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Jordy Meekes
Wolter H.J. Hassink

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Jordy Meekes
Utrecht University

Wolter H.J. Hassink
Utrecht University and IZA

ABSTRACT

The Role of the Housing Market in Workers' Resilience to Job Displacement after Firm Bankruptcy

We examine the role of the housing market in workers' adjustment to job displacement. Dutch administrative data were used and analysed with a quasi-experimental design involving job displacement. The empirical design eliminates the potential of endogenous selection into labour turnover. The estimates show that displaced workers experience, in addition to substantial losses in employment and wage, an increase in the commuting distance and a decrease in the probability of moving home. These patterns change over the worker's post-displacement period – the negative displacement effect on wages becomes more pronounced, whereas the increase in the commuting distance diminishes. Also, we examine the role of workers' housing tenure in the displacement effects. Compared with displaced tenants and outright owners, we find that more leveraged displaced owners are more rapidly re-employed and experience a smaller increase in the commuting distance, but experience also a higher loss in wage.

Corresponding author:
Wolter H.J. Hassink
Utrecht University
School of Economics
Kriekenpitplein 21–22
3584 EC Utrecht
The Netherlands

E-mail: w.h.j.hassink@uu.nl

1. Introduction

As in many other countries, the Dutch owner-occupied housing market and labour market suffered from strong negative developments during the Great Recession that started in 2008 (OECD, 2010).[1] The large scale at which the transaction prices and home property values fell in the Dutch housing market is very rare — it previously occurred in the period $1978 - 1982$. The central question we address is how workers adjust after job displacement, by focusing on margins of adjustment that are related to space and the importance of workers' housing tenure. A better understanding of the use of margins of adjustment by displaced workers is relevant for policies that aim to limit the impact of negative employment shocks (Crépon and Van den Berg, 2016) and policies that affect housing tenure choice through subsidising homeownership or stimulating mortgage debt (DiPasquale and Glaeser, 1999).

Our first aim is to examine whether the spatial structure of homes and jobs represents relevant margins of adjustment for displaced workers. The literature on job displacement argues, based on human capital theory, that displaced workers lose human capital and wage premiums, and consequently experience substantial losses in post-displacement employment and wage outcomes (Hamermesh, 1987; Topel, 1990; Jacobson et al., 1993). The focus on losses in human capital, however, ignores the way displaced workers could use margins of adjustment related to space such as commuting patterns and household moves, which are key to employment outcomes and wage dispersion.[2] Indeed, Huttunen et al. (2016) show that job displacement increases household moves, and argue that the losses in employment and income are highest for displaced home movers. Hence, Huttunen et al. (2016) suggest that displaced workers move home for non-economic reasons such as family ties. We would argue that the commuting distance, compared to moving home, is a more relevant margin of labour adjustment for displaced workers, as displacement generates a negative income shock that lowers individuals' ability to move. To better understand the use of margins of adjustment by displaced workers, we assess the displacement effects on employment, wages, commuting distance and moving home.

Our second aim is to examine the importance of workers' housing tenure for the displacement effects on employment, wages, commuting and moving home. The impact of workers' housing tenure on employment is theoretically ambiguous. On the one hand, homeowners relative to tenants, and mortgage owners relative to outright owners (i.e. owners who have paid off their entire mortgage), are less able to move home because of higher transaction costs and a more severe equity constraint (Stein, 1995; Chan, 2001; Ferreira et al., 2010; Andersson and Mayock, 2014).[3] This geographic immobility could hinder employment prospects. On the other, homeowners, relative to tenants, may search more efficiently for jobs due to the use of more effective search methods (Goss and Phillips, 1997; Morescalchi, 2016). Moreover, mortgage owners, relative to outright owners, search more intensively for jobs due to differences in housing costs and payment obligations. In turn, the higher search efficiency or intensity could increase employment prospects. The difference in the exit rate into employment among displaced workers who differ in homeownership and home

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[1]In the Netherlands, the owner-occupied housing sector experienced a decline of almost 50% in the number of transactions. Moreover, transaction prices decreased with over 20%. Unemployment rose from 3.4% in the third quarter of 2008 to its peak of 8.1% in the first quarter of 2014. The number of bankruptcies of firms increased from 3,589 in 2007 to 8,376 in 2013 (CBS, 2017).

[2]See, e.g., Zax (1991); Simpson and Van der Veen (1992); Smith and Zenou (1997); Van Ommeren et al. (2000); Brueckner et al. (2002); Manning (2003); Smith and Zenou (2003); Fernandez and Su (2004); Van Ommeren and Fosgerau (2009); Mulalic et al. (2014).

[3]In contrast, several studies find that negative home equity positively affects geographic mobility by increasing the foreclosure and default rate (e.g., Coulson and Grieco, 2013; Bricker and Bucks, 2016; Demyanyk et al., 2017). In the Dutch institutional context, however, this mechanism is less relevant, as Dutch borrowers are characterised by a relatively low default and foreclosure rate.

equity can thus be explained by differences in geographic mobility, search efficiency and search intensity. An alternative hypothesis is that unemployed workers who are highly leveraged and face a home equity constraint are more willing to accept a larger wage loss or a job that is further away. For example, Brown and Matsa (2017) show that unemployed workers who experience a home equity constraint are more willing to apply for positions that are closer in distance but pay lower wages. Ultimately, it is an empirical question how the worker's housing tenure category affects the use of the margins of adjustment.

For our empirical analysis, we created a monthly panel of employees based on rich administrative data sets that contain Dutch data of firms, employees and households in the period from January 2006 to December 2014. This time period is particularly suited as it includes the Great Recession and thereby allows us to incorporate data on the declining property values of homes and increasing number of bankruptcies of firms. We used data on job displacement due to firm bankruptcies (hereafter: job displacement) as an exogenous negative shock to the employment status of workers. The data on job displacement set the stage for a quasi-experimental design. This empirical design is important, since we examine incentive effects of workers' housing tenure in which endogenous selection into labour turnover should play no role. However, there could exist confounding factors that affect the probability of job displacement. The potential of selection into job displacement based on observables was minimised by exact matching on coarsened observables of treated (displaced) to similar control (non-displaced) workers (Iacus et al., 2011). We included individual-specific fixed effects and applied the double-differences (DD) and triple-differences (DDD) estimator to control for various sources of unobserved heterogeneity.

The displaced and matched non-displaced workers are followed for eighteen months prior until thirty-six months after job displacement. The framework of the DD estimator was applied to the coarsened exact matched sample to estimate the displacement effects. The displacement effects are inferred from reduced-form models on four margins of adjustment, i.e. changes in employment, hourly wage, commuting distance and moving home. The DDD estimator was applied to assess the role of workers' housing tenure in the effects of job displacement. Workers' housing tenure was categorised by tenancy and homeownership, where owners were classified in five groups based on their loan-to-value ratio (hereafter: LTV) that was expressed as a percentage.

Our analysis provides two sets of novel results. First, the estimates show that commuting and household moving are significant margins of adjustment in response to job displacement. Specifically, the average displacement effects we estimated show that displaced workers during the post-displacement period of thirty-six months, on average, (i) are about 25 percentage points less employed, (ii) experience a loss in wage of 6%, (iii) experience an increase in the commuting distance of 3 kilometres and (iv) have a 0.06 percentage points lower probability of moving home. The increase in the commuting distance and decrease in moving home represent, compared to the mean value, about a 20% and 14% change, respectively. Also, the results reveal a remarkable pattern over time since job displacement: the negative displacement effect on wages becomes more pronounced, whereas the positive effect on commuting distance becomes smaller. For displaced workers, the commuting distance seems a more relevant margin of labour adjustment than moving home. The first contribution of this paper is to document that the spatial structure of homes and jobs represents relevant margins of adjustment for workers who have been displaced.

Second, we find that workers' housing tenure plays a significant role in the displacement effects on employment, wages and the commuting distance, but not on the probability of moving home. We are not the first to examine the role of housing tenure in employment outcomes.[4] However, the literature ignores various selection problems that arise due to the correlations among workers' exit rate into unemployment,

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[4]So far, there is abundant evidence of positive homeownership and mortgage effects on the exit rate into employment (e.g., Goss and Phillips, 1997; Coulson and Fisher, 2002; Flatau et al., 2003; Munch et al., 2006; Battu et al., 2008; Baert et al., 2014;

cause of unemployment and housing tenure choice.[5] We contribute to this literature by exploiting a quasi-experimental design involving job displacement that eliminates the potential of endogenous selection into labour turnover. We find that displaced underwater owners (i.e. owners who face negative home equity), relative to displaced tenants, experience a 7 percentage points lower loss in employment. From the group of displaced homeowners, outright owners experience the highest loss in employment. Also, the results suggest that displaced tenants are more selective in post-displacement wages, and highly leveraged owners become employed relatively close to home. Displaced outright owners experience the highest increase in the commuting distance. The second contribution is to show that the effect of workers' housing tenure on the post-displacement outcomes in employment, wages and commute is substantial, and comparable to that of other relevant worker characteristics such as gender and sector.

2. Institutional Background and Data

2.1. Job Displacement

In the Netherlands, workers who are collectively displaced, for example through mass-layoffs, are protected by the Law Collective Redundancy Act (in Dutch: Wet Melding Collectief Ontslag). The Law Collective Redundancy Act does not hold for dismissals if the firm is declared bankrupt, as job displacement due to firm bankruptcy concerns an urgent case of displacement. This restriction has two implications for workers whose labour contract is terminated due to bankruptcy of the firm, and these implications are the reason we exploit the quasi-experimental design involving job displacement due to firm bankruptcy.

First, the notification requirement to displaced workers, which is specified in the Law Collective Redundancy Act, applies only at the request of the Public Employment Service. Therefore, in general, no advance notification is required from bankrupt firms to displaced workers. Second, if a firm goes bankrupt, no severance or transition payments are provided by the firm to the displaced worker. These implications are important, as heterogeneity in the advance notification and severance pay can have a confounding effect on the post-displacement length of the unemployment spell and earnings (Addison and Portugal, 1987; Nord and Ting, 1991).

2.2. Institutional Setting of the Dutch Housing Market

The institutional setting of the Dutch housing market has various characteristics that make it different from, e.g., the institutional setting of the U.S. housing market. First, in the Netherlands there is no formal down-payment requirement when buying a new home. Consequently, the probability of having a liquidity constraint to buy a new home is less likely. Second, Dutch homeowners are characterised by a relatively high LTV, as they can borrow more than the property value of the home. Only in August 2011 there was a formal limit to the LTV introduced, which was set at 106%. Third, all mortgage loans in the Netherlands are recourse loans. Hence, the phenomenon of strategic defaults, i.e. walking away from a home with negative home equity, does not exist. Fourth, homeowners in the Netherlands, but also in the U.S., can deduct home mortgage interest to reduce their taxable income. The deductibility of home mortgage interest stimulates mortgage debt. Finally, the social rented sector of the Dutch housing market is relatively large (CBS, 2017).

Caliendo et al., 2015; Morescalchi, 2016). However, there is little to no evidence that negative home equity of homeowners affects the labour market. At the micro level, Valletta (2013) finds that being an underwater homeowner (i.e. an owner who faces negative home equity) does not affect the exit rate into employment. At the aggregate level, Kothari et al. (2013) and Modestino and Dennett (2013) find a very small impact of the lower mobility caused by the housing bust on the U.S. employment rate.

[5]For a discussion of these correlations, see, e.g., Van Leuvensteijn and Koning (2004); Munch et al. (2008); Moriizumi and Naoi (2011); Head and Lloyd-Ellis (2012); Bricker and Bucks (2016).

In 2012, there were about 7,141,000 Dutch households. Of these households, approximately 59.32% were owner-occupied and 40.68% were rented. Of the households that rent, 88.47% rent social housing and 11.53% rent private housing.

2.3. Data Sets

We used various administrative data sets, retrieved from Statistics Netherlands, to create a monthly panel. The data sets we used contain data of individuals, households and firms over the time period 2006-2014. We selected displaced workers whose job was terminated due to bankruptcy between July 2007 and December 2011. Each individual employee was followed for eighteen months prior until thirty-six months after the actual or potential job displacement. The actual month of job displacement of a displaced worker is equivalent to the potential month of displacement of a matched non-displaced worker. In Appendix A, we provide additional information on the data construction and sample selections that were applied to create the appropriate sample of individual employees.

