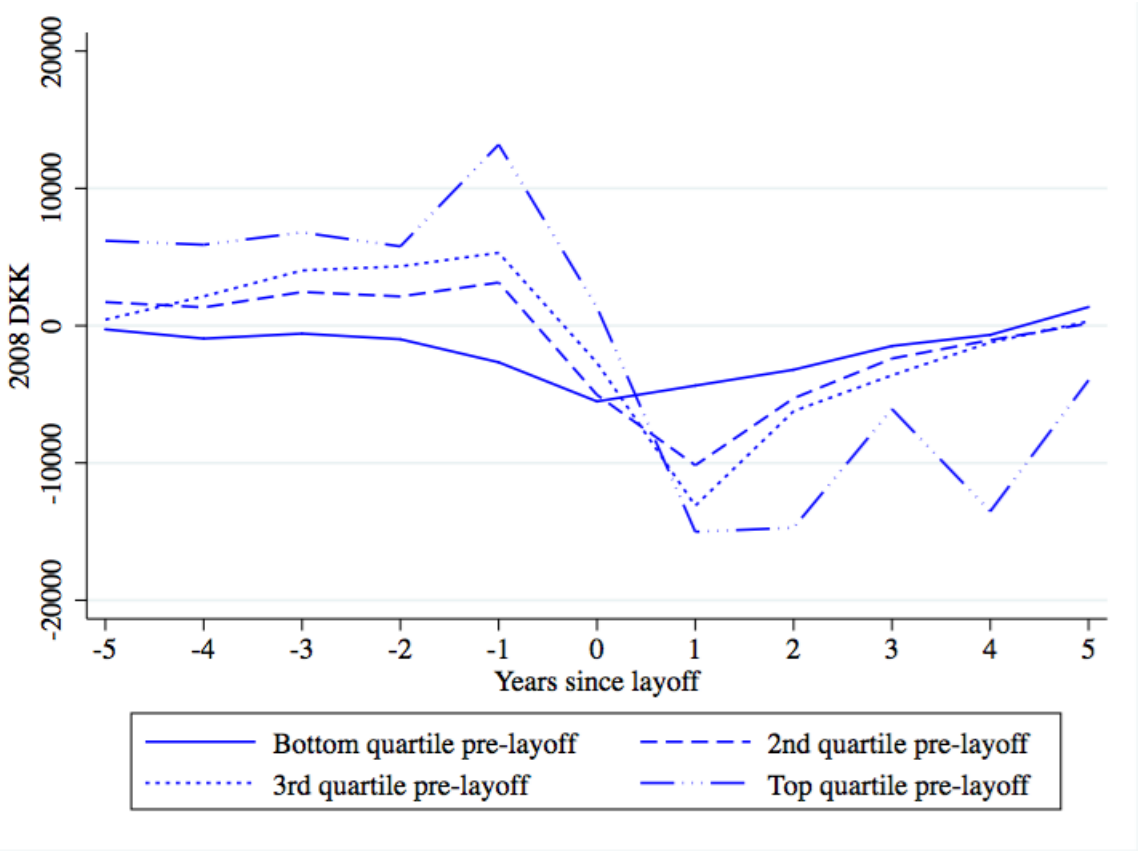

Figure 6: *

Figure 3: This figure plots the difference over time in disposable income (including taxes and transfers) for workers who a laid off compared to co-workers who are not laid off in companies experiencing mass layoffs, by their quartile of income in the year before the mass layoff event. The losses are calculated from a regression of income on person and time fixed effects, average earnings five years before displacement, a quadratic in age, and year-post-layoff fixed effects for laid off and non-laid off workers separately for each quartile of the pre-layoff income distribution. The difference in these year-post-layoff fixed effects are interpreted as the income losses of laid off workers.

