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Predicted Distributional Impacts of Climate Change Policy on Employment

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Document information

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Disclaimer

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Abstract

Efforts to reduce emissions to counter climate change are expected to have both costs and benefits, and these effects are likely to be unevenly distributed across the population. We examined the potential distributional impacts on employment in New Zealand from using different mitigation options ("pathways") designed to achieve net zero emissions of long-lived gases and to reduce biogenic methane emissions by 24-47% by 2050. For the analysis, we developed the Distributional Impacts Microsimulation for Employment (DIM-E). DIM-E uses results from a computable general equilibrium (CGE) model, C-PLAN, to estimate which industries, workers and jobs are expected to be most affected by different options to achieve these reductions. Overall, our results are similar to those from previous research in that the net employment effects are predicted to be relatively small, though some industries will be more affected than others. Moreover, the top net negative and top net positive industries ranked fairly consistently across the four time periods and across the different pathways that were analysed. On the net positive side, transport industries tended to dominate the industry rankings, and in later periods, some agriculture industries also tended to rank highly (e.g., Dairy Cattle Farming and Sheep/Beef Farming). On the net negative side, various manufacturing industries tended to dominate the top ranks, though oil and gas extraction was also consistently ranked. We also found that very few groups of workers were negatively affected (in terms of the number of worker-jobs) by any of the proposed pathways especially over the long term.

JEL codes

J01, Q52, R11

Keywords

Environmental Economics, Climate Change Mitigation, Distributional Impacts of Employment

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1. Introduction

Efforts to reduce emissions to counter climate change are expected to have both costs and benefits, and these effects are likely to be unevenly distributed across the population. In this paper, we examine the potential distributional impacts on employment in New Zealand from using different mitigation options designed to achieve net zero emissions of long-lived gases and to reduce biogenic methane emissions by 24-47% by 2050. For the analysis, we developed the Distributional Impacts Microsimulation for Employment (DIM-E). DIM-E uses results from a computable general equilibrium (CGE) model, Climate PoLicy ANalysis (C-PLAN) model[1], to estimate which industries, workers and jobs are expected to be most affected by different options to achieve these reductions.

To achieve these reductions in emissions, budgets for greenhouse gas emissions are to be set by the New Zealand government for three time periods: 2022-2025, 2026-2030, and 2031-2035. Since there are many different policy-mix options that could be used to meet these budgets, different pathways were simulated over these time periods to ensure that the budgets were achievable. These pathways were then modelled using C-PLAN to assess the potential economic effects of these different options. We use employment results from C-PLAN for these different pathways and apply them to more detailed employment information in order to better understand those industries, jobs and workers that are likely to be most impacted by the different pathways. Hence, while much of the literature focuses on the distributional impacts of specific policies, we estimate the potential distributional employment impacts from meeting emissions budgets using a mix of different actions and not from specific policies. However, the distributional impacts will depend on the exact policies put in place to deliver those budgets.

Most of the systematic, quantitative research in the international literature relating to the within-country distributional impacts of climate change policies primarily relates to the impact of carbon pricing on household energy bills, household incomes, or overall employment levels. (Büchs et al., 2011; Gough, 2013; Goulder et al., 2019; Longhi, 2015; Nikodinoska & Schröder, 2016; Preston et al., 2010; Rausch et al., 2011; Schaffrin & Reibling, 2015; Wang et al., 2016; White & Thumim, 2009). There is little quantitative research on the effects of these policies on employment in terms of the types of jobs and workers most likely to be affected. Hsiang et al. (2017) use low- and high-risk labour as one of many outcome measures (e.g., agricultural yields,

[1] The C-PLAN model is a global, recursive, dynamic CGE model tailored to the economic and emissions characteristics of New Zealand. (Winchester & White, 2021)

mortality, crime) to estimate economic damage at the US county level from climate change; however, this paper provides little detail about those groups most likely to be affected.

Relatively few papers have examined the distributional effects of environmental policies on employment. Roland-Holst et al. (2020) is one example of a study that downscaled results from a CGE model to examine job impacts using Full Time Equivalent (FTE) jobs to examine net job creation by county in an assessment of the U.S. state of Oregon's Cap-and-Trade Program.[2] They found most counties in the state experienced small FTE changes (between 0 and 1000) by 2050; however, the report did not include an analysis of job changes by industry, job, or worker characteristics.

Other research related to examining the employment effects of climate policies using CGE models includes Hafstead et al. (2018). They compared changes in aggregate and industry-level employment using a full-employment CGE model (which assumed that labour markets fully clear) to those from a search-CGE model (which introduced a search friction[3]) for different environmental policies and found that both models produced similar aggregate quantities of labour (in terms of hours). However, they also found that using an FTE calculation in the full employment model overestimated changes in the number of employed *workers* due compared to the search model. This was due to the search model allowing the hours per worker to vary while the FTE calculation assumed the number of hours per worker did not change. Their findings were similar across the different policies assessed.

When comparing industry-level employment changes between the two models, Hafstead et al. (2018) found that the models produced similar estimates of the number of employed workers because changes at this level were primarily driven by changes in demand across sectors, which were generally much larger than the changes in hours per worker. Moreover, they concluded that both models produced roughly the same ranking of industries in terms of net effects because these changes were driven by substitution away from carbon-intensive goods. The authors also noted that their research does not evaluate which model will generate more accurate predictions but primarily illustrated the robustness of results given different assumptions. Aubert & Chiroleu-Assouline (2019) also used a search-friction model to examine the implications of an environmental tax on incomes and unemployment composed of two types of workers (low- or high-skilled); however, they focused more on the implications for income than on employment outcomes.

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[2] This analysis assumed that future jobs would be created in the locations where the current jobs exist because there was not enough information available to predict the locations of these new jobs.

[3] Their search CGE-model imposed costs on firms to find workers, matched firms and unemployed workers, and allowed for negotiation over wages and hours.

Hafstead & Williams (2019) is one of the few papers that has focused on employment effects for workers in different industries. They used an extension of the search-CGE model from Hafstead et al. (2018) which included industry switching frictions and staggered wage bargaining to compare employment outcomes for three different types of environmental policies. In this model, the authors followed simulated workers based on their industry[4] when the policy was implemented. Hafstead & Williams (2019) concluded that the short-run differences (less than 18 months) in unemployment rates (including size and duration) between the policies and the business-as-usual scenario largely depended on two things: the ease with which workers could change industries and the magnitude of reallocation across industries caused by the policy.[5] This was particularly true for workers in mining and utilities[6]. Moreover, in their model, some high-turnover sectors like coal mining, which had high unemployment rates even without the policy, had lower unemployment rates in the medium term under the policy as it accelerated workers movement into lower-turnover sectors. The switching friction was relatively unimportant in determining the unemployment rate across all workers.

A general review of this literature and a thorough discussion about the climate policy questions related to employment are provided in Hafstead & Williams (2020). In this article, they concluded that existing research provides clear answers to some questions. For example, existing research indicates that changes in jobs due to policies are primarily reallocations across industries as opposed to substantial aggregate effects such as large net job gains or net job losses. Moreover, most of this reallocation occurs via less hiring rather than through separations.[7] They find that both results hold even for large, economy-wide policies. The latter result, however, may depend on the policy design (scale, scope, and implementation speed), but even so, policy design has a greater impact on short-term outcomes[8] and has little effect on the long term. Pre-announcements (as found in Hafstead & Williams (2019)) and phasing-in policies can be used to counter some of the short-term effects caused by these policies. In summary, research in this area has generally shown that environmental policy has little effect on overall employment – particularly in the long run.

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[4] These industries were broadly categorised as mining, utility, manufacturing, or other.

[5] More reallocation was better for workers as it provided more opportunities to move.

[6] Castellanos & Heutel (2019) found similar results using a static model to compare results when assuming perfect mobility between jobs to those assuming perfect immobility. They found little overall effect on the aggregate unemployment rate but more substantial differences for unemployment of workers in the oil and gas extraction sector and in the coal mining sector (more negativity affected under perfect immobility). They also found that policy design could be used to mitigate these effects.

[7] However, the authors note that this may be less true for already declining industries – these industries may have already reduced hiring substantially and hence increased job separations may be the only viable option remaining.

[8] This is particularly true for distributional effects the policy design is such that layoffs are required given that layoffs tend to increase the duration of unemployment and are more likely to lead to persistent negative effects for these workers.

In general, CGE models like C-PLAN are meant to be used for mid- and long-term projections (a decade or longer) – they are not designed to look at short-term outcomes (e.g., annual or shorter) because most models do not fully account for short-term fluctuations due to economic shocks or the business cycle. (Chen et al., 2016) For this reason, we have analysed the results from DIM-E over longer time periods in order to smooth these shorter-term fluctuations which should provide more robust results. Even so, the timing of the results may not happen exactly as predicted. However, by analysing these transitional periods, we can assess how the results are expected to unfold over time. Moreover, these simulation models are designed to examine how various aspects of the economy are likely to change due to different economic or policy conditions. (Chen et al., 2016)

In this paper, we present predicted employment trends to better understand the different types of workers that are most likely to be affected by the reallocation of employment across industries as mitigation efforts are undertaken, which is one of the areas in which Hafstead & Williams (2020) highlighted as needing more research. These results could be used to target policies to reduce search frictions and improve worker mobility, and thereby reduce the short-term negative effects of the reallocation.

Overall, we find that the net employment effects estimated in this analysis are predicted to be relatively small, though some industries will be more affected than others especially in the short- and medium-term. This is similar to previous research in this area. Moreover, we found the industry rankings of the top net negative and top net positive industries were fairly consistent across the four time periods and across the different pathways that we analysed.[9] On the net positive side, transport industries tended to dominate the industry rankings, and in later periods, some agriculture industries also tended to rank highly (e.g., Dairy Cattle Farming and Sheep/Beef Farming). On the net negative side, various manufacturing industries tended to dominate the top ranks, though oil and gas extraction was also consistently ranked.

By comparing the characteristics of workers and jobs in these top net positive and net negative industries, we also found that the average worker-job in some of the top net positive industries had relatively low pay and low FTE levels, while in the top net negative industries, annual earnings for the average worker-job were generally average or above average and FTE levels were also relatively high.[10]

[9] The net effects are in terms of the pathway results compared to the current policy scenario. Hence, industries that are net positive have more employment under the pathway than under the current policy scenario, and net negative industries have less employment under the pathway than under the current policy scenario.

[10] As discussed in Hafstead & Williams (2020), higher paying jobs may pay more to compensate for other negative aspects of the job (e.g., more dangerous, more physically demanding); however, there are a number of reasons why some jobs pay more than others (e.g., more skilled workers, demand for the product). In this case, the difference in average earnings

Using our simulation model, we also found that very few groups were negatively affected (in terms of the number of worker-jobs) by any of the pathways especially over the long term. Of course, there were exceptions. For example, workers in three sectors – Mining; Manufacturing; and Electricity, Gas, Water and Waste Services – were predicted to be negatively affected over the forecast period but Manufacturing more so than the other two industries. Workers in Taranaki and the West Coast were also predicted to be negatively affected by the end of the period; however, this is largely due to the concentration of negatively affected industries located in these regions. Given that the negative employment effects will likely outweigh the positive employment effects in these regions, workers in these regions may have reduced mobility and more difficulty during the transition.

The results presented in this report have been derived from models. These models are designed to better understand the implications of different actions and assumptions and to provide insights into the effects that could potentially occur under certain scenarios – they are not designed to exactly predict the future. Hence, any of the DIM-E results must be interpreted carefully, drawing on the scenario details and the outputs from the C-PLAN model.

The remainder of the paper is organised as follows. Section 2 describes the transition pathways that were used as the basis for the analysis. Section 3 describes the methodology used for the analysis, including information about the data, downscaling the CGE model results, and the simulation model. Section 4 covers the results, Section 5 provides a further discussion of the results, and Section 6 concludes.

2 The Pathways

There are a number of different ways that New Zealand could use to reduce greenhouse gas emissions to its targeted levels by 2050, and different mitigation options to achieve these results were considered. The Climate Change Commission (CCC) considered four different scenarios to achieve the proposed emissions budgets, called transition pathways, in developing its draft advice. These pathways were designed to deliver on New Zealand's targets to reduce biogenic methane emissions by at least 10% by 2030 and by 24-47% by 2050 relative to 2017, and to reduce emissions of all other greenhouse gases to net zero by 2050.

Transition Pathway 1 (TP1) was designed to set out the central assumptions across the energy and land system while the other three transition pathways were designed to test

could be due in part to the difference in the average FTE. For example, the average worker-job in Sheep/Beef is estimated to pay about $24,000 for 0.21 FTE, whereas, in Printing, the average worker-job pays about $50,000 for 0.62 FTE. For a full FTE, Sheep/Beef would be expected to pay about $114,000 and Printing would pay about $80,000 annually.

different mitigation options and technology uncertainties by deviating from these central assumptions in different ways. For example, Transition Pathway 2 (TP2) focused on methane technology and combined quicker uptake of methane reduction technologies with tighter methane targets. Transition Pathway 3 (TP3) constrained forestry removals in order to identify the costs of relying more heavily on emissions reductions. Transition Pathway 4 (TP4) focused on faster reductions and was designed to test the impacts of adopting more ambitious near-term emissions reduction targets for non-biogenic methane. As a baseline, a scenario was also developed to simulate the New Zealand economy under "business as usual" assumptions. This is called the Current Policy Reference scenario (CPR). The key assumptions for the CPR and the transition pathways are shown in Table 1.

For the CCC's final advice, a fifth transition pathway called the "demonstration path" was considered using an updated CPR. The updated CPR aligns more closely with baseline assumptions used in other modelling commissioned by the CCC including but not limited to assumptions on removals, land use, agricultural productivity, agricultural and waste emissions intensity, electricity generation, electric vehicle uptake, and oil prices. The demonstration path was designed to reduce emissions faster than the original four pathways to achieve net zero by 2040 rather than by 2050. Key assumptions about this path are also shown in Table 1.

Most of the results will be based on the pathways from the draft advice; however, some results for the demonstration path will also be presented.

3 Methodology

3.1 Data

The DIM-E uses data sourced from Statistics New Zealand's Integrated Data Infrastructure (IDI) and Longitudinal Business Database (LBD).[11] These data include population-wide, linked, administrative, census, and survey data for people and businesses. Each individual person or entity is given a unique identification number which allows them to be linked across different data sets. This allowed us to observe establishment- and enterprise-level information related to the business or businesses for which an individual works as well as information about individuals themselves.

Within the LBD, data are provided at different levels of the business including the enterprise level and the geographic unit level. The enterprise level pertains to a tax-reporting legal entity (e.g., sole proprietor, partnership, company). In the data, each enterprise is given a

[11] For more information about these data, see the Statistics New Zealand website.

unique, permanent enterprise number ("PENT") to allow the enterprise to be tracked over time, even if there is a change in the type of legal entity. For example, if a partnership decides to change to a limited liability company but is otherwise essentially the same entity, its PENT should remain the same. Geographic units are establishments of the enterprise (e.g., a grocery store chain would be represented in the data as the enterprise and each store would be considered a geographic unit). These establishments could be storefronts, headquarters, warehouses, or plants. Each establishment has been given a permanent unique identifier ("PBN"), which allowed us to track continuing activity at the same location.

Our analysis primarily relied on the monthly, linked employee-employer data to connect individual-level worker data in the IDI with the business-level data in the LBD.[12] This allowed us to observe both establishment- and enterprise-level information for each employee as well as information about the workers themselves (e.g., age, gender, ethnicity). The unit of observation in the monthly data set is a worker-job, which we defined as the employment relationship between a worker and a single enterprise.[13] Each worker-job is assigned to an establishment, and the industry and region for each worker-job is based on the establishment's industry and region.[14]

We used these data for the 2014 calendar year to estimate the number of worker-jobs in each ANZSIC06 code listed in the Appendix.[15] This was done by counting the number of unique worker-jobs in each month and averaging over the course of the year.

We also used worker-jobs data for the 2018 calendar year to describe characteristics of the workers in these jobs using unique worker-jobs over the course of the year. We estimated the characteristics for two mutually-exclusive sub-samples – worker-jobs with at least one short spell of work during the year ("short-spell worker-job") and worker-jobs with no short spells during the year ("not-short-spell worker-job").[16]

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[12] More detailed information about the LBD can be found on the Statistics NZ website and in Fabling and Sanderson (2016).

[13] Individuals appear in these data more than once if they have multiple jobs with different enterprises. However, if a worker was reassigned to a different location within the same enterprise, this is not counted as a new worker-job because the enterprise remains the same and only the enterprise changes.

[14] Note also that establishments and enterprises can be assigned separate industry codes and can even differ across the 1-digit ANZSIC06 industry classifications.

[15] We cleaned the data such that a worker-job can only be assigned to one ANZSIC06 industry code. It is possible for establishments to switch industry codes during a year, so to avoid double-counting worker-jobs in this instance, we replaced a worker-job's industry code to equal the most frequent ANZSIC06 code over the months for which the worker-job is observed during the year. When multiple industry codes were observed for the same number of months, we selected the lowest industry code (e.g., if the worker-job is observed in A011 for 6 months and in A012 for 6 months, the worker-job will be assigned to A011). However, these instances were infrequent. Workers could also be assigned to multiple establishments within the enterprise over the course of a year, and we used a similar methodology to assign workers to a single establishment within the enterprise during the year.

[16] A short spell is defined as a period of employment without an interior month, and thus consists only of a start and end month. Hence, short spells, by definition, are less than 3 months in duration. See Fabling and Maré (2015) for more details about the derivation of the data.

This component of the analysis used data from a variety of sources. For example, we merged 2018 Census data with the worker-jobs data to obtain workers' highest educational attainment. We used data for all worker-job months in 2018 and aggregated these to the annual level for each ANZSIC06 code listed in the Appendix.

Across multiple datasets in the IDI, we observed the following characteristics of workers: gender, ethnicity, age, highest qualification, migrant status[17], and number of jobs held per month. For worker-job characteristics, we used earnings from wages and salaries (from PAYE data), Full-Time Equivalent (FTE)[18], and region. We also distinguished worker-jobs that had at least one starting month during the year ("starts"), at least one ending month during the year ("ends"), and no start or end months during the year ("continuers"). These data provide the basis for the counts and averages per worker-job in the industry per year.

3.2 Downscaling CGE Model Results

We used the results from a global, recursive dynamic CGE model, C-PLAN, as the basis for the analysis in DIM-E. C-PLAN generates an employment index that we used for our analysis with a base year of 2014 and projections through 2050.[19] For these calculations, C-PLAN assumed full employment using a natural unemployment rate of 4.5% for the CCC's draft advice, which is based on the long-term unemployment rate used in the Treasury's Long-Term Fiscal Model. (Piscetik & Bell, 2016) For the final advice, the unemployment rate used in the modelling was 4.25% to align with the Treasury's Fiscal Strategy Model Projections.

The employment index from C-PLAN is based on changes in the total hours of work demanded by each sector. Generally, to estimate the effects on jobs, these hours estimates are converted into full-time equivalent jobs (FTE) using a constant hours-per-FTE conversion factor as described in Hafstead et al. (2018). We had considered a similar estimation strategy using industry-level hours data and industry-level jobs data (to estimate the hours per job). However, hours data are not collected systematically for all industries in New Zealand and are particularly problematic for agricultural industries.[20] Moreover, using a constant hours-per-job measure that is calculated from the jobs data provides the same results as simply applying the employment

[17] This was a binary variable depending on whether the worker had a visa accepted in the MBIE immigration data.
[18] This measure is based on worker's earnings in the month relative to the minimum wage as described in Fabling and Maré (2015).
[19] From the CGE model, the relevant parameter for employment is Employment (f,i,r,t) where *f* represents production factors, *i* represents industries, *r* represents regions (New Zealand or the rest of the world), and *t* represents time (annual). This parameter reports an employment index (EI) for each sector equal to one in the base year (2014) for each sector.
[20] It is possible that changes in hours in an industry will not translate directly to changes in the number of jobs in the industry. For example, during the pandemic, there were anecdotal reports that some employers in New Zealand reduced workers hours or reduced workers earnings rather than laying off or terminating employees. While that may be a feasible strategy in the short run, it is unlikely that it would be a feasible strategy over the longer term. Moreover, these lost earnings are equivalent to some portion of a worker-job. Hence, the reason we use the term 'worker-job equivalent'.

index directly to the jobs data. Hence, we used the simpler approach of applying the employment index directly to the data on jobs rather than using the other more complicated approach which would not have added anything more to the analysis.

Employment indexes were generated for the Current Policy Reference Scenario (CPR) and for each transition pathway for each industry. To define our industries, we used the 38 sectors represented in C-PLAN which were converted to the *2006 Australian and New Zealand Standard Industrial Classification* (ANZSIC06) codes to match Statistics New Zealand business and employment data. The ANZSIC06 codes and the corresponding C-PLAN sectors are shown in the Appendix.

Since the employment index from the CGE model includes changes in labour productivity and since we wanted to isolate the employment changes related to workers, we adjusted the employment index by removing the labour productivity (LP) component using the same growth rate originally used in C-PLAN. For the development of the draft advice, the growth rate used in the modelling was 1.2% annually for all sectors. For the development of the final advice, this was adjusted to 1% to align with general government climate projections and with the Fiscal Strategy Model Projections.

As an example, Figure 1 shows the employment indices for industries in Agriculture, Forestry, and Fishing (A)[21] from C-PLAN which include changes in LP (top panel) and with LP removed (bottom panel). Under the CPR and each TP, we can see that Forestry and Logging (A030) and Forestry Support Services (A051) are expected to grow (both before and after adjusting for LP) between 2022 and 2050. Sheep, Beef Cattle and Grain Farming (A014), on the other hand, is expected to decline between 2022 and 2050 under the CPR as well as under all four transition pathways (both before and after adjusting for LP).

We then estimated annual employment (in terms of worker-job equivalents) for 2014-2050 under the CPR and under each TP by multiplying the LP-adjusted employment indices by the number of worker-jobs in each ANZSIC06 industry in 2014, which were estimated using the linked employer-employee data from Statistics NZ.[22] We used these annual employment numbers to assess the year-over-year changes in worker-job equivalents ("WJEs") under each scenario for each ANZSIC06 industry. From year-to-year, an industry might grow, contract, or stay the same size in terms of WJEs, and this may be different across the different scenarios. If the year-over-year change was positive (i.e., an industry in 2016 has more jobs than in 2015), we

[21] When we discuss a specific ANZSIC06 industry, we also include the corresponding ANZSIC06 code in parentheses.
[22] See Section 3.1 for more detail about the data used.

counted this change as WJEs gained. Conversely, If the year-over-year change was negative (i.e., an industry in 2016 has fewer jobs than in 2015), we counted the change as WJEs lost.

Next, we compared the number of WJEs gained ("gains") and WJEs lost ("losses") under each transition pathway to those gained or lost under the CPR to calculate the net gains, net losses, and overall net change ("net") in each year for each transition pathway:

$$net\ gains_{TPi} = gains_{TPi} - gains_{CPR}$$
$$net\ losses_{TPi} = losses_{TPi} - losses_{CPR}$$
$$net_{TPi} = net\ gains_{TPi} - net\ losses_{TPi}$$

where i indicates the transition pathway.

The net changes were then summed over four time periods that correspond with the budget cycles: 4 years, 9 years, 14 years, and 29 years after the implementation of the policies (2022 is the first year with policy effects). This allowed us to evaluate the cumulative effects of each transition pathway at multiple points in time over the forecast period (2022-2050). While it is possible to evaluate the year-to-year effects given that we have annual data, the annual predictions from the model are likely to be lumpier (i.e., large changes from year-to-year) than the changes would actually be in reality and subject to more error caused by short-term fluctuations. Therefore, examining the cumulative effects is more meaningful than examining the annual changes. (Chen et al., 2016)

We then used these net changes to rank each industry under each transition pathway in terms of net positive changes ($net_{TPi} > 0$) and in terms of net negative changes ($net_{TPi} < 0$) during a given time period. A net positive change indicates that the industry will have more jobs under the transition pathway than under the CPR; however, this does not mean that the industry will grow during the time period. It is possible for an industry to lose jobs over the time period under both the transition pathway and under the CPR – a net positive change for the industry in this case indicates that the industry is expected to lose fewer jobs under the transition pathway than under the CPR. Similarly, a growing industry can have a net negative change which indicates that the industry is growing less under the transition pathway than under the CPR. Moreover, in a given time period, an industry can both grow and contract – the net effect depends on whether the industry ends up with more or less jobs under the transition pathway than under the CPR.

To better understand these changes, we categorise the net effects into four types:

- **Gain-Less Loss (GLL):** these are net positive changes due to fewer jobs lost under the transition pathway than under the CPR;

- **Gain-More Gain (GMG)**: these are net positive changes due to more jobs gained under the transition pathway than under the CPR;
- **Loss-Less Gain (LLG)**: these are net negative changes due to fewer jobs gained under the transition pathway than under the CPR; or
- **Lose-More Loss (LML)**: these are net negative changes due to more jobs lost under the transition pathway than under the CPR.

3.3 Simulation of Worker Characteristics

To better understand the types of workers that are expected to be affected under each transition pathway, we used the net change in worker-jobs for each of the four time periods (4-, 9-, 14-, and 29-years post-implementation) in each ANZSIC06 industry. We used these numbers as the basis for our simulated worker-jobs, with each simulated worker-job flagged as one of the four net effect types as specified at the end of Section 3.2: Gain-Less Loss (GLL); Gain-More Gain (GMG); Loss-Less Gain (LLG); or Loss-More Loss (LML). Next, we used the 2018 percentage of short-spell worker-jobs in each ANZSIC06 industry to simulate whether the worker-job was a short-spell worker-job.

We then separated the simulated data set into short-spell and non-short-spell worker-jobs in order to simulate the characteristics for each worker-job using separate profiles for short-spell and for non-short-spell worker-jobs in each ANZSIC06 industry from the 2018 worker-jobs data.[23] We ran the simulation 1000 times and calculated the sample mean for each characteristic.[24]

For characteristics of workers holding these jobs, we simulated gender, workers' ages, highest qualification, and ethnicity. For characteristics of the jobs themselves, we simulated average annual earnings (in 2018 NZD), region, and whether the worker-job was a continuer[25].

For workers' ages, the simulation was based on the percentage of workers in each age group in each ANZSIC06 industry rather than on the continuous distribution of worker age because using age groups provided a more accurate approximation of the profile of worker-jobs for our industries. For average annual earnings, we used a minimum and maximum value based on the distribution of earnings in each ANZSIC06 industry. This provided a more reasonable approximation of earnings in the simulation.

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[23] A number of industries, especially agricultural industries, use a number of short-spell workers, and the characteristics of worker-jobs are often very different for short-spell and non-short-spell worker-jobs.
[24] We compared the sample means from the simulation (based on the profiles for short-spell and non-short-spell worker-jobs) to the overall profile of all worker-jobs in a sample of industries, and the simulated sample means were close approximations of the overall worker-job profile for the industries.
[25] This was for non-short-spell jobs only since short-spell jobs, by definition, are not continuers.

While we have actual values for the characteristics of workers and jobs in the affected industries, the simulation allows us to go beyond industry classifications to examine the effects of the policies on different groups of workers across New Zealand and in different regions.

4 Results

4.1 Industries with Largest Employment Effects

We ranked the top net positive and top net negative industries using the total net employment change – in terms of the number of WJEs affected – for the time period under each transition pathway. We ranked industries in terms of the number of WJEs rather than in terms of the percentage changes within the industries in order to obtain a sense of the magnitude of the overall employment effects across the economy. If we ranked industries based on the percentage changes, we may find small changes in small industries ranked highly and end up overlooking industries with a larger number of WJEs affected because the change was a small percentage of the industry's employment.[26] However, when presenting the number of WJEs, we also calculated the percentage change that number represents in terms of the total number of WJEs in the industry at the beginning of the period.

The top net positive industries after the first budget period (2022-2025) under TP1 and TP2 are very similar as shown in Table 2, with the employment effects under TP2 (ranging from (25 to 87 WJEs) being about double the size of those under TP1 (ranging from 12 to 44 WJEs). For all of these industries, the net change is less than 1% of the industries' employment at the beginning of the period. Moreover, these industries are primarily in manufacturing.[27]

The top net positive industries under TP3, TP4 and the demonstration path after the first budget period (2022-2025) are also very similar to each other, with these industries primarily in transport and agriculture (shown in Table 2); however, the employment effects under TP4 are much larger (ranging from 101 to 1078 WJEs) than those under TP3 both in terms of the number of worker-job equivalents (ranging from 4 to 33 WJEs) as well as the percentage of the total industry. For example, Road Freight Transport (I461) is expected to have 33 more worker-job equivalents (or 0.34% of the WJEs in the industry at the beginning of the period) under TP3 relative to the CPR, but under TP4 that number is 1078 (3.78%). The largest percentage change in this group of industries is 4.64% in Water Transport Services (I521) under TP4. The

[26] Also, the mapping of the GTAP sectors to the ANZSIC06 sectors will assign the same percentage change to a number of the same sectors, and the point of this research was to analyze how these percentage translate into worker-jobs.
[27] School education is also in the top 10 net positive industries under TP1; however, this is likely due to sheer size of the industry. As can be seen in Table 2, the net change is only a small percentage of the overall size of the industry (0.01%).

employment effects under the demonstration path are closer in magnitude to TP3 than to TP4, ranging from 6 to 62 WJEs. Under the demonstration path, three industries – Fishing (A041), Electricity Distribution (D263), and Forestry/Logging (A030) – ranked in the top 10 that were not in the top 10 under TP3 or TP4.

For agriculture under TP3 and TP4, the model shows net positive effects in the main agricultural sectors such as Sheep, Beef Cattle and Grain Farming – which we will call Sheep/Beef (A014) – but also in related sectors such as Agriculture and Fishing Support Services (A052) and Meat and Meat Product Manufacturing (C111). It is important to note that while Sheep/Beef (A014) is expected to have more employment at the end of the period under TP3 and TP4 compared to the CPR, this does not mean that the industry is expected to grow. In fact, employment losses in the industry are expected to exceed any gains in this period. As can be seen in Figure 3 and Figure 4, Sheep/Beef (A014) is expected to have losses – around 300 WJEs annually – between 2022-2025 under the CPR and under all four transition pathways. Figure 4 shows the differences between the average annual expected losses under TP3 and TP4 relative to the CPR and how this translates to a net positive change (with fewer losses predicted under TP3 and TP4).

On the net negative side, the top industries at the first time period (2022-2025) under TP1 and TP2 are also similar, but less so than for the net positive results. The net negative results are shown in Table 3. Transport industries are ranked at the top of this list under TP1 and TP2 with are largely the same under both pathways (with between 15 and 128 fewer jobs in these industries under TP1 and between 17 and 110 fewer jobs under TP2 compared to the CPR). For both cases, the percentage changes within these industries are less than 1%. The industry with the largest net negative effect in this time period, Road Freight Transport (I461), is expected to have 128 fewer worker-job equivalents under TP1 than under the CPR in 2025 and 110 fewer under TP2 than under the CPR. Some agriculture and agriculture-related industries also end up in the top net negative industries: Sheep/Beef (A014), Meat and Meat Product Manufacturing (C111), Dairy Product Manufacturing (C113), and Agriculture and Fishing Support Services (A052).

TP3, TP4, and the demonstration path share a number of the same top net negative industries for 2022-2025, but again, the alignment is not as close as it is for the top net positive industries. Moreover, the magnitudes of the net negative effects are substantially larger under TP4 (ranging from -96 to -371) than under TP3 (ranging from -6 to -17 WJEs) as was the case for the net positive effects, and the demonstration path magnitudes (ranging from -8 to -31 WJEs) are again closer to TP3 than to TP4. Under TP3, TP4, and the demonstration path, manufacturing industries primarily make up the top 10 net negative industries with Other Machinery and Equipment Manufacturing (C249) ranked first under both TP3 and TP4. However, Meat and Meat Product Manufacturing (C111) ranked first under the demonstration path. Under TP3, Forestry and Logging (A030) is ranked 7th, and a number of the manufacturing industries in the other top 10 net negative industries under TP3 are related to Forestry and Logging.[28] This result is likely due to the assumption of less afforestation under TP3 than was assumed in the draft advice CPR.

Under TP4, however, neither Forestry and Logging (A030) nor its related industries are found in the top 10 net negative industries. In fact, under TP4, these industries are net positive over this time period. Under TP4, the only industry outside of manufacturing in the top 10 was Coal Mining (B060), and while this was ranked tenth under TP4 in terms of the total number of worker-jobs (96), this number represented a much larger percentage of the industry's employment (11.5%) than was the case for the other top 10 industries (which ranged from 0.83% to 2.85%). Moreover, the overall effect on manufacturing could be due to faster reductions by 2030 required under TP4 relative to the other TP scenarios, and so, TP4 requires emissions reductions from some of the hard to abate manufacturing industries. Under the demonstration path, the same was true – Coal Mining (B060) was the only non-manufacturing industry in the top 10, and it had a much larger percentage of its employment affected (about 1% compared to 0.03%-0.26% for the manufacturing industries).

By 2030, the cumulative effects of these polices are largely affecting the same industries regardless of the pathway examined, but with varying degrees. The top-ranked net positive industries are shown in Table 4. These industries are primarily transport- and agriculture-related industries under all four transition pathways. Under TP1 and TP2, the range for these net effects is between 36 and 770 more WJE relative to the CPR. In terms of percentage changes, the range is 0.2% to 2.67%. TP1 and TP2 have the same top 10 industries, just with slightly different ordering. For example, Dairy Cattle Farming (A016) – ranked 8th under TP1 – is ranked 2nd under TP2. Moreover, for those industries with similar rankings under TP1 and TP2, the number of WJE is also similar. Under TP3 and TP4, the top 10 industries vary slightly from those in TP1 and TP2; however, the magnitude of the net effects under TP3 and TP4 (ranging from 72 to 1330 WJE and from 537 to 4646 WJE, respectively) are much more substantial than those seen under TP1 and TP2. For Road Freight Transport (I461) which is ranked first under all four transition pathways, TP1 predicts 770 (2.70%) more WJE compared to the CPR; TP2 predicts 760 (2.67%); TP3 is close to twice that amount with 1,330 WJE (4.66%); and TP4 is about 6 times that of TP1 and TP2 with

[28] These include Other Wood Manufacturing (C149), Printing (C161), and Log Sawmilling and Timber Dressing (C141).

4,646 WJEs (16.29%). As expected, the cumulative numbers are becoming an increasingly larger percentage of industries' employment at the beginning of the period. Under TP4, the percentage change ranges from 0.51% for Cafes, Restaurants and Takeaway Food Services (H451) to 21.57% for Water Transport Support Services (I521).

On the net negative side, we are also seeing more alignment between the top-ranked industries across the four pathways by 2030 with manufacturing industries dominating the rankings as shown in Table 5. Coal Mining (B060) is the main industry outside of manufacturing that is in the top net negative industries across all the pathways (ranging from -69 to -334 WJEs), though it is ranked 12th under TP4. In terms of percentages, Coal Mining (B060) is the largest of the top net negative industries ranging from 8% to 40% depending on the pathway. TP2 has a number of industries outside of manufacturing in the top 10 (e.g., School Education (P802), Supermarket and Grocery Stores (G411)); however, the number of WJE for these industries is large because these industries themselves are large as the percentages show. For example, School Education is ranked 2nd with -116 WJE under TP2 even though this represents only 0.10% of WJEs in the industry at the beginning of the period (2022). As with the net positive changes, TP1 and TP2 have the smallest magnitudes (ranging from -49 to -168), TP4 has the largest magnitudes (ranging from -442 to -1764), and TP3 is in the middle (ranging from -91 to -311) of these.

