3 Job displacement in high-emission industries: Implications for the net-zero transition

César Barreto, Jonas Fluchtmann, Alexander Hijzen and Agnès Puymoyen

The net-zero transition will create new job opportunities in low-emission activities but also increase the risk of job loss in high-emission activities. Concerns about job loss are understandable given the persistent earnings losses associated with displacement. In addition, these concerns risk undermining public support for climate change mitigation policies. Developing effective policies to support displaced workers is therefore not only crucial to alleviate the consequences of job displacement but also to ensure that concerns about job loss do not result in a backlash stalling progress towards net-zero emissions. To inform the development of such policies, this chapter provides an in-depth analysis of the consequences of job displacement in high greenhouse gas (GHG) emission industries using harmonised linked employer-employee data from 14 OECD countries and provides a detailed discussion of policies to support workers who lose their job as a result of the net-zero transition.

In Brief

Key findings

The net-zero transition will have significant implications for labour markets. While necessary to combat climate change, the net-zero transition is increasing the risk of job displacement in industries with high greenhouse gas (GHG) emissions. This could lead to large and persistent earnings losses among displaced workers. Concerns over job loss, in particular, risk undermining public support for climate change mitigation policies. To address these challenges and help governments in developing better policies to support displaced workers, this chapter provides an in-depth empirical analysis of the costs of job displacement in high-emission industries, using harmonised linked employer-employee data from 14 OECD countries (Australia, Austria, Canada, Denmark, Estonia, Finland, France, Germany, Hungary, the Netherlands, Norway, Portugal, Spain and Sweden).

The main findings of the chapter can be summarised as follows:

- ***GHG emissions are highly concentrated in specific sectors, representing a relatively small segment of overall employment.*** High-emission industries, which include energy production, heavy manufacturing, as well as transport services, accounted for about 80% of GHG emissions in the OECD in 2019, but represented only about 7% of overall employment. Between 2019 and 2030, employment in high-emission industries is expected to contract at an average annual rate of more than 2% as a result of ambitious emission reduction targets (e.g. the EU's Fit for 55 legislative package), well above the average annual employment decline of about 1% observed in those industries since 2000. This fast projected contraction of employment in high-emission industries signals a pronounced increase in the risk of job displacement.
- ***Employment in high-emission sectors differs substantially from employment in other sectors of the economy, potentially aggravating the consequences of job displacement for workers.*** Workers currently employed in high-emission industries are predominantly male, somewhat older and more likely to reside in rural areas than other workers. They also tend to be employed in relatively high-paying firms but have relatively low educational attainment compared with workers in low-emission industries. The combination of low levels of education, relatively high wages and living in rural areas may have considerable implications for the costs of job displacement and the ability of displaced workers to find a new job quickly.
- ***Job displacement carries significantly larger costs in high-emission sectors than in other sectors of the economy***. In many cases, job displacement represents a life-changing event, with far-reaching consequences for earnings, the main focus of this chapter, but also health, well-being or even mortality. Job displacement in high-emission sectors is costly and significantly more so than in low-emission industries. While displaced workers in low-emission industries face a decline in earnings of 29% on average during the six years after displacement, displaced workers in high-emission industries experience a decrease of 36%. This is 24% more than the earnings loss in low-emission industries. Displaced workers in high-emission industries are also more likely to change industry, occupation or region than displaced workers in other industries. These findings suggest that displaced workers in high-emission industries face additional challenges compared with those displaced in other sectors, including a decline of activity in their industries, occupations and regions. This may also explain why the net-zero transition spurs anxiety among workers in industries at risk.

- ***Steeper earnings losses in high-emission sectors mainly reflect differences in the composition of firms and workers.*** In part, earnings losses are larger in high-emission industries because workers tend to be older, have longer tenure, lower levels of education, fewer portable skills and are more likely to be employed in routine manual occupations. These factors increase the difficulty of finding another job after displacement but particularly that of finding a stable job that pays well. Differences in wages upon re-employment account for about 30% of the overall difference in earnings losses between high-emission and low-emission industries. The bulk of these wage losses is firm related (the transition to firms offering lower wages) rather than worker related (the loss of firm-specific human capital). All in all, earnings losses are larger for displaced workers in high-emission industries partly because firms in these industries pay relatively high wages given worker skills and partly because of the specific characteristics of these workers.
- ***Well-functioning labour markets tend to reduce the costs of job displacement, irrespective of the industry.*** Earnings losses over the first six years following job displacement in both high- and low-emission industries are largest in countries such as Hungary, Portugal and Spain, where they are around twice as large as those seen in other countries, such as Australia, Germany and Sweden. Differences between countries in the earnings losses of displaced workers mainly reflect structural differences in the difficulty of finding another job, as reflected by the unemployment rate, and the functioning of labour markets, rather than differences in the composition of firms and workers. These structural differences are in turn likely to be related to the presence of effective and coherent labour market policies and institutions and, in particular, policies that facilitate labour market transitions.
- ***Developing specific policies to support displaced workers is essential, not only to mitigate income losses and facilitate job transitions towards quality jobs, but also to show that concerns about job losses are being addressed***. Policy makers in OECD countries have various tools at their disposal that can help alleviate the earnings losses of displaced workers and support job transitions. Well-designed out-of-work income support schemes, such as unemployment insurance and social assistance, can play a key role in reducing the earnings losses of displaced workers during joblessness. These schemes also support effective job search, enabling the unemployed to take the necessary time to find a job that aligns well with their skills (or to upgrade their skills). Forward-looking and effective upskilling and reskilling policies are needed to support transitions to emerging and in-demand industries and occupations and the acquisition of new skills. Early intervention measures targeted at workers at risk of dismissal or who have been given notice of dismissal, as well as measures to deal with collective redundancies, may be particularly important and can limit the incidence and consequences of job displacement. Minimum wages and collectively negotiated wage floors can further play an important role in limiting re-employment wage losses by ensuring that the proceeds of productive labour are effectively shared with workers, especially those with weak bargaining position. Targeted approaches, such as wage insurance schemes, may also be a complementary tool to help speed up the transition to new jobs, particularly when workers are offered lower wages than before displacement.

Introduction

Across the globe, governments are steering their economies towards net-zero greenhouse gas (GHG) emissions to mitigate the impacts of climate change, promote sustainable growth and ensure long-term economic resilience. While the aggregate employment effects of the "net-zero transition" are expected to be modest (see Chapter 2), it will have a profound impact on labour markets by shifting activity in sectors with high GHG intensity ("high-emission") to resource-efficient sectors with low GHG intensity ("low-emission"). While some sectors and firms may be able to reduce their footprint by changing the way they operate, considerable employment losses in the most polluting sectors seem inevitable. Indeed, employment in high-emission sectors – such as coal mining and extraction of petroleum, but also certain parts of the manufacturing sector that use energy intensively – is expected to decline substantially faster in the near future, involving potentially significant job losses (Borgonovi et al., 2023[1]). Concerns about job loss are understandable since they can lead to significant long-term reductions in earnings (Jacobson, Lalonde and Sullivan, 1993[2]) and negatively affect health and even life expectancy (Schaller and Stevens, 2015[3]; Sullivan and Wachter, 2009[4]). Such concerns could also compromise public support for climate change mitigation policies and the ability of governments to deliver on their emission reduction targets (Dechezleprêtre et al., 2023[5]; Dabla-Norris et al., 2023[6]). A key challenge for policy makers is how to support the net-zero transition without compromising public support for climate change mitigation policies. Policies that effectively address concerns about the potential negative labour market effects of the net-zero transition and prepare workers at risk of job loss for transitions to emerging and in-demand industries and occupations are key in overcoming this important challenge.

The objective of this chapter is to shed further light on the labour market effects of the net-zero transition, with an emphasis on its costs in terms of job losses, to help governments develop more effective policies to support workers who lose their job as a result of the net-zero transition.[1] The starting point of the analysis is that job losses due to the planned reduction of GHG emissions are expected to be concentrated in a small number of specific industries that account for the bulk of emissions but only a small fraction of employment. Accordingly, an analysis of job displacement in high-emission industries using historical data is likely to be highly informative of the challenges that workers who lose their job in the future because of the net-zero transition might face, given the characteristics of firms and workers in those industries and the level of policy support available to displaced workers.[2] If anything, these challenges may become even more important given the accelerated pace of change and the subsequent rise in the risk of displacement and the decline in job opportunities in high-emission industries for displaced workers. The analysis addresses two key questions. First, it analyses the extent to which the costs of job displacement differ between workers in high- and low-emission industries within countries. Previous evidence suggests that displaced workers in high-emission industries face particular challenges in finding another job, and once they do, wages might be lower (Walker, 2013[7]; Barreto, Grundke and Krill, 2023[8]; OECD, 2023[9]). Second, it analyses the extent to which the costs of job displacement in high-emission industries differ between countries. Systematic differences between countries may suggest that the broader institutional context plays an important role in shaping the cost of job displacement (Bertheau et al., 2023[10]).

The chapter is organised as follows. It starts with a descriptive analysis of what distinguishes employment in high-emission industries from employment in the rest of the economy. It then proceeds with an in-depth empirical examination of the consequences of job displacement in high-emission sectors using comprehensive linked employer-employee data for 14 OECD countries. Based on the evidence, the chapter presents a discussion of the policy options, with the objective of identifying strategies that can most effectively support the workers who are displaced because of the net-zero transition. The chapter is accompanied by a technical background paper which systematically decomposes the results by sub-sector (energy supply, heavy manufacturing and transport) and provides additional information on the methodology and data used (Barreto et al., forthcoming[11]).

3.1. Characterising employment in high-emission industries

To reduce GHG emissions, OECD countries have embarked on a wide range of efforts – see e.g. Nachtigall et al. (2022[12]). These include, among others, regulations of emission intensity, increasingly stricter carbon pricing measures (see Chapter 5) and incentives for green investment. As a result of these measures as well as other structural developments (e.g. technological change, globalisation), total GHG emissions in OECD countries dropped by approximately 6% between 1990 and 2021 (OECD, 2024[13]).

However, to make good on emission targets and contain the increase in global warming, policy efforts have to step up. For instance, by 2030 Japan aims to reduce GHG emissions by 46% from 2013 levels, while the United States have pledged a 50-52% reduction in GHG emissions from 2005 levels by 2030 and the EU's Fit for 55 legislative package mandates a 55% reduction in GHG emissions by 2030 compared to 1990 levels.[3] Meeting these targets by 2030 requires drastically increasing the pace with which GHG emissions are reduced now. For example, compared to their efforts since 1990, EU countries under Fit for 55 will have to roughly double their required annual emission reduction until 2030. Likewise, Japan will have to increase its annual emission reduction by 50% over the efforts since 2013, while the United States will have to almost quadruple their annual efforts until 2030 compared to what they achieved since 2005. The coming years will therefore require a more rapid transition through extensive policy reforms and green investment, which may cause more disruption, particularly in high-emission sectors.

This chapter considers the GHG intensity of economic sectors as the main determinant of whether they will be negatively affected by the net-zero transition, consistent with the focus of major emissions-reduction initiatives, such as Fit for 55.[4] High-emission sectors are defined as industries that consistently feature among the top-polluting industries in OECD countries. A detailed description of this approach is laid out in Box 3.1. The final list of high-emission industries includes energy supply, heavy manufacturing (basic metals, chemicals, coke and petroleum, paper, other non-metallic mineral products), mining and quarrying, as well as transport services (air, water and land).

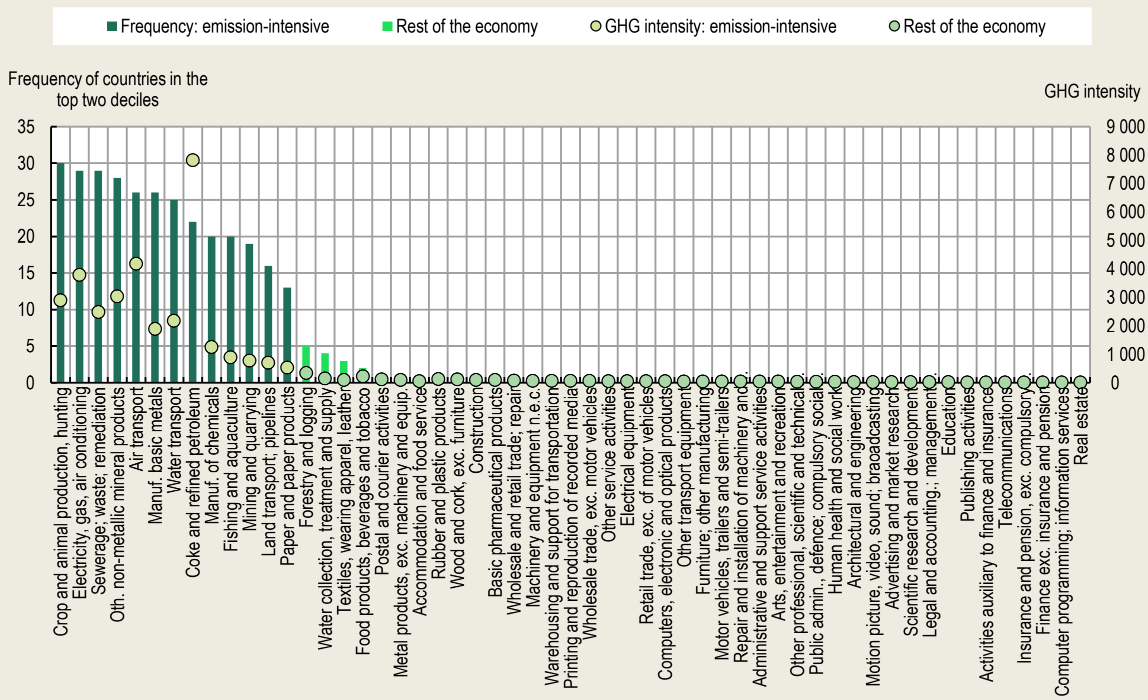
Box 3.1. Defining high-emission sectors

The classification of high-emission sectors in this chapter is based on Eurostat data for 27 EU countries as well as the United Kingdom, Norway, Iceland and Switzerland for 2-digit ISIC rev.4 sectors over the period 2009-20. The level of GHG emission intensity in a sector is measured by GHG emissions in CO_2-equivalent units per unit of value added (in tonnes per million EUR), excluding any supply chain linkage, and considers a broad set of gases contributing to global warming. Contributions of gases other than CO_2 are weighted in terms of how many times more damaging they are in trapping heat than carbon dioxide over a 100-year horizon. For example, methane is weighted as 28-30 CO_2-equivalent units as it is 28-30 times more effective in trapping heat.

This chapter categorises a sector as high emission if it ranks in the upper two deciles of the average GHG intensity distribution in at least 10 out of 32 countries (Figure 3.1). This threshold, as evident in Figure 3.1, effectively distinguishes high-emission sectors – averaging just below 2 500 CO_2-equivalent tonnes per million EUR of gross value added (in constant 2015 prices of the national currency) – from their counterparts. Notably, at the threshold, the frequency distribution shows a sharp decline of more than 50% in the frequency and 20% in GHG intensity.

Figure 3.1. Classification of high- and low-emission industries

GHG intensity within 2-digit NACE rev.2 sectors and frequency in top 2 deciles across 31 OECD countries, 2009-20 average



Note: GHG intensity is expressed as CO_2- equivalent emissions in tonnes per million EUR of gross value added.
Source: Eurostat – Air emissions accounts by NACE Rev. 2 activity.

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The list of sectors included in the definition encompass energy supply, as well as transport services (water, air and land), mining and manufacturing of energy-intensive products (basic metals, non-metallic mineral products, refined petroleum products, chemical- and paper products). The sewerage and waste-collection sector is omitted from the final list of high-emission industries as it is not expected to decline and indeed is a much needed industry for the net-zero transition (see Borgonovi et al. (2023[1])). The agricultural sector is entirely omitted from the list of industries studied in this chapter for two reasons. First, mass layoffs in agriculture are more likely to capture seasonal rather than structural adjustments in employment. Second, employment projections for many OECD countries do not suggest a decline in employment growth in the agricultural sector, in contrast to most other emission-intensive sectors, as current policy packages tend to shelter agricultural production from the climate mitigation effort (Borgonovi et al., 2023[1]).