2.4. Key Dependent Variables

The key dependent variables, which represent the four margins of adjustment, were operationalised as follows. Employment status was expressed as a zero-one indicator variable that equals one if the individual is employed. The natural logarithm of the hourly wage was constructed by taking the natural logarithm of the monthly contractual gross wage relative to the monthly number of contractual hours worked. The commuting distance was calculated by taking the absolute distance between the central business district (CBD) of the work municipality and the CBD of the neighbourhood of the home. Note that the hourly wage and commuting distance of workers are observed conditional on employment. Unfortunately, the commuting distance is not observed for workers if they were not in the job in December, as the work location is administered only in December. The number of observations that are missing for the model in which commuting distance is the dependent variable, can be observed by the comparison with the model on hourly wage.[6] See Table D1 in Appendix D for the within change in the hourly wage and commuting distance for displaced and non-displaced workers. Moving home was expressed as an indicator variable and equals one if the household has relocated.

2.5. Independent Variables and Covariates

The set of key independent variables consists of variables that represent the treatment status, post-displacement status and housing tenure. The set of covariates consists of various demographic characteristics and job characteristics. All variables were expressed as zero-one indicator variables.

The treatment status is time-constant and equals one for workers who have been displaced. The post-displacement status equals one if the month under observation is after the month of job displacement. To assess the time dimension of the displacement effects, the post-displacement variable was in some of the models replaced by fifty-five indicator variables. The indicator variables reflect the time gap in months of the period since job displacement and range from minus eighteen to plus thirty-six, respectively. An indicator variable equals one if the period since job displacement corresponds to the given time gap.

Workers' housing tenure was used to approximate the workers' degree of household leverage and it was represented by six indicator variables. We distinguished between tenants and homeowners, where owners were categorised based on their LTV. Note that we were not able to distinguish between tenants who rent

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[6]See Table E1 for the results using a sample where all individuals have complete information on commuting distance. We find similar results.

social or private housing. However, most tenants in our sample rent social housing, as 88.47% of all Dutch tenants do so. The LTV, which is expressed as a percentage, was constructed by the observed mortgage loan relative to the property value of the home. The six indicator variables equal one if the worker is a tenant (base category), is an outright owner (i.e. an owner who has an LTV equal to 0% on the home) and has an LTV between 0-33, 33-66, 66-100 and 100-133%, respectively.[7] Note that the so-called underwater homeowners have an LTV over 100% on the home.

The set of demographic characteristics consists of indicators for gender, Dutch nationality, and age (21-30, 30-40, 40-50 and 50-59 years). The set of job characteristics represents the worker's time-invariant job characteristics in the month of job displacement, and consists of indicators for job tenure (3-6, 6-12, 12-18 and over 18 years) and industry (manufacturing and services sector). In addition, the set of covariates includes indicators for the year of job displacement, having children aged 18 or lower, having a spouse, and the number of household members (1, 2, 3-4 and more than 4 members).

3. Identification Strategy

3.1. Identification Challenges

For our paper, the endogeneity problems of selection into labour turnover and selection into housing tenure required particular attention. Note that these selection issues are closely connected. For example, a sorting mechanism based on human capital or preferences for stability could simultaneously influence labour market outcomes and housing tenure choice (Flatau et al., 2003; Van Leuvensteijn and Koning, 2004; Munch et al., 2008; Moriizumi and Naoi, 2011; Head and Lloyd-Ellis, 2012; Bricker and Bucks, 2016). In this spirit, the likelihood of having a stable job, unemployment risk and housing tenure choice are likely to be correlated.

Selection issues are likely as various worker characteristics, for example age and gender (Kuhn, 2002; Von Wachter and Bender, 2006), job tenure (Farber, 1999), and industry and education (Farber et al., 1993), affect the probability and cause of exit into unemployment. In turn, the selection issues could be problematic as the cause of unemployment affects, through signalling, the magnitude of displacement effects on post-unemployment labour market outcomes (Gibbons and Katz, 1991; Stevens, 1997; Kuhn, 2002; Hu and Taber, 2011; Frederiksen et al., 2013). We controlled for the selection issues in various ways.

First, following the literature on job displacement, we deal with selection into labour turnover by using data on job displacement as an exogenous negative employment shock that set the stage for a quasi-experimental design (Eliason and Storrie, 2006).[8] This empirical design limits the problem of confounding factors that affect post-displacement labour turnover, as displaced workers have an identical signalling value on labour market outcomes and typically do not get an advance notification or severance pay. In line with the job displacement literature, workers with a job spell of at least three years were selected for the group of displaced and non-displaced workers. Thereby, all workers had prior to job displacement a stable employment pattern and displacement was likely to be unforeseen. Furthermore, this sample selection reduces the potential of selection into housing tenure based on the belief of having a stable job.

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[7]Unfortunately, the data on mortgage debt do not include the asset side in endowment mortgages. Hence, the levels of the mortgage debt were likely to be overestimated and the effect of workers' housing tenure is likely to be biased towards zero. To reduce the potential of the attenuation bias in the LTV, we operationalised housing tenure as a categorical variable. Table C5 in Appendix C shows the results for an indicator variable that represents homeownership and a continuous variable that represents owners' LTV. The main conclusions of the paper are robust to the use of a continuous variable to represent owners' LTV.

[8]In our sample, workers were displaced between July, 2007 and December, 2011. Hence, there is variation over time in the variable that represents treatment of workers. This greatly reduces the potential of standard errors that understate the standard deviation of the estimator (Bertrand et al., 2004).

Second, we deal with selection into job displacement based on observables, by applying Coarsened Exact Matching (CEM) that makes displaced and non-displaced workers balanced in covariates. CEM is a member of the class of Monotonic Imbalance Bounding matching methods and dominates the propensity score methods (Iacus et al., 2011). By balancing workers in covariates, the selection bias into displacement based on observables, which can arise from lack of common support, was greatly reduced (Heckman et al., 1997, 1998; Heckman and Smith, 1999). See Appendix B for additional information on how CEM was applied.

Third, to deal with bias based on unobserved heterogeneity, we apply the double-differences (DD) and triple-differences (DDD) estimator. DD was used to estimate the displacement effects, i.e. the change in outcome after treatment by comparing matched displaced to non-displaced workers. DDD was applied to examine the sources of differences in the displacement effects among workers who have been displaced. For example, the DDD estimate of a given housing tenure category equals the difference between the DD estimate for the given housing tenure category and the DD estimate for the reference category of housing tenure. The key identification restriction of the DD and DDD estimator requires that, conditional on observables, the change in outcomes of the displaced workers and non-displaced workers follow parallel paths.[9]

Finally, we controlled for many factors that affect the exit rate into unemployment, likelihood of homeownership and the LTV on the home. For example, we controlled for changes in age and the presence of children aged 18 or lower. Moreover, indicator variables for calendar month (107) and NUTS 3 area (39) were included to capture business cycle effects and area-specific fixed effects, respectively. Individual-specific fixed effects were incorporated to eliminate bias from time-invariant unobserved heterogeneity, e.g., constant skill or worker preferences that might simultaneously affect housing tenure choice and labour market outcomes.

In two robustness checks, which are shown in Appendix C, we controlled for changes in the wealth position and duration of home occupancy, and for education level, respectively, to correct for unobserved heterogeneity driven by human capital. Note that we did include individual-specific fixed effects but did not control for education in the main part of our analysis, because data on education is only available for individuals if they received their diploma after the year 1995. The use of the education data would lead to a substantial selection issue, as less leveraged owners, especially outright owners, are relatively old and received their diploma before the year 1995.

3.2. Margins of Adjustment

For each of the margins of adjustment a generic empirical model is specified to estimate the displacement effect. In what follows, Y represents one of the four possible margins of adjustment - employment, hourly wage, commuting distance and moving home. The empirical model is given as

$$Y_{it} = \delta(DISPLACED_i \times POST_{it}) + \rho POST_{it} + \beta' X_{it} + \alpha_i + N_r + D_t + \varepsilon_{it} \qquad (1)$$

$i \in 1, 2, ..., N; t \in 1, 2, ..., 108$

where subscripts i, t and r denote the worker, month and regional NUTS 3 area, respectively. The systematic differences in the outcome variables are captured by parameter δ of the two-way (double) interaction term between the scalar indicator variables *DISPLACED* and *POST*. The indicator variable *DISPLACED* is time-constant and equals one for workers who experienced job displacement. Note that the main effect of

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DISPLACED is accounted for by including individual-specific fixed effects. The indicator variable *POST* equals one for the post-displacement period of thirty-six months after job displacement. The base and omitted categories of the variables *DISPLACED* and *POST* are the non-displaced and the pre-displacement period, respectively. The worker's housing tenure and covariates are represented by vector *X*. The parameters of the covariates are represented by vector β. Individual-specific fixed effects are referred to by α. *N* represents indicators for the home location at the NUTS 3 level. Calendar month indicators are denoted by *D*. ε refers to the idiosyncratic error term.

The second empirical model, shown in (2), is specified to assess whether the displacement effect is persistent over the period since job displacement. The empirical model is

$$Y_{it} = \sum_{\tau=-18}^{36} [\delta^\tau DISPLACED_i \times G_{it}^\tau + \rho^\tau G_{it}^\tau] + \beta' X_{it} + \alpha_i + N_r + D_t + \varepsilon_{it} \tag{2}$$

where the time-dependent differences are captured using interaction terms among the indicator variables *DISPLACED* and G^τ. The main parameters of interest are referred to by δ^τ. Parameter τ is defined as the time gap in months of the period since job displacement, which ranges from minus eighteen to plus thirty-six in increments of one. The negative values of τ correspond to the months prior to job displacement. Parameter τ equals zero in the actual and potential month of displacement for the displaced and non-displaced, respectively. The scalar indicator variable G^τ, $\tau = -18, ..., 36$, refers to the τ-th time gap between the month of job displacement and the month under observation. For example, indicator variable $G^{\tau=12}$, which represents the base category, equals one if the period prior to job displacement is equal to twelve months. We used the twelfth month prior to job displacement as the base category, because workers might experience changes in outcomes close to the month of displacement in anticipation of the job displacement.

3.3. Housing Tenure and Margins of Adjustment

We added various interaction terms to assess the sources of differences in the use of margins of adjustment by displaced workers. Workers are distinguished by their housing tenure, demographic characteristics and job characteristics. The empirical model in (3) complements the model in (1), by adding multiple three-way (triple) interaction terms among a vector of worker characteristics *X*, *DISPLACED* and *POST*. The vector *X* includes time-varying variables (housing tenure and age) as well as time-invariant variables (gender, nationality and characteristics of the terminated job). The empirical model is

$$Y_{it} = (\kappa' X_{it}) \times DISPLACED_i \times POST_{it} + (\gamma' X_{it}) \times DISPLACED_i + (\eta' X_{it}) \times POST_{it}$$
$$+ \delta DISPLACED_i \times POST_{it} + \rho POST_{it} + \beta' X_{it} + \alpha_i + N_r + D_t + \varepsilon_{it} \tag{3}$$

where the parameters of interest are represented by vector κ.

The empirical model in (4) complements that of (2). The model in (4) is specified to assess the time dimension of the role of worker characteristics in the displacement effects. The time-dependent differences are captured by multiple three-way interaction terms among the indicator variables *X*, *DISPLACED* and G^τ. The empirical model is

$$Y_{it} = \sum_{\tau=-18}^{36} [(\kappa'^\tau X_{it}) \times DISPLACED_i \times G_{it}^\tau + \delta^\tau DISPLACED_i \times G_{it}^\tau + (\eta'^\tau X_{it}) \times G_{it}^\tau + \rho^\tau G_{it}^\tau]$$
$$+ (\gamma' X_{it}) \times DISPLACED_i + \beta' X_{it} + \alpha_i + N_r + D_t + \varepsilon_{it} \tag{4}$$

where the parameters of interest are denoted by vector κ^τ.

