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Involuntary job loss: welfare effects, earnings impacts and policy options

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Dean Hyslop, Dave Maré, Shakked Noy, and Isabelle Sin

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Author contact details

Dean Hyslop

Senior Fellow, Motu Economic and Public Policy Research

dean.hyslop@motu.org.nz

Dave Maré

Senior Fellow, Motu Economic and Public Policy Research

dave.mare@motu.org.nz

Shakked Noy

Research Analyst, Motu Economic and Public Policy Research

shakked.noy@motu.org.nz

Isabelle Sin

Senior Fellow, Motu Economic and Public Policy Research

izi.sin@motu.org.nz

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Motu Economic and Public Policy Research

PO Box 24390 info@motu.org.nz +64 4 9394250

Wellington www.motu.org.nz

New Zealand

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Abstract

Workers who experience involuntary job loss suffer from deep and persistent negative consequences. In this paper, we first summarise the evidence on the effects of involuntary job loss on displaced workers' wellbeing. We conclude that displacement harms workers' mental health and economic security in the short term and negatively affects their earnings and mortality risk in the long term. We then extrapolate the estimates of Hyslop and Townsend (2017) to estimate the economy-wide net-present value of wages lost as a result of displacement by the workers displaced in New Zealand in a representative year. Our estimates suggest that this value is likely between \$3.3 billion (in a year of economic upswing) and \$15.4 billion (in a year of very severe economic downswing). Finally, we survey the policy options available for dealing with involuntary displacement. We conclude that unemployment insurance or unemployment benefits can effectively mitigate the immediate negative effects of displacement and have only small downsides. By contrast, training and job placement programs are typically ineffective, but in some circumstances might have high potential upside.

JEL codes

J08, J24, J63

Keywords

Displaced workers, unemployment insurance, active labour market policies

Summary haiku

From jobs lost each year,
at least three billion dollars
of wages foregone.

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1 Introduction

Involuntary job losses are a widespread phenomenon with potentially deep consequences. More than 30,000 New Zealand workers are involuntarily displaced each year, and domestic evidence suggests that involuntary job loss has substantial and lasting impacts on displaced workers.¹

The aim of this paper is to provide a theoretical and empirical overview of involuntary job loss in New Zealand. In the first part of the paper, we describe the different channels through which involuntary job loss might affect a worker's wellbeing. In the second part, we present estimates of the net-present value of earnings losses attributable to the involuntary displacements that occur in New Zealand in a representative year. In the third part, we discuss the policy options available for addressing the effects of displacement.

We begin, in Section 2, by summarising the domestic and international evidence concerning the effects of involuntary displacement on workers' economic outcomes, mental health, and physical health. Overall, the evidence shows involuntary displacement has persistent negative effects on the economic outcomes of displaced workers. Displaced workers experience sharp drops in earnings and consumption immediately after being displaced; in the years that follow, their earnings slowly recover, but they continue to suffer from persistent wage and employment deficits causally attributable to their involuntary separation (Ruhm 1991; Jacobson et al. 1993; von Wachter et al. 2009; Davis and von Wachter 2011; Dixon and Maré 2013; Hyslop and Townsend 2017). These persistent deficits may arise because displaced workers lose valuable skills matches, lose wage premiums, accept subpar job offers due to liquidity constraints, enter self-reinforcing cycles of unemployment, or suffer from psychological discouragement.

Additionally, displacement causes workers to suffer from substantially worse mental health outcomes (Schaller and Stevens 2015; Cygan-Rehm et al. 2017). Displaced workers become substantially more likely to experience acute stress, depression, and feelings of hopelessness or uselessness (Farré et al. 2018). These effects are likely attributable to the financial stress of involuntary separation, damage to self-esteem or social status, and the loss of a community of coworkers.

Involuntary separations also worsen the physical health and increase the mortality risk of displaced workers. A worker's mortality risk increases substantially immediately after being displaced, and even 20 years after displacement their mortality risk remains higher than if they had not been displaced (Sullivan and von Wachter 2009; Eliason and Storrie 2009; Browning and Heinesen 2012). This increase in mortality is attributable to a number of factors, including stress-related diseases, increased consumption of alcohol and cigarettes, and suicide.

¹ See OECD (2017), Dixon and Maré (2013), and Hyslop and Townsend (2017).

In the second part of this paper, we provide estimates of the net-present value of all wages lost due to the involuntary job losses that take place in New Zealand in a representative year. Our estimates ignore all general-equilibrium and indirect effects of displacement, and exclusively represent the wages lost by displaced individuals. We produce these estimates by extrapolating the estimates in Dixon and Maré (2013) and Hyslop and Townsend (2017) and combining those estimates with basic population-level statistics.

Our central calculations suggest that the wages lost by individuals displaced annually during an economic upswing amount to about \$3.3 billion (1.1% of GDP) in net present value terms. Depending on our assumptions, this value could be between \$2.1 billion and \$5.2 billion. In an economic downswing comparable in severity to the Global Financial Crisis, our central estimate of wage loss is about \$8.8 billion (2.8% of GDP), with a range of between \$5.8 billion and \$14.3 billion. Finally, in a year of very severe economic downswing, this total may reach about \$15.4 billion (5.0% of GDP), with a range of between \$10.1 billion and \$25.0 billion.² These estimates require a number of strong assumptions, and thus have a high level of uncertainty associated with them. Varying the economic conditions assumed and our other assumptions generates estimates ranging from \$2.1 billion to \$25.0 billion. Given this uncertainty and the wide range of estimates across all scenarios, we emphasise that our results should be interpreted as indicative of the likely scale of wage losses, rather than precise estimates.

Finally, in the third part of this paper, we discuss possible policy options for dealing with involuntary displacements: unemployment insurance/unemployment benefits, and Active Labour Market Programmes (such as training programmes, job search assistance, or subsidised job placements). We begin with a theoretical discussion of the potential benefits and costs of these policies, and then survey the international evidence on their effectiveness.

The literature implies that unemployment insurance and unemployment benefits are effective at mitigating the short-term effects of displacement on workers' economic and health outcomes (Gruber 1997; Cylus et al. 2014; Cylus et al. 2015; East and Kuka 2015). Payments to displaced workers can mitigate displacement-induced drops in consumption and earnings and ease financial stress. However, the evidence suggests that at least part of the mental health costs of displacement occur independently of the financial effects of displacement and therefore cannot be ameliorated by transfers from the government. In addition, transfers to displaced workers have small negative effects on their labour supply (Rothstein 2011), and may increase the willingness of employers to lay off workers (Albanese et al. 2020).

² Notably, our "severe economic downswing" estimates are our most speculative, since they are not based on historical data.

Our assessment of Active Labour Market Programmes is more negative. There is a large amount of high-quality evidence on the effects of these programmes, which are typically targeted at low-skilled individuals in unemployment rather than displaced workers specifically (LaLonde 2003; McKenzie 2017; Card et al. 2018). Overall, this evidence suggests that under some circumstances Active Labour Market Programmes have moderate positive impacts, but these are usually limited to certain subgroups of participants. Furthermore, these positive impacts vanish when general-equilibrium effects are taken into account. This is because ALMPs help recipients get into jobs at the expense of other jobseekers.

That said, the low cost of Active Labour Market Programmes (relative to alternatives such as formal education) means that, if effective, they can offer very high rates of return on investment. Experimental deployment of Active Labour Market programmes combined with ongoing evaluations of their efficacy may therefore produce good outcomes for displaced workers.

2 Conceptual framework

2.1 The definition of involuntary job loss

This paper is about the effects of “involuntary job loss”, which we also refer to as “displacement”. Three definitions of involuntary job loss are relevant for our discussion: one conceptual definition, and two empirical definitions (one of which is used by studies that use surveys to identify job losses, and the other of which is used by studies that rely on administrative data).

First, we are conceptually interested in any instance where a worker is dismissed for external economic reasons. This includes layoffs, redundancies, and separations caused by firm shutdowns, but excludes the ending of contracts, employee resignations, separations caused by accidents or sickness, and just-cause dismissals (since the latter are due to individual employee behaviour). Our discussion of the effects of involuntary job loss on wellbeing is intended to encompass any of these kinds of involuntary job loss.

Second, throughout this paper we rely heavily on the estimates from a pair of New Zealand studies of involuntary job loss (Dixon and Maré 2013 and Hyslop and Townsend 2017). Our estimates of the economy-wide lifetime effects of involuntary job loss are calculated by extrapolating from these studies. The empirical definition of involuntary job loss used in these studies comes from a Survey of Families, Incomes, and Employment (SoFIE) question about job separations. Individuals who reported having separated from a job were asked the reason for their separation, and were classified as “involuntarily” having lost their jobs if they gave the reason “laid off/dismissed/made

redundant.”³ (Notably, this definition includes just-cause dismissals). When we discuss the estimates in either of these papers, or when we present our own estimates in Section 4, this is the underlying definition of involuntary displacement.

Third, due to the sparsity of New Zealand literature on the effects of involuntary job loss, we draw extensively on international literature. Much of this literature uses the approach pioneered by Jacobson et al. (1993), who use a large administrative employment dataset and focus on job separations that occur as part of “mass layoff” events (instances where a large segment of a firm’s workforce separates from the firm at the same time). Such studies restrict attention to a subset of involuntary job losses associated with firm downsizings or closures. This narrower definition of displacement should be borne in mind when considering the international evidence.

The available evidence suggests that studies using the mass-layoff definition of displacement do not produce radically different estimates than studies using survey-based definitions. Dixon and Stillman (2009) use a mass-layoff methodology with New Zealand administrative data, and produce estimates similar to those in Dixon and Maré (2013) and Hyslop and Townsend (2017), who use New Zealand survey data.

Finally, many studies of job displacement are restricted to “high-tenure” workers who are involuntarily displaced. For example, Dixon and Maré (2013) and Hyslop and Townsend (2017) restrict their attention to workers who were with their employer for at least 1 year before involuntarily losing their job, and Jacobson et al. (1993) restrict to workers with at least 6 years of tenure at their workplace. The rationale behind this restriction is usually that high-tenure workers are the most likely to be significantly impacted by displacement (Jacobson et al. 1993) or that high-tenure workers are more likely to be displaced for exogenous reasons (Dixon and Maré 2013). In this paper we include all involuntary job separations, not only those of high-tenure workers, since we are interested in the total earnings losses due to displacement across the whole economy. However, in supplementary specifications we restrict to the population of high-tenure workers.

Note that on any of the preceding definitions of “involuntary displacement,” only a small portion of unemployed workers at any point in time count as “involuntarily displaced.” Many people are unemployed for reasons unrelated to involuntary displacement. Our discussion of unemployment benefits and Active Labour Market Programmes in Section 5 should be read with this in mind, since typically these programmes apply to all unemployed workers (or in the case of ALMPs, only low-skilled unemployed workers), not just those who have been involuntarily displaced.

³ As Dixon and Maré (2013) note, this question groups layoffs together with just-cause dismissals, when ideally Dixon and Maré (2013) would prefer to focus solely on layoffs. Their decision to restrict to high-tenure workers is in part motivated by this fact, since high-tenure workers are much less likely to be dismissed for misconduct and an affirmative response to this question therefore indicates that the worker was probably laid off.

2.2 The earnings impacts of involuntary job loss: a theoretical framework

A substantial part of this paper is concerned with the long-term effects of involuntary job loss on displaced workers' earnings and employment outcomes. In Section 3, we highlight these long-term earnings losses as one of the primary mechanisms through which job loss affects displaced workers' wellbeing. And in Section 4, the effects we estimate are largely driven by the long-term earnings and employment deficits caused by displacement.

Here we lay out a theoretical framework that explains how involuntary job loss can have lasting negative impacts on workers' labour market outcomes. These impacts can occur through five mechanisms.

First, displaced workers may experience a loss of returns to skill (Neal 1995; Bingley and Westergaard-Nielsen 2004). During their tenure at a workplace, workers sometimes acquire job-specific skills that increase their productivity but that they are no longer able to leverage when they lose that job. Workers who are displaced due to the decline of an industry (either because of falling demand or technological change) may find themselves with obsolete skills. Furthermore, unemployment spells can cause a worker's skills to depreciate. These factors combine to mean that displaced workers can end up unable to utilise the skills that earned them their pre-displacement wages.

Second, displaced workers may lose access to wage premiums (Fackler et al. 2017). If markets are not fully competitive, workers may earn wage premiums either by extracting a share of product market rents or by earning labour market rents achieved via union bargaining or the erection of barriers to entry (e.g. occupational licensing). Workers who involuntarily separate from firms or industries where these wage rents are earned may therefore experience a drop in wages.

A worker may also earn a wage premium from a uniquely high-quality skills match between them and their employer. Similarly to the skill concerns mentioned above, this can cause displaced workers to experience a decrease in wages.

Third, job search has significant costs that workers may not be able to bear for extended periods of time (Chetty 2008). A displaced worker who has an urgent financial need to find re-employment might accept a subpar job offer simply to survive, and can therefore end up earning lower wages. This mechanism may explain why the costs of displacement are higher during recessions (Hyslop and Townsend 2017; Eliason and Storrie 2006), when job search is more difficult and costly due to the low ratio of vacancies to jobseekers.

Fourth, employers may be less willing to hire workers who have experienced unemployment spells, since this provides a negative signal about the worker's unobservable quality (Kroft et al. 2013). This can cause displaced workers to enter vicious cycles of long-term unemployment (Hijzen et al. 2010). However, recently displaced workers may be able to avoid this problem by quickly

finding reemployment, or if they can show that they were displaced as part of a “no-fault” restructuring or mass-layoff event.

Fifth and finally, involuntary displacement may lead to behavioural changes that prevent workers from finding quality reemployment (Clark et al. 2003). Displaced workers may lose motivation and become discouraged, experience decreased mental health, or become habituated to life without employment. On the other hand, long unemployment spells can also lower a worker’s reservation wage and thereby make them more likely to find re-employment.

Overall, there are a variety of reasons to expect that involuntary job loss will permanently affect displaced workers’ outcomes. In Section 3, we survey the empirical evidence on the magnitude and duration of these effects.

3 Economic and non-economic effects of involuntary job loss

This section provides an overview of the various channels through which involuntary job loss affects the wellbeing of displaced workers. Displacement may have broad consequences beyond the economic, and a narrow focus on the wage or employment effects of displacement neglects its effects on the psychological and physical wellbeing of displaced workers and their families.