The classification of "high-emission industries" shows not only significant consistency across the countries considered, but also across different measures of emission intensity, such as carbon intensity or fossil fuel energy intensity (see Barreto et al. (forthcoming[11]) for details). A key limitation of the present approach is the classification of industries based 2-digit ISIC rev. 4 sectors. This does not allow disentangling subsectors which may be expected to expand because of the net-zero transition such as renewable energy power generation or electrified land transport from sectors that are expected to contract. However, cross-country emission data, whether in the form of GHG emissions, carbon intensity or energy use, are not available at a more disaggregate level.

3.1.1. Emissions are highly concentrated in specific sectors accounting for just 7% of employment

High-emission industries, as defined in this chapter, account for about 80% of total GHG emissions across the OECD. There is some moderate variation across countries due to differences in the national energy mix, the size of high-emission industries and emission regulations. For instance, while high-emission industries in France and the Slovak Republic emit slightly less than 70% of national GHG emissions, the same sectors emit slightly more than 90% in the Czech Republic, Denmark, Greece, Finland, Iceland and Norway (Figure 3.2). Despite their significant contribution to emissions, high-emission industries employ only about 7% of the total workforce on average among OECD countries, suggesting that emissions are highly concentrated (Figure 3.2). Importantly, this fact implies that any future reductions in emissions will be concentrated in a comparatively small segment of the labour market. This is particularly true in Ireland, the Netherlands and the United Kingdom, where the share of the workforce in high-emission sectors is just below 5%, but even in Poland, the country with the highest share, where 79% of emissions is concentrated in industries representing 12% of the workforce.

Figure 3.2. High-emission industries are responsible for most emissions but employ only a fraction of the workforce

Share of GHG emissions and employment in high-emission industries by country, 2019*

Note: * Data refer to 2016 and to CO_2 emissions for Mexico and the United States. Average across 26 OECD countries shown. Agriculture is excluded.
Source: OECD National Accounts and Eurostat Air Emissions Accounts.

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3.1.2. Employment in high-emission industries has been declining and the decline is expected to accelerate in the years to come

Reducing GHG emissions can be achieved by reducing economic activity in high-emission sectors as well as by changing the production technology within these sectors – see also OECD (2023[14]). Both processes require restructuring that may involve job losses and arising opportunities. Alongside previous declines in GHG emissions, employment in high-emission industries has indeed been shrinking substantially in EU countries during the period 2000-19, while employment in other sectors has continued to expand (see Figure 3.4) – in some cases also through green investment coupled with the explicit aim of creating quality jobs (see Box 3.2). This has shifted the composition of employment away from emission-intensive industries towards other sectors with low emissions (Borgonovi et al., 2023[1]). This trend is not solely attributable to the net-zero transition but also other structural factors, including the pivotal change from manufacturing-based to less carbon-intensive, service-oriented economies (Autor and Dorn, 2013[15]; Goldschmidt and Schmieder, 2017[16]; OECD, 2019[17]). The need and commitment for an accelerated reduction in GHG emissions also means that OECD labour markets will have to adjust further to additional declines in emissions in high-emission industries. While some of this may be achieved by within-industry and within-firm emission reduction efforts, the transition is still expected to lead to the reallocation of jobs towards greener and other less polluting activities. This increases the risk of job displacement, and may also aggravate its consequences by limiting opportunities for finding another job in affected sectors.

Box 3.2. Green subsidies and job creation

Green subsidies are used increasingly widely but little is known about their employment effects

The scale of green investments has increased notably in recent years, especially after the 2008 financial crisis, with initiatives like the *American Recovery and Reinvestment Act* allocating USD 90 billion towards clean energy in the United States, resulting in job creation, although primarily in skill-rich regions (Popp et al., 2020[18]). This trend accelerated following COVID-19 and the ensuing cost of living crisis, leading to substantial investments such as the USD 370 billion *Inflation Reduction Act* in the United States, focused on green energy infrastructure and job quality, and the European Union's *Green Deal Industrial Plan* aimed at supporting the net-zero transition by enhancing manufacturing capacities for green products and technologies while also focusing on upgrading the workforce's skills for the green economy (U. S. White House, 2023[19]; European Commission, 2023[20]). These efforts highlight a strategic shift towards sustainable recovery, energy transition, and the creation of high-quality jobs.

The use of green subsidies may not only promote the replacement of high-emission intensive technologies by greener ones, but they are also expected to create new opportunities for workers green-driven occupations (cf. Chapter 2), including those that have been displaced as a result of the transition. However, the available evidence on the labour market effects of green subsidies is limited and rather mixed. While some studies point to significant employment effects (e.g. Markandya et al. (2016[21])), other suggest they are modest (Pestel, 2019[22]) or that the public costs per job created is rather high (Álvarez et al., 2021[23]). There are also important questions about the quality of the jobs that are created. While most studies find that many green-driven occupations tend to be relatively well paid (Curtis and Marinescu, 2023[24]), Chapter 2 of this publication highlights important challenges in this regard.

New evidence on the effects of green subsidies on job creation from France

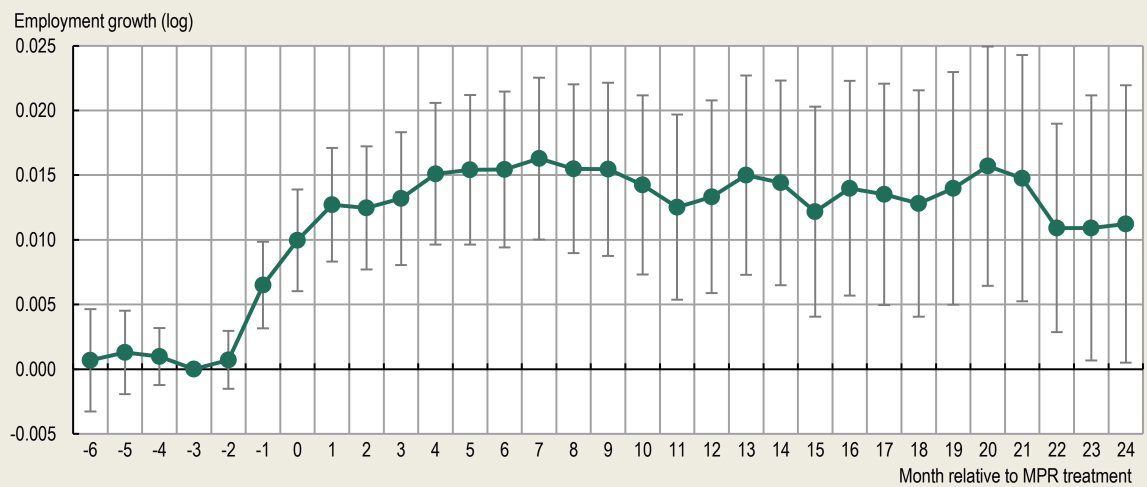
To provide evidence on the effect of green subsidies on job creation, this Box provides a preliminary evaluation of the French *MaPrimeRénov'* (MPR) programme. *MPR* was launched 1 January 2020 and provides subsidies for enhancing energy efficiency in housing up to a limit of EUR 20 000 for a single subsidy.[1] To receive the MPR subsidy the work must be conducted by a firm certified as a guarantor of the environment (*Reconnu Garant de l'Environnement*, RGE). In 2020 alone, there were more than 170 000 applicants.[2]

The effects of MPR are analysed empirically by comparing the monthly evolution of employment in firms who received subsidies with firms that never received a subsidy but have otherwise similar characteristics during the period 2020-22. To control for selection into the programme, recipient firms are matched to non-recipient firms in the same 2-digit industry, department, year and month (exact matching) and with similar characteristics in terms of recent employment developments, average firm wages, average municipality wages and average age in the firm (propensity score matching). The effects of MPR are analysed using an event-study design, which involves regressing log employment on a dummy for initial subsidy receipt interacted with months-since-treatment, controls for any subsequent subsidy received after first treatment as well as firm and year*month fixed effects. The results are presented in Figure 3.3. The results indicate that MPR led to an increase in employment of about 1.5% five months after the first subsidy. The effect slightly declines in subsequent months but some of the effect remains present during the period considered.

To provide an indication of the cost-effectiveness of the scheme in terms of euros per job created, it is possible to do a back-of-the-envelope calculation. This makes use of the estimated the percentage increase in employment due to the subsidy (1.5%), the average amount of the first subsidy (EUR 13 481) and the average pre-treatment level of firm employment (4.7 employees). This suggest that the cost job created was EUR 191 219. This is higher than the cost per job from Popp et al. (2020[18]) in the context of the *American Recovery and Reinvestment Act* for the United States, which pointed to a cost per job created of USD 66 700.

Figure 3.3. The impact of *MaPrimeRénov'* on employment growth

Event study estimates of the effect of *MaPrimeRénov'* on log employment by month, log points



Note: Estimates based on an event-study design which involves regressing log employment on a dummy for initial subsidy receipt interacted with months-since-treatment, controls for any subsequent subsidy received after first treatment as well as firm and year*month fixed effects. The dots represent point estimates which reflect the percentage increase in monthly employment due the initial receipt of a *MaPrimeRénov'* subsidy at the establishment level over the period 2021-23. The vertical markers reflect 95% confidence intervals based on standard errors clustered at the establishment level. The reference month for employment changes is -3 to avoid understating the magnitude of the treatment effect following Ashenfelter (1978[25]).
Source: OECD calculations based on administrative *MaPrimeRénov'* subsidy data linked to MMO data.

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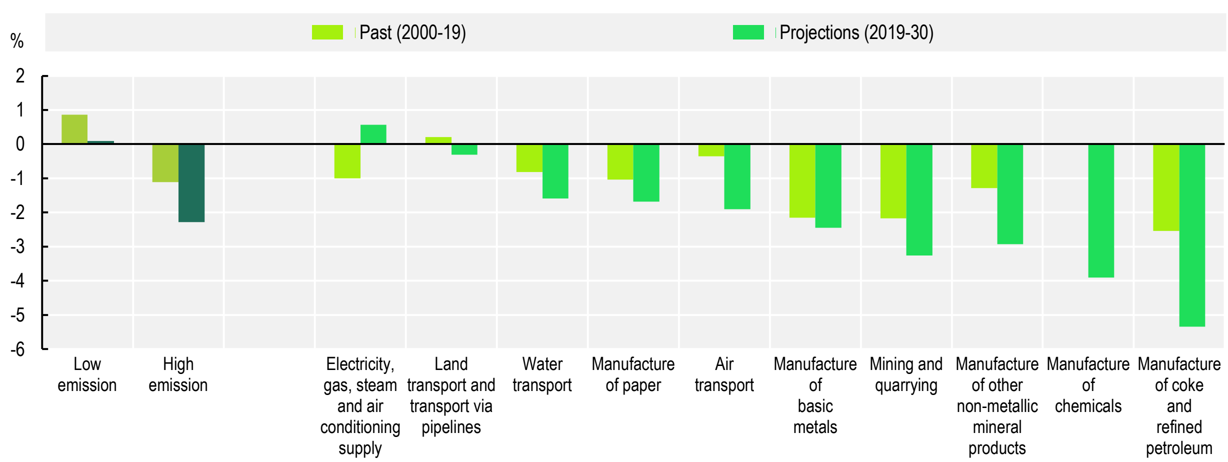
Note: This was box was prepared with contributions from Ian Whiton.
1. www.economie.gouv.fr/plan-de-relance/mesures/maprimerenov.
2. www.anah.fr/presse/detail/actualite/lancee-en-2020-maprimerenov-atteint-son-rythme-de-croisiere-avant-detre-ouverte-a-tous-en-janvier-2021/.

Projections based on the OECD ENV-Linkages Model show that most high-emission industries are expected to see noticeable declines in employment between 2019 and 2030 because of the implementation of climate-mitigation measures – e.g. the EU emission reduction targets (Fit-for-55) and similar packages implemented in the rest of the world (Borgonovi et al., 2023[1]).[5] Importantly, these declines are expected to markedly accelerate with respect to the past. In the EU, for example, the projected declines in the number of employed, which are expected to average 2.3% per year, are more than twice as large as the historical employment decline, which averaged 1.1% between 2000 and 2019 (Figure 3.4).

The projected pace of decline under EU Fit-for-55 also differs across high-emission industries. For example, employment in the manufacturing of chemicals as well as coke and refined petroleum is expected to decrease by 3.9% and 5.4% on average per year, respectively, while employment in manufacturing of basic metals and other non-metallic minerals as well as in mining and quarrying is expected to decrease by 2.5% and 3.3% on average per year. The manufacturing of paper as well as air and water transport see somewhat smaller average annual declines of just under 2% of employment, while land transport is projected to decline by on average 0.3% per year. Notably, the projections point to an increase in employment in electricity, gas, steam and air conditioning supply, which is a result of a strong increase in the use of greener sources of electricity generation in the energy mix of EU countries (which are bundled together with more GHG-intensive energy production in this industry) as evident from the more finely grained projections by Borgonovi et al. (2023[1]) or IEA (2023[26]). For example, employment in fossil-fuel powered electricity generation is projected to decline by about 80%, while employment in renewable and nuclear electricity generation is expected to substitute for it with an increase by 80%.

Figure 3.4. The speed of employment declines in high-emission sectors is projected to increase significantly

Past average annual employment changes between 2000 and 2019 and projected average annual employment changes between 2019 and 2030 under a 55% emission reduction for EU countries relative to 1990 levels (Fit for 55), average across countries, percentage



Note: The figure shows historical changes in employment between 2000 and 2019 as well as projected employment changes between 2019 and 2030, accounting for the Fit for 55 targets to reduce CO_2 – equivalent emissions by 55% in 2030 compared to 1990 levels. Agriculture is excluded. More information can be found in Borgonovi et al. (2023[1]).
Source: ENV-Linkages model.

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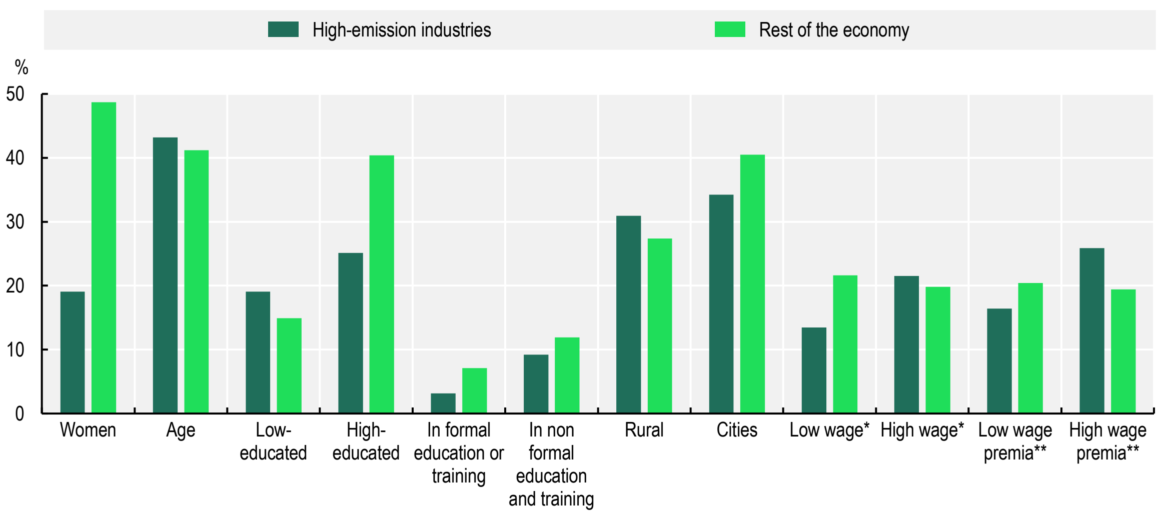
3.1.3. Workers in high-emissions sectors are well paid despite comparatively low education, more likely to be male and live in rural areas

The characteristics of workers in high-emission industries differ notably from those of workers in low-emission industries (Figure 3.5, Panel A). For example, workers in high-emission industries are more likely to have low educational attainment (20% versus 15%) and less likely to have high educational attainment (25% versus 40%) than workers in low-emission industries. Furthermore, workers in high-emission industries also participate less frequently in formal and non-formal education and training programmes (Figure 3.5, Panel A). However, despite their relatively low educational attainment, they are less likely to earn low wages (i.e. a wage in the bottom two deciles of the wage distribution) and slightly more likely to earn high wages (i.e. a wage in the upper two deciles) than workers in other sectors. Indeed, higher wages in high-emission industries reflect higher firm wage premia, i.e. employers paying higher wages irrespective of workforce composition, rather than differences in skills among workers.[6] Workers in high-emission industries are further much more likely to be male, somewhat older and more likely to live in rural areas (Figure 3.5, Panel A). The combination of low skills, relatively high wages and living in rural areas, in particular, could have potentially important implications for the costs of job displacement.