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4. Empirical Results

4.1. Displacement Effects on the Margins of Adjustment

We examine the displacement effects on the four margins of adjustment (see Eq. (1)). Columns (1), (2), (3) and (4) of Table 1 show the displacement effects on employment, hourly wage, commuting distance and moving home, respectively. For the variables displacement status (*DISPLACED*) and post-displacement period (*POST*), the omitted categories are the non-displaced workers and the pre-displacement period, respectively.

Table 1 shows that displaced workers are 25 percentage points less employed than non-displaced workers over the post-displacement period of thirty-six months. Moreover, re-employed displaced workers, compared with employed non-displaced workers, experience a loss of about 6% in hourly wage and an increase of 3 kilometres in the commuting distance. The increase of 3 kilometres in the commuting distance represents an increase of about 20%, as the average commuting distance for displaced workers in the month of displacement equals 15 kilometres (see the summary statistics presented in Table D3). Finally, we observe a negative displacement effect on the probability of moving home of 0.06 percentage points. The displacement effect on moving home corresponds to a decrease of about 14%, as the mean moving probability for displaced workers in the month of displacement equals 0.0043.[10]

Table 1
Displacement effects on the four margins of adjustment (Eq. (1))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × POST	−0.2531***	−0.0625***	3.1854***	−0.0006***
	(0.0026)	(0.0017)	(0.2328)	(0.0002)
Number of parameters	161	161	161	161
Number of individuals	54,229	54,229	54,229	54,229
Number of observations	2,982,595	2,719,570	2,686,298	2,982,595

Notes: Each column gives the dependent variable. Parameter estimates of the two-interaction term are reported. Clustered (by individual) standard errors are in parentheses. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. The reference categories of *DISPLACED* and *POST* consist of the non-displaced workers and pre-displacement period, respectively. The regression analyses include individual-specific fixed effects and indicator variables for *POST*, housing tenure (5), age (3), children aged 18 or lower, spouse, the number of household members (3), the NUTS 3 location of the household (39) and calendar month (107). The period under observation is from January 2006 to December 2014, in which displaced and non-displaced workers are observed for 18 months prior until 36 months after the actual and potential month of job displacement, respectively. Parameter estimates of the covariates are not reported.

The negative displacement effect on moving home suggests that displaced workers, compared to non-displaced workers, are less able or willing to move home. This could be explained by the fact that displacement generates a negative income shock, which increases difficulties in financing a new home or signing a new rent contract. In contrast to our findings, Huttunen et al. (2016) show, using Norwegian administrative data, that job displacement increases the propensity to move home between local labour markets by about 30%.[11] They find that displaced home movers experience higher losses in employment and wages than

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[10]The results in Table 1 are robust to standard errors clustered by firm. The conclusion with respect to the displacement effect on commute is robust to the use of the natural logarithm of the commuting distance. These results are available upon request.

[11]Note that we estimate the displacement effect on moving home for within and between local labour market moves together. For an empirical model in which the dependent variable is operationalised as moving home between NUTS 3 areas, we find no significant displacement effect. This result is available upon request.

stayers, and argue that workers are likely to move home for non-economic reasons such as family ties. An explanation for the difference in findings could be the fact that the surface area of the Netherlands is ten times as small as the surface area of Norway. This could make Dutch displaced workers relatively unwilling to move for non-economic reasons such as family ties, as family is relatively close. An alternative explanation is the difference in the length of the post-displacement period. The post-displacement period of thirty-six months we used could be too short to observe a displacement effect on household mobility. However, Huttunen et al. (2016) show that the increase in mobility takes place in the first two years after displacement. All in all, we argue that the commuting distance, compared to moving home, is a more relevant margin of labour adjustment for workers who have been displaced.

Figure 1 shows the context of changes in the outcome variables of matched displaced and non-displaced workers over the pre- and post-displacement period (see Eq. (2)). The fixed effects coefficients on employment and moving home are provided on the y-axis in percentage points (pp) in Figures 1A and 1D, respectively. The fixed effects coefficients on wages and the commuting distance are provided on the y-axis in percentages (%) and kilometres (km) in Figures 1B and 1C, respectively. The x-axis registers the time gap between the month of observation and the month of job displacement. The time gap equals zero in the month of actual and potential job displacement, for the displaced and non-displaced, respectively. Observe in Figure 1 parallel pre-displacement trends for the displaced and non-displaced workers in the outcome variables, which satisfy the identification restriction of the DD estimator.[12]

In Figure 1A, the vertical line between months zero and one reveals the exit rate out of employment by the displaced workers. Twelve to twenty-four months after job displacement, the loss in employment is about 27 and 20 percentage points, respectively. This finding is consistent with those reported in the job displacement literature. For example, Schwerdt (2011) finds an effect of 23 percentage points over a post-displacement period of five years. Ichino et al. (2017) find a loss of 27 percentage points over the post-displacement period of twelve to twenty-four months.

Figure 1B shows a decrease in the wage loss between one and four months after job displacement. This decrease in wage loss could be explained by the low number of re-employed displaced workers, i.e. only 20% of the displaced workers, one month after job displacement (see Figure 1A). Note that our paper is one of the few papers in the literature on job displacement that uses monthly data. For papers that use quarterly or annual data, such a pattern cannot be observed as the monthly variation is smoothened out. Importantly, after the fourth month since job displacement, the loss in wage increases over the post-displacement period and ranges between 4 and 7% (see Figure 1B). The estimates are in line with studies that examine the displacement effect on wage for Europe. For example, Schwerdt (2011) finds a wage loss due to job displacement, conditional on re-employment, of about 6%. Huttunen et al. (2011) find a loss of 3% in wage after 7 years. Note that studies that use U.S. data find higher wage losses due to the more centralised wage system (e.g., Couch and Placzek, 2010).

Figure 1C shows that displaced workers experience an increase in the commuting distance. However, after three months since job displacement, the increase in commute becomes smaller over the post-displacement spell. Note that Figures 1B and 1C show composition effects that are caused by workers who exit unemployment, workers who experience job-to-job transitions and workers who move home. Interestingly, the composition effects are almost entirely driven by workers who exit unemployment and take up their first job since displacement.[13] Hence, the estimates shown in Figures 1B and 1C reveal a novel pattern:

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[12]Figure 1B shows a small hump in the monthly wage upon job displacement. Dutch salaries are supplemented with a holiday bonus and year-end bonus that workers typically get paid in May and December, respectively. The hump in wage can be explained by these bonuses, as they are paid upon displacement. Note that this hump underscores the importance of using the twelfth month prior to displacement as the reference month. See Deelen et al. (2014) for a similar finding using Dutch administrative data.

[13]We show that this observation holds in Figure E1, where we present estimates based on a sample in which we select workers
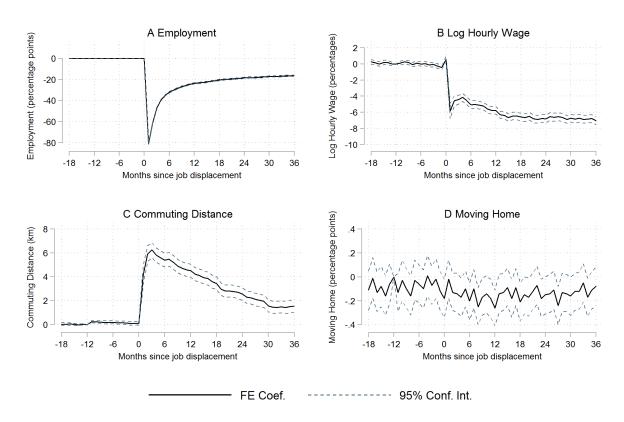
Fig. 1. Time-dependent displacement effects on employment (A), log hourly wage (B), commuting distance (C) and moving home (D) (Eq. (2)). Reference group is the group of non-displaced workers. Reference month is the twelfth month prior to job displacement. The 95% confidence intervals are computed using clustered standard errors by individual. All four fixed effects regression models include 266 parameters of which there are 54 two-way interaction terms. See Table 1 for additional notes and statistics.

displaced workers who have longer unemployment duration experience smaller increases in commute but higher losses in wage. To the best of our knowledge, this pattern has not been demonstrated in the literature.

We observe a small negative displacement effect, after six months since job displacement, on the probability of moving home (see Figure 1D). The finding suggests a delay in the impact of job displacement on the willingness or ability to move. This delay can be explained by the fact that household moves are characterised by a time gap between the month of transaction and the month of the actual move, as the actual move is realised once the home mover registers his or her relocation at the local municipality. Note, however, that the 36 two-way interaction terms that capture the post-displacement effect on moving home are jointly insignificant.

4.2. Housing Tenure and the Use of Margins of Adjustment

We examine the role of workers' housing tenure in the displacement effects on the margins of adjustment. To show the relative importance of workers' housing tenure, we also document the role of other sources of differences among workers in the displacement effects. The estimation results are displayed in Table 2 (see Eq. (3)). Workers' housing tenure is represented by *LTV* indicators, and the reference category

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who are in their first job since displacement and did not move home.

consists of workers who are tenants. The set of demographic characteristics includes *FEMALE*, *AGE* and *DUTCH NATIONALITY*, and the reference categories consist of workers who are male, aged 21 to 30 years and non-Dutch, respectively. The set of job characteristics includes *TENURE* and *MANUFACTURING*, and the reference categories consist of workers who are 3 to 6 years in the job and active in the service sector, respectively.[14]

The estimates presented in Column (1) show the sources of differences in the displacement effect on employment. Compared with displaced workers who are tenants, underwater owners are about 7 percentage points more employed after displacement. Tenants incur a loss in employment comparable to outright owners. Interestingly, our findings are consistent with papers that find positive homeownership and mortgage effects on the unemployment duration, but at odds with the paper by Valletta (2013) who finds no significant effect of negative home equity on unemployment duration. The difference in results could be explained by our quasi-experimental design that reduces the potential of selection into labour turnover. Finally, the estimates in Column (1) show that displaced workers who are female, older, non-Dutch and high-tenured experience a relatively high loss in employment. The importance of workers' housing tenure for the displacement effect on employment is substantial and comparable to that of other worker characteristics, such as gender and tenure in the job.

The parameter estimates in Column (2) highlight the role of worker characteristics in the displacement effect on hourly wage. Compared with displaced tenants and owners who have an LTV between 0% and 33%, displaced outright owners and owners with an LTV over 33% experience a 1 to 2 percentage points higher loss in hourly wage. The estimates suggest that more leveraged owners are less selective in wages when choosing jobs after job displacement.[15] Moreover, the estimates in Column (2) show that the loss in hourly wage increases with age and tenure in the job, and is higher for displaced workers who are active in the manufacturing sector compared with workers who are active in the service sector. To the best of our knowledge, this paper is the first to demonstrate the importance of workers' housing tenure for the post-displacement losses in employment and hourly wage.

Column (3) shows that various worker characteristics lead to a difference in the displacement effect on the commuting distance. Although displaced owners, compared with displaced tenants, do not experience a highly different displacement effect on commute, there is a significant difference within the group of displaced owners. Specifically, displaced outright owners experience an increase of about 3 kilometres in commute higher than underwater owners. However, note that the three-way interaction terms for workers' housing tenure on commute are jointly insignificant. In addition, displaced women experience a significantly lower increase in the commuting distance than men. Moreover, the parameter estimates indicate that displaced workers who are high-tenured and active in the manufacturing sectors experience a relatively high increase in commute.

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[14]We positively evaluate the external validity of our analyses, as we find a comparable role of demographic and job characteristics in the losses in employment and wage to that in the literature (Madden, 1987; Carrington, 1993; Carrington and Zaman, 1994; Chan and Stevens, 1999, 2001; Eliason and Storrie, 2006; Hijzen et al., 2010; Tatsiramos, 2010; Hardoy and Schøne, 2014; Hellerstein et al., 2016; Farber, 2017).

[15]The results indicate that the loss in employment is decreasing and the loss in wages is increasing in the worker's LTV. This observation is supported by the results in Table C1 of Appendix C, where we control for workers' non-housing wealth and duration of home occupancy.

