Replacement Rates and Long-Term Outcomes after Job Displacement

Barnette, Justin

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Justin Barnette
Department of Economics
Kent State University
jbarn25@kent.edu

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Abstract

The goal of this paper is to provide a bridge between the job displacement literature that uses long time panel data and similar work with a limited panel. This paper finds that a worker needs to replace 120% of their predisplacement income in the first two years after the event to avoid a long-term fall in income. This marginal replacement rate has variation with lower rates having much larger marginal impacts than higher replacement rates. The two results hold up to several robustness checks and generally align with a standard labor income process that has displacements as a fall in the permanent component of the process. These results provide proper context of how the first job after displacement affects the worker's later income growth.

Keywords: Displaced Workers, Job Loss, Unemployment
JEL Classification: J63, J31, E24

Introduction

Policy makers and economists want to understand the effects of job displacement. This is important because it is related to our understanding of globalization, recessions, and the economic consequences of mass layoffs. Several sources find that the effect of involuntary job displacement is a permanent decrease in income on average.[1] However, these permanent impacts vary with some of these workers recovering.[2] Additionally, most data available to study worker's income and unemployment are limited in their panel aspect. For example, the outgoing rotation groups of the Current Population Survey (CPS) provides two data points on respondents that are roughly one year apart. Data associated with training programs often work the same way in that they usually have a data point before entering a program and another after exit. These datasets with a limited panel dimension are much more broad which allows a better investigation into the characteristics of those with different experiences, though. But how informative is this for the longer consequences of job displacement?

The goal of this paper is to provide a bridge between the job displacement literature that uses long time panel data and similar work that uses data with a limited panel. This paper uses the Panel Study of Income Dynamics (PSID) which works well for this since it is a representative sample over a long time period and for this reason it is commonly used in the research on job displacement. This paper limits the displaced workers to those with information directly before and after their job displacement. In this way, a dataset is created where a portion of it can been examined as if it were one from a training program or from the outgoing rotation groups that do not have the long time panel element. This paper's sample allows an examination

[1] See Carrington and Fallick (2017) for a recent overview of these sources.
[2] See Barnette and Michaud (2017) for characteristics of a minority that experiences long-term recovery while Farber (2017) shows evidence for a minority that experience short-term recovery.

of the long-term impacts of displacement on workers based on the information before and after the event.

This paper finds that a reemployed worker gains approximately 3.5% in long-term hourly income for every 10% gain in this income after displacement relative to the hourly income before. This comparison of income before displacement to the income after it, is this paper's replacement rate, which is defined formally later. There is variation in this result with workers that have a lower replacement rate have a stronger marginal effect. For example, when examining workers that are displaced with a replacement rate lower than 120%, a 10% increase in their replacement rate leads to a 5.2% increase in long-term hourly income. For those workers with a replacement rate lower than 80%, a 10% increase in this replacement rate increases hourly income by 6.8%.

Displaced workers who are reemployed and recover at least 120% of their hourly income avoid the long-term impacts that have been documented in the literature. This recovery holds using different specifications to the estimation as well as different subsamples and various controls like the unemployment at the time of displacement. It is not clear where this cutoff point should be for an immediate replacement rate and its impact on the long-term income of a worker. A replacement rate of 100% is not enough since that only catches up to income before the displacement event rather than the worker catching up to their peers.

The replacement rates found in the literature are well below the 120% found in this paper which indicate that the workers from previous research do not recover in the long-term. In fact, most of the statistics in the literature suggest that these workers are not recovering their pre-displacement income. The program evaluation literature typically has replacement rates less than 100%. For example, Decker and Corson (1995) is the most cited paper to evaluate the

Trade Adjustment Assistance program and that paper documents replacement rates of 76-92%. Davis and Von Wachter (2011) use Social Security administration records in their study of displacement and their replacement rates are also less than 100%. Farber (2017) uses the Displaced Worker Surveys of the CPS to examine the short run changes of displaced workers. Although he finds 28-39% of full-time workers increase their earnings after displacement, on average, the displaced workers in his sample also have replacement rates below 100%.

The findings are checked against a calibrated simulation of the labor income process where a displacement there involves a shock in permanent income that is like that found in the data. This is used since there is little to no research on this topic. The income process produces results similar to the empirical results presented within this paper. In the simulation, agents no longer have these long-term negative consequences after achieving a replacement rate of at least 140%. The results also have similar variation with the lower replacement rates having bigger long run effects on income on the margin compared to the higher replacement rates. The biggest difference is at the low end of the replacement rates which show a smaller long-term impact in the simulation than in the PSID.

Data

This paper uses the heads of households between 18 and 65 years of age from the 1968-2017 waves of the PSID. The primary focus is on the sample constructed by the Survey Research Center which was designed to be representative of the US population although the robustness section of this paper examines the PSID data beyond this sample. Each individual needs to be present as the head of the household at least three times with at least three non-zero income observations as head of the household. Additional requirements for inclusion in this paper's sample are detailed below.

A key independent variable is involuntary displacement and this paper follows the literature to determine who has met this requirement in the PSID. The idea is to use workers who have changed jobs involuntarily.[3] Heads of households with reported low tenure are asked what had happened with their previous job. Respondents can choose from various options of what has happened but following work such as Stevens (1997) and more recently Krolikowski (2018), this paper considers displaced workers to be those that have changed their previous job due to being laid-off or due to the plant closing. Any respondents who have changed jobs prior to 1968 are not part of this sample since the respondents do not report the reason for changing their job prior to 1968.

The replacement rate is constructed by examining the dependent variable up to two years before displacement and up to two years after displacement. This paper uses the maximum value of the dependent variable from two years before displacement or in the year before the event; this is placed in the denominator. The same is done after displacement where the dependent variable in the year after displacement and two years after the event are examined. Again, the maximum value of the two is used with this value after displacement placed in the numerator of the replacement rate. The year before or after and two years before or after are used to account for the change in the PSID which moved to a biannual format after 1997. Additionally, the timing of displacement in the PSID is difficult as noted by Stevens (1997) and Krolikowski (2018) and this method helps with this timing issue. Creating the replacement rate in this fashion misses some displaced workers since they may be missing information in the two years before or after the displacement which leads to a missing replacement rate. All 13,525 observations for these 1,393 workers with a missing replacement rate are dropped from the sample. 75% of these are

[3] See Jung and Kuhn (2019) for a discussion on the terminology of displaced workers.

dropped because there is no information on these workers before displacement, which can occur if the worker is not consistently the head of the household or if the worker is displaced in the first year as the head

The main dependent variable for this paper is hourly income normalized with the consumer price index (CPIURS) to 2017 US dollars. Respondents of the PSID surveys are asked about several different types of income earned in the previous year along with the hours worked to obtain those different types of income. This main dependent variable is then simply the annual income from all income sources divided by all the hours worked by the individual. 62 observations are top coded in income and are therefore dropped from the sample.

The summary statistics for the sample of this paper are displayed in Table 1. The first column provides the summary statistics on those that are not displaced. This makes up those that are never displaced along with those that are not displaced but will be displaced later. Due to the way that the replacement rates are calculated, every worker in this sample is accounted for in that first column at least once. Overall, this paper will focus on 8,234 workers and their 102,077 observations.

The second column of Table 1 indicates that 2,055 workers in this study experience at least one displacement. The displaced workers are slightly older on average since they need to have been in the data at least once before this experience. These workers are of lower education which makes this an important control variable in the baseline estimation. The annual income and hourly income are lower for displaced workers which goes along with the literature on the topic. Although not presented in the table, the hourly income immediately before displacement is $22.53 but this is skewed by age, education, and the year of the sample. After accounting for these, the difference between workers that are never displaced versus workers that are not

displaced but will be displaced later is less than one percent.[4] Finally, just over half of the displaced workers experience more than one displacement.

This paper's replacement rates are larger than those mentioned in the introduction. The replacement rates in Table 1 indicate that workers replace their income within two years of displacement. The averages of the replacement rates are 133%-137% with the medians being 105%-110% depending on the measure of income. The differences of the replacement rates in Table 1 compared to those mentioned in the introduction are based on the nature of the data and the construction of the replacement rate. One difference is the replacement rate which is the maximum value of reported income found two years after the displacement event compared to this income two years before the event. Therefore, the length in time could be four years which is a contributor.[5] Another difference is due to losing displaced workers who have no replacement rates.