Figure 3.5. Workers in high-emission industries differ markedly from other workers

Characteristics of workers in high-emission and low-emission sectors, EU-28 countries, 2018/19, percentage of each category



Note: Data refer to the share of each category, expressed in percentages, except for age (average number of years). Low education refers to less than upper secondary, high education to more than upper secondary, tertiary. Participation in formal and non-formal education and training refers to participation over the 4 weeks prior to survey response in the EU-LFS. Cities refer to densely populated areas, rural areas refer to thinly populated areas. Towns and suburbs (intermediate density areas) are not shown. * High (low) wages refer to the top (bottom) two deciles of the hourly pay from the main job. ** High (low) wage premia refer to the top (bottom) two deciles of the firm-related wage premia distribution obtained from a regression of hourly pay onto categorical firm identifiers, age groups, gender, and education levels, and exclude Finland, Iceland, Luxembourg and Slovenia. Agriculture is excluded.
Source: Eurostat, EU-LFS, 2019; Eurostat, Structure of Earnings Survey, 2018 (deciles).

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3.2. Analysing the consequences of job loss in high-emission industries

This section provides an in-depth examination of the costs of job displacement in high-emission sectors based on harmonised linked employer-employee data from 14 OECD countries and a consistent econometric framework – see Barreto et al. (forthcoming[11]) for more details.

3.2.1. Methodology and data for analysing job displacement in high-emission industries

Determining the cost of job displacement for a given worker poses some methodological challenges. Ideally, one would like to compare the outcomes of the same worker in two states of the world, one in which the worker loses employment and another in which the worker continues to be employed. As this is evidently infeasible, the analysis in the chapter follows the literature by: i) focusing on mass layoffs to ensure focusing exclusively on workers who leave their jobs involuntarily; and ii) comparing the outcomes of displaced workers with those of observationally identical non-displaced workers from three years prior to displacement to six years after. The analysis is conducted separately for workers in high-emission industries and the rest of the private sector, as in Barreto, Grundke and Krill (2023[8]). As outcomes, it considers annual earnings, as well as its main components, including the probability of being employed, the number of days worked, daily wages and employer-specific wage policies as well as various mobility measures related to the probability of changing occupation, sector or region. For further details on the methodology, see Box 3.3 and Barreto et al. (forthcoming[11]).

In order to analyse the consequences of mass-layoffs for displaced workers, this chapter utilises linked employer-employee data for 14 OECD countries: Australia, Austria, Canada, Denmark, Estonia, Finland, France, Germany, Hungary, Portugal, the Netherlands, Norway, Spain and Sweden (see more information in Annex Table 3.B.1). The resulting dataset generally covers the years 2000 to 2019, and thus avoids potential confounding effects of the COVID-19 pandemic on labour markets. For some of the countries, the observation period begins later than 2000 or ends before 2019 – see Annex Table 3.B.1. The data are drawn from administrative records designed for tax or social security purposes or, in a few cases, mandatory employer surveys. As a result, these data are very comprehensive, often covering the universe of workers and firms in a country over several decades, and of high quality, given the financial implications of reporting errors for tax and social security systems.

Since tax and social security systems differ in their administrative requirements across countries, with potentially important implications for their comparability across countries, considerable effort has been made to harmonise the data (see Section 3 in Barreto et al. (forthcoming[11])). Individuals who are out of employment are recorded with zero earnings for such intervals, as is standard practice in the job displacement literature. The analysis is restricted to workers aged 18-50 in the private sector (but robustness checks are conducted to test the sensitivity of the results to focusing on workers aged 18-60).

Box 3.3. Estimating and decomposing the cost of job loss

This analysis follows the standard practice in the literature to estimate the cost of job loss separately for high-emission sectors and the rest of the economy (Barreto, Grundke and Krill, 2023[8]). It considers workers displaced from mass-layoff events, which are defined as events in which a firm reduces employment by at least 30%[1] To ensure that actual mass-layoffs are captured instead of mergers, acquisitions and outsourcing events of the firm, no more than 30% of displaced workers are allowed to be re-employed together in the same firm following the mass-layoff event.[2] The analysis is restricted to workers 18 to 50 years old to limit the influence of early retirement programmes (workers 18-60 are used in a robustness test). The analysis is further restricted to workers with at least two years of tenure in the year before displacement and in firms with at least 30 employees. Real yearly earnings are compiled from all sources, including income from multiple employers, overtime, bonuses, and severance payments, where available. Daily wages are calculated from the main employer for each respective year. Employers are identified at the establishment level or at the firm level if the former is not available.

The outcomes of workers who are displaced by a mass layoff (treated) are compared with those of non-displaced workers (control). As displaced and non-displaced workers may differ in their observable characteristics, each displaced worker is matched to an observationally similar non-displaced worker through a matching procedure ("statistical twinning"). First, treated units are matched with controls of the same gender in the same 1-digit industry and energy-related sector in the year prior to displacement. In addition, within the previously established cells, one-to-one nearest neighbour propensity score matching is applied. Propensity scores are estimated using a probit model that includes age, job tenure and firm size, as well as past wages. Using the estimated propensity scores, each displaced worker is assigned to its nearest non-displaced neighbour based on its propensity score. The matching procedure effectively balances the characteristics of displaced and non-displaced workers (Table 3 in Barreto et al. (forthcoming[11])). The underlying assumption for identification of causal effects is that, conditional on the observed covariates, displacement from a mass-layoff can be considered a random. This assumption would be violated if there is selection on unobservable characteristics (e.g. unobserved worker ability) that drives the probability of being treated by a mass layoff.

Based on the matched sample of treated and control workers, the outcomes of displaced and non-displaced workers are compared using the following event-study regression separately for workers in high-emission sectors and the rest of the private-sector:

$$y_{itc} = \alpha_i + \lambda_t + \sum_{k=-3}^{6} \gamma_k 1\{t = c + 1 + k\} + \sum_{k=-3}^{6} \theta_k 1\{t = c + 1 + k\} \times Displaced_i + X_{it}'\beta \ + r_{itc} \qquad (1)$$

where y_{itc} is the outcome of displaced worker *i* belonging to displacement cohort *c* or its matched non-displaced worker at time *t*. The coefficients of interest θ_k capture the change in outcome of displaced workers relative to that of non-displaced workers in the same sector, where *k* indexes event time such that *k=1* is the first post-displacement year and *k=0* the last year prior to displacement. The coefficients are normalised to *k*= *-2*, such that the effects are measured relative to that time period. The worker fixed effect α_i controls for time-invariant unobserved worker heterogeneity, λ_t is a calendar year fixed effect, γ_k a time since event fixed effect and X_{it}' contains a cubic of age. Finally, r_{itc} is the idiosyncratic error term. Standard errors are clustered at the worker level.

The outcomes considered are annual earnings relative to the pre-displacement average, the probability of being employed, the number of days worked, the log daily wage, the firm wage premium, and various mobility outcomes, such as the likelihood of changing the pre-displacement sector, occupation and region. Annual earnings are defined as the sum of labour payments (potentially, from different employers) in a given year divided by average pre-displacement annual earnings. The probability of being employed is a dummy equal to one if a worker has at least one day of dependent employment in a given year. In the event a worker is not observed in dependent employment in a given year, zero earnings are imputed, in line with the job displacement literature. This may overstate the actual costs of job loss to the extent that some displaced workers move to the public sector or become self-employed.[3] Days worked are defined as the total number of days in dependent employment in a given year conditional being employed at least one day irrespective of hours worked. Log daily wages are constructed as the natural logarithm of annual earnings divided by days worked at the main employer. Firm wage premia measure the average wage premia paid to all employees in a firm net of worker characteristics and is estimated using an AKM two-way fixed effects model (Abowd, Kramarz and Margolis, 1999[27]). Finally, the probability of changing sector, occupation or region is measured using a dummy which is equal to one if the observed value after displacement differs from its pre-displacement value and zero otherwise.

To provide an indication of the relative importance of the different components behind annual earnings losses, annual earnings y are decomposed into the components that can be attributed to the probability of being employed in the year p, the number of days worked in the year n, and the daily wage upon re-employment w (Schmieder, von Wachter and Heining, 2023[28]). Taking expectations over the samples of displaced and non-displaced workers, one can express the annual earnings of a displaced worker (D) relative to a non-displaced worker (ND) in each year relative to displacement as:

$$E[\Delta y] = E[p^{ND} n^{ND} w^{ND}] - E[p^D n^D w^D]$$

Rearranging terms gives:

$$E[\Delta y] = E[w^{ND}]E[n^D]\Delta E[p] + E[p^{ND}]E[w^{ND}]\Delta E[n] + E[p^D]E[n^D]\Delta E[w] + \mu$$

Where the first term gives the contribution of changes in the employment probability to changes in annual earnings relative to non-displaced workers, and the second and third term that of days worked and daily wages respectively. The contribution of the probability of being employed captures periods out of dependent employment lasting a full calendar year, in which annual earnings are imputed to be zero. The contribution of days worked captures periods of non-employment shorter than a full calendar year, which reflects a combination of non-employment and job instability. The contribution of daily wages captures changes in daily wages following displacement. To understand the sources of wage losses, the contribution of daily wages can be further decomposed into a worker- and a firm-related component (Lachowska, Mas and Woodbury, 2020[29]), by decomposing the treatment effect on wages $\Delta E[w]$ in the sum of changes in firm wage-premia $\Delta E[\Psi]$ plus changes in worker-related components $\Delta E[\rho]$ which capture the loss of human capital as well as match quality. The term μ is a residual which captures the change in the covariances between employment, days worked and daily wages that arises due to selection into employment. In practice, this component is very small and omitted for presentational purposes.

Note: A more detailed description of the methodology is available in Barreto et al. (forthcoming[11]).
1. A robustness check based on complete plant closures increases earnings losses across industries slightly but has no substantial impact on the differential effect between high- and low-emission industries.
2. Using a 20% threshold changes the patterns across countries and industries very little. It improves the identification of actual mass-layoffs. This increases estimated earnings losses, but with little impact on the differences between sectors and countries. However, a stricter threshold exacerbates small-sample issues with the number of displaced workers in the high-emission sector.
3. Nevertheless, using the British Household Panel Survey and studying the costs of job loss in the United Kingdom, Upward and Wright (2017[30]) find that reassigning earnings during periods of self-employment as zero makes very little difference to the estimated earnings losses. Bertheau et al. (2023[10]) also find that a similar exercise using Swedish data results in only minor differences.

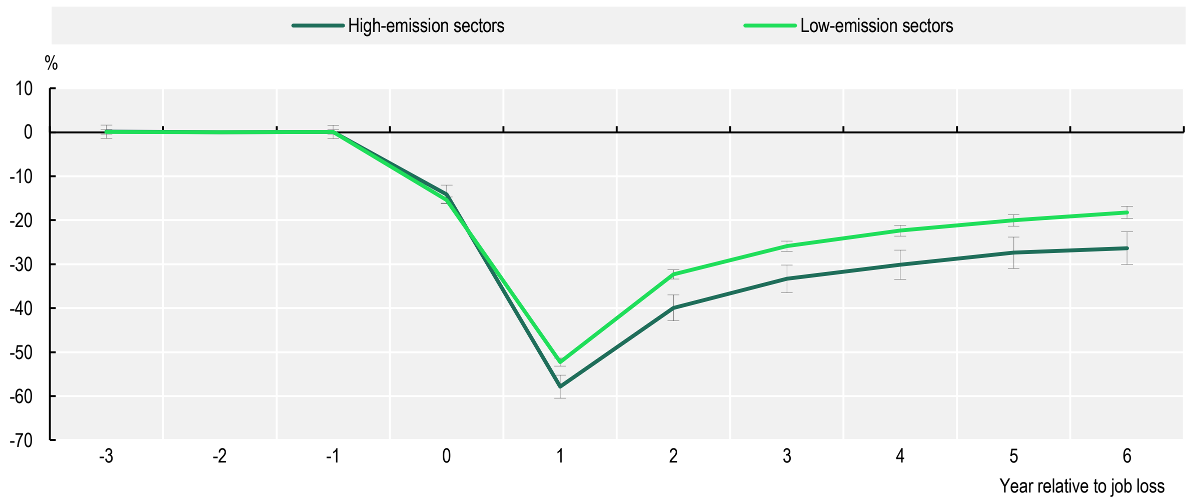
3.2.2. The consequences of job displacement in high- and low-emission industries on average across countries

Displaced workers in high-emission industries face larger and more persistent earnings losses than other displaced workers

Job displacement carries large costs for affected workers in all sectors, but workers displaced from high-emission industries face additional earnings losses exceeding those in low-emission industries. For instance, in the first year following a mass-layoff, workers displaced in low-emission industries see their earnings drop by 52% compared to non-displaced workers on average across countries. However, workers displaced from high-emission industries face a 6 percentage points additional drop to 58% compared to workers in low-emission industries (Figure 3.6). Even though the earnings of both groups of displaced workers gradually recover, the difference in earnings losses between them persists. After six years, the difference is 8 percentage points, with displaced workers in high-emission industries and low-emission industries workers having respectively 27% and 19% lower earnings relative to their non-displaced counterparts. On average during the six years since the year of displacement, the difference amounts to 7 percentage points, with earnings losses of 36% for workers displaced in high-emission industries and 29% for those in low-emission industries. Results echo previous findings by Haywood, Janser, & Koch (2023[31]), Andrews, Dwyer and Vass (2023[32]) and Rudd et al. (2022[33]) for displaced coal workers in respectively Germany, Australia and the United Kingdom, as well as Barreto, Grundke, & Krill (2023[8]) for displaced workers in carbon-intensive industries in Germany. However, for Canada, Chen and Morissette (2020[34]) find that, for a fraction of workers in the coal, gas and oil sector, displacement is not costly in the medium run.

Figure 3.6. Workers in high-emission industries face large and persistent job displacement costs

Difference in annual earnings between displaced workers and their matched counterparts relative to the time of displacement, average across countries, percentage



Note: The figure plots the average coefficients and the corresponding 90% confidence intervals across countries based on Equation (1). The coefficients capture the earnings losses of displaced workers relative to observationally comparable non-displaced workers. The point estimates show the impact of job loss on earnings in event time, where workers are displaced between time 0 and time 1, such that time 1 is the first post-displacement year. Related to this, earnings losses present a drop by construction at time 0, as earnings capture the sum of labour payments over the entire year and consequently already capture part of the displacement effect at time 0. The reference period for earnings losses is k=-2. Point estimates and confidence intervals from country-level regressions are averaged with equal weights. The countries included are Australia, Austria, Canada, Denmark, Estonia, Finland, Germany, Hungary, the Netherlands, Norway, Portugal, Spain, France, Sweden.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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The impact of job displacement in high-emission industries differs notably by sector as well, as laid out in detail in Barreto et al. (forthcoming[11]). For example, across countries, job displacement costs are most pronounced in industrial sectors that are intensive in energy demand, with earnings losses reaching 63% in the year of displacement relative to non-displaced workers. In transport sectors, earnings losses are comparable to or only moderately higher than in low-emission industries, while earnings losses for workers in energy supply industries vary considerably across countries.

Additional results that include older workers aged 50-60 at the time of displacement (Annex Figure 3.A.1) suggest that this slightly increases earnings losses in high-emission industries as older workers face somewhat larger earnings losses following displacement (see e.g. Athey et al. (2023[35])). On average over the 6 years following the year displacement, earnings losses in high-emission sectors increase by 1 percentage point to 37%, but the average difference with respect to low-emission sectors remains unchanged. This indicates that the estimated earnings losses presented in the baseline do not change much when including older workers. The baseline estimates moreover provide a better indication of the challenges that displaced workers face in transitioning to other jobs as they are less likely to be affected by early retirement.

Higher earnings losses in high-emission industries reflect a combination of fewer days worked, lower wages upon re-employment and longer spells out of work

Decomposing the earnings losses after job displacement into their contributions – namely (i) being out of work for an entire year, (ii) fewer days worked conditional on being employed at some point during the year and (iii) lower daily wages upon re-employment – can shed light on the underlying drivers that cause differences in job displacement costs for workers in high- and low-emission industries (see Box 3.3 for details on the methodology of decomposing earnings losses).[7] Differences in days worked in the first year after displacement are mainly related to the return to employment later in the year (i.e. after 1 January), whereas differences in subsequent years mainly reflect lower job stability upon re-employment.