Table 2
The role of observed worker characteristics in the effects of job displacement (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × POST×				
Housing tenure:				
LTV = 0%	0.0149	-0.0101	2.1910*	-0.0008
	(0.0153)	(0.0093)	(1.2563)	(0.0013)
0 < LTV ≤ 33%	0.0326***	0.0085	-0.3285	0.0006
	(0.0089)	(0.0057)	(0.7629)	(0.0006)
33 < LTV ≤ 66%	0.0231***	-0.0110**	-0.5991	0.0009
	(0.0077)	(0.0051)	(0.6997)	(0.0006)
66 < LTV ≤ 100%	0.0255***	-0.0208***	0.3057	0.0011*
	(0.0075)	(0.0049)	(0.6861)	(0.0006)
100 < LTV ≤ 133%	0.0688***	-0.0156**	-1.0898	0.0002
	(0.0093)	(0.0062)	(0.8926)	(0.0009)
Joint significance of *LTV*	11.51***	7.14***	1.55	1.17
Demographic characteristics:				
FEMALE	-0.0677***	-0.0051	-5.2966***	0
	(0.0067)	(0.0046)	(0.6522)	(0.0004)
30 < AGE ≤ 40 years	-0.0358***	-0.0257***	-1.5445*	0.0007
	(0.0094)	(0.0068)	(0.9334)	(0.0012)
40 < AGE ≤ 50 years	-0.0665***	-0.0498***	-0.801	0.0012
	(0.0097)	(0.0070)	(0.9374)	(0.0011)
50 < AGE ≤ 60 years	-0.1641***	-0.0603***	-1.0592	0.0013
	(0.0107)	(0.0075)	(1.0195)	(0.0012)
DUTCH NATIONALITY	0.0972***	-0.0097	0.3658	-0.0020**
	(0.0133)	(0.0083)	(0.9422)	(0.0008)
Joint significance of *AGE*	101.90***	27.53***	1.10	0.70
Job characteristics:				
6 < TENURE ≤ 12 years	-0.0076	-0.0065	2.7982***	0
	(0.0065)	(0.0044)	(0.6340)	(0.0005)
12 < TENURE ≤ 18 years	-0.0249***	-0.0142***	2.6314***	0.0005
	(0.0073)	(0.0049)	(0.6922)	(0.0005)
TENURE > 18 years	-0.0569***	-0.0443***	3.1450***	0.0004
	(0.0080)	(0.0054)	(0.7662)	(0.0004)
MANUFACTURING	0.0115**	-0.0225***	1.7336***	0
	(0.0053)	(0.0036)	(0.5083)	(0.0004)
Joint significance of *TENURE*	18.92***	24.81***	8.57***	0.96
Number of parameters	220	220	220	220
Number of individuals	54,229	54,229	54,229	54,229
Number of observations	2,982,595	2,719,570	2,686,298	2,982,595

Notes: Parameter estimates of the three-way interaction terms and F-Values of the joint significance of the three-way interaction terms are reported. Loan-to-value (LTV) represents five indicator variables for homeowners' LTV expressed as a percentage. The reference category of the *LTV* categories consists of workers who are tenants. The reference categories of *FEMALE*, *AGE* and *DUTCH NATIONALITY* consist of workers who are male, aged 21 to 30 years and non-Dutch, respectively. The reference categories of *TENURE* and *MANUFACTURING* consist of workers who are 3 to 6 years in the job and active in the service sector, respectively. The parameter estimates of the main and two-way interaction terms of the aforementioned independent variables are not reported. The regressions include individual-specific fixed effects and zero-one indicator variables for children aged 18 or lower, spouse, the number of household members (3), the year of job displacement (4), the NUTS 3 location of the household (39) and calendar month (107). The estimates of the main, two-way interaction and three-way interaction terms of children aged 18 or lower, spouse, number of household members and the year of job displacement are not reported. The main effects of the NUTS 3 location and calendar month are not reported. See Table 1 for addional notes.

The parameter estimates in Column (4) show that the displacement effect on moving home does not vary greatly in worker characteristics. For example, housing tenure seems to have no role in the displacement effect on moving home. The finding that the displacement effect on moving home does not differ between tenants and homeowners, could be explained by the fact that Dutch tenants typically are in social rented housing. Although social tenants have generally lower transaction costs of moving than homeowners, rent control and the waiting list for social rented housing reduce home moves (Munch and Svarer, 2002; Kattenberg and Hassink, 2017). In addition, the estimates suggest that for underwater owners, job displacement does not function as a trigger of default. The double trigger theory of default predicts that households are likely to experience a default and move home if two trigger events occur (e.g., Foote et al., 2008). Our finding is in contrast with the studies of Niu and Ding (2015); Bricker and Bucks (2016), who show that job loss increases the foreclosure rate in the U.S., especially for workers with negative home equity. The disparity between the findings can be explained by the different institutional setting, as in the Netherlands the share of housing going into default and foreclosure is relatively low. The main reason for the low rate of default is, among others, the fact that all mortgage loans are recourse loans.

Fig. 2. Housing tenure differential in the time-dependent displacement effects (Eq. (4)). All four fixed effects regression models include 2,763 parameters. See Figure 1 for additional notes and Table 2 for additional statistics.

We illustrate in Figure 2 the time-dependent differences in the importance of workers' housing tenure for the displacement effects (see Eq. 4).[16] We observe parallel pre-displacement trends in the outcome

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[16]See Figures F1-F6 in Appendix F for a comprehensive overview of the time-dependent differences in the importance of demographic and job characteristics for the displacement effects.

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variables except for moving home. The pre-displacement trend in moving home is relatively stable given the low number of monthly movers (see Table D3). Importantly, for each of the four margins of adjustment, the F-test on the joint significance of the eighteen pre-displacement three-way interaction terms is statistically insignificant. These results are available upon request.

Figure 2A shows that displaced tenants and outright owners experience a higher loss in employment than other displaced homeowners. This difference is relatively stable over the post-displacement period. Figure 2B illustrates that displaced workers who have an LTV between 0% and 33% experience a relatively low loss in wage. Figure 2C indicates that outright owners experience a relatively high increase in the commuting distance. We do not find significant differences in the displacement effect on moving home for workers who vary in housing tenure categories (see Figure 2D). All in all, the results indicate that the importance of workers' housing tenure for displacement effects on employment, wages and commute is relatively persistent over the period since displacement. The displacement effects by workers' housing tenure suggest that workers who are displaced choose among adjustment at the employment, wage and commuting margins. In this regard, we argue that these margins of adjustment, next to endogenous search (Morescalchi, 2016), are key to explaining the role of workers' housing tenure in employment outcomes.

5. Conclusions

The Great Recession that started in 2008 resulted in strong negative developments in the Dutch housing market and labour market. In this paper, we have examined workers' resilience to job displacement by focusing on the use of margins of adjustment that are related to space and the importance of workers' housing tenure. We used Dutch administrative data, which were analysed with a quasi-experimental design involving job displacement that eliminates selection into labour turnover. Our conclusions are twofold.

First, we conclude that the spatial structure of homes and jobs reflects relevant margins of adjustment in response to job displacement. Our novel finding is that displaced workers experience an average increase of about 20% in commuting distance and a decrease of about 14% in moving home over the post-displacement period of thirty-six months. Interestingly, the patterns of adjustment change over the worker's post-displacement period — a longer time since job displacement is associated with a lower loss in employment, a smaller increase in commute, and a higher loss in hourly wage. We showed that the patterns in wage and commute are caused by displaced workers who take up their first job since displacement. The results suggest a remarkable pattern: workers who experience a longer time of unemployment since job displacement prefer a smaller increase in the commuting distance to a lower loss in hourly wage. The results indicate that the commuting distance is a more relevant margin of labour adjustment than moving home for workers who have been displaced. Hence, there are societal costs, in addition to losses in employment and wages, due to an increase in the commuting distance. Our findings are relevant for policies that aim to limit the impact of negative employment shocks.

Second, we conclude that workers' housing tenure is a substantial and persistent source of heterogeneity in the displacement effects on employment, wages and commute, but not on moving home. We find that displaced underwater homeowners, compared to other displaced owners and tenants, experience a lower loss in employment. Moreover, highly leveraged owners experience a relatively high loss in wage and become employed relatively close to home. In addition, outright owners experience the highest increase in the commuting distance. The results suggest that more leveraged workers have a stronger incentive to become employed. Moreover, it seems that the geographic immobility of displaced homeowners (relative to tenants) and underwater owners (relative to other owners) does not hinder post-displacement employment outcomes. The geographic immobility of Dutch workers could be relatively unimportant for the functioning of the labour market, as the surface area of the Netherlands is relatively small. Further research is needed

to understand whether this observation also holds for other countries. Importantly, our findings are relevant for policies that subsidise homeownership or stimulate mortgage debt, as these policies does not seem to hamper displaced workers' labour market outcomes.

All in all, we showed that workers' housing tenure affects the post-displacement outcomes in employment, wage and commuting distance, but not in moving home. Consistent with financial incentive structures, this evidence suggests that more leveraged displaced owners prioritise sooner re-employment over lower wage losses. In this regard, endogenous job search intensity and efficiency alone does not fully explain the difference in the unemployment duration of workers who vary by housing tenure category. Based on the evidence, however, we cannot discuss the extent to which displaced workers make trade-offs between the use of margins of adjustment. Further research, based on a structural approach, is needed to better understand this issue.

Acknowledgements

Appendix A. Data Construction and Sample Selections

All individuals, firms and household addresses were uniquely identified on the basis of an encrypted Randomised Identification Number (RIN). We used the data set Bankruptcy Job Endings Register (*Failontslagtab*), which records the worker's RIN, the job's RIN and the date the firm entity is declared bankrupt for individuals who had a job at a firm where at least one entity of the firm experiences bankruptcy. Consequently, we possibly incorporated the so-called false-positives, i.e. we labelled voluntary job terminations in the bankrupted or non-bankrupted entity of a firm as a displacement due to firm bankruptcy. To limit the scope of false-positives we applied various data selections, which are discussed below.

Jobs that ended in year t or $t + 1$ surrounding a bankruptcy of a firm entity were registered in the Bankruptcy Job Endings Register. The time span of year t to $t + 1$ was chosen as jobs are recorded from firm payrolls that can continue after the verdict of bankruptcy. We selected workers for the group of displaced workers if the date of the job ending was earlier than one year after the date of bankruptcy or later than six months prior to the date of bankruptcy. This restriction ensured that the early leavers, who may have anticipated the plant closure, were incorporated in the analysis (see Schwerdt, 2011).

The Bankruptcy Job Endings Register was combined with multiple other registers. The Job Register (*Baankenmerkenbus*) was used to incorporate the date of job openings, the date of job endings and the RIN of the firm in which the worker was an employee. The Main Job Register (*Hfdbaanbus*) was used to distinguish between the main job and secondary job of an individual. The worker's main job, observed on a monthly basis, is the job with the highest wage. The Job and Wages Register (*Polisbus*) records monthly data based on income statements of employees to the tax office administration, including type of job (full-time or part-time), type of contract (fixed or temporary), number of hours worked and gross wage. The data set Work Location Register (*Gemstplbus*) was used to incorporate data on the municipality in which

the worker was employed.[17] The number of municipalities changed over the period under observation as various municipalities were aggregated. We used the set of 403 municipalities that existed in the year 2014. The Firm Register (*Betab*) was used to incorporate annual data on firm size and firm sector. Firm sectors were classified in 21 sectors according to a five-digit code (in Dutch: Standaard Bedrijfs Indeling), which is based on the International Standard Industrial Classification of All Economic Activities (ISIC). The extraterritorial organisations and bodies sector was excluded as no displaced worker was employed in this sector.