By 2035, the top net positive industries (shown in Table 6) are many of the same industries as seen in the earlier budget periods, with transport- and agriculture-related industries consistently in the top rankings. Road Freight Transport is still ranked 1st across all four pathways; however, while the cumulative net effect increased substantially under TP1, TP2, and TP3 compared to the previous time period, the net effect actually decreased under TP4 (from 4,646 WJE for 2022-2030 to 4,195 for 2022-2035). Generally speaking, the net effects for the top-ranked industries increased substantially under TP1-TP3 but under TP4 declined or increased by relatively less. Cafes, Restaurants, and Takeaway Food Services (H451) is one top-ranked industry that is not transport- or agriculture-related – it ranked in the top 10 industries across 3 of the 4 pathways (the exception is TP2). However, the net effect is still less than 1% of employment in the industry at the beginning of the period.

On the net negative side (shown in Table 7) for 2022-2035, there is more dispersion in the industries with top 10 rankings across the different pathways than in the previous budget period, but under all four transition pathways, these industries are primarily in manufacturing. Moreover, there is more alignment between these top-ranked industries under TP1 and TP3 than in prior periods. Outside of manufacturing, Coal Mining (B060) and Oil and Gas Extraction

(B070) are in the top 20 industries under all four transition pathways, and they generally have the largest changes in percentage terms. For Coal Mining (B060), the percentage change ranges between 15% and 45%. For Oil and Gas Extraction (B070), the percentage change ranges from 9% to 33%. Once again, some large industries (e.g., School Education (P802), Hospitals (Q840)) are in the top-ranked industries, but the effects generally represent less than 1% of WJEs in the industry. As with the net-positive industries, the net effects under TP4 generally were either smaller than in the previous period (2022-2030) or changed relatively little compared to the changes predicted under TP1-TP3.

By the end of the forecast period (2050), we found some changes in the top-ranked net positive industries as shown in Table 8. While transport industries are still in the top ranks, these are primarily in Air and Space Transport (I490) and other transport-related industries (e.g., Water Transport Support Services (I521), Air Transport Support Services (I522), Other Transport Equipment Manufacturing (C239)). Two consistently highly ranked industries in previous periods – Road Freight Transport (I461) and Road Passenger Transport (I462) – are no longer in the top net positive rankings and are actually net negative for 2022-2050. As shown in Table 9, Road Freight Transport is now ranked first for 2022-2050 for *net negative* industries under TP3 and TP4. For those industries still remaining in the top 10 net positive rankings, we see more substantial increases in the net effects over the previous period under TP1, TP2, and TP3 compared to TP4. For example, in Air and Space Transport (I490), the cumulative net positive effect under TP1 was 967 (10%) in the full forecast period but was 298 (3%) for 2022-2035. Under TP4, however, the equivalent numbers were 2076 (22%) for the full forecast period compared to 1361 (15%) under the previous period. Moreover, the net positive effects in the full forecast period under TP3 and TP4 are similar in magnitude. Under the demonstration path used for the final advice, the top net positive industries are very similar to those found for the pathways used for the draft advice. However, the magnitudes of the net positive effects are larger under the demonstration path (ranging from 850 to 3,225 WJEs) than those found under TP4 (ranging from 547 to 2,076 WJEs), which had the largest magnitudes of the transition pathways used in the draft advice.

To better understand the shift of Road Freight Transport (I461) from the top of the positive rankings in the early periods to the top of the negative rankings over the entire time period (2022-2050), we examined the cumulative gains and losses over the entire time period (shown in Figure 13 and Figure 14). This net negative effect over the full time period is largely driven by losses in the last time period (2036-2050). Figure 14 shows these effects most clearly – while there are losses in the last time period under both the CPR and the transition pathways, the losses under the transition pathways exceed those under the CPR and any offsetting gains in this time period are not substantial enough to counter these effects. The same pattern is true for the demonstration path used for the final advice. These results are most likely driven by early gains from undertaking mitigation efforts to reduce carbon emissions (e.g., uptake of electric vehicles) allowing for production to expand; however, as the marginal cost of reducing emissions increases as emissions are reduced, reducing output and hence employment is likely the most cost-effective option to reduce emissions for this industry in the last period.

For contrast, Figure 17 and Figure 18 show the results for Air and Space Transport (I490) which is consistently ranked in the top net positive industries over all four time periods. The net positive result in this industry is driven by gains under the pathways exceeding gains under their CPRs. This is true for the pathways used for the draft advice (TP1-TP4) and for the demonstration path used for the final advice.

On the net negative side for the full forecast period (2022-2050), manufacturing industries are still most prevalent in the top 10 industries. Coal Mining (B060) is no longer in this list of net negative industries; however, Oil and Gas Extraction (B070) is still on the list and had the largest net effects in percentage terms (ranging from 27% to 58% of the industry's initial employment). Road Freight Transport (I461) and Road Passenger Transport (I462) are in the top net-negative rankings under TP3, TP4, and the demonstration path. Forestry and Logging (A030) ranked 10th under TP3 and 11th under TP4, which was strictly driven by less growth under TP3 and TP4 relative to the CPR. Hence, constrained forestry removals under TP3 and TP4 are predicted to result in costs through lower job growth in forestry and forestry-related industries.

As with the net positive effects, we see more substantial increases in the net effects over the previous period under TP1, TP2, and TP3 compared to TP4 for those industries remaining in the top rankings; however, TP4 still has the largest magnitudes over the entire period. For example, the net effect for Other Machinery and Equipment Manufacturing (C249) was -1,329 (10%) under TP4 over the full forecast period but was -1,524 (12%) for the period 2022-2035, but under TP1, the net effects for this industry over the full forecast period were -606 (5%) compared to -247 (2%) for 2022-2035. Hence, under TP1 the net effects for this industry more than doubled, whereas under TP4, they actually reduced slightly. Moreover, comparing the net effects for these industries across the pathways showed similar magnitudes under TP3 and TP4 over the full period (2022-2050), though the TP4 magnitudes were still larger (ranging from -2,181 to -533 for the top 10). Under the demonstration path used for the final advice, the top 10 net negative industries were similar to those identified with the pathways used for the draft advice; however, two new industries were in the top 10 under the demonstration path: Fruit and

Tree Nut Growing (A013) ranked 6th and Computer and Electronic Equipment Manufacturing (C242) ranked 9th. Oil and Gas Extraction did not rank in the top 10 under the demonstration path – it ranked 17th in terms of the number of WJE, but it did have the largest percentage change (about 70% of the industry's initial employment). Moreover, the magnitudes of the net negative effects were larger under the demonstration path (ranging from -864 to -4,981) compared to those for the transition pathways used for the draft advice.

4.2 Characteristics of Most Affected Industries

To better understand the characteristics of workers and firms in these industries, we used the LBD and IDI data from 2018. First, we examined the distribution of enterprise size in terms of employees in the most affected industries. These are shown in Figure 39 with Agriculture (A) and Coal Mining (B) in the top panel and Manufacturing (C) and Transport (I) in the bottom panel. In agriculture, the vast majority of firms (more than 80%) had less than 20 employees. Sheep/Beef (A014) and Dairy Cattle Farming (A016) had the lowest percentage of firms with 20 or more employees of any of the industries shown. A number of manufacturing and transport industries had more than 80% of enterprises with less than 20 employees. In 2018, a few of these industries had approximately 40% of enterprises with 20 or more employees: Coal Mining (B060), Meat and Meat Product Manufacturing (C111), Log Sawmilling and Timber Dressing (C141), and Air Transport Support Services (I522).

Table 10 shows the 2018 worker-job characteristics from the top net positive industries at the end of 2050, and Table 11 shows the 2018 worker-job characteristics from these top net-negative industries. While these characteristics will change over time especially as the supply of and demand for workers in these sectors change, comparing these characteristics across net positive and net negative industries still provides relevant information about the types of jobs that will be affected under the different transition pathways especially as many of these industries' rankings persist over the four time periods.

For the net positive industries, the worker-jobs in some of these industries had relatively low pay and low FTE levels both in monthly and in annual terms. For example, the average worker-job in Sheep/Beef (A014) paid the equivalent of $23,427 annually with an annual average FTE of 0.21. Moreover, the average worker in Sheep/Beef (A014) had 2.69 jobs in the same month which is by far the highest of any industry shown in Table 10 or Table 11. For comparison, the average worker-job in 2018 across all industries paid the equivalent of around $60,000 annually. For worker-job starts and short-spells in Sheep/Beef (A014), the average worker had more than three jobs and earned less than the equivalent of $15,000 annually from the

Sheep/Beef worker-job ($14,228 for starts and $9,670 for short spells). Continuer worker-jobs in Sheep/Beef (A014) paid the equivalent of $53,573, had an annual average FTE of 0.74, and workers in these jobs averaged 1.11 jobs per month. Worker-jobs in Agriculture and Fishing Support Services (A052) had a similar profile to worker-jobs in Sheep/Beef (A014), though the average worker in Agriculture and Fishing Support Services (A052) had fewer jobs in the same month (1.52) than the average worker in in Sheep/Beef (A014). Worker-jobs in Cafes, Restaurants and Takeaway Food Services (H451) also have a similar profile to worker-jobs in Sheep/Beef (A014) with slightly lower average earnings ($21,446), slightly higher FTE (0.28), and younger workers (28.3 years). Moreover, workers in Cafes, Restaurants and Takeaway Food Services (H451) in 2018 were much younger than workers in the other industries presented in Table 10 or Table 11. Worker-jobs in Accommodation (H440) were also on the lower end of earnings but with higher average earnings ($26,145) and FTE (0.54) than the other industries mentioned thus far.

Compared to the industries with positive effects, worker-jobs in the top net negative industries shown in Table 11 generally had higher average earnings, higher FTE levels, fewer jobs per worker, and older workers in 2018. Amongst these industries, worker-jobs in Oil and Gas Extraction (B070) were notable for their high pay (the average worker-job had annual-equivalent earnings of $211,772 in 2018) and high FTE levels (with an annual average of 0.80 for the average worker-job). Workers in Oil and Gas were also slightly older than the workers in the other industries with an average age of 44.5. Road Passenger Transport (I462) is also notable amongst this group of industries as being the lowest paid, with low FTE levels and substantially older workers, with the average age for each worker-job type greater than 50 years.

4.3 Predicted Changes in Industry Employment over Time, 2022-2050

In this section, we will focus on the changes in industry employment between 2022 and 2050 in a few key sectors. In the model, climate policies are implemented under each transition pathway such that 2022 marks the first year where the effects of the policies will be seen. We break the full time period into four sub-periods. The first three align with the emissions budget cycles (2022-2025, 2026-2030, 2031-2035), and the last period (2036-2050) provides insight into the long-term cumulative effects of the policies. We analyse these changes for the transition pathways used to develop the draft advice and for the demonstration path used for the final advice.

4.3.1 Predicted Changes in Agriculture, Forestry, and Related Industries

For Sheep/Beef (A014), Figure 3 shows the predicted cumulative number of WJE losses (represented by the orange lines), WJE gains (represented by the green lines) for the different pathways (solid lines) compared to their CPRs[29] (dashed lines) at the end of each budget period and at the end of the projection. In Figure 3, WJE losses are predicted to be substantial (between 6,000 and 8,000) regardless of the scenario[30]; however, the transition pathways and the demonstration path all have fewer losses than their CPRs by the end of 2050. These differences largely drive the net positive result (represented by the solid blue line) in the later time periods. Some gains in jobs are expected under the transition pathways, primarily in the latter years, but not under the CPR. These additional gains add to the overall net positive result for this industry. Hence, even though the industry is predicted to decline from 2022 to 2050, it is predicted to decline less under the target pathways than it would have otherwise under the CPR. This is especially true under TP3 and TP4. The demonstration path and its CPR are predicted to have start with similar losses in Sheep/Beef (A014) but then end the period with fewer losses as shown in the last column of Figure 3. Moreover, unlike TP1-TP4, no gains are predicted under the demonstration path, which is likely due to the assumption of no methane technology becoming available between 2022 and 2050. Still, the cumulative net effects for the demonstration pathway at the end of the forecast period are similar to those for TP3 and TP4.

Figure 4 further shows these results broken down into annual average changes during each time period for each pathway compared to its CPR with average annual losses represented by orange bars, average annual gains represented by green bars, and the average annual net effects represented by blue bars. As can be seen in Figure 4, the only negative net effects in Sheep/Beef (A014) are expected in the first budget period (2022-2025) under TP1 and TP2, and while negative, the annual average effect is very close to zero. This result is largely driven by slightly more losses in TP1 and TP2 compared to the CPR in this first budget period. Moreover, Figure 4 clearly shows how the additional gains in Sheep/Beef (A014) in the last period (2036-2050) under the transition pathways add to the net positive effect. From Figure 4, we also see that the demonstration path most closely resembled the pattern for TP3, though with fewer losses especially in the latter three periods and without any of the gains in the last period.

Since this reduction in Sheep/Beef (A014) employment reflects reductions in output in the industry, we would also expect related, downstream industries to be affected as well. Hence, we examined the predicted effects for Meat and Meat Product Manufacturing (C111). Figure 5

[29] The transition pathways are compared to the CPR used for the draft advice and the demonstration path is compared to the CPR used for the final advice as described in Section 2.
[30] In 2014, we estimated approximately 19,000 WJEs in Sheep/Beef (A014).

shows the cumulative effects at the end of each time period after 2022 and is analogous to Figure 3. In Figure 5, the industry is clearly predicted to decline between 2022 and 2050 with the steepness of this decline fairly similar to that for Sheep/Beef (A014); however, the losses in C111 are predicted to be almost twice those seen in Sheep/Beef (A014) with none of the gains seen in Sheep/Beef (A014) under TP1-TP4. Moreover, in C111, the losses under TP1 and TP2 are very close to those under the CPR, much more so than under TP3 and TP4 (both of which are predicted to have fewer losses than the CPR). As in Sheep/Beef (A014), TP3 and TP4 are predicted to have a larger net-positive result for Meat and Meat Product Manufacturing (C111) than TP1 and TP2, and the cumulative net effect under the demonstration path is very similar to that for TP3 and TP4. Figure 6 shows the annual average changes for the transition pathways and demonstration path relative to their CPRs in each budget period (analogous to Figure 4) for Meat and Meat Product Manufacturing (C111). In Figure 6, it becomes clearer that the demonstration path under Meat and Meat Product Manufacturing (C111) is slightly net negative in the first period. Moreover, Figure 6 makes it easier to compare the profile of changes under the demonstration path to those for the transition pathways. In the first two budget periods, the profile of the demonstration path looks most similar to TP1 and TP2 though with fewer losses under the demonstration path. In the latter two periods, the demonstration path profile looks most similar to TP3.

For Dairy Cattle Farming (A016), the predicted cumulative and average annual effects are shown in Figure 7 and Figure 8, respectively. These figures show similar patterns to those seen for Sheep/Beef (A014), though unlike Sheep/Beef (A014), Dairy (A016) is not expected to have any gains under TP1-TP4. Still, under all four transition pathways and the demonstration path, the industry is predicted to end the period with more jobs than under their CPRs; hence, the net positive cumulative effect shown in Figure 7 which is strictly due to fewer losses. Dairy is predicted to lose 5,000-6,000 WJE between 2022 and 2050 under the transition pathways and more than 6,000 WJE under the CPR. Under TP2, TP3, and TP4, the cumulative number of losses ends up about the same, but the timing of the losses is slightly different with most of the net-positive effects under TP2 in the middle two time periods (2026-2030 and 2031-2035) with only a slight difference between TP2 and the CPR in the last period (2036-2050). This can be seen in the net effect for TP2 shown in both figures. Under TP3, the net line in Figure 7 is fairly smooth because the difference between the losses under the CPR and TP3 increases gradually over each time period. TP4 on the other hand is predicted to diverge from the CPR more in the first two time periods than in the last two time periods.

For Dairy Product Manufacturing (C113), a downstream industry for Dairy (A014), the model also predicts a general decline under the CPR and all four transition pathways as shown in Figure 9 and Figure 10. The same is true for the demonstration path and the CPR used for the final advice. By the end of 2050, around 3,000 jobs are predicted to be lost under the transition pathways and the CPR used for the draft advice. The losses are slightly less under the demonstration path and the CPR used for the final advice as shown in the last panel of Figure 9. Under TP4, the industry is also predicted to have some modest gains in the first period with no gains expected under its CPR. Moreover, most of the net positive effect under TP4 is realised in the first time period (2022-2025) as shown in Figure 10. Under TP1 and TP2, the industry is predicted to have more losses than the CPR in the first period (2022-2025); however, these net negative effects are offset in subsequent periods such that the industry is predicted to have more jobs relative to the CPR under TP1 and TP2 at the end of 2050. In fact, the industry is predicted to have more jobs at the end of 2050 under each transition pathway relative to the CPR, with the net positive effect predicted to be larger under TP3 and TP4 than under TP1 and TP2. In other words, this industry is predicted to decline between 2022 and 2050, but this decline would be slightly less under the transition pathways compared to the CPR used for the draft advice. The same is true for the demonstration path used in the final advice, though the net positive effect under the demonstration path is larger than the net positive effects predicted for the transition pathways used in the draft advice.

Forestry and Logging (A030) is predicted to grow between 2022 and 2050 with no cumulative losses under any scenario as shown in Figure 11 and Figure 12. Hence, the net effects for the transition pathways in this industry are strictly driven by differences in gains between the pathways and their CPRs. Under TP1 and TP2, gains are predicted to exceed gains under the CPR by 2050 (resulting in a net-positive effect) with the profiles for TP1 and TP2 looking exactly the same. Under TP3 and TP4, on the other hand, the industry is predicted to grow less than under the CPR between 2022 and 2050. Hence, the net-negative cumulative result at the end of the period for these two pathways. While the cumulative net effect at the end of the forecast period is similar for TP3 and TP4, the profile of the changes under the two pathways is different. For example, jobs gains under TP4 in the first two time periods are in fact greater than under the CPR but then slower growth in the second two time periods results in a net negative effect by 2050. Under TP3, growth is less than growth under the CPR in every time period, and hence the cumulative net effect of TP3 is always negative. The profile of gains under the demonstration path is most similar to the profile of gains under TP4, though far more gains were expected under the CPR used in the final advice compared to those under the CPR used for the draft advice. Hence, despite significantly more gains under the demonstration path compared to TP4, the net effects under the demonstration path and TP4 follow a similar trajectory, and hence, the profile for the net effects for both is also similar, though with a slightly less negative result at the end of the forecast period under the demonstration path.

4.3.2 Predicted Changes in Transport and Related Industries

As discussed in Section 4.1, the transport sector is predicted to see large positive and negative changes between 2022 and 2050. In fact, Road Freight Transport (I461) and Road Passenger Transport (I462) topped the list of most affected industries, positively in the first three periods and negatively in the last period, though the extent to which these industries are affected depends on the time period and on the transition pathway. Figure 13 and Figure 14 show the predicted results for Road Freight Transport (I461) with Figure 13 showing the cumulative effects and Figure 14 showing the annual averages across the four time periods for each transition pathway.[31] In this industry, the results for TP1, TP2, and TP3 are fairly similar, with the exception of more significant losses under TP3 in the last time period, as shown in Figure 14. Gains in all four pathways are also predicted to be substantial and to exceed gains under the CPR. Gains under TP4 are also predicted to be substantially greater than those predicted for the other transition pathways – approximately 7,250 WJE (25%) by the end of 2050. However, losses in the last period under TP4 (predicted to be around 9,000 at the end of 2050) will eliminate these gains. Under the CPR, many of the early gains for this industry (almost 3,600 WJE (13%) by the end of 2050) will also be eliminated by losses in the final period (predicted to be around 2,000), but overall, the industry would gain jobs under the CPR. Hence, the large net negative effect for TP4 at the end of 2050 (approximately 2200 WJE as shown in Table 9) is largely driven by the cumulative losses in the last period. The profile of changes predicted for the demonstration path is similar to those for TP3 and TP4; however, despite the demonstration path having more gains predicted relative to the CPR used for the final advice, the cumulative net effect at the end of the forecast period for the demonstration path is more negative than the net effect predicted for TP3 or TP4 due to substantially more net losses predicted for the demonstration path.

Under TP1 and TP2, Road Freight Transport (I461) is expected to grow (i.e., cumulative gains exceeding cumulative losses between 2022 and 2050); however, the industry is still expected to have fewer jobs under TP1 and TP2 in 2050 than under the draft advice CPR, and hence, the net-negative result at the end of the forecasting period.

[31] The results for Road Passenger Transport (I462) show the same patterns but with smaller magnitudes.

The early gains in this sector are likely explained by the early adoption of electric vehicles and other lower-cost solutions to reduce emissions in the initial time periods, but by the later time periods, these solutions are likely to have exhausted their ability to reduce emissions in the sector leaving reducing output as the best option for further reductions.

Results for the industry Scenic and Sightseeing Transport (I501) also follow a similar pattern to those for Road Freight Transport (I461) as shown in Figure 15 and Figure 16; however, the majority of gains in Scenic and Sightseeing Transport (I501) are in the first two time periods with losses starting in the third period. The magnitude of the gains and losses are also smaller than those predicted for Road Freight Transport (I461).

Not all transport sectors, however, follow these same trajectories. Air and Space Transport (I490) shown in Figure 17 and Figure 18 is primarily predicted to grow over the entire forecasting period and more so under the four transition pathways than under the CPR used for the draft advice.[32] Between 2022 and 2050, the industry is predicted to have substantial gains – approximately 3,000 WJE (33% of initial employment) under the CPR for the draft advice, 4,300 WJE under TP1 and TP2, and more than 5,000 WJE (more than 50%) under TP3 and TP4. The gains predicted under the CPR for the final advice are similar to those predicted for the CPR for the draft advice; however, the gains predicted under the demonstration path are substantially larger than those predicted even for TP3 or TP4.

Some relatively small losses in the industry are also predicted,[33] all of which occur in the first time period. Moreover, the transition pathways are predicted to have fewer losses than the CPR used in the draft advice with TP4 predicted to result in the least number of losses out of the transition pathways. The number of losses predicted under the demonstration path is similar to those predicted for TP4.

Under TP1-TP3, predicted growth in Air and Space Transport (I490) is less than that for the draft advice CPR; however, combined with the predicted losses under TP1-TP3, the net effect at the end of the first period for all three is close to zero, with a slight net negative result under TP1 and TP2 and a slight positive result for TP3. TP4 is the only pathway with a substantial net positive result in first period. TP4 is also predicted to have substantially more net gains in the second time period (2026-203) relative to the other pathways, but it is also then predicted to have fewer net gains in the latter two periods relative to the other transition pathways. TP3, on the other hand, is predicted to grow similarly to TP2 and TP3 in the middle two periods but with substantially more growth. Hence, even though TP3 and TP4 follow different trajectories, the

[32] The predicted changes for Air and Space Transport (I490) are also discussed in section 4.1.
[33] The losses are relatively small compared to the gains.

final net result is approximately 2,000 (20%) more WJE than under the CPR in 2050. Under TP1 and TP2, the net effect is approximately 1,000 (10%) more WJE than under the CPR in 2050. Under the demonstration path the net effect is more than 3,200 WJE (35%). Driven largely by substantial net gains, the overall cumulative net positive effect for this industry is quite large at the end of the period – hence, this industry ranked first under TP1, TP3, TP4, and the demonstration path as shown in Table 8.

Air Transport Support Services (I522) is predicted to follow the same trajectories as Air and Space Transport (I490) but with smaller magnitudes as shown in Figure 19 and Figure 20. Under TP1 and TP2, Air Transport Support Services (I522) is predicted to have close to 250 (10%) more WJE than the CPR in 2050 as shown in Table 8. Under TP3 and TP4, the net effect is about twice that predicted for TP1 and TP2 with between 525 and 550 (21-22%) more WJE than the CPR in 2050. Under the demonstration path, the net effect is 850 (35%) more WJE than the CPR in 2050.

Water Transport Support Services (I521) is another transport industry that generally is ranked in the top net-positive industries (ranging from 3rd to 5th). The predicted results for this industry are shown in Figure 21 and Figure 22. From these figures, we see that under the draft advice CPR, the industry is predicted to lose almost 1,000 WJE (20%) by 2050 with very few gains (which occur exclusively in the first period) to offset these losses. All four transition pathways, however, are predicted to have fewer losses and more gains by the end of 2050 than the draft advice CPR, which leads to a cumulative net positive effect at the end of the forecasting period – approximately 600 (12%) more WJE under TP1 and TP2 and approximately 1,300 (25%) more WJE under TP3 and TP4 compared to the draft advice CPR as shown in Table 8. The net effects predicted under the demonstration path are most similar to those predicted under TP3; however, the overall net positive effect predicted under the demonstration path (2,216) is much larger than that predicted for TP3 (1,256) which is driven primarily by larger net gains.

As can be seen in Figure 21 and Figure 22, most of the growth in Water Transport Support Services (I521) under TP4 occurs in the first two time periods with little additional growth in the latter two time periods. Moreover, while TP4 is predicted to have more gains by 2050 (approximately 1,100) than the other transition pathways, it is also predicted to have more losses (approximately 600) – though fewer losses are predicted under TP4 compared to the draft advice CPR in every time period. Under TP3, the industry is expected to end up with approximately the same number of WJE in 2050 as TP4 but with fewer losses. Under TP1 and TP2, the industry is expected to lose approximately 200 WJE over the forecasting period (between 2022 and 2050), but this is still less than is expected under the draft advice CPR (approximately 850). Hence, all four transition pathways end the forecasting period with a net positive effect.

4.3.3 Predicted Changes in Coal Mining, Oil and Gas Extraction, and Related Industries

As the NZ economy transitions away from fossil fuels, we would expect employment in Coal Mining (B060) and in Oil and Gas Extraction (B070) to decline. In Coal Mining (B060), substantial losses are predicted in the first two time periods with few gains to compensate for these losses; however, gains in the latter two time periods are predicted to largely offset these losses.[34] This is true under the CPR used for the draft advice and all four transition pathways as shown in Figure 23 and Figure 24.

Under the CPR used for the draft advice, cumulative losses are predicted to be around 230 by the end of 2050 (approximately 25% of initial WJE) but occur in the first two time periods with no additional losses in the latter two periods. Cumulative gains by the end of the period under the CPR used for the draft advice are predicted to be 500 WJE, which means that Coal Mining (B060) is predicted to grow over the full forecast period under the draft advice CPR. Given more losses and fewer gains under all the transition pathways relative to the draft advice CPR, the industry is predicted to either grow less (under TP1 and TP2) or decline (under TP3 and TP4).[35] Hence, all four transition pathways are predicted to have fewer WJE at the end of the forecast period compared to the draft advice CPR and hence a net-negative cumulative effect. The gains and losses predicted for this industry under the CPR used for the final advice are fairly similar to the those predicted under the draft advice CPR. However, the losses predicted under the demonstration path are more substantial and the gains much smaller compared to those predicted under the transition pathways used for the draft advice. Hence, the cumulative net negative result at the end of the forecast period for the demonstration path in the final advice is much larger compared to the net effects predicted for the transition pathways in the draft advice.

Overall, the projected changes in Coal Mining (B060) under TP1 and TP2 are very similar. Initially TP1 and TP2 are expected to have slightly fewer annual losses on average than the CPR, resulting in a slight net-positive effect in the first period. However, in the second time period, more losses and slightly fewer gains under TP1 and TP2 compared to the CPR result in a net-

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[34] This is consistent with the predicted changes in output in coal mining, which C-PLAN predicts will increase from 2030 onward as New Zealand exports coal to the Rest of the World (ROW). In the model, several export-earning sectors are constrained, and the balance of trade is fixed. Hence, as imports grow as the economy grows, New Zealand must export more from any unconstrained export sectors. Given that there is a fixed emissions price in the ROW rather than an emissions cap, emissions in the ROW are not constrained.

[35] Over the full forecast period, Coal Mining (B060) is predicted to gain approximately 20 WJE under TP1 and TP2 and to lose about 100 jobs under TP3 and TP4. Compared to the CPR which is predicted to gain approximately 280 WJE in this time period, the pathways will all result in fewer WJE compared to the CPR and, hence, a cumulative net-negative result.

negative effect. In the third period, TP1 and TP2 are also predicted to be net negative but this is largely driven by less growth rather than by more loss. In the fourth period, growth under TP1 and TP2 is predicted to be the same as under the CPR with no losses. Over the entire forecast period, TP1 and TP2 are predicted to have fewer gains and more losses than the CPR, for a net-negative effect of approximately 130 WJE.

TP3 and TP4 have similar net effects (approximately 400 fewer WJE than the CPR) over the entire forecast period; however, the timing of the changes differs between the two. For example, the cumulative net effect under TP3 shows a consistent (almost linear) decline in Figure 23 with differences in the first two periods driven by more losses and the latter two periods primarily driven by fewer gains. TP4, on the other hand, has an almost L-shaped cumulative net effect. This is primarily due to more losses under TP4 that are concentrated in the first two time periods, and a relatively small difference in gains between TP4 and the CPR in the latter two periods. It is of note that the gains under TP4 are similar in profile and in magnitude to those predicted under TP1 and TP2.

Figure 25 and Figure 26 show the predicted changes for Oil and Gas Extraction (B070). These predicted changes are similar to those for Coal Mining (B060) in that the industry is predicted to have substantial losses over the full forecast period with some offsetting gains under all scenarios. The pathways are all predicted to have more losses and fewer gains compared to the CPR; however, unlike Coal Mining (B060), Oil and Gas Extraction (B070) is expected to decline under all the scenarios. Under the CPR, the industry is predicted to lose approximately 200 WJE (20% of initial employment), whereas under the pathways, these losses range from 400 to 500 WJE (40-50%). Overall, TP1 and TP2 are predicted to have about 270 fewer jobs than the CPR by 2050 and around 540 fewer jobs under TP3 and TP4. The predicted gains and losses under the demonstration path are very similar to those predicted under TP4; however, the predicted losses under the CPR used in the final advice are less than those predicted under the CPR used in the draft advice. Hence, the net negative effect for the demonstration at the end of the forecast period is larger than the net effect predicted for TP4.

TP1 and TP2 again are predicted to have similar profiles, and TP3 and TP4 have different profiles but similar net effects at the end of 2050. For example, TP4 has more losses in the first two time periods and fewer in the latter two time periods than TP3. For TP3, average annual losses in the last three periods are predicted to be fairly consistent. Moreover, most of these gains are realised in the first period with no gains in the second period and relatively small gains in the last two periods. For this reason, cumulative gains under TP3 and TP4 are relatively flat compared to those under the CPR, TP1, and TP2 as shown in Figure 25.

One downstream industry of both Coal Mining (B060) and Oil and Gas Extraction (B070) is Petroleum Refining and Petroleum and Coal Product Manufacturing (C170). Figure 27 and Figure 28 show the cumulative and annual average predicted changes, respectively, for Petroleum Refining and Petroleum and Coal Product Manufacturing (C170). Overall, this industry is predicted to decline over the time period (2022-2050) despite small initial growth in the first period. This is true for the CPR and all four transition pathways. Under the CPR, this industry is expected to lose approximately 450 WJE between 2022 and 2050. Under TP1 and TP2, this number is approximately 525 WJE, and under TP3 and TP4, this number is closer to 560 WJE. All of the gains in this industry are expected to occur in in the first period and do little to offset the overall losses in any scenario. Hence, the net effect in this industry for any transition pathway is largely driven by the difference in losses between the transition pathway and the CPR. Once again, TP1 and TP2 are predicted to be the same, and TP3 and TP4 differ in their paths but end up with similar net effects. By the end of the period, TP1 and TP2 are predicted to have approximately 80 fewer jobs than the CPR. For TP3 and TP4, this number is approximately 115 fewer jobs than the CPR. The profile for the demonstration path looks very similar to TP4; however, due to fewer predicted losses under the CPR used for the final advice compared to the CPR used for the draft advice, the cumulative net effect at the end of the forecast period is more negative under the demonstration path. This is similar to the effects predicted for Oil and Gas Extraction (B070).

Another related industry is Other Mining Support Services (B109). The predicted cumulative changes for this industry, as shown in Figure 29, look very similar to those for Coal Mining (shown in Figure 23). This is true both for the transition pathways used in the draft advice as well as for the demonstration path used in the final advice. Overall, more losses and fewer gains are predicted under the transition pathways relative to the CPR used in the draft advice. Under TP1 and TP2, the predicted net effect is approximately 40 fewer jobs than under the CPR at the end of the period, and under TP3 and TP4, the net effect is approximately 110 fewer jobs than under the CPR used for the draft advice. Under the demonstration path, the net effect is closer to 200 fewer jobs than under the CPR used for the final advice.

Electricity Generation (D261) and other utilities could also be negatively impacted by the move away from fossil fuels or positively impacted by the increased need for renewable electricity as transport and process heat are electrified. While the industry classification Electricity Generation (D261) includes Fossil Fuel Electricity Generation, Hydro-electricity Generation, and Other Electricity Generation, we only have results for the overall category. Still, we would expect jobs within this category to move out of Fossil Fuel Electricity Generation and towards other types of electricity generation.

The model predicts initial losses (approximately 260 WJE) with minimal growth in the first period for Electricity Generation (D261) under the CPR and also under all four transition pathways. These initial losses are likely due to the assumption in both the draft advice CPR and the TPs that the New Zealand Aluminium Smelter at Tiwai Point closes between 2024 and 2026, which is expected to affect demand for electricity. In the last three periods, however, gains generally exceed losses under the CPR and all the transition pathways. The only exception is under TP4 in the second period where losses and gains are similar in magnitude. Moreover, by the end of 2050, cumulative gains and losses largely balance out under all the scenarios (the CPR and TP1-TP4) such that the cumulative net effects for all four transition pathways are very close to zero with TP1 and TP2 ending the forecasting period with about five more WJE than the CPR and TP3 and TP4 ending up with approximately 30 fewer WJE than the CPR. For the final advice, the predicted job losses under the demonstration path and its CPR are substantially larger than those predicted in the draft advice; however, the net losses in each scenario are very similar. Hence, the cumulative net effect predicted for the demonstration path is not substantially larger than those predicted for the transition pathways in the draft advice. Moreover, much of the negative net effect is driven by less growth under the demonstration path relative to its CPR than was predicted for the transition pathways relative to the draft advice CPR. The predicted effects for this industry are shown in Figure 31 (cumulative effects) and Figure 32 (annual average).

For Electricity Distribution (D263) and On Selling Electricity and Electricity Market Operation (D264), the cumulative and annual average effects for both industries look very similar to each other as shown in Figure 33, Figure 34, Figure 35, and Figure 36. Moreover, the profile of the cumulative net effects for these two industries are very similar to those seen in Figure 31 for Electricity Generation (D261) with a slightly positive net effect under TP1 and TP2 for both D263 and D264 and a slightly net-negative effect under TP3 and TP4 – with the net effect predicted to be less than 10 WJE in either direction by 2050. The main difference between the cumulative net effects under Electricity Distribution (D263) and On Selling Electricity and Electricity Market Operation (D264) compared to Electricity Generation (D261) is that the gains predicted for D263 and D264 start later under the transition pathways (i.e., in the last period for TP1-TP3 and the third period in TP4). Under the demonstration path, Electricity Distribution (D263) and On Selling Electricity and Electricity Market Operation (D264) also have very similar profiles to each other, and as with Electricity Generation (D261), we see much larger expected losses both for the demonstration path and its CPR compared to those predicted for the transition pathways and the CPR used in the draft advice. Even so, the cumulative net effect at the end of the forecast period in both D263 and D264 is very similar to the net effect predicted under TP4.

Gas Supply (D270) is another downstream utility that is expected to be affected by the move away from fossil fuels, and the predicted cumulative effects for this industry (shown in Figure 37) is most similar in profile to Oil and Gas Extraction (shown in Figure 25) though with fewer predicted gains especially in the latter periods under the CPR used for the draft advice. Gas Supply (D270) is predicted to primarily have losses between 2022 and 2050 with few offsetting gains, and generally speaking, more losses are predicted under the transition pathways than under the CPR. At the end of the period, losses in this industry under the CPR are predicted to be around 120 WJE, under TP1 and TP2 about 270 WJE, and under TP3 and TP4 approximately 480 losses are predicted. Under TP4, losses are concentrated under the first two periods, whereas under the other transition pathways, losses are spread more evenly across the four periods. For the final advice, the demonstration path and its CPR are predicted to have more gains than those seen for the transition pathways and used in the draft advice; however, the demonstration path is also predicted to have more losses than TP3 or TP4 which were predicted to have the much larger cumulative losses than TP1 or TP2. Hence, the net negative effect predicted under the demonstration pathway is larger than that predicted for TP3 or TP4.

