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Job Loss and Regional Mobility

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ABSTRACT
We study the migration behavior of displaced workers and find that job displacement increases regional mobility. We find, however, that non-economic factors such as family ties are very important for the migration decision, and that there is strong heterogeneity in outcomes. We find large income losses for workers who move to regions where they have family or to rural areas, while e.g. rural to urban movers realize a significant long-term increase in earnings. We also find that life events related to fertility, divorce and new relationships correlate with mobility after job loss and may partly explain the large income losses.

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1 Introduction

A long-standing puzzle in economics is why there are persistent differences in employment and earnings across regions (Blanchard and Katz, 1992). Regional-specific shocks, such as increased international trade with China and other low cost countries may have increased regional differences further over the last two decades.[1] Economists have also speculated that regional mismatch is a reason for the increased natural unemployment rate in the US following the Great Recession.[2] Why do more workers not relocate? Another question not well understood, is why workers who have lost their jobs in plant closures or mass layoffs suffer significant and long-lasting employment and earnings losses.[3] One possible explanation for both puzzles is that workers are immobile and face restrictions in their job search. Understanding the factors that determine migration is therefore important for policy makers developing policies for regions that face adverse economic shocks.

The costs of moving may vary due to family commitments, networks and preferences regarding local amenities. While the literature on both migration and job displacement is large, we know little specifically about the migration behavior of displaced workers and how they fare in the labor market. Little is also known about how location specific amenities such as family ties affect mobility. If workers make large trade-offs between income losses and the distance to their extended family, pure earnings analyses may overestimate the negative welfare effect of economic shocks for movers. We aim to fill these gaps in the literature by analyzing the mobility behavior and earnings of workers that have lost their jobs in plant closures and mass layoffs in Norway.

We ask three primary questions. First, what is the effect of job loss on the likelihood of

[1] See Autor, Dorn, and Hanson (2013) for an analysis of the impact of trade with China on regional labor markets in the US, and Balsvik, Jensen, and Salvanes (2015) for an analysis of the impact in Norway.
[2] Kroft et al. (2016) analyze the increased long-term unemployment rate in the US following the Great Recession.
[3] See e.g. Jacobson, LaLonde and Sullivan (1993), Eliason and Storrie (2006), Schmieder, von Wachter and Bender (2009), Rege, Telle and Votruba (2009), Couch and Placzek (2010) and Huttunen, Møen and Salvanes (2011).

moving? Second, what determines the choice to move after a job loss? Third, do earnings losses after job loss differ between movers and stayers? In the first part of the paper, we address the first two questions. We measure the effect of job displacement and background characteristics on the probability of relocation between regional labor markets in Norway, and we assess specifically the effect of family networks in the region where the workers lose their jobs and in the region to which they move.[4]

In the second part of the paper, we compare displaced movers and displaced stayers with a control group of non-displaced workers using the standard fixed effects framework. Since migration is a household decision, we assess family income as well as individual income. Our aim is to understand how much moving affects labor market outcomes after job loss and whether movers tend to be positively or negatively selected on unobservables. Theory predicts that workers move for various reasons after job loss. Job loss affects the costs of moving, but the moving decision is also influenced by economic gains and preferences for location specific amenities such as living close to other family members. Observed changes in income following migration are therefore not necessarily caused by the move itself. To better understand the sources of earnings differences between movers and stayers, we explore heterogeneity across workers in terms of their opportunity costs and the characteristics of the location that they stay in or move to. Mobility decisions after job loss will also be affected by events related to health and family formation. Such events can influence labor market outcomes and may be correlated with job loss.[5] In the final part of the paper, we therefore analyze the development of fertility, disability, divorce and cohabitation for displaced movers and stayers.

[4] It is well established that family ties influence workers' mobility decisions (Mincer, 1978). Alesina et al. (2015) show that individuals who inherit stronger family ties are less mobile, have lower wages, and are less often employed.
[5] See Lindo (2010), Del Bono, Weber and Winter-Ebmer (2012) and Huttunen and Kellokumpu (2016) on fertility; Charles and Stephens (2004), Eliason (2012) on divorce; and Sullivan and von Wachter (2009), Browning and Heinesen (2012) and Black, Devereux and Salvanes (2015) on health.

Key to our analysis is a long panel of linked employer-employee data that allows us to follow individuals even when they leave the labor force. By analyzing earnings and employment patterns several years prior to job loss, we can assess selection into mobility in a transparent way. Another unique feature is that we have information on spouses, children and the location of parents and siblings, as well as on disability and fertility.

We find that job displacement increases regional mobility, but workers with parents and siblings in the region are less likely to move than others. We also find that displaced workers that move are very heterogeneous. Migrants seem to be drawn disproportionately from both the high and the low end of the skill distribution in the region they leave. Movers are also more likely than stayers to have children after job loss, become divorced or start cohabiting with a new partner. This is in line with our theoretical framework.

When analyzing the post-displacement outcomes of movers and stayers, we find that displaced workers that move have significantly lower re-employment rates than those who stay on in the pre-displacement region. Our fixed effects estimation results also indicate that displaced movers have larger earnings and family income losses than displaced stayers, and that the difference is larger for women than for men. When splitting the sample by post-displacement regional status, we find that the earnings losses associated with migration is entirely driven by workers moving to rural regions and workers moving to a region where they have family. This suggests that non-economic reasons strongly influence the moving decision and, in particular, that workers are willing to suffer earnings losses in order to stay close to their families.

Even though a large literature has examined the effect of job displacement on outcomes such as earnings, employment, health, fertility and children's schooling, no previous study has explicitly documented how job displacement affects regional mobility and how workers select into

mobility after permanent job loss.[6] We are also the first to analyze how post-displacement earnings and employment patterns differ between movers and stayers, while accounting for the pre-displacement differences between the groups.[7]

The rest of the paper is organized as follows: Section 2 describes our theoretical framework. Section 3 describes the data sets. Section 4 lays out the empirical strategy. Section 5 presents evidence on how job loss influences workers' migration decisions and what factors affect selection into migration after job loss. Section 6 presents results on how job displacement affects labor market outcomes, and how these outcomes vary between movers and stayers. Section 7 concludes.

2 Theoretical Framework

The standard human capital framework predicts that a worker or family will move if the net returns of doing so exceed the costs. The traditional migration literature views the returns as pure economic gains at the individual or family level (Sjaastad, 1962, Mincer, 1978). The costs depend on the local labor market situation, family ties and unobserved components. The standard model predicts that young workers are more likely to move due to their long amortization period and highly educated workers are more likely to move due to their potential for high economic gains. The moving propensity for families decreases with family size since returns increase less than costs.

[6] There is a large literature examining the relationship between general unemployment and migration, see e.g. Pekkala and Hannu (2002) and the review by Greenwood (1997). Being unemployed increases individuals' likelihood of moving away from the region (see e.g. DaVanzo, 1978 and Pissarides and Wadsworth, 1989) and aggregate employment tends to be positively correlated with in-migration. Saks and Wozniak (2011) show that migration in the US is procyclical. They assume that increases in aggregate wages generate procyclical migration as credit constrained workers can then finance their moves. Gregg, Machin and Manning (2004) present evidence showing that unemployed workers in Britain are unlikely to move without first having a job.

[7] Boman (2011) provides some descriptive evidence on how post-displacement earnings differ between displaced movers and displaced stayers in Sweden, but there is no attempt to document or control for selection into mobility. Like us, he finds that movers tend to earn less than non-movers in the years following the move, but that the difference fades away over time.

When comparative advantage is taken into account, predictions about who moves are not so clear. The Borjas-Roy model shows that selection is based on relative returns to skills in the local labor market migrants move from and the one they move to.[8] Labor markets with higher returns to skills will attract migrants who were relatively more highly skilled in their previous labor market, while labor markets with lower returns to skills will attract migrants that were relatively lower skilled in their previous labor market. It may then be that high skilled workers are best rewarded in the same labor market that they are displaced from.[9]

The central idea of the approaches discussed so far is that job opportunities drive mobility decisions. Other strands of the literature suggest that the decision to move is affected by location specific amenities. These amenities could be access to cultural events in urban areas, but also nature and clean air in rural areas. Moretti (2011) extends the Rosen-Roback spatial equilibrium model of Roback (1982) to heterogeneous workers in terms of tastes for amenities. His model suggests that individuals differ with respect to preferences for these local amenities, and that these differences can explain worker selection into mobility after local shocks. The presence of extended family members can be thought of as one such amenity which affects both the cost of moving and the expected gains.[10] Parents are important and may affect mobility through several channels. People in general enjoy the company of their families, parents may influence workers' employment and earnings directly through their networks, they may help bring up grandchildren or they may be

[8] See Roy (1951), Borjas (1987, 1991), Borjas, Bronars, and Trejo (1992) and Abramitzky, Boustan and Eriksson (2012).

[9] Migration may also be modelled as a dynamic job search problem (Kennan and Walker, 2011). Workers move in search of a better locational match when the income realization in the current location is unfavorable. The dynamic approach allows for both home bias and a reduced cost of moving to a previous location.

[10] As far as we know, no-one has estimated people's willingness to pay for proximity to their family. Hedonic regression studies explaining the differences in average wages across locations show, however, that households are willing to pay substantial amounts for other location specific non-tradable quality-of-life amenities such as climate and public services. See Blomquist, Berger and Hoehn (1988), Gyourko and Tracy (1991) and Chen and Rosenthal (2008). This suggests that the willingness to pay for proximity to family may also be high.

elderly and in need of care.[11] Siblings may represent a positive incentive for co-location for much the same reasons as parents, but having siblings can also make it easier to move away from elderly parents since siblings are substitute caretakers.[12]

The job loss of a worker or his spouse affects the migration propensity by exogenously decreasing the opportunity costs of moving. Job loss causes the opportunity cost to fall because there is no longer any job-specific capital to lose and no wage to forgo. Workers will then recalculate the optimal location choice and take into account both economic gains and location-specific amenities. Theory suggests that the opportunity costs of moving differ between workers, which implies that observed post-migration earnings are not necessarily causal effects of mobility. This is so even if migration is triggered by exogenous job loss. To better understand this, consider first a displaced worker that is *forced* to move in order to find suitable employment because of a high unemployment rate in the region and industry from which he or she was displaced. The subsequent change in income relative to a stayer with similar human capital is then a result of the move itself. Consider next a worker who for personal reasons has *wanted* to move to another location for some time, but who has stayed on because the opportunity costs of moving are too high. When such a worker is displaced, the opportunity cost of moving is reduced and the optimal location may change. A move is in this case motivated by location-specific amenities rather than wage gains, and the change in income relative to a stayer with similar human capital is not a causal effect of migration. Causal interpretations are further complicated by the fact that job loss to some extent correlates with non-economic factors that influence both mobility and earnings such as health and family formation decisions.

[11] See Lin and Rogerson (1995), Glaser and Tomassini (2000), Alesina et al. (2015) and Kramarz and Skans (2014).
[12] See Konrad et al. (2002) and Rainer and Siedler (2009). These papers do not assess migration as such, but analyze proximity between siblings and parents. In these models older children may act strategically and migrate away from parents in need of care.

We will use the theories discussed above as a guidance for our empirical strategy and when interpreting the results. We are interested in understanding better the motives for moving, and how the decision-making process might differ between different types of workers. When we assess heterogeneity in the opportunity costs of moving in the first part of our analysis, we take into account gender, education level, age, family structure, spouses' employment, and the location of family members. When we assess the post-displacement labor market experience of movers and stayers in the second part of our analysis, we exploit the richness of our data to better understand the decision-making process and how labor market outcomes can be interpreted. We expect labor market outcomes to differ among workers who move for different reasons, and we therefore split the sample by gender and post move location characteristics such as urban status and the existence of family members. We also explore how job loss and migration interact with fertility, marital status and disability.

3 Data and Variable Definitions

Our primary data set is linked employer-employee data that cover all Norwegian residents between the age of 16 and 74 years in 1986-2008. It combines information from various administrative registers such as the education register, the family register, the tax and earnings register and the social security register. A unique person identification code allows us to follow workers over time. Unique spouse (i.e. married or cohabiting partner) codes also exist and allow us to analyze the outcomes of spouses over time. Likewise, unique firm and plant codes allow us to identify each worker's employer and to examine whether plants are downsizing or closing down. We also have a code for the individual's municipality of residence and the corresponding local labor market region at the end of the year. This allows us to analyze mobility and to add information on local

labor markets.[13]

Employment is measured as months of full-time equivalent employment over the year.[14] *Earnings* are measured as annual taxable labor income. The included components are regular labor income, income as self-employed, and benefits received while on sick leave, being unemployed or on parental leave.[15] We also use an alternative variable, *income*, which is earnings plus annual disability pension. This is done to capture the income of workers who leave the labor force. A third measure, *family income*, is defined as the sum of income for the worker and the spouse. Income and earnings are deflated to 1998 NOK using the national consumer price index. *Regionally adjusted real income* is annual income deflated by a regional price index. This index is primarily based on house price differences across labor market regions and allow us to account for differences in living expenses. *Tenure* is measured in years, using the start date of the employment in a given plant. *Education* is measured as the normalized length of the highest attained education and are obtained from the education register. Educational attainment is split into three groups: primary, secondary and tertiary education. The number of children and the children's age are obtained from the national registration office. *Urban status* is defined as living in one of the fifth largest labor market regions in Norway. Almost half of the population in Norway live in these urban regions. We calculate local *unemployment rates* using the individual level of months of unemployment variable. The unemployment rate is the sum of all unemployment months in the region divided by the sum of all employment and unemployment months in the region.

[13] Local labor markets span more than one municipality (the lowest administrative level), but are typically smaller than counties (the medium administrative level). There are 435 municipalities and 46 local labor market regions in Norway. In the years 1991-2001 average population is 7,226 in the municipalities and 68,527 in the local labor markets. The average size of the urban locations is about 350,000 while the average size of the rural locations is 35,000

[14] We have three intervals for working hours and use these to control for part-time employment as follows: Y_{itb}= 0.1*(months of employment) if a worker is working less than 20 hours per week. Y_{itb} = 0.5*(months of employment) if a worker is working 20-29 hours per week and Y_{itb} = months of employment if a worker is working more than 30 hours per week.

[15] Note that social assistance and student grants are not included.

In order to examine the importance of family ties for mobility, we define variables describing the location of parents and siblings. An indicator variable *Parents and sibling living in the labor market region* means that a worker has a parent or sibling in the same regional labor market in the year of the observation. Since it is well established that first-borns are more mobile than younger siblings (Konrad et al., 2002), we also define a variable *Younger siblings,* meaning that a worker has at least one younger sibling.

4 Sample Construction and Empirical Strategy

We include all sectors in the Norwegian economy, and study displacements taking place in the years 1991-2001. We label these years "base years". We construct separate samples for each base year by including observations of each worker five years prior to the base year and seven years after. In the analyses we pool the 11 base year samples to a panel spanning the years 1986-2008. This implies that the cross-sectional dimension in the panel is *person* x *base year*.

By tracing workers seven years after the displacement incident, we can account for unemployed workers, workers temporarily outside the labor force (for instance in education or on parental leave) and individuals who transfer to permanent disability pension. The latter is important because a large group of displaced workers leave the labor force permanently after job loss (Rege et al., 2009, Huttunen, Møen, and Salvanes, 2011). Our upper age restriction is chosen so that no workers included in the sample qualify for regular early pension schemes.