Registers that are based on municipal and tax office administration were used to incorporate personal, home and household information. The Population Register (*Gbapersoontab, Gbahuishoudensbus, Gbaburgerlijkestaatbus, Gbaadresgebeurtenisbus*) contains monthly data on the date of birth, gender, marital status, number of household members and moving home. The Address Object Register (*Gbaadresobjectbus, Vslgwbtab*) contains data on individuals' house address and home location at the neighbourhood level. The Highest Education Register (*Hoogsteopltab*) was used and contains data on workers' highest level of attained education. Education is categorised in lower, secondary and tertiary education based on the International Standard Classification of Education (ISCED). The Integrated Household Income data set (*Integraal Huishoudens Inkomen*), which is based on data measured on the 31st of December retrieved from the tax office, was used to incorporate data on housing tenure and household income. In the case of moving home, data on housing tenure was used from the year prior to that of moving. As an example, for household moves in 2006 we used data from 2005. The Integrated Capital data set (*Integraal-Vermogensbestand*), which consists of annual records from the tax office measured on the 1st of January, was used to incorporate data on the mortgage debt, non-housing wealth and property value of the home. In the case of moving home during the year, data on the mortgage debt and property value were used from the year after the move. As an example, for household moves in 2014 we used data from the year 2015.

The following selections were made to attain an appropriate sample for our analysis. To keep the employment history of a worker tractable, all job spells that were not identified as the main job were excluded. Moreover, we excluded groups of individuals for various reasons. First, we excluded all individuals who were not active in the labour market (e.g., disabled individuals, students and early retirees), who had no administered employment history (e.g., self-employed and long-term unemployed), or were aged below 21 or over 59 years. Second, our data do not distinguish between a bankrupt or restarted firm. Hence, we excluded workers from the group of displaced workers if more than 40% of the displaced workers who were employed at the bankrupt firm became re-employed at another but identical firm. Third, all workers who had ever an LTV over 133% during the period under observation were excluded from the sample, as a higher LTV suggests an administrative error. Finally, all workers with three or more household moves in one calendar year were excluded from the sample, as this would create the problem that we could not observe data on all homes. We kept individuals that experienced two household moves in one year, as on many occasions households move to one temporary accommodation following the sale of their home.

Prior to Coarsened Exact Matching, individuals were excluded from the group of displaced or non-displaced for various reasons. First, we excluded all workers whose hourly wage or housing tenure was not

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[17]Work location is not complete nor consistent as the CBS has only data that is measured in December on the number of plants of a firm, the location of each firm plant and the number of employees at each specific plant. Work location is imputed by the CBS using data on the location of the workplace and residential home. Each resident is linked to the closest plant of a firm, conditional on not exceeding the number of workers employed at that specific plant. Hence, we do not observe the work location of workers if they were not in the job in December. We assessed the consequences of the incompleteness and inconsistency of the variable work location by applying two robustness checks. First, we excluded all workers whose firm location is not completely observed for all jobs in the period 2006-2014 (see Table E1). Second, we ran a robustness check with firms that consist of 49 employees at maximum to ensure a low number of firm plants (see Table E2). We find similar results.

completely observed for all jobs and homes in the period 2006-2014. In multiple cases this was possible, as we did not perfectly link all the information of the Job Register to the Job and Wages Register and the Housing registers. In addition, we excluded individuals whose hourly wage is equal to or lower than one euro. Second, we excluded all workers with an employment spell shorter than three years. An employment spell of at least three years allows us to incorporate workers who had a stable job and who experienced an unexpected and involuntary job displacement. Thereby, the likelihood of false-positives was reduced. Moreover, this selection ensures that all workers were eligible for unemployment benefits for the first three months after job displacement, as in the Netherlands workers are eligible for one month of unemployment benefits for each year of tenure in the current job. By having a minimum benefits duration and controlling for the job tenure of the terminated job, we distance ourselves from the effect of benefits duration on post-unemployment labour market outcomes (Katz and Meyer, 1990; Bover et al., 2002). Third, we excluded all workers who, in the month prior to job displacement, worked at a firm with less than ten employees or who worked less than 64 hours in that month. Finally, we had to randomly exclude about 70% of the non-displaced workers (controls) due to computational limitations.

After the process of matching, if the displaced or non-displaced worker of a matched pair was not under observation for the entire period of fifty-five months, the matched pair was excluded. The matched pairs were excluded as the incomplete data imply data gaps due to, e.g., immigration, emigration or death. This selection ensured a weakly balanced sample.

Appendix B. Coarsened Exact Matching Procedure

In this Appendix we explain the Coarsened Exact Matching (CEM) procedure. In a matching algorithm there is the trade-off between efficiency and lower bias, i.e. the choice between complete matching and exact matching (Rubin, 2006; Caliendo and Kopeinig, 2008). Exact matching ensures a high quality of matching as the amount of imbalance between matched treated and controls is controlled and limited. However, CEM does not lead to complete matching. Complete matching is achieved if all treated are matched with at least one control. We performed CEM of treated to controls as we prefer a lower bias to efficiency gains. Moreover, we had the opportunity to exploit rich administrative data with a high number of potential controls. Exact matching on coarsened observables ensured that the treated and controls were observably equivalent.

Workers who were displaced due to firm bankruptcy are referred to as treated. The non-displaced are referred to as controls. In the month of job displacement, the treated were matched with a potential match of the group of controls. The controls were required to stay employed in the month of separation of the treated. Each treated was matched with a maximum of two controls. Note that the potential month of displacement of the matched control is equivalent to the actual month of job displacement of the matched treated. Except for job displacement due to firm bankruptcy, the controls were exposed to similar risks of labour turnover as the treated. These risks represent voluntary labour turnover and involuntary labour turnover. The treated or the matched controls were not allowed to be the counterfactual of another treated worker in the other months under observation. For this reason, the order of months in the period July 2007 to December 2011, in which we separately match treated workers with control workers, was taken randomly.

Before we applied CEM, the non-matched sample consisted of 31,888 treated workers. See Table D2 for individual summary statistics for the treated and controls based on the non-matched sample. The default set of matching variables we incorporated in the matching process consists of indicator variables for gender, age (21-30; 30-35; 35-40; 40-45; 45-50 and 50-59 years), children aged 18 or lower, spouse, Dutch nationality, tenancy, LTV (0; 0-33; 33-66; 66-100 and 100-133%), type of job (full-time or part-time), type of contract (fixed or temporary), job tenure (3-6; 6-12; 12-18 and over 18 years), work location (twelve provinces), firm

size (10-49; 50-99; 100-499 and 500 or more employed workers), firm industry (twenty-one ISIC sectors), calendar month and calendar year. The matched sample consisted of 20,152 treated workers, which implies a matching rate of 63%. See Table D3 in Appendix D for individual summary statistics of the treated and controls based on the matched sample.

The matching procedure we applied to balance treated and controls in covariates was successful. Based on the comparison of Table D3 to Table D2, we observe that the difference in sample means between the treated and controls was smaller after matching and many became economically insignificant. See Table D4 for an overview of the number of matched individuals by housing tenure category and treatment group. See Table D5 for firm size and firm sector summary statistics in the month of job actual displacement. See Table D6 for individual summary statistics distinguished by workers' housing tenure category.

To assess the implications of incomplete matching, we matched on the work location at the NUTS 3 level (40 areas) instead of at the provincial level (12 areas). The matched sample consisted of 14,284 matched treated workers. The matching rate decreased from 68% to 45%. Table E3 shows that the results are robust to a difference in the matching rate and matching on the NUTS 3 area.

As a robustness check, we matched not only on the default set of matching variables, but also on the worker's categories of the non-housing wealth position (below 0; 0-5,000; 5,000-25,000; 25,000-75,000 and over 75,000 euro) and duration of home occupancy (0-60; 60-180 and over 180 months). In this case, the number of matched treated was 10,128. In a separate robustness check, we used both the loan-to-income (LTI) ratio and LTV as approximations of household leverage.[18] For this robustness check, we matched not only on the default set of matching variables, but also on the LTI ratio categories (0-1.5; 1.5-3.0, 3.0-4.5; 4.5-6.0 and over 6.0). This approach resulted in 16,222 matched treated workers. As a final robustness check, we matched not only on the default set of matching variables, but also on the skill level (i.e. low, medium and high education). Matching on the skill level resulted in a relatively low number of 5,841 matched treated workers. The low number of matched treated individuals was caused by the selectivity of education data, as the education data were only available for individuals if they received their diploma after 1995. The three robustness checks are discussed in Appendix C.

Appendix C. Robustness Checks for the Empirical Models on Worker Characteristics

As discussed in Appendix B, we created a new matched sample for each of the three robustness checks. The matched samples for each robustness check were created based on a different set of matching variables, which included indicator variables for the non-housing wealth position and duration of home occupancy, LTI ratio, and skill level, respectively.

First, we assess whether the estimates of the interaction terms between job displacement and LTV are robust to the inclusion of approximations of non-housing wealth and duration of home occupancy. The non-housing wealth position of the displaced worker can be of importance for post-displacement outcomes, as it can aid job search through increased mobility or deter job search through decreased job search activity (Henley et al., 1994; Goss and Phillips, 1997). The duration of home occupancy approximates the willingness to move and is, consequently, an important driver behind the ability to become employed in a distant labour market. Moreover, we capture further unobserved heterogeneity in human capital by controlling for non-housing wealth and duration of home occupancy. Human capital is expected to be positively correlated to non-housing wealth and negatively correlated to duration of home occupancy, as high-skilled workers

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[18]We prefer the LTV to the LTI ratio as our main approximation of household leverage, because the LTV allows for within variation caused by changes in the property value and the mortgage debt. The LTI ratio does not allow for within variation caused by changes in income, as job displacement generates an artificial loss in income.

earn a relatively high income and are characterised by a relatively high geographical mobility (e.g., Bowles, 1970).

Table C1

The role of housing tenure, non-housing wealth and duration of home occupancy in the displacement effects (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
$DISPLACED \times POST \times$				
Housing tenure:				
$LTV = 0\%$	0.0249	-0.0033	4.9238**	-0.0006
	(0.0233)	(0.0141)	(1.9547)	(0.0018)
$0 < LTV \leq 33\%$	0.0195	0.0134	0.4676	0.0006
	(0.0133)	(0.0088)	(1.1557)	(0.0009)
$33 < LTV \leq 66\%$	0.0233**	-0.0192**	-1.2478	0.0002
	(0.0118)	(0.0079)	(1.0096)	(0.0008)
$66 < LTV \leq 100\%$	0.0380***	-0.0312***	-0.125	0.0001
	(0.0117)	(0.0078)	(1.0390)	(0.0009)
$100 < LTV \leq 133\%$	0.0836***	-0.0320***	-1.795	-0.0001
	(0.0145)	(0.0115)	(1.3998)	(0.0016)
Joint significance of LTV	6.93***	8.14***	2.63**	0.28
Non-housing wealth:				
$0 < WEALTH \leq 5,000$ euro	0.0482**	0.0146	-1.9366	-0.0040*
	(0.0192)	(0.0135)	(1.4872)	(0.0021)
$5,000 < WEALTH \leq 25,000$ euro	0.0540***	0.0242*	-2.4711*	-0.0025
	(0.0195)	(0.0136)	(1.4941)	(0.0020)
$25,000 < WEALTH \leq 75,000$ euro	0.0639***	0.0192	-2.1289	-0.0027
	(0.0204)	(0.0144)	(1.6134)	(0.0021)
$WEALTH > 75,000$ euro	0.0319	0.0004	-3.3393**	-0.002
	(0.0213)	(0.0155)	(1.6823)	(0.0021)
Joint significance of $WEALTH$	3.99***	2.87**	1.11	1.71
Duration of home occupancy:				
$60 < DURATION \leq 180$ months	-0.0115	-0.0092	1.3681	0.0003
	(0.0098)	(0.0068)	(0.8824)	(0.0011)
$DURATION > 180$ months	0.0362**	-0.0165*	0.8031	-0.0003
	(0.0151)	(0.0097)	(1.1801)	(0.0014)
Joint significance of $DURATION$	7.91***	1.51	1.31	0.37
Number of parameters	243	243	243	243
Number of individuals	24,950	24,950	24,950	24,950
Number of observations	1,372,250	1,246,029	1,230,402	1,372,250

Notes: The regression analyses include, besides the covariates, multiple three-way interaction terms. Three-way interaction terms are included among the variables *DISPLACED*, *POST* and *LTV*, among the variables *DISPLACED*, *POST* and *WEALTH* position, among the variables *DISPLACED*, *POST* and *DURATION* and among the variables *DISPLACED*, *POST* and all other covariates. *LTV* represents five indicator variables for homeowners' *LTV* expressed as a percentage. The reference category of each *LTV* indicator consists of workers who are tenants. The reference category of *WEALTH* consists of workers who have negative non-housing wealth. The reference category of *DURATION* consists of workers who live between zero and sixty months in their home. See Table 2 for additional notes.