Figures 1-3 suggest that the relatively high earnings cost of job loss is offset by unemployment insurance and other forms of taxes and transfers in the Danish economy. The total disposable income cost of job loss is not very large—the cumulative cost of job loss after five years is a little less than five thousand dollars (about twelve percent of median yearly income). There is heterogeneity in the costs of job loss. Workers earning the most in the year before their company experienced mass layoffs experience the largest and most persistent costs of job loss. Ideally,

policy makers are interested in not only the earnings costs of job loss, but also the income costs and in the welfare costs of job loss as measured by changes in consumption. Setting aside problems of measuring consumption when more time at home due to unemployment can translate to more household production, administrative data do not offer a direct measure of consumption. Unfortunately, using the imputation suggested by Browning and Leth-Petersen (2003)—expenditure defined as income minus the change in wealth from the previous year—does not give me enough power to detect an expenditure cost of job loss. Point estimates, however, suggest that there is no cumulative expenditure cost of job loss. Notably, this pattern (no measurable expenditure cost of job loss) persists when expanding the control group to include workers who do not experience mass layoffs, as in Davis and von Wachter (2011). The next subsection discusses workers' savings behavior in more detail.

4.2 Savings behavior before layoffs

This paper has documented non-negligible income costs of job loss in Denmark, but no detectible change in expenditure around the time of displacement. I do find evidence of increased savings among those facing future layoffs, consistent with a model in which workers have knowledge about their idiosyncratic layoff probabilities and smooth consumption accordingly. In this section, I study the savings behavior of workers *before* their company has mass layoffs. I will investigate the difference in savings between workers who are laid off and workers who keep their jobs as measured in three different ways: the change in savings in the year before layoffs, the ratio of the stock of savings to income accumulated to date, and the ratio of savings to average lifetime income ("permanent income") over time.[8] Table 6 below displays summary statistics for the relevant variables, where savings are measured as

$$\text{Savings} = \text{Money in bank} + \text{Bonds} + \text{Deeds}$$

[8]Both income to date and average lifetime income are constructed from the available data, which gives disposable income from 1983-2010, so age and year fixed effects are important controls. For example, for a person laid off in 1998, I have at most fifteen years of data on their income before the layoff. For a person laid off in 2008, I have twenty five years of data on disposable income before the layoff.

Table 6: Summary of constructed variables for workers eventually laid off

	mean	median	standard deviation	observations
Savings (yr. pre-layoff)	68551	16397	233257	33807
Income to date (yr. pre-layoff)	2562092	2421964	2145763	33807
Average lifetime income	184095	171094	108621	33807

Note: Summary statistics are for laid off workers included in the regressions below

Table 7 displays the results of a regression of savings as a fraction of income to date on an indicator of whether a worker experienced a mass layoff (was working in a firm which had a mass layoff the following year) and an indicator of whether the worker was laid off in the following year, as well as industry and time fixed effects and income to date. Compared to a 5 percent sample of workers from *industries* which have mass layoffs (industries in Table 3), workers from firms experiencing mass layoffs have three percentage points lower savings as a fraction of total disposable income earned to date. Among workers who mass layoffs, the average level of savings as a fraction of income to date is about five percent, so the difference in savings is non-negligible. Compared to their co-workers, workers who are eventually laid off have two percentage points higher savings as a fraction of income to date. This difference, which persists and becomes significant when demographic controls are included in the regression, will be the focus of the remainder of the paper.

Table 7: Savings/Income to date

Experience mass layoff	-0.034*
	(0.0183)
Laid off	0.022
	(0.0151)
R^2	0.002
N	139859

Note: Additional controls include industry and time fixed effects as well as income earned to date.

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

In Table 7, the only controls are industry and time fixed effects, as well as a linear income earned to date term. It seems that on average savings are lower for workers who experience

mass layoffs, but this could reflect unobservables correlated with choosing to work in a firm that may have mass layoffs, such as risk tolerance. Past studies have dealt with this problem using exogenous regional variation in layoff risk (see for example Carroll et al (2003)). I focus instead on the behavior of similar workers in the same firm in the same year, some of whom lose their job and others who do not. I find that conditional on a series of observables such as age, tenure, gender, and income, there are significant differences between the savings of workers who eventually lose their jobs in firms with mass layoffs and their more fortunate co-workers. Given the costs of job loss documented in the previous subsection, this difference in savings is consistent with a model in which workers have information about their individual probability of job loss and smooth consumption accordingly.