In line with earlier studies, displaced workers are understood to be individuals who involuntarily separate from their jobs due to exogenous shocks. We consider a worker displaced from his or her job in base year *b* if the worker is registered with a new or no plant code in year *b+1* and the plant in year *b* satisfies one of the following three criteria: (i) The plant has closed

down between years *b* and *b+1*. (ii) The plant has reduced its number of employees with at least 30 % between years *b* and *b+1* and had at least 20 workers in year *b*. (iii) The plant closes down the following year, i.e. between years *b+1* and *b+2*. The matches between workers and plants are based on administrative information from the end of May in the years 1991-1994 and the end of November in the years 1995-2001. This implies that the actual displacement can have taken place either in year *b* or in year *b+1*, but most likely in *b+1* when the match is done in November. Displaced workers are our treatment group. We use as control group all workers that were not displaced between years *b* and *b+1*. Importantly, we allow workers in the control group to separate for other reasons than displacement, such as voluntary job changes and sickness.

To ensure that the treatment and control groups are as similar as possible, we only include high-attachment workers in the base year samples. This is operationalized as workers who are between 25 and 50 years old in the base year; who are attached to plants with at least ten workers; who have at least one year of tenure; who have lived in their current labor market region for at least one year; who have worked at least 20 hours per week in all years *b-3* to *b*; who have annual earnings above NOK 30,000 in all years *b-3* to *b*; and who have not been displaced in the years *b-3* to *b*.

We split our treatment and control group into movers and stayers. Movers are defined as workers who change their local labor market code between years *b* and *b+2*. Local labor markets span several municipalities and are defined by Statistics Norway based on commuting patterns (Bhuller, 2009).

Displacement and regional mobility

We begin by estimating the effect of displacement and background factors on regional mobility separately for males and females, using the specification

$$M_{ib+2} = \delta D_{ib} + (\delta_g D_{ib} * G_{ib}) + \beta X_{ib} + \gamma_b + \varepsilon_{ib}. \quad (1)$$

M_{ib+2} is a dummy indicating whether worker *i* lives in a different region two years after the base year, *b*. D_{ib} is a dummy indicating whether worker *i* was displaced between years *b* and *b+1*. X_{ib} is a vector of observable *pre-displacement* worker, plant and labor market characteristics, measured in the base year, if nothing else is stated. We include age, age square, education (split into three categories), tenure, marital/cohabitation status, number of children, a dummy for children under age seven (preschool age), earnings in years *b-3*, *b-4* and *b-5*, months of employment in years *b-4* and *b-5*, a dummy for being in education in years *b-4* and *b-5*, years of residence in the pre-displacement region, plant size, region size, regional unemployment rate, a dummy for having a spouse, a dummy for having a spouse who is employed, a dummy for having younger siblings, a dummy indicating whether parents of the worker or the worker's spouse are living in the same pre-displacement region, a dummy indicating whether a sibling of the worker or the worker's spouse is living in the same pre-displacement region, and a dummy for having both parents and siblings in the pre-displacement region, base year two-digit NACE industry dummies, and base year region dummies. The specification also includes base year fixed effects, γ_b.

The displacement dummy, D_{ib} is the variable of main interest. The associated parameter δ gives the difference in regional mobility between displaced and non-displaced workers conditional on the pre-displacement controls. As the migration decision in families is determined by both spouses' employment status, we add an indicator for the other spouse's job displacement status in some specifications. To analyze heterogeneity in the moving propensity after job loss, we interact the displacement dummy with various group dummies defined by using pre-displacement variables such as education category, the earnings level in year *b-3*, pre-displacement urban status, pre-displacement family status (married or cohabiting) and a pre-displacement family tie indicator

(parent or spouse's parent living in the same pre-displacement region). These dummy variables are contained in the vector G_{ib}.

Income losses after displacement for movers and stayers

To analyze how the earnings effects of job loss are related to moving decisions, we estimate the following model separately for males and females:

$$Y_{ibt} = \sum_{j=-3}^{7} D_{ibt-j}^{mover} \delta_j^{mover} + \sum_{j=-3}^{7} D_{ibt-j}^{stayer} \delta_j^{stayer} + \beta X_{ibt} + \gamma_{bt} + \alpha_{ib} + \varepsilon_{ibt} \quad (2)$$

In equation (2), Y_{ibt} is either annual earnings, annual income (including disability pension) or family income for worker i in base year sample b at time t. X_{ibt} is a vector of observable pre-displacement characteristics from base year b and current year age and age square. The variables D_{ibt-j}^{mover} and D_{ibt-j}^{stayer} are the variables of main interest. These are dummy variables for displaced movers and stayers indicating whether a displacement occurred in year t-j, t being the observation year. The associated parameters δ_j^{mover} and δ_j^{stayer} measure the earnings or income differentials in pre- and post-displacement years $j \in [-3,\ldots,7]$ of displaced movers and displaced stayers relative to all non-displaced workers.

The specification also includes base-year specific time dummies, γ_{bt}, to ensure that we compare earnings of displaced and non-displaced workers in the same base year sample and with the same distance to the base year (-3 to 7). Finally, we also include base-year specific individual fixed effects, α_{ib}, to control for permanent differences in earnings between displaced movers and displaced stayers and non-displaced workers (in a given base year). When including worker base year fixed effects we cannot include any time invariant base year controls. We cluster standard

errors by individual *i* to allow for correlation of the error terms, ε_{ibt}, across different time periods and base years for individual *i*. We also acknowledge that earnings *growth* may differ between workers with different observational characteristics. Glaeser and Mare (2001) find e.g. that the earnings growth of highly educated workers and workers in urban areas differs from the earnings growth of less educated workers and workers in rural areas. In order to take such effects into account we let the age-earnings profiles differ between workers in urban and rural locations, and between workers in different educational categories. Specifically, we interact age and age square in the regression with base year urban status and education categories (primary, secondary and tertiary). These interaction terms are added to X_{ibt}.

At the end, we undertake a more descriptive regression analysis where we investigate whether workers who move to a region where they have parents (back home) have different labor market outcomes than those who most likely move for work-related reasons. In addition, we analyze whether moving to rural and urban areas makes a difference in terms of earnings. The reason for this descriptive exercise is that quite a few displaced workers move back to where they originally came from. There may be many reasons for this, such as cheaper housing, wanting to live closer to one's parents or to go back to where one grew up.

Family and health outcomes

In order to better understand the motives for moving, and to better interpret the outcomes, we analyze whether job loss and mobility decisions are associated with changes in the workers' decision to stay married, to form a family, and health status. We estimate the following linear probability model separately for each time period (*t*):

$$F_{ibt} = \lambda_j^{mover} D_{ibt-j}^{mover} + \lambda_j^{stayer} D_{ibt-j}^{stayer} + \beta X_{ibt} + \gamma_{bt} + \varepsilon_{ibt} \quad (3)$$

F_{ibt} is either an indicator for whether worker *i* in base year sample *b* at time *t* divorces the base year spouse, gets married or enters into cohabitation, gives birth, or receives disability pension. X_{ibt} contains current year age dummies and observable pre-displacement characteristics. As before, the variables D_{ibt-j}^{mover} and D_{ibt-j}^{stayer} are dummy variables for displaced movers and displaced stayers indicating whether a displacement occurred in year *t-j*. The associated parameters λ_j^{mover} and λ_j^{stayer} measure the outcome differentials in pre- and post-displacement years $j \in [-3,\ldots,7]$ of displaced movers and displaced stayers relative to all non-displaced workers.

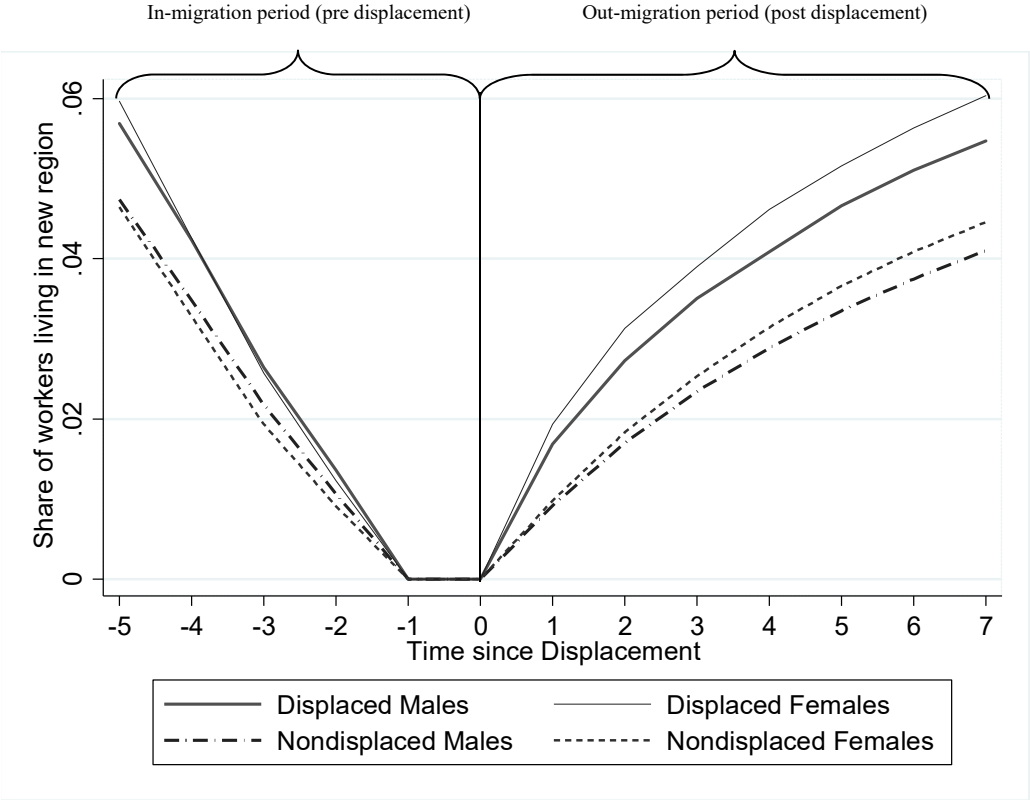
5 Job Displacement and the Mobility decision

Job loss represents a shock to income and theory suggests that this will increase the likelihood of migration by reducing the opportunity cost of moving. Figure 1 describes the share of movers among displaced and non-displaced workers up to seven years following displacement (out-migration from the base year region) and five years prior to displacement (in-migration to the base year region). As expected, we see that displaced workers of both genders have a higher probability of moving than non-displaced workers.[16] The share of displaced males that move to a new region by the second year after job loss is 2.7 %, while the share of non-displaced males that move is 1.7 %. The share of displaced females that move is 3.1 %, while the share of non-displaced females that move is 1.8 %. Hence, there is a 1-1.3 percentage point difference for displaced as compared to non-displaced workers. This indicates an unconditional increase in the probability of moving

[16] The figure also shows that mobility in Norway is high. Without restricting our data to prime age full time workers, the annual mobility rate across regional labor markets is almost 3 % and the mobility rate across municipalities is 4-5 %. These numbers are slightly lower than in the US, and in line with previous research that rank Norway and other Northern European countries on top with respect to regional mobility rates in Europe. See Molloy, Smith, and Wozniak, (2011) and Machin, Pelkonen, and Salvanes (2012).

after being displaced of about 60 %. Note, however, that this is from a relatively low level of around 2 %. From the second year onwards, the difference does not increase very much so it seems to be the first shock of displacement that drives the migration decision.

Figure 1. Share of workers living in a different region than in the base year



Moving is defined as living in a different labor market region than in the base year (year 0). Displacement happens between year 0 and year 1. The sample consists of prime age workers with high labor market attachment, cf. section 4. Staying in the same labor market both in year 0 and year -1 is part of the sample criteria.

With respect to in-migration, a first thing to notice is that the overall share of migrants is somewhat higher five years before displacement than five years after displacement. This is most likely a general age effect. As explained in the theory section, the likelihood of migration decreases with age. Another noticeable feature of figure 1 is that future displaced workers have a somewhat higher in-migration probability than future non-displaced workers. Although the pre-displacement difference is much smaller than the post displacement difference, this suggests that our effort to

sample workers that are strongly attached to the labor market is not enough to make the treatment and control groups perfectly comparable. It is a common finding in the displacement literature that displaced workers have slightly different characteristics than non-displaced workers. In table A1 in the appendix we make a more in-debt comparison of displaced and non-displaced workers in our sample. The numbers suggest that the higher in-migration rate is due to the fact that workers with short tenure are over-represented among those that become displaced. The workers in the displaced group have about one year shorter tenure on average. Along all other dimensions, the two groups are close to identical. We account for the observed difference by including several pre-displacement characteristics as control variables in our regression analyses.[17]

Regression results: The determinants of mobility

We analyze mobility using the specification given in equation (1), and report marginal probit effects in Table 1. The dependent variable is a dummy for whether the worker moves to a different labor market region within two years after job loss. Results for men are reported in panel A and results for women in panel B. Based on our theoretical framework, we expect a worker's mobility decision after job loss to depend on both education, spouses' employment situation, local economic conditions and location-specific amenities such as family ties.

From column (1) we see that displacement increases the probability of moving by 0.5-0.6 percentage points, all else equal. This is a small overall increase, but represents about a 30 % increase in the moving propensity since the mean probability of moving to a new region by year 2

[17] As a robustness exercise we have also used a formal pre-screening procedure to trim the sample. In this case, we first estimated the probability of displacement based on a rich set of pre-displacement characteristics from years *t-5* to *t*, see appendix, table A4. Next, we dropped observations with a predicted propensity for treatment below 0.05 and above 0.95 following Crump et al. (2009). With this sample procedure, the pre-displacmenet observable differences clearly diminish, as can be seen in table A3 and figure A10. Main results based on the prescreened sample are reported in figures A11 and A12. These figures are very similar to the corresponding figures 3 and 7 reported below.

Table 1. The effect of job displacement on regional mobility by pre-displacement characteristics

Panel A: Males	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Displaced	0.005**	0.005**	0.002**	0.005**	0.006**	0.006**	0.003**	0.003**
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)
Displaced*secondary edu		-0.000						
		(0.001)						
Displaced*tertiary edu		0.000						
		(0.001)						
Displaced*unemplmt rate			0.001**					
			(0.000)					
Displaced*rural				0.001*				
				(0.001)				
Displaced*spouse					-0.001*			
					(0.000)			
Displaced*family in region						-0.001**		
						(0.000)		
Displaced*spouse employed							0.000	
							(0.001)	
Spouse displaced								0.001**
								(0.000)
Observations	2317135	2317135	2317135	2317135	2317135	2317135	1522896	919262
Pseudo R2	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13

Panel B: Females	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Displaced	0.006**	0.004**	0.005**	0.005**	0.007**	0.007**	0.001	0.003**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Displaced*secondary edu		0.002						
		(0.002)						
Displaced*tertiary edu		0.001						
Displaced*unemplmt rate			0.000					
			(0.000)					
Displaced*rural				0.002*				
				(0.001)				
Displaced*spouse					-0.001			
					(0.001)			
Displaced*family in region						-0.001		
						(0.001)		
Displaced*spouse employed							0.002	
							(0.001)	
Spouse displaced								0.002**
								(0.001)
Observations	911250	911250	911250	911250	911250	911250	590943	410615
Pseudo R2	0.13	0.13	0.13	0.13	0.13	0.13	0.12	0.13

Note.─Probit marginal effects estimated based on equation (1). The dependent variable is a dummy for whether the worker moved to a different labor market region between years *b* and *b+2*. Displaced workers lost their job in a plant closure or downsizing between year *b* and year *b+1*. The sample consists of workers who were 25-50 years old and full time employed in the base year (*b*). Further details about the sampling criteria are given in section 4. In column 6 the sample is restricted to base year couples, and in column 7 to couples where both spouses were employed in the base year. A number of pre-displacement control variables are included but not reported: Age, age square, tenure, education (primary, secondary or tertiary), earnings at *b*-3, earnings at *b*-4, earnings at *b*-5, employment at *b*-4, employment at *b*-5, at school in *b*-4, at school in *b*-5, unemployment rate, location size, years in region in base year, spouse, spouse employed, children under 7, school age children, sibling in the region, parent in the region, both parent and sibling in the region, having younger siblings, plant size, plant size interacted with plant size under 20, base year fixed effects and base year specific region- and industry dummies. The latter imply that the variable "rural", which is used as an interaction effect, cannot be included on its own.