4.4 Simulated Characteristics of Workers in Affected Worker-Jobs

Using the net number of worker-job equivalents (WJE) in each industry, we simulate the characteristics of the job and the workers that fill these jobs using the overall characteristics from each industry in 2018. We then use the simulated worker-job characteristics to see which types of jobs and workers are expected to be most affected. To do this, we estimated the total number of worker-jobs affected either in a positive or negative way under the pathway and then estimate the percentage of worker-jobs in each group from the total number affected. For example, if 100 women are in worker-jobs expected to be negatively affected under a given transition pathway and 100 men are in worker-jobs expected to be positively affected, then the total number of affected worker-jobs is 200 and the percentage of worker-jobs affected for women would be -50% (negative to represent the negative direction) and 50% for men (positive to represent the positive direction).

We further classify the worker-job types based on the type of net effect the worker-job represents as outlined in Section 3.1: gain due to more gains in the transition pathway compared to the CPR (Gain-More Gain), gain due to fewer losses in the transition pathway compared to the CPR (Gain-Less Loss), loss due to fewer gains in the transition pathway compared to the CPR (Loss-Less Gain), or loss due to more losses under the transition pathway compared to the CPR (Loss-More Loss). This allows us to understand more than just which groups gain or lose WJE under each transition pathway but also what type of gain or loss is expected because different types of changes may require different policy solutions. It is also important to note that worker-jobs are not necessarily the same across industries in terms of earnings or average FTE. Hence, when aggregating across groups, it is important to note that we are netting in terms of number of jobs but not on any other dimensions, and hence, when we refer to groups being positively or negatively affected, we mean in terms of the number of worker-jobs.

4.4.1 Results based on Job Characteristics

Using this framework, we assess the results for worker-jobs by 1-digit ANZSIC06 industries. After the end of the first budget period, Manufacturing (C), Transport (I), and Agriculture (A) have the largest proportion of worker-jobs predicted to be affected as shown in Figure 40. Industries in these sectors were identified in the top-ranked industries as discussed in Section 4.1; however, the results in this section include all affected worker-jobs in all industries and not just those in the industries with the largest effects.

In Figure 40, the different pathways are predicted to have different results for these three industries at the end of the first period. Under TP1 and TP2, all three of these industries have opposite effects compared to those predicted under TP3 and TP4. For example, Transport (I) and Agriculture (A) are predicted to have net-negative effects under TP1 and TP2 and net-positive effects under TP3 and TP4 at the end of the first period. Manufacturing goes the opposite direction – a positive net effect under TP1 and TP2 and a negative net effect under TP3 and TP4.

By the end of the third period (2035), however, the predicted cumulative net effects in these industries are all in the same direction (results shown in Figure 41). Transport (I) and Agriculture (A) are both predicted to have net-positive cumulative effects, and Manufacturing (C) is predicted to have net-negative cumulative effects. With 25-40% of the affected WJE, Transport (I) has the largest share of the affected WJE.

By the end of the forecasting period (2050), Transport (I) still has a cumulative net-positive effect under all four pathways, but the magnitude is more in line with the shares of the other industries (results shown in Figure 42). This is likely due to the net-negative effects predicted in some of the transport industries (e.g., Road Freight Transport, Road Passenger Transport) in the last period. Manufacturing (C) is predicted to have the largest share of affected WJE (20-30%) under all four transition pathways, and the direction is negative. Agriculture (A) is predicted to have the largest share of WJE on the net-positive side under all four transition pathways. Moreover, by 2050, only Mining (B), Manufacturing (C), and Electricity, Gas, Water and Waste Services (D) are predicted to have a cumulative net negative effect. This is true across all four transition pathways.

We also used 2018 earnings information to simulate the average pay of workers from these jobs. While earnings will vary over the forecast period to account for inflation and changes in supply and demand, these estimates do not account for those changes. However, this analysis still provides an indication of the relative earnings across different net effect types as those are less likely to change especially in the short and medium term. From this analysis, the model predicts similar average annual earnings across the four net effect types under all four transition pathways, with the exception of Loss-More Loss under TP4. These results are shown in Figure 43. This is likely due to the loss of worker-jobs with above average pay in industries like Oil and Gas Extraction (B070) and in some of the manufacturing sectors. The average annual earnings for worker-jobs in this category by 2050, however, are more in line with the average earnings for worker-jobs in the other categories as shown in Figure 44. In this figure, the average earnings for worker-jobs categorised as Gain-Less Loss are the lowest of any of the net effect types. Moreover, average earnings in the two loss categories are slightly higher than the average earnings in the two gain categories under all four transition pathways at the end of 2050. This indicates that the worker-jobs reducing the number of jobs in the transition pathways relative to the CPR are expected to have slightly higher pay, on average, than the worker-jobs that are increasing the number of jobs in the transition pathways. However, more worker-jobs are expected at the end of the forecast period in the gain categories than in the loss categories as shown in Figure 45.

When we aggregated the net effects for WJEs simulated to have a short employment spell (short spells) and for those not having a short spell (not short spells), we find that the combined net effects at the end of the first time period (2022-2025) vary greatly depending on the transition pathway (shown in the left panel of Figure 46). For example, under TP1 and TP2 over this time period, both groups are negatively affected compared to the CPR with 29% of the net effects allocated to short spells under TP1 and 24% under TP2. Given that short spells are 16% of all worker-jobs, the model predicts that the short-spell worker-jobs are expected to be disproportionately affected. Under TP3 during the same time period, short-spell worker-jobs are expected to be positively affected, with their share of the net effects expected to be 95% of all affected worker-jobs. Under TP4, both groups are positively affected with short-spell workers gaining about 35% of the overall positive effect. At the end of the forecast period, both groups are predicted to be positively affected under all four transition pathways compared to the CPR as shown in the right panel of Figure 46, with a similar share for short-spell worker-jobs under TP1, TP3, and TP4 – approximately 1/3 for short spells. However, since short-spell worker-jobs are only 16% of all worker-jobs, these jobs are overrepresented in the net gains. Under TP2, short-spell worker-jobs are predicted to receive an even larger share (almost 60%) of the net gains than not-short-spell worker-jobs.

4.4.2 Results based on Worker Characteristics

Using a similar breakdown for men and women, we find that the net shares vary dramatically at the end of the first period as shown in the left panel of Figure 47. TP2 and TP3 are predicted to primarily affect female workers (negatively under TP2 and positively under TP3), whereas TP1 and TP4 primarily affect male workers (negatively under TP1 and positively under TP4). Since slightly more than 50% of worker-jobs were filled by women in 2018, all of these affects are disproportionate to the relative shares of male and female workers.

By the end of the forecast period, however, both men and women are predicted to have a net gain under all four transition pathways compared to the CPR, with women predicted to gain disproportionately more of the net effects particularly under TP3 and TP4 (85% and 87%). This is likely due to higher representation of women in worker-jobs in the Gain-More Gain category relative to the other categories at the end of the forecast period (around 60%). However, women's share of the worker-jobs in the net effects in each of the four categories is generally less than their share of all worker-jobs, which indicates that the industries most affected under the transition pathways tend to employ more men.

We also examined net effects by highest qualification. The categories were None, Secondary, Post-Secondary, Bachelor, Post-Graduate. These results are shown in Figure 48. After the first time period (shown in the left panel), we see that the results vary depending on the transition pathway and that all groups can be positively or negatively affected. Under TP2, all groups are negatively affected compared to the CPR which indicates that the reallocation of employment in the short-term under this pathway may be difficult. One consistent result in the first time period is that workers with secondary qualifications are generally predicted to have the largest share of affected jobs, but since these workers held the largest share (41%) of all worker-jobs in 2018, their share of the net effects is generally proportionate. Workers with no qualifications, on the other hand, held 12% of jobs in 2018 but their share of the net effects range from 15% to almost 40% in absolute terms (with negative net effects under TP1 and TP2 and positive net effects under TP3 and TP4). Workers with post-graduate degrees are predicted to be negatively affected over the first period under 3 of the 4 pathways (i.e., TP2, TP3 and TP4).

At the end of the forecast period, however, all groups are generally better off under all four transition pathways relative to the CPR with the exception of workers with post-graduate degrees under TP2. Workers with no qualifications are underrepresented in these gains under TP3 and TP4.

Aggregating the simulated worker-jobs by ethnicity indicates that most groups would be negatively affected under TP1 and TP2 over the first time period, whereas they would be positively affected under TP3 and TP4. These results are shown in Figure 49 (left panel). Approximately 16% of worker-jobs were held by Māori workers in 2018; however, 30-60% of the affected worker-jobs (either positively or negatively) are predicted to be held by Māori workers. Hence, Māori are predicted to be disproportionately represented in the share of worker-jobs affected under all four transition pathways in the initial period. Asian and European workers are generally underrepresented in their share of affected worker-jobs relative to their share of all worker-jobs (17% and 55% respectively) in the initial period. At the end of the forecast period, all groups are expected to gain under all four transition pathways with shares closer to their shares of all worker-jobs as shown in Figure 49 (right panel). Under TP1 and TP2, Māori workers are predicted to be overrepresented in the net effects with most of the other groups underrepresented.

To better understand these effects, we examine the share of each ethnicity group within each of the net effect types as shown in Figure 50. Overall, the shares of the net effects at the end of the first period (shown in the left panel) are fairly close to the overall shares of 2018 worker-jobs in each of the groups. There are some exceptions. Asians tend to be underrepresented in the Loss-More Loss category in the first period. Māori workers, on the other hand, tend to be overrepresented in many of the groups, though under TP4, Māori workers are underrepresented in both loss categories and overrepresented in both gains categories at the end of the first period. Pacific workers generally have a proportionate share of the worker-jobs in each of the categories in the first period; however, under TP4, they are also underrepresented in the Loss-More Loss category (2% of the worker-jobs in this category and 7% of worker-jobs in 2018). With Māori and Pacific workers underrepresented in the Loss-More Loss category under TP4 in the first period, workers of European ethnicity are overrepresented in this category (71% of the worker-jobs in this category and 55% of worker-jobs).

Over the full forecast period, the net effect shares of each ethnicity group are even more similar to their share of 2018 worker-jobs even under TP4. The main exception here is Māori. Under each pathway, overrepresented in the Gain-Less Loss worker-jobs (25-27% of the worker-jobs in this category and 16% of worker-jobs in 2018). Māori also have a slightly disproportionate share (20%) of worker-jobs in the Loss-More Loss.

The simulated results were also aggregated by age group as shown in Figure 51. Again, results after the initial period vary but workers in all age groups are predicted to be negatively affected under TP1 and TP2 but most groups are predicted to be positively affected under TP3 and TP4 (shown in left panel of Figure 51) relative to the CPR. Generally speaking, workers in the oldest age group tend to be overrepresented in the net effects (with shares ranging between 10% and 15%, negatively in TP1 and TP2 and positively in TP3 and TP4) under all pathways at the end of the first period as their share of all worker-jobs in 2018 was 4%. At the end of the forecast period (right panel of Figure 51), workers in most age groups are predicted to be positively affected under all four transition pathways. The exception is workers aged 50-64 under TP2 – these workers are negatively affected, but their share of all affected jobs is small. One result to note is that younger workers are predicted to have the largest shares (generally disproportionately so) under the transition pathways relative to the CPR over the full forecast period. Older workers, on the other hand, receive a disproportionately smaller share. Workers in these older age groups are generally overrepresented in the Loss-More Loss worker-jobs relative to their share of all worker-jobs. For example, workers in the oldest age group (65+) are predicted to hold 10% of worker-jobs in the Loss-More Loss category but held 4% of all worker-jobs in 2018. Similarly, workers in the 60-64 age group are predicted to hold 9% of Loss-More Loss worker-jobs but held only 5% of all worker-jobs in 2018.

4.4.3 Results for Regional Effects

The same analysis is run to better understand the expected regional effects. These results are shown in Figure 52. Over the course of the initial period (2022-2025), most regions are negatively affected under TP1 and TP2 and positively affected under TP3 and TP4. It is notable that the net effects for Auckland are small (with the largest share around 15% under TP2) given 35% of all worker-jobs (the largest share of all regions) were located there in 2018. At the end of the forecast period, most regions are expected to have net gains under all transition pathways relative to the CPR. However, Taranaki and the West Coast are predicted to be negatively affected under all four pathways. While Tasman is predicted to have a small net negative effect under TP3 and TP4, the region is overrepresented[36] in the net positive effects under TP1 and TP2. Moreover, Auckland is predicted to have the largest share of net positive effects under TP1,

[36] Tasman has a relatively small share of all worker-jobs (1 %),

TP3, and TP4, but it also had the largest share of all worker-jobs (35%) and is actually underrepresented in the net shares.

To better understand the regional results, we also examined the regional shares in the more detailed net effects categories (shown in Figure 53) at the end of the initial period (left panel) and at the end of forecasting period (shown in the right panel). At the end of the initial forecast, the regional shares under TP4 in the Loss-More Loss category stand out. Waikato, Taranaki, Wellington, West Coast and Southland all have substantially larger shares of worker-jobs in this category compared to their overall shares of 2018 worker-jobs.

At the end of the full forecast period, these differences are not as stark. In general, Taranaki, with only 2% of the worker-jobs in 2018, is still predicted to have a disproportionate share (6-7%) of worker-jobs in the Loss-More Loss category under all the pathways. In the other categories, Taranaki's share is predicted to be 2-4%. The West Coast, with 1% of all worker-jobs in 2018, is also generally overrepresented in the Loss-More Loss category at the end of the forecast period with 2% of worker-jobs in this category predicted to be in the West Coast under TP1, TP2, and TP4. Marlborough (approximately 1% of worker-jobs in 2018) generally gains under the transition pathways by the end of the forecast period, and it is generally overrepresented in the Gain-Less Loss category with 3-4% of worker-jobs. Auckland on the other hand is generally underrepresented in the Loss-More Loss and the Gain-Less Loss categories which indicates that the net effects in Auckland over the forecast period are disproportionately driven by industries that are growing rather than industries that are declining.

In Figure 54, we also mapped the net effects under TP4 by region for the initial period (left panel) and for the full forecast period (right panel) with lighter colours representing smaller values and darker colours representing larger values. These maps show Taranaki transitioning from a slightly positive effect in the first period to the region with the largest negative effect in the full forecast period. We also see Wellington shifting from slightly net negative to a stronger net positive result. Overall, the North Island seems to change the most substantially with darker regions like Northland, Waikato, Taranaki, and the Bay of Plenty becoming lighter (indicating relative reduction in their regional rankings) and lighter regions like Auckland and Wellington becoming darker (indicating relative improvement in their regional rankings).

5 Discussion

Generally, our results are similar to those found in previous research. The net effect of the pathways is predicted to be relatively small, especially annualised over the full forecast period; however, some industries are predicted to be disproportionately affected, some positively and some negatively under the four pathways. Moreover, the industries predicted to have the most negative net effects are similar to those found in other research: coal mining, oil and gas extraction, and manufacturing. Our results also indicate early negative effects in some agricultural sectors under TP1 and TP2. Even in the most affected industries, however, the net effects were predicted to be relatively small in scale.

We also found that the effects seen in the most affected industries were often reflected in other related industries as well, though often not to the same extent. For example, the employment effects predicted for Sheep/Beef (A014) were similar to those for Meat and Meat Product Manufacturing (C111), and employment effects predicted for Dairy Cattle Farming (A016) were similar to those predicted for Dairy Product Manufacturing. For Coal Mining (B060) and Oil and Gas Extraction (B070), employment effects in these industries were also reflected in other downstream industries including Petroleum Refining and Petroleum and Coal Product Manufacturing (C170) and Other Mining Support Services (B109). Electricity Distribution (D263) and On Selling Electricity and Electricity Market Operation (D264) also had similar profiles to those seen for Electricity Generation (D261). To some extent, this is to be expected as the C-PLAN model is designed to incorporate interactions between industries, and this is then flowing through to DIM-E. However, these results indicate the close relationships between these industries and the resultant spill over effects from changes in one industry to changes in the others. It should be also noted that some industries are predicted to decline and some industries are predicted to grow without any policy changes. The strength of this type of analysis is the ability to differentiate the changes that are expected to occur without the policies from those that are expected to occur due to the policies.

The four different transition pathways initially considered by the Climate Change Commission are predicted to have very different effects over the course of the forecasting period (2022-2050). Generally speaking, TP3 and TP4 are predicted to produce larger reallocation effects compared to TP1 and TP2. This is due to TP3 and TP4 requiring more effort to reduce gross emissions as they assume less afforestation. TP3 and TP4 also generally tend to produce similar net effects within industries but can have very different trajectories in getting to those end results. This is because the actions taken to reduce emissions within TP3 and TP4 are similar, but TP4 has faster emissions reductions before 2030 than TP3. Within industries, we found that TP1 and TP2 are also predicted to produce very similar results; however, unlike TP3 and TP4, they tend to follow similar trajectories.

Despite the similarities that we see within industries across these different pathways, we did not find the same to be true when we aggregated results for worker-jobs across different groups. In these analyses, we tended to find very different results under the transition pathways for different groups, especially over the course of the initial period. This was less true over the full forecast period where the transition pathways tended to produce positive net effects for most groups. This indicates that over the full time period (2022-2050) negative effects within groups were generally offset by positive effects within the same groups though not necessarily within the same time periods. The main exception to this was in the regional breakdowns where some regions had a negative net result over the full forecasting period – Taranaki and the West Coast were the only two regions predicted to have fewer jobs at the end of the period under all four transition pathways compared to the CPR.

These results are largely based on models that predict employment into the future using a variety of different assumptions, and while there are some events that cannot be foreseen or assumed (e.g., new technologies, recessions), these events will generally only change the net effects to the extent that they differentially affect the CPR relative to the transition pathways. Hence, these events may have less of an effect on the industry-level net effects and more of an effect at the worker-job level. For example, if a new technology arises in Air and Space Transport that eliminates 50% of worker-jobs and this industry is a main area of growth for workers with advanced degrees, we might find that workers with advanced degrees have a harder time balancing their net losses under the transition pathways without the expected gains in this industry.

One assumption used in this modelling is the full employment assumption that is used in C-PLAN when deriving the employment indices. This assumption causes the C-PLAN model to rebalance employment losses in declining industries with employment gains in growing industries to achieve full employment within the economy (assuming some fixed rate of growth). Other CGE models used internationally also use this assumption for their analyses, and generally given the length of time analysed using these models, this is a reasonable assumption as the labour market adjusts. Hence, this is one reason that we do not focus on annual changes but look at the cumulative effects over longer time periods. It is also important to note that in DIM-E we use a different source of data for our employment numbers, and we do not rebalance the employment estimates in DIM-E because we found that the overall differences between losses and gains under each scenario is fairly small especially relative to the size of the total number of worker-jobs.

Moreover, other research comparing the results from a full employment CGE model to a CGE model with more labour market dynamics (a search-CGE model) found that the full employment model overestimated the net effects in terms of the aggregate number of employed workers (using full-time equivalents) and that the industry-level results, including the rankings of industries based on net effects, were fairly similar. (Hafstead et al., 2018) Hence, our estimates of the overall net effects may be an overestimate, but the results in Hafstead et al. (2018) indicate that the relatively small net effects predicted by the model may be even smaller.

Another implicit assumption in DIM-E is that the characteristics of workers from 2018 will hold over the forecast period. While we expect the composition of the workforce to change, however, estimating these changes would require more assumptions about the ways in which we expect the workforce to change. Moreover, because we focus on differential changes, these changes to the composition would have to change the relative differences between industries that are negatively impacted and those that are positively impacted. The most likely scenario for this to occur is in the aging of the workforce which could bring workers with higher qualifications into the workforce given higher qualification levels of the younger generation. However, it is less likely that these effects will affect our short- and medium-term results given the time it takes for these changes to manifest.

The DIM-E also used the characteristics for the average short-spell and not-short-spell worker-job in the simulation of worker-job characteristics, but some types of workers may be more likely to enter and exit these industries especially in industries where large changes are expected. However, this would again require more assumptions about how these changes might occur across different industries. Without more research, modelling these transitions would be difficult.

In DIM-E, the focus is on employees, and it does not include working proprietors. However, because the net effects analysis focuses on the differences between the CPR and the transition pathways and on the differences across the different transition pathways, the results are expected to be similar. Again, the area that might be most impacted by the inclusion of working proprietors is in the examination of the effects on different groups of workers, yet this is only true if their characteristics differ dramatically across industries that are positively affected compared to those in industries that are negatively affected. Plus, the dynamics for working proprietors may be more affected by firm entry and exit which would require additional assumptions to the model.

It is also important to note that the numbers presented in these results are to provide scale to the predicted effects and to allow for relative comparisons across different scenarios, time periods, and groups. The best use of these results is to understand which industries, regions and workers are likely to be most affected by the changes and the expected direction these effects are likely to take in different time periods in order to prepare for the future. For example, Road Freight Transport and Road Passenger Transport are expected to grow between now and 2035 under the CPR, and substantially more under each of the four transition pathways, but then much of that growth is predicted to be lost by 2050. Knowing this, policymakers can find policy solutions to ease this transition for workers when the time comes. Alternatively, policymakers could assess what is limiting growth and see if there are feasible policy solutions to overcome these limitations.

Still, without workers with the right skills, predicted growth could be limited, so it is important to ensure that workers will have the rights skills to fill these jobs and that the jobs meet the needs of workers. If growth is in jobs that are low pay and low FTE with intermittent work, firms may also have trouble filling these jobs if workers want higher pay and more consistent schedules. As shown by other research, frictions that limit workers ability to transition plays a significant role in the short-term effects on workers, so reducing these frictions is important to reducing the negative effects of these policies. (Castellanos & Heutel, 2019; Hafstead et al., 2018) These results have flagged some potential issues with worker-jobs in some of the industries expected to grow, but further work needs to be done to better understand the skills required in areas of growth.

Moreover, while this work can be used to identify areas of potential growth and decline across industries, changes to the jobs within industries driven by these policies may be more difficult to identify. For example, changes in the industry Electricity Generation (D261) away from fossil fuels to renewable energy may require different types in workers and in different quantities. However, the results in this paper combine all types of electricity generation into one industry, and while we might assume that losses are related to electricity generation using fossil fuels and gains are in renewable energy areas, the current models are unable to separate these. Similarly, if reduced emissions in these scenarios are driven by a move to electric vehicles, mechanics for electric vehicles may require different skills than mechanics for other types of vehicles. Fewer mechanics may also be required if electric vehicles require less maintenance. Currently, DIM-E is silent on these types of effects because the main objective of the analysis was to better understand the shifts in employment across industries. Assessing these types of within-industry changes in skill requirements or in labour productivity may be better addressed using sector-specific analyses.

6 Conclusion

Using DIM-E, we assessed the potential distributional impacts on employment using pathways designed to deliver on New Zealand's targets to reduce biogenic methane emissions by at least

10% by 2030 and by 24-47% by 2050 relative to 2017, and to reduce emissions of all other greenhouse gases to net zero by 2050. These pathways allowed us to examine which industries and workers are most likely to be affected by different mitigation actions that could be taken to meet New Zealand's emissions budgets under varying assumptions.

Overall, we find that the net employment effects estimated in this analysis are predicted to be relatively small, though in percentage terms, some industries will be more affected than others especially in the short- and medium-term. Previous research in this area has found similar results. (Hafstead & Williams III, 2020) Moreover, we found the industry rankings were fairly consistent across the four time periods and across the different pathways that we analysed. On the net positive side, transport industries tended to dominate the industry rankings, and in later periods, some agriculture industries also tended to rank highly (e.g., Dairy Cattle Farming and Sheep/Beef Farming). On the net negative side, various manufacturing industries tended to dominate the top ranks, though oil and gas extraction was also consistently ranked.

Using our simulation model, we also found that very few groups were negatively affected (in terms of the number of worker-jobs) by any of the pathways especially over the long term. Of course, there were exceptions. For example, workers in three sectors – Mining; Manufacturing; and Electricity, Gas, Water and Waste Services – were predicted to be negatively affected over the forecast period but Manufacturing more so than the other two industries which reflected our results from the top-ranked industries. Workers in Taranaki and the West Coast were also predicted to be negatively affected by the end of the period; however, this is largely due to the concentration of negatively affected industries located in these regions. Given that the negative employment effects will likely outweigh the positive employment effects in these regions, workers in these regions may have reduced mobility and more difficulty during the transition.

It is important to note that these results are produced using models and that these models are designed to provide insights into the effects of changing actions and changing assumptions on our outcomes, but they are not designed to exactly predict the future. Hence, these results should be interpreted carefully, drawing on the scenario details and the outputs from the C-PLAN model.

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7 Tables

Table 1. Key Assumptions of Scenarios used in Draft and Final Advice

	Scenario	Forestry	Methane technology	Long-lived gases	Biogenic methane
DRAFT ADVICE	**Current Policy Reference (CPR)**	Projections from Ministry of Primary Industries	None	Business as usual	Business as usual (from 2026)
	Transition Pathway 1 (TP1): More removals	CPR exotic forestry (with additional native forests)	Low effectiveness and uptake only	Straight line path for gross emissions to net-zero in 2050	24% reduction in 2050
	Transition Pathway 2 (TP2): Methane technology	CPR exotic forestry (with additional native forests)	Higher effectiveness and uptake (vaccine)	Straight line path for gross emissions to net-zero in 2050	47% reduction in 2050
	Transition Pathway 3: (TP3) Less removals	About 2/3 of CPR exotic forestry (with additional native forests as in TP1)	Low effectiveness and uptake only	Straight line path for gross emissions to net-zero in 2050, accounting for forestry removals	24% reduction in 2050
	Transition Pathway 4 (TP4): Faster reductions	About 2/3 of CPR exotic forestry (with additional native forests as in TP1)	Low effectiveness and uptake only	36% reduction in gross emissions in 2030, net-zero in 2050	24% reduction in 2050
FINAL ADVICE	**Demonstration Path**	Annual average of 25,000 ha of exotic forestry in BP1 and BP2 and ramp down in BP3 (with additional native forests in BP1 and BP2; establish 25,000 ha annually in BP3)*	No methane technology, but improved agricultural emissions efficiency	Net zero in 2040*	24-47% reduction in 2050*

* As in ENZ demonstration path.

Table 2. Industries with Largest Net Positive Employment Changes, 2022-2025

		Draft Advice												**Final Advice**		
		TP1 Net Positive			**TP2 Net Positive**			**TP3 Net Positive**			**TP4 Net Positive**			**Demo Path Net Positive**		
			Worker-Job Equivalents			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**	
	Industry	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**
C249	Other Machinery and Equipment Manufacturing	**1**	**44**	**0.34%**	**1**	**87**	**0.67%**									
C251	Furniture Manufacturing	2	22	0.34%	3	44	0.67%									
C246	Specialised Machinery and Equipment Manufacturing	3	20	0.34%	4	39	0.67%									
C241	Professional and Scientific Equipment Manufacturing	4	16	0.34%	5	32	0.67%									
C133	Textile Product Manufacturing	5	15	0.34%	6	30	0.67%									
C242	Computer and Electronic Equipment Manufacturing	6	15	0.34%	7	30	0.67%									
P802	School Education	7	14	0.01%				29	1	0.00%						
C135	Clothing and Footwear Manufacturing	8	14	0.34%	9	27	0.67%									
C243	Electrical Equipment Manufacturing	9	13	0.34%	10	25	0.67%									
C222	Structural Metal Product Manufacturing	10	12	0.10%	8	27	0.22%									
I461	Road Freight Transport							**1**	**33**	**0.12%**	**1**	**1078**	**3.78%**	**1**	**62**	**0.22%**
I462	Road Passenger Transport							5	12	0.12%	2	407	3.78%	2	23	0.22%
I490	Air and Space Transport							4	13	0.14%	3	244	2.62%	5	20	0.21%
I521	Water Transport Support Services							7	9	0.17%	4	239	4.64%	6	18	0.33%
C113	Dairy Product Manufacturing							2	15	0.14%	5	189	1.81%	3	23	0.21%
A052	Agriculture and Fishing Support Services							6	9	0.04%	6	140	0.67%	16	4	0.02%
A014	Sheep, Beef Cattle and Grain Farming							3	14	0.08%	7	134	0.74%			
C111	Meat and Meat Product Manufacturing										8	125	0.47%			
A013	Fruit and Tree Nut Growing							9	6	0.04%	9	102	0.67%	17	3	0.02%
C191	Polymer Product Manufacturing							8	7	0.07%	10	101	1.04%	4	21	0.21%
A016	Dairy Cattle Farming							10	4	0.02%	11	98	0.40%	8	6	0.03%
H451	Cafes, Restaurants and Takeaway Food Services				2	48	0.04%	14	2	0.00%	12	81	0.08%			
A041	Fishing													9	6	0.36%
D263	Electricity Distribution													7	7	0.21%
A030	Forestry and Logging													10	6	0.12%

Table 3: Industries with Largest Net Negative Employment Changes, 2022-2025

		Draft Advice												**Final Advice**		
		TP1 Net Negative			**TP2 Net Negative**			**TP3 Net Negative**			**TP4 Net Negative**			**Demo Path Net Negative**		
			Worker-Job Equivalents			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**	
	Industry	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**
I461	Road Freight Transport	**1**	**-128**	**0.45%**	**1**	**-110**	**0.39%**									
I462	Road Passenger Transport	2	-48	0.45%	3	-42	0.39%									
I521	Water Transport Support Services	3	-36	0.71%	4	-36	0.70%									
C111	Meat and Meat Product Manufacturing	4	-35	0.13%	2	-42	0.16%	31	-1	0.00%				**1**	**-31**	**0.12%**
I490	Air and Space Transport	5	-30	0.32%	8	-23	0.25%									
C113	Dairy Product Manufacturing	6	-22	0.21%	6	-31	0.30%									
A052	Agriculture and Fishing Support Services	7	-18	0.09%	16	-13	0.06%									
H451	Cafes, Restaurants and Takeaway Food Services	8	-17	0.02%												
A014	Sheep, Beef Cattle and Grain Farming	9	-17	0.10%	13	-16	0.09%							12	-6	0.03%
C149	Other Wood Product Manufacturing	10	-15	0.13%				2	-11	0.10%						
C161	Printing	11	-14	0.13%				3	-10	0.10%						
C141	Log Sawmilling and Timber Dressing	14	-12	0.13%				5	-8	0.10%						
A030	Forestry and Logging	30	-4	0.08%	73	-3	0.06%	7	-7	0.15%						
C249	Other Machinery and Equipment Manufacturing							**1**	**-17**	**0.13%**	**1**	**-371**	**2.85%**	2	-29	0.26%
C251	Furniture Manufacturing							4	-9	0.13%	2	-186	2.85%	3	-14	0.26%
C246	Specialised Machinery and Equipment Manufacturing							6	-8	0.13%	3	-165	2.85%	4	-13	0.26%
C241	Professional and Scientific Equipment Manufacturing							8	-6	0.13%	4	-135	2.85%	5	-10	0.26%
C133	Textile Product Manufacturing							9	-6	0.13%	5	-127	2.85%	6	-10	0.26%
C242	Computer and Electronic Equipment Manufacturing							10	-6	0.13%	6	-126	2.85%	7	-10	0.26%
C135	Clothing and Footwear Manufacturing							13	-5	0.13%	7	-115	2.85%	9	-9	0.26%
C243	Electrical Equipment Manufacturing							14	-5	0.13%	8	-108	2.85%	10	-8	0.26%
C222	Structural Metal Product Manufacturing							15	-5	0.04%	9	-101	0.83%			
B060	Coal Mining							11	-6	0.71%	10	-96	11.52%	8	-9	1.01%
P802	School Education				5	-35	0.03%				13	-64	0.06%	24	-2	0.00%
Q840	Hospitals				7	-25	0.03%				18	-46	0.06%			
G411	Supermarket and Grocery Stores				9	-19	0.03%				21	-35	0.06%			
Q860	Residential Care Services				10	-17	0.03%				22	-32	0.06%			

Table 4: Industries with Largest Net Positive Employment Changes, 2022-2030

Industry		TP1 Net Positive			TP2 Net Positive			TP3 Net Positive			TP4 Net Positive		
			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents	
		Rank	N	%	Rank	N	%	Rank	N	%	Rank	N	%
I461	Road Freight Transport	**1**	**770**	**2.70%**	**1**	**760**	**2.67%**	**1**	**1330**	**4.66%**	**1**	**4646**	**16.29%**
I462	Road Passenger Transport	2	290	2.70%	3	287	2.67%	2	502	4.66%	2	1753	16.29%
I490	Air and Space Transport	3	139	1.49%	5	137	1.47%	3	264	2.83%	3	1283	13.77%
I521	Water Transport Support Services	4	129	2.50%	6	128	2.48%	4	240	4.66%	4	1112	21.57%
A014	Sheep, Beef Cattle and Grain Farming	5	62	0.34%	7	62	0.34%	5	189	1.05%	5	677	3.75%
A052	Agriculture and Fishing Support Services	6	59	0.28%	4	184	0.88%	7	137	0.65%	6	663	3.16%
C191	Polymer Product Manufacturing	7	55	0.56%	8	54	0.56%	8	112	1.15%	8	656	6.74%
A016	Dairy Cattle Farming	8	49	0.20%	2	537	2.19%	9	94	0.38%	10	537	2.19%
I501	Scenic and Sightseeing Transport	9	41	2.31%	9	41	2.28%	10	72	4.03%	14	265	14.82%
I522	Air Transport Support Services	10	37	1.49%	10	36	1.47%	11	69	2.83%	12	338	13.77%
H451	Cafes, Restaurants and Takeaway Food Services	20	17	0.02%				13	64	0.06%	9	545	0.51%
C111	Meat and Meat Product Manufacturing	21	15	0.06%	29	7	0.03%	6	152	0.57%	7	657	2.46%

Table 5: Industries with Largest Net Negative Employment Changes, 2022-2030

Industry		TP1 Net Negative			TP2 Net Negative			TP3 Net Negative			TP4 Net Negative		
			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents	
		Rank	N	%	Rank	N	%	Rank	N	%	Rank	N	%
C249	Other Machinery and Equipment Manufacturing	**1**	**-168**	**1.29%**	**1**	**-167**	**1.29%**	**1**	**-311**	**2.39%**	**1**	**-1764**	**13.55%**
C251	Furniture Manufacturing	2	-84	1.29%	3	-84	1.29%	2	-156	2.39%	2	-883	13.55%
C246	Specialised Machinery and Equipment Manufacturing	3	-75	1.29%	5	-74	1.29%	3	-138	2.39%	3	-784	13.55%
B060	Coal Mining	4	-69	8.30%	6	-69	8.30%	9	-92	11.02%	12	-334	40.08%
C241	Professional and Scientific Equipment Manufacturing	5	-61	1.29%	8	-61	1.29%	4	-113	2.39%	4	-640	13.55%
C133	Textile Product Manufacturing	6	-57	1.29%	10	-57	1.29%	5	-106	2.39%	5	-603	13.55%
C242	Computer and Electronic Equipment Manufacturing	7	-57	1.29%	11	-57	1.29%	6	-105	2.39%	6	-598	13.55%
C135	Clothing and Footwear Manufacturing	8	-52	1.29%	15	-52	1.29%	7	-96	2.39%	7	-544	13.55%
C222	Structural Metal Product Manufacturing	9	-51	0.42%	14	-54	0.44%	8	-95	0.78%	8	-527	4.34%
C243	Electrical Equipment Manufacturing	10	-49	1.29%	17	-49	1.29%	10	-91	2.39%	9	-514	13.55%
C259	Other Manufacturing	11	-42	1.29%	19	-42	1.29%	12	-78	2.39%	10	-442	13.55%
P802	School Education	12	-37	0.03%	2	-116	0.10%	11	-79	0.07%	16	-243	0.21%
Q840	Hospitals	16	-27	0.03%	4	-84	0.10%	16	-57	0.07%	20	-175	0.21%
G411	Supermarket and Grocery Stores	20	-20	0.03%	7	-63	0.10%	19	-43	0.07%	22	-132	0.21%
Q860	Residential Care Services	22	-19	0.03%	9	-58	0.10%	21	-40	0.07%	24	-122	0.21%