In Table 8 below, I display results of regressions of two measures of changes in savings in the year before a layoff. The first two columns of Table 8 (one with firm fixed effects and the other without) display the coefficients of interest from a regression of savings as a fraction of total disposable income earned to date on an indicator of whether or not a worker was laid off in the following year, as well as the controls described above.

$$\text{Savings/Income to date}_i = \alpha + \beta \text{Laid off}_i + \delta \text{Income to date}_i + \gamma X_i + \varepsilon_i \tag{2}$$

The average ratio of savings to income to date is 5 percent in the year before a layoff, so the difference of about 3 percent in the first two regressions is not negligible and reflects starkly different savings behavior. The difference is the level of savings in the year before a layoff between those who are laid off and their co-workers is large and is the result of accumulation of savings over their lifetime, not necessarily around the time of layoffs. Next, I investigate the change in savings of workers who are eventually laid off in the year before layoffs. The last two columns give the change in money in the bank in the year before a layoff for workers who are laid off vs. not, conditional on their current income, a quintic in age, and dummies for year, education, gender, industry, and tenure interacted with layoff year:

$$\Delta\text{Money in Bank}_i = \alpha + \beta \text{Laid off}_i + \delta \text{Income}_i + \gamma X_i + \varepsilon_i \tag{3}$$

Workers who are laid off save a little over 2,600 DKK more in their bank account than those who are not laid off. This translates to about $450 extra dollars. The mean change in savings

is 11,443 DKK (a little under $2,000).

Table 8: Savings in the year before a layoff

	Savings/Income to date		Change in money in bank	
Laid off	0.028*	0.034*	2526*	2122
	(0.017)	(0.018)	(1416)	(1491)
Real disposable income			0.140***	0.143***
			(0.0054)	(0.0055)
Real dips. income to date	5.82×10^{-8}	8.78×10^{-8}*		
	(4.80×10^{-8})	(4.92×10^{-8})		
R^2	0.001	0.014	0.008	0.031
N	111586	111586	111301	111301
Includes firm fixed effects	N	Y	N	Y

Note: Additional controls include a quintic in age, and dummies for year, education, gender, industry, layoff year interacted with tenure.

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

Almost all of the change in savings comes from changes in money in the bank. Focusing on this most liquid measure of savings, Table 9 describes the difference between money in the bank (as a fraction of income to date) of displaced workers relative to their non-displaced counterparts over time. Each column represents a regression like regression (2), but using data on savings x years before a layoff, for $x = 1, 2, 3, 4$, and 5.

Table 9: Money in the bank as a fraction of income to date

Years pre-layoff:	1	1	2	3	4	5
Laid off	0.019*	0.021**	0.039	0.029	-0.070	-0.056
	(0.0101)	(0.0107)	(0.0248)	(0.1717)	(0.0781)	(0.0742)
R^2	0.002	0.013	0.013	0.076	0.027	0.012
N	111586	111586	111293	110671	109285	107796
Includes firm fixed effects	N	Y	Y	Y	Y	Y

Note: Additional controls include real disposable income to date, a quintic in age, and dummies for year, education, gender, industry, layoff year interacted with tenure.

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

Comparing money in the bank as a fraction of income to date for workers who are eventually laid off and their co-workers, displaced workers save more in the year before the mass layoff event and two years before the mass layoff. After this, the estimates are very noisily estimated. There is no significant difference in savings three, four, or five years before the layoff event. The sign changes to reveal lower savings four and five years before the layoff event. However, this sign change is confounded by the fact that I require workers in my sample to have at least three years tenure before the layoff (so that many workers have different jobs more than three years before the mass layoff). In particular, many experience a job change four years before the mass layoff. In any case, evidence of differences in the savings behavior of eventually displaced workers appear two years before a mass layoff.

Next, I use a more common definition of savings: savings as a fraction of permanent income. This definition is useful when studying implications of the lifecycle consumption smoothing and precautionary savings models (see for example Carroll et al. 2003). In addition, it is less variable than income to date, making the estimates less sensitive to outliers[9]. My (not perfect) measure of permanent income is the average income of an individual between 1983 and 2010, when their income is recorded, controlling for age, gender, education, tenure, and firm-effects. The patterns revealed in the data are completely consistent with a model in which workers who are laid off have some expectation that their income will be lower in the future, so they increase their savings in the periods before a layoff.