The non-housing wealth is represented by five zero-one indicator variables that equal one for non-

housing household wealth below 0 (base category), between 0-5,000; 5,000-25,000; 25,000-75,000 and over 75,000 euro, respectively. The duration of home occupancy is represented by three zero-one indicator variables that equal one if the period in the home equals 0-60 (base category), 60-180 and over 180 months, respectively.

Table C1 shows the role of workers' housing tenure, non-housing wealth and duration of home occupancy in the displacement effects on the margins of adjustment. The estimates indicate that workers who have positive non-housing wealth experience a relatively low loss in employment. The results suggest that the loss in employment is decreasing and the loss in wage is increasing in workers' LTV. This result support the results of the model in which we do not control for non-housing wealth and duration of home occupancy (See Table 2). Note that by simultaneously controlling for housing tenure, non-housing wealth and duration of home occupancy, the fixed effects coefficients of the two highest LTV categories on hourly wage become slightly higher. Also, the role of housing tenure in the displacement effect on commuting distance is more pronounced. Compared with displaced underwater owners, displaced outright owners experience an increase in the commuting distance of about 7 kilometres higher.

Second, we assess whether our results are robust to the inclusion of the LTI ratio as an additional approximation of the financial incentive to work. The LTI ratio is constructed by the mortgage loan of year t relative to the gross household income of year t-1, where year t is the year of job displacement. The LTI ratio is time-invariant, to prevent the situation that a large share of variation in the LTI ratio is caused by changes in household income following job displacement. The LTI ratio is operationalised as five zero-one indicator variables, which equal one if the LTI ratio ranges between 0-1.5 (base category), 1.5-3.0, 3.0-4.5, 4.5-6.0 and over 6.0, respectively.

Table C2 shows the role of workers' housing tenure and LTI ratio in the displacement effects. We find that the fixed effects coefficients of the LTV on wage become higher if we include variables that represent the LTI ratio. However, the fixed effects coefficients of the LTV on employment become smaller and less significant. Compared with displaced workers who have an LTI ratio between 0 to 1.5, displaced workers with an LTI ratio over 6.0 experience a lower loss in the hourly wage. Note, however, that the results in Table C2 are relatively sensitive, as the categorical variables *LTV* and *LTI* ratio are highly correlated, i.e. a correlation equal to 0.88.

Third, we assess whether our results are robust to the inclusion of the worker's skill level. The impact of skill on the post-displacement losses is theoretically ambiguous. On the one hand, high-skilled workers have a higher job offer arrival rate. The higher job offer arrival rate is driven by the higher willingness to commute and relocate (Zax, 1991). Consequently, the distribution of job offers is increasing in the skill level of the displaced worker. Moreover, the market power of employers is decreasing in the skill level of the displaced worker. Hence, the losses in employment and wages for high-skilled displaced workers are likely to be relatively low. On the other hand, high-skilled workers have a relatively high wage premium due to their firm-specific human capital. If high-skilled workers invested more in human capital than low-skilled workers, the displacement effect on wage would be higher for high-skilled workers. Hijzen et al. (2010) show that high skilled workers have higher initial losses in wage than unskilled workers, but two years after job displacement the skill difference in wage losses becomes statistically insignificant. Farber (2017) shows that a higher number of years in education decreases the losses in employment and earnings.

The data we used on skill level is based on the international standard classification of education 1997, and is represented by three variables that equal one if the skill level is low (base category), medium, and high, respectively. We only incorporated the skill level in a robustness check, because the education data is highly selective as it is only available for individuals who received their diploma after the year 1995.

The fixed effects coefficients of LTV on employment that are shown in Tables C3 and C4 are based

Table C2

The role of housing tenure and the loan-to-income ratio in the effects of job displacement (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED $\times$ *POST* $\times$				
Housing tenure:				
$LTV = 0\%$	0.0182	-0.0157	1.2188	-0.0015
	(0.0171)	(0.0098)	(1.4024)	(0.0009)
$0 < LTV \leq 33\%$	0.0462***	-0.0058	-0.8464	-0.0005
	(0.0109)	(0.0070)	(0.9083)	(0.0005)
$33 < LTV \leq 66\%$	0.0278*	-0.0313***	0.6234	-0.0001
	(0.0168)	(0.0109)	(1.4444)	(0.0007)
$66 < LTV \leq 100\%$	0.0181	-0.0499***	1.4075	-0.0011
	(0.0192)	(0.0128)	(1.7113)	(0.0009)
$100 < LTV \leq 133\%$	0.0318	-0.0436***	1.1386	-0.0009
	(0.0218)	(0.0150)	(2.0181)	(0.0014)
Joint significance of *LTV*	4.32***	3.85***	0.80	1.19
Loan-to-income:				
$1.5 < LTI \leq 3.0$	0.0096	-0.0013	-0.9248	-0.0003
	(0.0140)	(0.0089)	(1.1891)	(0.0005)
$3.0 < LTI \leq 4.5$	0.0078	0.017	-2.8291*	0.0008
	(0.0173)	(0.0115)	(1.5171)	(0.0007)
$4.5 < LTI \leq 6.0$	0.028	0.0318**	-2.0954	0.0005
	(0.0193)	(0.0128)	(1.7196)	(0.0009)
$LTI > 6.0$	0.0243	0.0437***	-1.9796	0.0011
	(0.0202)	(0.0136)	(1.8190)	(0.0011)
Joint significance of *LTI*	0.99	4.62***	1.05	1.36
Number of parameters	218	218	218	218
Number of individuals	41,359	41,359	41,359	41,359
Number of observations	2,274,745	2,065,937	2,040,254	2,274,745

Notes: Parameter estimates of the three-way interaction terms among *DISPLACED*, *POST* and *LTI*, and among *DISPLACED*, *POST* and *LTI* are displayed. The reference categories of *LTV* and *LTI* consist of workers who are tenants and who have an LTI ratio between 0 and 1.5, respectively. The parameter estimates of the covariates and the two-way interaction terms are not reported. See Table 2 for additional notes.

on the sample in which we matched on the default set of matching variables and workers' skill level. The coefficients of the three-way interaction terms including the LTV without controlling for workers' skill level (see Table C3) are similar to the coefficients of the model including covariates for workers' skill level (see Table C4). Hence, we argue that the results are robust to the inclusion of variables that represent the skill level. Note, however, that compared to the parameter estimates provided in Table 2 of the model in which we do not match and control for the skill level, the coefficients shown in Tables C3 and C4 are different. Specifically, by matching on and controlling for housing tenure and skill level, the coefficients of

the two highest LTV categories on hourly wage become smaller. Hence, Tables C3 and C4 suggest that the difference in results is completely driven by the difference in sample, which can be explained by the fact that the education data is highly selective.

Table C3

The role of housing tenure in the effects of job displacement, sample of Table C4 (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × *POST*×				
Housing tenure:				
LTV = 0%	-0.0092	0.0187	2.1841	0.0013
	(0.0308)	(0.0191)	(2.8782)	(0.0033)
0 < *LTV* ≤ 33%	0.0137	0.0136	0.6967	0.0018
	(0.0180)	(0.0117)	(1.4101)	(0.0014)
33 < *LTV* ≤ 66%	0.0007	-0.0016	-1.3845	0.0028**
	(0.0156)	(0.0104)	(1.4063)	(0.0013)
66 < *LTV* ≤ 100%	0.0068	-0.0211**	0.5587	0.0011
	(0.0147)	(0.0096)	(1.3440)	(0.0013)
100 < *LTV* ≤ 133%	0.0684***	0.0060	-1.2052	0.0016
	(0.0169)	(0.0121)	(1.6898)	(0.0018)
Joint significance of *LTV*	4.39***	2.65**	0.84	1.23
Number of parameters	219	219	219	219
Number of individuals	14,028	14,028	14,028	14,028
Number of observations	771,54	686,218	674,767	771,54

Notes: The regression analyses include, besides the covariates, multiple three-way interaction terms. Three-way interaction terms are included among the variables *DISPLACED*, *POST* and *LTV* and among the variables *DISPLACED*, *POST* and all other covariates. See Table 2 for additional notes.

Table C4
The role of housing tenure and skill level in the effects of job displacement (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × *POST*×				
Housing tenure:				
$LTV = 0\%$	-0.0105	0.0185	1.4114	0.0011
	(0.0309)	(0.0190)	(2.9060)	(0.0033)
$0 < LTV \leq 33\%$	0.0120	0.0154	0.2910	0.0017
	(0.0181)	(0.0118)	(1.4346)	(0.0014)
$33 < LTV \leq 66\%$	-0.0007	-0.0006	-1.9666	0.0027**
	(0.0157)	(0.0105)	(1.4490)	(0.0013)
$66 < LTV \leq 100\%$	0.0090	-0.0207**	-0.4087	0.0009
	(0.0150)	(0.0099)	(1.3951)	(0.0014)
$100 < LTV \leq 133\%$	0.0733***	0.0042	-2.3556	0.0014
	(0.0172)	(0.0123)	(1.7555)	(0.0019)
Joint significance of *LTV*	4.90***	2.61**	1.01	1.14
Skill:				
MEDIUM SKILL	0.0175	-0.0087	1.7206	0.0004
	(0.0126)	(0.0081)	(1.1172)	(0.0009)
HIGH SKILL	-0.0165	0.0058	4.7758***	0.0009
	(0.0176)	(0.0115)	(1.7802)	(0.0013)
Joint significance of *SKILL*	3.45**	1.52	3.60**	0.22
Number of parameters	223	223	223	223
Number of individuals	14,028	14,028	14,028	14,028
Number of observations	771,54	686,218	674,767	771,54

Notes: The regression analyses include, besides the covariates, multiple three-way interaction terms. Three-way interaction terms are included among the variables *DISPLACED*, *POST* and *LTV*, among the variables *DISPLACED*, *POST* and *SKILL* and among the variables *DISPLACED*, *POST* and all other covariates. The reference category of *SKILL* consists of workers who attained lower education. See Table 2 for additional notes.

Table C5

The role of homeownership and continuous LTV in the effects of job displacement (Eq. (3))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × *POST*×				
Housing tenure:				
HOMEOWNERSHIP	0.0193**	0.0048	-0.0153	0.0005
	(0.0088)	(0.0057)	(0.7604)	(0.0006)
CONTINUOUS LTV	0.0002**	-0.0003***	-0.0044	0
	(0.0001)	(0.0001)	(0.0089)	(0)
Number of parameters	208	208	208	208
Number of individuals	54,229	54,229	54,229	54,229
Number of observations	2,982,594	2,719,569	2,686,297	2,982,594

Notes: The regression analyses include, besides the covariates, multiple three-way interaction terms. Three-way interaction terms are included among the variables *DISPLACED*, *POST* and *HOMEOWNERSHIP* and among the variables *DISPLACED*, *POST* and *CONTINUOUS LTV* and all other covariates. The reference category of *HOMEOWNERSHIP* consists of workers who are tenants. See Table 2 for additional notes.

Appendix D. Summary Statistics

Table D1 provides multiple statistics that improve our understanding of the within change in hourly wage and commuting distance for the displaced and non-displaced. The within change is calculated by taking the difference between the values of each variable eighteen months after job displacement and the month of potential or actual job displacement.

The displaced are characterised by a decrease in the hourly wage and the non-displaced by an increase in hourly wage. Half of all displaced workers experience no or a modest decline in commuting distance. For the displaced, the within hourly wage change follows a distribution with a long tail to the left. For the non-displaced, the within hourly wage change follows a distribution with a long tail to the right.