Methodology

This paper estimates the cost to displacement using an approach that builds off of Jacobson, LaLonde, and Sullivan (1993), Stevens (1997), and Krolikowski (2018). An equation like the following has also been used recently in Jolly (2015) and several current working papers:

$$Y_{it} = \alpha_i + \psi_t + \beta X_{it} + \boldsymbol{\delta D_{it}} + \rho R_{it} + \epsilon_{it} \qquad (1)$$

The dependent variable, Y_{it}, is the log transformation of income with the main emphasis of this paper being on hourly income. Although this paper also uses annual income for this estimation, the annual income is not the focus since the results could be driven by hours and the

[4] This adjusted comparison of never displaced workers to workers who will be displaced later is done with a basic regression of log hourly income on age, age^2, age^3, time dummies and the level of education; the difference in the residuals is 0.006.

[5] An alternative calculation for the replacement rate using the annual data from the PSID is explored in the robustness section of this paper. It lowers the replacement rate by 10 percentage points but it does not change the main results from this paper.

hourly rate. The estimation includes fixed effects for the individual, α_i, and controls for time using annual year dummy variables with ψ_t. The time varying variables, X_{it}, include the age, age squared and the cubic of age. Because the age income profile varies based on education level, age, age squared and the cubic of age is also interacted with whether the head of the household has at least 16 years of education and less than 12 years of education. This addresses the differences in education for displaced worker that is evident in the summary statistics.

$\boldsymbol{D_{it}}$ is a vector of time varying dummy indicators related to displacement and this vector takes two different formats in this paper. The paper begins with a dummy variable for six years before displacement then a different dummy variable for every year up until displacement, with one for the year of displacement and a different variable for every year after displacement until a dummy indicator for whether it has been at least 20 years since displacement. This vector also includes time variant dummy variables for whether the worker has been displaced at least twice, three times, four times or at least five times since Stevens (1997) highlights the cost of multiple job losses. For workers that are never displaced, the dummy indicators are zero. These dummies are also zero for workers that are displaced at least seven years later in the sample. Therefore, this avoids the bias of the original specification in Jacobson, LaLonde, and Sullivan (1993) that is noted in Krolikowski (2018) and Jung and Kuhn (2019).

The main specification for this paper has this vector, $\boldsymbol{D_{it}}$, as time variant dummy indicators on the frequency that this worker has been displaced. Stephens (2001) has a specification like this to estimate the average of the post displacement effects on consumption. Previous research such as Huckfeldt (2018) also suggest that the fall in hourly income is a permanent fall with no change over time. While this approach does not account for the decrease in income that may occur before the displacement occurs, not controlling for the time

immediately before displacement provides a cleaner interpretation for the effect of the replacement rate.[6] $\boldsymbol{D_{it}}$ still includes time variant dummy indicators on whether this worker has been displaced at least twice, three times, four times or at least five times. The dummies in this specification are zero if the worker has not been displaced at the time of the interview but will be any time later in the sample.

The replacement rate, R_{it}, takes various forms to indicate how it impacts income. First, this paper considers the replacement rate, R_{it}, as a vector of dummy variables for the replacement rate in increments of 10 percentage points and ending at whether the replacement rate was at least 290%.[7] This specification has a dummy variable for the worker's replacement rate between zero percent and 10%, 20% to 30%, etc. As an example, if the worker had a replacement rate between zero to 10%, that dummy variable is one for all the years once displacement occurs. The distribution of these dummy variables are plotted in Figure 1. The plots for hourly and annual replacement rates are relatively smooth with the last point indicating that approximately 5 percent of replacement rates are above 290%. These dummy variables are useful since it allows flexibility in examining the effect of the replacement rate on long-term income. The actual replacement rate is also considered to examine the marginal impact of a changing replacement rate and how additional variables may affect this impact.

Results

The first set of estimates are shown in Figure 2**.** The results have estimates of a similar range as that found in Huckfeldt (2018) and Krolikowski (2018). Specifically, hourly income falls by about 14% in the year after displacement. Nineteen years later, hourly income is still

[6] The robustness section shows that changing to a specification that controls for the time leading up to the displacement has no impact on the results.
[7] The main results of this paper are unchanged when using 20% increments for the replacement rates.

approximately 13% lower than what you would expect given the worker's age and education level. Income begins falling before displacement as is commonly found in the this literature going back to at least Jacobson, LaLonde, and Sullivan (1993). In this case, the hourly income is approximately 5% lower four years before prior to displacement with the results smaller and statistically insignificant five and six years before the event. Figure 2 also demonstrates the impact of involuntarily job displacement on annual income. The figure shows that one year after job displacement, annual income is approximately 35% lower than normal. This is a much bigger drop than the change in hourly income, but this difference is due to the change in hours.

The point estimates from Figure 2 for the changes in hourly income are not statistically different from one another for nearly every year after displacement. Three years after displacement, the point estimate for the change in hourly income reaches its largest fall. However, the estimates are not statistically different from one another for every year after one year since the event. Additionally, after three years since displacement, the difference between the impact on hourly income and annual income is no longer statistically significant. This provides further support for the specification that estimates the average of the post displacement effects with simple time varying dummy variables. This specification with the simple time varying dummy variables decreases the estimated cost of involuntary job displacement since it ignores the fall before the event takes place. Ignoring the time before displacement simply shifts the curve from figure 2 up; this shift does not impact the main results of this paper as is discussed later and shown in Table 3.

Figure 3 demonstrates how the hourly income replacement rate impacts this long-term cost to this income. This figure plots the results for the coefficients on the various replacement rate bins. These results indicate that when a worker's replacement rate for hourly income is

between 90% and 100%, the long-term impact on that income is a fall of approximately 12.1%. If the replacement rate is 100% to 110%, hourly income for these workers is 8.1% smaller compared to another worker of the same age and education class. However, the difference of these two groups are not statistically significant. In fact, these results are not statistically different until workers have had at least 120% of hourly income replaced. At this 120% replacement rate, the long-term cost to involuntary job displacement is not statistically different than zero. Figure 3 also has annual income with a replacement rate on this income above 120% leading to no long-term damages to annual income.

Figure 3 demonstrates variation for recovery based on replacement rates. Overall, a fitted trend for hourly income in this figure has a slope of 0.35 indicating that a 10 percent increase would increase long-term hourly income by 3.5%. A fitted trend for annual income implies a 10 percent increase in this replacement rate leads to annual income increasing by 5%. Low replacement rates have a steeper slope indicating that marginal changes in this rate have a larger impact over one's life.[8] Alternatively, high replacement rates have a smaller slope indicating that these marginal changes in the replacement rate have a smaller impact on the long-term. Figure 3 demonstrates that changes to annual income are like changes to hourly income but the more extreme replacement rates having a bigger impact on long-term annual income since there are two things that can be impacted here: the rate and the hours. The asymmetry in slopes also exist for annual income with the lower replacement rates having a larger marginal impact than the higher replacement rates.

Table 2 displays the results when estimating the average effect of each job displacement for those that have a replacement rate below the 95th percentile.[9] The standard errors in this paper

[8] This changing slope of Figure 3 is investigated more thoroughly in the robustness section of this paper.
[9] The robustness section examines the main results of this paper when using all the displaced workers.

are clustered at the individual level. The results indicate that hourly income drops by approximately 11% upon displacement. This is slightly smaller in magnitudes compared to Figure 2 since in that figure, the average fall in hourly income is 13%. This result of 11% is smaller since the fall in income is compared to one or two years before displacement as opposed to being compared to seven or eight years before displacement.[10]

The marginal impact of the replacement rates due to displacement is also in Table 2. The result of 0.352 for the coefficient on the replacement rate indicates that for every 10-percentage point increase in the replacement rate for hourly income, this income rises by 3.52%. This is in line with the slope of Figure 3. For a further demonstration of these marginal effects along with the general cost of displacement, consider a displaced worker who is only displaced once and has a 75% replacement rate for hourly income. This income would be 48.8% lower than the worker's peers due to the displacement but with a replacement rate of 75%, this worker's hourly income is 22.4% lower (0.352*0.75 - 0.488 = -0.224). A worker in the same situation with an 85% replacement rate for hourly income ends with this income being 18.9% lower overall.

Robustness

The rest of Table 2 provides slight alterations to the baseline estimation of equation (1). The baseline estimation in column (2) does not include controls for the time before displacement. This is not done in the baseline because doing so would include a control on the year for which the replacement rate is calculated. However, column (3) includes these controls which results in no statistical difference in the marginal impact on the replacement rates. Column (4) reruns the baseline estimation with individual time trend controls to be sure that the growth rates in income are not driving the results. Again, these controls are not included in the baseline estimation since

[10] This difference in relative comparison does not impact the main results of this paper.

this would also affect the interpretation of the replacement rates. With these included, the marginal impact of the replacement rate is larger in magnitude but this is coming from the difference of the estimates at the lower end as is clear in Figure A of the appendix. Recall that Figure 2 makes clear that the changes in hourly and annual income converge quickly and therefore we find similar results in column (5) compared to column (2). The impact of the replacement rate on income overall has a greater magnitude but because annual income is a product of hours and the hourly rate, the results are noisier.