Figure 4 below displays the average of money in the bank as a fraction of average lifetime income ("permanent income") for workers who a laid off compared to co-workers who are not laid off in companies experiencing mass layoffs. There is an increase in the savings rate for workers who are laid off in the years before a layoff, and after this their savings rate flattens.

[9]Trimming the top 1% and bottom 1% of income to date, the difference in money in the bank between the laid off and their coworkers falls by about 70% (but remains significant). Estimates in Table 10 are only more significant (at the 5% level) and unchanged in magnitude after trimming.

Figure 7: Money in the bank as a fraction of average lifetime income

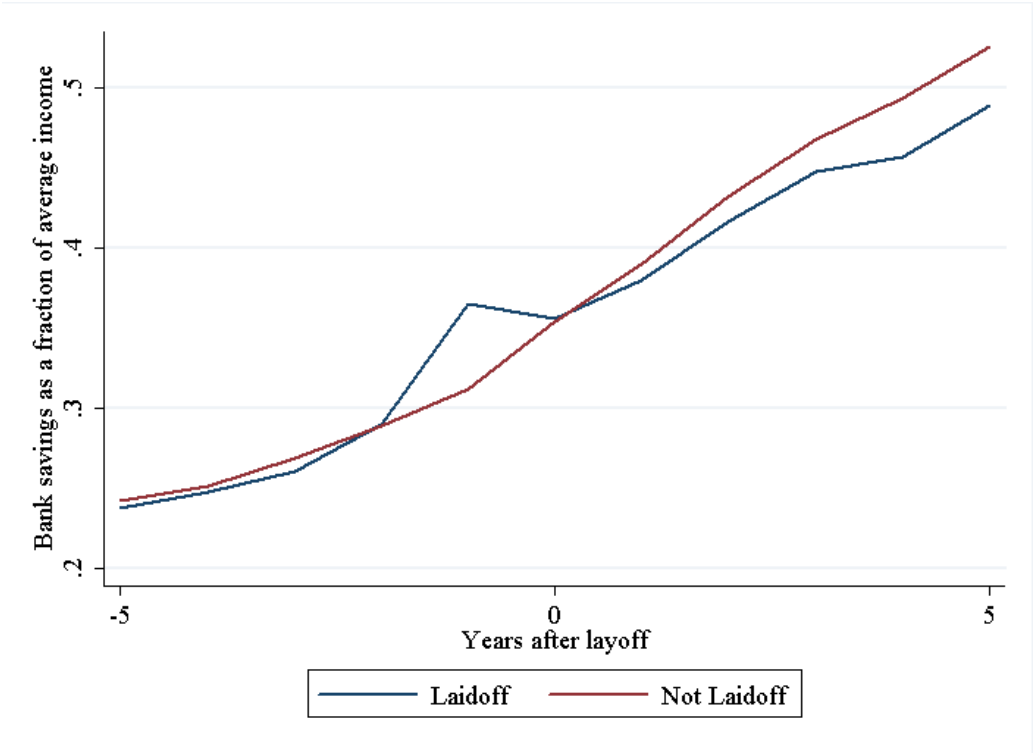

Figure 8: *

Figure 4: This figure plots average money in the bank as a fraction of average lifetime income ("permanent income") for workers who a laid off compared to co-workers who are not laid off in companies experiencing mass layoffs. The lifetime income is constructed by simply taking the average of income observed in the dataset, which has income data from 1983-2010.

To formalize this analysis, I regress bank savings as a fraction of income on a linear time trend which differs for the laid off and non-laid off, permanent income, a layoff indicator, and number of controls, including a quintic in age, and dummies for year, education, gender, tenure, and firm-level indicators:

$$\begin{aligned}\text{Money in bank/PI}_{it} = \alpha + \beta_1 \text{Laid off}_i + \beta_2 \text{Years until layoff}_{it} \\ + \beta_3 \text{Laid off} \times \text{Years until layoff}_{it} + \delta \text{Perm. Income}_i + \gamma X_{it} + \varepsilon_{it} \qquad (4)\end{aligned}$$

The average ratio of money in the bank to permanent income is about 0.33 in the year before a layoff. Table 10 reports the results of this regression, where the first column includes industry and layoff year dummies and the second column replaces these with firm fixed effects. These numbers imply an extra savings of a little more than $500 dollars in four years, or 30 percent of

post-layoff income loss in the first year.