Half of all displaced workers experience a sharp increase in commuting distance after job displacement. The mean within change in the commuting distance for the non-displaced is close to zero. Only the bottom and top 5% experience a relatively small decrease and increase, respectively. The within commuting change has a substantial skewness and follows an asymmetrical distribution with a long tail to the right, especially for the displaced.

Table D1
The within change in hourly wage and commuting distance for displaced and non-displaced workers

	Hourly wage (log)		Commuting distance (km)	
	Displaced	Non-displaced	Displaced	Non-displaced
Mean	-0.0245	0.0414	3.6006	0.2691
St. Dev.	0.3116	0.1786	32.3825	14.8189
Variance	0.0971	0.0319	1,048.6236	219.6010
Skewness	-0.9973	1.1729	1.1568	0.2277
Kurtosis	31.2475	55.6833	14.4843	54.4108
1th percentile	-0.9594	-0.4967	-95.3368	-49.6782
5th percentile	-0.4577	-0.1572	-38.1269	-6.6214
25th percentile	-0.1247	-0.0010	-1.8662	0
50th percentile	0.0018	0.0338	0	0
75th percentile	0.0979	0.0871	8.9507	0
95th percentile	0.3351	0.2462	51.5134	9.3275
99th percentile	0.7473	0.5854	129.5867	54.6074
Number of observations	15,196	32,693	14,551	32,483

Notes: The individual summary statistics are based on the within change, measured by the difference in the values of each variable between the eighteenth month after job displacement and the month of job displacement.

Table D2

Individual summary statistics using the non-matched sample

	Displaced		Non-displaced		
	Mean	St. Dev.	Mean	St. Dev	t-statistic
Employment (=1)	1	0	1	0	
Hourly wage (log)	2.8579	0.3796	2.7951	0.4176	29.48***
Hourly wage (€)	18.8743	11.261	18.6003	41.4605	4.31***
Commuting distance (km)	14.8073	21.1692	17.5219	24.8161	-22.88***
Moving home (=1)	0.004	0.0632	0.0044	0.0661	-1.07
LTV (%)	59.5615	32.8507	60.6925	33.4721	-5.23***
LTI ratio	2.9782	28.1622	2.8718	3.4081	0.67
Mortgage debt (€)	120,461	115,406	111,089	113,978	14.49***
Property value (€)	215,537	222,552	197,057	284,727	14.81***
Non-housing wealth (€)	66,307	277,218	55,221	219,700	7.14***
Annual household income (€)	44,152	21,141	42,026	22,134	17.95***
Age (in years)	43.8438	8.5612	43.0404	8.7444	16.74***
Female (=1)	0.4381	0.4962	0.2692	0.4435	60.77***
Dutch (=1)	0.9116	0.2839	0.9022	0.2971	5.90***
Spouse (=1)	0.6223	0.4848	0.5971	0.4905	9.30***
No child (=1)	0.5192	0.4996	0.5316	0.499	-4.42***
Household members (#)	3.0033	1.3089	2.9828	1.3043	2.81***
Fixed contract (=1)	0.9539	0.2097	0.9166	0.2766	31.77***
Full-time job (=1)	0.6039	0.4891	0.7215	0.4483	-42.92***
Tenure in the job (in months)	148.9688	94.051	132.5316	87.3091	31.19***
Manufacturing sector (=1)	0.2497	0.4328	0.4759	0.4994	-93.24***
Duration of home occupancy (in months)	106.8996	58.4576	108.0195	59.7186	-3.42***
Number of individuals (#)	31,888		24,043,844		

Notes: The individual summary statistics, provided for the month of actual or potential displacement, are based on the sample prior to matching. The time period under observation is from July 2007 to December 2011. Sample means with standard deviations are provided for the treatment group and control group. The t-statistic is provided to assess whether the mean and standard deviation of each variable for the groups of displaced and non-displaced workers are statistically different from each other. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. By construction, all displaced and non-displaced were employed in the month of actual or potential displacement.

Table D3

Individual summary statistics using the matched sample

	Displaced		Non-displaced		
	Mean	St. Dev.	Mean	St. Dev	t-statistic
Employment (=1)	1	0	1	0	
Hourly wage (log)	2.8426	0.3686	2.8314	0.4101	3.30***
Hourly wage (€)	18.4981	8.8651	19.1812	38.6269	-3.13***
Commuting distance (km)	15.0456	21.5756	17.2607	24.4967	-10.98***
Moving home (=1)	0.0043	0.0651	0.0036	0.0597	1.22
LTV (%)	59.4587	31.7348	59.7254	31.9765	-0.81
LTI ratio	2.8357	2.9655	2.8737	3.3361	-1.38
Mortgage debt (€)	115,651	110,932	113,492	111,257	2.19**
Property value (€)	208,041	201,155	205,066	334,756	1.29
Non-housing wealth (€)	59,137	197,274	53,153	181,760	3.51***
Annual household income (€)	43,279	20,449	42,812	22,963	2.45**
Age (in years)	43.4753	8.7785	43.537	8.7269	-0.79
Female (=1)	0.2093	0.4069	0.2137	0.4099	-1.19
Dutch (=1)	0.9525	0.2127	0.9457	0.2267	3.54***
Spouse (=1)	0.6439	0.4789	0.6369	0.4809	1.63
No child (=1)	0.513	0.4998	0.5227	0.4995	-2.17**
Household members (#)	3.0727	1.3076	3.0375	1.2991	3.03***
Fixed contract (=1)	0.979	0.1432	0.9719	0.1652	5.29***
Full-time job (=1)	0.7946	0.404	0.784	0.4115	2.93***
Tenure in the job (in months)	143.0305	90.6646	142.8202	91.7574	0.26
Manufacturing sector (=1)	0.5266	0.4993	0.5209	0.4996	1.28
Duration of home occupancy (in months)	110.0975	59.4983	111.1839	59.5814	-2.05**
Number of individuals (#)	20,152		34,077		

Notes: The individual summary statistics, provided for the month of actual or potential displacement, are based on the sample after matching. The time period under observation is from July 2007 to December 2011. Sample means with standard deviations are provided for the treatment group and control group. The t-statistic is provided to assess whether the mean and standard deviation of each variable for the groups of displaced and non-displaced workers are statistically different from each other. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. By construction, all displaced and non-displaced were employed in the month of actual or potential displacement.

Table D4

Number of matched individuals

	Number of individuals		
	Displaced	Non-displaced	All
	(1)	(2)	(3)
Housing tenure:			
Tenant	5,256	8,804	14,060
$LTV = 0\%$	537	812	1,349
$0 < LTV \leq 33\%$	2,959	5,124	8,083
$33 < LTV \leq 66\%$	4,843	8,347	13,190
$66 < LTV \leq 100\%$	4,796	8,193	12,989
$100 < LTV \leq 133\%$	1,761	2,797	4,558
Total	20,152	34,077	54,229

Notes: The number of matched individuals is provided for each housing tenure category and treatment group.

Table D5
Firm summary statistics in the month of job displacement

	Firms			
	Bankrupt firms		Non-bankrupt firms	
	Mean	St. Dev.	Mean	St. Dev.
Firm size:				
1-9 employees (=1)	0	0	0	0
10-49 employees (=1)	0.7247	0.4467	0.6258	0.4839
50-99 employees (=1)	0.1114	0.3147	0.1400	0.3470
100-499 employees (=1)	0.1025	0.3033	0.1702	0.3758
500 or more employees (=1)	0.0614	0.2401	0.0640	0.2447
Firm sector:				
Agriculture, forestry and fishing (=1)	0.0099	0.0991	0.0042	0.0644
Mining and quarrying (=1)	0	0	0	0
Manufacturing (=1)	0.2415	0.4280	0.3474	0.4762
Electricity, gas, steam and air conditioning supply (=1)	0	0	0	0
Water supply; sewerage, waste management and remediation (=1)	0.0010	0.0311	0.0002	0.0136
Construction (=1)	0.1951	0.3963	0.2010	0.4008
Wholesale and retail trade; repair of motor vehicles and cycles (=1)	0.1999	0.4000	0.2207	0.4147
Transportation and storage (=1)	0.0691	0.2537	0.0515	0.2209
Accommodation and food service activities (=1)	0.0121	0.1093	0.0041	0.0636
Information and communication (=1)	0.0372	0.1893	0.0163	0.1268
Financial and insurance activities (=1)	0.0321	0.1764	0.0274	0.1634
Real estate activities (=1)	0.0041	0.0640	0.0012	0.0343
Professional, scientific and technical activities (=1)	0.0851	0.2790	0.0542	0.2265
Administrative and support service activities (=1)	0.0645	0.2457	0.0315	0.1746
Public administration and defence; compulsory social security (=1)	0	0	0	0
Education (=1)	0.0065	0.0805	0.0052	0.0717
Human health and social work activities (=1)	0.0317	0.1751	0.0314	0.1743
Arts, entertainment and recreation (=1)	0.0034	0.0581	0.0011	0.0338
Other service activities (=1)	0.0068	0.0820	0.0027	0.0518
Activities of households as employers and for own use (=1)	0	0	0	0
Activities of extraterritorial organisations and bodies (=1)	0	0	0	0
Number of firms (#)	4,137		27,109	

Notes: Means and standard deviations are provided at the firm level. The time period under observation is from July 2007 to December 2011. Bankrupts firms consist of all distinct firms of which an entity is declared bankrupt and a worker is displaced in the month of actual displacement. Non-bankrupt firms consist of all distinct firms where matched non-displaced workers work in the month of potential displacement.

Table D6

Individual summary statistics using the matched sample for each housing tenure category

		Housing tenure				
			LTV			
	Tenant	0%	0-33%	33-66%	66-100%	100-133%
Employment (=1)	1	1	1	1	1	1
Hourly wage (log)	2.6505	2.8474	2.8877	2.9223	2.9296	2.8711
Hourly wage (€)	14.8504	18.4154	19.1421	20.0920	20.2513	18.9327
Commuting distance (km)	12.2651	13.3215	13.9457	16.0412	17.1179	17.2717
Moving home (=1)	0.0081	0.0049	0.0023	0.0016	0.0032	0.0068
LTV (%)	/	0	19.8261	49.5076	83.0918	109.7967
LTI ratio	0.0399	0	1.4240	3.3449	5.3308	6.2244
Mortgage debt (€)	1,467	0	62,635	140,532	215,205	239,894
Property value (€)	/	328,333	330,791	285,318	260,397	219,108
Non-Housing Wealth (€)	23,576	219,632	94,881	66,394	56,354	45,496
Annual household income (€)	34,575	52,589	48,824	46,945	44,78	42,478
Age (in years)	42.3176	46.4894	48.4207	46.1283	41.1604	36.0476
Female (=1)	0.2299	0.1268	0.1501	0.2155	0.2212	0.2242
Dutch (=1)	0.8772	0.9938	0.9971	0.9835	0.9663	0.9632
Spouse (=1)	0.4048	0.6170	0.8300	0.7944	0.6687	0.5409
No child (=1)	0.6984	0.6995	0.5246	0.4222	0.3969	0.4655
Household members (#)	2.5125	3.1293	3.4461	3.3830	3.1767	2.9042
Fixed contract (=1)	0.9626	0.9840	0.9865	0.9865	0.9856	0.9743
Full-time job (=1)	0.8128	0.8399	0.7982	0.7657	0.7873	0.8259
Tenure in the job (in months)	126.0956	175.5739	174.0796	162.0679	132.7751	103.2345
Manufacturing sector (=1)	0.5034	0.7020	0.6472	0.5401	0.4748	0.4394
Duration of home occupancy (in months)	101.7157	144.5369	149.8603	127.7999	89.5446	61.0132
Number of observations (#)	5,256	537	2,959	4,843	4,796	1,761

Notes: Sample means, based on the sample after matching, are provided for each housing tenure category of the treatment group in the month of actual displacement. The time period under observation is from July 2007 to December 2011. By construction, all displaced and non-displaced are employed in the month of actual or potential displacement. The LTV and property value is observed if the worker is homeowner and not if the worker is tenant. Tenants can have a mortgage debt if they owned a home prior to their current rented home.