On average over the six years following the year of job displacement, the lower likelihood of being in employment is the main factor behind earnings losses in both high- and low-emission industries (Figure 3.7 Panel A and Panel B). However, the 6-year average masks considerable variation in the importance of the earnings components over time. Initially, in the first year following displacement, differences in employment overwhelmingly drive earnings losses as reflected by differences in the probability of being employed and the number of days worked upon re-employment later in the year. By contrast, differences in re-employment wages play a marginal role. Over time, however, wages become more important for explaining earnings losses after displacement in high- and low-emission industries (both in relative and absolute terms). This increasing importance of wages may be explained by the earlier re-employment of workers with the highest skills and earnings potential as well as the gradual adjustment of job search toward lower paying jobs over prolonged unemployment duration – see e.g. Maibom et al. (2023[36]) and Hijzen, Upward and Wright (2010[37]). The days worked component falls strongly after the first year following job loss. From then on, differences in days worked mainly reflect differences in job instability upon re-employment while differences in the timing of job finding following displacement are negligible. Displaced workers may face higher job instability upon re-employment as they are more likely to be employed on temporary contracts and have lower job tenure.

Figure 3.7. Differences in earnings losses reflect larger wage losses, fewer days worked as well as longer spells out of work

Contribution of daily wages, days worked and employment to overall earnings losses after job loss in high- and low-emission industries in percentage (Panel A and B) and the difference in earnings losses between high- and low-emission industries in percentage points (Panel C), average across countries

Note: Average across countries of the contribution of daily wages, the probability of being employed, and days worked to the total earnings loss of displaced workers relative to observationally comparable non-displaced workers (see Box 3.3). The bars show the contribution of each margin to the overall earnings six years after job loss and on average over the six years following the year of job loss. The contributions of daily wages and days worked are conditional on being employed in a given year. The contribution of the probability of being employed captures the role of years in which no earnings from dependent employment are recorded in which case zero earnings are imputed. Point estimates from country-level regressions are averaged assigning each country an equal weight. The countries included are: Austria, Denmark, Finland, France, Germany, Hungary, the Netherlands, Portugal, Spain and Sweden. Due to missing daily wage and days worked information, Australia, Canada, Estonia and Norway are excluded.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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While employment is the main driver of earnings losses for displaced workers in high- and low-emission industries, its contribution stands out less strongly for explaining differences in earnings losses between high- and low-emission industries, particularly after the first year following job loss (Figure 3.7, Panel C). In the first year following displacement, differences in earnings losses between high- and low-emission industries mainly reflect a combination of a lower probability of employment and fewer days worked upon re-employment in the course of the year (see discussion above). In subsequent years, however, differences in earnings losses mainly reflect lower wages and days worked upon re-employment. In other words, after the first year following displacement, larger earnings losses in high-emission industries largely reflect lower job quality upon re-employment due to transitions to less well-paid and less stable jobs. Six years after displacement, the employment margin explains only about 31% of the difference in earnings losses, while differences in days worked (reflecting both the return to work during the year and job stability upon re-employment) account for 31% and differences in wages for 38%.

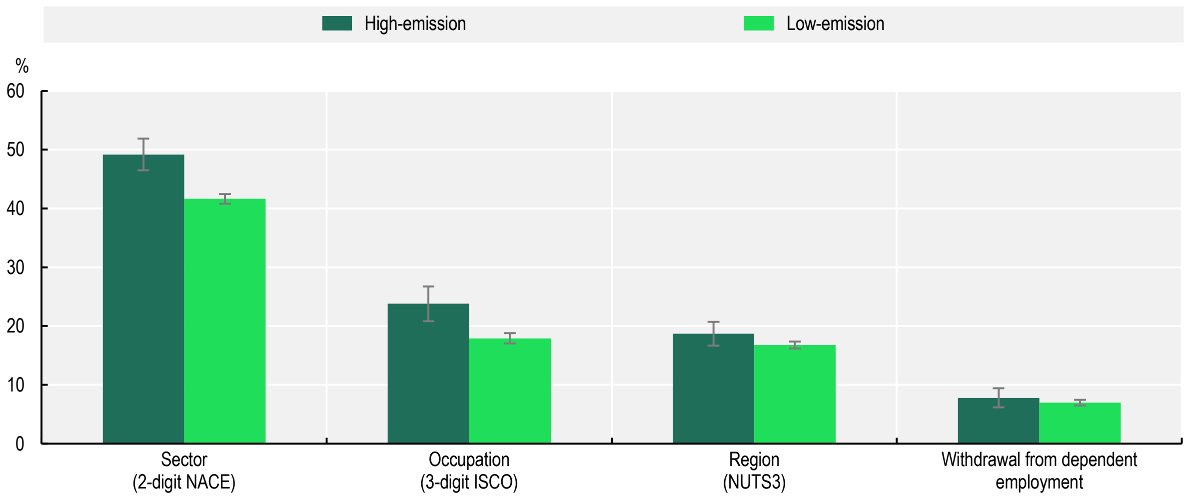
Displaced workers from high-emission industries are more likely to change industry and occupation

Workers displaced from high-emission industries are more likely to move to different sectors and occupations than displaced workers in other sectors (Figure 3.8). Six years after displacement, the probability of changing sector is around 49% for workers displaced from high-emission industries, about 8 percentage points higher than that for workers displaced from low-emission industries. Similarly, the probability of occupational switching after 6 years is 24% for displaced workers in high-emission industries, about 6 percentage points higher than in low-emission industries. Sectoral and occupational changes are likely to be costly due to the loss of industry- or occupation-specific human capital, contributing to the earnings losses of displaced workers (Huckfeldt, 2022[38]; Barreto, Grundke and Krill, 2023[8]; Kambourov and Manovskii, 2009[39]; Neal, 1995[40]; Gathmann and Schönberg, 2010[41]). Consequently, such changes reflect the difficulties that displaced workers in high-emission industries face in finding a job in the same industry and occupation.

Displaced workers in high-emission industries are slightly more likely to move to a different region, but this difference is not statistically significant (Figure 3.8). The probability of switching regions is 19% for workers displaced from high-emission industries, about 2 percentage points higher than in low-emission sectors. Albeit small, these differences could reflect the need for high-emission workers to find re-employment in local labour markets with better availability of jobs. Indeed, the high regional concentration of high-emission activities suggests that job displacement in these industries will necessitate additional geographic mobility as these sectors decline – see e.g. Lim, Aklin and Frank (2023[42]), OECD (2023[43]) and Chapter 2. Importantly for high-emission industries, the positive effect of regional mobility on earnings is most pronounced for workers who move from rural regions to urban ones (Huttunen, Møen and Salvanes, 2018[44]).

Figure 3.8. Workers displaced from high-emission industries change sector and occupation more often

Transition probability six years after job displacement, average across countries, percentage



Note: Bars show the probability of working in a different occupation, region, or sector than that recorded in the year before displacement (relative to matched non-displaced workers) and the vertical markers reflect the corresponding 90% confidence intervals. For withdrawals from dependent employment, the bar corresponds to the probability of permanent exits, i.e. a worker that is employed at time t but non-employed in all subsequent periods. As we exclude self-employment in all countries, it is possible that this partly captures transitions into self-employment. All differences between sectors are statistically significant at the 10% level. For sectoral changes and withdrawals from dependent employment, all 14 countries are considered. For occupational changes, the figure includes Germany, Denmark, Finland, Hungary, Norway and Sweden. For regional changes, the figure includes Australia, Austria, Germany, Denmark, Finland, Hungary, the Netherlands, Norway, and Sweden.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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Workers in high-emission industries are slightly more likely to withdraw from dependent employment following displacement, but again these differences are not statistically significant. Such exits from dependent employment may reflect transitions into self-employment or exits from the labour force, including early retirement (Figure 3.8). After six years, their likelihood of withdrawing from dependent employment is 8%, compared to 7% for low-emission industries. As the sample of displaced workers focuses on prime-aged workers (until the age of 50), this effect may reflect a higher likelihood of entering self-employment–- a status generally not covered in the administrative records–- or disability (Schaller and Stevens, 2015[3]) rather than early retirement. For displaced workers above the age of 50, the probability of withdrawing from dependent employment is larger for workers displaced in high- and low-emission industries, while the difference between the two also marginally increases (results not shown here). Withdrawal from the labour market for older workers is more likely to reflect early retirement (Chan and Huff Stevens, 2001[45]).

3.2.3. Cross-country differences in the consequences of job displacement in high-emission industries

With a focus on the average across countries included in the analysis, this chapter has so far shown that the costs of job displacement in high-emission industries are substantial and noticeably higher than those for workers displaced in low-emission industries. However, there may be important variation across countries in the level of job displacement costs for workers displaced in high-emission industries as well as in the difference in job displacement cost for workers in low-emission industries. The following sub-section therefore leverages the cross-country nature of the data to explore variation in job displacement costs within and between countries.

Workers displaced from high-emission sectors face particularly large earnings losses in all countries

Qualitatively, the within-country differences in job displacement costs between displaced workers in high- and low-emission industries are similar: in all countries considered in the analysis, displaced workers in high-emission industries face larger earnings losses on average over the first six years since displacement than displaced workers in other industries (Figure 3.9). This suggests that elevated displacement costs in high-emission industries are likely to be a common factor in OECD labour markets, and likely extend beyond the countries included in this analysis. However, there is wide variation in the quantitative differences in earnings losses between high- and low-emission industries across countries. The difference in average earnings losses between workers displaced in high- and low-emission industries is lowest in Australia, Canada, Germany, the Netherlands, Portugal and Sweden (below 5 percentage points), and highest France and Spain where it is more than 12 percentage points Differences in earnings losses to some extent reflect differences in the sectoral composition of high-emission industries. In countries, such as Australia and the Netherlands, displacement is concentrated in transport where earnings losses tend to be similar to those in low-emission industries, whereas in countries such as Hungary, displacement is concentrated in heavy manufacturing where earnings losses tend to be largest (see Barreto et al. (forthcoming[11])). However, even within detailed industries, there may be important differences in the challenges that displaced workers face across countries. In France, large differences in earnings losses are mainly driven by differences in days worked and re-employment wages, while in Austria and Spain differences in all three components are sizeable. The Netherlands stand out as differences in employment probabilities substantially reduce the difference in earnings losses between displaced workers in high- and low-emission industries.

Figure 3.9. The costs of job displacement in high-emission industries are consistently larger than those in low-emission industries

Decomposition of the average difference in earnings losses over six years since displacement between high- and low-emission industries into the contributions associated with wages, employment and days workers by country, percentage

Note: The bars show the average difference in the job loss effect on earnings between high- and low-emission industries over a period of six years after displacement. Countries are sorted based on the difference in earnings losses between high- and low-emission sectors. Due to missing information on daily wages and days worked, the bars for Australia, Canada, Estonia and Norway are not decomposed into the different components.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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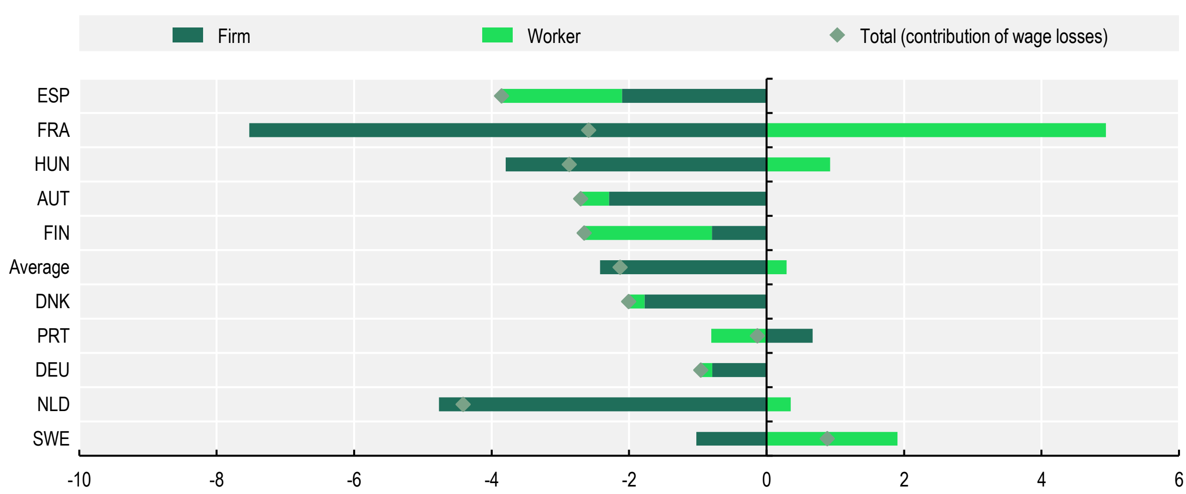
Differences in wage losses tend to be firm-related rather than worker-related

Wage losses upon re-employment may be either worker-related or firm-related. Worker-related wage losses stem from the loss of firm-specific skills and a decline in the quality of the match, whereas firm-related wage losses reflect a decline in the generosity of a firm's wage policies (Lachowska, Mas and Woodbury, 2020[29]). Decomposing the contribution of wage losses to earnings losses into a worker- and a firm-related component suggests that firm-related wage losses account for most of the difference in wage losses between high- and low-emission industries, echoing the results of Barreto, Grundke and Krill (2023[8]). On average across countries, differences in average wage losses between high- and low-emission industries are entirely firm-related (Figure 3.10). Indeed, in several countries worker-related losses to be smaller in high-emission industries. This is the case in France, Hungary, the Netherlands and Sweden. One possible explanation for this may be that workers in high-emission industries have lower skills and hence are less at risk of losing (firm-specific) human capital following job loss. Overall, these results suggest that displaced workers from high-emission industries undergo larger earnings losses in part because they were displaced from higher paying firms. This may mean that these workers move to less productive firms, firms where workers capture lower rents, or lose compensating wage differentials for physically demanding working conditions (Card et al., 2018[46]; Sorkin, 2018[47]; Hirsch and Mueller, 2020[48]). Evidence for Portugal (not shown) suggests that displaced workers in high-emission industries move to less productive firms, while evidence from France by Brandily, Hémet and Malgouyres (2022[49]) shows that displaced workers may re-allocate to higher productivity firms that pay lower wages because of a loss in bargaining power.[8] This loss in bargaining power is in line with the finding in Chapter 2 that workers employed in occupations concentrated in high-emission sectors are more likely to be covered by a collective bargaining agreement than other workers.

Figure 3.10. Higher wage losses in high-emission sectors tend to be firm-related rather than worker-related

Contribution of wage losses to the difference in overall earnings losses between displaced workers from high- and low-emission sectors, decomposed into differences in firm- and worker-related losses, average over six years following displacement, percentage points



Note: Bars represent the contribution of wage losses to the overall difference in earnings losses between displaced workers from high-emission and low-emission industries on average over the six years after displacement (see Box 3.3). The bars are decomposed into the contribution of a firm-related component (e.g. firm wage policies) and a worker-related component (i.e. human capital, match quality) following Lachowska et al. (2020[29]). Countries are sorted based on the difference in wage losses between high- and low-emission sectors. The figure excludes Australia, Canada, Estonia and Norway due to missing information on daily wages.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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After focusing on the within-country variation in job displacement costs, the remainder of this sub-section considers how differences in the costs of job displacement for workers in high-emission industries vary between countries in levels.