Table 6: Industries with Largest Net Positive Employment Changes, 2022-2035

Industry		TP1 Net Positive			TP2 Net Positive			TP3 Net Positive			TP4 Net Positive		
			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents	
		Rank	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**
I461	Road Freight Transport	**1**	**1143**	**4.01%**	**1**	**1112**	**3.90%**	**1**	**1920**	**6.73%**	**1**	**4195**	**14.71%**
I462	Road Passenger Transport	2	431	4.01%	3	420	3.90%	2	725	6.73%	2	1583	14.71%
I490	Air and Space Transport	3	298	3.20%	5	289	3.10%	3	491	5.27%	3	1361	14.60%
I521	Water Transport Support Services	4	247	4.80%	6	245	4.76%	4	400	7.77%	4	1108	21.50%
H451	Cafes, Restaurants and Takeaway Food Services	5	122	0.11%	26	20	0.02%	8	210	0.20%	6	709	0.66%
A014	Sheep, Beef Cattle and Grain Farming	6	117	0.65%	7	115	0.64%	5	339	1.88%	5	724	4.01%
A052	Agriculture and Fishing Support Services	7	107	0.51%	4	324	1.54%	7	228	1.09%	7	602	2.87%
A016	Dairy Cattle Farming	8	97	0.40%	2	939	3.82%	9	178	0.72%	9	534	2.18%
C191	Polymer Product Manufacturing	9	96	0.98%	8	94	0.97%	10	160	1.65%	10	395	4.06%
I522	Air Transport Support Services	10	79	3.20%	9	76	3.10%	11	129	5.27%	11	358	14.60%
A041	Fishing	11	61	3.83%	10	61	3.80%	14	100	6.26%	12	288	17.96%
C111	Meat and Meat Product Manufacturing	21	36	0.14%	21	32	0.12%	6	272	1.02%	8	587	2.20%

Table 7: Industries with Largest Net Negative Employment Changes, 2022-2035

		TP1 Net Negative			TP2 Net Negative			TP3 Net Negative			TP4 Net Negative		
			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents			Worker-Job Equivalents	
Industry		Rank	N	%	Rank	N	%	Rank	N	%	Rank	N	%
C249	Other Machinery and Equipment Manufacturing	**1**	**-247**	**1.90%**	**1**	**-280**	**2.15%**	**1**	**-403**	**3.09%**	**1**	**-1524**	**11.71%**
B060	Coal Mining	2	-131	15.69%	5	-131	15.71%	3	-195	23.32%	11	-371	44.51%
C251	Furniture Manufacturing	3	-124	1.90%	4	-140	2.15%	2	-202	3.09%	2	-763	11.71%
C246	Specialised Machinery and Equipment Manufacturing	4	-110	1.90%	6	-125	2.15%	4	-179	3.09%	3	-678	11.71%
P802	School Education	5	-95	0.08%	2	-197	0.17%	5	-172	0.15%	15	-232	0.20%
C241	Professional and Scientific Equipment Manufacturing	6	-90	1.90%	8	-102	2.15%	6	-146	3.09%	4	-553	11.71%
C222	Structural Metal Product Manufacturing	7	-87	0.71%	9	-101	0.83%	7	-144	1.19%	7	-514	4.23%
B070	Oil and Gas Extraction	8	-86	9.33%	17	-86	9.37%	8	-141	15.34%	13	-306	33.28%
C133	Textile Product Manufacturing	9	-84	1.90%	11	-96	2.15%	9	-138	3.09%	5	-521	11.71%
C242	Computer and Electronic Equipment Manufacturing	10	-84	1.90%	12	-95	2.15%	10	-136	3.09%	6	-516	11.71%
C135	Clothing and Footwear Manufacturing	11	-76	1.90%	15	-86	2.15%	11	-124	3.09%	8	-470	11.71%
C243	Electrical Equipment Manufacturing	12	-72	1.90%	18	-82	2.15%	13	-117	3.09%	9	-444	11.71%
Q840	Hospitals	13	-69	0.08%	3	-142	0.17%	12	-124	0.15%	19	-167	0.20%
C259	Other Manufacturing	14	-62	1.90%	20	-70	2.15%	16	-101	3.09%	10	-382	11.71%
G411	Supermarket and Grocery Stores	17	-52	0.08%	7	-108	0.17%	18	-94	0.15%	22	-127	0.20%
Q860	Residential Care Services	18	-48	0.08%	10	-99	0.17%	19	-86	0.15%	23	-116	0.20%

Table 8: Industries with Largest Net Positive Employment Changes, 2022-2050

		Draft Advice												**Final Advice**		
		TP1 Net Positive			**TP2 Net Positive**			**TP3 Net Positive**			**TP4 Net Positive**			**Demo Path Net Positive**		
			Worker-Job Equivalents			**Worker-Job Equivalents**			**Rank**			**Worker-Job Equivalents**			**Worker-job Equivalents**	
Industry		**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**
I490	Air and Space Transport	**1**	**967**	**10.38%**	3	956	10.26%	**1**	**1995**	**21.42%**	**1**	**2076**	**22.28%**	**1**	**3225**	**35.14%**
A014	Sheep, Beef Cattle and Grain Farming	2	751	4.16%	**1**	**1255**	**6.96%**	2	1643	9.11%	2	1669	9.25%	4	1571	8.67%
I521	Water Transport Support Services	3	607	11.78%	5	605	11.75%	4	1256	24.36%	4	1315	25.52%	3	2216	41.50%
H451	Cafes, Restaurants and Takeaway Food Services	4	569	0.53%	6	482	0.45%	3	1271	1.18%	3	1339	1.24%	2	2474	2.39%
A016	Dairy Cattle Farming	5	562	2.29%	2	1111	4.53%	5	958	3.90%	5	982	4.00%	8	995	4.02%
A052	Agriculture and Fishing Support Services	6	470	2.24%	4	757	3.61%	7	830	3.95%	7	828	3.94%	25	417	1.99%
I522	Air Transport Support Services	7	255	10.38%	7	252	10.26%	10	526	21.42%	10	547	22.28%	10	850	35.14%
C239	Other Transport Equipment Manufacturing	8	229	2.34%	8	207	2.11%	8	558	5.71%	8	592	6.06%	6	1125	12.51%
H440	Accommodation	9	183	0.53%	9	155	0.45%	11	410	1.18%	11	432	1.24%	11	798	2.39%
A041	Fishing	10	148	9.24%	10	148	9.21%	13	319	19.85%	13	333	20.75%	17	583	35.94%
C111	Meat and Meat Product Manufacturing	16	100	0.38%	14	102	0.38%	6	945	3.54%	6	969	3.63%	9	967	3.68%
P802	School Education	17	100	0.09%				9	534	0.47%	9	592	0.52%	5	1424	1.29%
Q840	Hospitals													7	1027	1.29%

Table 9: Industries with Largest Net Negative Employment Changes, 2022-2050

		Draft Advice												**Final Advice**		
		TP1 Net Negative			**TP2 Net Negative**			**TP3 Net Negative**			**TP4 Net Negative**			**Demo Path Net Negative**		
			Worker-Job Equivalents			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**			**Worker-Job Equivalents**	
Industry		**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**	**Rank**	**N**	**%**
C249	Other Machinery and Equipment Manufacturing	**1**	**-606**	**4.66%**	**1**	**-645**	**4.96%**	2	-1265	9.73%	2	-1329	10.21%	2	-2723	24.07%
C149	Other Wood Product Manufacturing	2	-341	3.00%	2	-365	3.21%	3	-886	7.80%	3	-887	7.81%	10	-864	8.27%
C161	Printing	3	-305	3.00%	3	-327	3.21%	4	-793	7.80%	5	-794	7.81%	14	-773	8.27%
C251	Furniture Manufacturing	4	-304	4.66%	4	-323	4.96%	7	-634	9.73%	7	-666	10.21%	4	-1364	24.07%
C222	Structural Metal Product Manufacturing	5	-271	2.23%	6	-285	2.34%	8	-629	5.17%	8	-661	5.43%			
C246	Specialised Machinery and Equipment Manufacturing	6	-270	4.66%	5	-287	4.96%	9	-563	9.73%	9	-591	10.21%	5	-1211	24.07%
C141	Log Sawmilling and Timber Dressing	7	-257	3.00%	7	-275	3.21%	6	-667	7.80%	6	-667	7.81%	16	-650	8.27%
B070	Oil and Gas Extraction	8	-247	26.85%	8	-247	26.86%	11	-492	53.53%	10	-533	58.01%	17	-629	70.26%
C241	Professional and Scientific Equipment Manufacturing	9	-220	4.66%	9	-234	4.96%	12	-459	9.73%	12	-482	10.21%	7	-988	24.07%
C133	Textile Product Manufacturing	10	-207	4.66%	10	-221	4.96%	14	-433	9.73%	14	-454	10.21%	8	-931	24.07%
I461	Road Freight Transport	25	-59	0.21%	20	-87	0.31%	**1**	**-1835**	**6.43%**	**1**	**-2181**	**7.65%**	**1**	**-4981**	**17.92%**
I462	Road Passenger Transport	31	-22	0.21%	30	-33	0.31%	5	-692	6.43%	4	-823	7.65%	3	-1880	17.92%
A030	Forestry and Logging							10	-506	10.61%	11	-494	10.37%			
C242	Computer and Electronic Equipment Manufacturing													9	-923	24.07%
A013	Fruit and Tree Nut Growing													6	-1026	6.84%

Table 10: 2018 Worker-Job Characteristics in Top Net Positive Industries, 2022-2050

		Average Annual Earnings (2018 NZD)				Average Monthly FTE				Average Annual FTE				Average Jobs per Worker				Average Worker Age			
	Industry	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**
I522	Air Transport Support Services	70,476	92,103	39,174	24,541	0.80	0.95	0.64	0.28	0.62	0.94	0.29	0.06	1.14	1.04	1.27	1.49	37.8	42.5	32.8	34.9
A014	Sheep, Beef Cattle and Grain Farming	**23,427**	**53,573**	**14,228**	**9,670**	**0.40**	**0.85**	**0.26**	**0.17**	**0.21**	**0.74**	**0.08**	**0.03**	**2.69**	**1.11**	**3.21**	**3.65**	35.2	44.1	33.0	32.8
I521	Water Transport Support Services	66,253	85,571	36,455	18,889	0.78	0.96	0.54	0.25	0.63	0.95	0.25	0.05	1.15	1.03	1.30	1.46	43.7	47.4	38.8	40.1
H451	Cafes, Restaurants and Takeaway Food Services	**21,466**	**34,673**	**16,599**	**9,645**	**0.48**	**0.75**	**0.39**	**0.20**	**0.28**	**0.73**	**0.16**	**0.03**	1.30	1.09	1.37	1.56	**28.3**	**34.2**	**26.7**	**26.6**
A016	Dairy Cattle Farming	38,663	54,560	29,665	17,653	0.65	0.89	0.53	0.28	0.39	0.85	0.21	0.05	1.25	1.06	1.36	1.60	32.9	38.6	30.7	29.7
A052	Agriculture and Fishing Support Services	**25,868**	**53,602**	**21,725**	**14,260**	**0.46**	**0.87**	**0.40**	**0.26**	**0.20**	**0.84**	**0.12**	**0.04**	**1.52**	**1.12**	**1.60**	**1.77**	31.9	41.7	30.7	28.8
I522	Air Transport Support Services	70,476	92,103	39,174	24,541	0.80	0.95	0.64	0.28	0.62	0.94	0.29	0.06	1.14	1.04	1.27	1.49	37.8	42.5	32.8	34.9
C239	Other Transport Equipment Manufacturing	75,646	86,434	48,959	24,344	0.88	0.98	0.68	0.27	0.68	0.87	0.32	0.05	1.08	1.02	1.20	1.36	41.6	44.3	36.1	39.0
H440	Accommodation	**26,145**	**40,422**	**19,050**	**11,717**	**0.54**	**0.80**	**0.43**	**0.22**	**0.33**	**0.77**	**0.17**	**0.04**	1.29	1.10	1.38	1.55	34.1	41.9	31.2	30.4
A041	Fishing	51,087	71,634	39,665	30,989	0.67	0.91	0.53	0.31	0.44	0.85	0.21	0.05	1.21	1.08	1.30	1.51	38.0	43.0	35.5	32.7
C111	Meat and Meat Product Manufacturing	48,872	60,641	39,458	26,649	0.80	0.96	0.68	0.36	0.54	0.93	0.27	0.10	1.12	1.03	1.19	1.34	38.4	43.6	34.7	32.3
P802	School Education	43,563	59,115	27,050	17,839	0.66	0.87	0.43	0.23	0.53	0.86	0.21	0.03	1.15	1.06	1.26	1.35	46.7	48.9	44.2	44.1

Note that some of these growing industries are fairly low pay and with relatively low FTE levels both in monthly and in annual terms. The average worker in Sheep, Beef Cattle and Grain Farming have 2.69 also has the highest number of jobs (2.69 jobs). For worker-job starts and short-spells, the average worker has more than three jobs. Agriculture and Fishing Support Services workers also tend to have more jobs than workers in other industries (1.52 jobs for the average worker) especially for starts and short-spell worker jobs. For worker-jobs in Cafes, Restaurants and Takeaway Food Services, workers are much younger than workers in other industries.

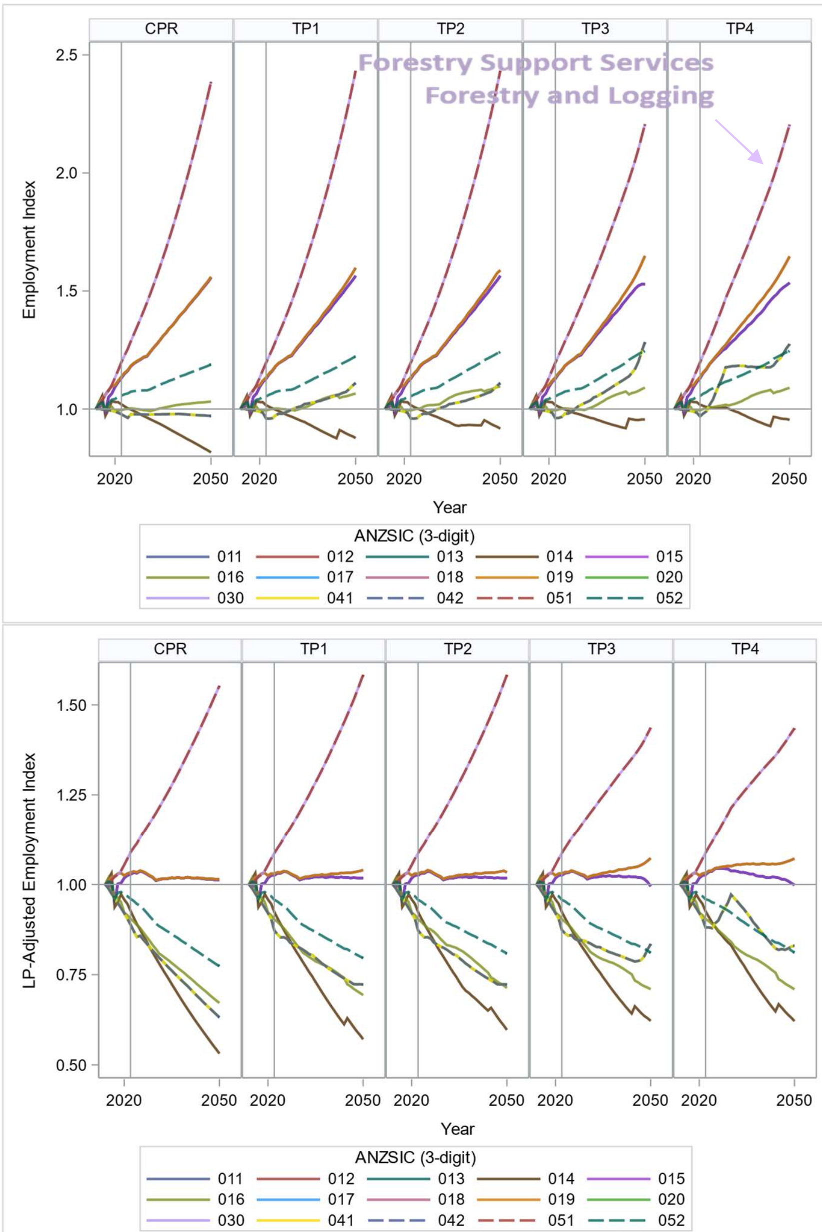
Table 11: 2018 Worker-Job Characteristics in Top Net Negative Industries, 2022-2050

		Average Annual Earnings (2018 NZD)				**Average Monthly FTE**				**Average Annual FTE**				**Average Jobs per Worker**				**Average Worker Age**			
	Industry	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**	**Ave WJ**	**Contin**	**Starts**	**Short Spells**
C249	Other Machinery and Equipment Manufacturing	59,127	71,087	42,010	23,417	0.81	0.95	0.64	0.32	0.63	0.94	0.30	0.06	1.13	1.03	1.25	1.44	41.3	44.4	37.1	36.7
C149	Other Wood Product Manufacturing	52,401	61,524	38,748	22,188	0.83	0.96	0.66	0.30	0.65	0.94	0.32	0.05	1.11	1.02	1.22	1.40	39.9	43.7	34.4	32.4
C161	Printing	49,716	61,375	29,140	11,395	0.77	0.93	0.53	0.23	0.62	0.92	0.25	0.04	1.14	1.04	1.30	1.52	40.9	45.8	33.4	30.1
C251	Furniture Manufacturing	47,712	56,666	34,624	16,515	0.80	0.94	0.63	0.29	0.62	0.91	0.30	0.06	1.11	1.03	1.22	1.39	39.7	43.7	34.2	31.0
C222	Structural Metal Product Manufacturing	57,686	67,977	42,864	22,478	0.85	0.97	0.70	0.33	0.66	0.95	0.34	0.07	1.10	1.02	1.21	1.38	39.7	43.2	35.0	34.0
C246	Specialised Machinery and Equipment Manufacturing	63,686	75,355	42,471	23,433	0.85	0.97	0.66	0.27	0.70	0.96	0.33	0.05	1.11	1.02	1.28	1.63	40.6	44.0	34.4	31.6
C141	Log Sawmilling and Timber Dressing	53,158	63,400	38,955	31,494	0.84	0.97	0.67	0.35	0.66	0.96	0.32	0.07	1.11	1.02	1.23	1.40	40.3	45.1	34.6	33.7
B070	Oil and Gas Extraction	211,772	170,153	177,377	299,421	0.94	1.00	0.80	0.45	0.80	0.99	0.38	0.09	1.04	1.01	1.17	1.33	44.5	46.0	40.0	45.9
C241	Professional and Scientific Equipment Manufacturing	72,723	83,289	49,184	35,916	0.90	0.98	0.74	0.39	0.75	0.97	0.38	0.14	1.08	1.02	1.22	1.28	39.8	42.8	33.3	33.4
C133	Textile Product Manufacturing	47,913	57,875	33,365	19,973	0.80	0.94	0.62	0.28	0.63	0.91	0.30	0.05	1.12	1.04	1.24	1.42	41.8	46.6	35.1	32.4
I461	Road Freight Transport	54,951	68,259	41,297	21,679	0.78	0.96	0.63	0.30	0.57	0.93	0.28	0.06	1.17	1.03	1.30	1.53	43.2	47.1	39.6	38.3
I462	Road Passenger Transport	38,043	44,309	27,227	13,168	0.68	0.81	0.53	0.23	0.52	0.80	0.26	0.06	1.19	1.09	1.32	1.52	**53.3**	**56.3**	**50.2**	**51.0**
A030	Forestry and Logging	51,918	68,968	38,518	17,759	0.75	0.96	0.59	0.27	0.53	0.94	0.27	0.05	1.35	1.03	1.65	2.49	38.0	42.2	35.1	34.5

Compared to the industries being positively impacted, worker-jobs in the top negatively affected industries seem to be higher paid, higher FTE levels, fewer jobs per worker, and older workers. Worker-jobs in Oil and Gas Extraction (B070) are notable for their high pay and high FTE levels. Workers in Oil and Gas also appear to slightly older than the workers in the other industries. Road Passenger Transport (I462) is also notable amongst this group of industries as being the lowest paid, with low FTE levels and substantially older workers with the average age for all categories greater than 50 years.

8 Figures

Figure 1. Employment Indices from C-PLAN for Agriculture before (top panel) and after (bottom panel) Productivity Adjustment for Draft Advice, 2014-2050



ANZSIC06 Industry	
A011	Nursery and Floriculture Production
A012	Mushroom and Vegetable Growing
A013	Fruit and Tree Nut Growing
A014	Sheep, Beef Cattle and Grain Farming
A015	Other Crop Growing
A016	Dairy Cattle Farming
A017	Poultry Farming
A018	Deer Farming
A019	Other Livestock Farming
A020	Aquaculture
A030	Forestry and Logging
A041	Fishing
A042	Hunting and Trapping
A051	Forestry Support Services
A052	Agriculture and Fishing Support Services

Figure 2. Employment Indices from C-PLAN for Agriculture before (top panel) and after (bottom panel) Productivity Adjustment for Demonstration Path for Final Advice, 2014-2050

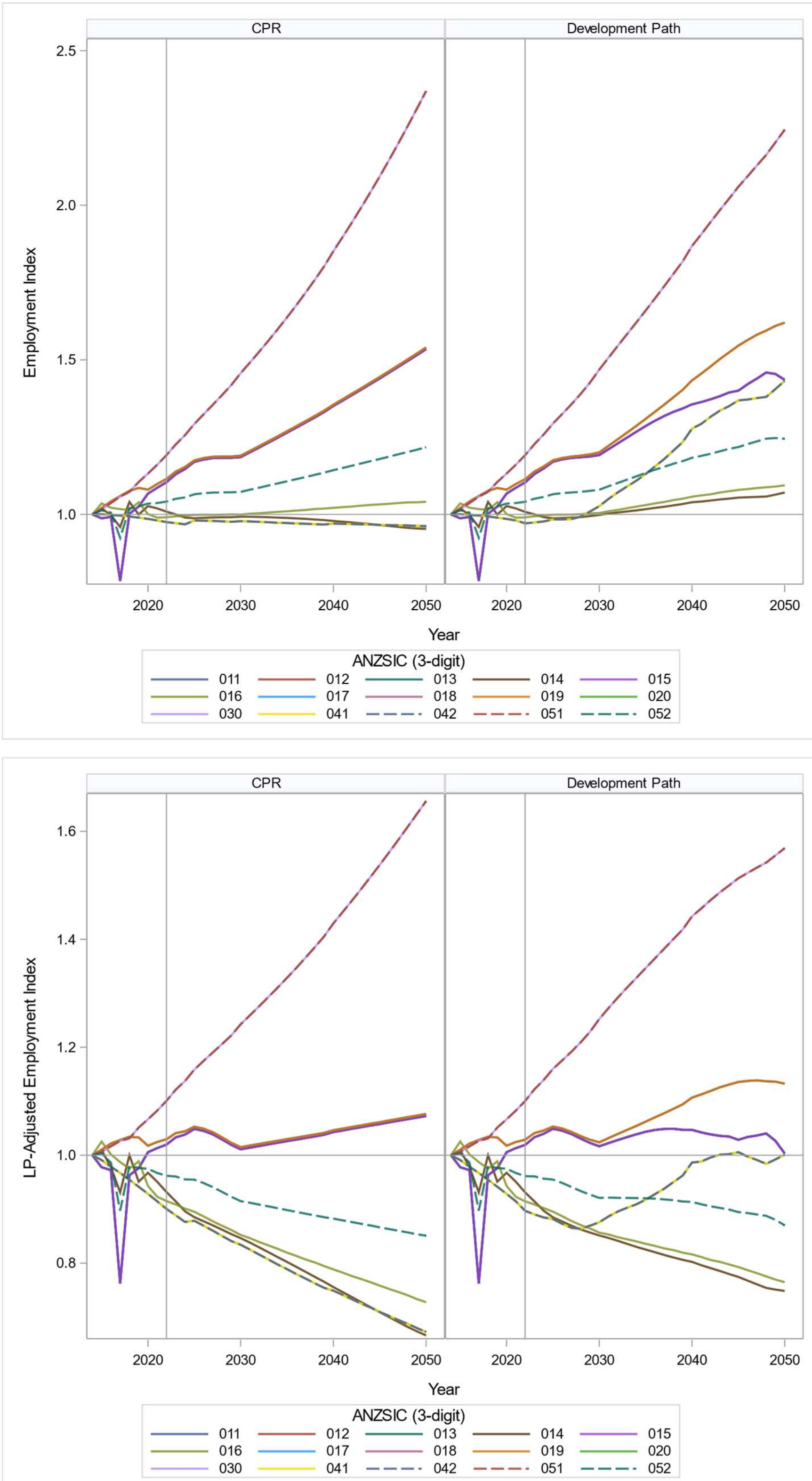


Figure 3. Cumulative Employment Changes in Sheep, Beef Cattle and Grain Farming (A014)

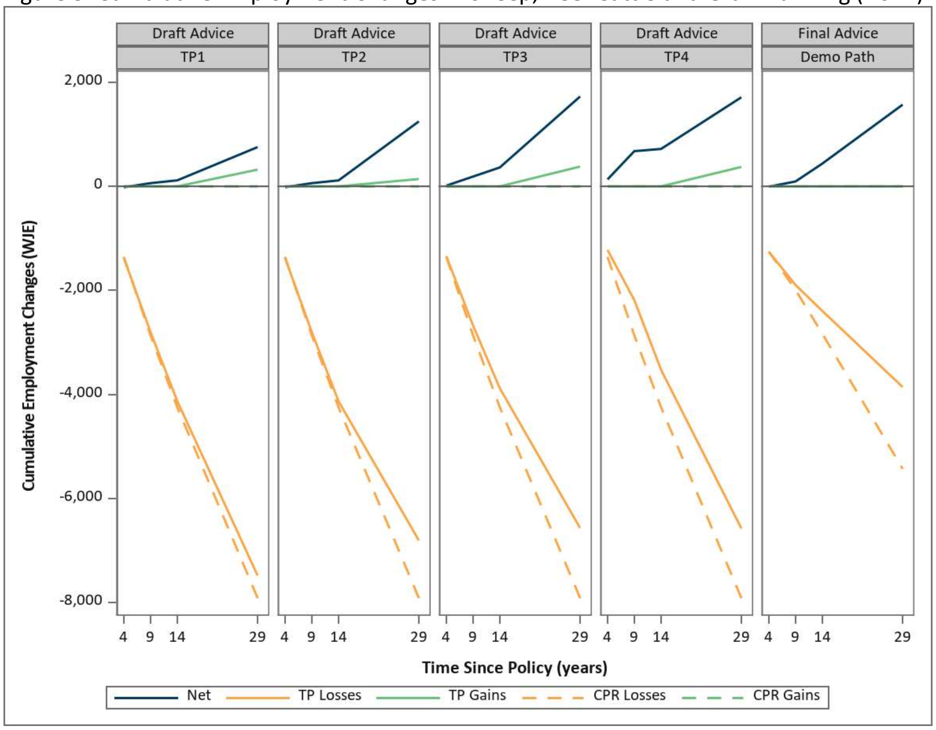


Figure 4. Average Annual Employment Changes in Sheep, Beef Cattle and Grain Farming (A014) by Budget Period

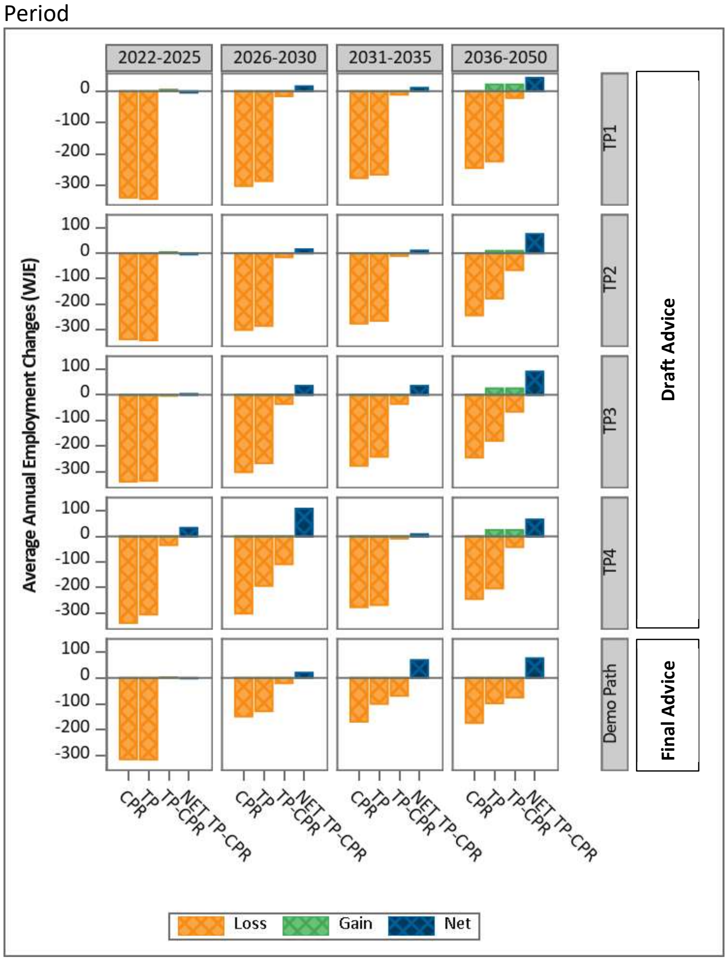


Figure 5. Cumulative Employment Changes in Meat and Meat Product Manufacturing(C111), 2022-2050

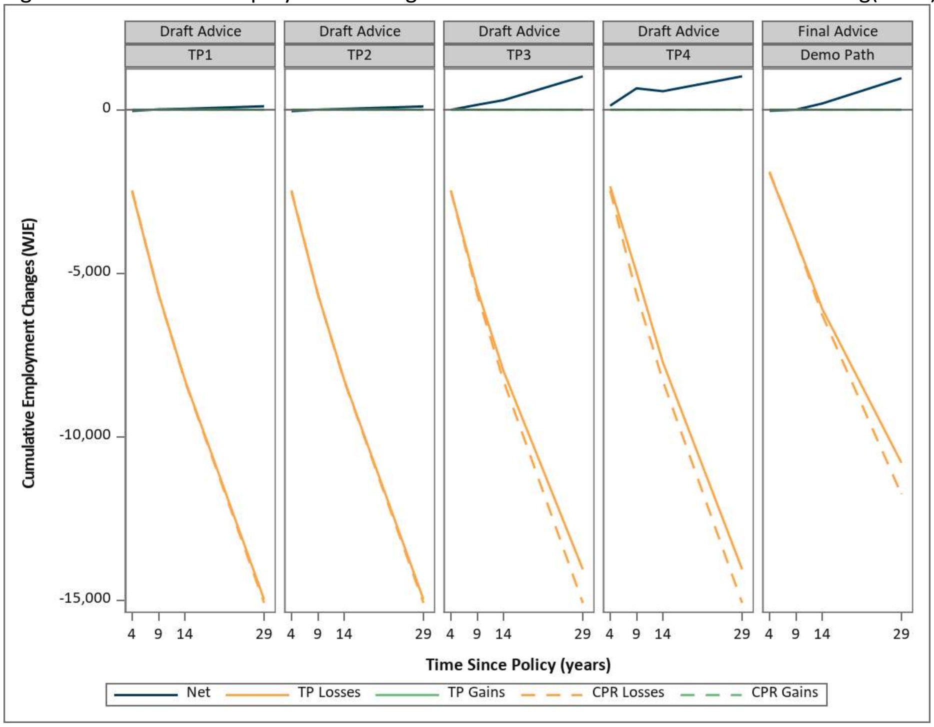


Figure 6. Average Annual Employment Changes in Meat and Meat Product Manufacturing (C111) by Budget Period

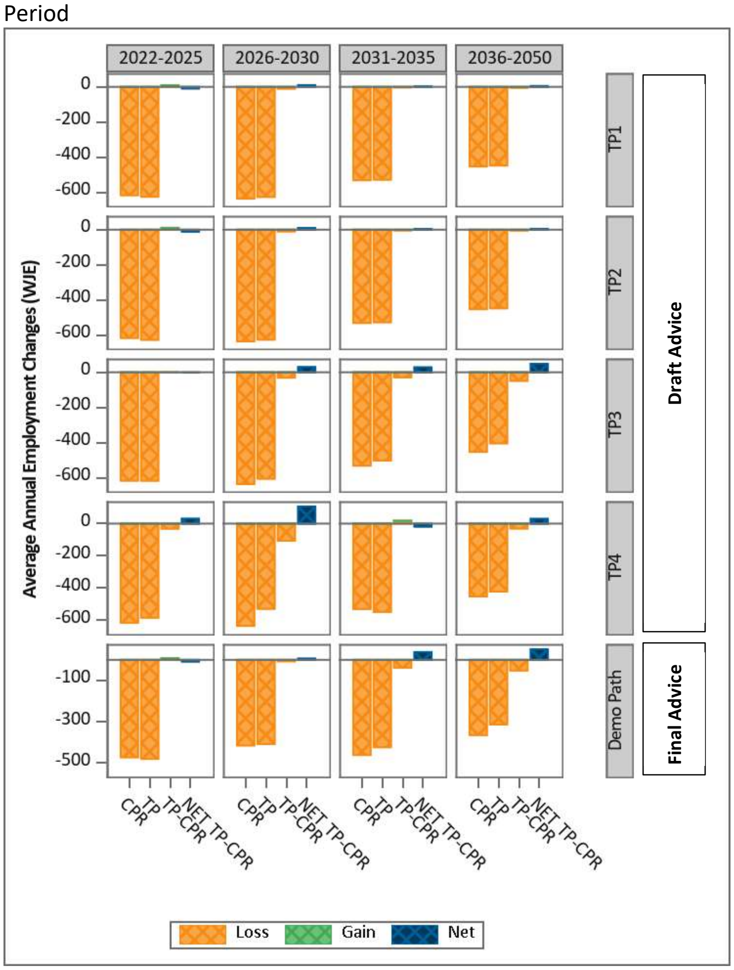


Figure 7. Cumulative Employment Changes in Dairy Cattle Farming (A016)

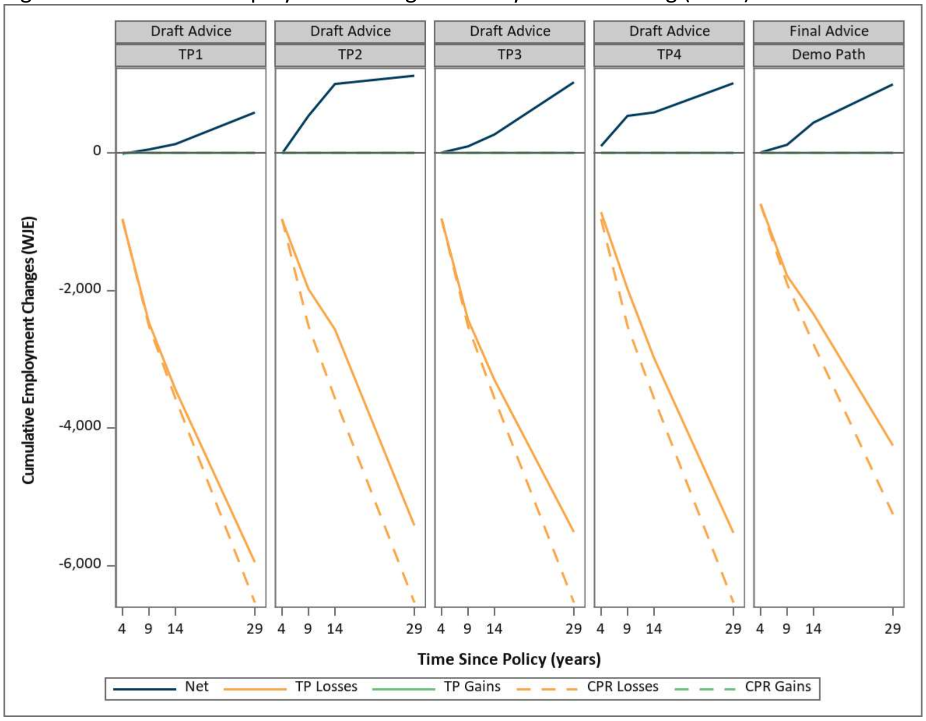


Figure 8. Average Annual Employment Changes in Dairy Cattle Farming (A016) by Budget Period