Appendix E. Robustness Checks for Models on Margins of Adjustment

Table E1
Two-way interaction model for sample of workers who have full information on the firm location (Eq. (1))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × POST	−0.2577***	−0.0512***	3.0087***	−0.0006***
	(0.0033)	(0.0020)	(0.2824)	(0.0002)
Number of parameters	161	161	161	161
Number of individuals	36,530	36,530	36,530	36,530
Number of observations	2,009,150	1,839,235	1,839,235	2,009,150

Notes: Each column gives the dependent variable. Clustered (by individual) standard errors are in parentheses. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. The reference category of *DISPLACED* and *POST*, consists of the non-displaced workers and pre-displacement period, respectively. The regression analyses include individual-specific fixed effects and indicator variables for housing tenure (5), age (3), children aged 18 or lower, spouse, the number of household members (3), the NUTS 3 location of the household (39) and calendar month (107). The period under observation is from January 2006 to December 2014. The parameter estimates of the covariates and the main effect of *POST* are not reported.

Table E2
Two-way interaction model for sample with firms which have 49 employees at maximum (Eq. (1))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × POST	−0.2338***	−0.0515***	3.9953***	−0.0007***
	(0.0035)	(0.0023)	(0.2860)	(0.0002)
Number of parameters	161	161	161	161
Number of individuals	27,375	27,375	27,375	27,375
Number of observations	1,505,625	1,375,974	1,358,117	1,505,625

Notes: Each column gives the dependent variable. Clustered (by individual) standard errors are in parentheses. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. The reference category of *DISPLACED* and *POST*, consists of the non-displaced workers and pre-displacement period, respectively. The regression analyses include individual-specific fixed effects and indicator variables for housing tenure (5), age (3), children aged 18 or lower, spouse, the number of household members (3), the NUTS 3 location of the household (39) and calendar month (107). The period under observation is from January 2006 to December 2014. The parameter estimates of the covariates and the main effect of *POST* are not reported.
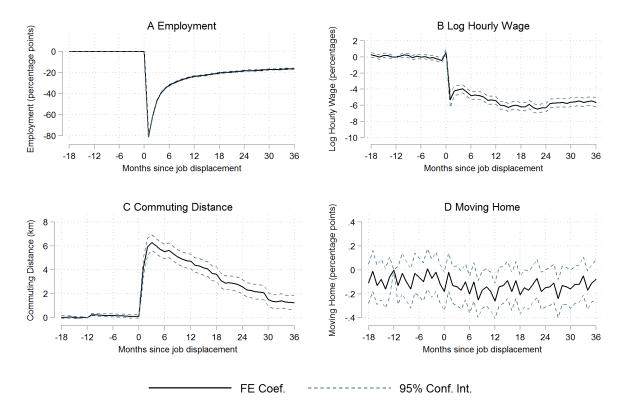
Table E3

Two-way interaction model for sample of workers who are matched on 40 NUTS 3 areas (Eq. (1))

	Employment (=1)	Hourly wage (log)	Commuting distance (km)	Moving home (=1)
	(1)	(2)	(3)	(4)
DISPLACED × POST	−0.2526***	−0.0649***	3.0940***	−0.0003
	(0.0031)	(0.0020)	(0.2790)	(0.0002)
Number of parameters	161	161	161	161
Number of individuals	35,756	35,756	35,756	35,756
Number of observations	1,966,580	1,782,424	1,760,123	1,966,580

Notes: Each column gives the dependent variable. Clustered (by individual) standard errors are in parentheses. ***,**,*, correspond to the significance level of 1%, 5%, 10%, respectively. The reference category of *DISPLACED* and *POST*, consists of the non-displaced workers and pre-displacement period, respectively. The regression analyses include individual-specific fixed effects and indicator variables for housing tenure (5), age (3), children aged 18 or lower, spouse, the number of household members (3), the NUTS 3 location of the household (39) and calendar month (107). The period under observation is from January 2006 to December 2014. The parameter estimates of the covariates and the main effect of *POST* are not reported.

Fig. E1. Displacement effects on employment (A), log hourly wage (B), commuting distance (C) and moving home (D) (Eq. (2)). For B and C, the post-displacement observations are included conditional on being in the first post-displacement job and not moved home. Reference group is the group of non-displaced workers. Reference month is the twelfth month prior to job displacement. The 95% confidence intervals are computed using standard errors clustered by individual. All four fixed effects regression models include 266 parameters of which there are 54 two-way interaction terms. See Table 1 for additional notes and statistics.
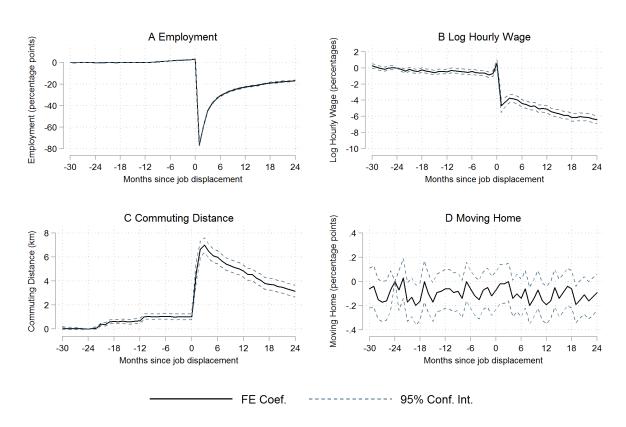
Fig. E2. Placebo treatment on employment (A), log hourly wage (B), commuting distance (C) and moving home (D) (Eq. (2)). Displaced workers are matched to non-displaced workers in the month of placebo treatment, i.e. the twelfth month prior to actual displacement. Reference group is the group of non-displaced workers. Reference month is the twenty-fourth month prior to job displacement. The 95% confidence intervals are computed using standard errors clustered by individual. All four fixed effects regression models include 266 parameters of which there are 54 two-way interaction terms. See Table 1 for additional notes and statistics.

Appendix F. Time-dependent Differences in the Importance of Demographic and Job Characteristics for the Displacement Effects

Figures F1-F6 show the importance of demographic characteristics for the displacement effects. Figure F1 highlights the gender differential in displacement effects. On the one hand, women experience a higher loss in employment than men. Importantly, the difference in the loss in employment diminishes over time since job displacement. On the other, women experience a smaller increase in the commuting distance than men. Figures F2A-F2B show that age directly increases the loss in employment and hourly wage. The age differentials in the displacement effect on employment and hourly wage are relatively persistent over the post-displacement period. Figure F3 shows that the nationality differential in displacement effects varies across time since job displacement. The estimates show that displaced workers who have Dutch nationality experience relatively modest losses in employment.

Figures F4-F6 highlight the role of job characteristics in the displacement effects. Figures F4A-F4B show that the worker's length of tenure in the displaced job, especially in the case of a job tenure higher than 18 years, increases the loss in employment and hourly wage, respectively. Figure F4C shows that workers who had a relatively short job tenure experience the smallest increase in the commuting distance. Figure F5 shows that displaced workers who were active in the manufacturing sector, as compared with the service sector, experience a substantial and persistent higher loss in the hourly wage of about 2-3 percentage points and a higher increase in the commuting distance of about 2 kilometres. The estimates shown in Figures F6A indicate that workers who are displaced later in time experience a higher loss in employment and hourly wage. Figure F6C shows that workers who were displaced in 2007 experience a relatively large increase in the commuting distance. This finding can be explained by a potential seasonality effect, as the workers who were displaced in 2007 were displaced between July to December. The other displacement cohorts consist of workers who were displaced in any month of the calendar year.
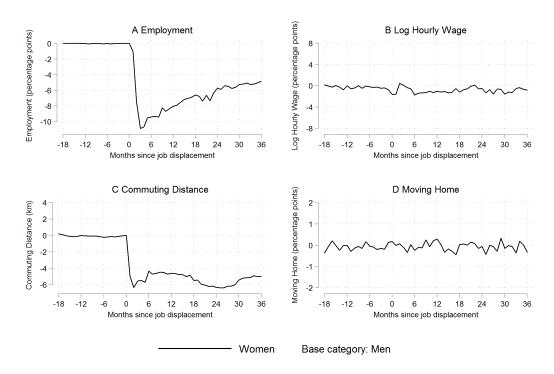

Fig. F1. Gender differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.
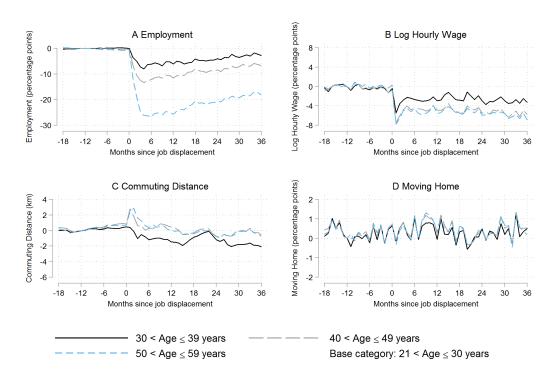
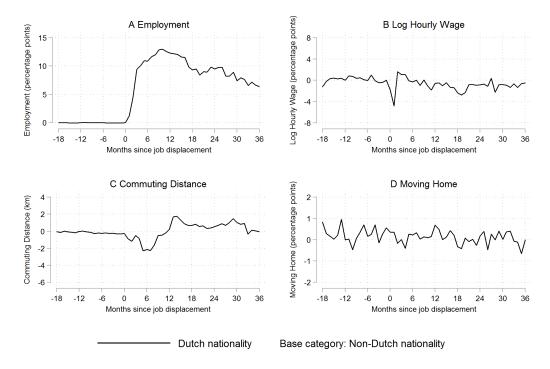**Fig. F2.** Age differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.

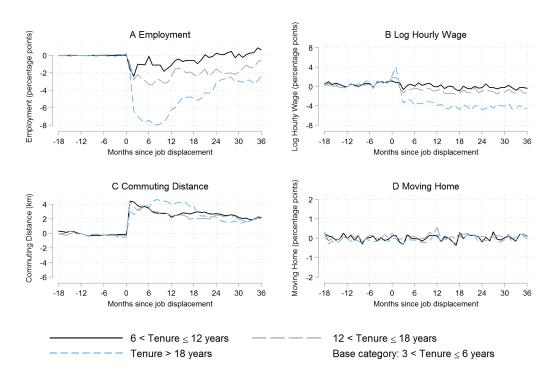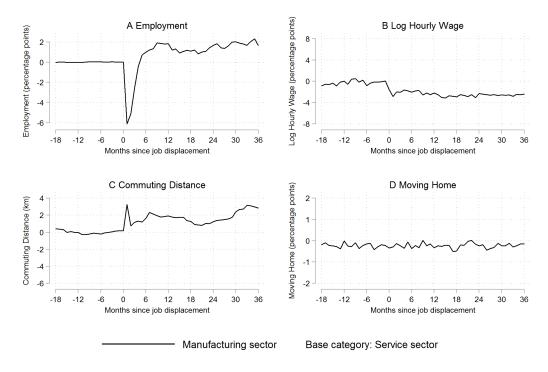**Fig. F3.** Nationality differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.

Fig. F4. Job tenure differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.

Fig. F5. Industry differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.
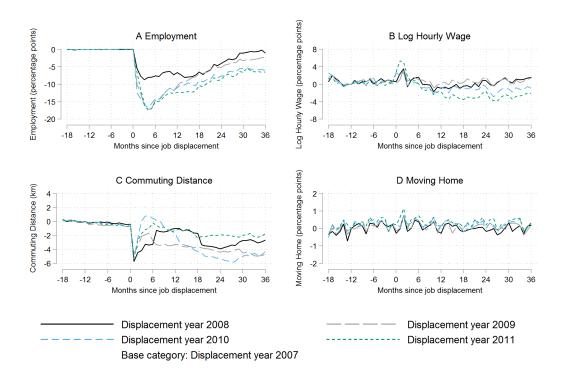
Fig. F6. Displacement year differential in displacement effects (Eq. (4)). See Figs. 1-2 and Table 2 for additional notes.

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