Davis and Von Wachter (2011) show that the unemployment rate at the time of displacement is also important for understanding the long-term fall in income after the event. For this reason, column (4) of Table 2 examines the results while controlling for the state unemployment rate at the time of displacement. The marginal effect of an increase in the replacement rate is no different for this specification compared to the baseline specification in column (2).[11] Also, notice that because state unemployment rates are publicly available starting in 1976, the observations and individuals for this subsample is smaller.[12]

The results of several more robustness checks are in Table 3. The nature of these checks involve different samples for which the estimate is run. For each of these samples, the same requirements are used in creating the main sample: each household must be in the sample three times with at least three non-zero observations on hourly income, which is the dependent variable in all the estimations in Table 3. While the specification is the same as the one in column (2) of Table 2, Table 3 only reports the coefficient on being displaced at least once and the coefficient on the replacement rate.

[11] Figure A of the appendix also demonstrates that controlling for the state unemployment rate does little to the main results of this paper.
[12] Using the national unemployment rate at the time of displacement produces results which are not statistically different from the state's unemployment rate at the time of displacement.

Overall, Table 3 contains the main results of 24 estimations. The sections labeled a, b, c, and d have different samples for displaced workers in the estimation. Section a has all the displaced workers from this paper's sample. Section b only has the displaced workers with a replacement rate below 293%, which are the replacement rates below the 95th percentile; this is the same discriminating factor used throughout this paper and presented in Table 2. Section c has estimations for the displaced workers with replacement rates below 120% and section d has estimations for the displaced sample with replacement rates below 80%. For each of section b, c or d, if a displaced worker has a replacement rate above the threshold, every observation for that worker is ignored.[13]

The columns of Table 3 indicate different samples for the main estimation. Column 1 is the main sample from this paper. For a frame of reference, the results in column (1) and section b of Table 3 represents the key components of the baseline estimation presented in column (2) of Table 2. Column (2) uses the representative sample from the PSID discussed above together with the oversampled poverty group. To account for this oversampling, column (2) uses the household weights provided by the PSID. Column (3) is the same as the main sample of this paper but only includes observations from workers that are at least 25 years old since workers with 25 years of age are less likely to increase their education after a displacement compared to an 18-year-old. Column (4) provides the results for estimations that only uses workers that have at least three years of tenure unless it is a displaced worker who must have had 3 years of tenure before the displacement. This column is provided since workers that enter training programs typically have several years tenure; this is also commonly used in the displaced worker literature. Column (5) uses the PSID waves before 1998 since these waves are conducted annually. Using

[13] The results are nearly identical when including the observations for these workers with relatively higher replacement rates before displacement.

this subset allows the construction of an alternative replacement rate using one year before displacement and one year after rather than the two years before and after as mentioned above.

Table 3 makes clear that the sample in this paper is not driving the main results. The effect of the marginal impact is usually not statistically different while moving across the table from column 1 through column 5. Table 2 also demonstrates the changing slope that is visible in Figure 3 as well as the figures in the appendix. When including displaced workers regardless of their replacement rate, the results usually indicate that an increase in 10% of the replacement rate indicates a 1.2% increase in long-term hourly income. However, when examining lower replacement rates, these marginal effects rise. For replacement rates below 120%, the marginal impacts rise to a 5.2% increase in long-term hourly income for a 10% increase in this replacement rate. The marginal impact rises even more for displaced workers with replacement rates below 80%. Again, this idea is imbedded in Figure 3 although it is shown more formally here.

The marginal impacts for the different groups also allow us to examine what would be the break-even point based on these slopes. Consider column (1) of section c in Table (2) for the sample with replacement rates below 120%. A displacement causes a 63% drop in long-term hourly income but a replacement rate of 121% indicates a full recovery (-0.63+1.21*0.52). The break-even point for section c is consistently around 120% which goes along with the findings in Figure 3 as well as the figures in the appendix.

Although not presented here, estimating the changes in long-term hourly income for those with replacement rates above 120% relative to those that have not been displaced yet again yields no long-term change. This is also not driven by those with the best replacement rates. As an example, for a replacement rate above 120% but below 160%, which constitutes 21% of the

displacement observations, the point estimates are positive although not statistically different from zero. Additionally, although not present in the tables, there are no major differences in education, race, marital status, nor the number of children for those with replacement rates above 120% versus those below.

Simulation

To examine the context of this paper's results, consider a basic and common income process with both transitory and permanent shocks that has been used throughout the literature.[14]

$$Y_{i,s} = P_{i,s}\theta_{i,s} \tag{2}$$

$$P_{i,s} = G_s P_{i,s-1}\phi_{i,s} \tag{3}$$

$$\log \theta_{i,s} \sim N(-\frac{\sigma_\theta^2}{2}, \sigma_\theta^2) \tag{4}$$

$$\underset{\text{Shock}}{P_{i,S}} = \begin{cases} (1-d) & \text{with probabilty } \pi \\ \phi_S \text{ where } \log \phi_S \sim N\left(-\frac{\sigma_\phi^2}{2}, \sigma_\phi^2\right) & \text{with probability } (1-\pi) \end{cases} \tag{5}$$

Income for agent *i* at age *s* is denoted with $Y_{i,s}$ in equation (2) and it has a temporary component, $\theta_{i,s}$, and a permanent component, $P_{i,s}$. The temporary component is a one period shock that follows a log normal process described in equation (4); this has an expected value of one. The process for the permanent component follows equation (3). Specifically, it grows at a standard rate G_s, for all agents that depends on the age of the agent. This permanent component is also subject to shocks, $\phi_{i,s}$. These shocks can either follow a log normal process with an expected value of one at probability π, otherwise the permanent process experiences a fall of *d*.

Simulating the income process like this common. Support for using this type of process goes back to at least MaCurdy (1982). Heathcote, Perri, and Violante (2010) provide a review of

[14] See the Meghir and Pistaferri (2011) in the latest Handbook of Labor Economics for more details on simulating the income process.

several papers that use this along with different strategies for calibrating it. Carroll and Samwick (1997) use this process with log normal shocks like (4) and (5) but they apply an additional shock to the temporary component rather than the permanent component here. Barnette (2020) uses the same process as the one used in this paper to study the effects of displacement on wealth and consumption.

The parameters for equations (2) through (5) are estimated from this paper's sample that comes from the PSID. This paper follows Heathcote, Perri, and Violante (2010) in estimating the distribution for the two different shocks (θ and ϕ) using the method of first differences of log hourly income. The results for this procedure are available in Table 4. The permanent effect for displacement, d, is set to 0.127, which is the average effect from job displacement after controlling for the fall in income before the event.[15] The average growth rate in hourly income for the middle 90% of each age, s, determines G_s. The bottom and top 5% of growth rates are dropped because these rates are taken without condition which leads to extreme values.[16] The probability of this shock, π, is based on the data with it chosen so that 24.96% of the sample experiences at least one displacement like that in the data; this results in the displacement shock hitting 0.6% of the observations ($\pi = 0.006$).

These equations create artificial data for 200,000 hypothetical agents aged 18 through age 65. The starting point for the permanent component of income is at age 47 since this is halfway through the lifespan of the workers. $P_{i,47}$ is set to \$31.37 for every agent, to match the average hourly income for a 47-year old in this paper's sample. Using this as a starting point and using

[15] This choice is not driving any of the results for the simulation. Table E section a in the appendix shows alternative results using the effect of displacement being a 9% fall in the permanent component. Table E section b shows another alternative with the agents losing 5% in the permanent component in the four years before displacement and losing the rest in the year of the event; the results show little change.

[16] The results for the simulation are nearly identical when dropping the bottom and top 25% of income growth observations conditional on age in the PSID to calibrate G_s.

the process of equation (3) creates artificial permanent components forward and back for each agent participating in the labor force for every year of age 18 through age 65. With $P_{i,s}$ created for every agent at every age, this is plugged into equation (2) to create an artificial hourly income for every agent at every age.

Summary statistics for the simulated data are in Table 1. The biggest differences are the ages with agents in the simulation working every year from 18 through 65, the age distribution is slightly older there compared to the PSID.[17] This age difference is part of the reason that the average hourly income is larger for non-displaced agents versus their counterparts in the data. This is also part of the reason for the big difference in income for the displaced agents in the simulation. There, the displaced agents are nearly 9 years older on average which explains why their income is larger than the non-displaced agents.