* $p<0.05$

** $p<0.01$

is 1.7-1.8 % for non-displaced workers. The coefficients on our control variables are as expected. In order to avoid a very lengthy table they are not reported, but we find e.g. that college educated workers have a much higher probability of moving than others, that high local unemployment rate increases the probability of moving and that having a spouse that is employed, having school aged children, and having parents in the region, all reduce the probability of moving (See the appendix, table A5).

In columns (2)-(7), we analyze selection on observables into mobility by including interaction terms between displacement and important observable pre-displacement characteristics. Concentrating on men, the first thing to notice is that higher education does not seem to increase the moving propensity more for displaced than for non-displaced workers. In line with theory, however, we find that high local unemployment rate increases the moving propensity for displaced workers more than for non-displaced workers. Likewise, living in a rural location increases the moving propensity after job loss. With respect to family variables, we find that displaced workers with a spouse have lower moving propensity, and that those who have family members in the region also are less likely to move after job loss. To investigate how spouses' employment matters for mobility, we restrict the sample to couples in the last two columns. In column (6) we analyze the importance of whether the spouse is employed or not, and in column (7) the importance of whether the spouse is also displaced. We find that having an employed spouse does not reduce mobility more for displaced than for non-displaced workers, but that having a spouse that is also displaced increases the moving propensity. Note from panel B that this effect is twice as large for women having their husband displaced, as for men having their wife displaced. None of the other estimated interaction terms differs much between displaced men and displaced women, but only the effect of living in a rural area is significant for women.

6 Labor market outcomes for movers and non-movers

Having established that displacement affects the propensity to move, we now investigate how those who move after displacement succeed in the labor market as compared to displaced workers who stay and non-displaced workers. We acknowledge that this analysis is descriptive as the decision to move is endogenous, but we conduct the analysis within a fixed effects framework.

As discussed in section 2, the motive for moving will differ among workers. Some workers move in order to improve their labor market outcomes while others move for non-work related reasons, i.e. typically family related reasons. The former group may consist of both positively selected workers (moving because they obtain a better wage offer in a different location) and negatively selected workers (moving because they cannot find a new job in their current location). Hence, movers may be a very heterogeneous group. They will differ both in terms of preferences, how severely they are affected, and with respect to life events that may be correlated with job loss.

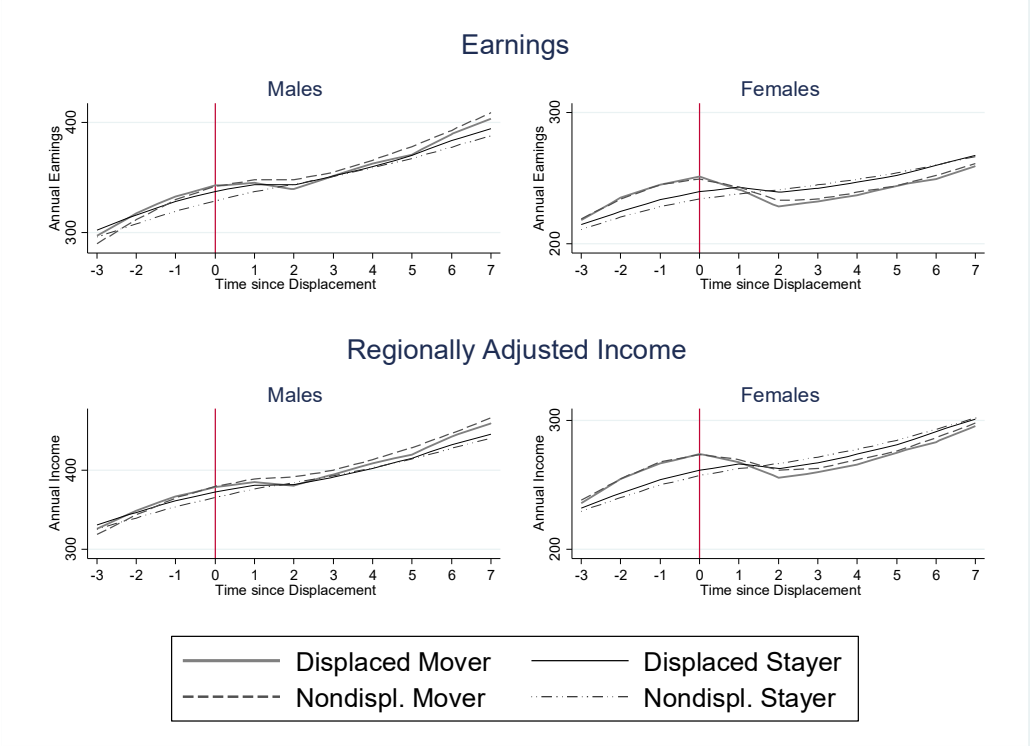
Earnings and income after job loss by moving status

In figure 2 we present mean annual earnings and regionally adjusted income by moving and displacement status. Workers are included in the sample even if they have zero annual earnings. This implies that we capture the joint effect of changes in employment and wage rates. In the regression analyses to follow, we will compare displaced movers to displaced stayers – and then compare both groups to a control group of all non-displaced workers. It is therefore of particular interest to assess whether the various groups have similar pre-displacement trends.

We see that the pre-displacement earnings differences between displaced and non-displaced workers are relatively small and that the differences are mostly level effects. Note also that the difference between movers and stayers is more evident than the difference between displaced and non-displaced workers. In both groups, movers have on average higher pre-displacement earnings

than stayers in year 0, suggesting that movers are on average positively selected on observables. Changing the outcome variable from earnings to regionally adjusted income (including disability pension) in the lower part of the figure gives very similar results, but it seems to make the loss for displaced movers slightly smaller.

Figure 2. Annual earnings and income by job displacement and moving status



The sample consists of workers who were 25-50 years old and full time employed in the base year (year 0). Further details about the sampling criteria are given in section 4. Displaced workers lost their job in a plant closure or plant downsizing between years 0 and 1. A mover is a worker who lives in a different labor market region in year 2 than in the year before the job loss (year 0). Earnings and income are measured in 1000 real 1998 NOK.

The graphs in figure 2 show that job loss opens up an earnings gap between displaced and non-displaced workers. This is in line with the previous literature. The largest earnings drop in the figure is observed for female movers, but the difference between displaced and non-displaced female movers is small. More interesting, and perhaps puzzling, is the finding that displaced movers seem to have a larger earnings drop than displaced stayers even though movers at the outset

appear to be positively selected. This underlines the fact that displaced workers move partly for non-work related reasons so that the estimated effect is a mix of causation and selection. As explained in the theory section, there may be personal latent motives for relocation so that a reduction in opportunity costs caused by job loss triggers a migration decision that is not primarily driven by earnings. We will investigate alternative explanations in more detail below, using regression and by splitting the sample. We will start by comparing OLS results to a simple person fixed effects framework in order to account for selection driven by talent.

Main regression results

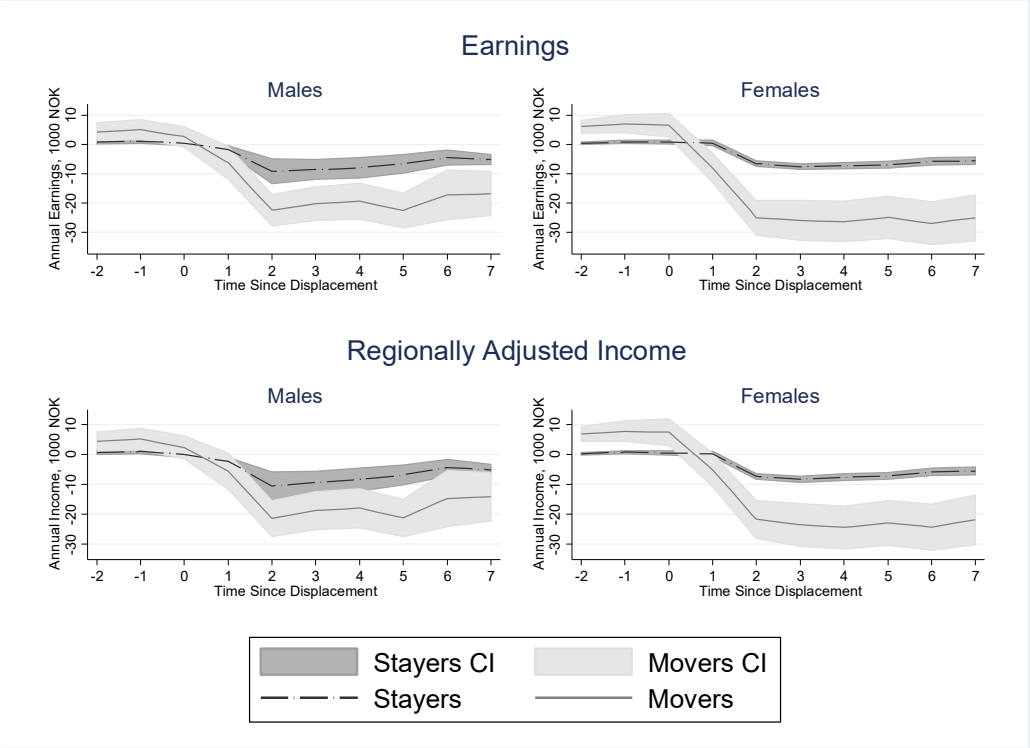
Our main earnings regression is specified is equation (2), and the estimated earnings profiles for stayers and movers are visualized in the upper panel of figure 3. What we have plotted is the FE point estimates and confidence intervals for the job displacement dummies. [18] We see long-lasting earnings reductions for movers as well as for stayers but the loss is significantly larger for movers than for stayers.[19] This suggests again, that the mobility decision is driven by other reasons than economic gains.

The average annual earnings decrease for displaced male movers in the second post displacement year is 22,400 NOK (about 4000 current US dollars).[20] This corresponds to -6.2 % when compared to their counterfactual earnings.[21] For displaced male stayers the average decrease

[18] Tabulated regression results are included in appendix, table A6. A more detailed discussion of the results can also be found in the appendix.
[19] A priori, one might expect the earnings loss to be largest in year 1, but since displacement happens between years 0 and 1, many displaced workers are non-displaced in parts of year 1. Moreover, severance pay and termination payment agreements are commonly used when firms downsize. This will typically be paid out in year 1 or year 2, and can be in the order of one month's pay per year of service.
[20] Our earnings measure is real 1998 NOK. Changing this to 2016 NOK implies multiplying by a factor of 1.45. The current exchange rate is 8.1 NOK per USD.
[21] Following Davis and von Wachter (2011) the counterfactual earnings in absence of job displacement are constructed by adding the absolute value of the estimated earnings loss to the mean earnings of the group in the period.

in the second post displacement year is 9,200 NOK (about 1650 current US dollars). This corresponds to -2.6 % of their counterfactual earnings. From figure 3 we also see that the earnings loss associated with job displacement is very long-lasting. In year 7 the estimated earnings loss is still 4.0 % for displaced movers and 1.3 % for displaced stayers.[22]

Figure 3. Earnings and regionally adjusted income for displaced workers by moving status



The figure displays FE-coefficients and confidence intervals from equation (2). The latter income measure also includes disability pension and is deflated with regional CPIs to capture differences in living expenses between regions. Earnings and income are measured in 1000 real 1998 NOK. See the subtext to table A6 in the appendix for further details about the specification.

[22] The estimated annual earnings loss after displacement is relatively small as compared to estimates for the US and other countries. Davis and von Wachter (2011) found that in recovery periods earnings losses in the US are around 23 % immediately after displacement and 10 % seven years after. In recessions, the losses are even larger. Estimates for Germany by Schmieder et al. (2009) and from Finland by Huttunen and Kellokumpu (2016) also indicate short-term losses around 20 % and long-term losses around 10 %. Both of these studies focus on job displacement during deep recessions, however. We analyze a long and quite stable period with relatively low unemployment, see the appendix, figure A3. In addition, workers in Norway have generous social insurance in the form of unemployment and welfare benefits.

For women, the difference in the earnings loss between stayers and movers is even more pronounced. In the second post displacement year, the earnings drop for displaced female movers is on average 25,300 NOK. Since average female earnings are lower than male average earnings, this corresponds to -10.0 % of counterfactual earnings. For displaced female workers who stay in the pre-displacement region the estimated loss is 6,400 NOK, corresponding to -2.6 %.

The difference between movers and stayers may partly reflect the fact that some workers move to regions with lower costs of living. In order to take this into account, we have run the same regressions using a regionally adjusted income measure as dependent variable. These results are reported in the lower panel of figure 3. Again, we find that movers have larger income losses after job displacement than stayers. The short-term magnitude is about the same as for earnings, but the difference between movers and stayers diminishes somewhat more over time.

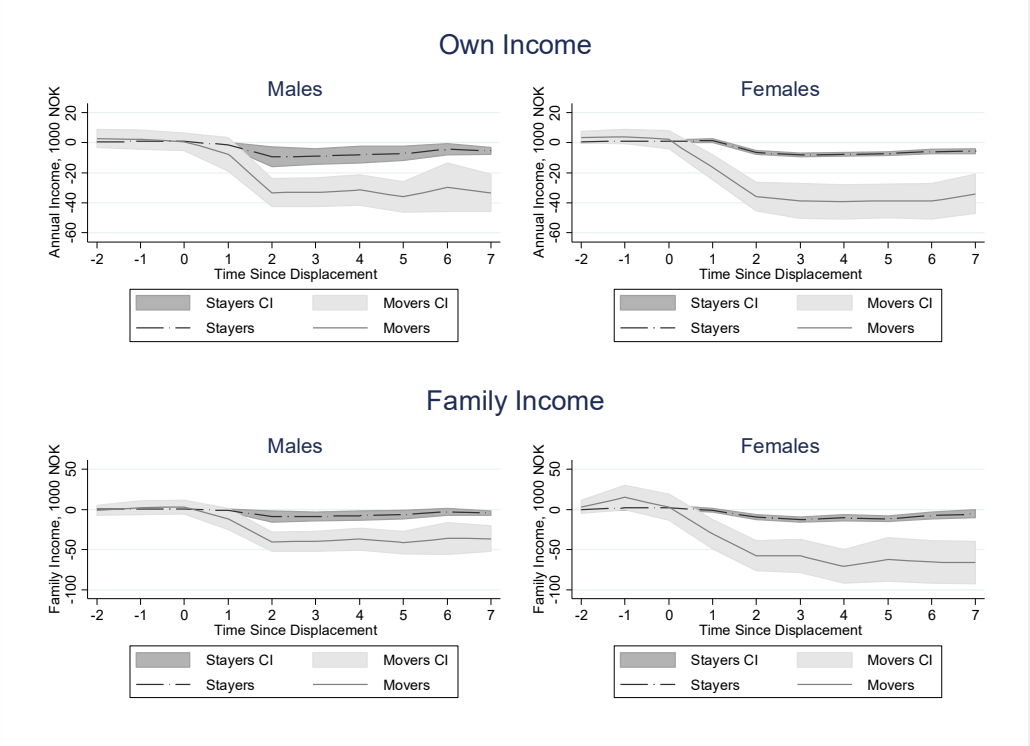
Family income after job loss by moving status

The results so far indicate that the earnings losses after job loss differ between movers and stayers, especially among females. Since Mincer (1978), it has been well established that it is the net family gain rather than the net personal gain that motivates migration. In order to take this into account, we also estimate the effect of displacement and mobility on total family income for a sample of workers that had a spouse in the base year. Total family income is the sum of a worker's own annual real income and the annual real income of the spouse. The regression results with total family income as dependent variable are presented in the lower panel of figure 4. For comparison, own income-results are presented in the upper panel.