We discuss three ways in which displacement affects displaced workers’ wellbeing. First, displacement has both immediate and long term negative effects on workers’ earnings and employment. Second, displacement worsens displaced workers’ mental health. Finally, displacement adversely affects displaced workers’ physical health and mortality risk. Note these channels are interrelated. For instance, the mental health of displaced workers may worsen in part because of the deterioration in their financial circumstances, and their physical health and familial relationships may worsen in part because of the changes in their mental health.

Given the scarcity of New Zealand-specific evidence on the wellbeing effects of displacement, we rely heavily on international studies when describing the evidence for the aforementioned channels. However, international evidence may not generalise to the New Zealand context. The effects of displacement depend on features of the economic, institutional, and social context, which vary substantially among countries. In particular, existing government and private sector support systems for displaced workers may ameliorate some of the negative effects of displacement. As we might therefore expect, the international literature shows substantial cross-country heterogeneity in the effects of displacement. This should be borne in mind when drawing conclusions for New Zealand from international evidence.

3.1 Short term employment and earnings effects

First, displacement affects the earnings of displaced workers, who lose the wages from the job from which they separated. This can have large effects on their short-term economic security and consumption, though we should expect increases in benefit income to partially offset lost earnings.

Using New Zealand data, Hyslop and Townsend (2017, 2019) show that in the first year after a displacement event, displaced workers are 20-25% less likely to be employed and receive 30% lower earnings conditional on being employed (henceforth, we will use “conditional earnings” to refer to “earnings conditional on being employed”). Dixon and Maré (2013) find similar effects. These effects are more severe during recessions; Hyslop and Townsend (2017) find that workers displaced during the Global Financial Crisis experienced employment deficits that were about 5 percentage points worse than those displaced during the preceding economic upswing, though there was no difference in the conditional earnings deficits. In addition, these effects are more severe for older workers and for women.

Despite the different institutional setting and (as discussed in Section 2) different definition of involuntary job separations, evidence from the United States corroborates the New Zealand findings. US studies show that the unconditional earnings of displaced workers fall by about 30% in the first year following displacement, with the impacts being larger for workers displaced during recessions (Jacobson et al. 1993; von Wachter et al. 2009; Davis and von Wachter 2011). Furthermore, displaced workers begin to lose earnings (relative to non-displaced workers) several years before their displacement, perhaps reflecting the beginning of their employer’s financial struggles. (Dixon and Maré 2013 find evidence that displaced New Zealand workers also begin losing earnings prior to the displacement event, but Hyslop and Townsend 2017 do not find any evidence that this occurs).

Displacement affects displaced workers’ consumption in addition to their earnings. Stephens (2001) shows that displaced workers’ spending on food drops by about 10% as a result of being displaced, with the drop beginning to appear one or two years before the displacement event and persisting for 6 or more years after the displacement event. Browning and Crossley (2008) similarly estimate a short-term 4-10% drop in aggregate consumption due to displacement. The impacts of displacement on consumption are smaller than the impacts on earnings, due to consumption smoothing on the part of workers. Follow-up research by Stephens (2004) finds mixed evidence on consumption smoothing: households are fairly good at predicting whether they will experience displacement, but whether a household anticipated being displaced is unrelated to whether that household successfully smooths their post-displacement consumption.

Unfortunately, detailed breakdowns of displacement-induced drops in consumption do not exist. However, we can use cross-sectional evidence about the spending patterns of high vs low income households to hypothesise about direct and indirect pathways through which decreases in

consumption could affect wellbeing. Low-income households may reduce their consumption of comparatively expensive healthy foods (Kirkpatrick and Tarasuk 2003; Ward et al. 2013), and may reduce preventative spending on health, such as spending on heating and winter clothes (Anderson et al. 2012). Such effects could contribute to the adverse health effects of displacement that we describe later. Moreover, households are likely to cut their spending on products and experiences from which they derive enjoyment, which can be expected to worsen their subjective wellbeing.

3.2 Long term employment and earnings effects

In addition to these short-term effects on earnings and consumption, there is a plethora of evidence that involuntary job displacement has persistent long-run negative effects on the earnings and employment rates of displaced workers. Hyslop and Townsend (2017) examine the outcomes of displaced New Zealanders for up to 5 years after their displacement event. They find that, 5 years after displacement, displaced workers still suffer from an 8-12 percentage point employment deficit and a 14-20% conditional earnings deficit.

These findings are consistent with a longstanding literature on the persistent effects of displacement. Canonical research by Ruhm (1991), Farber (1993), and Jacobson et al. (1993) finds that, while the earnings penalty of displacement decreases in magnitude over time, displaced workers still suffer from a 20-30% earnings penalty 6 years after displacement. More recent research by von Wachter et al. (2009) and Davis and von Wachter (2011) shows that earnings deficits of 5-10% persist for as long as 20 years after the displacement event.

Studies in this literature, including Hyslop and Townsend (2017), typically use event-study designs to estimate the causal effects of displacement. These designs make use of panel data on the employment outcomes of a population of workers. Workers who are displaced at some point during the time period covered by the dataset form the “treatment group.” Meanwhile, the “control group” (used to represent the counterfactual outcomes of displaced workers) consists of workers who are *never* displaced across the time period covered by the dataset.

Krolikowski (2018) makes an important point about the interpretation of such estimates. Suppose we are interested in estimating the causal effect of a particular instance of being displaced on a worker’s outcomes (allowing for the possibility that, even in a counterfactual where the worker is not displaced at this moment, the worker may still be displaced at other times in their career). In that case, using a comparison group of workers who are never displaced over the period of study will lead to an overestimate of the causal effect of the particular instance of displacement.

To illustrate, consider a worker i who is displaced at time t . Suppose we take worker i ’s outcomes from time t to time $t + 10$ and compare them to the outcomes of worker j , who was not

displaced at any point between time t and time $t + 10$, and who is in all relevant respects identical to worker i . This will *not* produce an estimate of the causal effect of worker i 's displacement at time t , since, in a counterfactual where worker i was not displaced at time t , worker i would have still faced a positive probability of being displaced through periods $t + 1$ to $t + 10$. Thus worker i 's counterfactual expected earnings are lower than the actual earnings of worker j . Comparing worker i to worker j therefore leads to an overestimate of the effects of worker i 's displacement.

In this paper, we are not interested in the effects of the existence of involuntary separations as a general phenomenon. Rather, we are interested in the expected effects of a particular instance of involuntary separation on the displaced workers' outcomes. In other words, we are interested in the causal effect that Krolikowski (2018) considers. Since we rely on estimates from Hyslop and Townsend (2017) that use a comparison group of never-displaced workers, the bias that Krolikowski identifies will affect our estimates.

Krolikowski (2018) shows that accounting for this bias has minimal effect on estimates of the short-term earnings losses associated with displacement, but does significantly reduce the estimated magnitude of the long-term effects of displacement on earnings and employment. As a result, the estimates cited above should be treated cautiously; the true magnitude of the long-term effects is likely substantially lower. However, even when this bias is accounted for, Krolikowski (2018) finds involuntary displacements are still associated with persistent earnings and employment deficits up to 10 years later.

Overall, there is robust evidence that involuntary job loss has large and persistent effects on the earnings and employment prospects of displaced workers. Naturally, these effects translate into long-term effects on the wellbeing of displaced workers.

3.3 Mental health

Involuntary job loss may also adversely affect the mental health of displaced workers. In a study of US workers between 1996 and 2012, Schaller and Stevens (2015) show that the general mental health of displaced workers deteriorates post-displacement, and those workers become substantially more likely to report symptoms of depression and anxiety in the short-term. Cygan-Rehm et al. (2017) show these effects are also present in Australia, Germany, and the UK.

Farré et al. (2018) show Spanish construction workers driven into unemployment during the GFC became much more likely to exhibit "stress, hopelessness, and feelings of uselessness." On the other hand, Brand et al. (2008) show workers who are individually fired experience increases in depression, but workers who lose their jobs in a collective mass layoff do not. As the authors argue, this suggests the mental health effects of displacement occur because of individual loss of self-esteem and feelings of personal inadequacy, rather than the intrinsic stress of not having a job.

Displacement also has spillover effects on the mental health of the displaced worker's family. Using data from Britain and Germany, respectively, Mendolia (2014) and Marcus (2013) show job displacements are associated with a sharp decline in the mental health of the displaced person's spouse. Displacements can also lead to a breakdown in marital relationships; Charles and Stephens (2004) find that in the US the probability of divorce rises after one of the partners is individually laid off, but not after one of the partners loses their job due to a mass plant closure. The authors argue this is because an individual layoff conveys negative information about the displaced partner's quality, while mass layoffs do not have the same informational content. This suggests it is not the stress itself of joblessness that contributes to these marriage breakdowns.

Displacement could affect the mental health of displaced workers via several plausible mechanisms. First, the increased financial precarity of displaced workers is likely to induce anxiety and stress. However, this cannot account for the entirety of the effects on mental health, since individual layoffs and mass layoffs have the same average financial effects but individual layoffs have more intense mental health effects (Brand et al. 2008; Mendolia 2014). Second, loss of interactions and relationships with coworkers could adversely affect the mental health of displaced workers (Mallinckrodt and Fretz 1988). Finally, displacement may harm the self-esteem, identity, or social status of displaced workers (Winefield et al. 1992). The mechanisms through which displacement damages mental health will affect the extent to which various policies might mitigate this damage.

3.4 Physical health and mortality

Involuntarily displaced workers experience a striking increase in short and long-term mortality. Using US data on men only, Sullivan and von Wachter (2009) show displacement is associated with a short-term 50-100% increase in mortality rates, and a 10-15% increase even in the 20th year after displacement. These effects are relative to a base mortality rate of about 0.6% per year; the authors suggest that they are attributable to acute stress in the short-term and chronic stress or reduced investment in health in the long-term. Using Swedish data, Eliason and Storrie (2009) find displacement is associated with an immediate 44% increase in mortality among men, though not among women, and a doubling in suicide rates and alcohol-related mortality in the short run among both men and women. According to their results, men also experience an increase in stress-related and heart-related diseases. Browning and Heinesen (2012) use Danish data on men to find a 79% increase in mortality risk in the year immediately following a displacement event. The increase in mortality risk persists into the long-term, albeit with a decreasing magnitude; the average increase in mortality risk from the 1st to the 20th post-displacement year is 11%. This increase in mortality is driven by increases in the frequency of circulatory diseases, suicides and suicide attempts, traffic

accidents, alcohol-related diseases, and mental illnesses. A consistent theme throughout these three papers is that increases in mortality manifest primarily among men.

This increase in mortality risk is partially driven by changes in the behaviour of displaced workers. Black et al. (2015) show that displaced workers in Norway become much more likely to smoke, and Deb et al. (2011) find that displaced workers in the US are more likely to drink alcohol and to become overweight (though there is mixed evidence on this point, with several previous studies finding no effect on these outcomes – see McKee-Ryan et al. 2005). Deb et al. (2011) argue these negative effects are concentrated among “at-risk” individuals who were already exhibiting unhealthy behaviours before they were displaced. Because drinking, smoking, and overeating in this context may all be coping mechanisms for psychological distress, policies that help displaced workers to alleviate or more healthily deal with their distress could plausibly reduce the mortality effect of displacement.

The effects of displacement on physical health and mortality are much smaller (or non-existent) among older (50+ years old) workers (Salm 2009; Sullivan and von Wachter 2009). This may be because older displaced workers are able to use their displacement as an opportunity to transition into an early retirement, and consequently their lives are not disrupted as much as the lives of younger workers. Alternatively, this may be driven by the fact that older workers in the US are more able to access Social Security benefits, disability benefits, and employer pension plans. Finally, smaller (percentage) effect sizes among older workers could be attributable to the fact that older workers have a much higher base mortality rate.

Two points are worth noting. First, evidence from the United States (Sullivan and von Wachter 2009; Deb et al. 2011; Salm 2009) on the health effects of displacement should be interpreted with caution. The US is unique in that job loss is often accompanied by a loss of employer-provided health insurance, which can affect a displaced person’s health outcomes. In countries like New Zealand, where the public health system is extensive and insurance is usually not tied to a person’s job, the health effects of displacement are likely to be milder. Indeed, Schaller and Stevens (2015) find that the effects of displacement on health in the US are partially but not entirely driven by loss of access to private health insurance.

Second, declines in mental health contribute to displacement-induced declines in physical health (Schaller and Stevens 2015). Stress and anxiety are inherently corrosive to physical health, and declines in mental health can drive displaced workers towards unhealthy behaviours such as drinking or smoking. This suggests that ameliorating the mental health effects of displacement could also mitigate the physical health effects.

3.5 Conclusions

Involuntarily displaced workers suffer from several conceptually distinct but causally interrelated harms. Displaced workers lose out on income and economic security, which can induce intense stress and anxiety. They lose access to a community of coworkers, and the social status and self-esteem accorded by their job, which can worsen their mental health. Deteriorating mental health can in turn trigger unhealthy coping mechanisms, which worsen their physical health and increase their mortality risk in the long-term. Finally, on average their long-term economic outcomes never fully recover: they suffer from persistent earnings and employment deficits.

4 Estimates of the economy-wide value of lost wages due to involuntary job loss

In this section, we estimate the net present value of all wages lost due to the involuntary job displacements that occur in New Zealand in a representative year. We do this by extrapolating outwards the estimates in Hyslop and Townsend (2017) of the earnings effects of involuntary job loss, and combining those estimates with population-level statistics.

More specifically, consider individual i in year t . If individual i is not displaced in year t , they will experience a particular lifetime stream of earnings. We can sum up this stream, with an appropriate discount rate, to obtain the net present value of individual i 's lifetime earnings in the absence of displacement. Call this net present value $NPV_{no\ displacement\ in\ year\ t}$. Alternatively, if individual i is displaced in year t , they will earn a (lower) lifetime stream of earnings. Call the net present value of this stream $NPV_{displacement\ in\ year\ t}$. We can obtain the net present value of the earnings cost of being displaced in year t for individual i by taking

$$NPV_{no\ displacement\ in\ year\ t} - NPV_{displacement\ in\ year\ t}$$

If we sum this quantity across *all* individuals who are displaced in year t , we obtain an estimate of our quantity: the total net-present value of wages lost due to the displacements that occur in year t . A more formal conceptual framework and definition of our quantity of interest is presented in Appendix 1.

Importantly, this quantity is not the cost to the economy of the job displacements, since it does not take into account the general-equilibrium effects of displacement or the flow-on effects of displacement on government expenditure, taxation, firm performance, and a variety of other outcomes. Our estimates should therefore not be used to justify policy interventions on the basis of the total societal costs of job displacement, since they are not representative of those society-wide costs.