The rate of displacement is lower in the simulation than that in the data since the target was to hit the proportion of agents displaced.[18] 24% of the agents are displaced leading to 13% of the observations being of displaced agents whereas 21% of the observations are of displaced workers in the data. This smaller rate of displacement explains why a large majority of the displaced agents only experience one displacement while the data has a little less than half of the displaced individuals only experiencing one displacement. Finally, the replacement rates are similar. On average, agents earn 35% more income after their displacement compared to the data's rate of a 33% increase after displacement. This again points to the fact that the replacement rates are higher here than elsewhere in the literature based on replacement rates

[17] The main results for the paper are unchanged when changing the simulation's age distribution and the distribution of labor force experience to be like that in the PSID.
[18] The main results for the paper are unchanged if the calibration strategy is instead to target the displaced observations instead of the displaced agents.

being calculated from the maximum of two years before displacement compared to two years after displacement.

The main purpose of this artificial data is to use it to estimate equation (1). Again, the dependent variable is log income from the simulation with this calibrated to hourly income from the PSID. The time varying controls are age, age squared and age to the third power with the displacement vector being simple time variant indicators of whether one has been displaced at least once, at least twice, at least three times or at least four times. There is no indicator for being displaced five times since it is so rare in the simulation as is clear in the summary statistics of Table 1. The replacement rate is constructed like the one from the data. Specifically, the rate uses the maximum of the income in either the period before displacement or two periods before displacement. Similarly, the rate uses the maximum of the income in the period after displacement or in two periods after displacement. For proper comparison to the PSID, the estimates include individual fixed effects. Additionally, for estimating displacement, the Table 2 includes those displaced agents in the bottom 95% of replacement rates.

The results for the simulation's estimations are within Table 5. Column (1) indicates that being displaced once costs the agents approximately 12% of their income on average.[19] Column (2) presents the estimation along with the replacement rate. The coefficient on the replacement rate indicates that an agent that increases their replacement rate by 10% increases their overall hourly income by 2.37%. Column (3) looks at those displaced with replacement rates below the 95th percentile. The coefficient on the replacement rate here indicates that an agent that increases their replacement rate by 10% increases their long-term hourly income by 2.76%. While this is less than the 3.52% from the data, the difference is not large.

[19] When using a vector of displacement indicators indicating time since displacement, the coefficients are not statistically different from the 11.9% in column (1) of Table 5.

Figure 3 demonstrates the effects of replacement rates in the simulation further. Recall that this figure uses 10% replacement rate bins on the x-axis with the y-axis being the coefficients from estimating equation (1) with this variety on indicator variables. For most of the points, the results from the simulation run through the data's results. The agents with the poor replacement rates on the left side of the figure ultimately do better than those in the data for the most part which could indicate that there is something inherently different for agents in the data that end with poor replacement rates. Agents on the right side of the figure have estimates that intersect the data's estimates indicating that the marginal effect is smaller in the simulation for those with greater replacement rates. However, this change in the slope is not as great as that in the data. This is clear in comparing the marginal result of column (2) of Table 5 with column (5) of the same table; there, the marginal impact increases from 0.237 to 0.542. This change in the PSID is represented in Table 3 by comparing section a with section d. For the baseline specification, the marginal impact increases from 0.122 to 0.71.

Conclusion

The paper provides a link between labor datasets with a long time panel element to datasets that are missing this element. It provides evidence of the impacts that the first job after displacement has on long term income and should be useful for researchers that use training data or supplements to the CPS such as the Displaced Worker Survey and the Merged Outgoing Rotation Groups.

The paper shows two main empirical items. One, a replacement rate over 120% leads to recovery relative to other workers. The other main item is that this marginal effect of the replacement rate on long-term income is much greater with smaller replacement rates compared to the larger ones. This paper shows that for displaced workers who replace less than 293% of

their previous hourly income, an increase of 10% in this replacement rate increases long term hourly income by 3.5%. However, for replacement rates below 80%, a 10% increase in the replacement rate for hourly income increases this long term income by 7.1%.

The simulation in this paper is calibrated to the representative sample of the PSID and it suggests that a replacement rate of at least 140% is needed to avoid this long run damage. The simulation also has this asymmetry although it is less exaggerated. For agents in the simulation that replace less than 300% of their income after displacement, a 10% increase leads to a 2.4% increase in permanent income. For agents with replacement rates below 80%, a 10% increase in their replacement rate increases permanent income by 5.4%.

The results of this paper provide more context for analyzing the effects of displacement using data that is lacking long time panel elements. Most of these datasets show displaced workers with replacement rates below 100% which is troubling given the findings in this paper. However, this paper shows stronger marginal effects for those with these lower replacement rates. Therefore, this paper's findings demonstrate the importance of understanding these marginal differences since it leads to better long-term outcomes.

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Table 1: Summary Statistics

	PSID		**Simulation**	
VARIABLES	Not Displaced	Displaced	Not Displaced	Displaced
Age	39.2	42.4	40.4	49.3
Less Than 12 Years of Education	14%	18%		
12-15 Years of Education	54%	61%		
At Least 16 Years of Education	32%	22%		
Male	82%	87%		
White	90%	89%		
Annual Income	$59,295	$53,037		
Ann. Income Replacement Rate		137%		
Median Income Replacement Rate		105%		
Hourly Income	$27.90	$26.22	$31.29	$38.05
Hourly Income Replacement Rate		133%		130%
Median Hourly Income Rep. Rate		110%		109%
Displaced Once		46%		83%
Displaced Twice		25%		15%
Displaced Three Times		14%		1.5%
Displaced Four Times		8%		0.14%
Displaced at Least Five Times		7%		0.004%
Workers	8,234	2,055	200,000	48,907
Observations	80,447	21,630	8,370,241	1,229,759

Note: All dollar values are adjusted to a 2017 base year. The first column indicates the observations and workers that have not been displaced. The second column indicates the averages for the observations of displaced workers once the displacement has occurred. See more details on these variables and differences in the ***Data*** section. The third and fourth columns come from the simulation.

Table 2: Various Specifications for the Cost of Job Displacement on Income

Independent Variables Below	(1) No Replacement Rate Control	(2) Baseline	(3) Control Before Displacement	(4) Individual Time Trends	(5) Annual Baseline	(6) State Un-Employ-ment Rates
Displaced at Least Once	-0.115***	-0.488***	-0.500***	-0.604***	-0.672***	-0.491***
	(0.013)	(0.029)	(0.031)	(0.030)	(0.033)	(0.047)
Displaced at Least Twice	-0.087***	-0.089***	-0.089***	-0.088***	-0.114***	-0.106***
	(0.019)	(0.019)	(0.019)	(0.020)	(0.025)	(0.022)
Displaced at Least 3x	-0.042	-0.044	-0.045	-0.025	-0.091**	-0.043
	(0.027)	(0.027)	(0.027)	(0.032)	(0.039)	(0.031)
Displaced at Least 4x	-0.057	-0.069*	-0.070*	-0.090**	-0.059	-0.050
	(0.037)	(0.037)	(0.037)	(0.041)	(0.057)	(0.041)
Displaced at Least 5x	-0.124*	-0.125*	-0.125*	0.009	-0.042	-0.088
	(0.070)	(0.070)	(0.070)	(0.076)	(0.103)	(0.073)
Replacement Rate		0.352***	0.351***	0.444***	0.514***	0.344***
		(0.025)	(0.025)	(0.025)	(0.027)	(0.029)
State Unemployment Rate at Displacement						0.128
						(0.487)
Observations	100,464	100,464	100,464	100,464	100,590	84,490
Within R-Squared	0.158	0.164	0.164	0.364	0.150	0.124
Number of ID	8,132	8,132	8,132	8,132	8,120	7,529
Dependent Variable:	Hourly Income	Hourly Income	Hourly Income	Hourly Income	Annual Income	Hourly Income

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged income with robust standard errors clustered at the individual level. Displaced workers above the 95th percentile in replacement rates are not included in this table. The last row indicates the dependent variable which is logged hourly income outside of column (5) that uses the log of annual income. Column (1) does not control for the replacement rate. Column (2) is the baseline specification. Column (3) controls for six years before displacement, column (4) contains individual specific time trends, and column (6) includes a control for the state unemployment rate. Coefficients not displayed in this table include a function of age and education levels along with time and individual fixed effects.