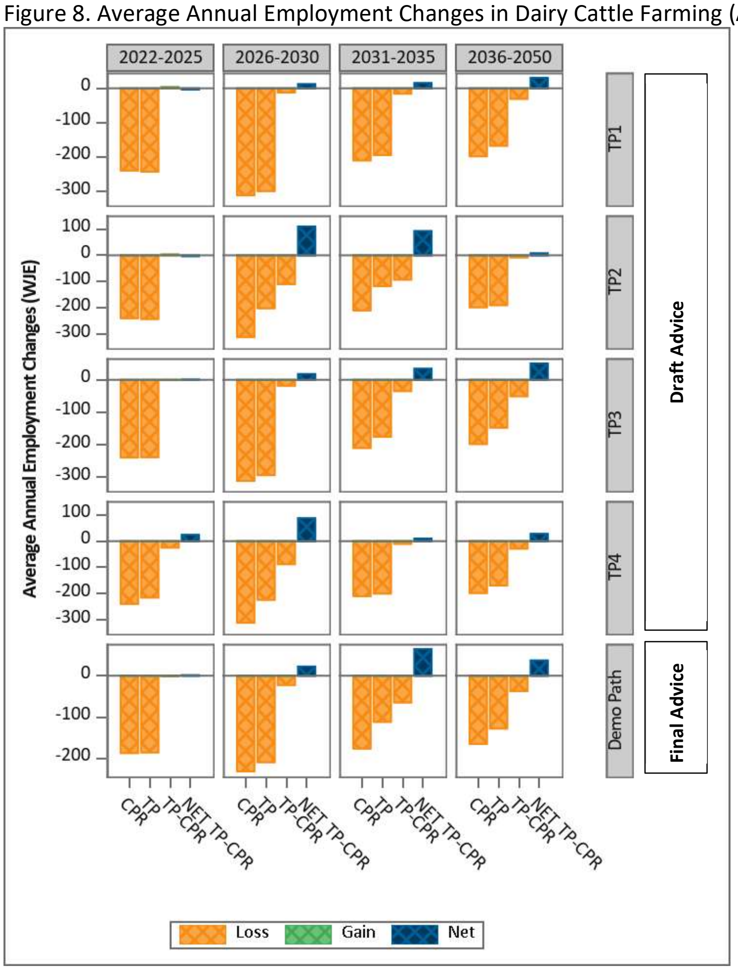


Figure 9. Cumulative Employment Changes in Dairy Product Manufacturing(C113)

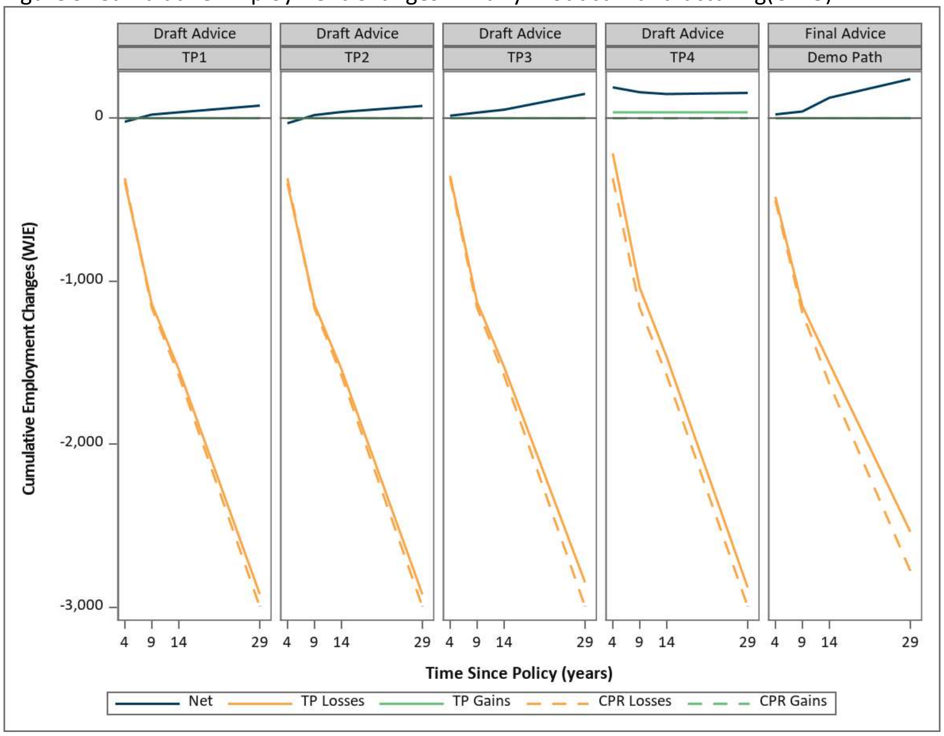


Figure 10. Average Annual Employment Changes in Dairy Product Manufacturing(C113) by Budget Period

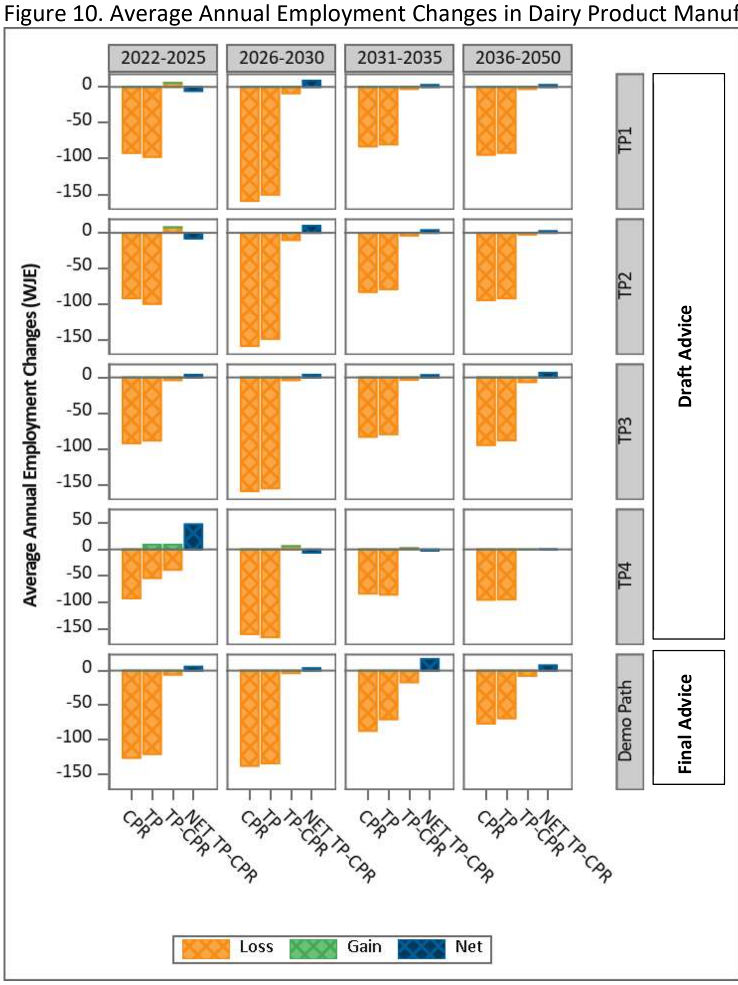


Figure 11. Cumulative Employment Changes in Forestry and Logging (A030), 2022-2050

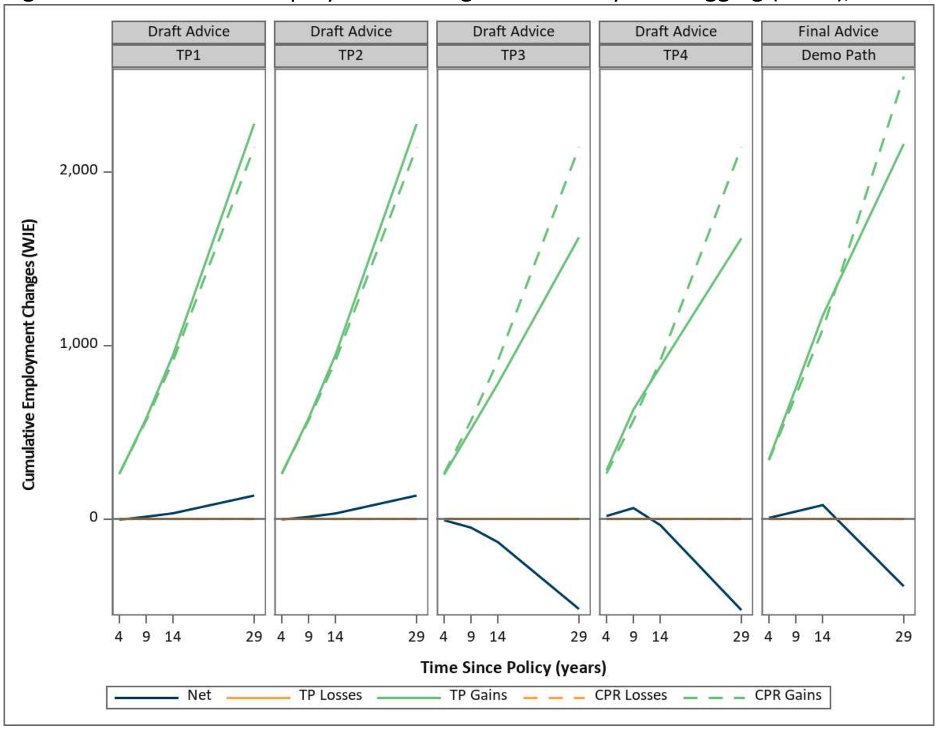


Figure 12. Average Annual Employment Changes in Forestry and Logging (A030) by Budget Period

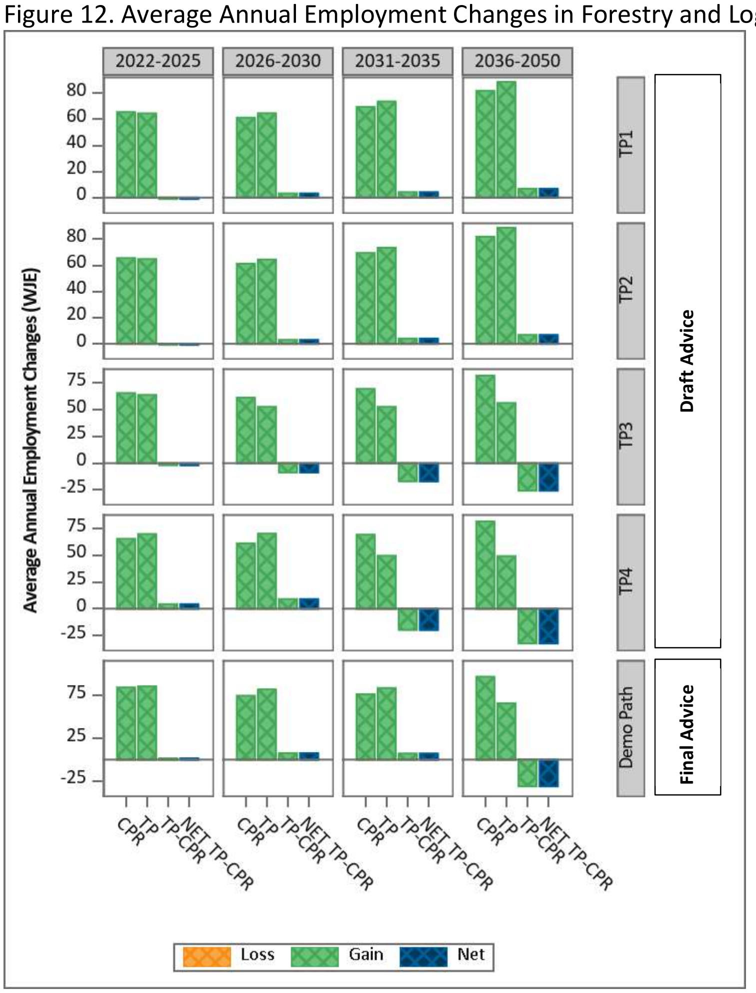


Figure 13. Cumulative Employment Changes in Road Freight Transport (I461), 2022-2050

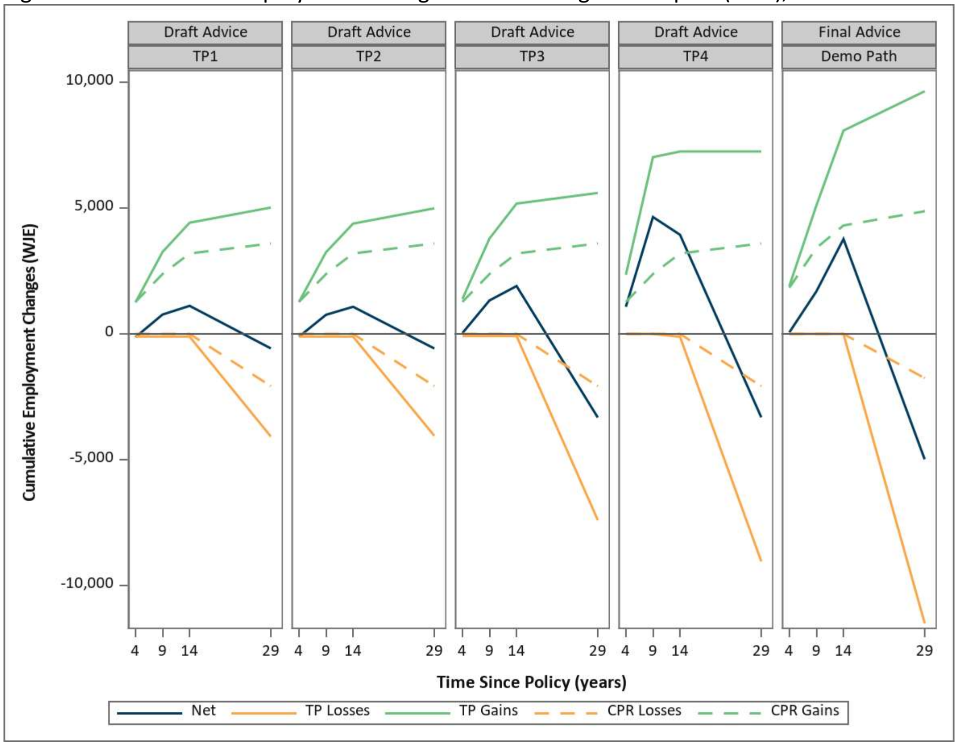


Figure 14. Average Annual Employment Changes in Road Freight Transport (I461) by Budget Period

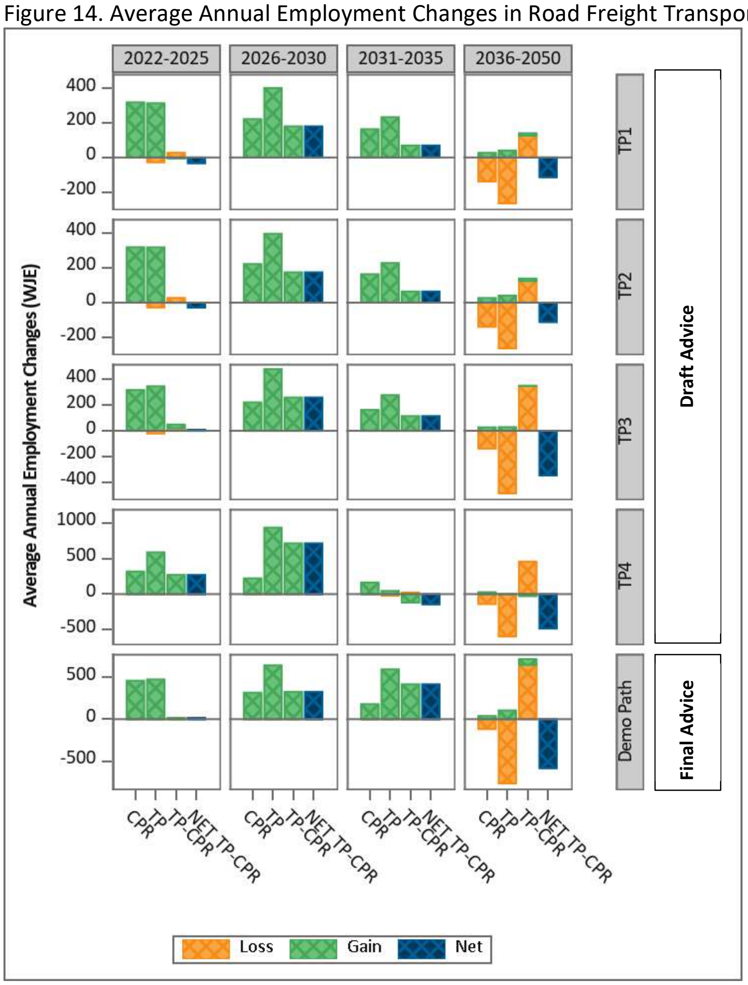


Figure 15. Cumulative Employment Changes in Scenic and Sightseeing Transport (I501)

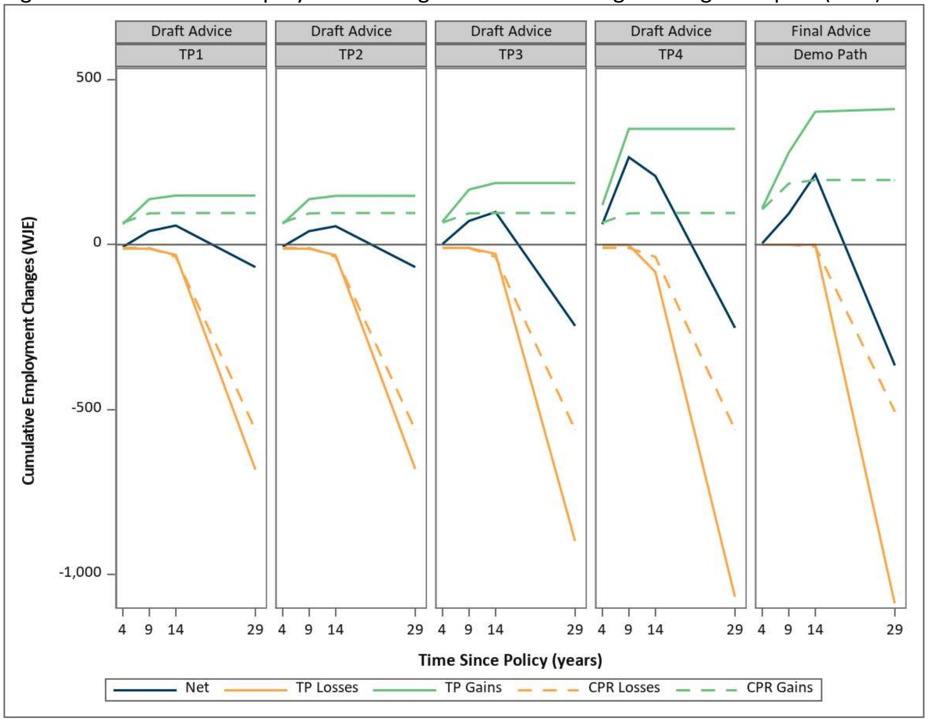


Figure 16. Average Annual Employment Changes in Scenic and Sightseeing Transport (I501) by Budget Period

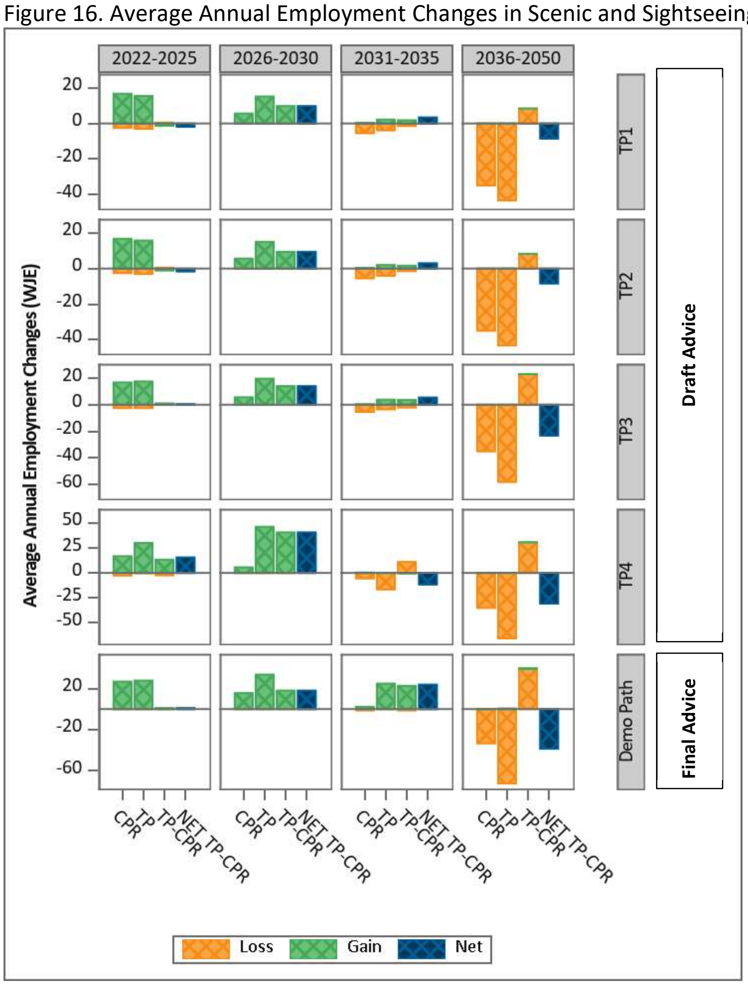


Figure 17. Cumulative Employment Changes in Air and Space Transport (I490), 2022-2050

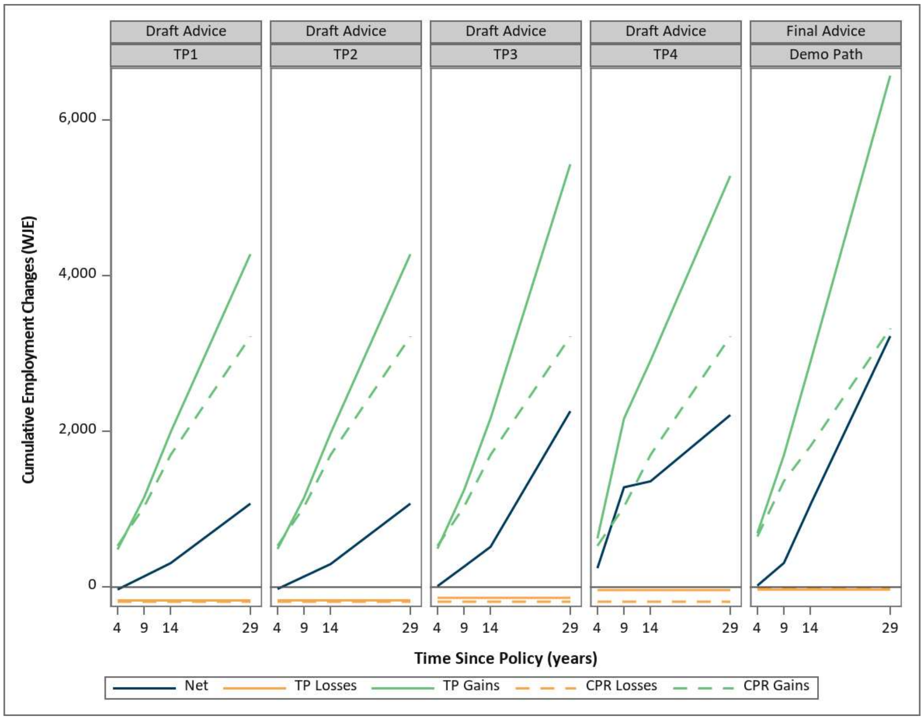


Figure 18. Average Annual Employment Changes in Air and Space Transport (I490) by Budget Period

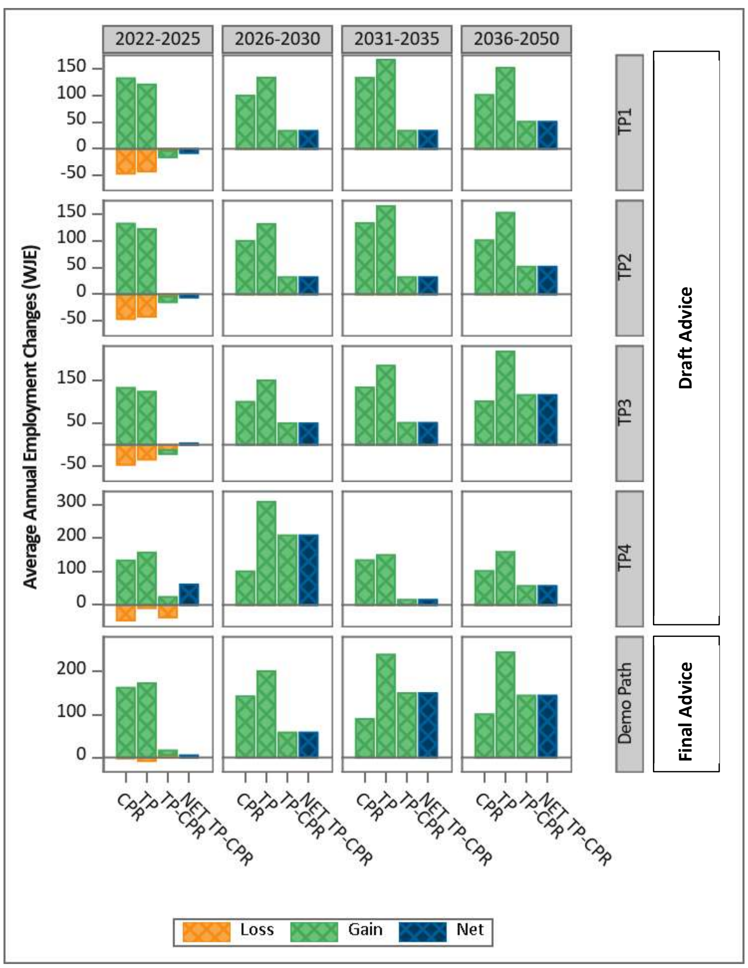


Figure 19. Cumulative Employment Changes in Air Transport Support Services (I522)

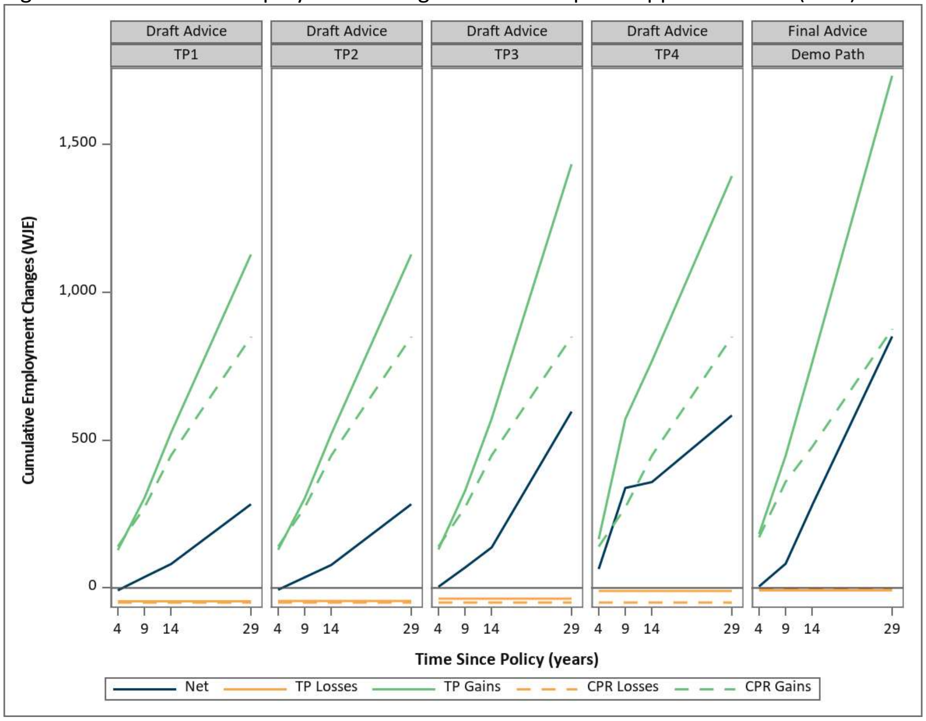


Figure 20. Average Annual Employment Changes in Air Transport Support Services (I522) by Budget Period

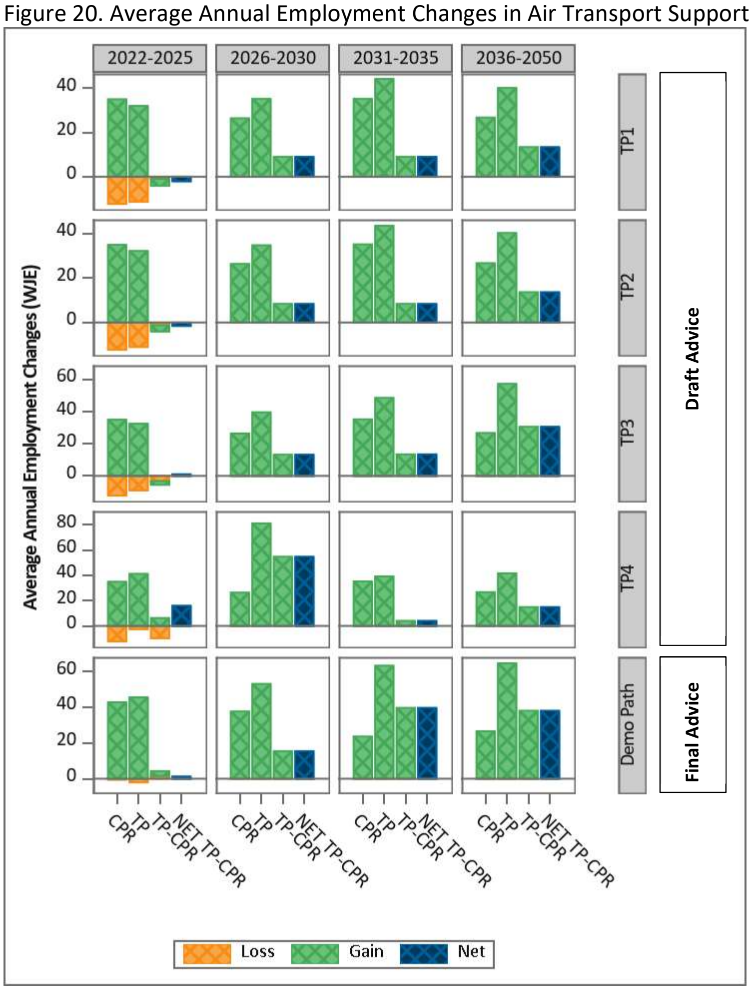


Figure 21. Cumulative Employment Changes in Water Transport Support Services (I521)

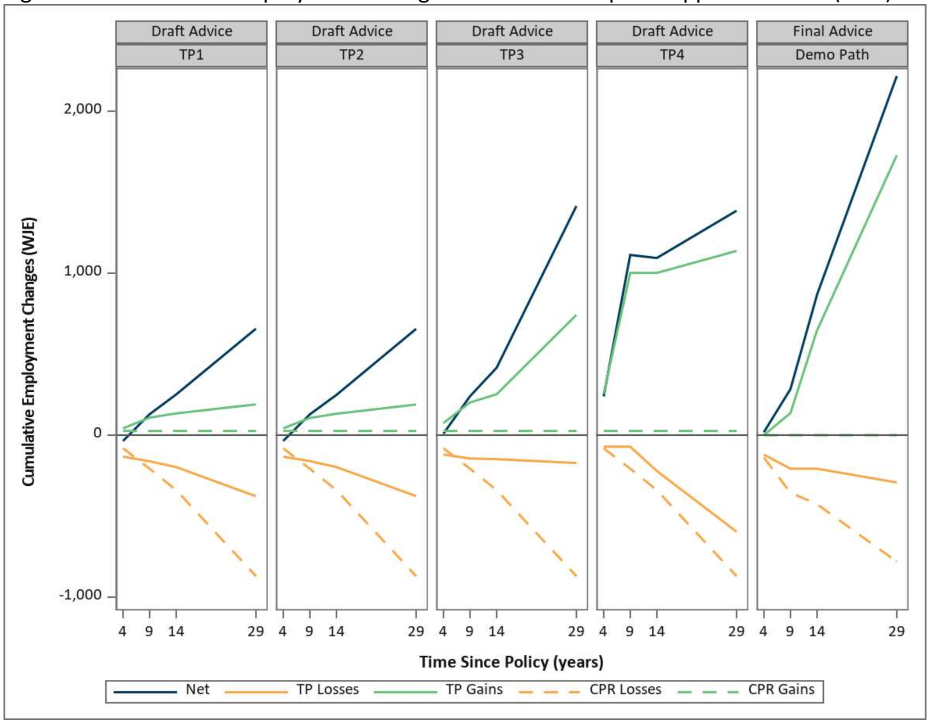


Figure 22. Average Annual Employment Changes in Water Transport Support Services (I521) by Budget Period

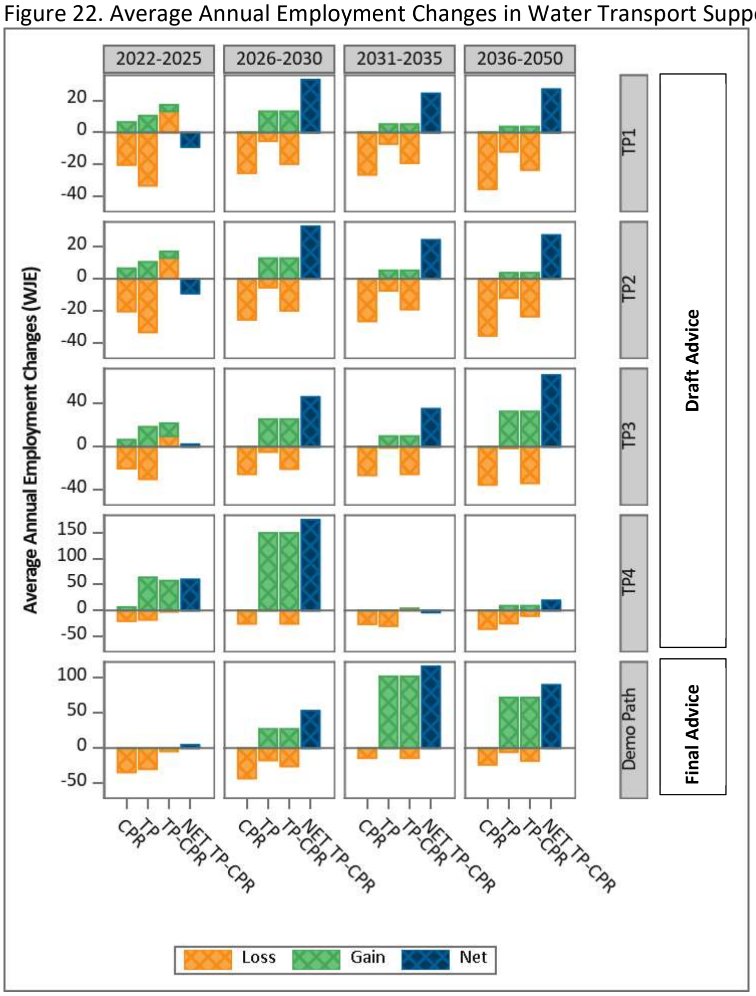


Figure 23. Cumulative Employment Changes in Coal Mining (B060)