In addition to this quantity, we produce estimates of the net present value of the increase in welfare benefits received by individuals who are displaced during a representative year.

4.1 Methodology and assumptions

In this subsection, we provide a high-level description of the methodology we use to arrive at our estimates. We focus on the key assumptions and limitations of the methodology, rather than the technical details. A summary of the assumptions we make is available in Table 1.

We begin by creating a conceptual population that represents the New Zealand workforce, broken down by 5-year age brackets. This population is created using publicly-available statistics from the 2013 Census and 2013 Household Labour Force Survey. Population numbers from these datasets are inflated to account for population growth since 2013. All our estimates in this section are in 2019 New Zealand dollars and are based on the size of the 2019 New Zealand population.

As we previously described, studies of involuntary job loss typically focus on “high-tenure” displaced workers. Hyslop and Townsend (2017) and Dixon and Maré (2013), whose estimates form the basis of our calculations, restrict to workers who spent at least 1 year in their job prior to being displaced. Correspondingly, we shrink our conceptual population by 25% to account for the fact that only 75% of workers have at least 1 year of job tenure (according to publicly available statistics from the 2018 Survey of Working Life). We assume that this 75% figure is constant across age groups, and assume that high-tenure and low-tenure workers have the same conditional earnings. These assumptions are obviously unrealistic, but are unlikely to create significant bias in our results.

As we describe later, we present estimates of our quantity for the full New Zealand workforce (including both low- and high-tenure workers) as well as for high-tenure workers only, but our conceptual population restricts to high-tenure workers.

4.1.1 *Forecasting employment and wage trajectories*

Having created this population, we create expected lifetime wage and employment trajectories for each individual assuming they are not displaced in the year of interest. Each individual, in each subsequent year, is assumed to have a probability of employment equal to the employment rate in their age bracket, and a wage conditional on employment equal to the mean conditional wage in their age bracket inflated by a constant rate of annual wage growth.

Assumptions

Parameter	Upswing value	Downswing value	Severe downswing value	Explanation
Discount rate	0.023	0.023	0.023	Treasury's long-term real discount rate
Real wage growth rate				
Low	0	0	0	
Normal	0.012	0.012	0.012	Treasury's assumption about real wage growth
High	0.02	0.02	0.02	
Displacement rates (high-tenure)				
20-24 year olds	0.017	0.037	0.056	Upswing values are the values from Table 2 of DM, multiplied by 1.5/1.8 (avg disp rate in pre-GFC years/avg disp rate overall) to account for the fact that they are averages that include GFC years. Downswing values are Table 2 DM values multiplied by 3.3/1.8 for the same reason. Severe downswing values are Table 2 DM values multiplied by 5/1.8 (assumed 5% disp rate in severe downturn/avg disp rate in DM).
25-34 year olds	0.014	0.031	0.047	
35-44 year olds	0.014	0.031	0.047	
45-54 year olds	0.015	0.033	0.050	
55-64 year olds	0.017	0.038	0.058	
Displacement rates (full-sample)				
20-24 year olds	0.023	0.051	0.078	High-tenure displacement rates multiplied by 1.4 to account for the fact that, as per Appendix Table 1 of HT, there are about 40% as many low-tenure displacements as there are high-tenure displacements. (That is, if N is the total number of low-tenure displacements and M is the total number of high-tenure displacements, $N=0.4M$).
25-34 year olds	0.020	0.044	0.066	
35-44 year olds	0.020	0.044	0.066	
45-54 year olds	0.021	0.046	0.070	
55-64 year olds	0.024	0.054	0.082	
Employment impacts (high-tenure, 30-49 year olds only)				
1 year post-displacement	0.200	0.283	0.348	Upswing values are from Col 1 Table 7 of HT, multiplied by 0.87 to account for the fact that the estimates include GFC years. 0.87 is the average effect size in Col 1 of the pre-2008 panel of Table 6 of HT divided by the average effect size in Col 1 Table 6 of HT. Downswing values are from Col 1 Table 7 of HT, multiplied by 1.23, which is calculated in the same way except using the post-2008 panel of Table 6 of HT. Severe downswing values are Col 1 Table 7 HT values multiplied by 1.23^2 , which is just the downswing values multiplied by 1.23 again.
2 years post-displacement	0.110	0.155	0.191	
3 years post-displacement	0.068	0.096	0.118	
4 years post-displacement	0.065	0.091	0.112	
5 years post-displacement	0.062	0.087	0.107	
Employment impacts (full-sample, 30-49 year olds only)				
1 year post-displacement	0.175	0.248	0.304	High-tenure values adjusted to account for the presence of low-tenure workers who suffer less severe impacts. The 1-year value is the high-tenure value multiplied by $(1-0.25*0.5)$, to account for the fact that 25% of the sample (the low-tenure workers) suffer impacts about 50% as large in the short-term (as per Table 9 of DS). The other values are the high-tenure values multiplied by $(1-0.25*0.66)$ to account for the fact that low-tenure workers suffer impacts about 33% as large in the long-term (Table 9 of DS).
2 years post-displacement	0.092	0.129	0.159	
3 years post-displacement	0.057	0.080	0.099	
4 years post-displacement	0.054	0.076	0.093	
5 years post-displacement	0.052	0.073	0.090	
Employment impacts for other age groups, and conditional earnings impacts for all age groups, are analogously calculated.				
Benefit receipt impacts (all age groups and samples)				
1 year post-displacement	0.096	0.096	0.096	These numbers are taken directly from Col 3 Table 5 of HT.
2 years post-displacement	0.066	0.066	0.066	
3 years post-displacement	0.062	0.062	0.062	
4 years post-displacement	0.048	0.048	0.048	
5 years post-displacement	0.043	0.043	0.043	

Table 1: Assumptions

More concretely, consider individual i , who belongs to the 20-24 year old age bracket in our population dataset. Let t denote the representative year that we study. In year t , individual i is assumed to be 22 years old (the mid-point of their age bracket), employed, and earning the average weekly wage among employed 20-24-year-olds (\$605). In years $t + 1$ and $t + 2$, individual i is 23 and 24, and in each of these years has a probability of employment equal to the employment rate among 20-24 year olds (65%). We assume an annual real wage growth rate of 1.2%. Thus in year $t + 1$, individual i has a weekly wage conditional on employment equal to $\$605 * 1.012$, and in year $t + 2$ individual i has a weekly wage conditional on employment equal to $\$605 * 1.012^2$. Low-tenure and high-tenure workers are assumed to earn the same average wages.

Subsequently, in year $t + 3$, individual i is 25 years old, and now has a probability of employment of 73.5% (the employment rate among 25-29 year olds) and a conditional wage of $\$861 * 1.012^3$, \$861 being the average weekly wage among 25-29 year olds. This process continues analogously until individual i is assumed to retire at age 65.

This process of creating expected wage and employment trajectories relies on two assumptions worth highlighting. First, by treating an individual's employment status at each subsequent year as an independent event, this process ignores the persistence of employment: people who are employed tend to stay employed. Thus an individual who is employed and not displaced in period t has a greater-than-average probability of employment for their age in subsequent periods. Ignoring the persistence of employment means we underestimate the probability of employment of non-displaced individuals, which biases our estimates downwards. As a robustness check, we try an alternative specification where individuals who are not displaced in period t remain employed with probability 1 for the rest of their working lives. This alternative specification will result in an overestimate of the wage effect of displacement.

Second, by using the cross-sectional age-wage relationship to predict future wages, this methodology assumes the age-wage relationship will remain constant over time. This is unlikely to be strictly accurate, but the impact on our results should be small.

4.1.2 *Displacement rates*

After creating these predicted employment and wage trajectories in the absence of displacement, we assume a certain percentage of workers in each age group are displaced during year t . Our estimates of age-specific displacement rates are taken from Table 2 of Dixon and Maré (2013). We consider three different displacement rate scenarios. The first scenario represents times of economic upswing, and uses the displacement rates from Table 2 scaled down to account for the fact that they are averages taken over a time period that includes the Global Financial Crisis. These upswing displacement rates vary among age groups from 1.4% to 1.7%. The second scenario represents an economic "downturn" roughly analogous to the GFC, and uses the displacement rates from Table 2

scaled up to account for the fact that they are averages taken over a time period that includes non-GFC years. These downswing displacement rates range among age groups from 3.1% to 3.8%. Finally, our third scenario represents a severe economic downswing, and scales up the age-specific displacement rates to give an average displacement rate of 5%. The 5% figure is purely hypothetical, and is not based on any particular piece of data.

As we described above, our conceptual population is restricted to high-tenure workers, but we also present estimates for the full New Zealand workforce (including low-tenure workers as well). Appendix Table 1 of Hyslop and Townsend (2017) shows that the annual number of low-tenure displacements is about 40% of the annual number of high-tenure displacements. Since we assume there are no differences between high-tenure and low-tenure workers, this means we can extend our estimates to the full New Zealand workforce by multiplying these displacement rates by 1.4.

Notably, the aforementioned displacement rates are substantially lower than annual separation rates that can be calculated from administrative data (which can range from 10-20%). This is because separation rates calculated from administrative data do not distinguish between voluntary separations and involuntary displacement; the presence of many workers who take on successive short-term jobs therefore massively inflates the separations rate relative to the displacement rate. Since our estimates are based on self-reported HLFs data that distinguishes between voluntary and involuntary displacement, our estimates much more accurately reflect the rate of involuntary displacement.

4.1.3 Forecasting employment and wages for displaced workers

We next restrict our attention to the workers who are displaced in our representative year. We estimate their wage and employment trajectories, this time under the assumption they are displaced in the year of interest. These trajectories are calculated in the same way we described above, except that in each future year an individual's probability of employment is adjusted for the employment deficit associated with displacement, and their wages conditional on employment are adjusted for the conditional wage deficit associated with displacement.

Our estimates of the employment and conditional-earnings deficits associated with displacement come from Table 7 of Hyslop and Townsend (2017), which estimates separately the effects of displacement for each age group. Across our different specifications, we adjust these estimates on two axes: depending on whether we consider high-tenure workers or the full workforce, and depending on whether we consider an economic upswing, downswing, or severe downswing.

The estimates in Hyslop and Townsend (2017) are calculated from a sample of high-tenure displaced workers. In specifications where we restrict to high-tenure workers, we use these estimates. However, in specifications where we consider the full New Zealand workforce, we adjust

these estimates for the fact that low-tenure workers are plausibly much less impacted by displacement (since they have less firm-specific human capital to lose). The estimates from Dixon and Stillman (2009) suggest that the impacts on low-tenure workers are about 50% as large in the short-term and 33% as large in the long term; we therefore adjust the impacts for the fact that 25% of the population is experiencing an effect that is 33-50% smaller.

To account for the fact involuntary displacements during recessions appear to be more harmful, we also adjust the impacts of displacement between our upswing, downswing, and severe downswing scenarios. Hyslop and Townsend (2017) present estimates split up between pre-GFC and during-GFC years, so we use the pre-GFC estimates for our upswing impacts and the during-GFC estimates for our downswing impacts. For the severe downswing displacement impacts, we inflate our downswing impacts by the ratio of downswing average impact magnitude to upswing average impact magnitude. Again, this is a purely hypothetical adjustment not based on any data.

Hyslop and Townsend (2017) estimate the effects of displacement for the first 5 years following a displacement event; our analysis requires us to extrapolate these out to retirement age, meaning up to 43 years after displacement.

The estimates from Hyslop and Townsend (2017) exhibit a fairly consistent pattern across different specifications. As Figures 1 and 2 illustrate, they start off large in Year 1, drop sharply in Years 2 and 3, and then flatten off and remain roughly constant in Years 3-5 at between a quarter and half of the Year 1 impacts.

Figure 1: Employment deficits from Hyslop and Townsend (2017)

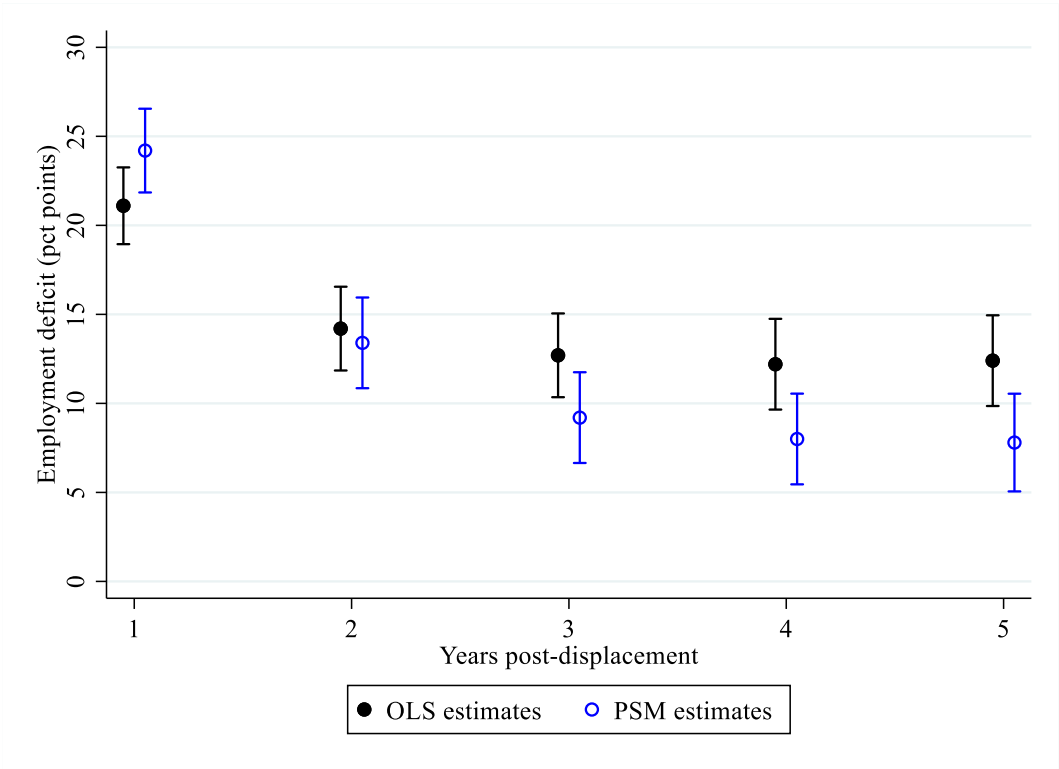
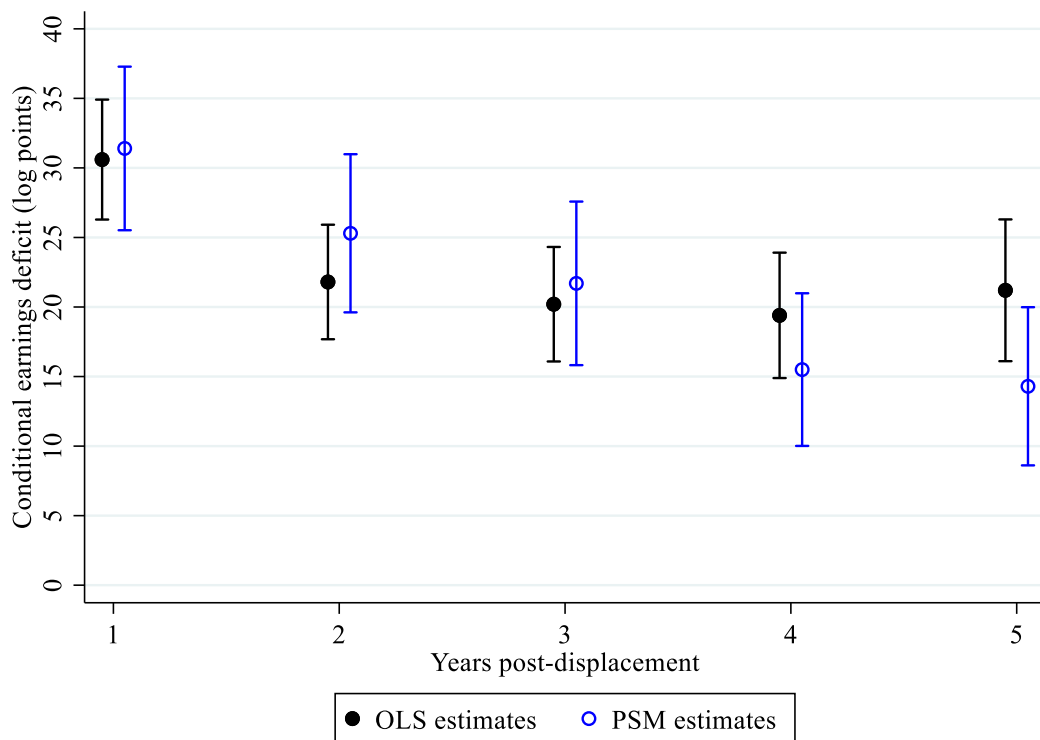