Table 3: Various Samples for the Cost of Job Displacement on Hourly Income

VARIABLES	(1) Main Sample	(2) Weighted Large PSID Sample	(3) 25-Year-Old Minimum	(4) At Least 3 Years Tenure	(5) Pre-1998 w/1 Year Bands
a. All Replacement Rates					
Displaced at Least Once	-0.243***	-0.257***	-0.228***	-0.280***	-0.304***
Replacement Rate	0.122***	0.123***	0.106***	0.121***	0.177***
b. Replacement Rates Below the 95th Percentile (Below 293%)					
Displaced at Least Once	-0.488***	-0.530***	-0.487***	-0.507***	-0.472***
Replacement Rate	0.352***	0.381***	0.354***	0.353***	0.347***
c. Replacement Rates Below 120%					
Displaced at Least Once	-0.630***	-0.691***	-0.635***	-0.646***	-0.573***
Replacement Rate	0.520***	0.581***	0.533***	0.531***	0.475***
d. Replacement Rates Below 80%					
Displaced at Least Once	-0.731***	-0.784***	-0.736***	-0.652***	-0.637***
Replacement Rate	0.710***	0.766***	0.720***	0.504***	0.555***

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged hourly income with robust standard errors clustered at the individual level. Section **a.** includes all displaced workers, section **b.** does not include displaced workers above the 95th percentile in replacement rates, section **c.** does not include displaced workers with replacement rates above 120% and section **d.** does not include displaced workers with replacement rates above 80%. Column (2) includes the main sample and the oversampled poverty group along with the sample weights from the PSID. Column (3) does not include observations from anybody younger than 25 years old. Column (4) does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. Column (5) does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. Coefficients not displayed in this table include additional displacement indicators, a function of age and education levels along with time and individual fixed effects. See the appendix tables A-D for more information on each estimation.

Table 4: Simulation Parameters

Parameter	Value
σ_θ^2	0.3862
σ_ϕ^2	0.1923
d	0.1276
π	0.006
$P_{i,47}$	31.371

Note: These parameters make up those used in simulating labor processes with equations (2)-(5) to match the US representative sample of the PSID. σ_θ^2 and σ_ϕ^2 are the standard deviations for temporary and permanent shocks, respectively. d is the fall in permanent income due to displacement and π is the frequency of this displacement in the simulation. $P_{i,47}$ is the permanent level of income for all 47-year-old agents. See the **Simulation** section for more details.

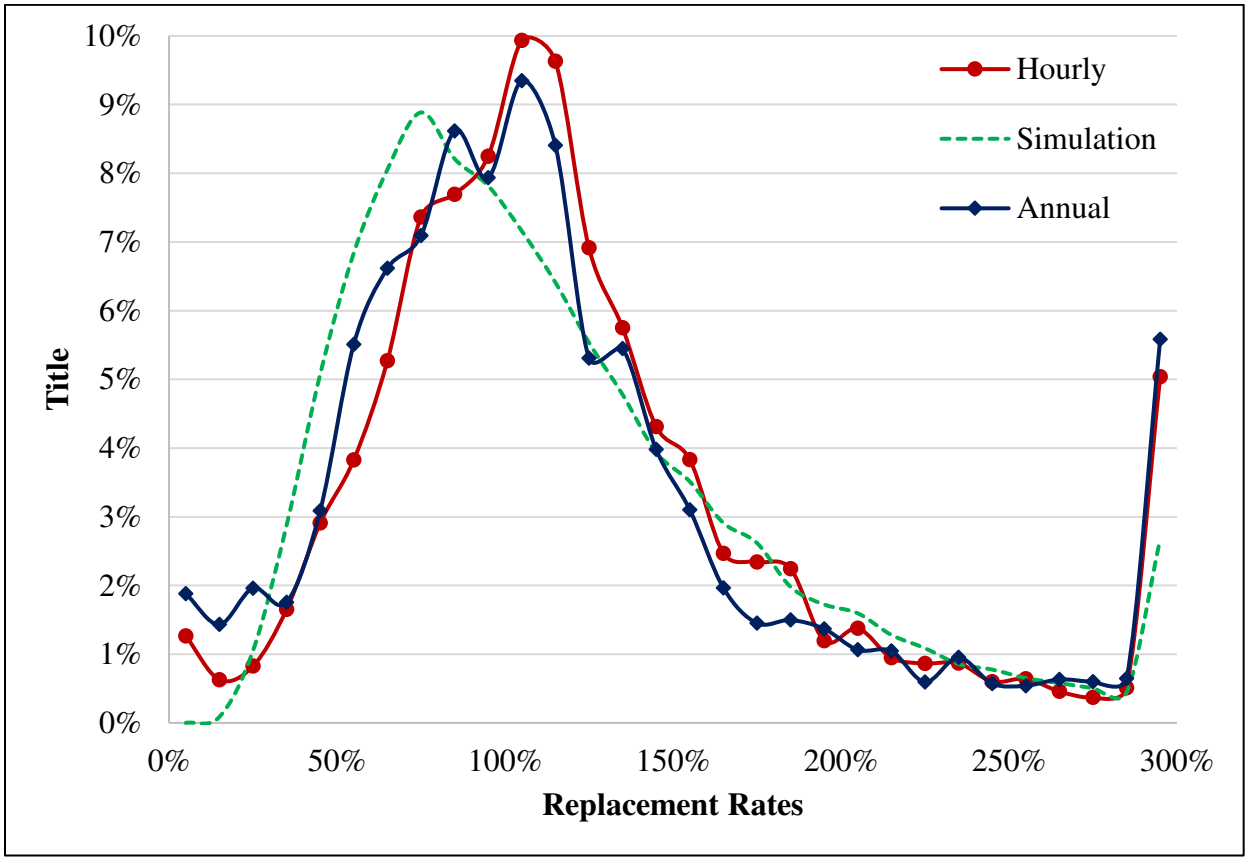
Table 5: Simulated Cost of Job Displacement to Income

VARIABLES	(1) No Replacement Rate Control	(2) All Replacement Rates	(3) Below 95th Percentile of RR	(4) Below 120% Rep. Ratio	(5) Below 80% Replacement Ratio
Displaced at Least Once	-0.119***	-0.389***	-0.427***	-0.549***	-0.610***
	(0.004)	(0.007)	(0.009)	(0.015)	(0.024)
Displaced at Least Twice	-0.115***	-0.118***	-0.115***	-0.102***	-0.114***
	(0.010)	(0.010)	(0.010)	(0.013)	(0.020)
Displaced at Least 3x	-0.101***	-0.102***	-0.101***	-0.150***	-0.152**
	(0.034)	(0.034)	(0.034)	(0.044)	(0.064)
Displaced at Least 4x	-0.128	-0.121	-0.132	0.026	0.227
	(0.117)	(0.118)	(0.118)	(0.176)	(0.190)
Replacement Rate		0.237***	0.276***	0.433***	0.542***
		(0.006)	(0.007)	(0.019)	(0.041)
Observations	9,600,000	9,600,000	9,524,688	8,709,360	8,035,968
Within R-Squared	0.409	0.410	0.410	0.409	0.411
Number of ID	200,000	200,000	198,431	181,445	167,416

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

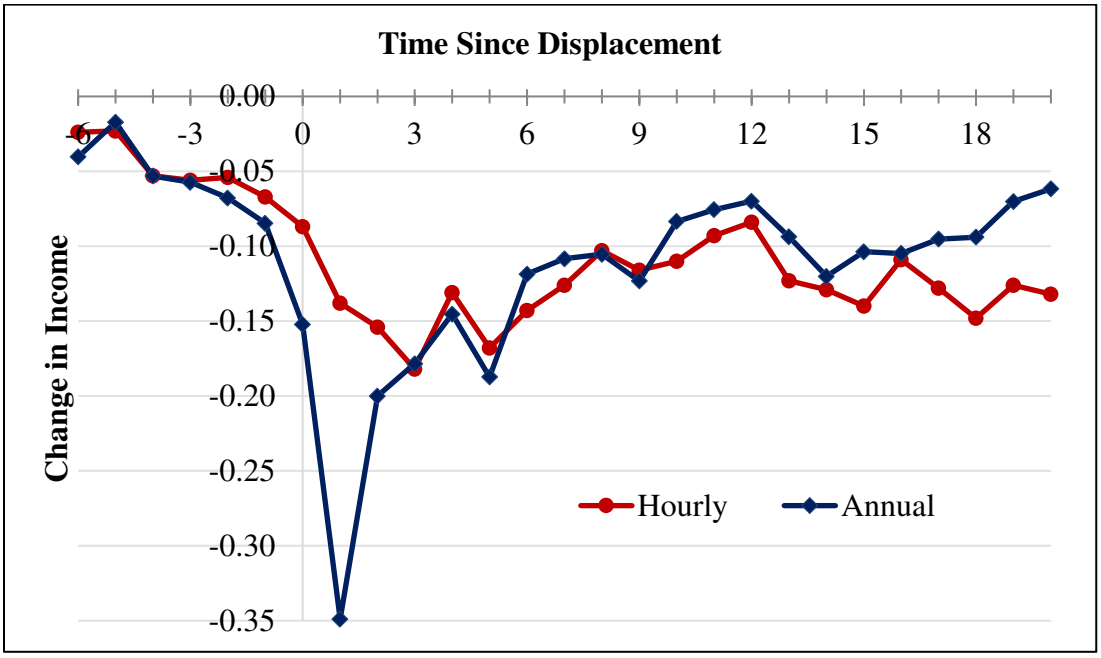
Note: This table contains the key coefficients from the estimation of equation (1) on simulated log hourly income with robust standard errors clustered at the individual level. Column (1) and (2) includes all displaced agents. Column (3) does not include displaced workers above the 95th percentile in replacement rates. Column (4) does not include displaced workers with replacement rates above 120% and column (5) does not include displaced workers with replacement rates above 80%. Coefficients not displayed in this table include a function of age along with individual fixed effects. See the **Simulation** section for more details.