Table 10: Money in the bank/PI pre-layoff

	(1)	(2)
Years until layoff × laid off	0.0036^{*}	0.0036^{*}
	(0.0020)	(0.0020)
Years until layoff	0.0197^{***}	0.0175^{***}
	(0.0021)	(0.0021)
Laid off	-0.0156^{**}	-0.0196^{**}
	(0.0068)	(0.0068)
Permanent Income	$1.21 \times 10^{-7***}$	$1.08 \times 10^{-7***}$
	(1.22×10^{-8})	(1.26×10^{-8})
R^2	0.014	0.023
N	550897	550897

Note: Additional controls include a quintic in age, dummies for year, education, gender, and layoff year interacted with tenure. (1) also includes industry while (2) replaces these with firm fixed effects.

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

In summary, the savings behavior of workers who experience mass layoff events is consistent with a model in which agents have private information about their idiosyncratic probability of a layoff. Those who are actually laid off save more in the years leading up to a layoff (enough to offset about 30 percent of total income losses) than co-workers who keep their job. These extra savings mostly show up in bank balances.

If this savings behavior is consistent with implications of life-cycle models of savings, then those workers who save the most in anticipation of layoffs would also have the largest costs of job loss. In Figure 5 below, I plot the difference between the cost of job loss for workers who increased their savings in the year before they were laid off and the cost of job loss for workers who did not increase their savings in the year before they were laid off. These are the coefficients

μ_k from the following regression:

$$e_{it} = \alpha_i + \gamma_t + \sum_{k=-17}^{12} \nu_k Y_{it}^k + \bar{e}_i \lambda_t + \beta X_{it} + \sum_{k=-18}^{12} (\delta_k D_{it}^k + \mu_k S_{it}^k) + u_{it} \tag{5}$$

where e_{it} is disposable income and S_{it}^k is a dummy that turns on k years after displacement for a worker who is eventually laid off and increased his savings in the year before a mass layoff.