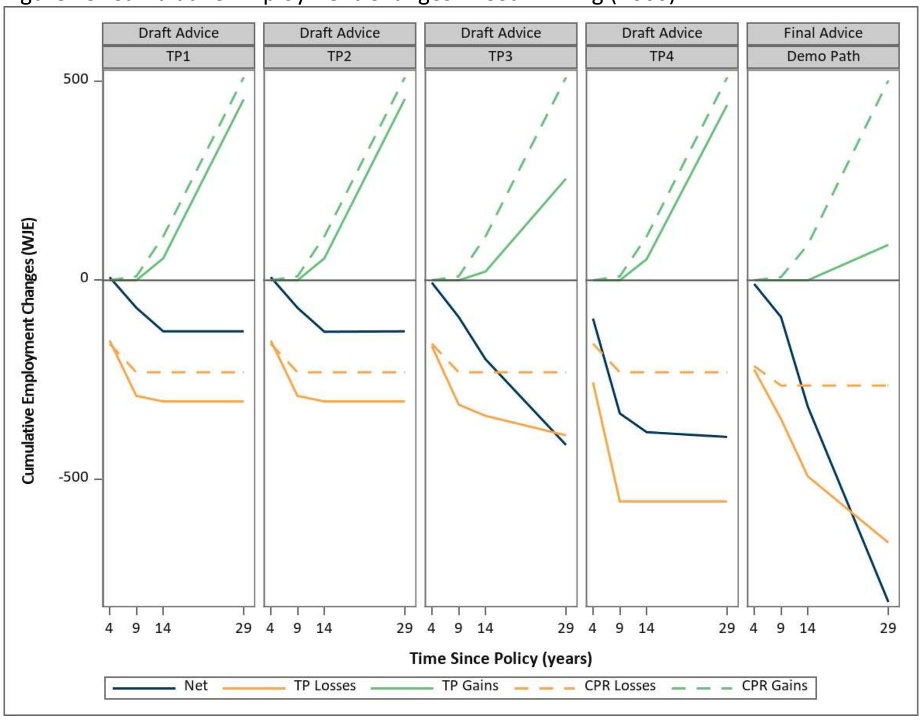


Figure 24. Average Annual Employment Changes in Coal Mining (B060) by Budget Period

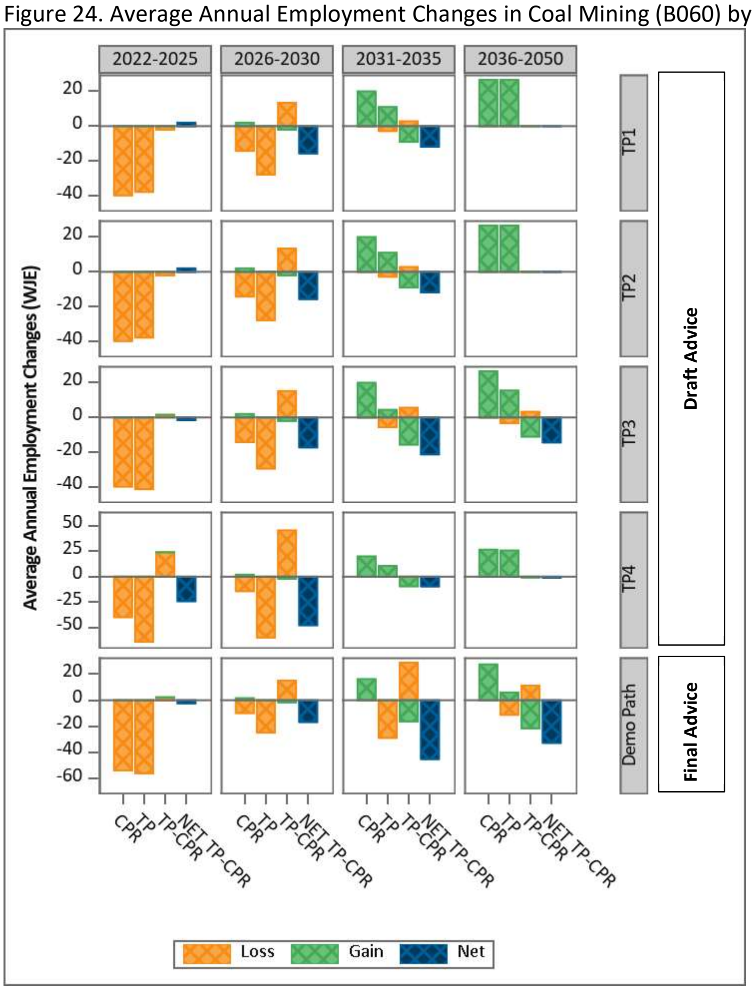


Figure 25. Cumulative Employment Changes in Oil and Gas Extraction (B070)

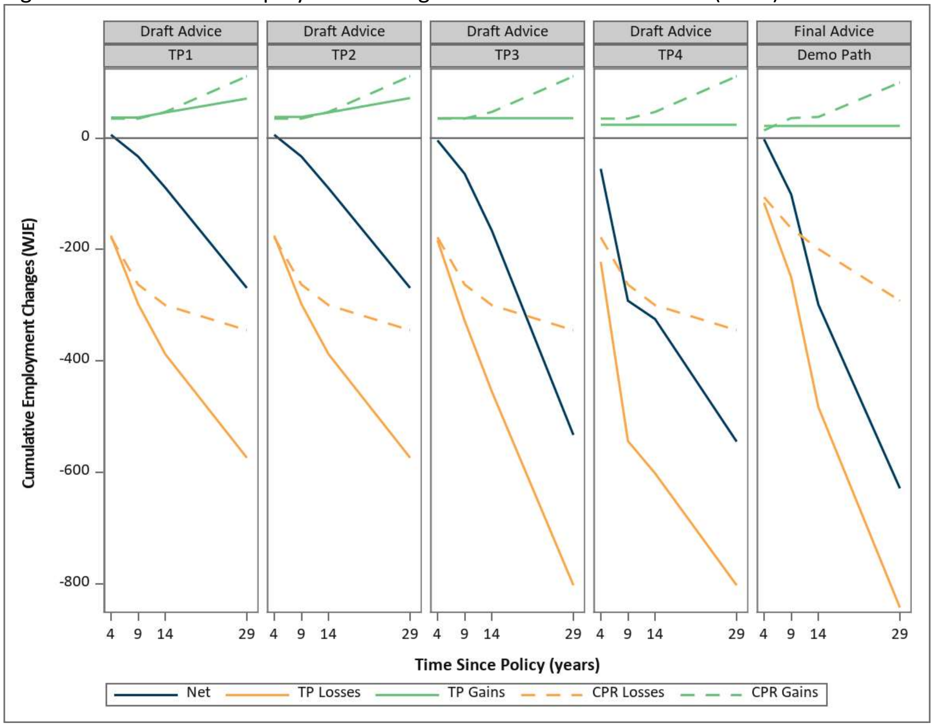


Figure 26. Average Annual Employment Changes in Oil and Gas Extraction (B070) by Budget Period

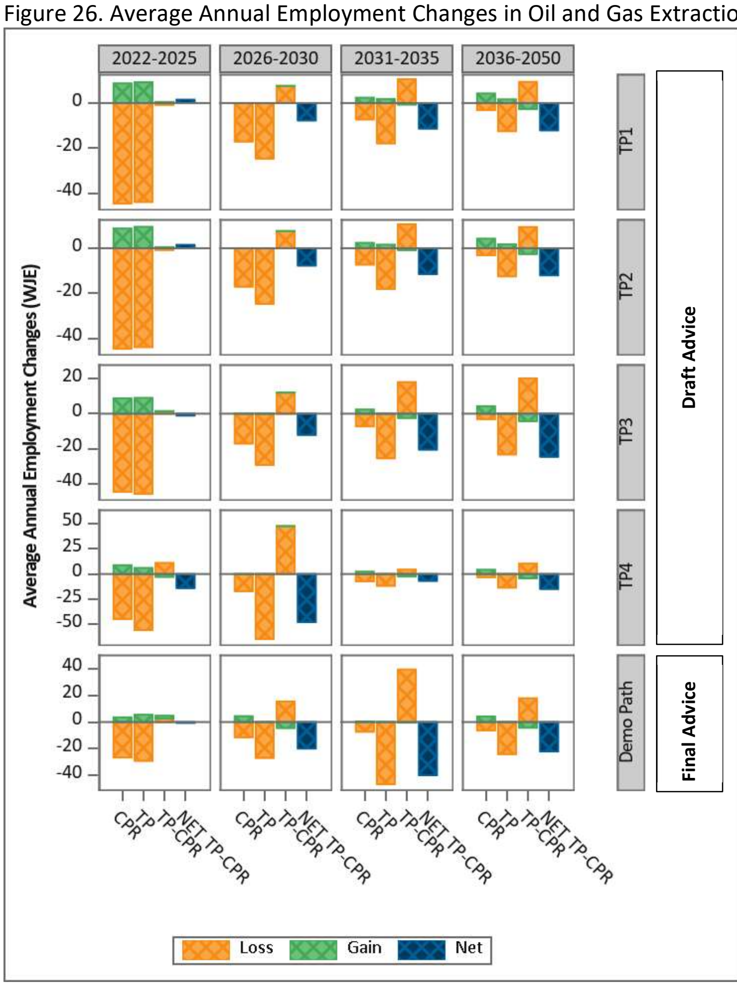


Figure 27. Cumulative Employment Changes in Petroleum Refining and Petroleum and Coal Product Manufacturing (C170)

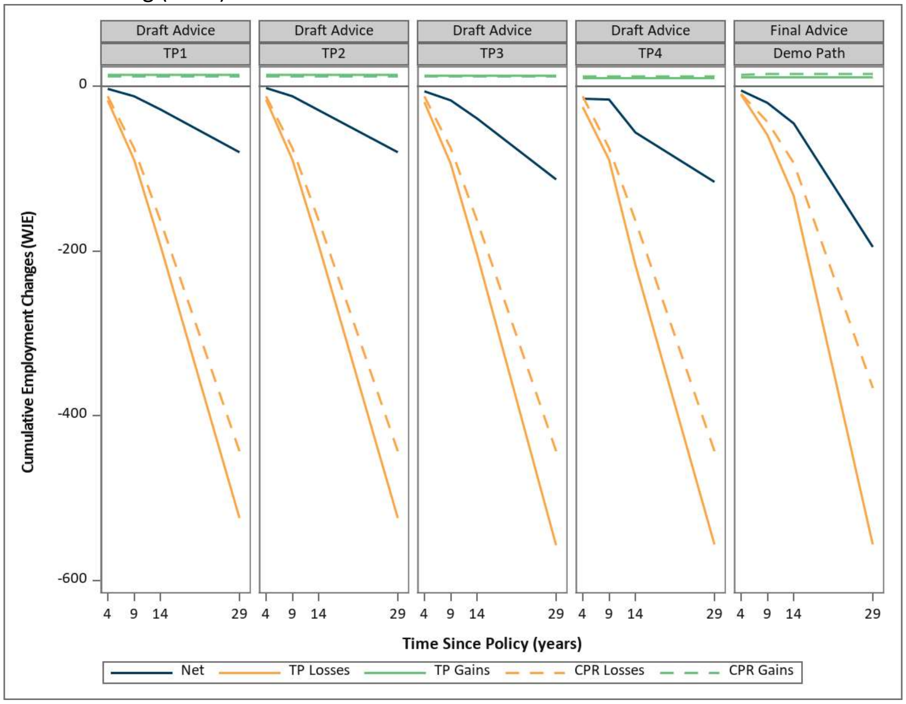


Figure 28. Average Annual Employment Changes in Petroleum Refining and Petroleum and Coal Product Manufacturing (C170) by Budget Period

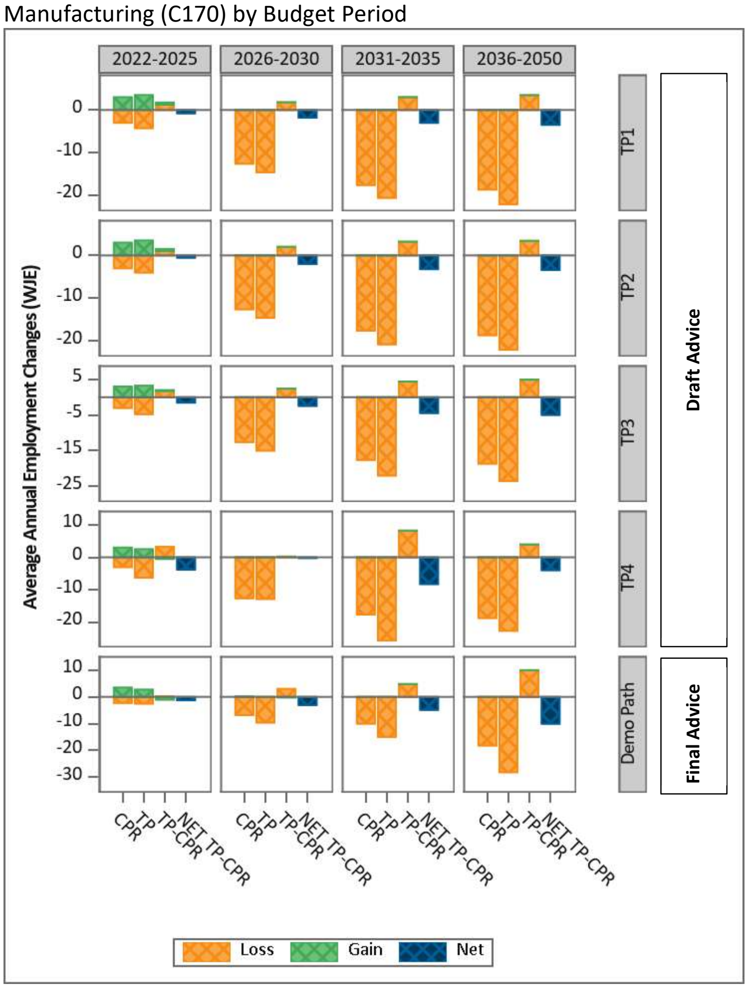


Figure 29. Cumulative Employment Changes in Other Mining Support Services (B109)

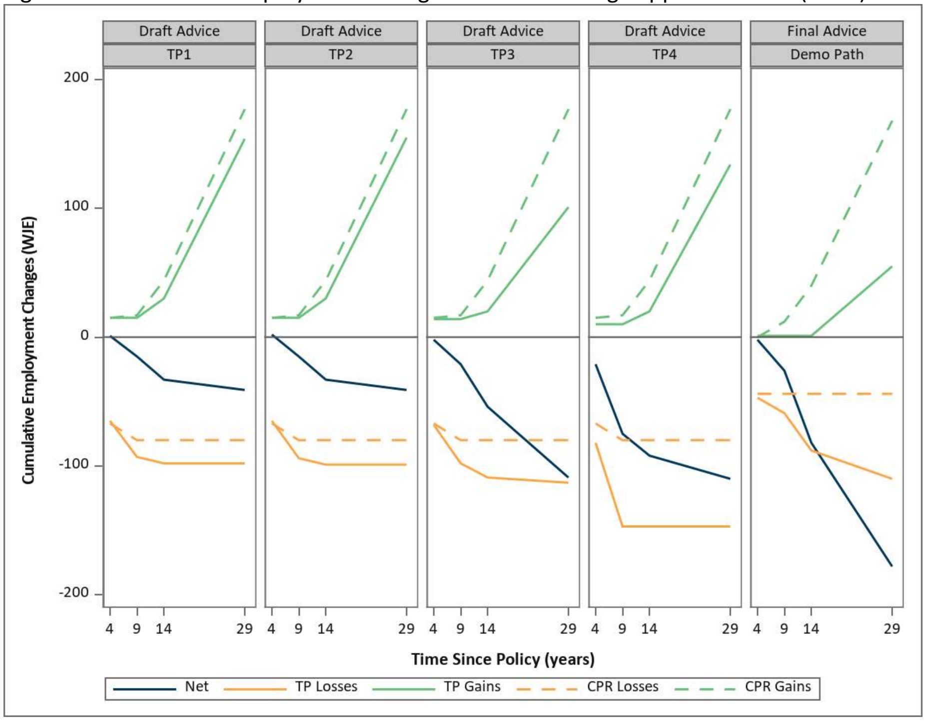


Figure 30. Average Annual Employment Changes in Other Mining Support Services (B109) by Budget Period

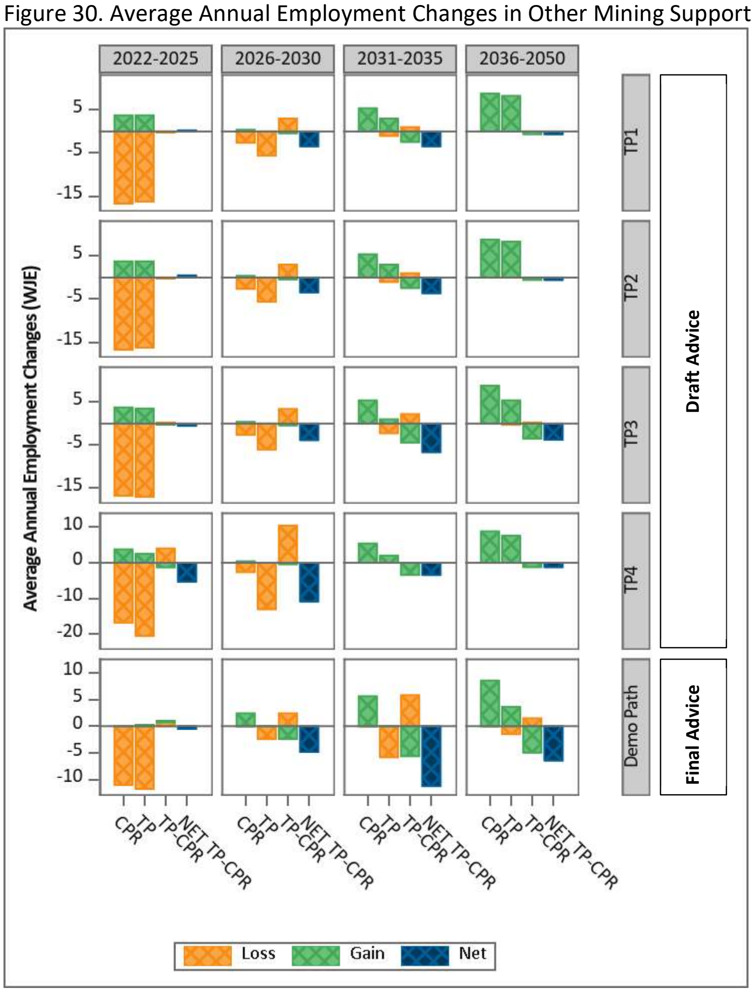


Figure 31. Cumulative Employment Changes in Electricity Generation (D261)

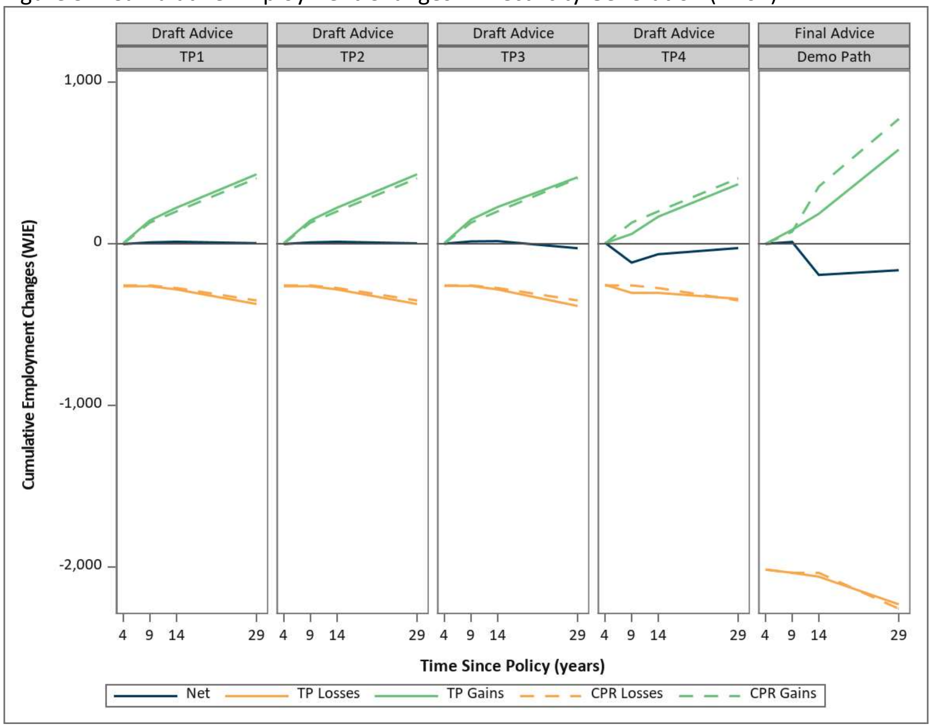


Figure 32. Average Annual Employment Changes in Electricity Generation (D261) by Budget Period

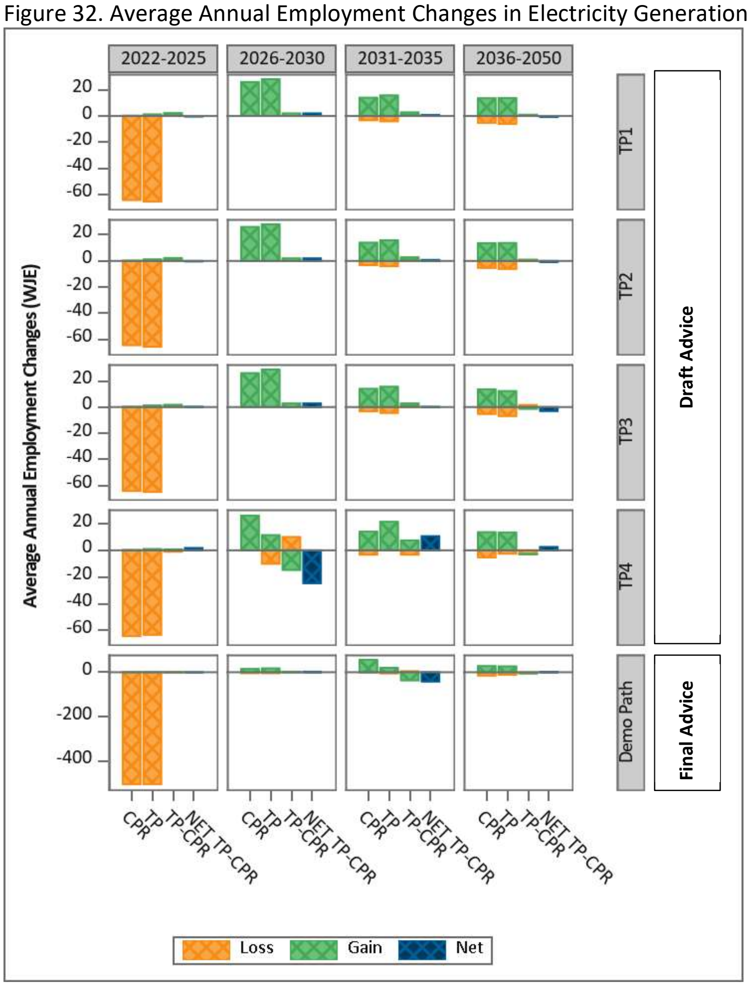


Figure 33. Cumulative Employment Changes in Electricity Distribution (D263)

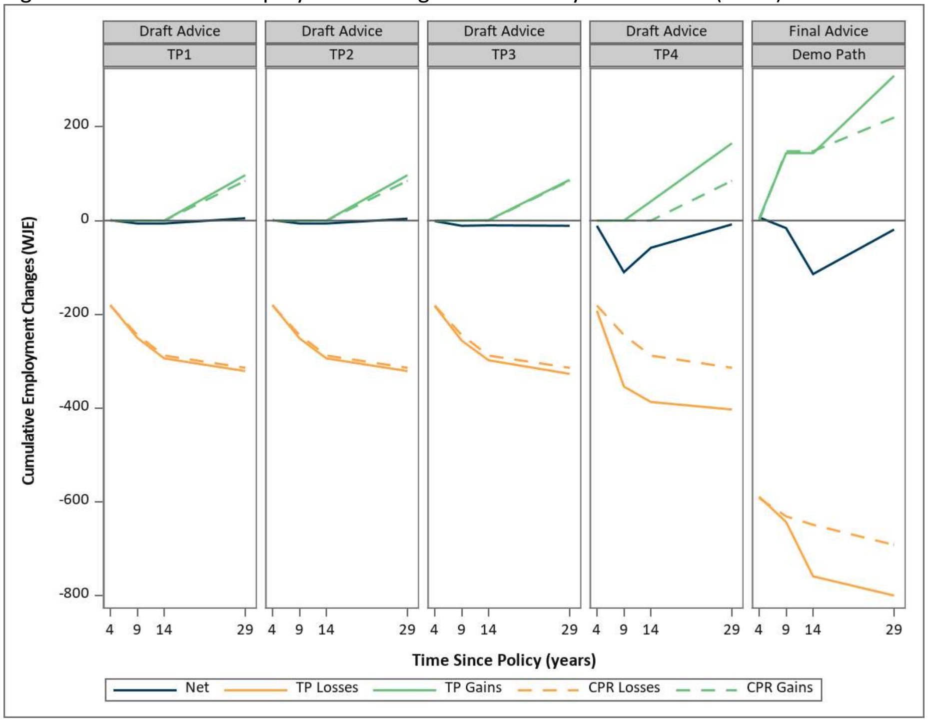


Figure 34. Average Annual Employment Changes in Electricity Distribution (D263) by Budget Period

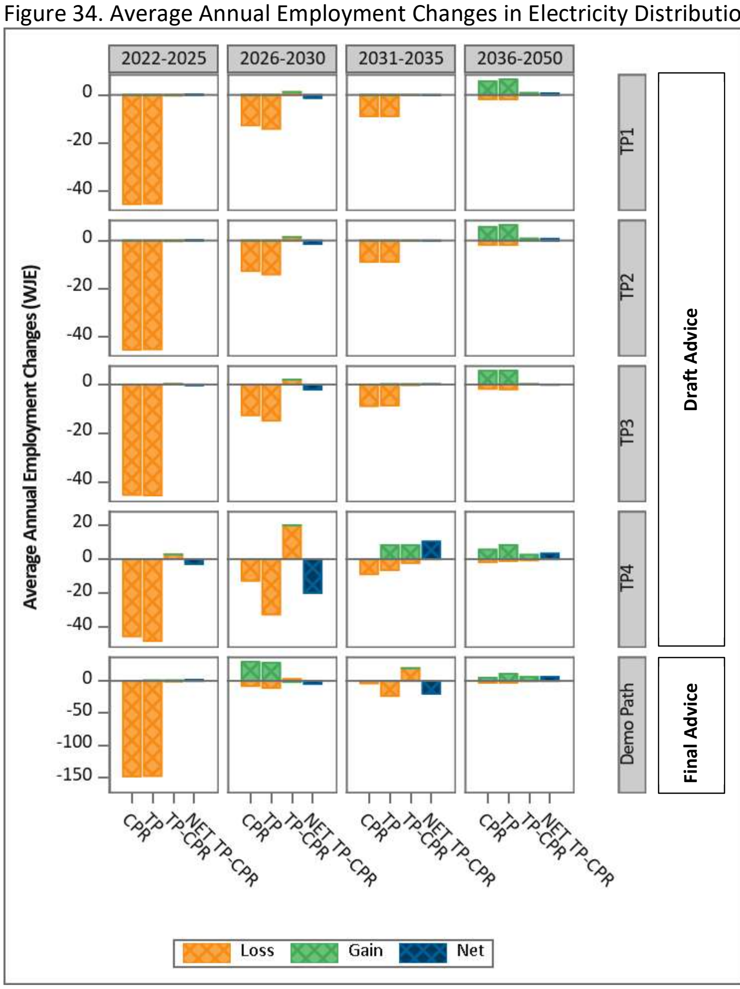


Figure 35. Cumulative Employment Changes in On Selling Electricity and Electricity Market Operation (D264)

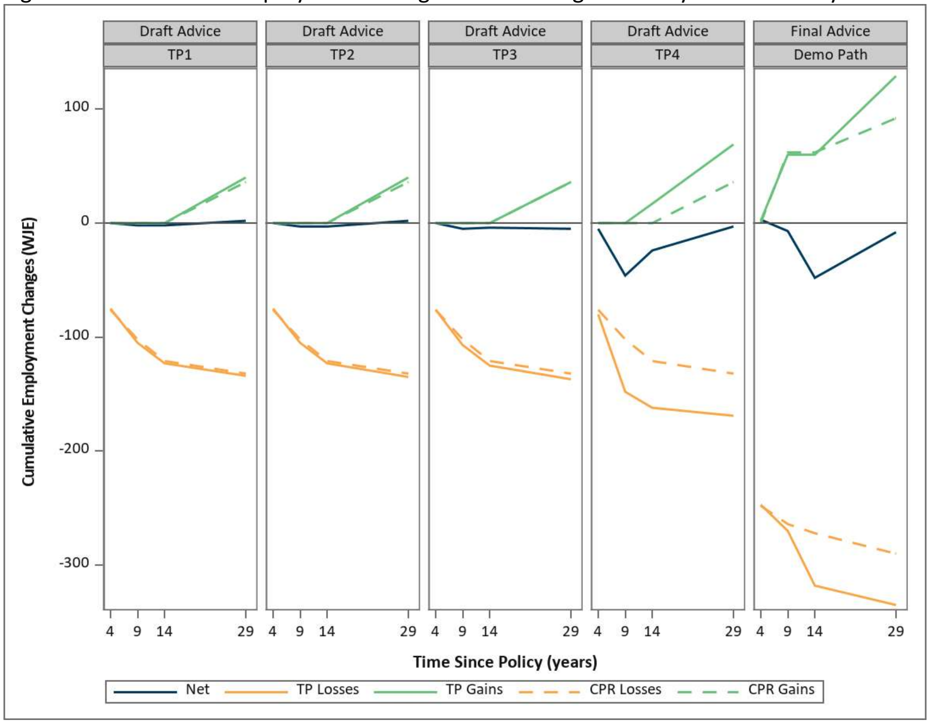


Figure 36. Average Annual Employment Changes in On Selling Electricity and Electricity Market Operation (D264) by Budget Period

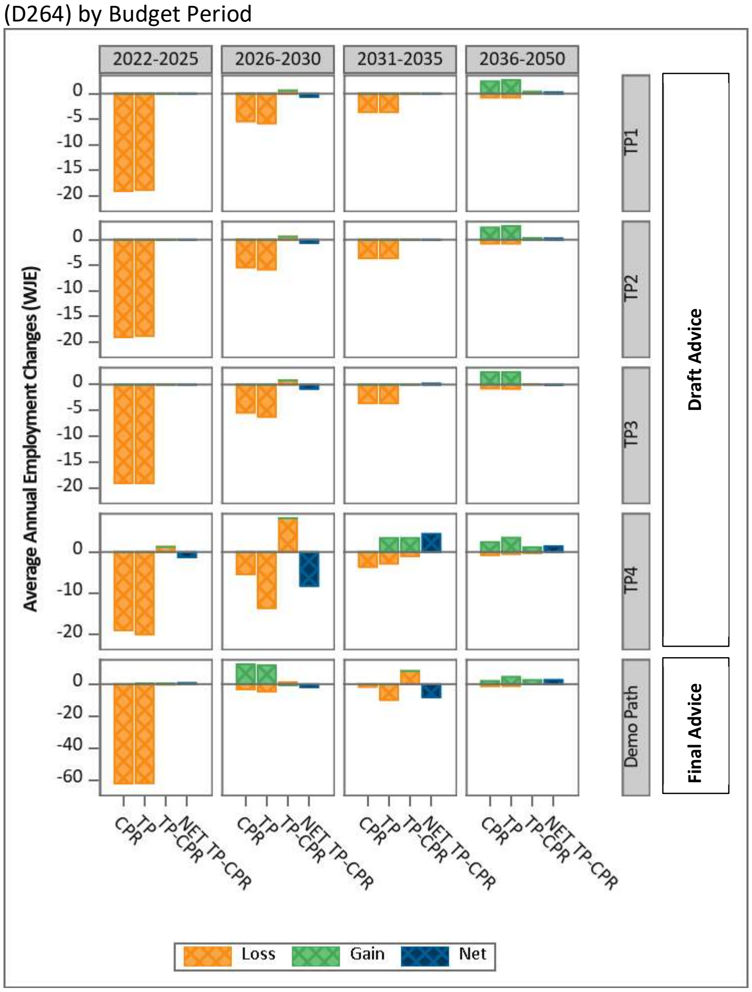


Figure 37. Cumulative Employment Changes in Gas Supply (D270)

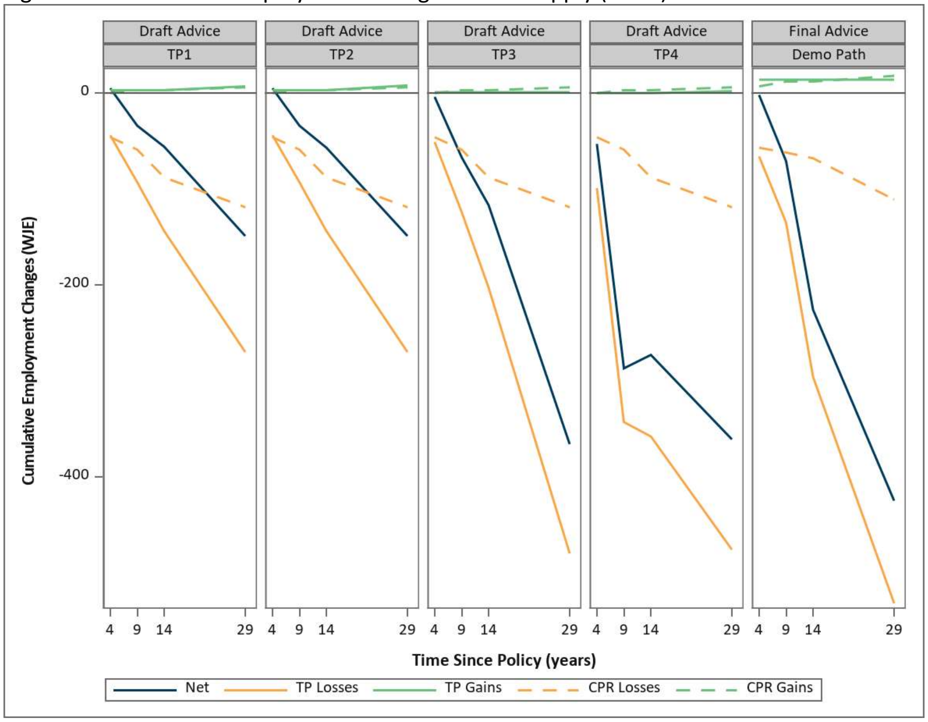


Figure 38. Average Annual Employment Changes in Gas Supply (D270) by Budget Period