Figure 1: Replacement Rates Density



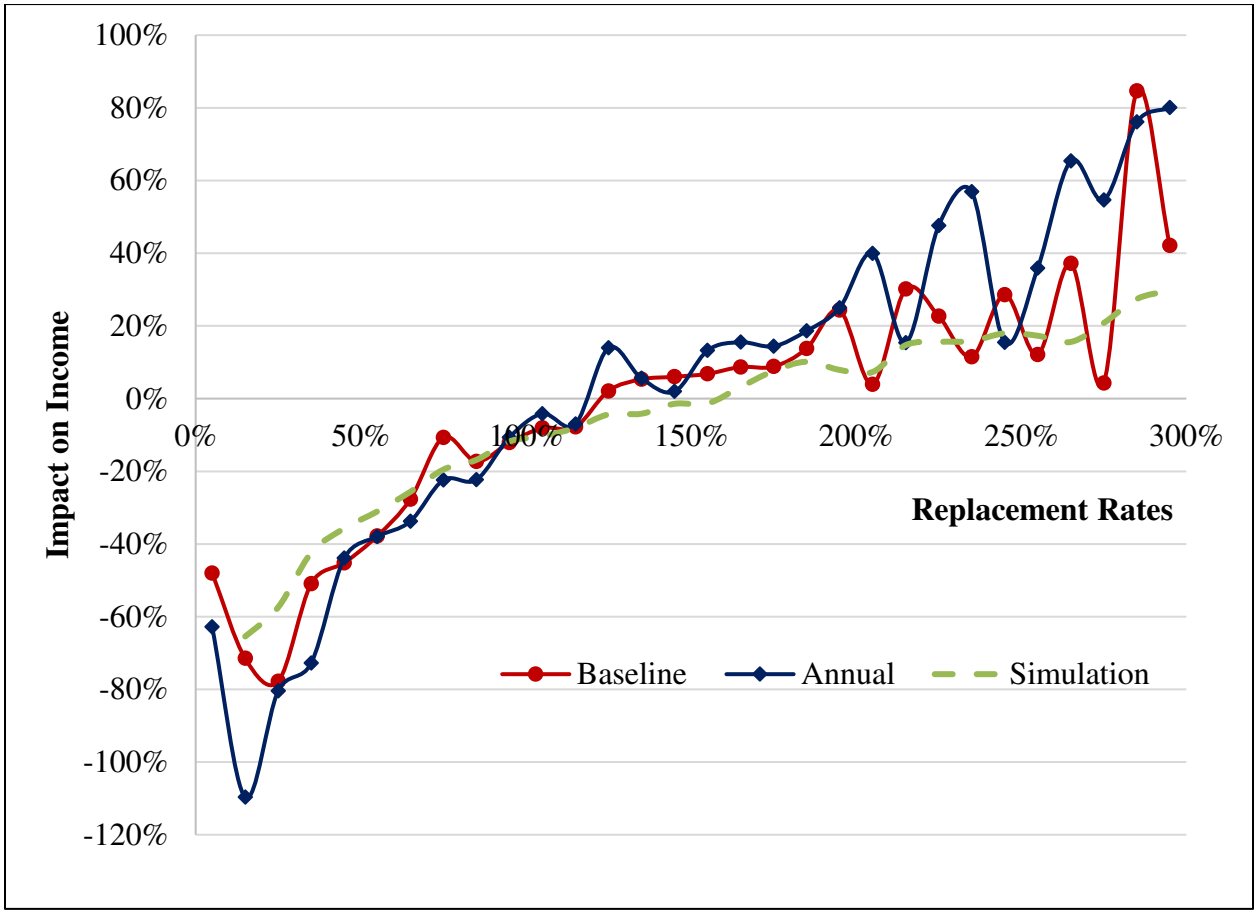
Note: This figure indicates the percentage of the displaced with the replacement rate shown on the x-axis. The x-axis indicates different replacement rates in 10% increments starting at 0-10% and ending at 290%. The line with circular markers indicates the percentage from the PSID using hourly income and the line with diamond markers indicates these percentages using annual income. The dashed line comes from the simulation.

Figure 2: Changes in Income Due to Displacement



Note: This figure contains the coefficients on time since displacement from estimating equation (1) on logged income of all displaced workers. Additional controls include displacement indicators, a function of age and education levels along with time and individual fixed effects. The x-axis is time since displacement with the y-axis being the value of the coefficient on the time since displacement. The line with circular markers indicates the effects of displacement on hourly income and the line with diamond markers indicates the effects of displacement on annual income.

Figure 3: Replacement Rates and Hourly Income



Note: This figure contains the coefficients on various replacement rate dummy variables from estimating equation (1) on logged income for all displaced workers. Additional controls include displacement indicators, a function of age and education levels along with time and individual fixed effects. The x-axis indicates different replacement rates in 10% increments starting at 0-10% and ending at 290%. The y-axis indicates the values for coefficients on the replacement rate dummy bins. The line with circular markers indicates the impacts of the replacement rate on long-term hourly income and the line with diamond markers indicates the impacts on annual income. The dashed line indicates the impacts of the replacement rate on long-term income in the simulation.

Appendix

Table A: Cost of Job Displacement on Income (All Replacement Rates)

VARIABLES	(1) Main	(2) Weighted Large PSID Sample	(3) 25-Year-Old Minimum	(4) 3 Years Tenure	(5) Pre-1998 w/ 1 Year Bands
Displaced at Least Once	-0.243***	-0.257***	-0.228***	-0.280***	-0.304***
	(0.029)	(0.025)	(0.028)	(0.036)	(0.035)
Displaced at Least Twice	-0.087***	-0.078***	-0.092***	-0.138***	-0.061***
	(0.019)	(0.017)	(0.021)	(0.028)	(0.023)
Displaced at Least 3x	-0.029	-0.039	-0.011	-0.049	-0.030
	(0.026)	(0.025)	(0.032)	(0.043)	(0.030)
Displaced at Least 4x	-0.082**	-0.086**	-0.087	-0.169**	-0.117***
	(0.036)	(0.035)	(0.053)	(0.069)	(0.042)
Displaced at Least 5x	-0.117*	-0.094	-0.122	-0.180	-0.074
	(0.068)	(0.061)	(0.090)	(0.137)	(0.102)
Replacement Rate	0.122***	0.123***	0.106***	0.121***	0.177***
	(0.023)	(0.019)	(0.021)	(0.031)	(0.029)
Observations	102,077	171,269	87,768	53,503	66,034
Within R-Squared	0.161	0.143	0.126	0.191	0.155
Number of ID	8,234	15,121	7,220	5,029	5,179

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged hourly income with robust standard errors clustered at the individual level. This table displays more of the results from Section **a.** of **Table 3**, which has no discrimination based on replacement rates. Column (2) includes the main sample and the oversampled poverty group along with the sample weights from the PSID. Column (3) does not include observations from anybody younger than 25 years old. Column (4) does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. Column (5) does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. Coefficients not displayed in this table include a function of age and education levels along with time and individual fixed effects. See the **Robustness** section for more details on each estimation.

Table B: Cost of Displacement on Income (Replacement Rates Below the 95th Percentile)

VARIABLES	(1) Baseline	(2) Weighted Large PSID Sample	(3) 25-Year-Old Minimum	(4) 3 Years Tenure	(5) Pre-1998 w/ 1 Year Bands
Displaced at Least Once	-0.488***	-0.530***	-0.487***	-0.507***	-0.472***
	(0.029)	(0.027)	(0.033)	(0.041)	(0.034)
Displaced at Least Twice	-0.089***	-0.076***	-0.085***	-0.141***	-0.058**
	(0.019)	(0.017)	(0.021)	(0.028)	(0.023)
Displaced at Least 3x	-0.044	-0.052**	-0.029	-0.069	-0.047
	(0.027)	(0.025)	(0.033)	(0.044)	(0.031)
Displaced at Least 4x	-0.069*	-0.084**	-0.114**	-0.169***	-0.121***
	(0.037)	(0.035)	(0.051)	(0.063)	(0.041)
Displaced at Least 5x	-0.125*	-0.085	-0.140	-0.120	-0.085
	(0.070)	(0.061)	(0.091)	(0.140)	(0.110)
Replacement Rate	0.352***	0.381***	0.354***	0.353***	0.347***
	(0.025)	(0.022)	(0.029)	(0.040)	(0.029)
Observations	100,464	168,410	86,509	52,753	64,914
Within R-Squared	0.164	0.146	0.129	0.196	0.156
Number of ID	8,132	14,905	7,142	4,984	5,109

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged hourly income with robust standard errors clustered at the individual level. This table displays more of the results from Section **b.** of **Table 3**, which does not include displaced workers with replacement rates above 293% (the 95th percentile). Column (2) includes baseline sample and the oversampled poverty group along with the sample weights from the PSID. Column (3) does not include observations from anybody younger than 25 years old. Column (4) does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. Column (5) does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. Coefficients not displayed in this table include a function of age and education levels along with time and individual fixed effects. See the **Robustness** section for more details on each estimation.