Figure 9: Difference in cost of job loss by savings behavior pre-layoff

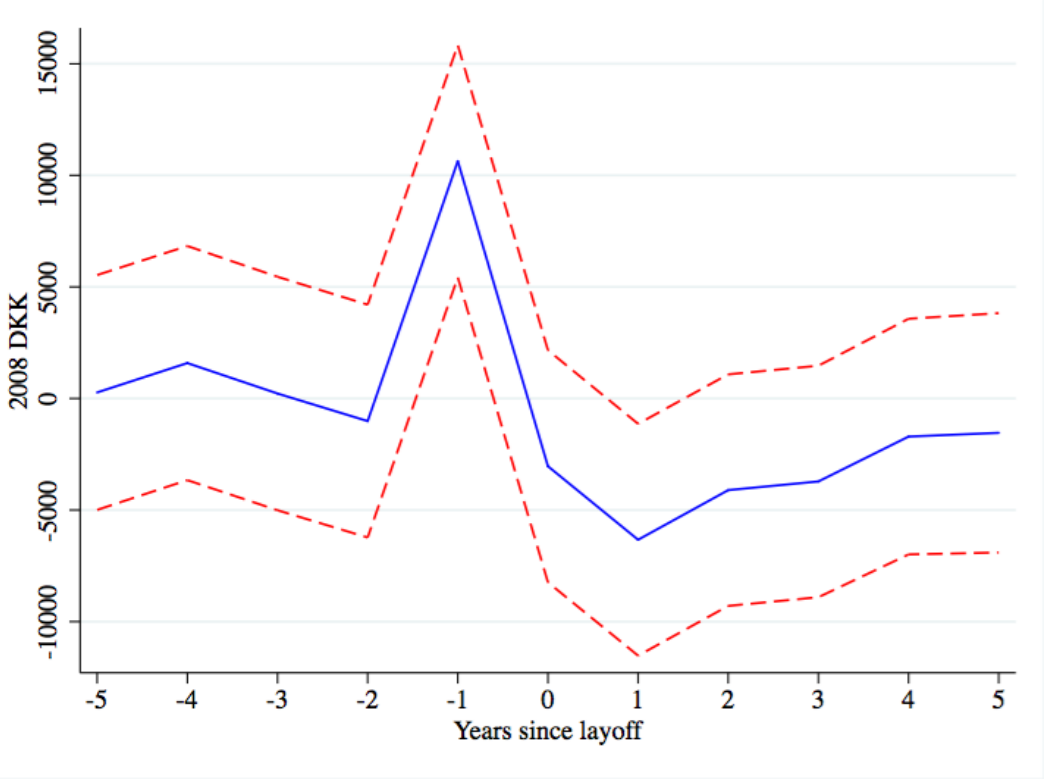

Figure 10: *

Figure 5: This figure plots the difference over time in the cost of job loss for workers who increased their savings in the year before they were laid off and those workers who did not. Essentially, this is the difference in Figure 3 for savers vs. non savers. The red lines give 95 percent confidence intervals for this difference. The difference and standard errors are calculated from a regression of income on person and time fixed effects, average earnings five years before displacement, a quadratic in age, year-post-layoff fixed effects for laid off workers who save in the year before layoffs, laid off workers who don't save in the year before layoffs, and non-laid off workers. The difference in these year-post-layoff fixed effects are interpreted as the income losses of laid off workers. The difference in income losses between savers and non savers is plotted above.

Figure 5 shows that workers who made relatively less money in the year before a layoff were less likely to save in the year before a layoff (the spike in the "cost" of job loss at $k = -1$). This is unsurprising. Interestingly, there is a persistently higher cost of job loss for workers who saved in the year before they were laid off compared to those who didn't save. This is consistent with workers optimizing in the face of private information about the probability that they are laid off and their subsequent career outcomes. Those who do not face large costs of job loss do not save as much as those who face large costs. The differences are significant at the 10 percent level two years post-layoff and the cumulative difference is different from zero with a p-value of 0.0378. The cumulative difference is different from zero at the ten percent level through four years post-displacement.

This result goes towards addressing the concern that workers who are eventually laid off change their savings behavior in anticipation of the layoff only because they are given advanced warning of the layoff. In part, the increase in savings two years before a layoff documented in Table 8 addresses this concern. In addition, the correlation between savings pre-layoff and subsequent earnings losses in Figure 5 is consistent with a model in which workers know their cost of job loss in advance and are able to partially insure themselves against this adverse event.

5 Conclusion

This paper documents the cost of job loss in earnings, disposable income, and expenditure terms using Danish tax register data. Workers who are displaced from firms during mass layoffs have earnings about $6,900 lower in the first year after displacement than their non-displaced counterparts. Disposable income losses are smaller—the cumulative loss after five years is about $4,800. Losses are largest and most persistent in the top quartile of the income distribution.

These income losses are far smaller than the earnings losses reported for the US by (for example) Couch and Placzek (2010), Jacobson, LaLonde, and Sullivan (1993), and Davis and von Wachter (2011). A great deal of the difference is likely in the generosity of unemployment benefits—at 90 percent of pre-layoff income in Denmark for low income workers. Consumption smoothing in response to a somewhat anticipated layoff event offers another explanation for difference in results. Comparing co-workers in a firm which has mass layoffs, I find that the workers eventually laid off have higher savings than their more fortunate counterparts in the years before the layoff event. This finding is consistent with a model in which workers are able

to smooth consumption in response to an anticipated income shock.

Savings behavior changes detectably two years before the layoff—well before firms would provide workers with notice of coming layoffs—and differs between those who will eventually lose their job and those who won't in a way that cannot be explained by observables such as tenure, gender, or age. Workers who will eventually be let go change their behavior to adjust to idiosyncratic layoff probabilities. In addition, those workers who save the most also have higher costs of job loss after displacement. These results provide evidence of sophisticated consumption smoothing. The magnitude of savings is small, but consistent with what would be expected given the generosity of unemployment benefits in Denmark.

The evidence that those actually laid off increase their savings more before a mass layoff suggests that workers have some private information about their layoff risk. The ability to smooth isn't evident from calculations of the earnings costs of job loss, which are large even in Denmark. Workers who eventually lose their job are able to anticipate these layoffs and respond optimally by increasing their savings. This paper has demonstrated that earnings losses are an upper bound on the true costs of job loss and the calculation of earnings losses may mask important differences governing layoff decisions unobservable to the econometrician but known to workers themselves.

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