For displaced males with a spouse in the base year, there is a reduction in own income and family income after job loss. As before, movers have larger losses than stayers in the years immediately following job loss. The family income loss in year 2 for displaced male movers that

have a spouse in the base year is 40,300 NOK (-7.0 %) and for similar displaced male stayers it is 8,900 NOK (-1.6 %). For displaced female movers that have a spouse in the base year, the drop in year 2 family income is 57,700 NOK (-9.7 %) and for similar female stayers it is 9,600 NOK (-1.7 %). The difference in family income loss between movers and stayers appears to be permanent. Hence, optimization over family income does not explain why movers experience lower post-displacement earnings than stayers.[23]

Figure 4. Own and family income for base year couples after displacement



The sample is restricted to workers that were married or had a cohabiting partner in year 0. The dependent variable is own annual taxable real income in the upper panel, and total family income in the lower panel. Family income includes disability pension for both the worker and the spouse (married or cohabiting partner). Income is measured in 1000 real 1998 NOK. The regressions include individual fixed effects. See the subtext to table A6 in the appendix for further details about the specification.

[23] As an extension to our family analyses we have also looked at the earnings effect of having a spouse that experiences job loss. The results are reported in figure A4 in the appendix. Interestingly, we find that for movers the short-term effect of having a spouse that loses his or her job is as large as the effect of own job loss, but the long-term effects are smaller. Comparing males and females, we find that the effect on own income of spousal job loss is somewhat larger for females than for males, while the effect on family income of spousal job loss is smaller for females than for males.

In order to further understand why there seems to be a negative effect of mobility on own income, even conditional on worker fixed effects, we will focus on two more issues. First, we assess worker heterogeneity in the opportunity costs of moving by splitting the sample by moving motives, such as family network amenities, and whether one is moving to an urban or rural labor market. Second, since migration can be affected by life events that may correlate with job loss, such as health, fertility and family formation decisions, we will explicitly look at how such outcomes interact with the mobility decision after job loss.

To what extent does the earnings loss depend on where you move to?

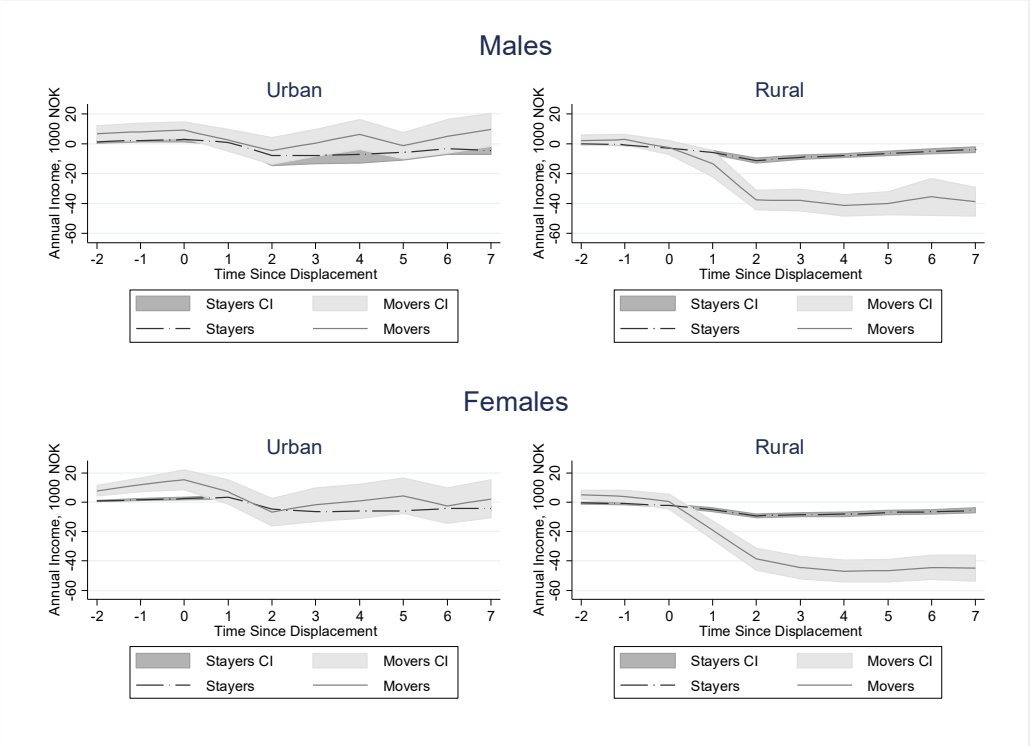
Figure 5 shows that displaced workers who move to urban regions do not suffer any significant post-displacement earnings losses at all. The earnings loss associated with job displacement for movers is entirely driven by individuals who move to rural locations.[24] Stayers, both urban and rural, also suffer income losses after displacement, but the drop is very modest.[25] We have further investigated how the post-displacement earnings losses differ depending on whether one is moving *from* an urban or *from* a rural location. Not surprisingly, these results indicate that movers from urban to rural locations suffer the biggest earnings losses (reported in the appendix, figure A6). It is also interesting to note that rural to urban displaced movers realize

[24] Urban is defined as living in one of the five largest labor market regions as described in section 3. About 60 % of the displaced stayers live in an urban region in year *b+2*, and about 50 % of the displaced movers live in an urban region in year *b+2*. We have also experimented with using only the three and seven largest labor market regions. The results remain qualitatively similar, see the appendix, figure A7 for earnings results and table A5 for probability of migration results.

[25] Using employment as dependent variable, we also find bigger employment losses for displaced workers moving to rural regions than for those moving to urban regions. With respect to employment, however, there is a difference between those who move to an urban region and those who stay in an urban region after displacement. The former group is less employed (see the appendix, figure A5)

a significant long-term increase in earnings, and that rural to rural movers do significantly worse in the short-run than rural stayers.

Figure 5. Income after job displacement by mobility and urban status

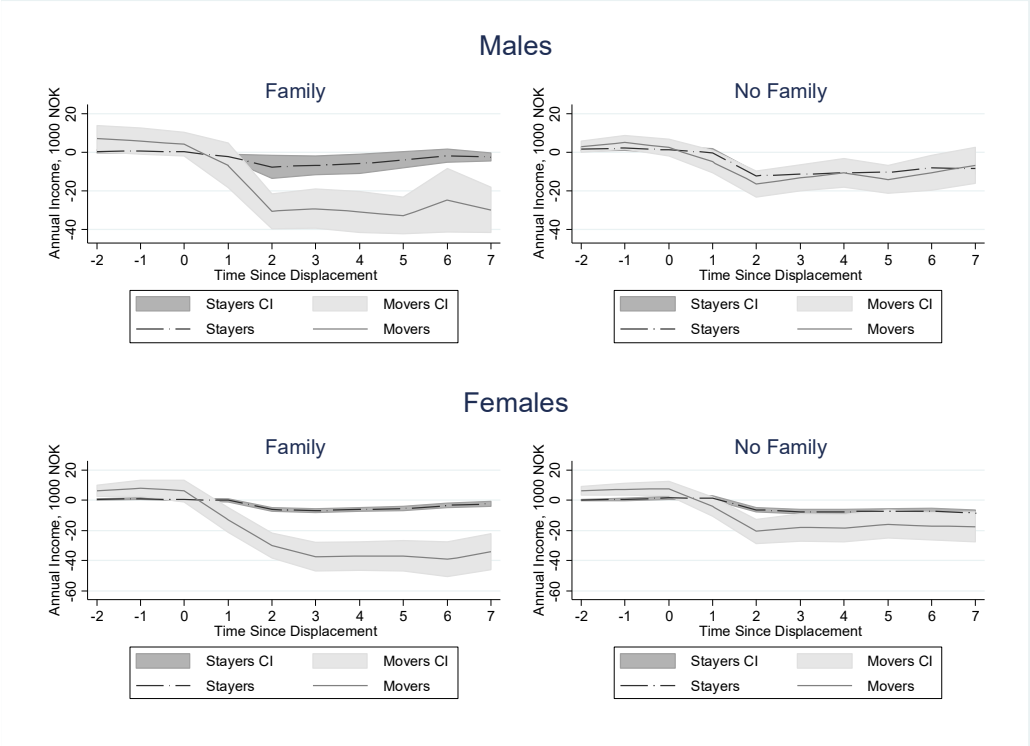


A mover is a worker who lives in a different region in year 2 after displacement than in the year before displacement (year 0). The dependent variable is real annual income measured in 1000 real 1998 NOK. Urban region means that the worker lives in one of the five largest labor market regions in Norway. The other regions are classified as rural. The regressions include individual fixed effects. See the subtext to table A6 in the appendix for further details about the regression and sample.

Figure 6 shows that workers who move to a region where they or their spouse have parents suffer bigger earnings losses than workers who move to regions where they do not have family. Interestingly, those who stay in regions where they have family seem to suffer the smallest earnings losses. This suggests that family networks play an important role in finding a new job. Otherwise, one would think that the higher opportunity cost of moving should make this group accept lower wage offers than e.g. workers who move to a region where they do not have family or workers

staying in a region where they do not have family.[26]

Figure 6. Income after job displacement by mobility and family ties in the region



A mover is a worker who lives in a different region in year 2 after displacement than in the year before displacement (year 0). The dependent variable is real annual income. Family in region means that parents of the worker or the worker's spouse live in the same region as the worker in year 2 after displacement. The regressions include individual fixed effects. See the subtext to table A6 in the appendix for further details about the regression and sample.

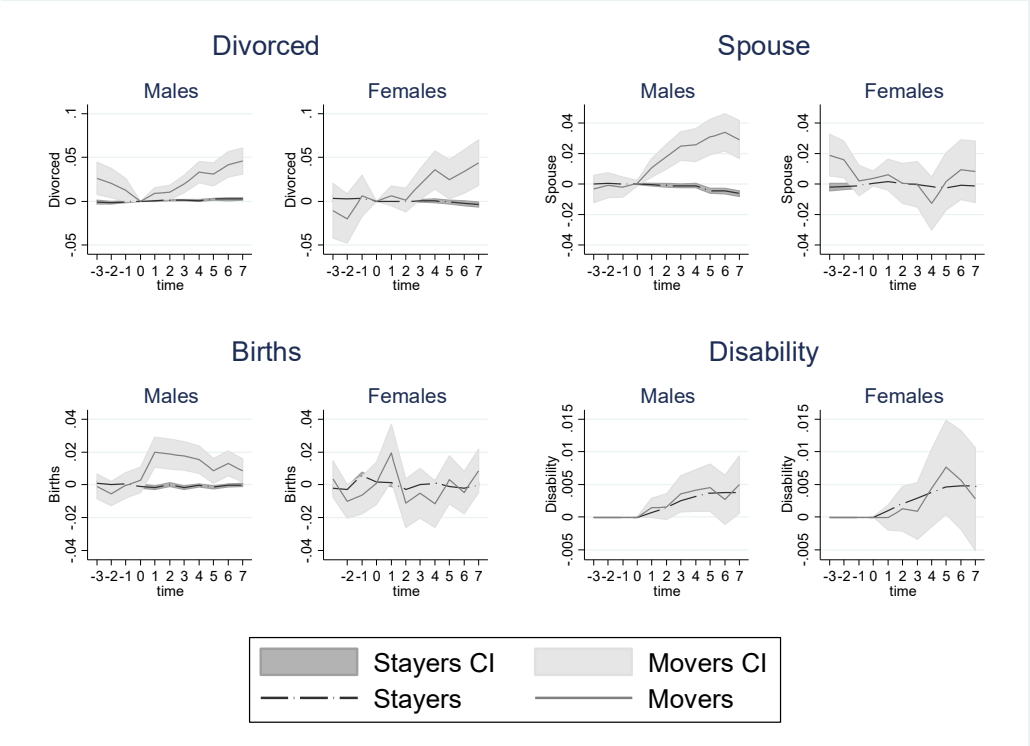
Fertility and family formation decisions around move and job loss

As discussed in section 2, several studies have documented that job loss affects health, the decision to stay married and to have children. We will now analyze how such outcomes interact with the mobility decision after job loss. Although health and personal life events may affect the decision to move, the following labor market outcomes can obviously not be seen as causal effects of

[26] Further analyses are available in the appendix. Figure A8 shows effects on employment, and in figure A9 we investigate how the earnings losses differ depending on whether the workers are moving *from* a region where they have family or *from* a region where they do not have family. We see that workers who move back to family from a region without any family members have the biggest earnings losses.

moving after job loss.

Figure 7. How job displacement relates to fertility, cohabitation, divorce, and disability



Each panel plots regression coefficients and 90 % confidence intervals obtained from separate OLS regressions for each time period. The dependent variable is an indicator for (i) divorce (ii) cohabitation with married or unmarried partner (iii) getting children and (iv) receiving disability pension. The divorce-regression is run on a sample that only includes workers who were cohabiting in the base year. The following base year control variables are included, but not reported: Age (dummies), education (three categories), tenure, marital status, having a partner (not in the divorce and cohabitation regression), school age children, children under school age, parent in the region, sibling in the region, both parent and sibling in the region, younger siblings, plant size (numerical), plant size under 20, plant size interacted with plant size under 20, in school at year *b-4*, in school at year *b-5*, real earnings in year *b-4*, real earnings in year *b-5*, employment months in year *b-4*, employment months in year *b-5*, living in the base year region in year *b-4*, year *b-3*, and year *b-2*, region-, industry- and base year dummies.

In figure 7 we show coefficients from OLS regressions that estimate the effect of being a displaced mover and a displaced stayer on the probability of four outcomes: (i) divorce (ii) cohabitation with married or unmarried partner (iii) fertility and (iv) receiving disability pension. Divorce is defined as not living together with your base year partner. In all four regressions, the comparison group is all non-displaced workers, i.e. both movers and stayers. Figure 7 shows that

being a displaced mover is associated with increased likelihood of becoming divorced. Being a displaced stayer is not associated with divorce, hence the finding for displaced movers may primarily reflect a link between divorce and migration rather than between divorce and displacement. With respect to cohabitation, we find that being a male displaced mover is associated with an increasing likelihood of cohabitation, while this is not the case for displaced female movers or displaced stayers. This pattern resembles what we found with respect to divorce, and may suggest that males are more likely to move than females when families or relationships form or break up. Next, we see that being a displaced male mover is associated with fertility, while there is no such association for displaced female movers, nor for displaced stayers. One explanation for the difference between men and women may be that male displacement represents a larger decline in the opportunity cost of moving than female displacement. Hence, for couples who are about to have children, male displacement is a more important window of opportunity for relocation. Also, we should bear in mind that in the male display we use couples where the male is full time employed in years *t-3* to *t*, and in the female display we use couples where the woman is full time employed in years *t-3* to *t*. It may well be that couples where the woman is well-attached to the labor market are different from couples where the man is well-attached to the labor market. Finally, with respect to disability, we find a strong effect for both displaced movers and displaced stayers. This result is consistent with previous analyses showing that job loss has a negative effect on health related outcomes (see footnote 5.) In sum, people use the changing conditions following job loss to make mobility and family decisions. These correlated shocks may partly explain earnings losses following a regional move.