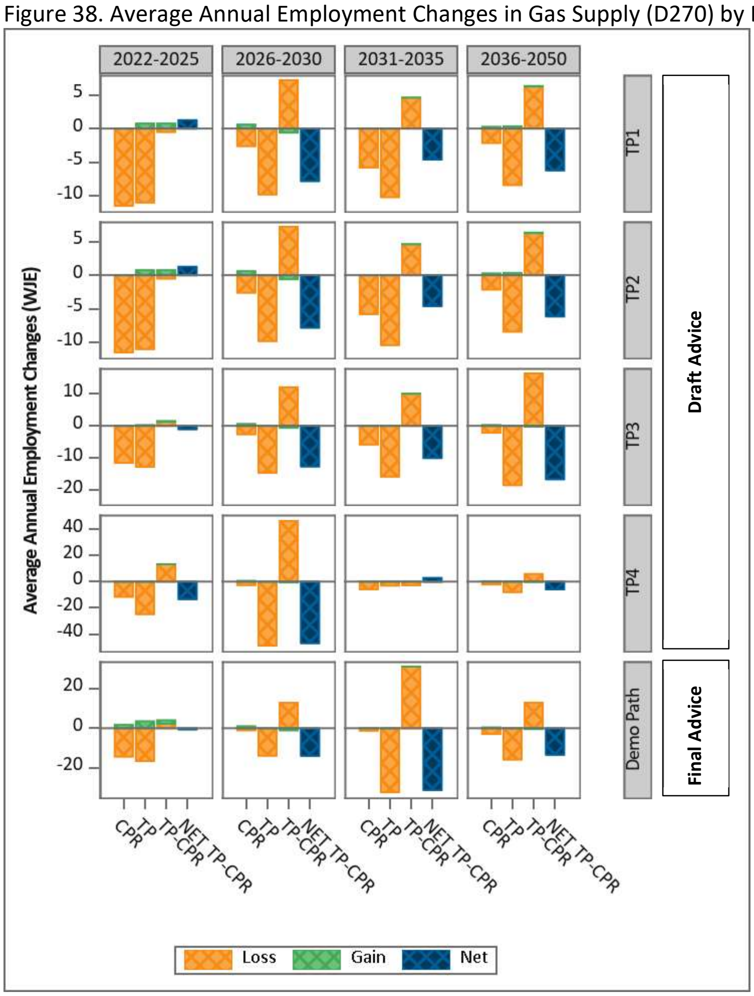


Figure 39: Enterprise Size for Most Affected Industries, 2018

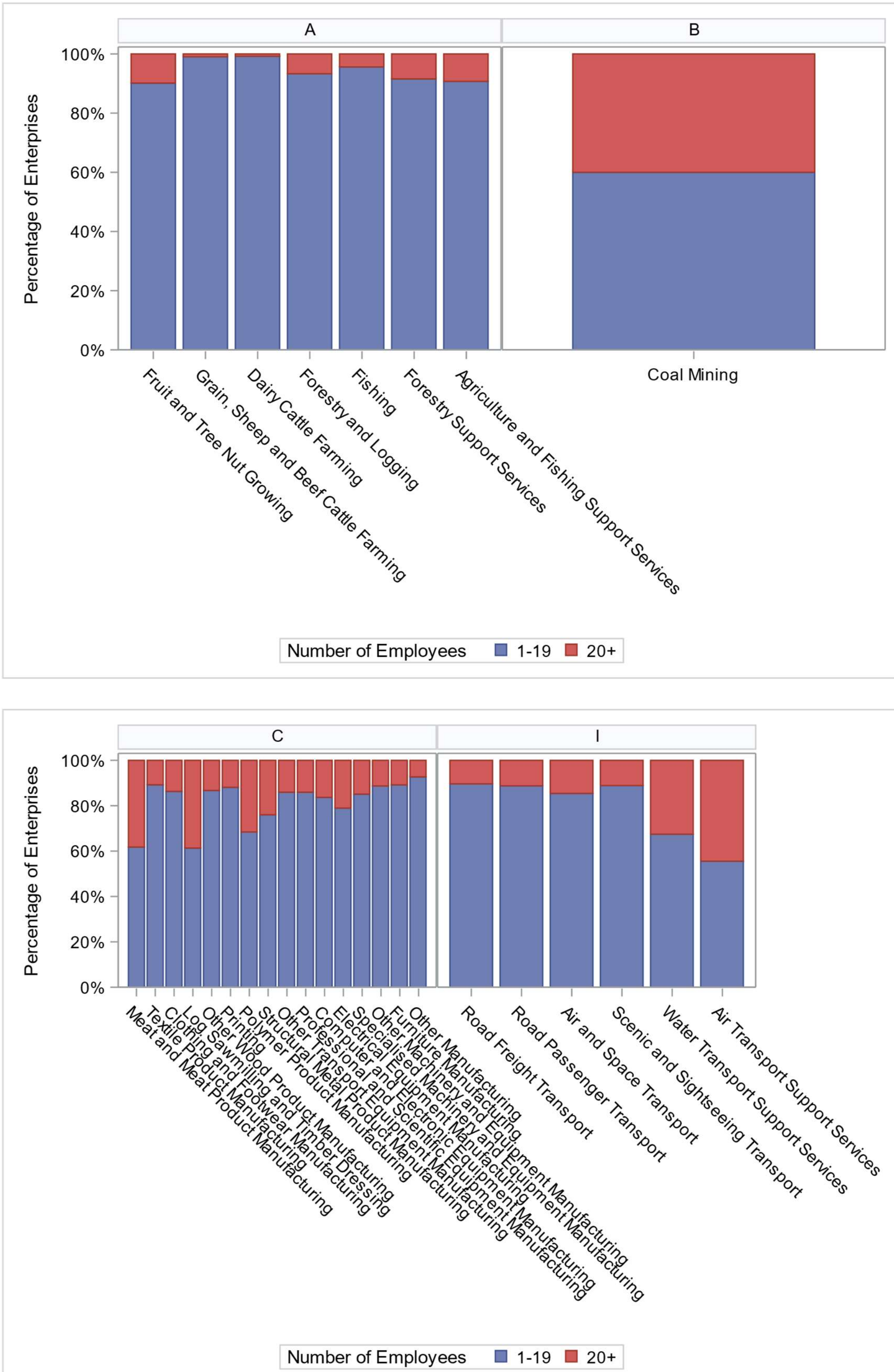


Figure 40. Cumulative Net Effects by 1-digit Industry, 2022-2025

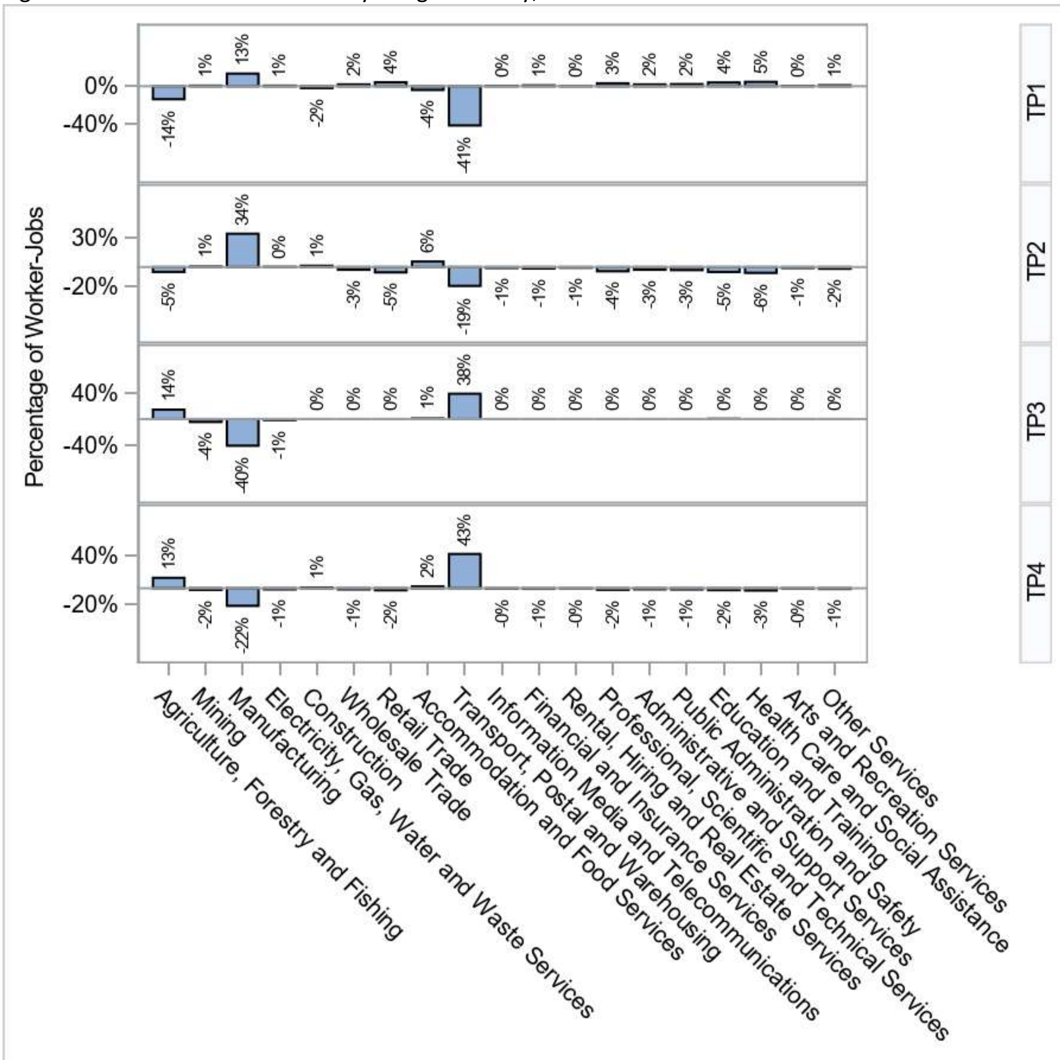


Figure 41. Cumulative Net Effects by 1-digit Industry for Draft Advice, 2022-2035

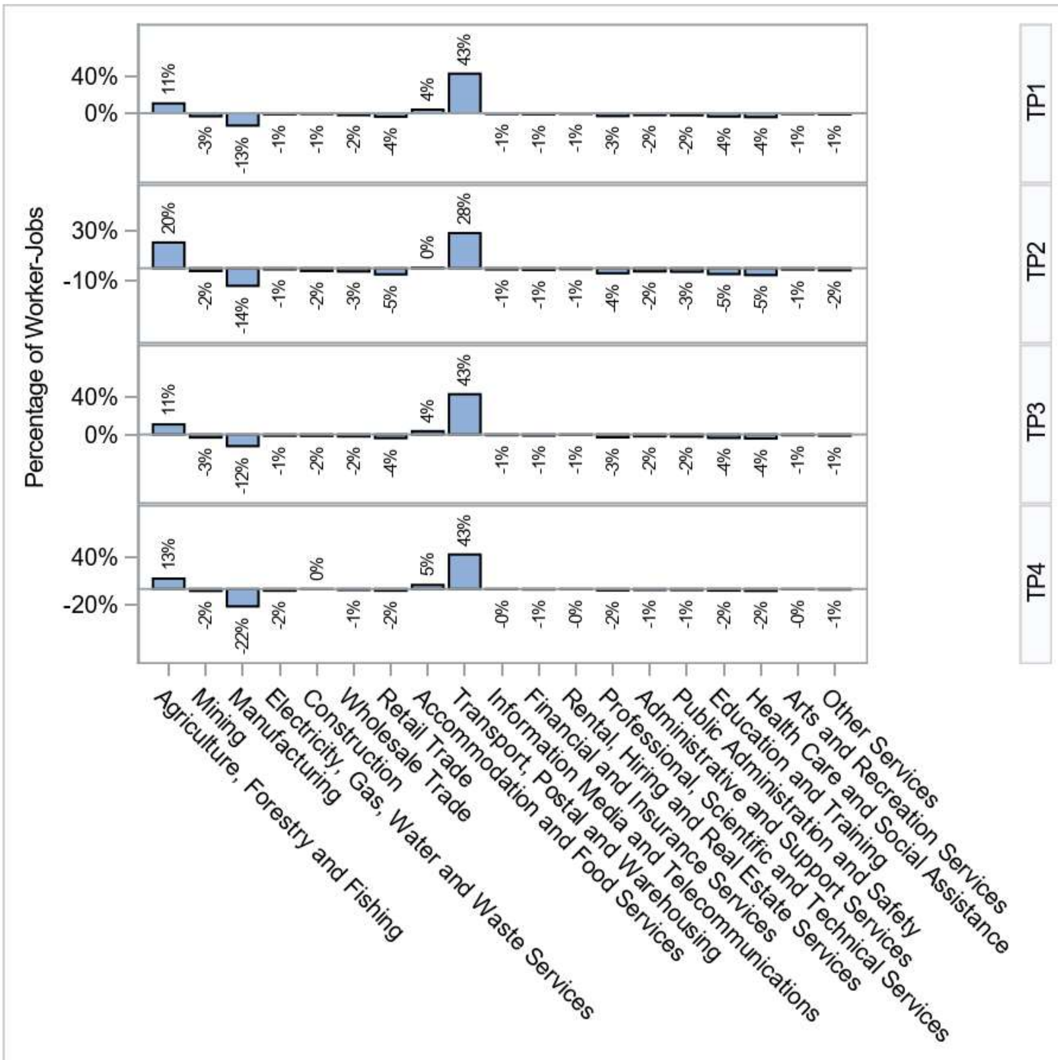


Figure 42. Cumulative Net Effects by 1-digit Industry for Draft Advice, 2022-2050

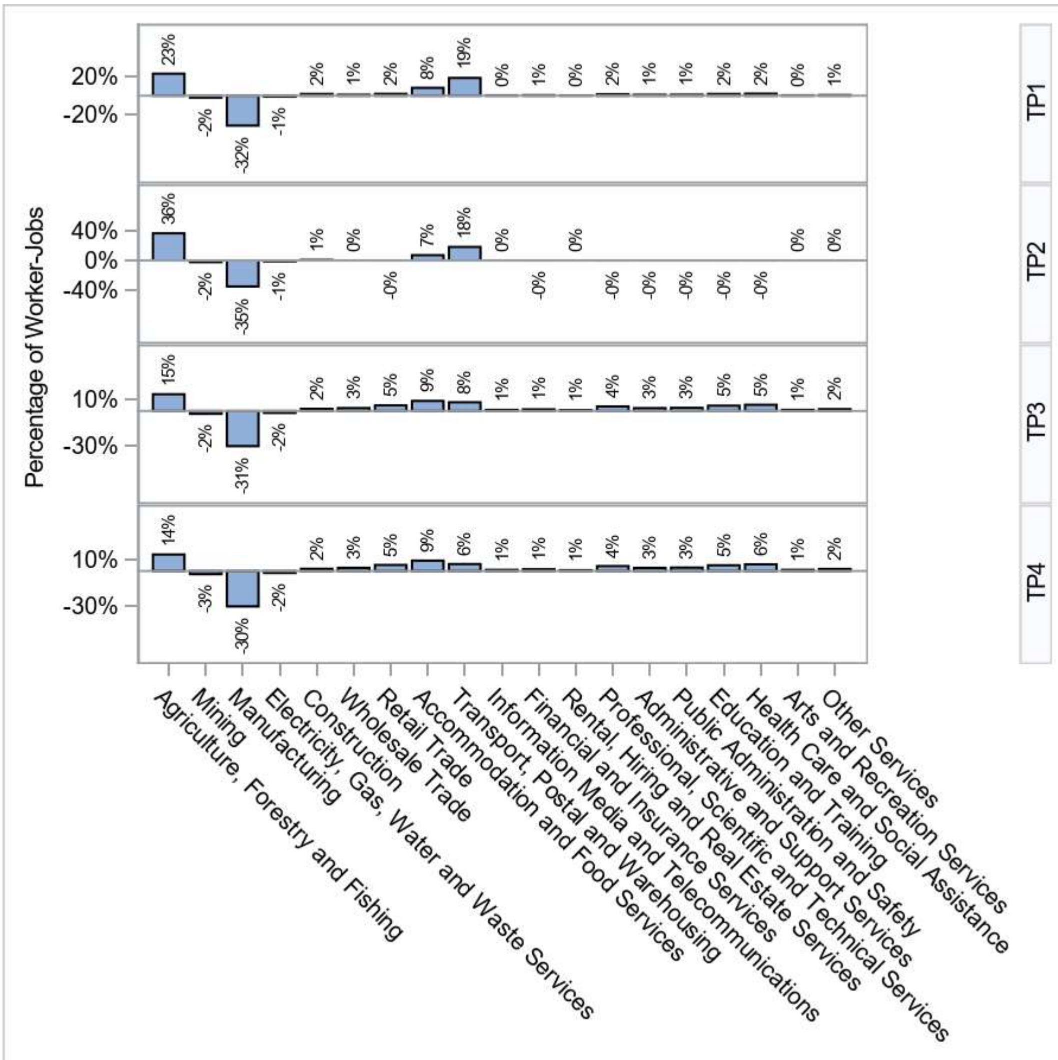


Figure 43. Simulated Worker-Job Earnings by Net Effect Type, 2022-2025

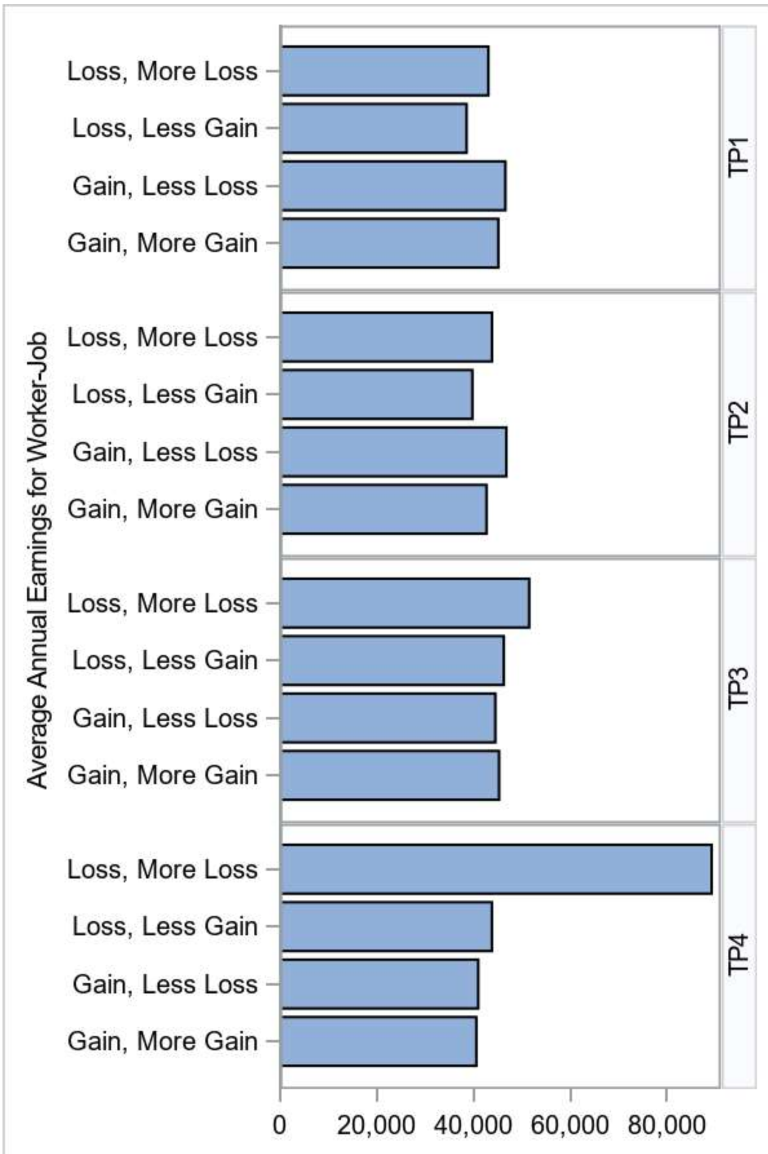


Figure 44. Simulated Worker-Job Earnings by Net Effect Type, 2022-2050

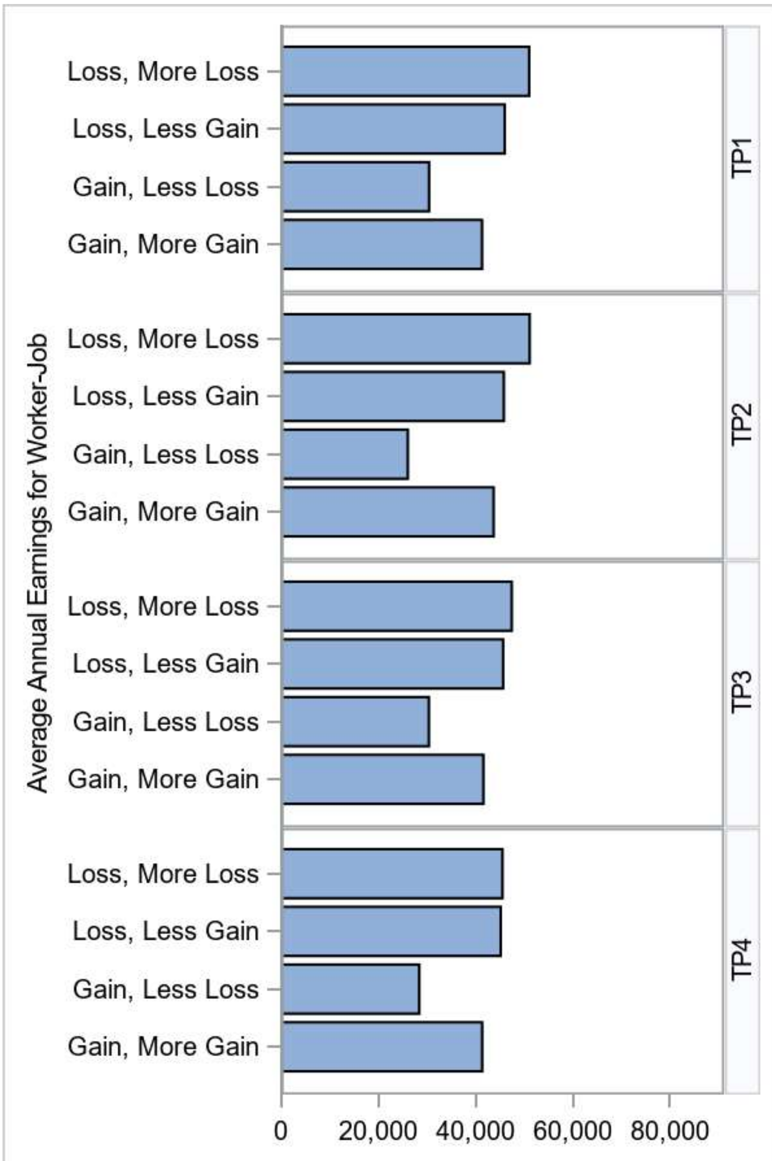
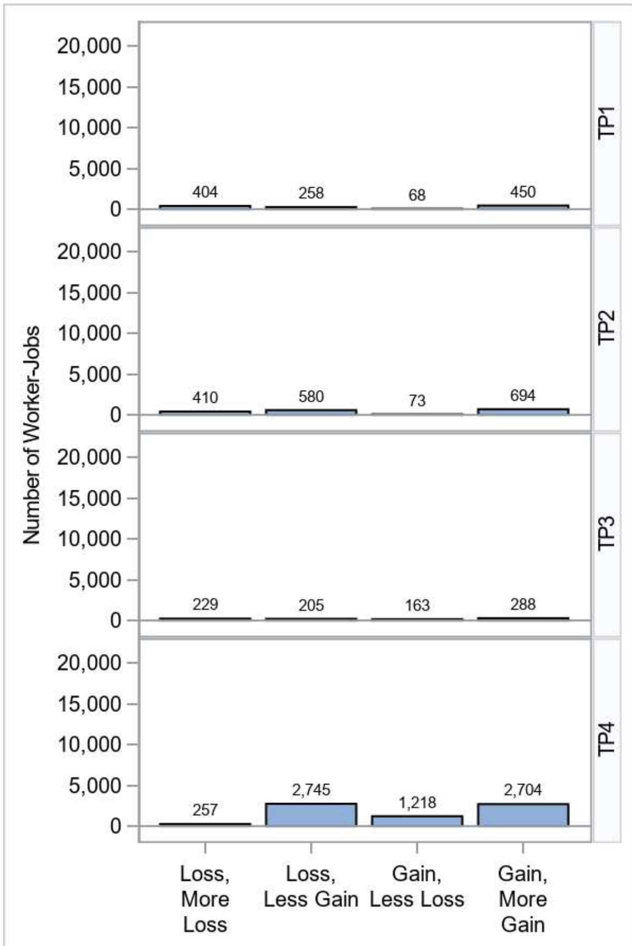


Figure 45. Counts of Simulated Worker-Jobs by Net Effect Type for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)



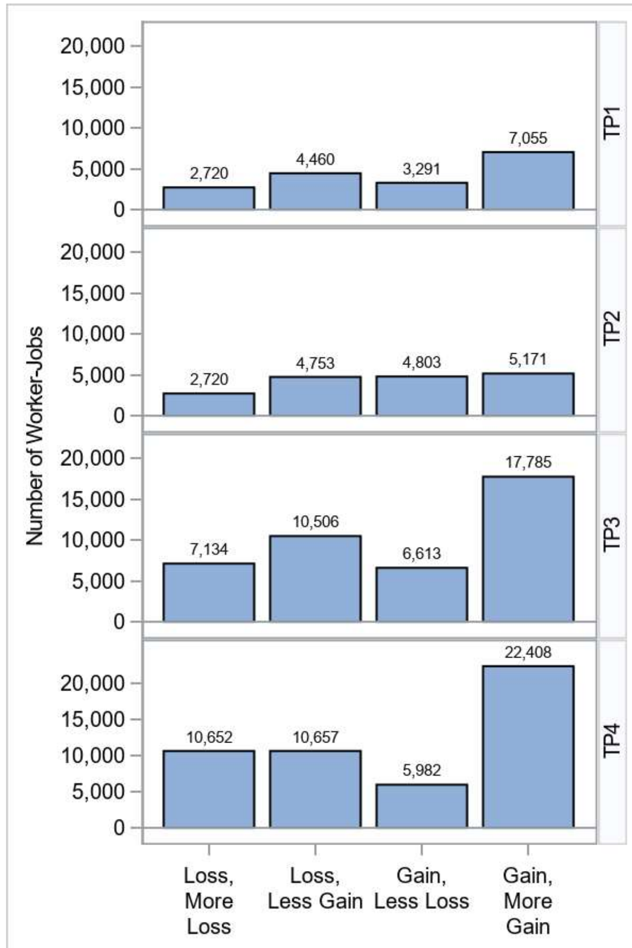
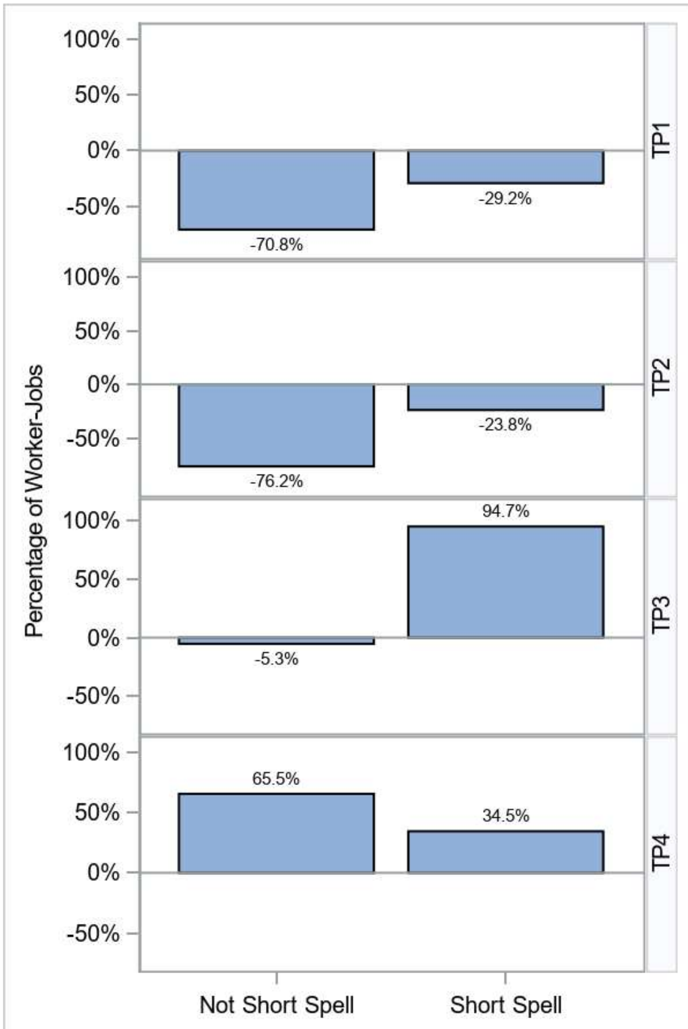


Figure 46. Share of Net Worker-Jobs for Short Spell Worker-Jobs for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)



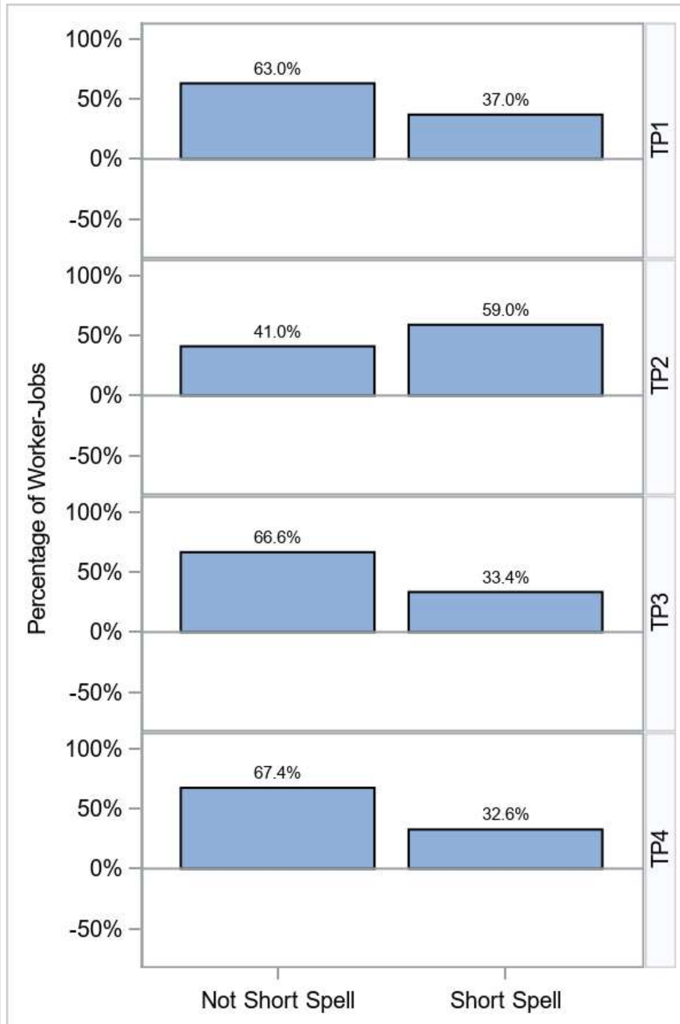


Figure 47. Share of Net Worker-Jobs by Gender for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

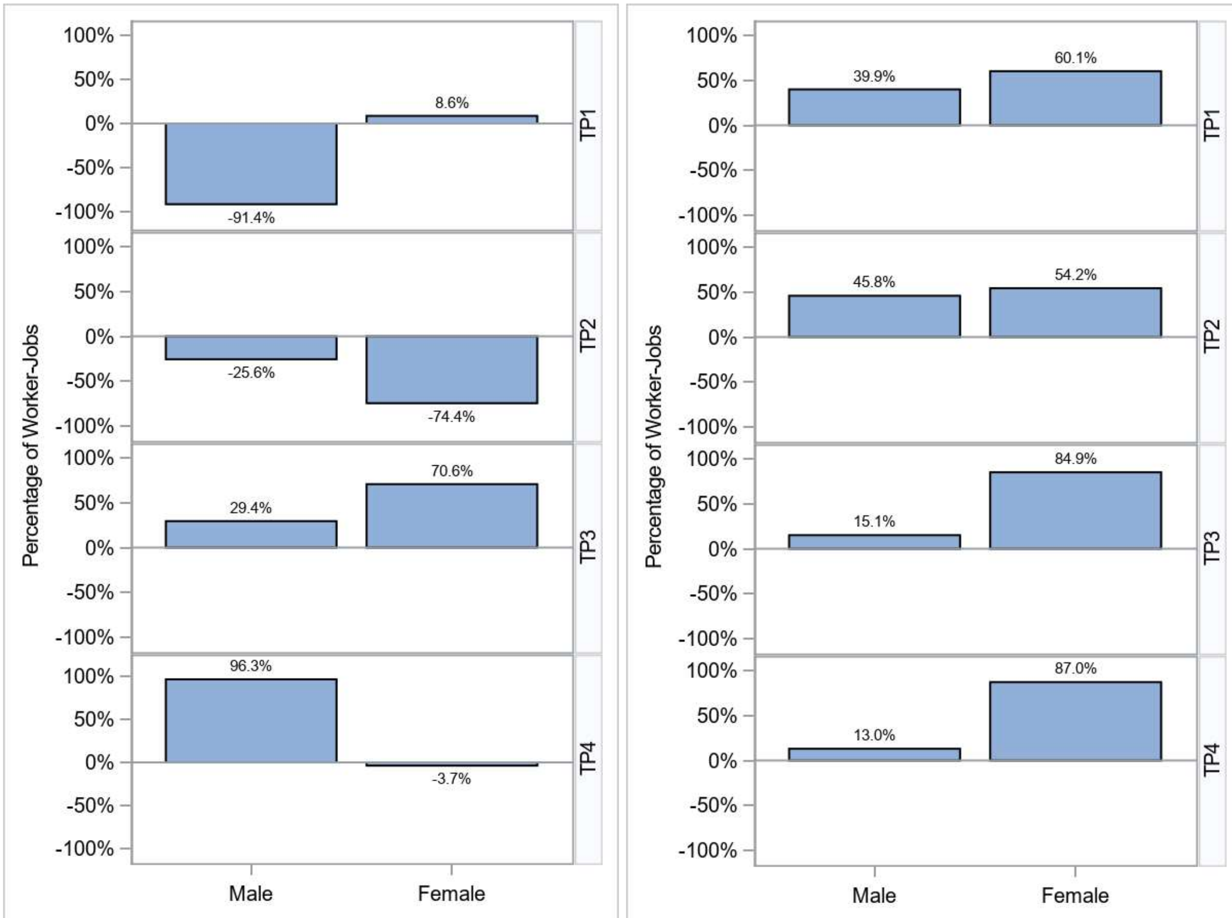


Figure 48. Share of Net Worker-Jobs by Highest Qualification for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