There are large differences in the cost of job displacement in high-emission industries between countries

There are large differences in the cost of job displacement between countries (Bertheau et al., 2023[10]). With less than 30%, average annual earnings losses of displaced workers in high-emission industries are particularly low in Australia, Canada, Germany, the Netherlands, Norway and Sweden, but are especially high in Portugal, where they exceed 60% (Figure 3.11). These differences reflect to an important extent differences in the opportunities of displaced workers to find another job as well as the number of days worked once a job is found. In Portugal, the country with the highest earnings losses, more than 43 percentage points of the earnings losses following displacement in high-emission sectors can be explained by being out of employment for an entire year, with a further 24 percentage points attributable to fewer days worked and about 5 percentage points to lower re-employment wages. In contrast, in Sweden, the country with the third lowest earnings losses, employment and days worked respectively explain 14 percentage points and 9 percentage points. By contrast, the contribution of wage losses upon re-employment varies much less between countries, typically between 6 percentage points and 11 percentage point at most. The main exceptions are Sweden and the Netherlands where wage losses upon re-employment are much less important than in the other countries considered. Note that the differences between countries in the cost of job displacement and the importance of joblessness are similar in both high- and low-emission sectors, which suggests that factors related to the incidence of joblessness affect both sectors in a similar way.[9]

Figure 3.11. Country-differences in the costs of job displacement in high-emission industries mainly reflect differences in the incidence of joblessness

Decomposition of the average earnings losses over six years since displacement in high-emission industries into the contributions associated with wages, employment and days workers by country, percentage

Note: Bars refer to the average effect of job loss on earnings over six years following displacement for workers in high-emission sectors. Countries are sorted based on the level of earnings losses for high-emission sectors. Due to missing information on daily wages and days worked, the bars for Australia, Canada, Estonia and Norway are not decomposed into components.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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3.2.4. A tentative exploration of the mechanisms behind cross-country patterns in the consequences of job displacement

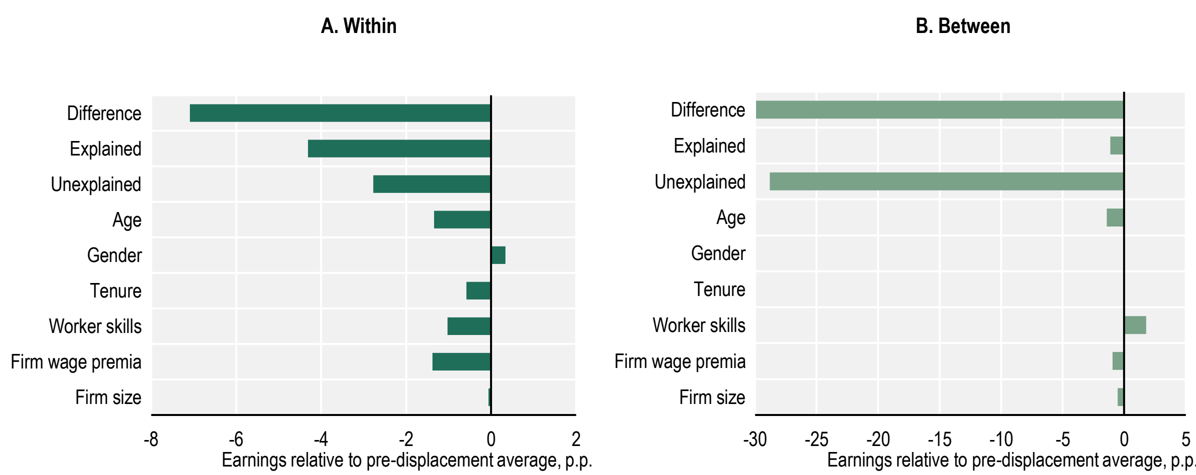
This sub-section provides a tentative exploration of the different mechanisms that may drive the country patterns described above by focusing on the composition of the workforce, the economic structure of countries and the nature of policies and institutions.

The composition of workers and firms explains most of the differences in the costs of job displacement between high- and low-emission industries, but hardly any of the differences across countries

While job displacement effects are estimated by comparing observationally similar displaced and non-displaced workers before and after mass-layoff events, displaced workers from high-emission sectors and the rest of the private sector can still differ in important ways (see e.g. Figure 3.5). This raises the question to what extent differences in the composition of firms and workers between displaced workers in high- and low-emission industries can account for differences in the costs of job displacement between high- and low-emission industries. By the same token, one may also ask to what extent differences in the composition of firms and workers explain differences in the costs of job displacement in high-emission industries between countries. To evaluate how much such composition effects contribute to within- and between-country differences in job displacement costs, Figure 3.12 presents an Oaxaca-Blinder decomposition accounting for individual and firm characteristics (see Box 3.4 for details).

Figure 3.12. Composition is important for within-country differences, but explains little between-country differences in job displacement costs

Oaxaca-Blinder decompositions of earnings gap after six years, between high- and low-emission industries within countries (left panel) and between high-emission industries between countries (right panel)



Note: The left panel refers to within-country differences in job displacement costs between workers in high- and low-emission industries and decomposes the difference in mean earnings losses within a country between sectors net of year effects. The reference group is displaced workers in low-emission industries. The right panel refers to between-country differences in job displacement costs for workers in high-emission industries and decomposes the difference in mean earnings losses for workers in high-emission sectors between countries. For the right panel, the reference country is Norway as it is the country with the lowest earnings losses. Worker skills are measured by the worker-related wage component, whereas firm wage premia are measured by the firm-related wage component. Both are estimated using two-way fixed effects wage models (Abowd, Kramarz and Margolis, 1999[27]). The decomposition excludes Australia and Spain as it is not possible to estimate two-way fixed effects for firms and workers due to data limitations.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

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The composition of workers and firms is a key determinant for the differences in the costs of job displacement between high- and low-emission industries. About two-thirds of the differences in earnings losses between workers in high- and low-emission industries can be attributed to differences in the composition of workers and firms (Figure 3.12, Panel A). Displaced workers in high-emission industries tend to be older, have longer tenure and lower levels of portable skills (as measured by the worker-related component of wages). These are all factors that are associated with larger earnings losses.[10] Moreover, workers in high-emission industries tend to be disproportionately displaced from firms with high wage premia, i.e. firms that pay relatively high wages after taking account of worker skills, which are lost at re-employment (see above). Finally, displaced workers in high-emission industries are more likely to be employed in routine-manual occupations which further increases earnings losses (see Box 3.4).

By contrast, differences in the composition of firms and workers explain barely any of the between-country differences in the costs of job displacement in high-emission industries (Figure 3.12, Panel B). Instead, between-country differences in the cost of displacement in high-emission industries are likely to reflect structural differences related to the functioning of the labour market more broadly, as reflected in differences in the incidence of joblessness (Bertheau et al., 2023[10]).[11]

Box 3.4. The role of composition in the cost of job displacement in high-emission industries

While the analysis of job displacement is based on comparing the outcomes of displaced workers with those who are not displaced but have similar characteristics in the same sector (i.e. high-emission, low-emission), the characteristics of displaced workers in high-emission sectors may still differ from those in low-emission sectors or from those of displaced workers in high-emission sectors in other countries. Consequently, differences in the cost of job displacement between industries or countries may reflect differences in the composition of displaced workers or differences in the cost of job displacement for similar displaced workers. Oaxaca-Blinder decompositions can be used to shed light on the role of composition in explaining differences in the cost of job displacement between industries and countries. The remainder of this box first discusses the methodology and presents some additional results on the role of occupations.

Methodology

Start by denoting the *individual-level* difference-in-differences estimate (Δy_i) as:

$$\Delta y_i = \left(\bar{y}^{D}_{i,after} - \bar{y}^{D}_{i,before}\right) - \left(\bar{y}^{ND}_{i,after} - \bar{y}^{ND}_{i,before}\right) \quad (2)$$

where $\bar{y}^{h}_{i,after}$ indicates the average outcome for $h \,\epsilon\, \{Displaced, Non-displaced\}$ after job displacement (1 to 6 years) and $\bar{y}^{h}_{i,before}$ the corresponding average outcome before job displacement (-3 to -1 years). The individual-level difference-indifferences estimate Δy_i in turn can be written as a linear model of the observable characteristics of displaced (and non-displaced) workers in high- and low-emission industries:

$$\Delta y^{s}_{i} = X^{s}_{i}\beta^{s} + \vartheta^{s}_{i} \quad (3)$$

where $X^{s}_{i}, s \,\epsilon\, \{High, Low\}$ is a vector of worker and firm characteristics measured before displacement (i.e. in the baseline period at t=0 and ϑ^{s}_{i} is an error term.

Using equations (1) and (2), the Oaxaca-Blinder decomposition of the difference in the difference-in-differences estimate between high- and low-emission industries can be written as:

$$\Delta\bar{y}^{High}_{i} - \Delta\bar{y}^{Low}_{i} = \left(\bar{X}^{High}_{i} - \bar{X}^{Low}_{i}\right)\beta^{Low} + \bar{X}^{High}_{i}\left(\beta^{High} - \beta^{Low}\right) \quad (4)$$

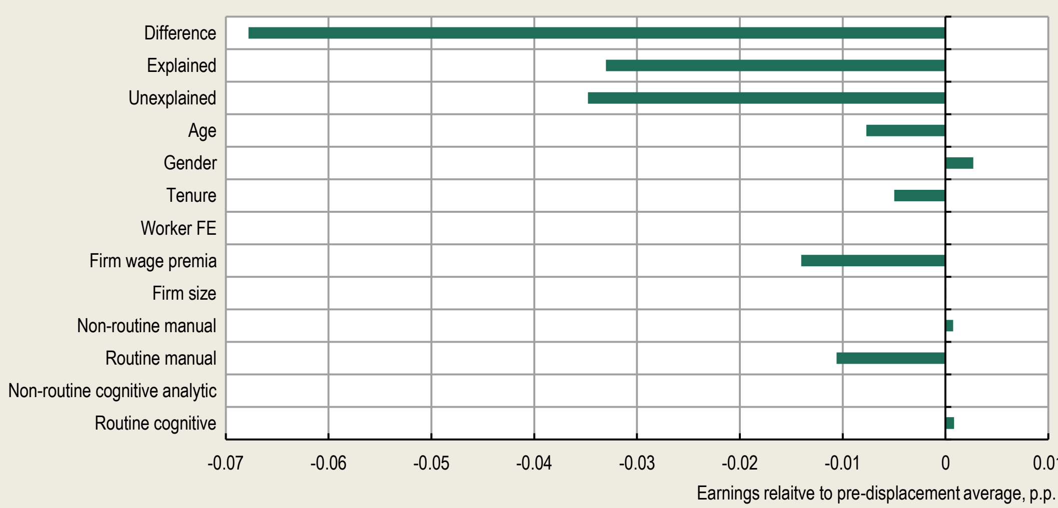
where the first component on the right-hand side captures the role of composition effect, i.e. the part that is explained by differences in observable characteristics between displaced workers in high- and low-emission industries, and the second component captures the structural effect, i.e. unexplained differences in the cost of job displacement between high- and low-emission industries holding composition constant. A similar decomposition can be used to shed light on the drivers of differences in the cost of job displacement in high-emission industries between countries. The results of the decomposition between industries within countries and within industries between countries are presented in Figure 3.12.

The role of occupational composition

While the baseline analysis for all countries focuses on the role of firm and worker composition in explaining differences in the cost of job displacement between industries and countries, for a subset of countries with information 3-digit occupations (ISCO), it is possible to go further by analysing the role of differences in the composition of occupations. Occupations are categorised into five groups based on their task content following Autor, Levy and Murnane (2003[50]): non-routine manual, routine-manual, non-routine cognitive analytic, routine-cognitive and non-routine interactive. The analysis reveals that occupational composition plays an important role in explaining differences in the earnings losses of displacement between high- and low-emission industries, on average across countries analysed (Figure 3.13). More specifically, the concentration of routine-manual occupations accounts for 32% of the difference in earnings losses between high- and low-emission industries. This suggests that displaced workers in emission-intensive occupations may have difficulty finding another job because opportunities in the same occupation are limited and they lack the skills to move to other occupations with higher skill requirements.

Figure 3.13. The concentration of manual routine occupations in high-emission industries contributes to higher earnings losses from job displacement

Oaxaca-Blinder Decomposition, difference in earnings losses between high- and low-emission sectors including occupational measures



Note: Average across Germany, Finland, Portugal, Hungary and Sweden. Each bar represents the contribution of a given occupational measure to the overall difference in earnings losses between high- and low-emission sectors based on an Oaxaca-Blinder decomposition. The reference category is non-routine interactive.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

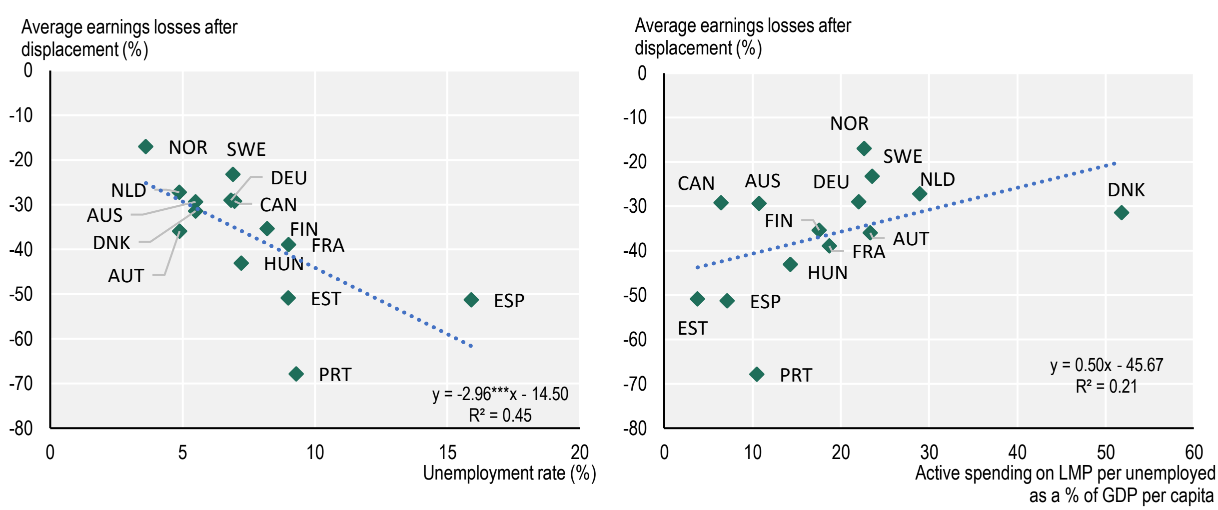
StatLink https://stat.link/w1n74g

Policies and institutions play a key role in explaining differences in the cost of job displacement across countries

Differences in how well labour markets are functioning and the degree to which job transitions are facilitated may partially explain why the incidence of joblessness is an important correlate of differences in the costs of job displacement across countries. A well-functioning labour market is a labour market that provides opportunities for work to all (OECD, 2018[51]). A useful simple measure of this is the average unemployment rate. Indeed, countries with lower average unemployment rates have noticeably lower average job displacement costs for workers in high-emission industries (Figure 3.14, Panel A). For example, Australia, Canada, Denmark, Germany, the Netherlands, Norway and Sweden, are all countries where unemployment rates were relatively low over the period considered and have the lowest costs of job displacement among all countries considered. Similarly, Portugal and Spain, countries where unemployment tended to be relatively high, exhibit the highest costs of job displacement. At the same time, labour market policies may also be an important determinant of the costs of job displacement. For instance, countries with high expenditure on active labour market policies (ALMPs), such as spending on job search assistance and training initiatives, are also those with comparatively low job displacement costs (Figure 3.14, Panel B). For example, Denmark, Germany the Netherlands, Norway and Sweden spend an equivalent of around 20% or more of their annual GDP per capita per unemployed person, while displaced workers incur earnings losses of around 30% or less. In other countries, such as Estonia, which spends only slightly more than 5% of their annual GDP per capita per unemployed person, earnings losses are more than 50%.[12] However, in contrast to the unemployment rate, these patterns across countries are only suggestive as they are not statistically significant.[13]

Figure 3.14. Well-functioning labour markets and ALMPs may reduce job displacement costs

Average unemployment rate, public spending on ALMPs and average earnings losses after displacement in high-emission industries



Note: The figure displays the correlation of the unemployment rate and ALMP spending with earnings losses after job displacement in high-emission industries, which does not necessarily mean that there is a causal link.***, **, * indicate significance at the 1%, 5% and 10% level respectively. ALMP: Active labour market programmes; LMP: Labour market programmes.
Source: OECD Employment Database; OECD Social Expenditure Database; National linked employer employee data, see Annex Table 3.B.1 for details.

StatLink https://stat.link/ikg0py

3.3. Supporting displaced workers in high-emission industries

Building on the results of the previous sections as well as on findings from the broader literature and the OECD policy questionnaire on labour and social policies for the net-zero transition, this section discusses how labour market policies can best support displaced workers during the net-zero transition. While long-term planning and preparation for labour market adjustments in the net-zero transition may reduce the risk of job displacement in high-emission industries, some degree of job loss may be inevitable. The findings in this chapter suggest that the costs of job displacement are typically lower in countries with well-functioning labour markets where policies and institutions support effective job transitions. As such, the development and implementation of adequate labour market policies are essential, not only to support displaced workers in general, but also to maintain public support for the net-zero transition – see e.g. Dechezleprêtre et al. (2023[5]) and Dabla-Norris et al. (2023[6]). Beyond specific labour market policies, regional and place-based policies may be an important factor as well – see Box 3.5 as well as OECD (2023[14]; 2023[43]) and Causa et al. (2024[52]).