7 Concluding remarks

It is well established that there are large and persistent differences in unemployment rates and economic activity across different locations. We also know that individuals that lose their jobs for exogenous reasons suffer long-lasting and permanent earnings losses. Much less is known about the reasons for these losses and why individuals with severe losses do not move to locations with better employment opportunities. We have analyzed the geographic mobility of workers after permanent job loss, and investigated factors that influence workers' migration decisions. We have based the analysis on a framework where workers' or families' decision to move after job loss depends on three types of factors: (i) the returns to mobility in terms of employment and earnings (ii) location-specific amenities such as family ties and (iii) personal events related to family formation and health. Our rich Norwegian register data include information on workers', spouses' and parents' characteristics including location, employment history, disability and fertility. This allows us to investigate the factors that influence mobility in great detail.

Our results show that non-economic factors strongly influence the migration decisions for workers who experience job loss. Workers are less likely to move away from regions where their parents or siblings live, and some move back home after a job loss. Mobility decisions after job loss are also related to family-forming decisions such as divorce, birth and cohabitation. We show that earnings losses after job displacement differ sharply among groups of workers that have different motives for moving. On average, displaced workers who move to a new region after job loss suffer larger income losses than displaced stayers, but the difference between displaced movers and displaced stayers is driven entirely by workers who move to rural regions and to regions where they have family.

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Appendix

Table A1 Panel A. Sample means, displaced and non-displaced workers by gender

	Males		Females	
	Displaced	Non-displaced	Displaced	Non-displaced
Age	38,3	38,4	37,8	38,4
Secondary education	0,64	0,65	0,64	0,64
Tertiary education	0,23	0,21	0,21	0,20
Tenure	6,81	7,91	6,39	7,34
Cohabiting or married	0,65	0,66	0,62	0,65
Years in region	4,86	4,89	4,86	4,89
No. of school age children	0,45	0,45	0,34	0,36
No. of children under 7	0,20	0,20	0,17	0,16
Parent in region	0,68	0,69	0,60	0,60
Sibling in region	0,75	0,75	0,69	0,69
Parent and sibling in region	0,61	0,62	0,54	0,54
Younger siblings	0,49	0,49	0,47	0,46
Plant size (no. of co-workers)	268	258	262	249
Earnings *b-3*	302 157	295 771	214 530	211 067
Earnings *b-4*	284 659	281 010	199 652	198 314
Earnings *b-5*	268 629	267 343	185 599	185 878
Employment months *b-4*	11,0	11,1	9,8	9,8
Employment months *b-5*	10,4	10,6	9,1	9,2
At school *b-4*	0,06	0,06	0,06	0,06
At school *b-5*	0,05	0,06	0,06	0,06
Observations	109 018	2 257 798	40 738	895 176

Table A1 Panel B. Sample means, displaced and non-displaced workers by gender and moving status

	Males				Females			
	Displaced Movers	Displaced Stayers	Non-displaced Movers	Non-displaced Stayers	Displaced Movers	Displaced Stayers	Non-displaced Movers	Non-displaced Stayers
Age	35.08	38.35	34.82	38.50	33.80	37.93	34.03	38.46
Sec edu	0.55	0.64	0.56	0.65	0.59	0.64	0.56	0.64
Tertiary edu	0.35	0.22	0.34	0.20	0.33	0.21	0.34	0.20
Tenure	5.05	6.86	5.45	7.95	4.71	6.45	5.42	7.38
Cohab/married	0.46	0.65	0.49	0.67	0.38	0.63	0.42	0.65
Yrs in region	4.22	4.88	4.24	4.90	4.25	4.88	4.34	4.90
No sch age ch	0.28	0.45	0.28	0.45	0.19	0.35	0.18	0.36
No of ch u 7	0.26	0.20	0.27	0.19	0.19	0.17	0.20	0.16
Parent in reg	0.42	0.69	0.44	0.69	0.40	0.61	0.41	0.60
Sibl in region	0.52	0.75	0.52	0.76	0.47	0.69	0.50	0.69
P & sibl in reg	0.36	0.62	0.37	0.63	0.32	0.54	0.35	0.54
Younger sibl	0.53	0.49	0.54	0.49	0.53	0.47	0.55	0.46
Plant size	265.51	267.57	284.38	257.94	251.93	261.92	283.06	248.05
Earnings *b-3*	297 375	302 289	290 042	295 868	218 186	214 414	219 211	210 916
Earnings *b-4*	266 736	285 155	261 292	281 347	193 306	199 854	196 636	198 345
Earnings *b-5*	241 248	269 386	236 195	267 875	172 781	186 007	175 734	186 065
Empl mths *b-4*	9.98	10.97	10.05	11.13	9.29	9.79	9.54	9.85
Empl mths *b-5*	8.97	10.43	9.03	10.66	8.27	9.11	8.50	9.22
At school *b-4*	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
At school *b-5*	0.05	0.05	0.06	0.06	0.05	0.06	0.06	0.06
Observations	2933	106 085	37 915	2219 883	1258	39 480	16 226	878 950

Note. The sample consists of workers who were 25-50 years old and full time employed in the base year (b). See section 4 for further details about the sampling criteria. Displaced workers lost their job in a plant closure or downsizing between years *b* and year *b+1*.

Table A2 Employment status at years *b+2* and *b+7* by gender, displacement and moving status

Panel A: Males	Displaced		Non-Displaced	
Two years after	Stayers	Movers	Stayers	Movers
Employed	84.26	76.14	91.87	79.17
Same plant	4.44	2.02	75.34	30.79
Same firm. different plant	15.10	10.18	2.86	6.40
Same industry. different firm	18.97	14.66	3.04	8.47
Different private sector industry	44.58	46.44	10.24	31.51
Public sector	1.16	2.83	0.39	2.01
Not employed	15.74	23.86	8.13	20.83
Parental leave	3.00	5.02	3.38	5.68
In school	0.76	1.38	0.29	0.96
Unemployed	4.57	7.68	1.39	5.27
No family in the region	3.63	4.04	1.13	2.41
Family in region	0.94	3.64	0.26	2.86
Outside the labor force	7.42	9.77	3.08	8.93
No family in the region	6.09	4.82	2.57	4.56
Family in the region	1.33	4.95	0.51	4.37
No. of observations	105743	2967	2217763	38349
Seven years after				
Employed	85.09	78.59	88,17	80,08
Not-employed	14.91	21.41	11,83	19,92
No. of observations	104670	2905	2194760	37628

Panel B: Females	Displaced		Non-Displaced	
Two years after	Stayers	Movers	Stayers	Movers
Employed	76.87	60.74	85.51	62.36
Same plant	3.43	0.78	70.74	19.95
Same firm. different plant	12.40	6.66	2.26	4.93
Same industry. different firm	18.02	8.86	2.65	7.25
Different private sector industry	40.48	39.26	9.07	26.42
Public sector	2.54	5.17	0.78	3.81
Not-employed	23.13	39.26	14.49	37.64
Parental leave	9.23	16.07	8.64	16.36
In school	0.87	1.49	0.36	1.26
Unemployed	5.00	11.13	1.57	8.78
No family in the region	3.74	4.94	1.18	4.00
Family in region	1.27	6.19	0.38	4.78
Outside the labor force	8.03	10.58	3.92	11.25
No family in the region	6.17	5.17	3.03	5.57
Family in the region	1.86	5.41	0.89	5.67
No. of observations	39437	1276	878588	16395
Seven years after	Stayers	Movers	Stayers	Movers
Employed	79.93	69.67	83.59	70.20
Not-employed	20.07	30.33	16.41	29.80
No. of observations	39079	1266	871179	16173

Note. Parental leave means that the individual has received some parental benefit during the year. If a worker has one or more parental leave months he or she is classified as not employed. Family is defined as parent or sibling of the worker or the worker's spouse.

Table A3 Sample means of selected pre-displacement characteristics for prescreened sample

	Males		Females	
	Displaced	Non-displaced	Displaced	Non-displaced
Age	38.07	37.87	36.87	36.90
Secondary education	0.62	0.62	0.63	0.62
Tertiary education	0.25	0.25	0.23	0.23
Tenure	5.06	4.90	5.04	4.87
Cohabiting or married	0.63	0.63	0.56	0.57
Years in region	4.82	4.82	4.80	4.81
No. of school age children	0.44	0.44	0.32	0.32
No. of children under 7	0.20	0.21	0.18	0.18
Parent in region	0.67	0.68	0.60	0.60
Sibling in region	0.73	0.74	0.69	0.69
Parent and sibling in region	0.59	0.60	0.53	0.54
Younger siblings	0.48	0.49	0.49	0.49
Plant size (no. of co-workers)	313.31	263.72	334.74	235.32
Earnings *b-3*	310 205	308 004	220 394	219 322
Earnings *b-4*	289 120	287 869	201 847	200 730
Earnings *b-5*	269 585	268 532	185 283	184 028
Employment months *b-4*	10.67	10.62	9.67	9.60
Employment months *b-5*	10.00	9.93	8.88	8.81
At school *b-4*	0.06	0.06	0.06	0.06
At school *b-5*	0.05	0.05	0.06	0.06
Observations	57 412	783 916	19 307	257 749

Note. The prescreened sample consists of workers who were 25-50 years old and full time employed in the base year and whose estimated propensity to be displaced (model reported in table A5) was above 0.05 and below 0.95. Displaced workers lost their job in a plant closure or downsizing between years 0 and year 1.

Table A4 Effect of pre-displacement characteristics on the probability to be displaced

	(1)	(2)
Displacement probability	Males	Females
Age	0.002**	-0.000
	(0.000)	(0.000)
Age squared	-0.000**	0.000
	(0.000)	(0.000)
Secondary education	-0.001**	-0.001
	(0.000)	(0.001)
Tertiary education	-0.004**	-0.005**
	(0.000)	(0.001)
Unemployment rate	0.002**	0.002**
	(0.000)	(0.001)
Partner (cohabiting or married)	0.001	0.000
	(0.001)	(0.001)
Married	-0.003**	-0.003**
	(0.001)	(0.001)
School Age Children	0.001	-0.001*
	(0.000)	(0.001)
Tenure	-0.003**	-0.002**
	(0.000)	(0.000)
Tenure squared	0.000**	0.000**
	(0.000)	(0.000)
Size of the Region/10000	0.002**	0.001**
	(0.000)	(0.000)
Under School Age Children	-0.000	-0.001
	(0.000)	(0.001)
Parent in the Region	0.000	-0.000
	(0.001)	(0.001)
Sibling in the Region	0.000	0.000
	(0.000)	(0.001)
Parent and Sibling in the Region	-0.001	-0.000
	(0.001)	(0.001)
Younger Siblings	-0.001*	0.000
	(0.000)	(0.000)
Plant size	0.021**	-0.001
	(0.003)	(0.005)
Earnings at *b-2*	0.000	-0.000
	(0.000)	(0.000)
Earnings at *b-3*	0.000	0.000
	(0.000)	(0.000)
Earnings at *b-4*	0.000**	-0.000
	(0.000)	(0.000)
Earnings at *b-5*	0.000	-0.000
	(0.000)	(0.000)
Employment Months *b-4*	-0.000**	-0.000
	(0.000)	(0.000)
Employment Months *b-5*	-0.000*	0.000
	(0.000)	(0.000)
At School in year *b-4*	0.001	0.001
	(0.001)	(0.001)
At School in year *b-5*	-0.001	0.001
	(0.001)	(0.001)
Same region in *b-2*	-0.003	-0.001
	(0.002)	(0.002)
Observations	2 366 809	935 902
Pseudo R2	0.03	0.03

Note. Marginal effects from probit model that estimates the probability of displacement based on background characteristics. The following variables are included but not reported: Base year, industry and region dummies, tenure below 1 (based on job starting datse), same region in *b-3*, same region in *b-4*, same region in *b-5* and base year fixed effects. * p<0.05, ** p<0.01.

Table A5 Probit model for the probability of migration. Alternative urban definitions

	(1) Males	(2) Males	(3) Males	(4) Females	(5) Females	(6) Females
Displaced	0.006**	0.006**	0.006**	0.009**	0.008**	0.008**
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Displaced*urban7	-0.001			-0.002**		
	(0.000)			(0.001)		
Displaced*urban5		-0.001*			-0.002**	
		(0.000)			(0.001)	
Displaced*urban3			-0.001**			-0.002*
			(0.000)			(0.001)
Secondary	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tertiary	0.005**	0.005**	0.005**	0.004**	0.004**	0.004**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Earnings *b-3*	0.000*	0.000*	0.000*	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Spouse	0.002**	0.002**	0.002**	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Spouse employed	-0.003**	-0.003**	-0.003**	-0.002**	-0.002**	-0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Parent in the Region	-0.014**	-0.014**	-0.014**	-0.012**	-0.012**	-0.012**
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
School age children	-0.004**	-0.004**	-0.004**	-0.007**	-0.007**	-0.007**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2317135	2317135	2317135	911250	911250	911250
Pseudo R2	0.13	0.13	0.13	0.13	0.13	0.13

Note. Probit marginal effects estimated based on equation (1) in the main text. The dependent variable is a dummy for whether the worker moved to a different labor market region between years *b* and *b+2*. Displaced workers lost their job in a plant closure or downsizing between year *b* and year *b+1*. The sample consists of workers who were 25-50 years old and full time employed in the base year (*b*). Further details about the sampling criteria are given in section 4. A number of pre-displacement control variables are included but not reported: Age, age square, tenure, earnings at *b*-4, earnings at *b*-5, employment at *b*-4, employment at *b*-5, at school in *b*-4, at school in *b*-5, location size, years in region in base year, children under 7, sibling in the region, parent in the region, both parent and sibling in the region, having younger siblings, plant size, plant size interacted with plant size under 20, base year fixed effects and base year specific region- and industry dummies. The latter imply that the urban-variables, which are used as interaction effects, cannot be included on its own. Urban 7 is dummy for living in one of the seventh largest labor market regions, urban 5 is dummy for living in one of the 5th largest regions, and urban 3 is dummy for living in one of the 3rd largest labor market regions.
* p<0.05, ** p<0.01.