Figure 2: Conditional earnings deficits from Hyslop and Townsend (2017)



Note that an earnings deficit of 30 log points is roughly equivalent to a 30% earnings deficit.

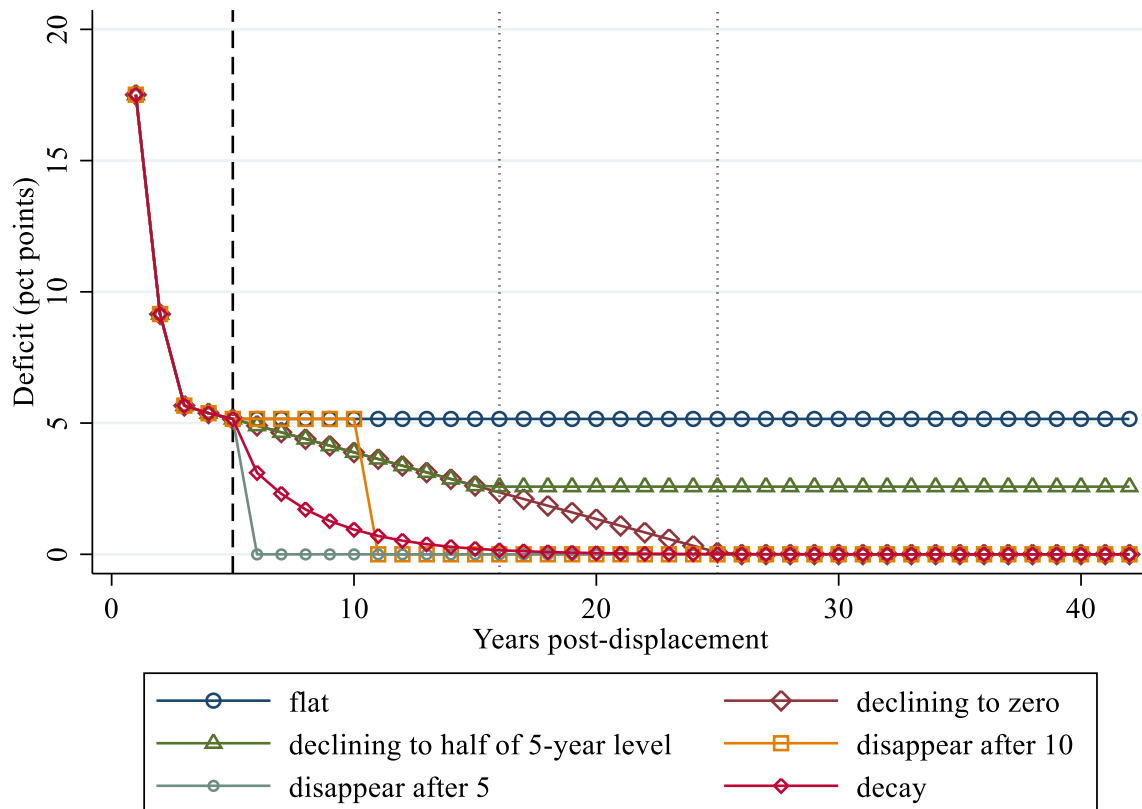
Longer-horizon estimates from the US suggest a somewhat different pattern. The estimates in Figure 5 of Davis and von Wachter (2011) suggest that the unconditional earnings effects of displacement decline linearly for the first 10 years after displacement, at which point they flatten out at about half of the Year 1 impacts, and remain there until 20 years after displacement. Note however these estimates examine unconditional earnings (rather than employment rates plus conditional earnings), and restrict to men with at least 3 years of job tenure.

To avoid our results being driven by the particular assumptions we use to extrapolate, we report estimates from a variety of extrapolations that we consider reasonable. As a lower-bound estimate on the costs of displacement, we assume the effects of displacement drop to zero after 5 years. As an upper-bound estimate, we assume the effects remain at their Year 5 levels for the rest of a worker's life. (Here, "the effects of displacement" means each of "the percentage-point effects of displacement on employment probability" and "the percentage effect of displacement on conditional earnings").

In addition to these upper and lower bounds, we present four intermediate estimates. The first assumes the effects remain at their 5-year level until 10 years after displacement, after which they disappear entirely. The second assumes the effects decline linearly to zero according to their gradient between Year 3 and Year 5. The third assumes the effects decline linearly in the same way

until they reach half their Year 5 level, at which point they remain constant until retirement age. Finally, the fourth fits an exponential decay model to the Year 1-5 estimates and assumes effects decline according to that model. Figures 3 and 4 display examples of the effects trajectory under each of these assumptions.

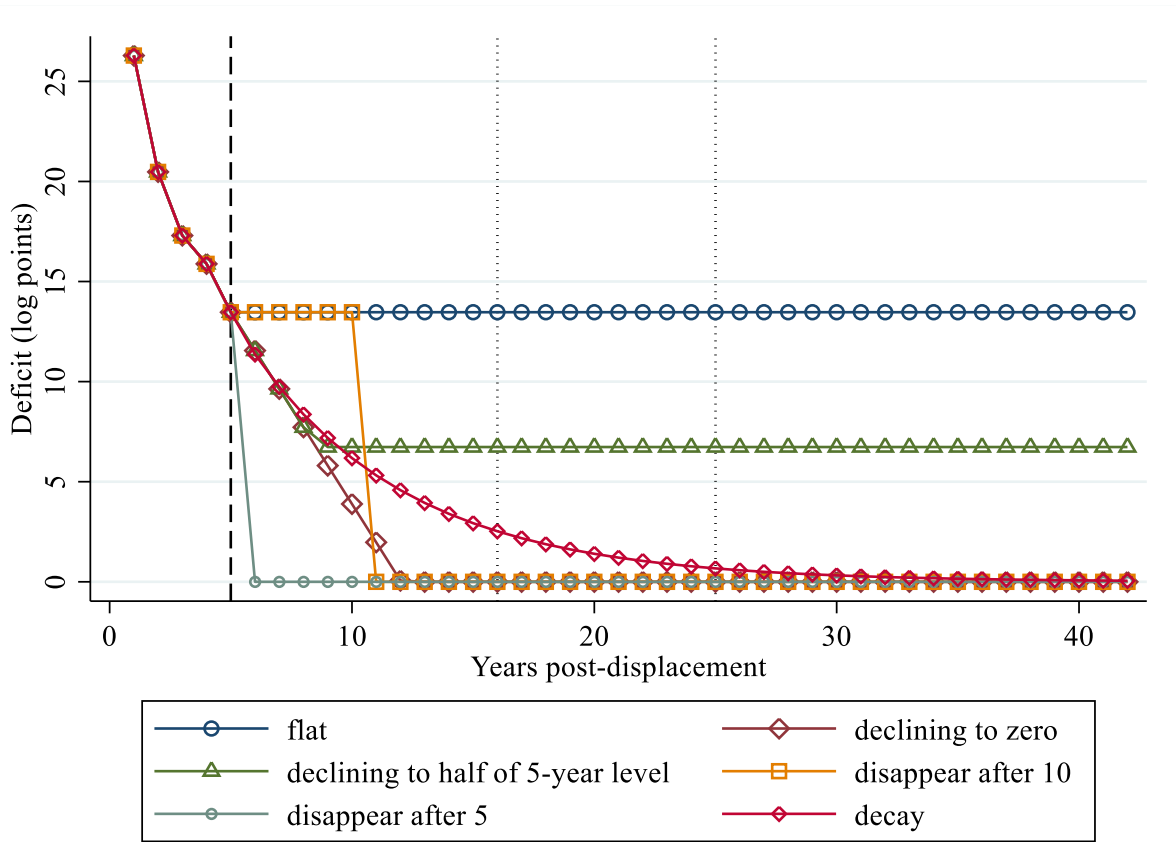
Figure 3: Employment deficit extrapolations (30-49 years old)



Notes: The dashed line indicates the end of the empirical estimates from Hyslop and Townsend (2017) and the beginning of our extrapolations. The two dotted lines indicate the earliest and latest times at which a person in this age group might retire.

Although we report all of these estimates, our weakly preferred specification is the one where the effects decline linearly to zero according to their Year 3-5 gradient. This preference is based on two considerations. First, the evidence from Davis and von Wachter (2011) suggests the effects of displacement will continue to decline after 5 years. Second, although the evidence from Davis and von Wachter (2011) suggests that displacement results in significant permanent deficits, the estimates from Krolikowski (2018) (which correct for the problems with using a comparison group of never-displaced workers) show that the effects of displacement fall to zero after about 8-10 years. Our linear-decline extrapolation results in deficits that fall to zero after about 10 years in most cases.

Figure 4: conditional earnings deficit extrapolations (30-49 year olds)



Notes: The dashed line indicates the end of the empirical estimates from Hyslop and Townsend (2017) and the beginning of our extrapolations. The two dotted lines indicate the earliest and latest times at which a person in this age group might retire. An X log point deficit is roughly equivalent to an X% deficit.

4.2 Calculating the NPV of wages lost due to the displacements in a representative year

Finally, having identified our displaced population and estimated employment and wage trajectories that take into account their displacement, we are ready to calculate our quantity of interest. We calculate the net present value of the lifetime earnings of each individual in our displaced sample, and then calculate the net present value of their lifetime earnings using the employment and wage trajectories we calculated at the beginning (the trajectories that assumed they were not displaced). We use a real discount rate of 2.3%, based on the Treasury’s numbers.⁴ We then take the difference

⁴ This is Treasury’s long-term risk-free nominal discount rate of 4.3%, allowing for 2% annual inflation. <https://www.treasury.govt.nz/information-and-services/state-sector-leadership/guidance/financial-reporting-policies-and-guidance/discount-rates/discount-rates-and-cpi-assumptions-accounting-valuation-purposes>

between these two net present values, and sum up this difference across all individuals in our sample to obtain our quantity of interest.

4.3 Calculating effects of displacement on benefit receipt

Using a similar approach, we calculate the net present value of the increase in welfare benefits received by displaced individuals. Unfortunately, the available data on benefit receipt are far more limited than the data on earnings and employment. We therefore implement the following simple procedure.

Hyslop and Townsend (2017) focus on the impacts of displacement on first-tier benefits, excluding second-tier benefits such as Accommodation Supplements and Disability Allowances. In their dataset, 3% of never-displaced workers and 6% of displaced workers earn first-tier benefit income. Conditional on earning some benefit income, never-displaced workers receive an average of \$1,070 a month, while displaced beneficiaries receive a lower average of \$886 a month. Hyslop and Townsend (2017) find that displacement increases a worker's probability of receiving benefits by 4-10 percentage points in each of the first 5 years, but does not have a statistically significant effect on a worker's conditional benefit earnings. (That is, there is an extensive-margin effect on benefit receipt but no intensive-margin effect).

We therefore focus on the extensive margin. We assume non-displaced workers have an annual 3% probability of receiving benefit income, and displaced workers have a probability of benefit receipt equal to 3% plus the impact of displacement. As given by Table 5 of Hyslop and Townsend (2017), this impact is 9.6 percentage points in the first year and declines to 4.3 percentage points by Year 5. Beyond Year 5 we extrapolate using the techniques described above. Benefit recipients (regardless of whether they are displaced or not) earn $\$1,070 \times 12$ a year. With these numbers in place, we can calculate the effects of displacement on the net present value of benefit receipt of all the displaced individuals in our sample.

The benefit-receipt methodology has several limitations in addition to the general limitations of our strategy. First, the numbers from Hyslop and Townsend (2017), in addition to being restricted to first-tier benefits, are restricted to benefits for which the displaced individual is a primary claimant. Displacement may also affect the benefit receipt of a displaced worker's partner and dependents, and these effects are not picked up by our analysis. This means our estimates will tend to understate the true effects on benefit receipt. In addition, our benefit receipt number of \$1,070 is based on a crude population mean. The direction of the resulting bias is unclear.

4.4 Results

4.4.1 Lost earnings due to displacement

Table 2 presents our main results. It displays estimates of our quantity of interest across different economic conditions and using different methods of extrapolation. All estimates in Table 2 assume a 2.3% real discount rate and 1.2% real wage growth, cover the full New Zealand workforce, and do not allow for autocorrelation of employment status.