Box 3.5. Regional transition initiatives for declining industries

Transitions and diversification in the Australian automotive industry

Since the early 2000s, the Australian automotive industry suffered substantial challenges, mainly resulting from high production costs and challenges to compete on the global market. Even though the Australian Government established the *Automotive Transformation Scheme* in 2011, providing AUD 1 billion to encourage competitive investment and innovation in the sector, between 2013 and 2014 all remaining Australian car manufacturers declared to cease operations by 2017. Initial projections expected a loss of 27 500 jobs, many of which would be lost in the industry's supply chain. These developments posed challenges for regions in which the automotive industry was strongly embedded, such as in Northern Adelaide (South Australia) and greater Melbourne and Geelong (Victoria).

To create new jobs and stimulate economic growth in these regions, the Australian Government established the *Growth Fund* in 2014, including various sub-programmes designed to support high-value manufacturing, encourage investment in new business opportunities, and assist supply chain companies to diversify, therefore providing strong incentives to transition production and employment to new sectors. Workers received funding of up to AUD 1 300 for training and job search assistance. The state governments of Victoria and South Australia, as well as the car manufacturers themselves, provided additional transition and diversification supports for workers.

Following these initiatives, the actual number of redundancies was significantly lower than that initially projected, with approximately 14 000 workers being made redundant. Much of this was achieved through a diversification of supply chain companies. These developments are partially attributable to the *Growth Fund* and the substantial lead time to the closure of the Australian car manufacturing industry (Department of Employment and Workplace Relations, 2019[53]). Despite these initiatives, regional unemployment rates rose well beyond the national average, for example in Northern Adelaide. This may suggest that even comprehensive place-based policy initiatives may not be able to fully avert the economic scarring of a decline of strongly embedded regional industries (Beer, 2018[54]).

Structural transformation and the end of the German coal industry

Due to high production costs and limited economic feasibility, Germany began a phasing-out of subsidies for hard coal mining in 2007, marking the end of the sector by 2018. To accommodate this process, the *German Hard Coal Mining Act* offered financial aid to facilitate structural change in the affected states of North-Rhine-Westphalia (particularly the Ruhr area and Ibbenbüren) and Saarland, including re-training of workers and adjustment benefits in the transition to early retirement. In parallel, Germany also focuses on the phase-out of lignite coal mining by 2038, which is predominately concentrated in Eastern Germany (Lusatia) as well as North-Rhine-Westphalia (the Rhineland).[1]

Under broad public consensus, the *Commission on Growth, Structural Change and Employment*, established in 2018, developed a comprehensive strategy to ensure economic sustainability and opportunities for regions affected by the lignite exit. Expecting significant employment losses, various programmes were put in place to facilitate the transition of lignite workers to other industries, alongside research funding as well as wider support for economic restructuring and environmental rehabilitation in the affected regions. Younger workers and those with transferable skills were offered re-training and job placement services, while older workers were offered adjustment benefits in the transition to early retirement. The cost of these programmes was about EUR 40 billion, while an additional maximum of EUR 5 billion was allocated for early retirement (OECD, 2020[55]; Südekum, 2022[56]).

1. The current German Government is considering an earlier phase-out of lignite mining by 2030.

3.3.1. Unemployment compensation

Job displacement results in unemployment and the temporary loss of labour earnings until new employment is found (at which point partial earnings losses typically persist). In most OECD countries workers are predominantly insured against income shocks through public or contributory income support schemes, such as unemployment insurance and social assistance. However, severance pay and early retirement schemes also play an important role in some countries, particularly for older workers (Figure 3.15). For example, over the first year of unemployment, 40-year-old displaced workers previously earning two-thirds of the national average wage at job tenure of 4 years receive about 6.4 months of previous gross earnings as unemployment compensation including severance pay, on average across the OECD, whereas workers aged 60 with 20 years of tenure receive as much as 9.5 months of previous pay.

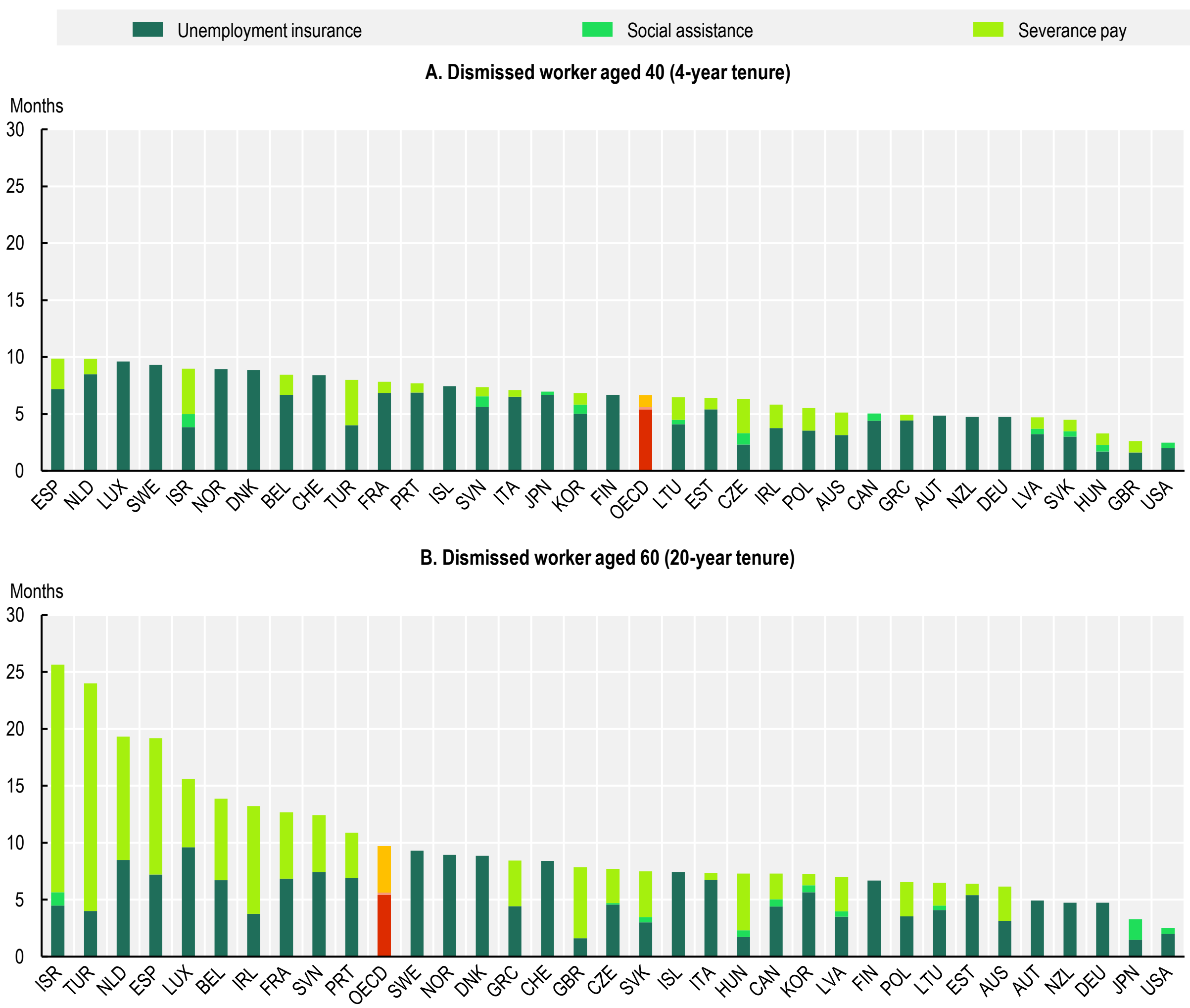
Unemployment insurance and social assistance

Arguably the most important tool to support displaced workers' incomes is unemployment insurance (UI). By providing crucial income support during periods out of work, conditional on active job search, UI facilitates good job transitions by allowing recipients to take the necessary time to find a job that aligns well with their skills and aspirations, rather than hastily accepting a poor job match. This does not only limit wage losses upon re-employment, but also supports the structural transformation by helping to secure a more stable match between workers' skills and job requirements (Nekoei and Weber, 2017[57]; OECD, 2023[58]). However, the UI benefit system needs to be carefully designed to avoid weakening incentives to job search and prolong unemployment spells – which in turn increases the risk of skill depreciation and reduced re-employment wages (Schmieder, von Wachter and Bender, 2016[59]) – while providing the necessary income security (OECD, 2023[58]; Marinescu and Skandalis, 2020[60]).

Across the OECD, the value of income support through UI varies strongly, driven by differences in income replacement levels and the duration of entitlements. For example, when considering only the first year of unemployment – a period after which many displaced workers have already found re-employment – income support through UI averages about 5.4 months' worth of previous gross annual earnings, with some countries providing somewhat different support by age (e.g. Czechia, Japan and Slovenia) (Figure 3.15) (OECD, 2023[58]). Moreover, in many OECD countries, UI provides additional support beyond one year. Unemployment insurance is typically part of a wider social safety net that can support displaced workers, though these make up a much smaller part of income support following job displacement (Figure 3.15). For example, after the expiry of UI entitlement, or at low levels of previous earnings, social assistance can provide additional support – averaging about 0.2 months' worth of gross pay. This is particularly important in countries where the maximum duration of UI is relatively short.

Figure 3.15. Income support over the first year of unemployment differs widely across countries

Value of gross income-supports in number of months of previous gross earnings over the1st year of unemployment,* 2022



Note: *The data only concern income support paid over the first year of unemployment and therefore do not consider potential support provided beyond the one-year mark. Data refer to 2022 and a single and childless worker earnings 67% of the national average wage with full eligibility to unemployment insurance. Age (for the 40-year-old worker) and earnings level are roughly matched to the cross-sample average of the countries included the displacement analysis of this chapter. Previous earnings, out-of-work benefits and severance pay are all expressed in gross terms. Severance pay refers to legislation in place as of 2019 and assumes dismissal for economic reasons/redundancy and, whenever regulations differ, a blue-collar worker. More information on severance pay regulation can be found in the methodology document to the OECD Indicators of Employment Protection (see www.oecd.org/els/emp/OECD2019-EPL.pdf). More information on the coverage of unemployment insurance and social assistance schemes, including the different treatment of unemployment insurance and unemployment assistance systems, can be found in the OECD Tax-Benefit Model methodology and the detailed country-specific policy rules (see www.oecd.org/social/benefits-and-wages).

Source: OECD Tax-Benefit Models and OECD Indicators of Employment Protection.

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Severance pay

In many OECD countries, severance pay is a key component in dismissal proceedings, providing compensation that aims to partially offset the sudden loss of income (OECD, 2018[51]). The level of severance pay differs significantly among OECD countries, but typically increases with tenure (Figure 3.15). With an average of one months' worth of gross pay across the OECD, it makes up a small part of income support in the year following job loss at shorter tenures. However, at longer tenures, it replaces on average slightly more than 4 months' worth of pay, with disbursements worth more than a year of pay for workers in Türkiye and Spain. As such, it can provide extra income security for workers that may find it harder to find re-employment at older ages. At the same time, it can provide a basis for social partners to bargain over transition measures (more below), while also providing incentives for workers to pursue internal flexibility through training and internal reorientation of the existing workforce. Some countries also mandate additional compensation in the case of collective dismissals (e.g. in Mexico). In some countries, additional severance payments can be mandated through collective agreements (e.g. in New Zealand and Türkiye) (OECD, 2020[61]).

Despite the role of severance pay as an income support, it may not be an efficient tool to reduce job displacement costs and facilitate labour market adjustment. This may result in providing too much support for displaced workers who find a suitable job quickly while it may leave too little support for those who have more difficulty doing so this. However, it is typically disbursed as a one-off payment that is less distortive in terms of job search incentives than unemployment insurance as it does not depend on being unemployed.[14] Moreover, as severance pay depends on previous earnings and, in contrast to UI benefits, is not capped, it can be a particularly important source of unemployment compensation for displaced workers previously earning relatively high wages. At the same time, high levels of severance pay entitlements may reduce job mobility among workers at risk of displacement (Garcia-Louzao, 2022[62]). Instead, it may be more beneficial to operate longer notice periods rather than higher severance pay as it can facilitate pre-displacement interventions by the public employment services (OECD, 2020[61]).

Early retirement schemes

Early retirement schemes facilitate an earlier transition into the pension system and have historically been available for many workers under different conditions, for example to facilitate economic restructuring and reduce excess labour supply – see e.g. Mirkin (1987[63]). In recent decades, however, they were often reserved for workers in physically demanding and hazardous occupations. These occupations partially overlap with those in high-emission industries, so that early retirement options have found application in the net-zero transition, but also for jobs that may not be physically demanding. For instance, in some countries, older displaced workers in declining industries are entitled to schemes that facilitate a labour market exit instead of extensive reskilling and training for the transition to new industries and occupations. For example, while the German coal exit plan offers displaced coal miners the possibility to retire from the age of 50 (underground miners) or 57 (surface lignite miners), other workers in the coal industry – such as technical, logistical, and administrative staff in coal and lignite mines and power plants – can claim an adjustment benefit from age 58, securing parts of lost employment income until the option to transition to early retirement at age 63 (Furnaro et al., 2021[64]).

However, early retirement schemes are hard to unwind once in place and can have significant negative and long-lasting effects on overall labour supply, economic growth and the sustainability of public finances (OECD, 2018[51]; 2009[65]). In light of rapid population ageing and labour shortages, early retirement can be seen as an expensive and unsustainable scheme to accommodate job loss. In addition, if the prospect of early retirement is not conditional on job displacement, it can dampen the incentives for early adjustment and occupational re-orientation. For example, in Poland, underground miners with an employment history of at least 25 years can retire at the age of 50. This scheme therefore creates strong incentives to stay employed in the coal mining industry and may limit sectoral and occupational mobility (Baran et al., 2018[66]). Early retirement schemes are therefore a strategically imprudent and economically counterproductive approach to react to the labour market challenges of the net-zero transition and their use should be strictly limited to exceptional cases, such as for physically demanding and hazardous occupations in which workers may also have a lower life expectancy – see also OECD (2023[67]).

3.3.2. Adequate wages and in-work income supports

Workers displaced in high-emission industries typically face pronounced wage losses upon re-employment and may be reluctant to accept jobs in new industries and/or occupations if wages are well below their previous earnings.[15] This can potentially prolong joblessness in the hope of finding higher-wage employment, with the additional risk that waiting for a better job may involve skill depreciation, potentially undermining re-employment wages and increasing public expenditures on income support. By improving remuneration for workers facing particularly low re-employment wages, wage setting institutions can ensure that all workers are paid fair wages (Criscuolo et al., 2022[68]; OECD, 2019[69]). In-work benefits can be complementary in this regard, providing additional financial support and work incentives.

Wage-setting institutions

Wage-setting institutions, in the form of minimum wages and collective bargaining, have an important role to play in ensuring that productivity gains are broadly shared with workers (OECD, 2018[51]), including in low-emission industries where firms tend to offer lower levels of wages for a given level of skills. In many countries, workers in low-emission industries such as hotels and restaurants are more likely to benefit from a minimum wage, while workers in high-emission industries are more likely to be unionised and covered by a collective agreement, which may be one of the reasons why such workers tend to be paid higher wages everything else equal (OECD, 2019[69]).[16]Job displacement from high-emission industries may lead to lower collective bargaining coverage – when such workers move to firms or industries that are less likely to be covered by a collective agreement (see Chapter 2 and Zwysen (2024[70])). Recent evidence from France shows that firm-related wage losses following job displacement tend to reflect transitions to more productive firms that pay lower wages conditional on skills and are less likely to conclude collective agreements (Brandily, Hémet and Malgouyres, 2022[49]). Minimum wages and broad-based collective bargaining systems can help avoid that job displacement reduces the sharing of productivity gains with vulnerable workers.