Table C: Cost of Job Displacement on Income (Less than 120% Replacement Rate)

VARIABLES	(1) Main	(2) Weighted Large PSID Sample	(3) 25-Year-Old Minimum	(4) 3 Years Tenure	(5) Pre-1998 w/ 1 Year Bands
Displaced at Least Once	-0.630***	-0.691***	-0.635***	-0.646***	-0.573***
	(0.043)	(0.044)	(0.048)	(0.057)	(0.055)
Displaced at Least Twice	-0.096***	-0.080***	-0.087***	-0.140***	-0.080***
	(0.024)	(0.022)	(0.027)	(0.035)	(0.030)
Displaced at Least 3x	-0.018	-0.028	-0.004	-0.064	-0.026
	(0.035)	(0.030)	(0.040)	(0.057)	(0.038)
Displaced at Least 4x	-0.061	-0.069	-0.086	-0.167**	-0.066
	(0.050)	(0.048)	(0.064)	(0.082)	(0.055)
Displaced at Least 5x	-0.143	-0.112	-0.055	-0.148	-0.129
	(0.099)	(0.081)	(0.119)	(0.213)	(0.137)
Replacement Rate	0.520***	0.581***	0.533***	0.531***	0.475***
	(0.048)	(0.049)	(0.053)	(0.065)	(0.065)
Observations	89,345	148,164	79,074	49,133	58,925
Within R-Squared	0.160	0.142	0.128	0.203	0.154
Number of ID	7,452	13,529	6,666	4,760	4,740

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged hourly income with robust standard errors clustered at the individual level. This table displays more of the results from Section **c.** of **Table 3**, which does not include displaced workers with replacement rates above 120%. Column (2) includes main sample and the oversampled poverty group along with the sample weights from the PSID. Column (3) does not include observations from anybody younger than 25 years old. Column (4) does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. Column (5) does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. Coefficients not displayed in this table include a function of age and education levels along with time and individual fixed effects. See the **Robustness** section for more details on each estimation.

Table D: Cost of Job Displacement on Income (Less than 80% Replacement Rate)

VARIABLES	(1) Main	(2) Weighted Large PSID Sample	(3) 25-Year-Old Minimum	(4) 3 Years Tenure	(5) Pre-1998 w/ 1 Year Bands
Displaced at Least Once	-0.731***	-0.784***	-0.736***	-0.652***	-0.637***
	(0.061)	(0.066)	(0.071)	(0.083)	(0.083)
Displaced at Least Twice	-0.069*	-0.049	-0.072*	-0.086	0.003
	(0.039)	(0.036)	(0.041)	(0.053)	(0.043)
Displaced at Least 3x	-0.012	-0.031	0.038	0.000	-0.027
	(0.058)	(0.050)	(0.067)	(0.099)	(0.062)
Displaced at Least 4x	-0.046	-0.072	-0.104	-0.163	-0.133
	(0.088)	(0.085)	(0.118)	(0.143)	(0.099)
Displaced at Least 5x	-0.136	-0.158*	-0.192	-0.672	0.010
	(0.125)	(0.083)	(0.195)	(0.452)	(0.182)
Replacement Rate	0.710***	0.766***	0.720***	0.504***	0.555***
	(0.102)	(0.109)	(0.118)	(0.131)	(0.143)
Observations	76,879	127,412	68,877	43,425	51,180
Within R-Squared	0.165	0.145	0.132	0.227	0.156
Number of ID	6,753	12,207	6,089	4,423	4,291

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

Note: This table contains the key coefficients from the estimation of equation (1) on logged hourly income with robust standard errors clustered at the individual level. This table displays more of the results from Section **d.** of **Table 3**, which does not include displaced workers with replacement rates above 80%. Column (2) includes main sample and the oversampled poverty group along with the sample weights from the PSID. Column (3) does not include observations from anybody younger than 25 years old. Column (4) does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. Column (5) does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. Coefficients not displayed in this table include a function of age and education levels along with time and individual fixed effects. See the **Robustness** section for more details on each estimation.

Table E: Simulation Robustness – Different Displacement Effects

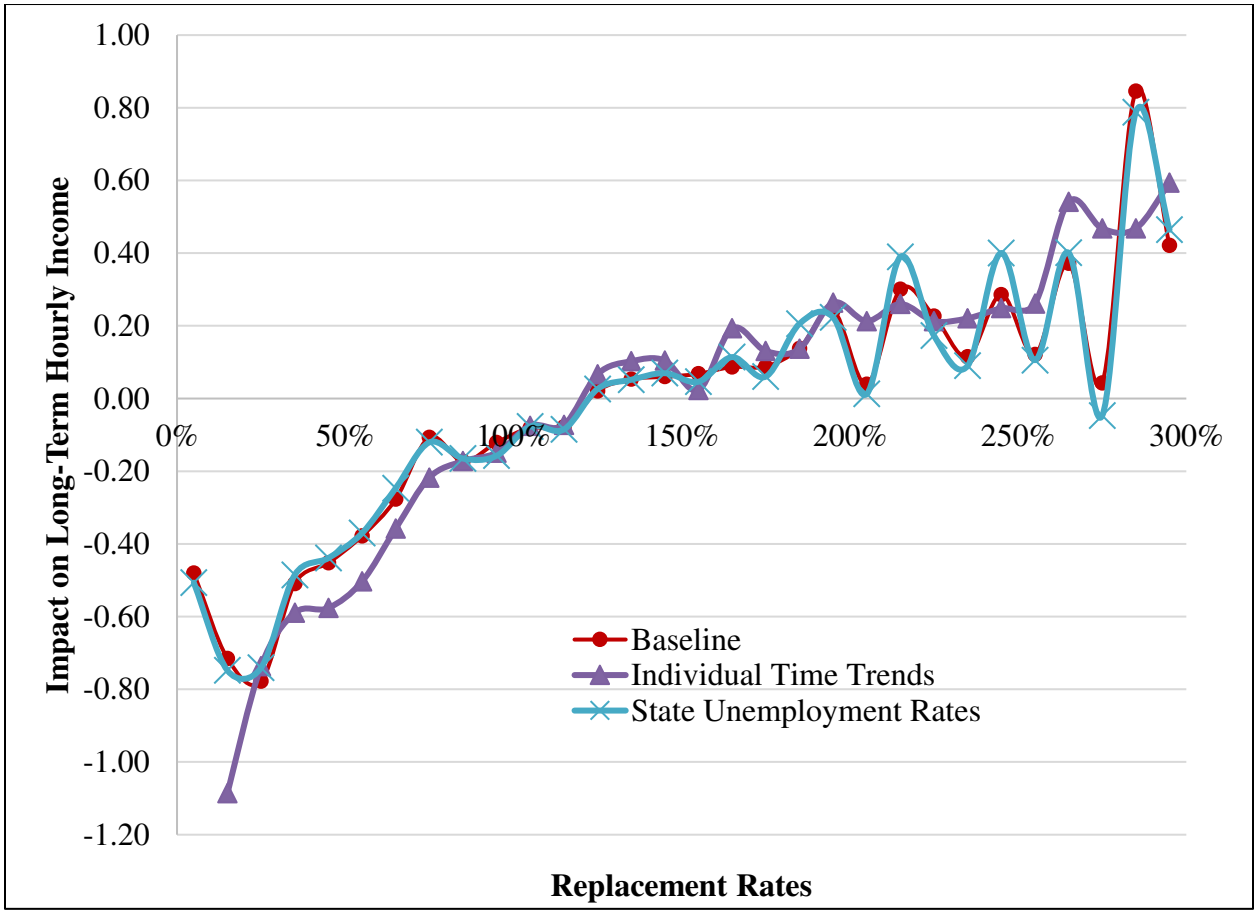
Section 1. Smaller Permanent Displacement Cost				
VARIABLES	(1)	(2)	(3)	(4)
Displaced at Least Once	-0.078***	-0.348***	-0.089***	-0.389***
	(0.004)	(0.007)	(0.004)	(0.009)
Displaced at Least Twice	-0.075***	-0.078***	-0.073***	-0.076***
	(0.010)	(0.010)	(0.011)	(0.011)
Displaced at Least 3x	-0.060*	-0.061*	-0.061*	-0.062*
	(0.034)	(0.034)	(0.034)	(0.034)
Displaced at Least 4x	-0.086	-0.080	-0.093	-0.089
	(0.117)	(0.117)	(0.117)	(0.118)
Replacement Rate		0.228***		0.267***
		(0.005)		(0.007)
Observations	9,600,000	9,600,000	9,538,514	9,538,514
Within R-Squared	0.411	0.412	0.411	0.412
Number of ID	200,000	200,000	200,000	200,000