Table 2: Estimates of NPV of wage losses

NPV of economy-wide lifetime wages lost to wage scarring			
	Upswing	Downswing	Severe downswing
Upper bound: the 5-year impacts remain forever	\$5.2b (1.7%)	\$14.3b (4.6%)	\$25.0b (8.1%)
Intermediate: the 5-year impacts decline to half their 5-year level	\$3.8b (1.2%)	\$10.0b (3.5%)	\$18.5b (5.9%)
Intermediate: the 5-year impacts decline to zero	\$3.3b (1.1%)	\$8.8b (2.8%)	\$15.4b (5.0%)
Intermediate: the 5-year impacts decay to zero	\$2.9b (1.0%)	\$8.1b (2.6%)	\$14.3b (4.6%)
Intermediate: the 5-year impacts fall to zero in year 11	\$3.2b (1.0%)	\$8.9b (2.9%)	\$15.7b (5.8%)
Lower bound: the impacts fall to zero in year 6	\$2.1b (0.7%)	\$5.8b (1.9%)	\$10.1b (3.3%)

Notes: each cost is presented as a figure in billions of 2019 dollars and as a percentage of 2019 GDP. Preferred specification is highlighted in green. These numbers assume a 2.3% real discount rate and 1.2% real wage growth. These estimates cover the full New Zealand workforce and do not allow for autocorrelation of employment status.

As Table 2 shows, our preferred specification suggests that during economic upswings (when about 31,000 individuals are displaced annually), the net present value of all wages lost to involuntary displacements in a given year is \$3.3 billion (1.1% of GDP). Depending on the method of extrapolation, this value could be between \$2 and \$5 billion. Meanwhile, during downswings (when about 65,000 individuals are displaced annually), the net-present value of lost wages is \$8.8 billion (2.8% of GDP) according to our preferred specification. However, it could range between \$5 billion and \$14 billion. Finally, during a severe downswing (when roughly 100,000 individuals are displaced annually), this number is \$15.4 billion (5.0% of GDP), but could range between \$10 and \$25 billion.

Table 3 disaggregates the economic upswing results by age group. For the average member of each 5-year age grouping, it displays the net-present value of wages lost to an involuntary

displacement; the net-present value of the individual’s future earnings in the counterfactual where they are not displaced; the lost earnings due to displacement as a percentage of counterfactual future earnings; and the lost earnings due to displacement as a number of years of lost earnings. (This last statistic simply divides the lost earnings by the individual’s average counterfactual earnings over all future years).

Table 3: Estimates disaggregated by age group

NPV of future lost wages and NPV of counterfactual future wages				
	NPV of losses	NPV of CF earnings	Losses as % of CF earnings	Years of lost earnings
Age 20-24	\$16,909	\$1,560,654	0.2%	0.10
Age 25-29	\$31,583	\$1,502,897	1.2%	0.45
Age 30-34	\$154,737	\$1,360,734	10.6%	3.38
Age 35-39	\$133,890	\$1,192,649	10.2%	2.75
Age 40-44	\$85,964	\$970,116	7.4%	1.64
Age 45-49	\$93,946	\$776,234	10.3%	1.76
Age 50-54	\$196,514	\$554,109	33.3%	4.0
Age 55-59	\$137,495	\$323,548	38.3%	2.68
Age 60-64	\$50,283	\$92,340	51.9%	1.04

Notes: this table displays, for the average worker in each age group, the following quantities: (a) the NPV of future wages they lose (in expectation) to displacement, (b) the NPV of their future wages if they are not displaced, (c) the quantity in (a) as a percentage of (b), and (d) the quantity in (a) as a number of years of lost future earnings. The horizontal lines display the three categories over which displacement percentage effects are allowed to vary (20-29, 30-49, and 50+). These numbers rely on the "baseline" extrapolation model according to which the 5-year impacts decline to zero according to their gradient in years 3-5.

The results in Table 3 show that the hardest-hit individuals are those between 30 and 40 years of age, or between 50 and 60 years of age, at the time they are displaced. Since the average individual’s earnings peak between the ages of 40 and 50, the 30-40 year olds who are displaced immediately before reaching this peak lose out on large amounts of earnings. Meanwhile, Table 7 of Hyslop and Townsend (2017) shows that workers older than 50 are the hardest-hit by displacement in percentage terms. Displaced workers who are near retirement do not have many remaining years of earnings to lose out on, but workers who are in their early-to-mid 50s are very badly hit by displacement.

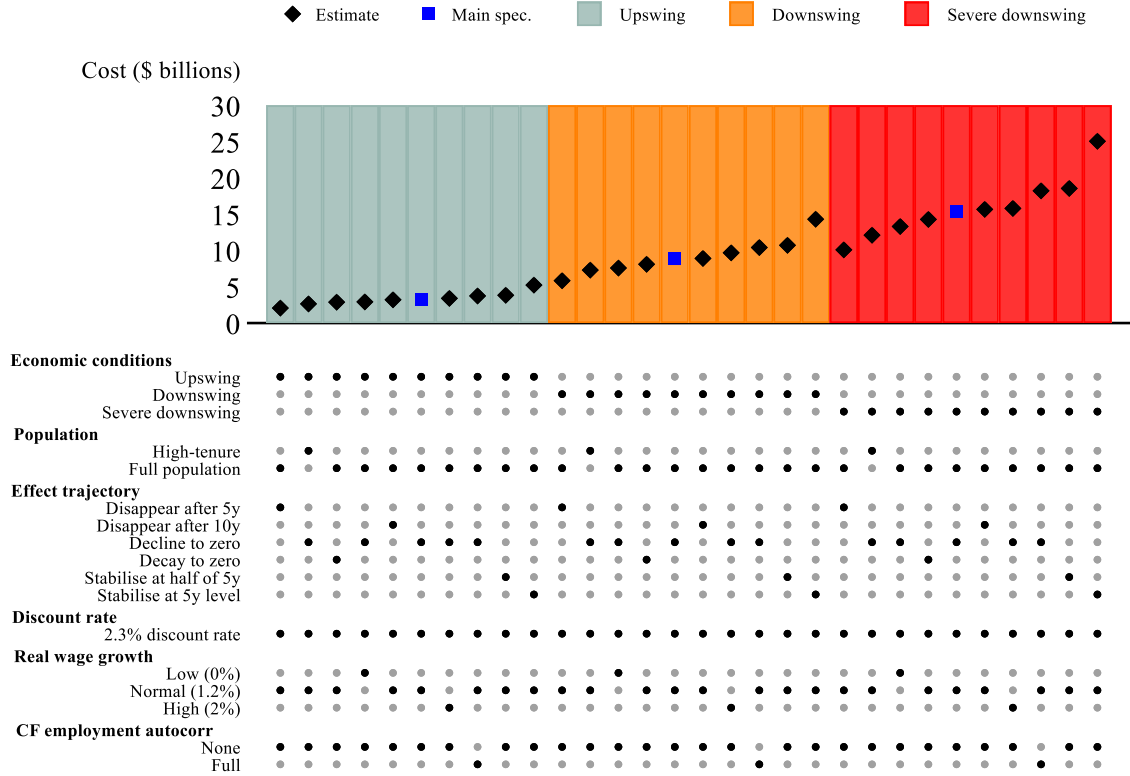
Displaced workers aged between 30 and 40, or between 50 and 60, lose 2.5-3.5 years of earnings as a result of their displacement. These results are comparable to those of Davis and von Wachter (2011), who find that workers displaced during recessions lose between 1.4 and 2.8 years of earnings in present-value terms.⁵ Table 3 shows that workers aged 40-50 at the time of displacement

⁵ Davis and von Wachter (2011) use a real discount rate of 5% (twice as large as ours), which may explain why their estimates are smaller.

lose about 1.7 years of earnings, and workers aged 60-64 lose about 1 year of earnings. By comparison, young workers (aged between 20-30) lose only 0.1-0.45 years of earnings, both because the percentage impacts of displacement on young workers are much smaller, and because young workers are displaced during a relatively low-earning period of their life.

Finally, Figure 5 displays a more comprehensive set of estimates that vary our core assumptions.⁶ In Figure 5, we present 10 estimates for each economic scenario. These 10 estimates consist of our main specification plus 9 estimates where we deviate from our main specification by switching one assumption at a time. Figure 5 shows that the smallest estimates tend to be obtained by restricting to the population of high-tenure workers or assuming that the effects of displacement disappear after 5 years, while the largest estimates are obtained by assuming that the Year 5 effects of displacement persist until retirement.

Figure 5: Estimates of the NPV of lost wages



Notes: this figure plots estimates of the net-present value of all wages lost by displaced individuals as the result of the displacements that occur in a representative year. We present 9 estimates within each of the “Upswing,” “Downswing,” and “Severe Downswing” scenarios; each of these estimates deviates from our preferred specification by altering one assumption. The “high-tenure” assumption restricts to workers with >=1 year of job tenure; the “effects trajectory” assumptions determine how we extrapolate from Hyslop and Townsend’s (2017) estimates, as we describe earlier; the “real wage growth” assumptions alter the assumed long-run rate of real wage growth; and the “CF employment

⁶ Thanks to Hans H. Sievertsen for the code used to create these specification charts. See <https://github.com/hhsievertsen/speccurve>

autocorr” determines whether a displaced person’s counterfactual employment statuses are treated as independent across time (in the “None” condition) or whether a person who is counterfactually employed in one period remains counterfactually employed forever (in the “Full” condition).

The smallest and largest estimates in Figure 5 do *not* provide upper and lower bounds on our estimates, since we could obtain even smaller or even larger numbers by altering multiple assumptions simultaneously (for example, restricting to the high-tenure population *and* assuming the effects disappear after 5 years).

4.4.2 Increases in benefit receipt due to displacement

Analogous estimates of the net-present value of increases in benefit receipt due to displacement are presented in Table 4 and Figure 6. Notably, the scale of the impacts here is much smaller: the estimates in Figure 6 range from 0.1 to 1 billion dollars, whereas the estimates in Figure 5 range from 2 to 25 billion dollars.

Table 4: Estimates of the NPV of increases in benefit receipt

NPV of economy-wide lifetime increases in benefit receipt			
	Upswing	Downswing	Severe downswing
Upper bound: the 5-year impacts remain forever	\$0.32b (0.10%)	\$0.66b (0.21%)	\$1.0b (0.33%)
Intermediate: the 5-year impacts decline to half their 5-year level	\$0.22b (0.06%)	\$0.47b (0.15%)	\$0.72 (0.23%)
Intermediate: the 5-year impacts decline to zero	\$0.14b (0.04%)	\$0.30b (0.10%)	\$0.47b (0.15%)
Intermediate: the 5-year impacts decay to zero	\$0.16b (0.05%)	\$0.32b (0.10%)	\$0.54b (0.17%)
Intermediate: the 5-year impacts fall to zero in year 11	\$0.16b (0.05%)	\$0.40b (0.12%)	\$0.58 (0.19%)
Lower bound: the impacts fall to zero in year 6	\$0.12b (0.04%)	\$0.25b (0.08%)	\$0.40b (0.13%)

Notes: each cost is presented as a figure in billions of 2019 dollars and as a percentage of 2019 GDP. Preferred specification is highlighted in green. These numbers assume a 2.3% real discount rate and 1.2% real wage growth. These estimates cover the full New Zealand workforce and do not allow for autocorrelation of employment status.

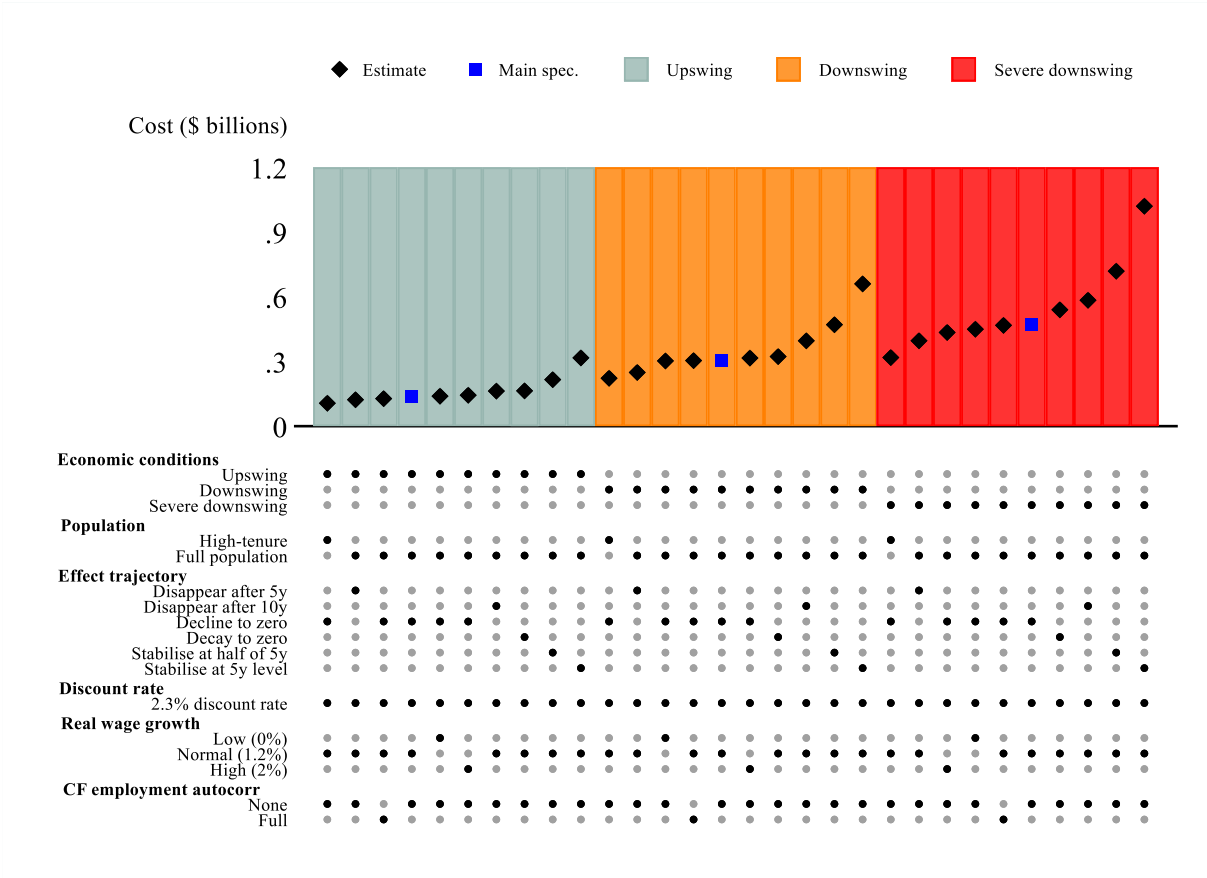
Table 4 shows that in an economic upswing, a year’s worth of displacements is estimated to lead to an increase in benefit receipt of about \$0.14 billion, or 0.4 percent of the government’s total expenditure on social security and welfare.⁷ (Recall, however, that our results only cover first-

⁷ Source: <https://www.treasury.govt.nz/information-and-services/financial-management-and-advice/revenue-and-expenditure>

tier benefits whose primary claimant is the displaced individual). Depending on the method of extrapolation, this value could be between \$0.1 and \$0.3 billion. During a downswing, this number is equal to \$0.30 billion, and could be between \$0.2 and \$0.7 billion. Finally, during a severe economic downswing, this number is \$0.48 billion and could be between \$0.4 and \$1 billion.