Table A6. Main regression. The effect of job displacement on earnings by moving status

Earnings	Males		Females	
	OLS	FE	OLS	FE
Displaced*stayer_3	0.69		-1.75**	
	(0.45)		(0.38)	
Displaced*stayer_2	1.68**	0.83*	-1.37**	0.44*
	(0.54)	(0.33)	(0.39)	(0.21)
Displaced*stayer_1	2.19**	1.19**	-0.91*	0.95**
	(0.59)	(0.37)	(0.41)	(0.27)
Displaced*stayer_0	1.74*	0.58	-1.02*	0.87*
	(0.72)	(0.53)	(0.47)	(0.35)
Displaced*stayer1	-0.57	-1.66**	-1.41**	0.56
	(0.71)	(0.61)	(0.54)	(0.44)
Displaced*stayer2	-8.10**	-9.21**	-8.53**	-6.50**
	(2.07)	(2.17)	(0.56)	(0.48)
Displaced*stayer3	-7.31**	-8.58**	-9.60**	-7.56**
	(1.64)	(1.74)	(0.58)	(0.50)
Displaced*stayer4	-6.52**	-7.94**	-9.26**	-7.21**
	(1.72)	(1.82)	(0.63)	(0.56)
Displaced*stayer5	-4.97**	-6.58**	-8.97**	-6.91**
	(1.52)	(1.60)	(0.65)	(0.58)
Displaced*stayer6	-2.72*	-4.47**	-7.84**	-5.72**
	(1.31)	(1.33)	(0.70)	(0.64)
Displaced*stayer7	-3.18**	-5.10**	-7.70**	-5.54**
	(0.92)	(0.87)	(0.73)	(0.66)
Displaced*mover_3	2.88		0.40	
	(2.12)		(1.98)	
Displaced*mover_2	7.98**	4.37**	5.77**	6.13**
	(2.57)	(1.57)	(1.99)	(1.17)
Displaced*mover_1	9.43**	5.09**	6.09**	7.18**
	(2.58)	(1.73)	(2.11)	(1.60)
Displaced*mover_0	7.80**	2.72	4.83*	6.63**
	(2.53)	(1.79)	(2.44)	(2.09)
Displaced*mover1	-0.37	-6.21*	-10.44**	-7.95**
	(3.54)	(2.90)	(2.79)	(2.61)
Displaced*mover2	-15.48**	-22.40**	-28.13**	-25.04**
	(3.03)	(2.79)	(2.98)	(3.04)
Displaced*mover3	-12.82**	-20.22**	-29.86**	-25.95**
	(3.21)	(2.954)	(3.50)	(3.48)
Displaced*mover4	-11.45**	-19.35**	-30.72**	-26.37**
	(3.51)	(3.15)	(3.64)	(3.52)
Displaced*mover5	-13.98**	-22.55**	-29.85**	-24.95**
	(3.28)	(3.016)	(3.91)	(3.69)
Displaced*mover6	-7.98	-17.25**	-32.55**	-26.94**
	(4.62)	(4.32)	(3.91)	(3.75)
Displaced*mover7	-6.69	-16.73**	-31.41**	-25.07**
	(4.07)	(3.84)	(4.20)	(4.05)
Observations	26000754	26000754	10288112	10288112
Number of groups (id x base year)		2379111		940127
R-squared	0.09	0.02	0.24	0.08

Note. The dependent variable is annual earnings, i.e. total annual labor income and benefits such as parental benefits and unemployment benefits. Earnings are measured in 1000 real 1998 NOK. The sample consists of workers who were 25-50 years old and full time employed in the base year (year 0). Further details about the sampling criteria are given in section 4 of the paper. Displaced workers lost their job in a plant closure or a plant downsizing between years 0 and 1. A mover is a worker who lives in a different labor market region in year 2 than in the year before the job loss (year 0). All models include base-year specific time dummies and age and age square in interaction with base year education level and base year urban status. The OLS model also includes additional pre-displacement controls: Dummies for educational categories, marital status, tenure, cohabiting partner, school age children, under school age children, parent in the region, spouse's parent in the region, sibling in the region, both parent and sibling in the region, younger siblings, at school in *b-4*, at school in *b-5*, regional dummies, and industry dummies. Since the FE model includes fixed effects for each individual in a given base year sample, we cannot estimate the effect for the first time period *b-3*. This period is thus used as base-level in the FE-regressions. We cluster standard errors by individuals. The coefficients in columns (2) and (4) are graphed in figure 3 in the paper. * $p<0.05$, ** $p<0.01$.

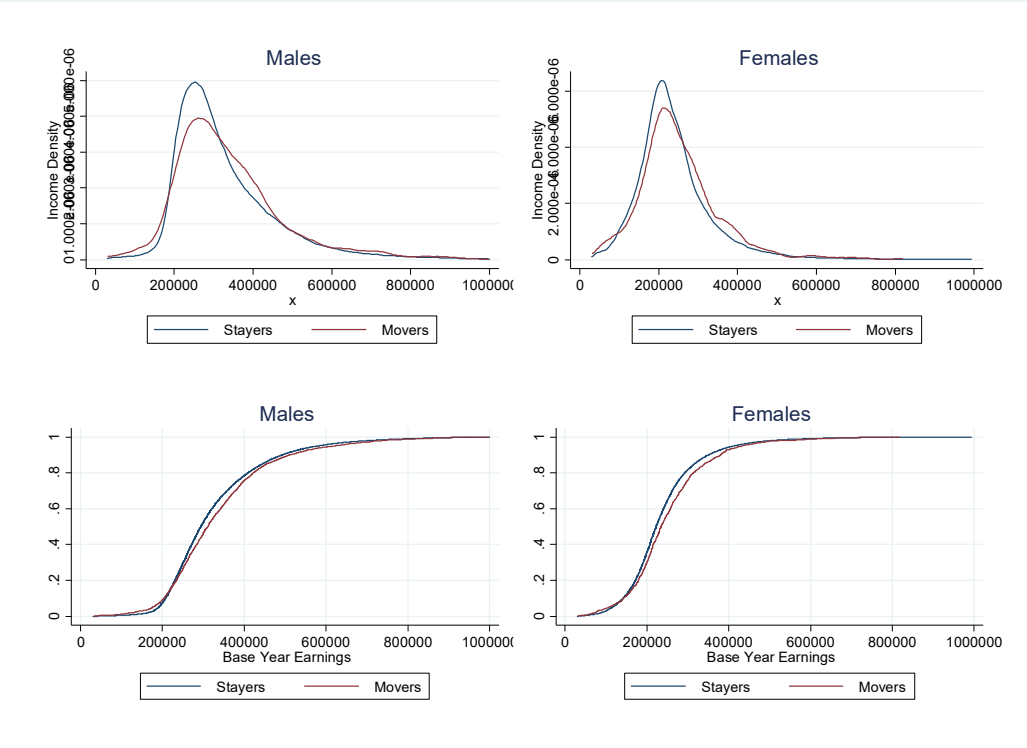
Main regression results

Table A6 gives the results of estimating equation (2) in the main text for men and women separately, with and without individual specific fixed effects. Starting with the pre-displacement coefficients, we see that there are only small pre-displacement earnings differences once we condition on observables. There is a tendency for displaced male stayers to be positively selected and for displaced female stayers to be negatively selected in terms of pre-displacement earnings, but the coefficients are negligible compared to the average pre-displacement earnings level for the non-displaced comparison group (see table A1). For displaced movers, positive selection is a bit more evident as compared to all non-displaced workers, but three years prior to displacement the coefficients are small and insignificant for both men and women. Movers, however, have a bit steeper earnings growth in the years leading up to the displacement incident. This is also evident in figure 2 in the paper.

The pre displacement differences we observe in the OLS regression have a corresponding effect on the post displacement FE coefficients. The post-displacement earnings effect for male movers is more negative when estimated with FE than with OLS, implying on average positive selection on unobservables. For female movers there is no such obvious difference between OLS and FE. To explore selection further, we have looked at the pre-displacement income and residual income distributions for displaced movers and stayers. These are reported in figures A1 and A2 and indicate that movers are overrepresented in both the high and the low end of the income distribution. This finding is consistent with there being different motives for moving as outlined in the theory section.

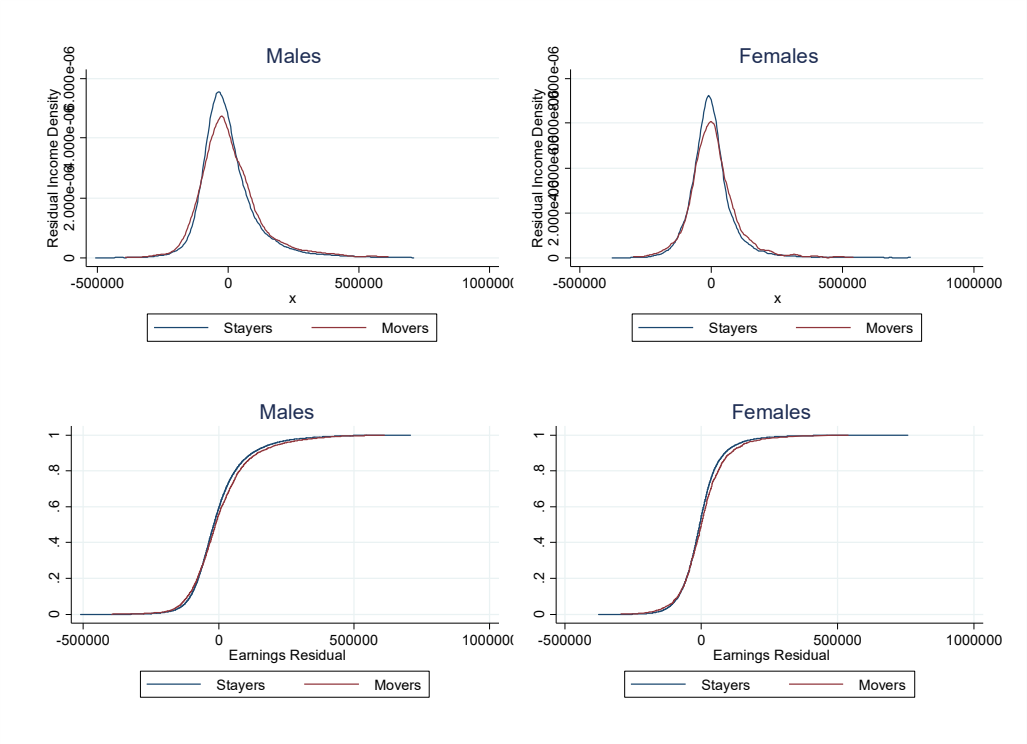
The post-displacement coefficients are the coefficients of main interest. We see that job loss has a long-lasting negative effect on earnings for movers as well as for stayers. For displaced males the earnings loss is largest in year 2 and for displaced females the earnings loss is largest in year 3 (stayers) and year 4 (movers). A priori, one might expect the earnings loss to be largest in year 1, but since displacement happens between years 0 and 1, many displaced workers are non-displaced in parts of year 1. Moreover, severance pay and termination payment agreements are commonly used when firms downsize. This will typically be paid out in year 1 or year 2, and can be in the order of one month's pay per year of service.

Figure A1 Relative income distributions



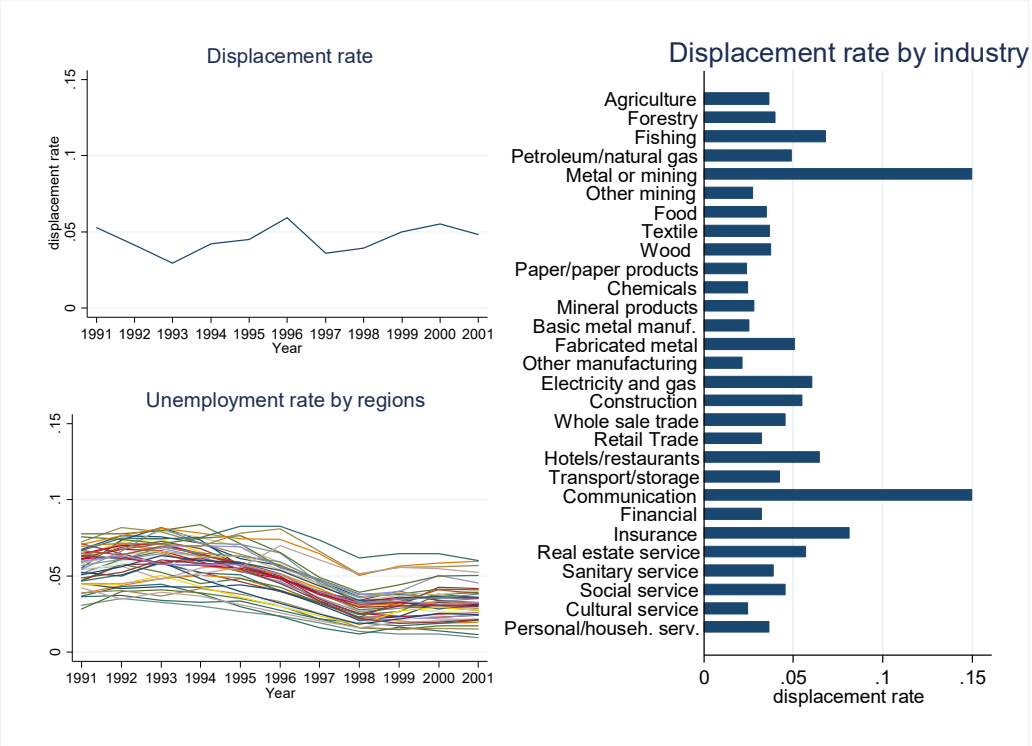
Annual income in base year 0. The sample consists of workers who were 25-50 years old and full time employed in base year 0, and who were displaced from their jobs between years 0 and 1. Further details about the sampling criteria are given in section 4. Workers earning more than 1000 000 NOK are excluded from the figures.

Figure A2 Relative income residual distributions



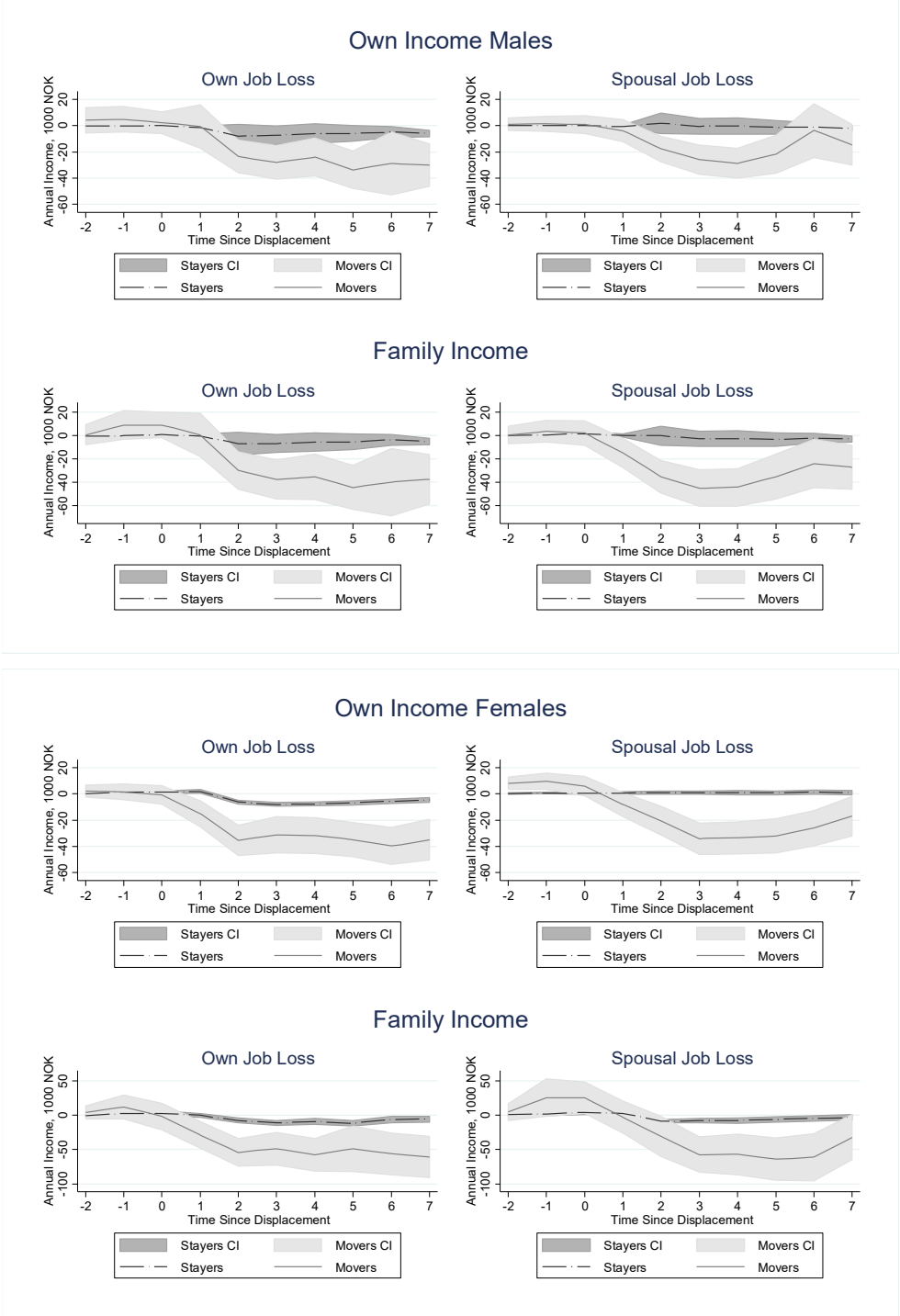
Annual income residuals in base year 0. The income residuals are obtained by regressing base year income on the following control variables: Dummies for educational categories, marital status, tenure, cohabiting partner, school age children, under school age children, parent in the region, spouse's parent in the region, sibling in the region, both parent and sibling in the region, younger siblings, at school in *b-4*, at school in *b-5*, regional dummies, and industry dummies. The sample consists of workers who were 25-50 years old and full time employed in base year 0, and who were displaced from their jobs between years 0 and 1. Further details about the sampling criteria are given in section 4. Workers earning more than 1000 000 NOK are excluded from the figures.