Section 2. Permanent Displacement Cost Begins Before Event				
VARIABLES	(1)	(2)	(3)	(4)
Displaced at Least Once	-0.085***	-0.358***	-0.095***	-0.399***
	(0.004)	(0.007)	(0.004)	(0.008)
Displaced at Least Twice	-0.049***	-0.053***	-0.049***	-0.051***
	(0.010)	(0.010)	(0.010)	(0.010)
Displaced at Least 3x	-0.038	-0.038	-0.038	-0.039
	(0.034)	(0.034)	(0.034)	(0.034)
Displaced at Least 4x	-0.059	-0.052	-0.066	-0.061
	(0.116)	(0.117)	(0.116)	(0.117)
Replacement Rate		0.225***		0.264***
		(0.005)		(0.006)
Observations	9,600,000	9,600,000	9,538,533	9,538,533
Within R-Squared	0.411	0.412	0.411	0.412
Number of ID	200,000	200,000	200,000	200,000

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

Note: This table contains the key coefficients from the estimation of equation (1) on simulated log hourly income with robust standard errors clustered at the individual level. Columns (1) and (2) includes all displaced agents. Columns (3) and (4) do not include displaced workers above the 95th percentile in replacement rates. Displaced agents for the simulation in **Section 1** experience a permanent fall of 9.1% at the time of displacement; 9.1% comes from the average cost of displacement without controlling for the fall before the event. Displaced agents for the simulation in **Section 2** experience a permanent fall before displacement like that in the data; there is an approximate 5.7% permanent decline four years before displacement with the event adding another permanent fall of 7% to be in line with the PSID findings.

Figure A: Replacement Rates and Hourly Income Robustness Specifications

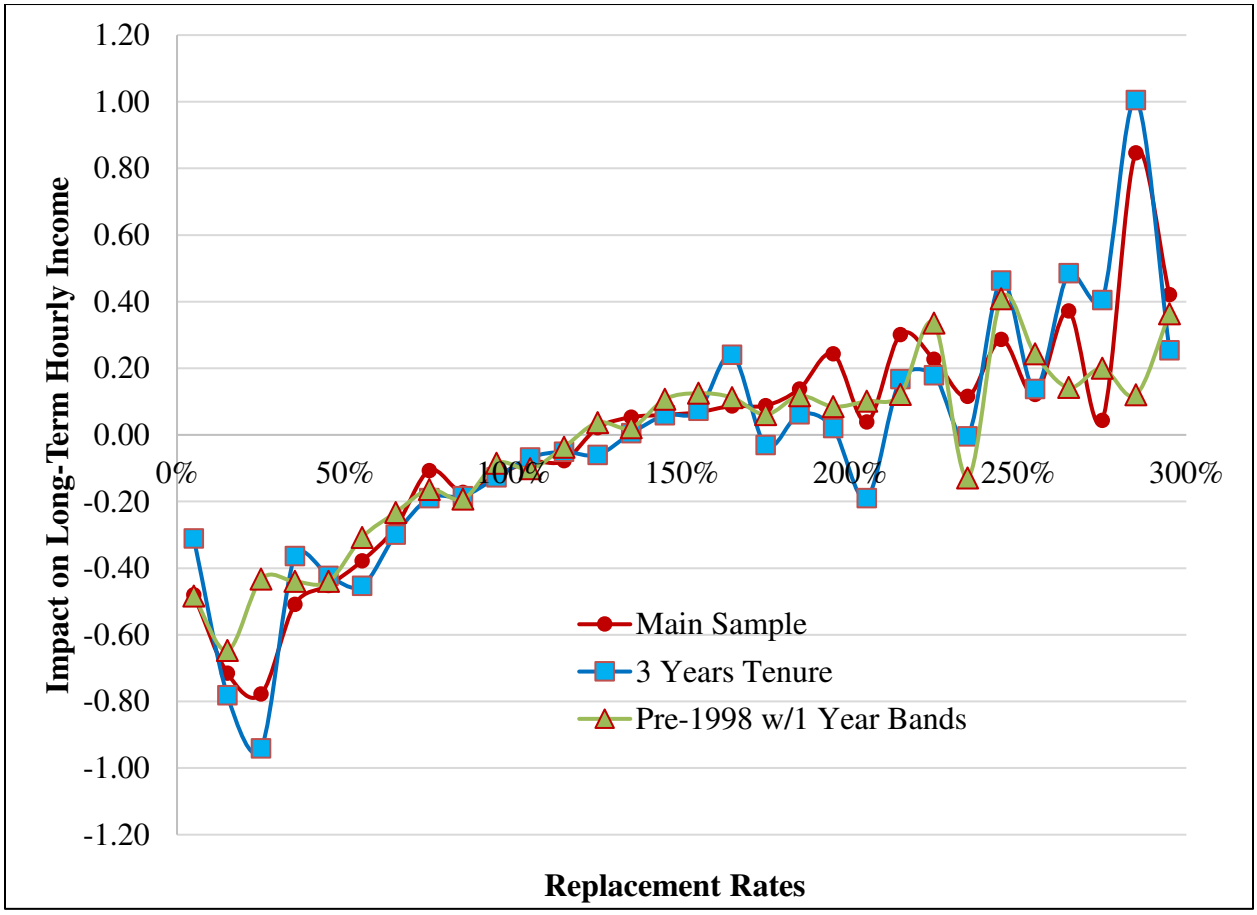


Note: This figure contains the coefficients on various replacement rate dummy variables from estimating equation (1) on logged hourly income for all displaced workers. Additional controls include displacement indicators, a function of age and education levels along with time and individual fixed effects. The x-axis indicates different replacement rates in 10% increments starting at 0-10% and ending at 290%. The y-axis indicates the values for coefficients on the replacement rate dummy bins. The line with circular markers labeled, Baseline, indicates the impacts of the replacement rate on long-term hourly income; this is the same line labeled Hourly from Figure 3. The line with triangular markers indicates the impacts on hourly income when the estimation includes individual time trends. The line with X markers indicates the impacts on hourly income when the estimation includes state unemployment rates. See the **Robustness** section for more details.

Figure B: Replacement Rates and Hourly Income Robustness on Samples 1

Note: This figure contains the coefficients on various replacement rate dummy variables from estimating equation (1) on logged hourly income for all displaced workers. Additional controls include displacement indicators, a function of age and education levels along with time and individual fixed effects. The x-axis indicates different replacement rates in 10% increments starting at 0-10% and ending at 290%. The y-axis indicates the values for coefficients on the replacement rate dummy bins. The line with circular markers labeled, Main Sample, indicates the impacts of the replacement rate on long-term hourly income; this is the same line labeled Hourly from Figure 3. The line with star markers indicates the impacts on the main sample and the oversampled poverty group along with the sample weights from the PSID. The line with square markers indicates the impacts when the sample does not include observations from anybody younger than 25 years old. See the **Robustness** section for more details.

Figure C: Replacement Rates and Hourly Income Robustness on Samples 2



Note: This figure contains the coefficients on various replacement rate dummy variables from estimating equation (1) on logged hourly income for all displaced workers. Additional controls include displacement indicators, a function of age and education levels along with time and individual fixed effects. The x-axis indicates different replacement rates in 10% increments starting at 0-10% and ending at 290%. The y-axis indicates the values for coefficients on the replacement rate dummy bins. The line with circular markers labeled, Main Sample, indicates the impacts of the replacement rate on long-term hourly income; this is the same line labeled Hourly from Figure 3. The line with outlined box markers indicates the impacts when the sample does not include observations from anybody with less than 3 years of tenure unless they were displaced; displaced workers must have had 3 years of tenure before displacement. The line with outlined triangle markers indicates the impacts when the sample does not include years after 1997 and uses replacement rates based on the year before displacement and the year after the event instead of the two years used elsewhere in this paper. See the **Robustness** section for more details.