Wage insurance

Wage insurance (partially) covers the differences between pre-displacement and re-employment wages, typically on a temporary basis (Cahuc, 2018[71]). As such, it can increase job search incentives and reduce reservation wages and may be particularly effective in speeding up re-employment (Hyman, Kovak and Leive, 2024[72]). While in principle it can be provided on a permanent basis, limiting the duration of wage insurance eligibility and/or progressively reducing payments over time can reduce the risk of benefit dependency. The need for wage insurance may also decline over time as workers gain experience and develop job-specific human capital, which is reflected in wage increases. Furthermore, wage insurance could avert permanent labour market exit through early retirement schemes of older workers for whom the scope of reskilling may be limited (ILO/OECD, 2022[73]). To support displaced older workers, some countries have implemented such schemes in the past (Box 3.6). In the United States, it was targeted to trade-displaced workers and led to higher cumulative earnings over the four years following displacement by significantly speeding up re-employment. As a result, it paid essentially for itself through reduced expenditure on UI and increased tax receipts (Hyman, Kovak and Leive, 2024[72]). Schemes in other countries, such as Germany, were generally not targeted to specific groups of displaced workers beyond their age (Box 3.6).

Box 3.6. Wage insurance schemes in the United States, Germany and elsewhere

United States: Reemployment Trade Adjustment Assistance

To help workers who lost their job due to increased international trade and to foster public support for globalisation, the United States introduced *Trade Adjustment Assistance* (TAA) in 1962, running until 2022. While primarily covering costs of retraining programmes and offering extended UI benefits, a wage insurance programme entitled *Reemployment Trade Adjustment Assistance* (RTAA) was introduced in 2009. It aimed at mitigating the financial implications of job displacement while also encouraging and expediting reemployment (Hyman, Kovak and Leive, 2024[72]).[1]

Under the RTAA, TAA-certified workers aged 50 or older with pre-tax re-employment earnings up to USD 50 000 were eligible to receive a supplement to 50% of the wage difference with their previous job. These benefits were capped at USD 10 000 and paid for a maximum of two years from the date of re-employment or the end of state-funded UI entitlements (26 weeks, in most states). Participation rates were relatively low, with about 30 000 workers receiving wage insurance benefits between 2009 and 2021 (Hyman, Kovak and Leive, 2024[72]).

Recent evidence shows that RTAA- eligibility increased the speed of re-employment, while resulting in higher cumulative long-run earnings, particularly through faster re-employment. At the same time, there is no evidence that the quality of re-employment job is worse for RTAA-eligible workers. Because the estimated fiscal externalities of the programme in terms of reduced UI-expenditure and increased tax receipts exceeded wage insurance payments, the net costs of the programme were found to be positive, i.e. the programme yielded a net benefit to the government (Hyman et al., 2021[74]; Hyman, Kovak and Leive, 2024[72]).Three years following displacement, employment probabilities and earnings are similar for workers who were and were not eligible for wage insurance (and were instead eligible for extensive training). This suggests that the RTAA primarily worked as an inexpensive income-smoothing scheme after displacement for workers who find it hard to secure quality employment at ages close to retirement.

Germany: *Entgeltsicherung* (Wage Security)

Aiming to ease the transition of displaced workers back into employment, the German *Entgeltsicherung* (Wage Security) programme was in place between 2003 and 2011, targeting unemployed workers aged 50 or above with a minimum remaining UI benefit entitlement of 120 days. Beneficiaries received 50% of the net wage differential to their prior earnings in the first year of re-employment and 30% in the second year.[2] Moreover, pension insurance contributions were topped up to 90% of the contribution paid on the prior salary (Dietz et al., 2011[75]).

The uptake of the scheme was relatively low, in part owing to limited efforts by the public employment services to promote its use. For example, between 2003 and 2006, fewer than 10 000 workers received wage insurance payments, most of which were prior high-income earners. Likely due to the low initial take-up, the main evaluation of the programme in 2005 found no significant effects on re-employment (Brussig et al., 2006[76]; ZEW/IAB/IAT, 2006[77]). However, before the programme expired, take-up substantially increased, peaking at 20 000 participants in 2011 (Stephan, van den Berg and Homrighausen, 2016[78]). As such, a potential evaluation of the *Entgeltsicherung* based on later periods of the programme could be promising and may further enrich the understanding of wage insurance programmes for employment outcomes.

France and Japan: Other schemes

A few other countries have also implemented schemes or trials comparable to wage insurance. For example, since 2011, France's *contrat de sécurisation professionnelle* (job security contract) is accessible to workers laid off for economic reasons in companies with up to 1 000 employees (or those in reorganisation or liquidation proceedings), and offers a maximum of 12 months of full compensation of lost wages, capped at 50% of their remaining entitlements to UI benefits (Cahuc, 2018[71]). It has been shown to lead to somewhat faster re-employment and more stable employment relations (DARES, 2021[79]).

Japan's *Continuous employment benefits for the elderly* (高年齢雇用継続給付) supports workers between 60 and 65 years old, who are often laid-off and immediately re-hired as non-regular workers at lowered wages after firm-specific mandatory retirement age (OECD, 2018[80]). This scheme is compensating up to 15% of wages that fall below 75% of the average wage over the 6 months before reaching the age of 60. From 2025, the benefits will be reduced to a maximum of 10% of the wage level (MHLW, 2024[81]).

1. Between 2002 and 2009, the United States piloted the *Alternative Trade Adjustment Assistance* (ATAA), which, compared to the RTAA, had tighter eligibility criteria and lower take-up rates (Hyman et al., 2021[74]).
2. The wage difference had to be at least EUR 50 and re-employment wages were required to be at least at tariff wage level (local customary wages if the company is not subject to a collective agreement) while the employment relationship must have been subject to social insurance contributions (Dietz et al., 2011[75]).

Wage insurance schemes can be a useful complementary tool for compensating wage losses of displaced workers in the net-zero transition, while increasing the incentives for job search and the take-up of job offers. For example, Haywood, Janser and Koch (2023[31]) propose a wage insurance scheme to reduce job displacement costs resulting from the decline of the German coal industry, arguing that it reduces the welfare costs of the coal exit by over two-thirds – substantially more than it is estimated to cost. However, wage insurance schemes for workers displaced in high-emission industries could raise equity concerns, as these workers previously worked in well-protected sectors that extracted high rents with correspondingly high firm wage premia. In addition, subsidizing wage differentials could also pose the risk of lock-in effects in low-productivity and/or low-quality jobs and therefore undermine the productivity-enhancing nature of job reallocation (Cahuc, 2018[71]; Parsons, 2023[82]). These concerns need to be balanced against the potential efficacy of wage insurance and the possibility that it frees up resources to support other priority projects, as illustrated by the example of the United States. More generally, wage insurance could be one of the tools to support displaced workers in the net-zero transition, especially where other income and employment support policies are less developed. Indeed, public interest in wage insurance schemes to support displaced workers during the structural transformation has been growing recently.[17]

Make-work-pay policies

In-work benefits supplement labour income, often on a permanent basis, and can make work more attractive relative to income support during joblessness. As such, in-work benefits may alleviate in-work poverty and can be particularly valuable to workers with a low earnings potential and weak work incentives (see e.g. Immervoll and Pearson (2009[83])). In-work benefits can therefore be particularly useful to support displaced workers whose skills have become obsolete due to the loss of firm-specific human capital and whose earnings potential has been seriously compromised. Examples of in-work benefit schemes in the OECD include cash benefits, such as the French *prime d'activité* for low-wage earners, as well as tax credits, such as the *Earned Income Tax Credit* (EITC) in the United States. However, in-work benefits can partially be captured by employers by offering lower wages, particulary in the absence of moderate minimum wage floors. For example, it has been estimated that employers capture about 36% of every USD spent on EITC (Nichols and Rothstein, 2016[84]).

3.3.3. Activation policies and lifelong learning

Active labour market policies (ALMPs) and lifelong learning are important in supporting displaced workers in high-emission industries, given the difficulty that such workers have in finding equally well-paying jobs. By supporting job search and equipping workers with the necessary skills, such policies can facilitate transitions towards expanding sectors and occupations, including those associated with less polluting activities, as well as sectors and occupations with persistent labour shortages. Importantly, in countries with higher public expenditure on ALMPs, displaced workers tend to have lower average earnings losses (Figure 3.14). This evidence cautiously suggests that ALMPs with well-funded public employment services (PES) may help to mitigate the costs of job displacement. As shown in Figure 3.5, workers in high-emission industries rarely engage in formal and non-formal education and training in employment, and less often than workers in other sectors of the economy. This might suggest that workers in high-emission industries are less adaptable to growing skills demands and therefore may be less prepared to transition to new industries.

Public employment services

Public employment services (PES) can play a pivotal role in helping displaced workers in the job search process and steering them towards opportunities in expanding segments of the economy. Where barriers may persist, PES can further help in identifying relevant training and reskilling opportunities based on the skill-demands on the labour market, alongside financial support for such activities. Indeed, job search assistance has been shown to be more effective than other ALMPs in increasing re-employment probabilities (Card, Kluve and Weber, 2017[85]). Job search assistance is often used to steer vulnerable job seekers to green and in-demand jobs (e.g. in Colombia, the Slovak Republic and Spain, among others). For example, as part of the Recovery and Resilience Mechanism, Spain supports vulnerable unemployed that are affected by the net-zero transition, including women, younger and older workers, people with disabilities, the long-term unemployed, with dedicated job search assistance, alongside training programmes, that specifically aim for employment in green jobs (European Commission, 2023[86]). To efficiently support displaced workers during the net-zero transition, PES must not only be adequately staffed, but the staff must also be well aware of the transitions labour market effects, including a detailed sense of declining and emerging industries. PES must therefore be supported through continuous upskilling through best practice sharing, online modules, and extensive training, which can equip PES staff to adequately guide job seekers during the net-zero transition and to recommend the most relevant training and reskilling opportunities that maximise the chances of job seekers to find good quality jobs. Systematic skills assessment and anticipation (SAA) approaches can be a further tool in this process – see Chapter 4 and OECD (2023[43]). This will also require a detailed understanding of which transitions from high-emission industries and occupations are feasible, for example through a detailed analysis of skill-distances between different occupations and whether these can efficiently be closed through training offers (Sanchez-Reaza, Ambasz and Djukic, 2023[87]). In addition to PES, private employment services can also play a role in contributing to the effective reallocation of displaced workers (Langenbucher and Vodopivec, 2022[88]).

Skill-related training

In general, job transitions of workers in high-emission occupations are heavily self-contained with little mobility to other occupations (see Box 3.7). While this can suggest that employment in other occupations is not attractive enough, other barriers related to skills or location can also impede successful transitions (Lim, Aklin and Frank, 2023[42]). At the same time, workers in high-emission industries are more likely to be older and less educated than workers in other sectors, groups which often face technological gaps and might differ in their learning styles and preferences (OECD, 2019[89]). As such, high quality job training and reskilling initiatives that are tailored to the specific needs of workers in high-emission industries may be crucial to equip workers with the right skills for transitions to occupations with other skill demands – see Chapter 4. Estonia, for example, specifically supports the up- and reskilling of displaced workers in the shale oil industry to allow for transitions into new sectors and occupations (European Commission, 2023[86]). Similar to job search assistance, skill-related training and occupational re-orientation programmes can be effective in increasing re-employment probabilities, particularly in the medium and long run (Card, Kluve and Weber, 2017[85]). They have also been shown to increase re-employment wages after displacement in the Austrian steel industry (Winter-Ebmer, 2006[90]).[18]

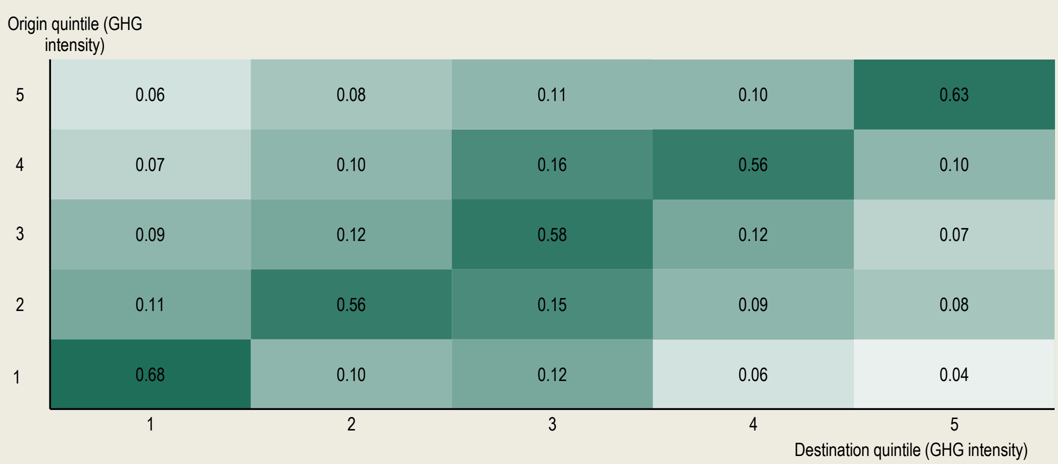
Box 3.7. Where do workers in occupations concentrated in high-emission industries go when they change job?

As employment in high-emission industries adjusts, understanding occupational mobility and labour market re-allocation becomes critical. To this end, this box documents occupational transitions at a disaggregate level (3-digit ISCO)[1] according to the degree of emission intensity. Occupations are grouped into quintiles, based on their concentration in high-emission industries[2] (e.g. quintile 5 represents occupations that are most concentrated in high-emission industries). Transitions across quintiles weighted by employment to account for the differences in employment levels which influence transition levels into and out of the quintiles. The probability of moving from one quintile to another is defined as the within-country sum of transitions between the two, divided by the total outflow from the origin quintile, and then averaged across countries (Finland, Germany, Hungary and Portugal). In contrast to the main analysis of this chapter, this box considers all transitions and not just those originating from mass layoffs.

Workers in the most emission-intensive occupations predominantly transition to similarly emission-intensive occupations (Figure 3.16). Nearly two-thirds of these transitions remain within the 5th quintile of the emission intensity distribution. It is less common for these workers to move to occupations of lower emission intensity, especially those at the very bottom of the distribution. While there is also a significant number of within-quintile transitions everywhere, the highest and lowest emission intensity quintiles are the most self-contained. This hints at potential mobility barriers, related to for example skills or geography, posing challenges for workers seeking less emission-intense roles during the net-zero transition. This concentration highlights a pressing need for targeted policies to ensure a balanced and sustainable occupational transition.

Figure 3.16. Workers from emission-intensive occupations tend to move to other emission-intensive occupations

Transition probabilities across emp. weighted quantiles of the within occupation emission intensity concentration



Note: Data refers to transitions between quintiles of the within-occupation emission intensity concentration over the period 2000-19. Transition probabilities are calculated based on employment weighted quintile-to-quintile job flows over the total amount of job outflows from the origin quintile within each country and are then averaged across Germany, Hungary, Finland and Portugal.
Source: National linked employer employee data, see Barreto et al. (forthcoming[11]) (Table 1) for details.

StatLink https://stat.link/0r4vbz

1. The differences in the share of occupational changes between Figure 3.16 and Figure 3.8 arise from differences in the aggregation levels of the analyses and the focus of Figure 3.8 on job changes due to displacement, while Figure 3.16 includes all job changes.
2. For example, metal-processing-plant operators have a particularly high concentration in high-emission industries, whereas senior managers are more equally distributed across sectors and therefore have a much lower concentration in high-emission industries.

3.3.4. Managing and reducing the cost of job displacement

Mass layoff regulation and early intervention

Most OECD countries have specific regulations for mass layoffs (or "collective dismissals") that go beyond those for individual dismissals. These encompass requirements and guidelines that aim to reduce the effects of job displacement on workers, while offering firms the flexibility to adjust their workforce subject to these conditions. Examples are extended notice periods, mandatory consultation with employees or their representatives, additional severance pay provisions and measures to facilitate the transition to re-employment (OECD, 2020[61]). Extended notice requirements, in particular, can play an important role in facilitating early interventions by public employment services as discussed in more detail below.

Early interventions during the notice period by the public employment services, before (individual or collective) dismissal takes place, can be particularly effective at reducing the cost of job displacement, for example by reducing stigma effects of unemployment, or even preventing it entirely by facilitating direct job-to-job transitions prior to displacement (OECD, 2018[91]). Training and adaptation towards new roles within the same firm can also help to avoid displacement (e.g. financed through the *Qualifizierungsgeld* in Germany). Despite their effectiveness, these early intervention strategies are not as widely implemented as they could be. One good example is the region of Silesia in Poland, where workers at risk of displacement in coal and coal-related firms receive comprehensive outplacement services before dismissal takes place. A wider application of these strategies could reduce the incidence of job loss through early transitions to new employment and better accommodate its consequences by providing early assistance (OECD, 2020[61]; 2018[51]).