Figure A3 Displacement rate by time and industry, and regional unemployment rate by time



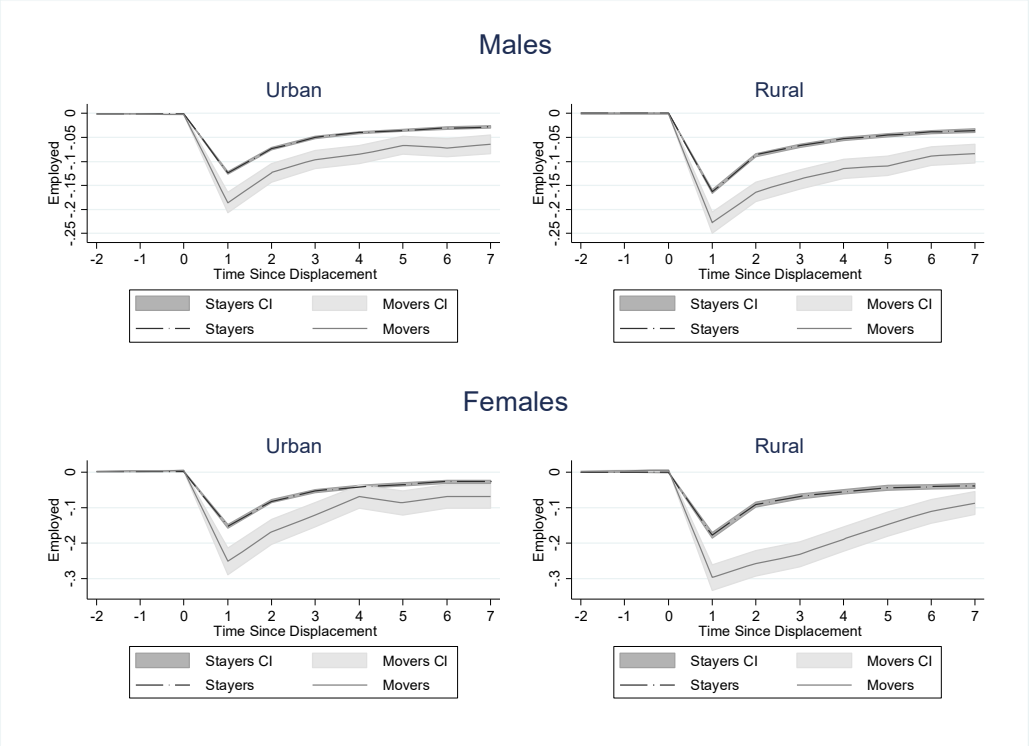
Displacement rate in the sample of workers who were 25-50 years old and full time employed in the given year and working in plants with at least ten employees. Displacement is defined as losing a job in plant closure or separating from a plant (with at least 20 employees) that is downsizing by more than 30 % within the year. Further details about the sampling criteria and displacement definition are given in section 4.

Figure A4 Effect of own and spousal job loss on earnings



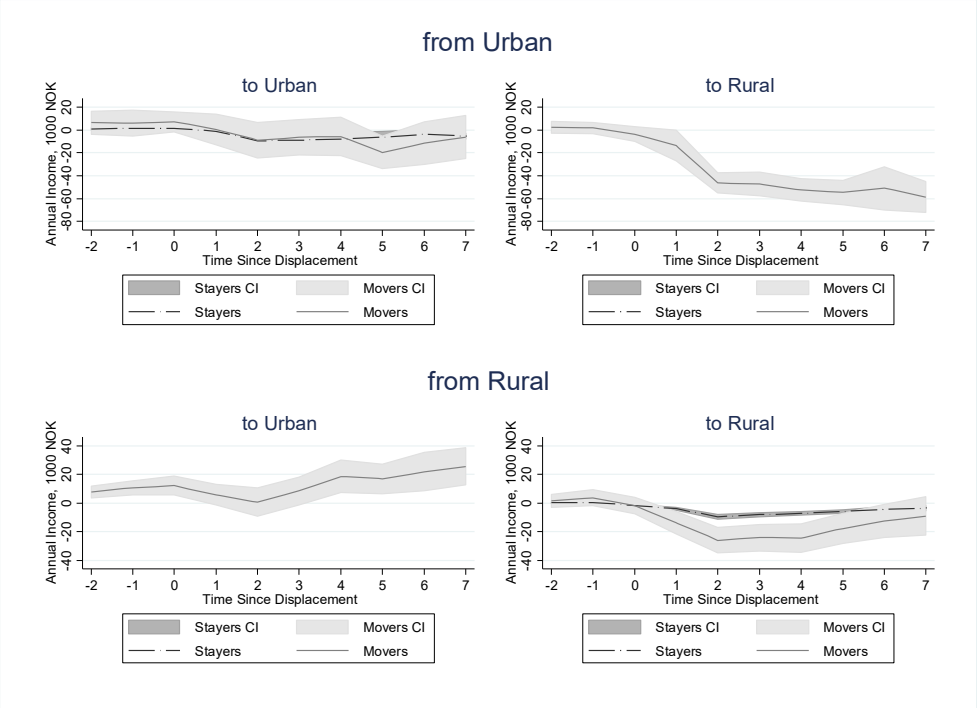
In panel A we compare male own job loss and spouse's job loss for couples where the male had at least one year of tenure and had stayed in the region at least one year and was working in plants with at least ten workers and was full time employed in *b-3* to *b*, and whose partner was working in year *b* in a plant with at least ten workers (no tenure or other restrictions for the partner). In panel B we have couples where the woman had at least one year of tenure and had stayed in the region at least one year, was working in a plant with at least ten workers, and was full time employed from *b-3* to *b* (base year), and whose partner was working in year *t* in a plant with at least ten workers.

Figure A5 Employment by urban status

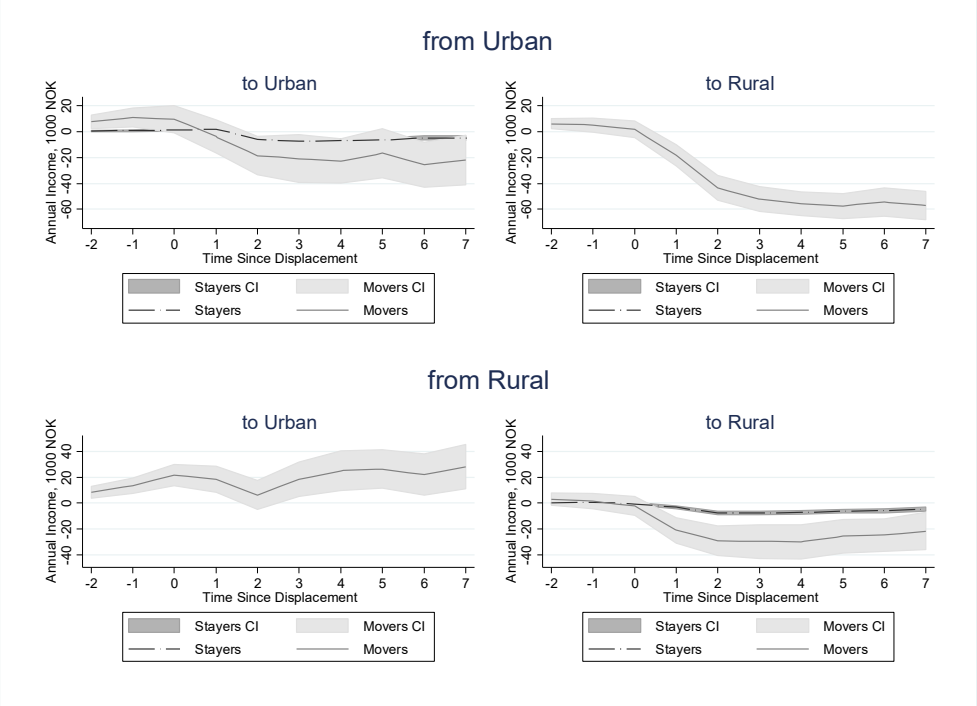


Employment is measured as months of full-time equivalent employment over the year**.** See the text under figure 5 for further details.

Figure A6 Annual income by urban status in base year and in year *b+2*
Males

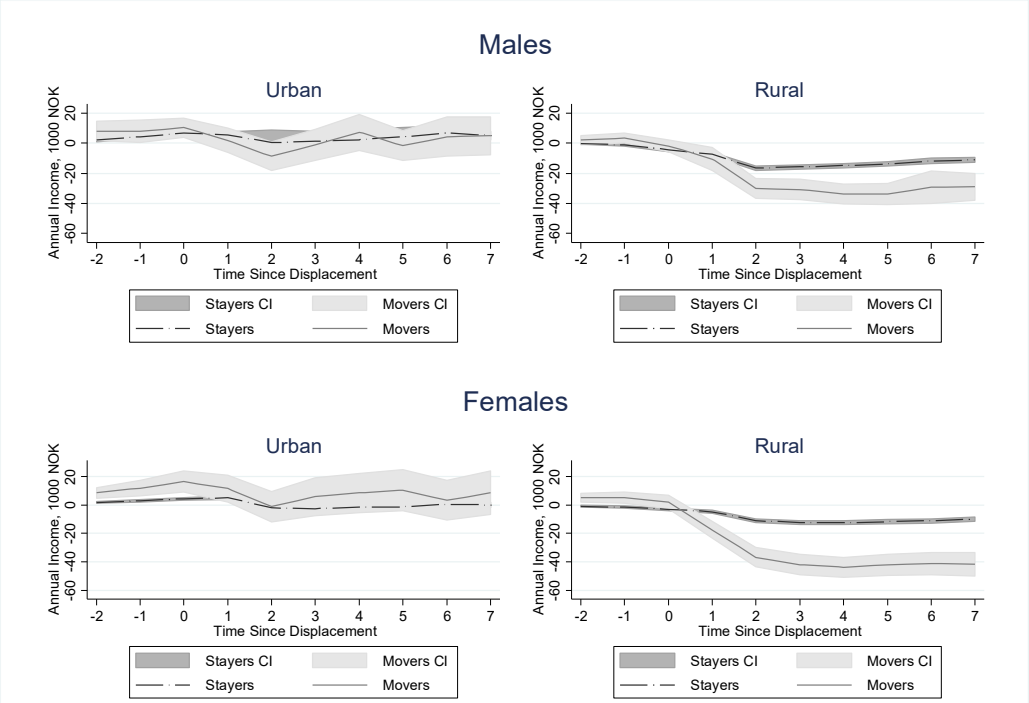


Females

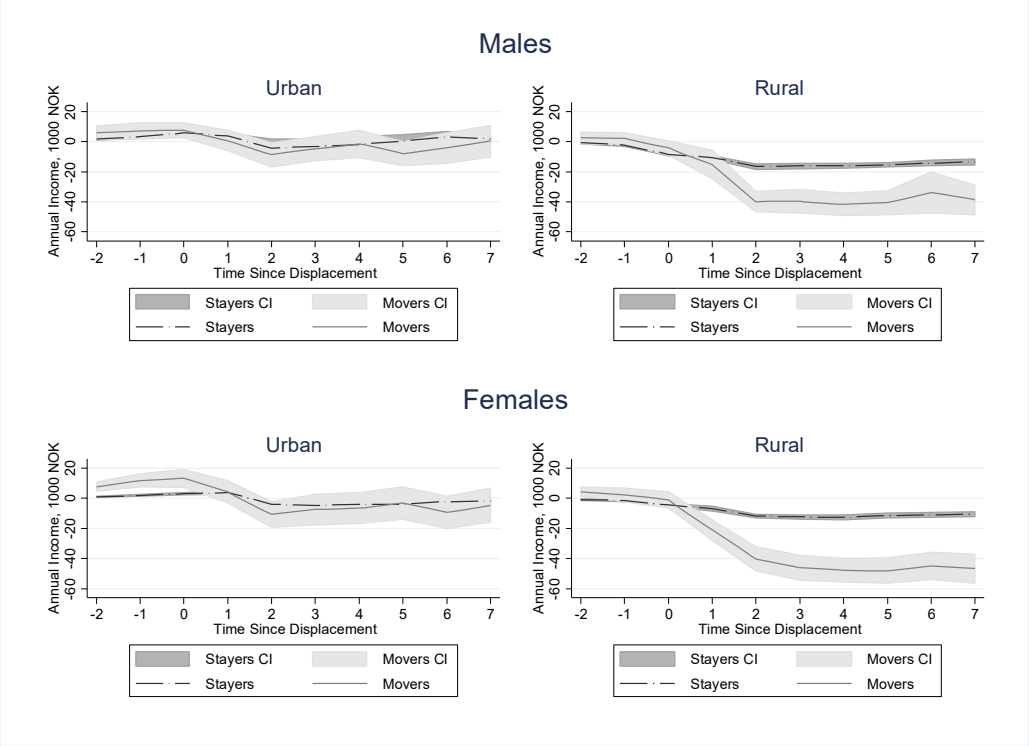


"From"-status is defined by the workers' location in base year *b*, and "to" refers to the workers' location in year *b+2*. Urban is defined as belonging to one of the five largest labor markets. See text under figure 5 for more details.

Figure A7 Annual earnings by urban status in year *b+2*. Alternative urban definitions
Panel A: Urban is defined as belonging to one of the three largest labor markets.