Meanwhile, Figure 6 displays a comprehensive set of benefit-receipt estimates. The patterns in Figure 6 are similar to Figure 5; the highest estimates are obtained by assuming that the Year 5 effects on benefit receipt persist until retirement, while the lowest estimates are obtained by assuming the effects disappear after 5 years.

Figure 6: Estimates of the NPV of benefit receipt increases



Notes: this figure plots estimates of the net-present value of all wages lost by displaced individuals as the result of the displacements that occur in a representative year. We present 9 estimates within each of the “Upswing,” “Downswing,” and “Severe Downswing” scenarios; each of these estimates deviates from our preferred specification by altering one assumption. The “high-tenure” assumption restricts to workers with ≥ 1 year of job tenure; the “effects trajectory” assumptions determine how we extrapolate from Hyslop and Townsend’s (2017) estimates, as we describe earlier; the “real wage growth” assumptions alter the assumed long-run rate of real wage growth; and the “CF employment autocorr” determines whether a displaced person’s counterfactual employment statuses are treated as independent across time (in the “None” condition) or whether a person who is counterfactually employed in one period remains counterfactually employed forever (in the “Full” condition).

We do not disaggregate the benefit receipt results by age group because we assume that benefit rates and base receipt probabilities are homogenous across age groups.

5 Effectiveness of policies to mitigate the negative effects of involuntary job loss

In this section, we critically evaluate the standard policy options for ameliorating the effects of involuntary job loss.

A displacement-focused policy may have one of two distinct goals. Firstly, it may be aimed at supporting workers in the immediate aftermath of displacement: mitigating the effects of displacement on economic security and mental health by providing workers with a financial safety net, mental health support services, and so on. This sort of policy is motivated by a concern for the immediate welfare of the displaced person and their family.

Second, a policy may aim to help workers quickly transition back into work that is a good match for their skills, with the aim of preventing or reducing the long-term wage and employment deficits discussed in Section 3. For example, education and training programmes or job-placement policies can serve this purpose. This sort of policy is also motivated by a concern for the welfare of the displaced person, but can additionally be justified through its broader beneficial effects on the economy.

Different policies may be required to achieve each goal, though policies such as job-placement programmes may simultaneously serve both purposes.

5.1 Policies

Policies targeted at involuntarily displaced workers tend to fall into two categories. The first category consists of unemployment insurance or unemployment benefit payments, which provide displaced workers with cash or vouchers. The second category consists of job training programmes, job placement programmes, and job search assistance programmes. These programmes provide workers with skills training, directly negotiate job placements with employers, and indirectly help displaced workers search for a new job.

This latter set of policies are often collectively referred to as “Active Labour Market Programmes” (ALMPs). It makes sense to group them together because, in practice, the boundaries between different types of ALMP are hazy. For example, as LaLonde (2003) points out, many “training” courses provide only a brief period of training, followed by placement in government-subsidized private employment. Thus, training programmes, job placement programmes, and job search assistance programmes often blur together.

In this section, we discuss these two types of policies. For each policy type, we begin by describing the theoretical rationale for and arguments against the policy. Subsequently, we provide an overview of the empirical evidence about the effects of the policy.

Note that while unemployment insurance schemes are (by their nature) targeted at workers who become displaced, unemployment benefit schemes and Active Labour Market Programs are often broader and aim to help all unemployed workers, regardless of whether they have been recently displaced.

5.2 Unemployment insurance and benefits

5.2.1 *Theoretical discussion*

Payments to displaced workers can come in two forms. They can firstly take the form of *unemployment insurance*, a form of social insurance that provides a mechanism for all members of society to pool their risk of unemployment and thereby insulate themselves from the full effects of displacement. Governments can have a reason to provide unemployment insurance (rather than leaving it up to the private insurance market) either because a private insurance market would be afflicted with adverse selection, or because individuals would irrationally fail to voluntarily insure themselves, or because uninsured individuals create negative externalities (such as crime).⁸

Unemployment insurance can either consist of flat payments to displaced workers, or an income replacement scheme that provides displaced workers with a percentage of their pre-displacement income. Income replacement schemes are common in Europe, Canada, and the US (Spencer 2019), and typically last for a few months post-displacement. They may be superior to flat payments because of the existence of reference-dependent preferences (O'Donoghue and Sprenger 2018).

Unemployment insurance systems can also be financed in a number of ways. Insurance could be financed by general taxation, or by specific premiums paid by workers or firms; the latter option would allow premiums to be adjusted across different firms or industries. As discussed in OECD (2017), unemployment insurance could take the form of mandatory redundancy payments from employers.

Second, payments to unemployed workers can come in the form of *unemployment benefits*, payments made to unemployed workers either for redistributive purposes or to fulfil the government's obligation to provide everyone with a minimum standard of living. As we describe below, unemployment benefits can also be implemented alongside unemployment insurance in a two-tiered system designed to support displaced workers while encouraging job search.

⁸ Gruber (2019).

Although unemployment insurance and unemployment benefit programmes are conceptually distinct and have different motivations, they have similar potential harms. The most direct social cost of unemployment insurance/benefits (henceforth “unemployment payments”) consists of the distortionary effects of the taxes used to fund them.⁹ (Mandatory employer-provided redundancy payments have a different cost, in the form of lower equilibrium wages.) In addition, unemployment payments may create a moral hazard problem that distorts the incentives of both workers and employers.

Displaced workers who receive unemployment payments may take longer to find a new job, which increases the fiscal burden of unemployment payments and reduces aggregate production.¹⁰ Increased search duration may also directly affect the welfare of payment recipients. On the one hand, giving displaced workers the financial freedom to spend longer searching for a new job might facilitate higher quality job matches. On the other hand, if displaced workers are incentivized to prolong their job search, this may cause their skills to depreciate or send a negative signal to prospective employers, causing them to end up in worse-quality jobs. Because these two effects go in opposite directions, the effects of unemployment payments on recipients’ subsequent job match quality is theoretically ambiguous.

Chetty (2008) makes another subtle point. It is typically assumed that if unemployment payments increase the search duration of recipients, this is because unemployment payments distort the relative prices of labour and leisure in a way that causes recipients to make socially suboptimal decisions. But Chetty notes that if payment recipients face credit constraints that prevent them from smoothing consumption, then their decisions in the absence of unemployment benefits reflect a socially suboptimal market failure. Unemployment payments can correct for this market failure in a way that results in socially optimal extensions of search duration. Thus, longer search durations may in fact be socially beneficial, depending on whether they are driven by a moral hazard effect or by the removal of credit constraints. Of course, calibrating the magnitude and duration of unemployment payments to optimally correct for this market failure would be a very difficult exercise.

Because the effects of increased search duration on subsequent job quality are theoretically ambiguous, and because increased search duration may reflect a correction of credit market failures, the welfare effects of increased job search duration are theoretically ambiguous. In other words, even if unemployment payments reduce the labour supply of recipients, it’s not clear that this is a bad thing from the perspective of a social planner maximising social utility.

⁹ Since unemployment insurance is a transfer payment, its cost is not the amount of dollars spent, but the deadweight loss of the taxation used to raise those dollars.

¹⁰ In the canonical model of Chetty (2006), this distortion of displaced workers’ labour supply is the central harm of generous unemployment insurance. According to Chetty’s framework, setting the optimal level of unemployment insurance requires grappling with a tradeoff between the benefits of allowing workers to smooth consumption and the harms of reduced labour supply.

In any case, unemployment payment policies can be designed to mitigate effects on the search duration of recipients. First, as Schmieder and von Wachter (2016) note, most countries package unemployment insurance payments with job search requirements and assistance. In these countries, displaced workers are required to actively look for a new job in order to receive unemployment insurance payments, and they are assigned a case worker who monitors their progress and helps them find job offers. Requiring and monitoring job search could ameliorate any effects of unemployment insurance on search duration, especially if recipients are required to accept job offers the government considers suitable.

In addition, as Tatsiramos and van Ours (2014) note, economic theory predicts that the effects of unemployment insurance on search duration can be minimised by having insurance payments decrease in magnitude over time. One natural way to do this is to have a “two-tiered” payment system, where displaced workers receive unemployment insurance payments equal to a set percentage of their pre-displacement income for an initial amount of time, and at the end of this time if they have not found a job they are moved onto an unemployment benefit program that gives lower flat payments.

Unemployment payment systems can therefore be designed to limit effects on the labour supply of recipients. However, whether this should be done is theoretically ambiguous, since the welfare effects of increased search duration are ambiguous.

Unemployment payment programs can also distort the behaviour of employers. Employers who are concerned for the welfare of their workers may be more likely to lay off workers if a generous unemployment payments system exists (though this could be avoided under a system of unemployment insurance that adjusts premiums according to the layoff rates at different firms). This will increase the frequency of layoffs, but may also enhance economic efficiency if employers would otherwise refrain from making economically efficient layoffs for compassionate reasons. Relatedly, unemployment payments may make employers more willing to hire employees when they are uncertain whether those employees will be needed in the long-term, and may make workers more willing to make risky human capital investments or sign up to work at start-ups with an uncertain future (Brown and Kaufold 1988; Acemoglu and Shimer 1999).

At a practical level, unemployment payments that apply only to involuntarily displaced workers are difficult to target. Voluntary displacements could easily be styled as involuntary to give the departing worker access to unemployment payments.

Unemployment payments may also fail to mitigate the mental health costs of displacement. As we discussed earlier, there is evidence that displacement worsens mental health partly by reducing a person’s self-esteem and social status, and by causing them to lose a community of coworkers. While unemployment payments can help prevent the financial stress associated with

displacement, they cannot restore self-esteem, status, or social relationships. Insofar as the physical health effects of displacement are driven by deteriorations in mental health, this also means that unemployment payments cannot completely mitigate the physical health costs of displacement.

Rigorously means-tested unemployment payments could also worsen the mental health and social status of displaced workers if they forced them through a difficult, dehumanising, or humiliating process of applying for benefits. (This is relative to a system of more easily accessible unemployment payments, not relative to no unemployment payments).

Despite these potential harms, unemployment payments can ease financial stress (which is especially important given that the mortality effects surveyed previously are significantly driven by increases in stress); they can reduce decreases in expenditure on preventative health behaviours; and they can protect the subjective wellbeing of displaced individuals by allowing them to maintain a higher level of consumption.

We can wrap up this discussion by emphasising that in addition to the technocratic considerations we have discussed, the optimal system of unemployment payments depends crucially on the goals of policymakers. A system of unemployment payments can have a number of different purposes: it could be intended as a system of insurance that enables efficient pooling of risk; a means of compensating individuals who suffer economic hardship through no fault of their own; a way to help individuals smooth consumption despite liquidity constraints (Chetty 2006); a way to ensure that everyone can access a minimum standard of living; a way to reduce relative deprivation and preserve dignity; or a mechanism through which to promote social justice by helping the oppressed. Each of these goals may demand a system of unemployment payments that is structured and financed differently.

5.2.2 Empirical evidence of effects

Much empirical evidence on the effects of unemployment payments is drawn from the US, where cross-state variation in unemployment insurance generosity can be exploited to generate quasi-experimental estimates of the effects of unemployment insurance. (In the US, unemployment insurance is set at the state level, and there are large differences in eligibility criteria, benefit duration, and benefit generosity across different states.) Studies in the literature also frequently draw on data from European countries, where some convenient natural experiments have occurred that enable quasi-experimental study of unemployment insurance and unemployment benefits. These findings from overseas may not generalise to New Zealand.

In this section, we cover four aspects of the empirical evidence on unemployment payments. First, we survey the evidence on the effects of payments on the immediate post-displacement outcomes of displaced workers. Next, we discuss the effects of unemployment payments on recipients' labour supply. We then discuss the welfare implications of reductions in labour supply

caused by unemployment payments. Finally, we discuss the effects of unemployment payments on the behaviour of employers.

The overall takeaway from this evidence is that unemployment insurance¹¹ is an effective tool for ameliorating the short-term effects of job loss on displaced workers' consumption and mental and physical health (though insurance payments only mitigate, and do not fully offset, these effects). In addition, unemployment insurance has small negative effects on the labour supply of displaced workers, and slightly increases the propensity of employers to fire their workers, but the welfare implications of these latter two effects are ambiguous, and negative welfare effects are likely to be small.

5.2.3 Unemployment payments and short-term post-displacement outcomes

To begin with, there is evidence that unemployment insurance helps cushion the initial blow of displacement. Gruber (1997) and East and Kuka (2015) show unemployment insurance has historically played a large role in mitigating displacement-induced drops in consumption. Cylus et al. (2014) find that generous unemployment insurance helps offset the impacts of higher unemployment rates on suicide rates, and Cylus et al. (2015) find that in US states with more generous unemployment insurance, the health costs of displacement are lower. Kuka (2020) also finds that unemployment insurance ameliorates the health impacts of displacement, but this occurs partially through increases in the health insurance coverage of displaced workers, so may not generalise to the New Zealand context, where health insurance is not ubiquitously tied to employment relationships.

In addition to the immediate positive impacts on consumption and health, there is evidence generous unemployment insurance helps displaced workers avoid mortgage defaults (Hsu et al. 2018) and enables them to enrol in higher education¹² (Barr and Turner 2015).