Social plans and transition initiatives

Social plans and transition initiatives can also play an important role in mitigating the costs associated with job displacement and preparing displaced workers for re-employment. These measures typically operate through co-ordinated efforts between employers and worker representatives (and sometimes PES) to reduce the number of dismissals and, particularly, mitigate their negative consequences for workers. Some of these efforts also aim to create structured pathways for displaced workers that can significantly increase their re-employment chances. A number of countries operate short-time work schemes to support company restructuring (e.g. Germany, Spain). While this may appear counter-intuitive, the rationale of these schemes is to either prepare workers for a different role in their firm (e.g. using a greener technology) or help them move onto a different firm (e.g. with lower emissions).

For example, in Germany, transfer companies (*Transfergesellschaften)* can be established as part of a social plan during mass layoffs. Workers can voluntarily enter transfer companies for up to a year, where they receive job search assistance and skill training, while public funds and employer top-ups compensate them for wage losses. These measures reduce earnings losses by about a third in the first year after displacement and enhance employment outcomes, particularly for those at higher risk of prolonged unemployment who are also more likely to select into transfer companies (Fackler, Stegmaier and Upward, 2023[92]). Another example are Sweden's job security councils (*Trygghetsrådet*). These are established through collective agreements and financed by employers, offer supplementary financial supports and job search assistance on top of what is provided by the PES and UI (OECD, 2015[93]). While the support of job security councils does not appear to have a significant effect on unemployment duration or re-employment wages, at least for blue-collar workers, it does appear to lead to more stable jobs (Andersson, 2018[94]).

3.4. Concluding remarks

The net-zero transition is essential for a sustainable future, yet it presents significant challenges. While the aggregate employment effects are likely to be modest, the net-zero transition is expected to have a significant impact on workers in high-emission firms and industries, which will have to change the way they operate and, in some cases, reduce or even close certain activities. Forward-looking climate change mitigation policies that provide future guidance to firms on the planned reduction of GHG emissions and the availability of reconversion and green subsidy schemes can help firms anticipate future change and prevent some involuntary job losses. However, some job losses are inevitable, and policies that support displaced workers, by providing income support during joblessness and facilitating the transition into new jobs, are therefore of vital importance. Proactive skills and labour market policies are particularly important. Early interventions by public employment services, as early as during the notice period before workers lose their job, can be particularly effective in reorienting displaced workers towards new jobs, potentially in emerging and in-demand industries and occupations, and in reducing the costs of job loss. Forward-looking upskilling and reskilling policies are key to ensuring that workers in declining high-emission activities can develop the skills that are needed to make successful transitions to expanding activities. This not only would reduce the cost of job displacement by shortening the time spent out of work and increasing re-employment wages, but also may enable workers to seize emerging opportunities, including in low-emission activities, before displacement takes place.

When considering policies to support displaced workers, an important question is whether workers who lose their job as a result of the net-zero transition should receive targeted support or whether it is best to rely on universal policies that provide effective support to all displaced workers irrespective of the reason (OECD, 2005[95]). The answer to this question may vary from country to country, but there may be a political economy argument for introducing specific policies for workers displaced because of the net-zero transition. Such policies can be seen as a way of compensating workers for the costs of policy-induced structural change but also as a means of maintaining public support for climate change mitigation policies. However, such targeted policies also raise important implementation issues related to the difficulty of justifying differences in regulatory treatment between different groups of displaced workers and the fact that the reason for job displacement is not always easy to establish in practice. Universal systems may be preferable from this perspective, but also require a political consensus for strong income support and re-employment policies that is not always present.

This chapter raises several important avenues for future work. First, the consequences of job displacement in high-emission activities and the corresponding policy responses are likely to depend to an important degree on the regional context. Future work could analyse the extent to which the costs of job displacement depend on the regional concentration of high-emission activities, how far mass layoffs and firm closures affect local labour market outcomes, and the role of place-based policies that take account of local conditions as well as policies that facilitate geographical mobility. Second, there is a need for a better understanding of the specific barriers that prevent workers in high-emission industries from making successful job transitions. The chapter already shows that transitions between high- and low-emission occupations are rare. Future work could explore the extent to which low occupational mobility reflects barriers related to skills, geography or lack of demand. This work would not only help to increase understanding of how to better accompany displaced workers in declining activities but also why firms with persistent labour shortages have difficulty in finding suitable workers.

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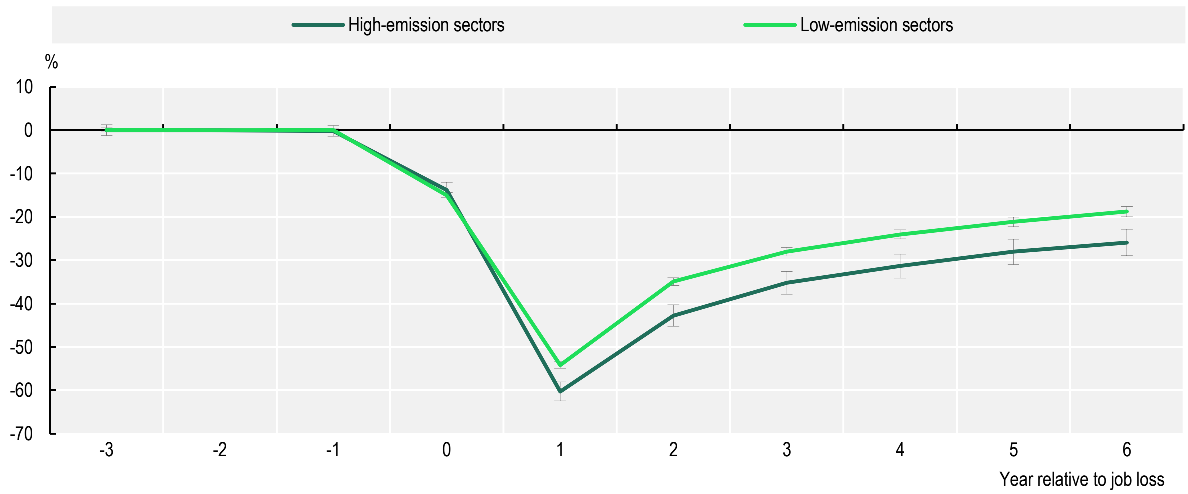
Annex 3.A. Additional figures

Annex Figure 3.A.1. Displacement costs are slightly larger when including older workers

Difference in annual earnings between displaced workers and their matched counterparts relative to the time of displacement, average across countries, workers aged 18 to 60, percentage



Note: The figure plots the average coefficients and the corresponding 90% confidence intervals across countries based on Equation (1) for workers aged 16 to 60. The coefficients capture the earnings losses of displaced workers relative to observationally comparable non-displaced workers. The point estimates show the impact of job loss on earnings in event time, where workers are displaced between time 0 and time 1, such that time 1 is the first post-displacement year. Related to this, earnings losses present a drop by construction at time 0, as earnings capture the sum of labour payments over the entire year and consequently already capture part of the displacement effect at time 0. The reference period for earnings losses is k=-2. Point estimates and confidence intervals from country-level regressions are averaged assigning each country an equal weight. The countries included are: Australia, Austria, Canada, Denmark, Estonia, Finland, Germany, Hungary, the Netherlands, Norway, Portugal, Spain, France, Sweden.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

StatLink https://stat.link/yf4gt1

Annex Figure 3.A.2. Country-rankings in the level of earnings losses following displacement in low-emission industries roughly mirror those for high-emission industries

Decomposition of the average earnings losses over six years since displacement in low-emission industries into the contributions associated with wages, employment and days workers by country, percentage

Note: Bars refer to the average effect of job loss on earnings over six years following displacement for workers in low-emission sectors. Countries are sorted based on the level of earnings losses for low-emission sectors. Due to missing information on daily wages and days worked, the bars for Australia, Canada, Estonia and Norway are not decomposed into components.
Source: National linked employer employee data, see Annex Table 3.B.1 for details.

StatLink https://stat.link/zip64g

Annex 3.B. Additional tables

Annex Table 3.B.1. Data sources

Country	Name	Source	Sample	Period
Australia	Person Level Integrated Data Asset (PLIDA)	Tax administration	10% random sample of workers	2002-19
Austria	AMS-BMASK Arbeitsmarktdatenbank	Social security administration	Universe	2000-19
Canada	Canadian Employer-Employee Dynamics Database	Tax administration	Universe	2001-19
Denmark	Integrerede Database for Arbejdsmarkedsforskning (IDA) and other data from Statistics Denmark	Tax administration	Universe	2000-19
Estonia	Data from the Tax and Customs Board Register	Tax administration	Universe	2003-19
Finland	FOLK employment data from Statistics Finland, Employer Payroll Report from Tax Admin.	Tax administration	Universe	2000-19
France	Panel DADS	Social security administration	8.5% random sample of workers	2002-19
Germany	Integrierte Erwerbsbiographien (IEB)	Social security administration	10% random sample of workers	2000-19
Hungary	ADMIN – I – Panel of administrative data (OEP, ONYF, NAV, NMH, OH)	Social security administration	50% random sample of workers	2003-17
Netherlands	CBS Microdata from Statistics Netherlands	Tax administration	Universe	2006-19
Norway	Arbeidsgiver- og arbeidstakerregister (Aa-registeret), Lønns- og trekkoppgaveregisteret (LTO)	Tax administration	Universe	2000-19
Portugal	Quadros de Pessoal	Mandatory employer survey	Universe	2002-19
Spain	Muestra Continua de Vidas Laborales con Datos Fiscales (MCVL-CDF)	Social security and tax administration	4% random sample of workers	2006-19
Sweden	Longitudinell integrationsdatabas för sjukförsäkrings- och arbetsmarknadsstudier (LISA), Företagens ekonomi (FEK), Jobbregistret (JOBB)	Social security administration	Universe	2002-18

Notes

[1] The analysis of job displacement in this chapter is based on contributions by Stefano Lombardi (VATT, IFAU, IZA and UCLS), Patrick Bennett (University of Liverpool and IZA), Antoine Bertheau (NHH and IZA), Winnie Chan (StatCan), Andrei Gorshkov (Uppsala University), Jonathan Hambur (Reserve Bank of Australia), Benjamin Lochner (FAU, IAB and IZA), Jordy Meekes (Leiden University and IZA), Tahsin Mehdi (StatCan), Balázs Muraközy (University of Liverpool), Gulnara Nolan (Reserve Bank of Australia), Oskar Nordström Skans (Uppsala University, UCLS, IZA and IFAU), Kjell Salvanes (NHH and IZA), and Rune Vejlin (Aarhus University and IZA). This chapter is part of a broader OECD project that mobilises linked employer-employee data for cross-country research and policy analysis (LinkEED 2.0). For more details, please visit: www.oecd.org/employment/emp/linkeedv2.htm.

[2] Considerable shocks or long-term declines that impact activity and employment in high-emission industries are not unprecedented. For example, the unexpected collapse of the international oil price between 2014 and 2016 had a profound impact on the Norwegian economy, with workers in the oil industry experiencing high rates of job loss and unemployment compared with other workers (Juelsrud and Wold, 2019[96]; Salvanes, 2022[97]). Likewise, the decline of the coal industry in several OECD countries and the associated loss of jobs have led to substantial long-term losses in earnings and reduced labour market prospects among affected workers (Andrews, Dwyer and Vass, 2023[32]; Haywood, Janser and Koch, 2023[31]; Rud et al., 2022[33]; Chen and Morissette, 2020[34]).

[3] Fit for 55 stipulates a 55% overall reduction in emissions, with varying targets across different sectors. For example, a 61% reduction from 2005 levels for sectors under the EU Emission Trading System (ETS), while the sectors governed by the Effort Sharing Regulation (ESR) are tasked with achieving a 40% reduction.

[4] For an overview and the development of approaches measuring high-emission jobs, rather than industries, see Chapter 2 and Causa, Nguyen and Soldani (2024[101]).

[5] The OECD ENV-Linkages model is a computable general equilibrium model linking economic activity and greenhouse gas emission across various macroeconomic sectors and regions. See more in Château, Dellink and Lanzi (2014[100]).

[6] This can reflect different factors, including that workers in high-emission industries may be employed in more productive firms, firms in high-emission industries capture higher rents, workers in high-emission industries have a strong bargaining power thanks to higher trade union density and collective bargaining coverage or firms in high-emission industries compensation for physically demanding working conditions by paying higher wages (Card et al., 2018[46]; Sorkin, 2018[47]; Hirsch and Mueller, 2020[48]; Brandily, Hémet and Malgouyres, 2022[49]).

[7] Lower wages upon re-employment, measured as daily wages, reflect a combination of hourly wages and working time. Daily instead of hourly wages are used to enhance the cross-country comparability of the results – see Barreto et al. (forthcoming[11]). Fewer days worked conditional on being employed at least one day during the year may reflect a combination of the return to work during the year (as the first job after displacement starts after 1 January), the instability of employment following displacement (for example if workers are more likely to be re-employed on temporary contracts) or permanent exits during the year from employment (for example workers moving to inactivity or self-employment after 1 January).

[8] The authors find that displaced workers tend to move to firms that are less likely to conclude a firm-level collective agreement and tend to have a less organised workforces.

[9] The country ranking of earnings losses following job displacement in high emission industries is broadly similar to that in low-emission industries, which are more representative of the overall experience of job loss in the economy (Annex Figure 3.A.2). One notable exception is France, which moves from having slightly above-average earnings losses to below-average earnings losses. The importance of joblessness for explaining between-country differences remains unaltered.

[10] Older workers with high tenure in their pre-displacement jobs are particularly vulnerable to the prospect of job loss, while male workers on average tend to have lower losses compared to females (Illing, Schmieder and Trenke, 2022[98]; Athey et al., 2023[35]). When including all workers up to the age of 60 in the analysis, the age component in the Oaxaca-Blinder decomposition contributes slightly more to the differences in the costs of job displacement between high- and low-emission industries (results not shown).

[11] Between-country differences are analysed relative to the country with the smallest earnings losses (Norway).

[12] The association between spending on ALMPs and the earnings losses due to job displacement varies considerably across categories of spending and is strongest with spending case workers, job-search-assistance and counselling.

[13] For earnings losses in low-emission industries, the slope coefficients with respect to the average unemployment rate and the average spending on ALMP per unemployed as a percentage of GDP per capita are -2.08 and 0.40 respectively. This indicates that the association between these variables is qualitatively similar to that in high-emission industries.

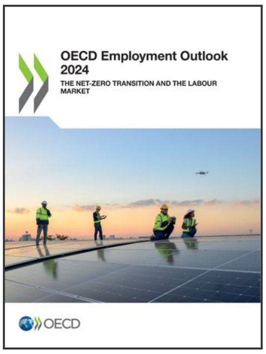
[14] Severance pay can also affect job search through an income effect which may increase the overall duration of unemployment (Chetty, 2008[99]).

[15] In some countries, e.g. Germany, unemployed job seekers can decline job offers without repercussions if the offered wage is significantly lower than the wage on which the unemployment benefit is calculated.

[16] For example, in Germany, the presence of strong trade union confederations in high-emission industries plays a crucial role for job quality as compared to other sectors (Jäger, Noy and Schoefer, 2022[102]). Overall, German firms bound by collective agreements and those with works councils tend to offer higher wage premia (Hirsch and Mueller, 2020[48]).

[17] See, for example, articles in Le Monde (2024), "*Comment mieux accompagner la transition environnementale sur le marché du travail?*", https://www.lemonde.fr/idees/article/2024/05/17/comment-mieux-accompagner-la-transition-environnementale-sur-le-marche-du-travail_6233817_3232.html and in the Financial Times (2024), "*What if the government insured you against a pay cut*?", www.ft.com/content/651c615e-4237-4b21-9158-016cb577d0f0.

[18] The meta-analysis of Card, Kluve and Weber (2017[85]) suggests that the employment effects of job search assistance and retraining efforts have different time profiles. While assistance programmes focusing on immediate job placement show consistent short- and long-term effects, training reskilling initiatives have greater employment effects over medium to long durations.



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