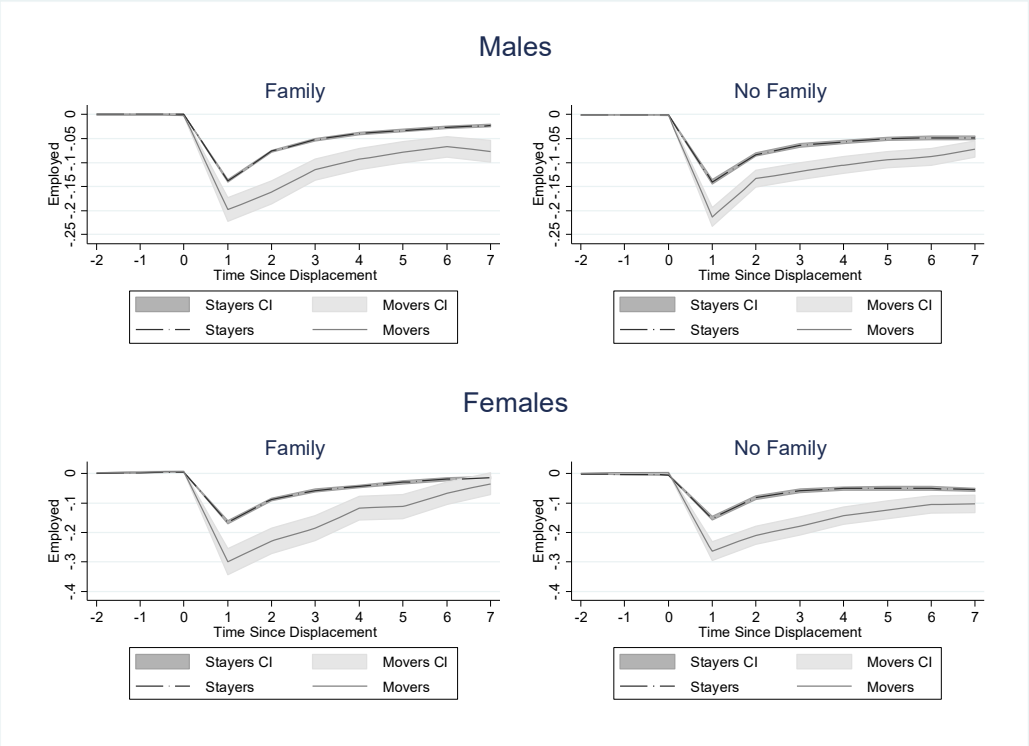


Panel B: Urban is defined as belonging to one of the seven largest labor markets.



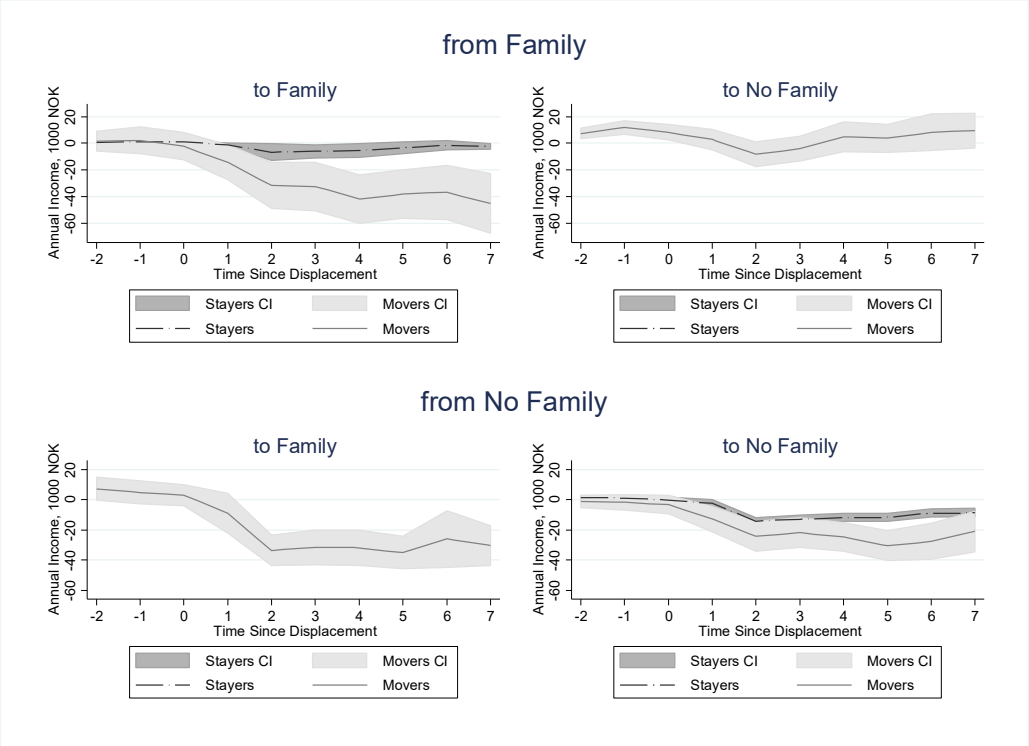
See text under figure 5 for more details.

Figure A8. Employment by family status

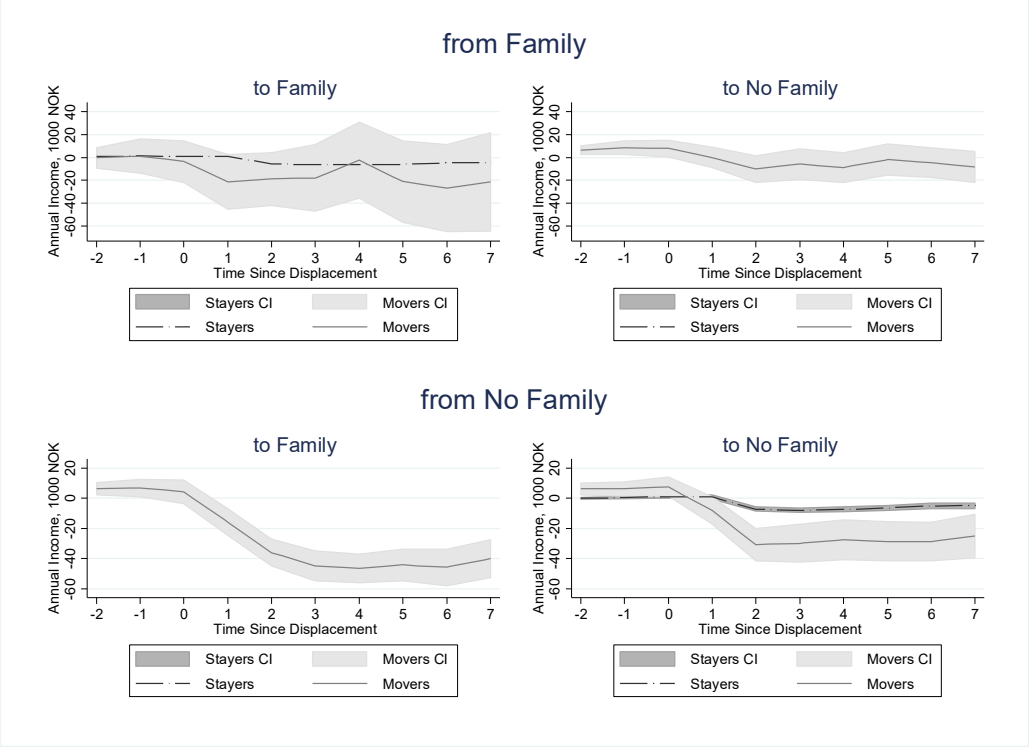


Employment is measured as months of full time equivalent employment over the year. See the text under figure 6 for further details.

Figure A9. Annual earnings by family status in base year and year *b+2*
Males

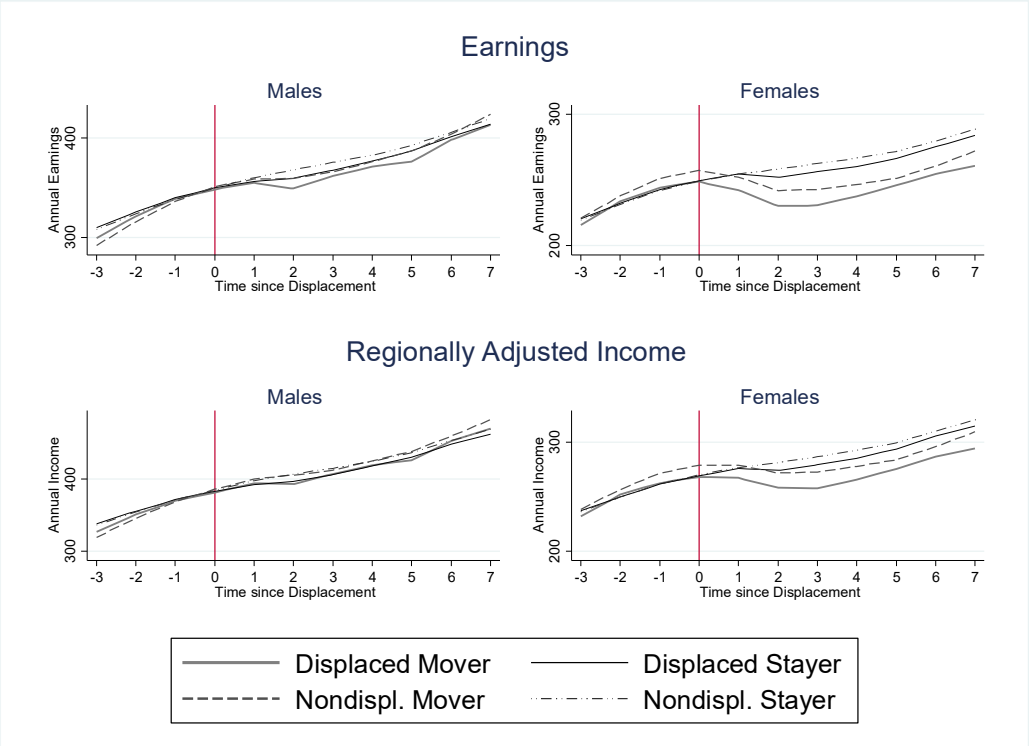


Females



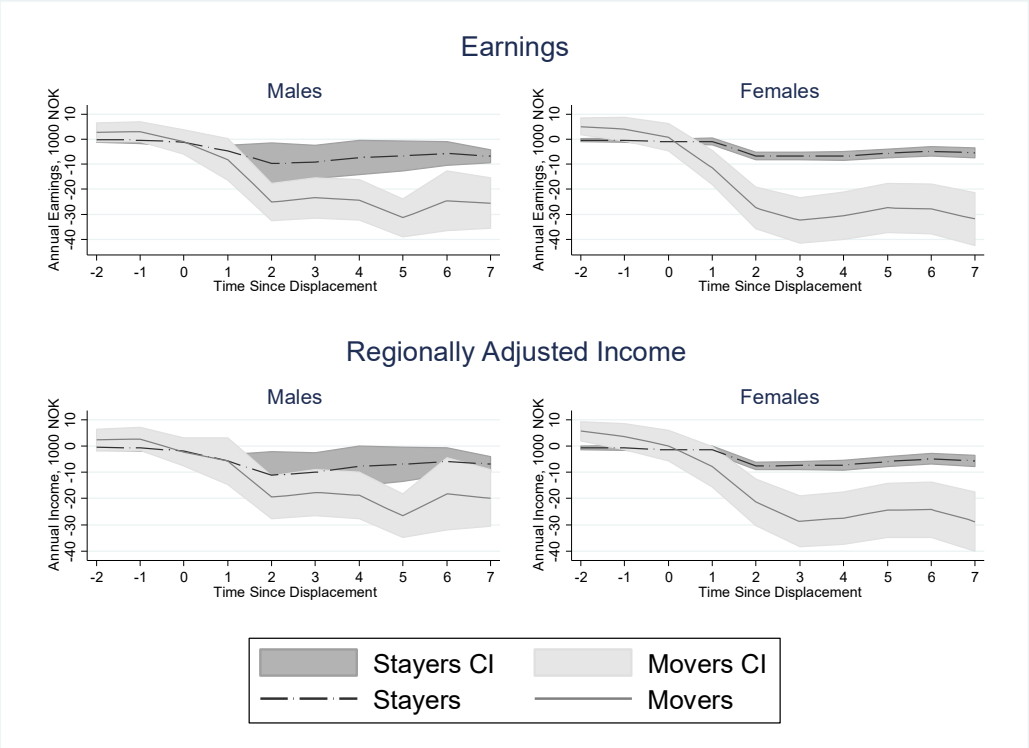
"From"-status is defined by the workers' location in base year *b*, and "to" refers to the workers' location in year *b+2*. See text under figure 6 for more details.

Figure A10. Descriptive earnings figure for prescreened sample



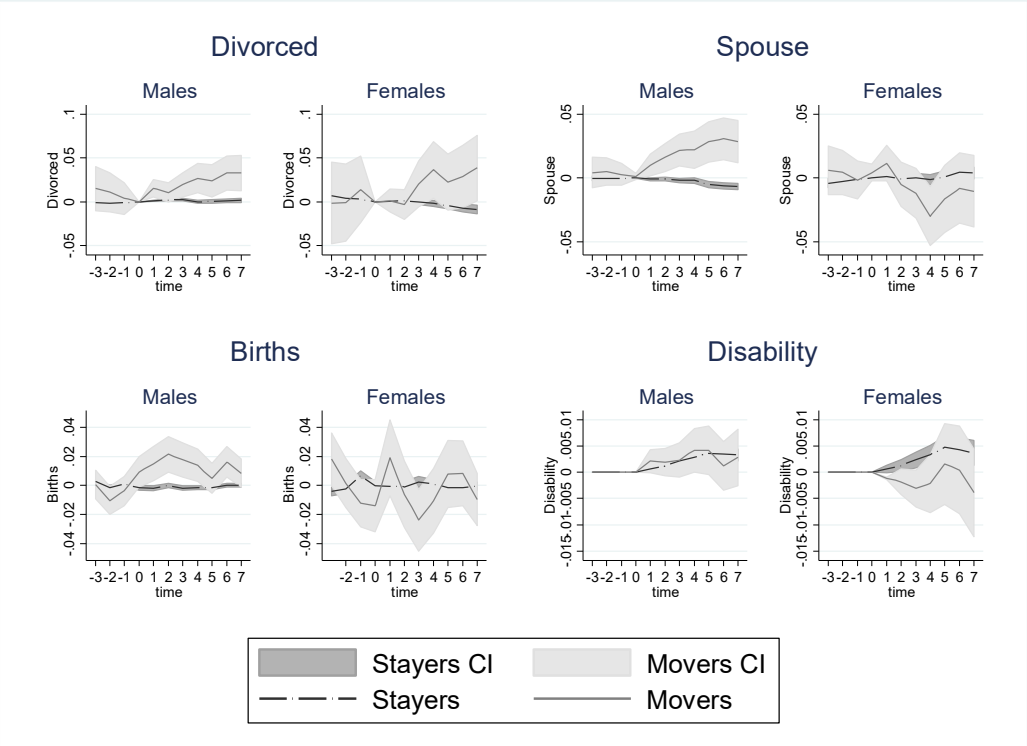
The sample consists of workers who were 25-50 years old and full time employed in the base year and whose estimated propensity to be displaced (model reported in table A5) was above 0.05 and below 0.95. Displaced workers lost their job in a plant closure or plant downsizing between years 0 and 1. Further details about the sampling criteria and displacement definition are given in section 4.

Figure A11. FE earnings and income regressions for prescreened sample



Fixed effects regression results similar to figure 3 for a sample that is prescreened by propensity score. Observations with propensity to be displaced below 0.05 and above 0.95 are dropped (model reported in table A5). Displaced workers lost their job in a plant closure or plant downsizing between years 0 and 1. Further details about the sampling criteria and displacement definition are given in section 4.

Figure A12. Family outcome regressions for prescreened sample



Regression results similar to those in figure 7 for a sample that is prescreened by propensity score. Observations with propensity to be displaced below 0.05 and above 0.95 are dropped. (See model reported in table A5.)

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