5.2.4 Unemployment payments and decreases in labour supply

Unemployment insurance generosity can come in two forms: long eligibility durations, and high payment magnitudes. Recent empirical literature shows unemployment insurance generosity, regardless of form, has small to moderate negative effects on the labour supply of unemployed workers, by causing them to extend the length of their job search.

In terms of eligibility duration, Marinescu (2017) finds a 10% increase in the length of time for which unemployment insurance can be claimed decreases economy-level job applications by 1%. Rothstein (2011) finds that major extensions of unemployment insurance duration in the wake of the

¹¹ And presumably, by extension, unemployment benefits.

¹² Comparatively generous student allowance and student loan services in New Zealand may mean this does not generalise to the New Zealand context.

Global Financial Crisis increased the unemployment rate by 0.1-0.5 percentage points, while Hagedorn et al. (2013) find a larger effect of about 2 percentage points.

In terms of the magnitude of unemployment payments, evidence from Schmieder and von Wachter (2016), Kroft and Notowidigdo (2016), and Doris et al. (2020) suggests increases in the magnitude have a slightly larger negative effect on the labour supply of recipients, though this effect too is small to moderate in size.

Most of the abovementioned studies on search duration are of insurance programmes that incorporate job search requirements. Experimental studies (Fredriksson and Holmlund 2006; Petrongolo 2009; Arni et al. 2012) show attaching such requirements to unemployment insurance reduces the search duration of insurance recipients. This may mean the effects of insurance generosity on search duration would be larger in the absence of job search requirements.

5.2.5 The welfare implications of increased job-search duration

As we noted in our theoretical discussion, the welfare effects of increases in job search duration caused by generous unemployment payments are theoretically ambiguous. In particular, whether increased search duration is socially harmful depends on three questions. First, whether longer job searches enable payment recipients to find higher-quality jobs. Second, whether increased search duration primarily reflects distortions of the relative prices of labour and leisure, or relaxation of credit constraints. Third, the general-equilibrium effects of increased search duration. In this section, we address these questions in turn.

First, as we noted above, increases in search duration caused by unemployment payments may theoretically have either a positive or negative effect on the quality of the jobs that payment recipients end up in. Increases in search duration might enable the discovery of higher-quality job matches, but may also lead to depreciations in skill or negative signals that worsen job match quality.

The empirical evidence suggests that increases in the generosity of unemployment payments do not significantly affect the quality of jobs that recipients end up in.¹³ A meta-analysis by Schmieder and von Wachter (2016) concludes that generous unemployment benefits have very small and imprecisely estimated negative effects on the re-employment wages of recipients. Meanwhile, a meta-analysis by Tatsiramos and van Ours (2014) concludes that unemployment benefits have no average effect on re-employment outcomes, though these zero net effects probably mask some individual-level heterogeneity.¹⁴ This suggests that increased search duration does not produce benefits in the form of higher-quality job matches.

Next, recall that Chetty (2008) points out that increases in search duration as a result of unemployment benefits may reflect a socially optimal removal of credit constraints, rather than a

¹³ "Quality" is typically measured by those jobs' wages and durations.

¹⁴ See also Card et al. (2007), Lalive (2007), and van Ours and Vodopivec (2008), all of whom find no effect on subsequent job match quality. Schmieder and et al. (2016) find a small negative effect on re-employment wages.

distortion of the relative prices of labour and leisure. Chetty's empirical results suggest that about 60% of the increase in search duration attributable to unemployment benefits is due to this dynamic. If Chetty's results hold, then the increases in search duration detected in the empirical literature are 60% caused by a beneficial mechanism and 40% by a harmful mechanism. This suggests that increased search duration may not be as socially harmful as they at first appear.

Finally, Lalive et al. (2015) and Schmieder and von Wachter (2016) show that increases in the search duration of payment recipients has beneficial externalities by allowing other jobseekers to find work more easily. This will mitigate any social harms of increased search duration.

Overall, the evidence suggests that at worst unemployment payments create a low level of harm via the mechanism of increased search durations.

5.2.6 Unemployment payments and employer moral hazard

There is evidence that if a worker is eligible for unemployment insurance, this increases their employer's willingness to lay them off. Albanese et al. (2020) find that when a worker becomes eligible for unemployment insurance, they experience a 12% increase in the probability of being laid off (relative to a base layoff probability of about 0.5% every two weeks). As we noted previously, this may not be a bad thing, since reluctance to lay people off for compassionate reasons may not be economically efficient.

5.2.7 Conclusion

To sum up, unemployment payments appear to have a beneficial smoothing effect on the income and consumption of displaced workers, which also reduces the health costs of displacement. Generous unemployment payments also slightly reduce unemployed workers' labour supply by causing them to extend their job search duration, but the magnitude of this effect is small and its welfare costs are unlikely to be significant. Finally, unemployment payments increases employers' willingness to fire workers, but again the welfare costs of this effect are unlikely to be large because this effect enhances economic efficiency.

5.3 Active labour market policies

5.3.1 Theoretical discussion

Active labour market policies (training and education programmes, job placement programmes, and job search assistance programmes) aim to facilitate displaced workers' transitions to reemployment. ALMPs can achieve this purpose by directly mitigating the previously-discussed mechanisms through which involuntary displacement worsens workers' outcomes.

First, insofar as job displacement causes workers' skills to deteriorate, ALMPs can provide displaced workers with education and training that can restore their skills or help them retrain for a new industry (Jacobson et al. 2011). The government may have a reason to directly provide this education either because central coordination and provision lowers costs, or because public provision of retraining is seen as an appropriate form of redistribution or compensation.

Second, if the difficulty and costliness of job search is a significant barrier for displaced workers, ALMPs can lower these costs by providing advice, information, and even direct negotiations of job placement or provision of subsidised jobs. Government provision of these services can be justified by the existence of significant information asymmetries and frictions in the labour market (Vooren et al. 2019).

Third, if displacement results in psychological harms that make workers feel discouraged and hopeless, ALMPs can help prevent this by emotionally supporting workers and encouraging and motivating them to "keep in the game" of job search.

Finally, ALMPs may be aimed at ensuring equitable access to employment, for example by giving disadvantaged workers preferential access to employment opportunities through the selective provision of wage subsidies. Indeed, most of the ALMPs we discuss in the empirical section below are aimed at "disadvantaged" workers (usually proxied by long-term unemployment status) rather than displaced workers (LaLonde 2003).

The rationale behind ALMPs therefore relies on the existence of displacement-induced skill deterioration, job search frictions, worker discouragement, or inequitable outcomes, and on the ability of ALMPs to effectively mitigate these problems.

Crucially, even if ALMPs increase the probability that displaced workers find new jobs, this is not a straightforwardly socially beneficial outcome, since ALMPs might connect displaced workers with jobs at the expense of other jobseekers. If an ALMP successfully connects displaced worker A with a job, this might seem like a strictly desirable outcome; but if the job would otherwise have gone to labour market entrant B, the outcome may not be beneficial on net.

Overall, the effects of ALMPs are theoretically ambiguous, and empirical evidence is necessary to evaluate them.

5.3.2 Empirical evidence of effects

There is a large body of high-quality evidence on the effects of ALMPs, including a number of randomised-controlled trials of ALMPs. This body of evidence is summarised in LaLonde (2003), Card et al. (2018), and McKenzie (2017); here, we summarise the key conclusions of these three meta-analyses.

The takeaway from these meta-analyses is that some ALMPs, in some contexts, have modest positive effects on the labour market outcomes of some recipients (though it is unclear whether

these effects are positive once general equilibrium considerations are taken into account). Since ALMPs are relatively cheap to deploy (compared to alternatives such as formal schooling), this means that ALMPs can potentially offer very high rates of return on investment. However, there is no evidence that ALMPs are typically effective, so any ALMP put in place should be critically evaluated and continued only if found to be cost effective.

LaLonde (2003) concludes:

[...] experimental evaluations indicate that a variety of employment and training services can raise the postprogram earnings of disadvantaged adult women but that such programs have mixed impacts on disadvantaged adult men and usually no effects on the earnings of youth.

Moreover,

[...] when adult women participate in these programs these earnings gains usually (a) are modest in size, (b) persist for several years, (c) arise from a variety of treatments, and (d) sometimes are achieved at remarkably little expense.

Notably, the experiments LaLonde (2003) cites were mainly conducted in the US in the 1970s and 1980s; the labour market conditions faced by women in that context are plausibly quite different than the labour market conditions of displaced workers in New Zealand today, so we should be cautious about over-interpreting this evidence.

Meanwhile, Card et al. (2018) summarise their findings as follows

[...] we conclude that: (1) average impacts [of ALMPs] are close to zero in the short run, but become more positive 2–3 years after completion of the program; (2) the time profile of impacts varies by type of program, with larger average gains for programs that emphasize human capital accumulation; (3) there is systematic heterogeneity across participant groups, with larger impacts for females and participants who enter from long term unemployment; (4) active labor market programs are more likely to show positive impacts in a recession.

In addition, they compare the average effect sizes of different types of ALMPs, and conclude that

Job search assistance programs that emphasize “work first” tend to have similar impacts in the short and long run, whereas training and private sector employment programs have larger average effects in the medium and longer runs. Public sector employment subsidies tend to have small or even negative average impacts at all horizons.

Finally, McKenzie (2017) surveys the evidence on the effects of ALMPs in developing countries, and concludes:

[...] traditional ALMPs that focus on skill training, wage subsidies, and job search assistance have at best modest impacts in most circumstances. I compare this to expectations of program impacts from participants and policymakers, and show that both groups tend to have over-optimistic expectations of how beneficial these programs can be.

Overall, these meta-analyses suggest that ALMPs have highly heterogeneous effects that are modestly positive on average, particularly for adult women and the long-term unemployed. In addition, ALMPs are more effective in weak economic conditions, and ALMPs focused on helping workers acquire skills are more beneficial in the long-run (though their effects take longer to materialise).

However, the evidence summarised in these three meta-analyses mainly examines the effects of ALMPs on the earnings and employment outcomes of ALMP beneficiaries. This can produce a misleading picture of the net impacts of ALMPs since, as we noted above, ALMPs might improve beneficiaries' outcomes simply by crowding out other jobseekers. As Card et al. (2018) emphasise:

At best, these studies measure the partial equilibrium effects of ALMPs, comparing the mean outcomes in a treatment group to those of an untreated control or comparison group.

Indeed, there is strong empirical evidence that the positive effects of ALMPs at least in part reflect a crowding-out of other jobseekers. Crépon et al. (2013) analyse the results of a large-scale randomized evaluation of a job placement assistance programme in France. The experiment used a two-step design. In the first step, different labour market areas were randomly assigned a proportion of jobseekers who would receive assistance (either 0%, 25%, 50%, 75%, or 100%). In the second step, the appropriate percentage of jobseekers in each labour market area were randomly selected to receive assistance. This two-step design allowed the researchers to evaluate the general equilibrium effects of the placement assistance programme, since they could compare the aggregate labour market outcomes of areas where different percentages of jobseekers received assistance.

The results in Crépon et al. (2013) do not paint a rosy picture. The researchers conclude:

After eight months, eligible, unemployed youths who were assigned to the program were significantly more likely to have found a stable job than those who were not. But these gains are transitory, and they appear to have come partly at the expense of eligible workers who did not benefit from the program, particularly in labor markets where they compete mainly with other educated workers, and in weak labor markets. Overall, the program seems to have had very little net benefits.

This evidence should lower our estimation of ALMPs (relative to the picture we formed based on the meta-analyses). We can conclude, overall, that some ALMPs, some of the time, may yield very high returns on investment, possibly even when we account for their general equilibrium effects. However, we cannot conclude ALMPs are typically effective.

We conclude by noting that, while the evidence on education-focused ALMPs specifically is sparse, there is suggestive evidence that education can dramatically improve the prospects of older displaced workers. A pair of studies by Jacobson et al. (2005a, 2005b) estimate that displaced workers in the US aged 35 or older who chose to enrol in community college education experienced substantial increases in their long-term earnings prospects. These estimates may be confounded by unobserved differences between displaced workers who do or do not choose to pursue education, but they could suggest the returns to education for displaced workers may be high. As a result, education-focused ALMPs may have high potential rates of return.

6 Conclusion

Involuntary job losses are deeply consequential for the workers who are displaced. In this paper, we have provided two perspectives on the consequences of involuntary displacements. In Section 3, we outlined the various channels through which displacement affects workers' wellbeing. We concluded that displacement adversely affects the economic outcomes, mental health, and physical health of displaced workers through a variety of mechanisms. In Section 4, we took a quantitative approach and estimated the total wages lost to the involuntary displacements that occur in a representative year.

Policymakers are not helpless when it comes to mitigating the effects of involuntary displacement, and indeed a number of policies with this objective are currently in place in New Zealand. In Section 5, we gave an overview of the available policy options. Unemployment benefits and unemployment insurance can partially mitigate the effects of displacement on workers' short-term economic and health outcomes, but may have small negative effects on workers' labour supply. Meanwhile, Active Labour Market Programs are not typically effective but can potentially offer very high returns on investment.

Overall, we have emphasised that involuntary job loss is an important phenomenon with deep and long-lasting effects.