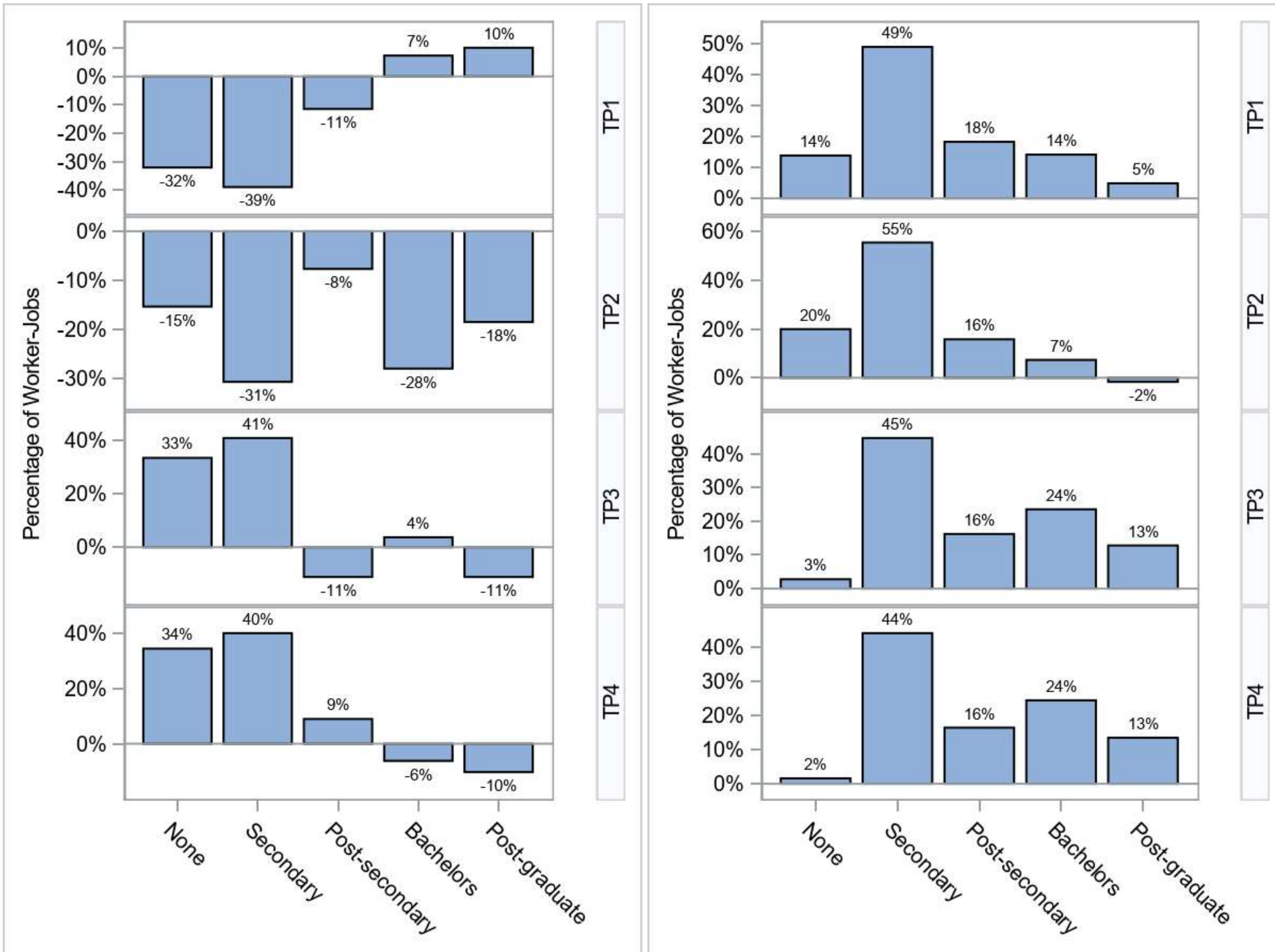


Figure 49. Share of Net Worker-Jobs by Ethnicity for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

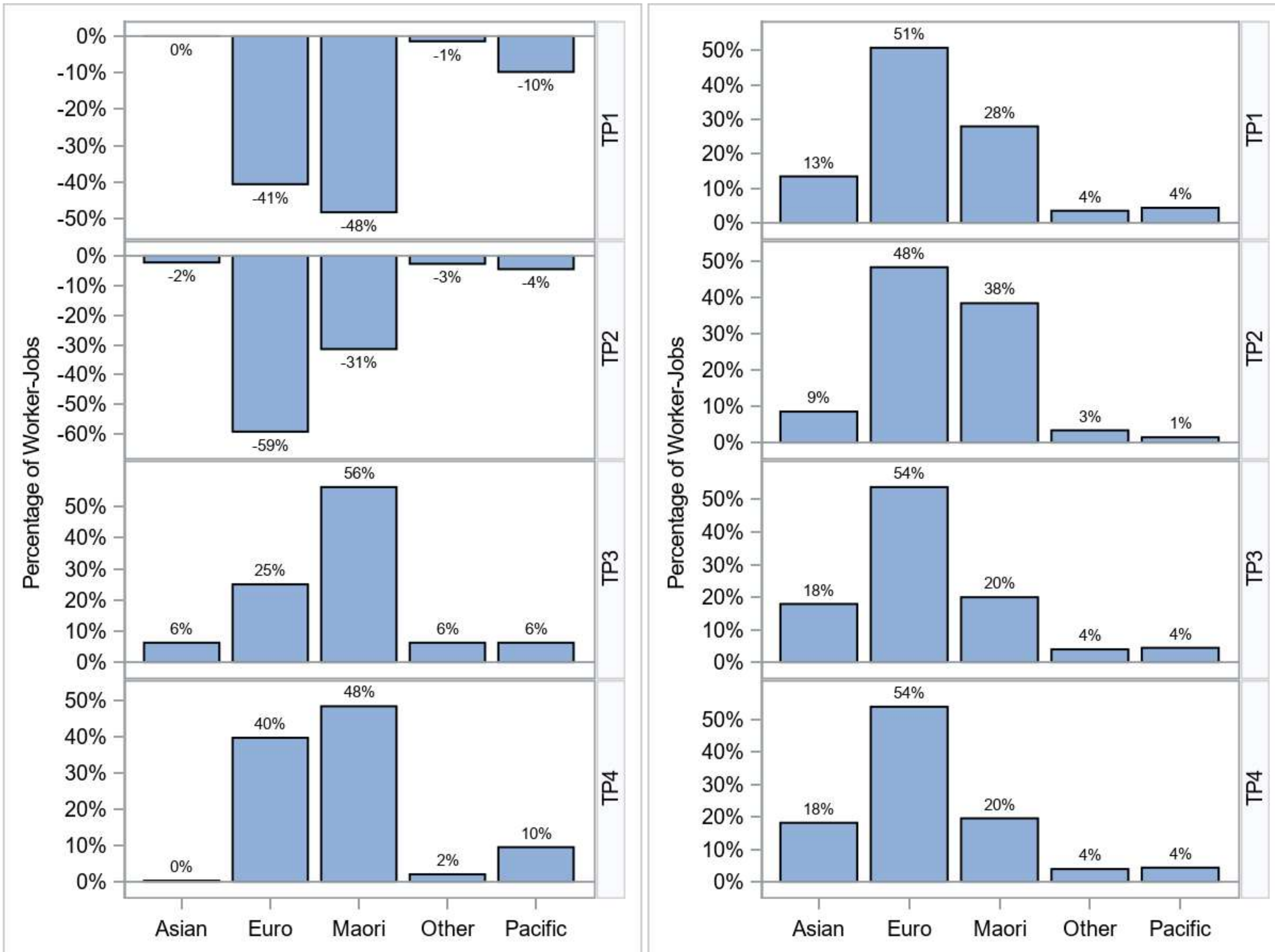


Figure 50. Detailed Shares of Net Effects by Ethnicity for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

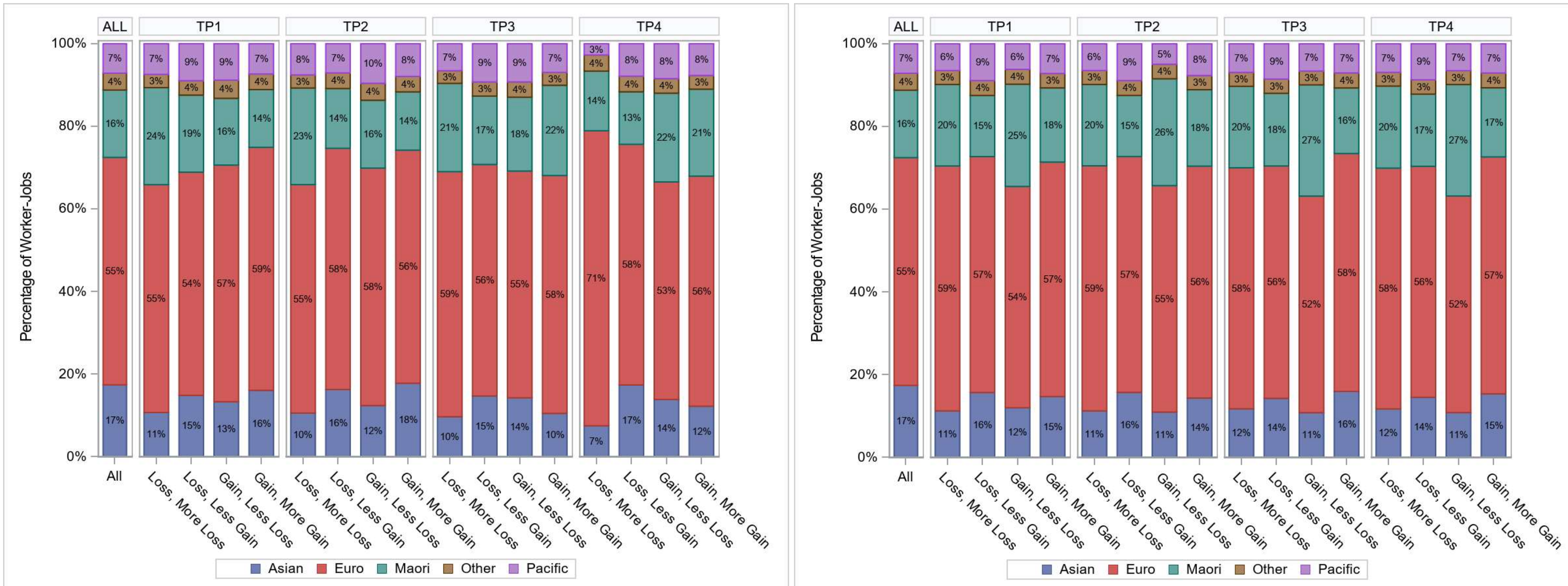


Figure 51. Share of Net Worker-Jobs by Age for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

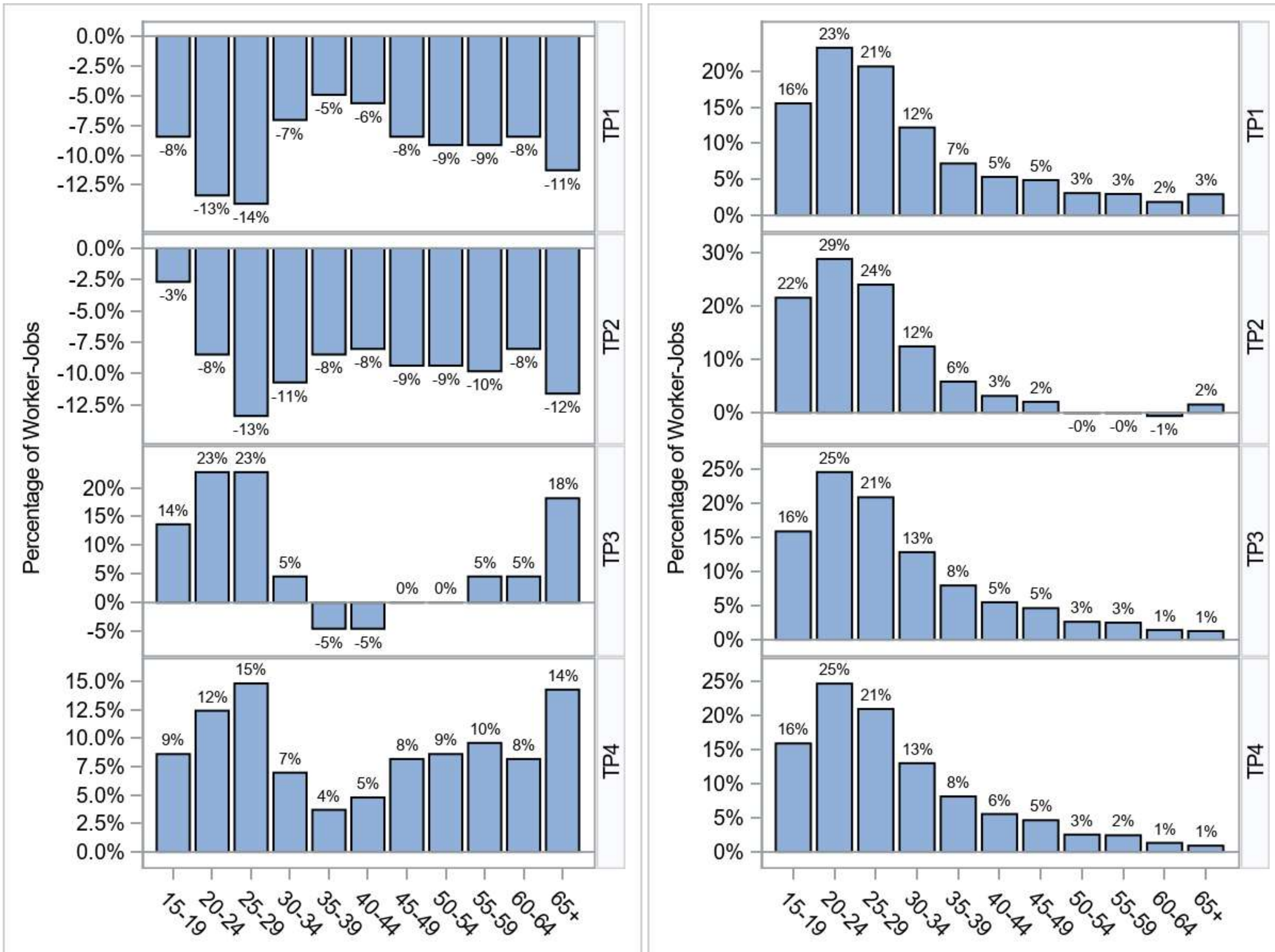


Figure 52. Share of Net Worker-Jobs by Region for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

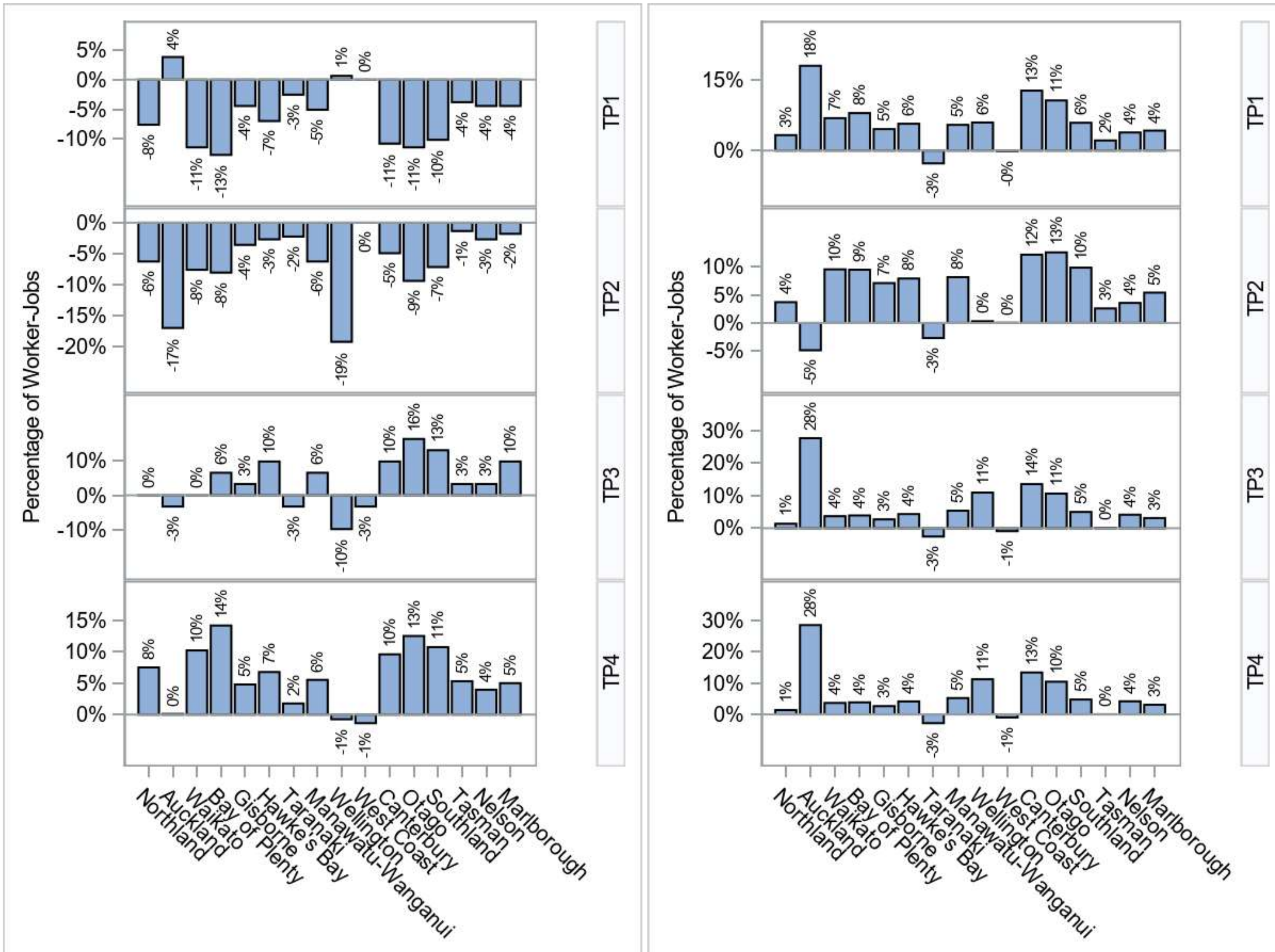


Figure 53. Detailed Shares of Net Effects by Region for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)

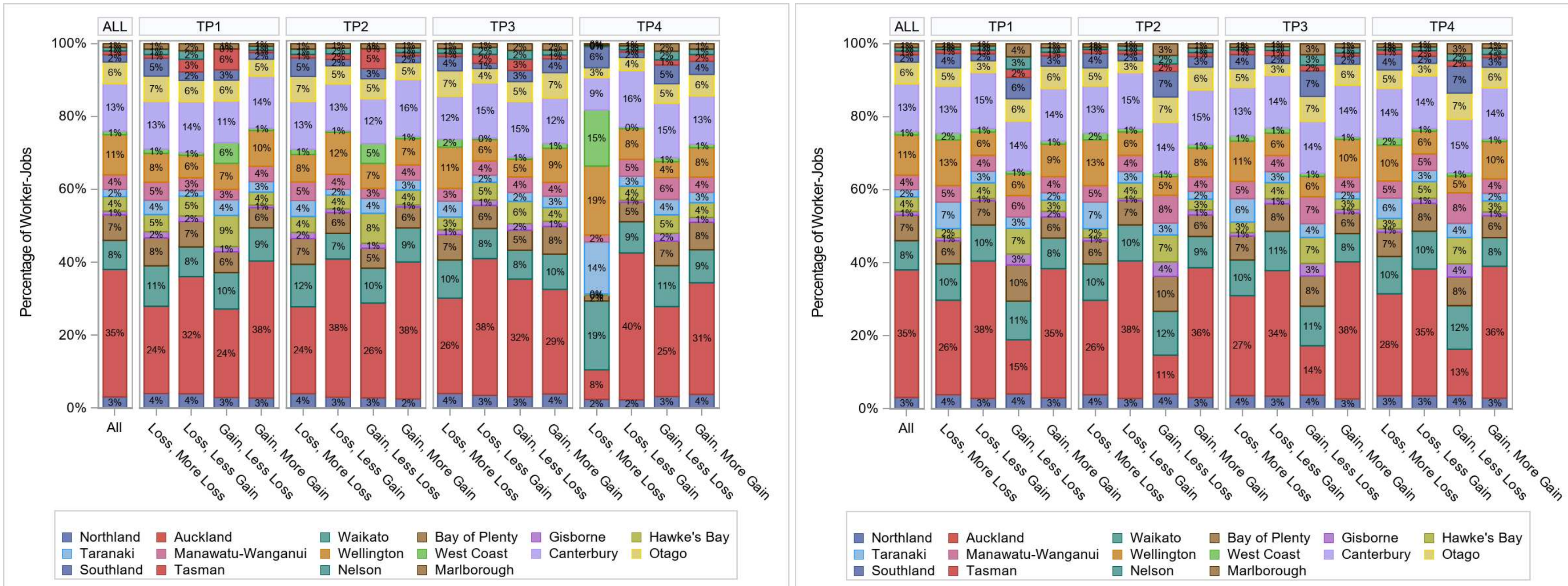
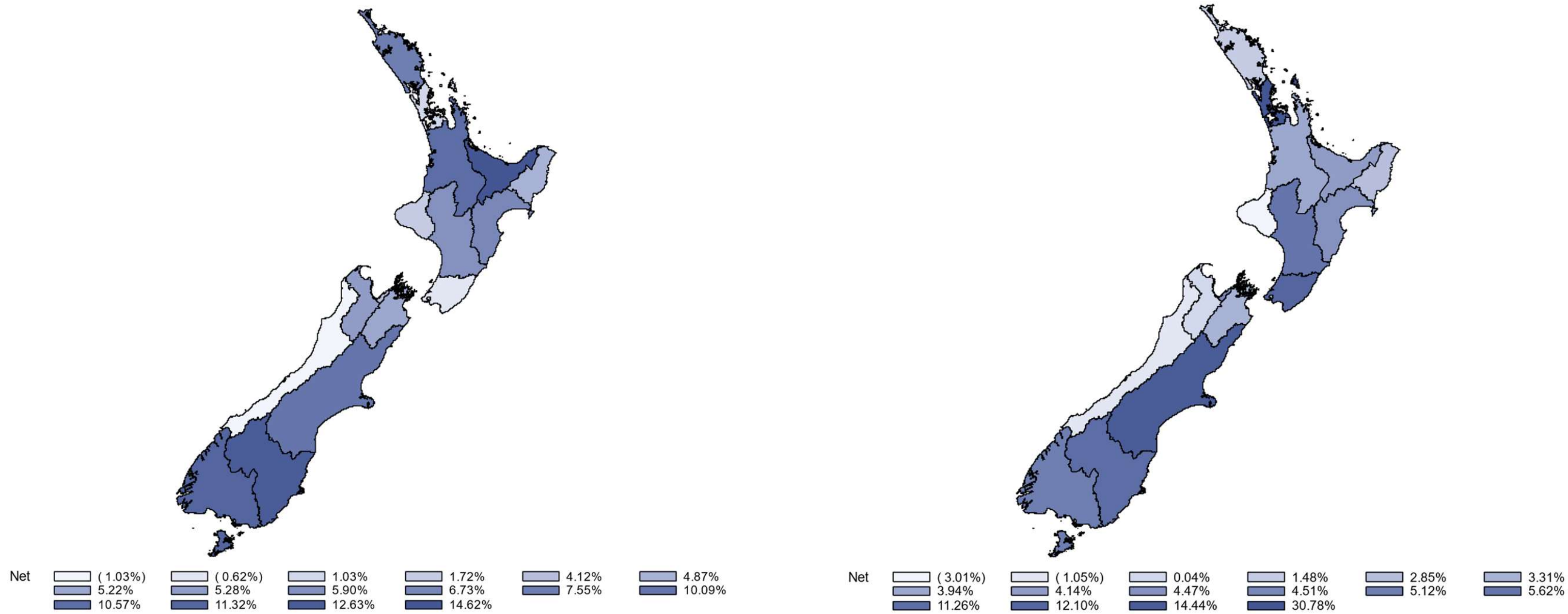


Figure 54. Net Effects by Region Under TP4 for 2022-2025 (Left Panel) and for 2022-2050 (Right Panel)



Appendix

Table of ANZSIC06 to GTAP Sectors

ANZSIC06 Code	ANZSIC Sector Description	GTAP Code	GTAP Sector Description
011	Nursery and Floriculture Production	hor	Horticulture
012	Mushroom and Vegetable Growing	hor	Horticulture
013	Fruit and Tree Nut Growing	hor	Horticulture
014	Grain, Sheep and Beef Cattle Farming	b_s	Beef and Sheep Farming
015	Other Crop Growing	hor	Horticulture
016	Dairy Cattle Farming	rmk	Dairy Farming
017	Poultry Farming	oap	Other Animal Products
018	Deer Farming	oap	Other Animal Products
019	Other Livestock Farming	oap	Other Animal Products
020	Aquaculture	fsh	Fishing
030	Forestry and Logging	frs	Forestry
041	Fishing	fsh	Fishing
042	Hunting and Trapping	fsh	Fishing
051	Forestry Support Services	frs	Forestry
052	Agriculture and Fishing Support Services	rmk b_s oap hor fsh	Dairy Farming, Beef and Sheep Farming, Other Animal Products, Horticulture Fishing
060	Coal Mining	col	Coal
070	Oil and Gas Extraction	cru gas	Oil and Gas
080	Metal Ore Mining	oxt	Mining of Metal Ores
091	Construction Material Mining	oxt	Mining of Metal Ores
099	Other Non-Metallic Mineral Mining and Quarrying	oxt	Mining of Metal Ores
101	Exploration	cru gas oxt	Oil, Gas and Mining of Metal Ores
109	Other Mining Support Services	cru gas oxt	Oil, Gas and Mining of Metal Ores
111	Meat and Meat Product Manufacturing	mtp	Meat Products
112	Seafood Processing	ofd	Other Food Processing
113	Dairy Product Manufacturing	mil	Dairy Products
114	Fruit and Vegetable Processing	ofd	Other Food Processing
115	Oil and Fat Manufacturing	ofd	Other Food Processing
116	Grain Mill and Cereal Product Manufacturing	ofd	Other Food Processing
117	Bakery Product Manufacturing	ofd	Other Food Processing
118	Sugar and Confectionery Manufacturing	ofd	Other Food Processing
119	Other Food Product Manufacturing	ofd	Other Food Processing

121	Beverage Manufacturing	ofd	Other Food Processing
122	Cigarette and Tobacco Product Manufacturing	ofd	Other Food Processing
131	Textile Fibre, Yarn and Woven Fabric Manufacturing	omf	Other Manufacturing
132	Leather Tanning and Fur Dressing	omf	Other Manufacturing
133	Textile Product Manufacturing	omf	Other Manufacturing
134	Knitted Product Manufacturing	omf	Other Manufacturing
135	Clothing and Footwear Manufacturing	omf	Other Manufacturing
141	Log Sawmilling and Timber Dressing	w_p	Wood, Wood Products, Paper and Paper Products
149	Other Wood Product Manufacturing	w_p	Wood, Wood Products, Paper and Paper Products
151	Pulp, Paper and Paperboard Manufacturing	w_p	Wood, Wood Products, Paper and Paper Products
152	Converted Paper Product Manufacturing	w_p	Wood, Wood Products, Paper and Paper Products
161	Printing	w_p	Wood, Wood Products, Paper and Paper Products
162	Reproduction of Recorded Media	w_p	Wood, Wood Products, Paper and Paper Products
170	Petroleum Refining and Petroleum and Coal Product Manufacturing	oil	Petroleum Products
181	Chemical Manufacturing	crp	Chemical Rubber and Plastic Products
182	Basic Polymer Manufacturing	crp	Chemical Rubber and Plastic Products
183	Fertiliser and Pesticide Manufacturing	crp	Chemical Rubber and Plastic Products
184	Pharmaceutical and Medicinal Product Manufacturing	crp	Chemical Rubber and Plastic Products
185	Cleaning Compound and Toiletry Preparation Manufacturing	crp	Chemical Rubber and Plastic Products
189	Other Basic Chemical Product Manufacturing	crp	Chemical Rubber and Plastic Products
191	Polymer Product Manufacturing	crp	Chemical Rubber and Plastic Products
192	Natural Rubber Product Manufacturing	crp	Chemical Rubber and Plastic Products
201	Glass and Glass Product Manufacturing	nmm	Non-Metallic Maniufacturing
202	Ceramic Product Manufacturing	nmm	Non-Metallic Maniufacturing
203	Cement, Lime, Plaster and Concrete Product Manufacturing	nmm	Non-Metallic Maniufacturing
209	Other Non-Metallic Mineral Product Manufacturing	nmm	Non-Metallic Maniufacturing
211	Basic Ferrous Metal Manufacturing	i_s	Iron and Steel
212	Basic Ferrous Metal Product Manufacturing	i_s	Iron and Steel

213	Basic Non-Ferrous Metal Manufacturing	nfm	Non-Ferrous Metals
214	Basic Non-Ferrous Metal Product Manufacturing	nfm	Non-Ferrous Metals
221	Iron and Steel Forging	i_s	Iron and Steel
222	Structural Metal Product Manufacturing	fmp	Fabricated Metal Products
223	Metal Container Manufacturing	fmp	Fabricated Metal Products
224	Other Sheet Metal Product Manufacturing	fmp	Fabricated Metal Products
229	Other Fabricated Metal Product Manufacturing	fmp	Fabricated Metal Products
231	Motor Vehicle and Motor Vehicle Part Manufacturing	mvh	Motor Vehicles and Parts
239	Other Transport Equipment Manufacturing	mvh	Motor Vehicles and Parts
241	Professional and Scientific Equipment Manufacturing	omf	Other Manufacturing
242	Computer and Electronic Equipment Manufacturing	omf	Other Manufacturing
243	Electrical Equipment Manufacturing	omf	Other Manufacturing
244	Domestic Appliance Manufacturing	omf	Other Manufacturing
245	Pump, Compressor, Heating and Ventilation Equipment Manufacturing	omf	Other Manufacturing
246	Specialised Machinery and Equipment Manufacturing	omf	Other Manufacturing
249	Other Machinery and Equipment Manufacturing	omf	Other Manufacturing
251	Furniture Manufacturing	omf	Other Manufacturing
259	Other Manufacturing	omf	Other Manufacturing
261	Electricity Generation	ecoa egas ehyd ewin esol eoth	Coal Electricity, Gas Electricity, Hydro Electricity, Wind Electricity, Solar Electricity and Geothermal Electricity
262	Electricity Transmission	tnd	Transmission and Distribution
263	Electricity Distribution	tnd	Transmission and Distribution
264	On Selling Electricity and Electricity Market Operation	tnd	Transmission and Distribution
270	Gas Supply	gas	Gas
281	Water Supply, Sewerage and Drainage Services	ser	Services
291	Waste Collection Services	ser	Services
292	Waste Treatment, Disposal and Remediation Services	ser	Services
301	Residential Building Construction	cns	Construction
302	Non-Residential Building Construction	cns	Construction
310	Heavy and Civil Engineering Construction	cns	Construction
321	Land Development and Site Preparation Services	cns	Construction

322	Building Structure Services	cns	Construction
323	Building Installation Services	cns	Construction
324	Building Completion Services	cns	Construction
329	Other Construction Services	cns	Construction
331	Agricultural Product Wholesaling	ser	Services
332	Mineral, Metal and Chemical Wholesaling	ser	Services
333	Timber and Hardware Goods Wholesaling	ser	Services
341	Specialised Industrial Machinery and Equipment Wholesaling	ser	Services
349	Other Machinery and Equipment Wholesaling	ser	Services
350	Motor Vehicle and Motor Vehicle Parts Wholesaling	ser	Services
360	Grocery, Liquor and Tobacco Product Wholesaling	ser	Services
371	Textile, Clothing and Footwear Wholesaling	ser	Services
372	Pharmaceutical and Toiletry Goods Wholesaling	ser	Services
373	Furniture, Floor Coverings and Other Goods Wholesaling	ser	Services
380	Commission Based Wholesaling	ser	Services
391	Motor Vehicle Retailing	ser	Services
392	Motor Vehicle Parts Retailing	ser	Services
400	Fuel Retailing	ser	Services
411	Supermarket and Grocery Stores	ser	Services
412	Specialised Food Retailing	ser	Services
421	Furniture, Floor Coverings, Houseware and Textile Goods Retailing	ser	Services
422	Electrical and Electronic Goods Retailing	ser	Services
423	Hardware, Building and Garden Supplies Retailing	ser	Services
424	Recreational Goods Retailing	ser	Services
425	Clothing, Footwear and Personal Accessories Retailing	ser	Services
426	Department Stores	ser	Services
427	Pharmaceutical and Other Store-Based Retailing	ser	Services
431	Non Store Retailing	ser	Services
432	Retail Commission Based Buying and/or Selling	ser	Services
440	Accommodation	afs	Accommodation and Food Services
451	Cafes, Restaurants and Takeaway Food Services	afs	Accommodation and Food Services
452	Pubs, Taverns and Bars	afs	Accommodation and Food Services
453	Clubs (Hospitality)	afs	Accommodation and Food Services
461	Road Freight Transport	rtp	Road Transport

462	Road Passenger Transport	rtp	Road Transport
471	Rail Freight Transport	rtp	Road Transport
472	Rail Passenger Transport	rtp	Road Transport
481	Water Freight Transport	wtp	Water Transport
482	Water Passenger Transport	wtp	Water Transport
490	Air and Space Transport	atp	Air Transport
501	Scenic and Sightseeing Transport	rtp atp wtp	Road transport, Air Transport and Water Transport
502	Pipeline and Other Transport	rtp	Road Transport
510	Postal and Courier Pick-up and Delivery Services	ser	Services
521	Water Transport Support Services	wtp	Water Transport
522	Air Transport Support Services	atp	Air Transport
529	Other Transport Support Services	ser	Services
530	Warehousing and Storage Services	ser	Services
541	Newspaper, Periodical, Book and Directory Publishing	ser	Services
542	Software Publishing	ser	Services
551	Motion Picture and Video Activities	ser	Services
552	Sound Recording and Music Publishing	ser	Services
561	Radio Broadcasting	ser	Services
562	Television Broadcasting	ser	Services
570	Internet Publishing and Broadcasting	ser	Services
580	Telecommunications Services	ser	Services
591	Internet Service Providers and Web Search Portals	ser	Services
592	Data Processing, Web Hosting and Electronic Information Storage Services	ser	Services
601	Libraries and Archives	ser	Services
602	Other Information Services	ser	Services
621	Central Banking	ser	Services
622	Depository Financial Intermediation	ser	Services
623	Non-depository Financing	ser	Services
624	Financial Asset Investing	ser	Services
631	Life Insurance	ser	Services
632	Health and General Insurance	ser	Services
633	Superannuation Funds	ser	Services
641	Auxiliary Finance and Investment Services	ser	Services
642	Auxiliary Insurance Services	ser	Services
661	Motor Vehicle and Transport Equipment Rental and Hiring	ser	Services
662	Farm Animals and Bloodstock Leasing	ser	Services

663	Other Goods and Equipment Rental and Hiring	ser	Services
664	Non-Financial Intangible Assets (except Copyrights) Leasing	ser	Services
671	Property Operators	ser	Services
672	Real Estate Services	ser	Services
691	Scientific Research Services	ser	Services
692	Architectural, Engineering and Technical Services	ser	Services
693	Legal and Accounting Services	ser	Services
694	Advertising Services	ser	Services
695	Market Research and Statistical Services	ser	Services
696	Management and Other Consulting Services	ser	Services
697	Veterinary Services	ser	Services
699	Other Professional, Scientific and Technical Services	ser	Services
700	Computer Systems Design and Related Services	ser	Services
721	Employment Services	ser	Services
722	Travel Agency Services	ser	Services
729	Other Administrative Services	ser	Services
731	Building Cleaning, Pest Control and Gardening Services	ser	Services
732	Packaging and Labelling Services	ser	Services
751	Central Government Administration	ser	Services
752	State Government Administration	ser	Services
753	Local Government Administration	ser	Services
754	Justice	ser	Services
755	Government Representation	ser	Services
760	Defence	ser	Services
771	Public Order and Safety Services	ser	Services
772	Regulatory Services	ser	Services
801	Preschool Education	ser	Services
802	School Education	ser	Services
810	Tertiary Education	ser	Services
821	Adult, Community and Other Education	ser	Services
822	Educational Support Services	ser	Services
840	Hospitals	ser	Services
851	Medical Services	ser	Services
852	Pathology and Diagnostic Imaging Services	ser	Services
853	Allied Health Services	ser	Services
859	Other Health Care Services	ser	Services
860	Residential Care Services	ser	Services
871	Child Care Services	ser	Services

879	Other Social Assistance Services	ser	Services
891	Museum Operation	ser	Services
892	Parks and Gardens Operations	ser	Services
900	Creative and Performing Arts Activities	ser	Services
911	Sport and Physical Recreation Activities	ser	Services
912	Horse and Dog Racing Activities	ser	Services
913	Amusement and Other Recreation Activities	ser	Services
920	Gambling Activities	ser	Services
941	Automotive Repair and Maintenance	ser	Services
942	Machinery and Equipment Repair and Maintenance	ser	Services
949	Other Repair and Maintenance	ser	Services
951	Personal Care Services	ser	Services
952	Funeral, Crematorium and Cemetery Services	ser	Services
953	Other Personal Services	ser	Services
954	Religious Services	ser	Services
955	Civic, Professional and Other Interest Group Services	ser	Services
960	Private Households Employing Staff	ser	Services