References

- Acemoglu, Daron and Robert Shimer. 1999. "Efficient Unemployment Insurance." *Journal of Political Economy*, 107:5, pp.893-928
- Albanese, Andrea, Matteo Picchio, and Corinna Ghirelli. "Timed to Say Goodbye: Does Unemployment Benefit Eligibility Affect Worker Layoffs?" *Labour Economics*, 65
- Anderson, Will, Vicki White, and Andrea Finney. 2012. "Coping with Low Incomes and Cold Homes." *Energy Policy*, 49, pp.40-52
- Arni, Patrick P., Rafael Lalive, and Jan C. van Ours. 2012. "How Effective are Unemployment Benefit Sanctions? Looking Beyond Unemployment Exit." *Journal of Applied Econometrics*, 28:7, pp.1153-1178
- Barr, Andrew and Sarah Turner. 2015. "Out of Work and into School: Labor Market Policies and College Enrolment During the Great Recession." *Journal of Public Economics*, 124, pp.63-73
- Bingley, Paul and Niels Westergaard-Nielsen. 2003. "Returns to Tenure, Firm-Specific Human Capital and Worker Heterogeneity." *International Journal of Manpower*, 24:7, pp.774-788
- Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. 2015. "Losing Heart? The Effect of Job Displacement on Health." *Industrial and Labor Relations Review*, 68:4, pp.833-861
- Brand, Jennie E., Becca R. Levy, and William T. Gallo. 2008. "Effects of Layoffs and Plant Closings on Subsequent Depression Among Older Workers." *Research on Aging*, 30:6, pp.701-721
- Brown, Eleanor and Howard Kaufold. "Human Capital Accumulation and the Optimal Level of Unemployment Insurance Provision." *Journal of Labor Economics*, 6:4, pp.493-514
- Browning, Martin and Eskil Heinesen. 2012. "Effect of Job Loss due to Plant Closure on Mortality and Hospitalization." *Journal of Health Economics*, 31, pp.599-616
- Browning, Martin and Thomas F. Crossley. 2008. "The Long-run Cost of Job Loss as Measured by Consumption Changes." *Journal of Econometrics*, 1-2, pp.109-120
- Card, David, Jochen Kluge, and Andrea Weber. 2018. "What Works? A Meta Analysis of Recent Active Labor Market Programme Evaluations." *Journal of the European Economic Association*, 16:3, pp.894-931
- Charles, Kerwin Kofi and Melvin Stephens Jr. 2004. "Job Displacement, Disability, and Divorce." *Journal of Labor Economics*, 22:2, pp.489-522
- Chetty, Raj. 2006. "A General Formula for the Optimal Level of Social Insurance." *Journal of Public Economics*, 90, pp.1879-1901
- Chetty, Raj. 2008. "Moral Hazard Versus Liquidity and Optimal Unemployment Insurance." *Journal of Political Economy*, 116:2, pp.173-234
- Clark, Andrew, Yannis Georgellis, and Peter Sanfrey. 2003. "Scarring: The Psychological Impact of Past Unemployment." *Economica*, 68:270, pp.221-241
- Crépon, Bruno, Esther Duflo, Marc Gurgand, Roland Rathelot, and Philippe Zamora. 2013. "Do Labor Market Policies have Displacement Effects? Evidence from a Clustered Randomized Experiment." *Quarterly Journal of Economics*, 128:2, pp.531-580
- Cygan-Rehm, Kamila, Daniel Kuehnle, and Michael Oberfichtner. "Bounding the Causal effect of Unemployment on Mental Health: Nonparametric Evidence from Four Countries." *Health Economics*, 26:12, p.1844-1861
- Cylus, Jonathan, M. Maria Glymour, and Mauricio Avendano. 2014. "Do Generous Unemployment Benefit Programmes Reduce Suicide Rates? A State Fixed-Effect Analysis Covering 1968-2008." *American Journal of Epidemiology*, 180:1 pp.45-52
- Cylus, Jonathan, M. Maria Glymour, and Mauricio Avendano. 2015. "Health Effects of Unemployment Benefit Programme Generosity." *American Journal of Public Health*, 105:2, pp.317-323

- Davis, Steven J. and Till von Wachter. 2011. "Recessions and the Cost of Job Loss." *NBER Working Paper 17638*, National Bureau of Economic Research, Cambridge MA.
- Deb, Partha, William T. Gallo, Padmaja Ayyagari, Jason M. Fletcher, and Jody L. Sindelar. 2011. "The Effect of Job Loss on Overweight and Drinking." *Journal of Health Economics*, 30, pp.317-327
- Dixon, Sylvia and David C. Maré. 2013. "The Costs of Involuntary Job Loss: Impacts on Workers' Employment and Earnings." *Motu Working Paper 13-03*. Motu Economic and Public Policy Research Trust, Wellington, NZ.
- Dixon, Sylvia and Steven Stillman. 2009. "The Impact of Firm Closure on Workers' Future Labour Market Outcomes." *Statistics New Zealand Working Paper*
- Doris, Aedín, Donal O'Neill, and Olive Sweetman. 2020. "Does Reducing Unemployment Benefits during a Recession Reduce Youth Unemployment? Evidence from a 50 Percent Cut in Unemployment Assistance." *Journal of Human Resources*, 55:3, pp.902-925
- East, Chloe N. and Elira Kuka. 2015 "Reexamining the Consumption Smoothing Benefits of Unemployment Insurance." *Journal of Public Economics*, 132, pp.32-50
- Eliason, Marcus and Donald Storrie. 2006. "Lasting or Latent Scars? Swedish Evidence on the Long-Term Effects of Job Displacement." *Journal of Labor Economics*, 24:4, pp.831-856
- Eliason, Marcus and Donald Storrie. 2009. "Does Job Loss Shorten Life?" *Journal of Human Resources*, 44:2, pp.277-302
- Fackler, Daniel, Steffen Müller, and Jens Stegmaier. 2017. "Explaining Wage Losses After Job Displacement: Employer Size and Lost Firm Rents." *IWH Discussion Papers 32/2017*
- Farber, Henry S. 1993. "The Incidence and Costs of Job Loss: 1982-1991." *Brookings Papers on Economic Activity: Microeconomics*, pp.73-132
- Farré, Lídia, Francesco Fasani, and Hannes Mueller. "Feeling Useless: The Effect of Unemployment on Mental Health in the Great Recession." *IZA Journal of Labor Economics*, 7:8, pp.1-34
- Fredriksson, Peter and Bertil Holmlund. 2006. "Improving Incentives in Unemployment Insurance: A Review of Recent Research." *Journal of Economic Surveys*, 20:3, pp.357-386
- Gruber, Jonathan. 1997. "The Consumption Smoothing Benefits of Unemployment Insurance." *American Economic Review*, 87:1, pp.192-205
- Gruber, Jonathan. 2019. *Public Finance and Public Policy*, 6th ed., New York: Worth Publishers
- Hagedorn, Marcus, Fatih Karahan, Iourii Manovskii, and Kurt Mitman. 2013. "Unemployment Benefits and Unemployment in the Great Recession: The Role of Macro Effects." *NBER Working Paper 19499*, National Bureau of Economic Research, Cambridge MA.
- Hijzen, Alexander, Richard Upward, and Peter W. Wright. 2010. "The Income Losses of Displaced Workers." *Journal of Human Resources*, 45:1, pp.243-269
- Hsu, Joanne W., David A. Matsa, and Brian T. Melzer. 2018. "Unemployment Insurance as a Housing Market Stabilizer." *American Economic Review*, 108:1, pp.49-81
- Hyslop, Dean and Wilbur Townsend. 2017. "The Longer Term Impacts of Job Displacement on Labour Market Outcomes." *Motu Working Paper 17-12*. Motu Economic and Public Policy Research Trust, Wellington, NZ.
- Hyslop, Dean and Wilbur Townsend. 2019. "The Longer-term Impacts of Job Displacement on Labour Market Outcomes in New Zealand." *Australian Economic Review*, 52:2, pp.158-177
- Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 1993. "Earnings Losses of Displaced Workers." *American Economic Review*, 83:4, pp. 685-709
- Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 2005. "Estimating the Returns to Community College Schooling for Displaced Workers." *Journal of Econometrics*, 125:1-2, pp.271-304

- Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 2005. "The Impact of Community College Retraining on Older Displaced Workers: Should We Teach Old Dogs New Tricks?" *Industrial and Labor Relations Review*, 58:3, pp.398-415
- Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 2011. "Policies to Reduce High-Tenured Displaced Workers' Earnings Losses Through Retraining." *The Hamilton Project Discussion Paper*
- Kirkpatrick, Sharon and Valerie Tarasuk. 2003. "The Relationship Between Low Income and Household Food Expenditure Patterns in Canada." *Public Health Nutrition*, 6:6, pp.589-597
- Kroft, Kory and Matthew J. Notowidigdo. 2016. "Should Unemployment Insurance Vary with the Unemployment Rate? Theory and Evidence." *The Review of Economic Studies*, 83:3, pp.1092-1124
- Kroft, Kory, Fabian Lange, and Matthew J. Notowidigdo. "Duration Dependence and Labor Market Conditions: Evidence from a Field Experiment." *Quarterly Journal of Economics*, 128:3, pp.1123-1167
- Krolkowski, Pawel. 2018. "Choosing a Control Group for Displaced Workers." *Industrial and Labor Relations Review*, 71:5, pp.1242-1254
- Kuka, Elira. 2020. "Quantifying the Benefits of Social Insurance: Unemployment Insurance and Health." *Review of Economics and Statistics*, 102:3, pp.490-505
- Lalive, Rafael, Camille Landais, and Josef Zweimüller. 2015 "Market Externalities of Large Unemployment Insurance Extension Programmes." *American Economic Review*, 105:12, pp.3564-3596
- LaLonde, Robert J. 2003. "Employment and Training Programmes," in *Means-Tested Transfer Programmes in the United States*, edited by Robert A. Moffitt, University of Chicago Press, pp.517-585
- Mallinckrodt, Brent and Bruce R. Fretz. 1988. "Social Support and the Impact of Job Loss on Older Professionals." *Journal of Counseling Psychology*, 35:3, pp.281-286
- Marcus, Jan. 2013. "The Effect of Unemployment on the Mental Health of Spouses – Evidence from Plant Closures in Germany." *Journal of Health Economics*, 32, pp.546-558
- Marinescu, Ioana. 2017. "The General Equilibrium Impacts of Unemployment Insurance: Evidence from a Large Online Job Board." *Journal of Public Economics*, 150, pp.14-29
- McKee-Ryan, Frances M., Zhaoli Song, Connie R. Wanberg, and Angelo J. Kinicki. 2005. "Psychological and Physical Well-Being During Unemployment: A Meta-Analytic Study." *Journal of Applied Psychology*, 90:1, pp.53-76
- McKenzie, David. "How Effective Are Active Labor Market Policies in Developing Countries? A Critical Review of Recent Evidence." *The World Bank Research Observer*, 32:2, pp.127-154
- Mendolia, Silvia. 2014. "The Impact of Husband's Job Loss on Partners' Mental Health." *Review of Economics of the Household*, 12, pp.277-294
- Neal, Derek. 1995. "Industry-Specific Human Capital: Evidence from Displaced Workers." *Journal of Labor Economics*, 13:4, pp.653-677
- O'Donoghue, Ted and Charles Sprenger. 2018. "Reference-Dependent Preferences," in *Handbook of Behavioral Economics: Applications and Foundations 1*, edited by B. Douglas Bernheim, Stefano DellaVigna, and David Laibson, North Holland, pp.1-77
- OECD. 2017. *Back to Work: New Zealand: Improving the Re-employment Prospects of Displaced Workers*, OECD Publishing, Paris.
- Petrongolo, Barbara. 2009. "The Long-term Effects of Job Search Requirements: Evidence from the UK JSA Reform." *Journal of Public Economics*, 93:11-12, pp.1234-1253

- Rothstein, Jesse. 2011. "Unemployment Insurance and Job Search in the Great Recession." *NBER Working Paper 17534*, National Bureau of Economic Research, Cambridge MA.
- Ruhm, Christopher J. 1991. "Are Workers Permanently Scarred by Job Displacements?" *American Economic Review*, 81:1, pp.319-324
- Salm, Martin. 2009. "Does Job Loss Cause Ill Health?" *Health Economics*, 18:9, pp.1075-1089
- Schaller, Jessamyn and Ann Huff Stevens. "Short-run Effects of Job Loss on Health Conditions, Health Insurance, and Health Care Utilization." *Journal of Health Economics*, 43, pp.190-203
- Schmieder, Johannes F. and Till von Wachter. 2016 "The Effects of Unemployment Insurance Benefits: New Evidence and Interpretation." *Annual Review of Economics*, 8, pp. 547-581
- Schmieder, Johannes F., Till von Wachter, and Joerg Heining. 2019. "The Costs of Job Displacement over the Business Cycle and Its Sources: Evidence from Germany." *Unpublished Working Paper*
- Schmieder, Johannes F., Till von Wachter, and Stefan Bender. 2016. "The Effect of Unemployment Benefits and Nonemployment Durations on Wages." *American Economic Review*, 106:3, pp.739-777
- Spencer, Kathy. 2019. "Unemployment Insurance: What Can it Offer NZ?" *Productivity Commission Report*
- Stephens, Melvin Jr. 2001. "The Long-run Consumption Effects of Earnings Shocks." *Review of Economics and Statistics*, 83:1, pp.28-36
- Stephens, Melvin Jr. 2004. "Job Loss Expectations, Realizations, and Household Consumption Behavior." *Review of Economics and Statistics*, 86:1, pp.253-269
- Sullivan, Daniel and Till von Wachter. 2009. "Job Displacement and Mortality: An Analysis Using Administrative Data." *Quarterly Journal of Economics*, 124:3, pp.1265-1306
- Tatsiramos, Konstantinos and Jan C. van Ours. 2014. "Labor Market Effects of Unemployment Insurance Design." *Journal of Economic Surveys*, 28:2, pp.284-311
- von Wachter, Till, Jae Song, and Joyce Manchester. 2009. "Long-Term Earnings Losses due to Mass Layoffs during the 1982 Recession: An Analysis Using U.S. Administrative Data from 1974 to 2004." *Unpublished Working Paper*
- Vooren, Melvin, Carla Haelermans, Wim Groot, Henriëtte Maassen van den Brink. 2019. "The Effectiveness of Active Labor Market Policies: A Meta-analysis." *Journal of Economic Surveys*, 33:1, pp.1-25
- Ward, Paul R., Fiona Verity, Patricia Carter, George Tsourtos, John Coveney, and Kwan Chui Wong. 2013. "Food Stress in Adelaide: The Relationship between Low Income and the Affordability of Healthy Food." *Journal of Environmental and Public Health*, online publication

Appendix

Consider the following theoretical framework. An individual i is displaced during year t , at the age of 25. Had they not been displaced, at each subsequent year s they would have a probability of being employed p and an earnings conditional on being employed $(1 + \tau)^{s-t}y$. Here, $1 + \tau$ represents the rate of real wage growth. Thus, using a discount rate of δ and assuming they retire at age 65, had they not been displaced then the net present value of their lifetime earnings would be

$$NPV_1 = \sum_{s=t}^{t+40} (1 - \delta)^{s-t} (1 + \tau)^{s-t} p y$$

However, since individual i was displaced at time t , they suffer penalties to their employment probability and conditional earnings. Suppose that, $s - t$ years after the displacement event, a displaced person is α_{s-t} percentage points less likely to be employed, and their earnings conditional on being employed are β_{s-t} percent lower. In that case, the net present value of individual i 's lifetime earnings (accounting for their displacement) is

$$NPV_2 = \sum_{s=t}^{t+40} (1 - \delta)^{s-t} (1 + \tau)^{s-t} (p - \alpha_{s-t})(1 - \beta_{s-t} y)$$

And the net present value of wages that individual i loses to displacement is

$$NPV_1 - NPV_2$$

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