Sectoral reallocation and income growth in the labour market during the COVID-19 pandemic*

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Abstract

This paper discusses the impact of the COVID-19 pandemic on the labour market in New Zealand, analysing labour flows and income pressures. The study uses a large administrative dataset to understand labour reallocation during the pandemic and links this to two different measures of income growth. We find that the COVID-19 shock was both an atypical and relatively persistent reallocation shock to the New Zealand labour market. In particular, the observed increase in job-to-job transitions was predominantly driven by higher-than-usual transitions *between* industries rather than *within* industries. It is these increased between-industry transitions that have been positively correlated with aggregate labour market income growth.

Keywords: sectoral reallocation, labour market dynamics, COVID-19, wage and income growth

1. Introduction

The COVID-19 pandemic period has been described as an atypical reallocation shock for global labour markets (Casarico and Lattanzio (2022), Barrero et al. (2021), Barrero et al. (2020)), with the pandemic having significant implications for both the demand for and supply of labour. The immediate and relatively severe government health restrictions shifted both consumer and business behaviour in ways that would have reallocated labour demand across the economy. This includes the inability to consume and trade due to statutory restrictions, and a reduction in consumer demand from an increase in precautionary behaviour. Similarly, altered worker decision-making – for example, through increased precautionary behaviour in response to health risks – would have changed labour supply.

In New Zealand, these pandemic-related impacts were expected to lead to an increase in structural unemployment as skill mismatches increased (Bannister et al., 2020). This increase was expected to be relatively persistent, especially in an economy whose international labour flows were restricted by stringent border controls. Instead, after a mild, short-lived increase

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(with no clear outward shift in the Beveridge curve RBNZ (2021)), the unemployment rate fell dramatically in the face of a strong bounce-back in aggregate economic activity. This paper uses a large administrative dataset to analyse labour market flows in New Zealand, with a focus on understanding labour reallocation over the COVID-19 pandemic period.

Overall, we find that there has been an increase in job-to-job transitions relative to pre-pandemic ("normal") levels in New Zealand.[1] However, this has predominantly been driven by higher-than-usual transitions between industries rather than within industries. Unsurprisingly, employment in high-contact and tourism-related industries was the most negatively affected, while construction and healthcare industries exhibited growth in relative employment shares. Relatively reduced flows into high-contact and tourism-related industries can be seen across all other industries, whereas the pull into the healthcare industry has been stronger than usual - especially from high-contact and tourism-related industries, as well as primary and secondary sectors (including the construction industry). This is a somewhat surprising finding, suggesting that skills are generally more transferable between industries than would have been assumed *a priori*.

In addition, this paper investigates the relationship between labour flows and income pressures, distinguishing between within-industry and between-industry transitions. In line with the findings of Coleman and Zheng (2020), we find that it is these between-industry job-to-job transitions that are positively correlated with income growth at the aggregate level. In particular, our results suggest the increase in income growth over the COVID-19 period might have been supported by higher between-industry flows, even after controlling for the impacts of inflation and economic activity.

2. Related literature

In the face of a global pandemic - unprecedented in its scale, at least in recent memory - governments worldwide began closing borders and significantly reducing economic activity in certain industries. This had an immediate and large, but highly unequal, impact on labour markets. For example, industries that allowed for working-from-home benefitted from the labour reallocation in the US (Barrero et al., 2021), while non-essential high-contact industries experienced the largest job losses (Famiglietti et al., 2020).

The COVID-19 shock would have resulted in increased flows into and out of the labour market, but also within the labour market, with workers changing jobs within industries or between them. In the euro area, US, UK, and Australia, elevated job-to-job flows followed the onset of the pandemic (Gómez (2022), Barrero et al. (2020), Black and Chow (2022)), although the composition of those elevated flows (whether driven by within- or between-industry flows) differed by country and industry.[2] For example, Thwaites et al. (2021) finds

[1] Where job-to-job transitions capture workers who are moving from one employer to another without a spell of unemployment, and we consider the 5-year average prior to the onset of the pandemic to represent normal levels.

[2] It should be noted that there exists some disagreement in the literature as regards to the reallocative nature of the COVID-19 shock. For example, Consolo and Petroulakis (2022) find no clear evidence of an increase in job-to-job transitions or mismatch unemployment in the US.

that while between-industry employment reallocation doubled relative to pre-pandemic levels in the UK, it was still the within-industry component that drove excess reallocation. Black and Chow (2022) similarly find that within-sector flows are generally a larger driver of increased job mobility (job-to-job flows), but the relative contribution of each type of flow (within, or between) differs by industry grouping.

Overall, job-to-job transitions have been shown to be pro-cyclical, indicating growing or easing income pressures (Ball et al. (2020), Karagedikli et al. (2018), Karahan et al. (2017)). In particular, between-industry transitions tend to result in higher wage premiums (Coleman and Zheng, 2020), which has important implications for inflation dynamics. Together with the implications of job-to-job transitions for productivity growth, Guerrieri et al. (2021) and Ferrante et al. (2023) highlight the relevance of understanding sectoral demand reallocation for the conduct of optimal monetary policy.

3. Data

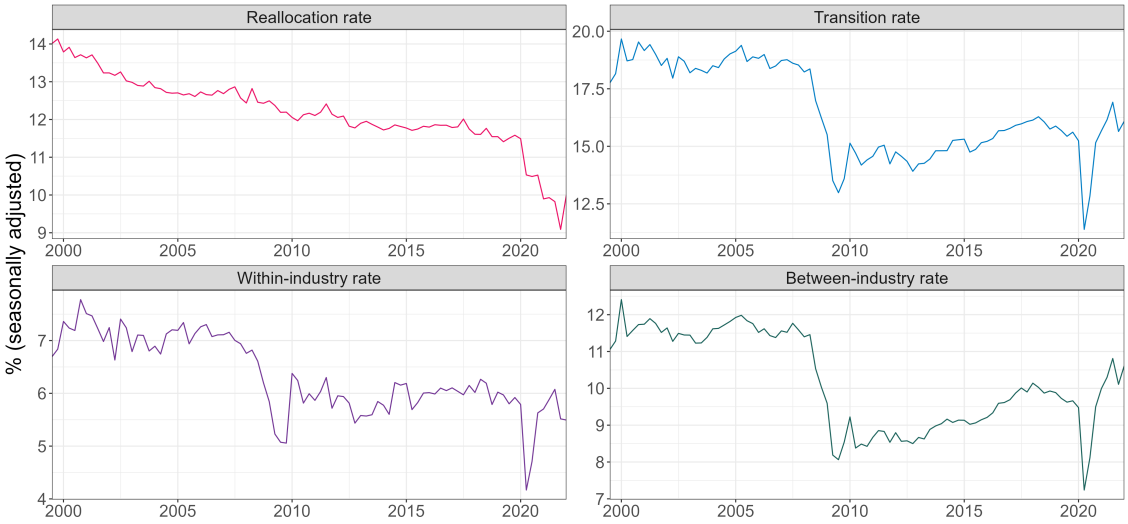
We use the Employer Monthly Schedule (EMS) dataset in the Integrated Data Infrastructure (IDI) database managed by Statistics New Zealand (Stats NZ).[3] This dataset matches paid jobs to firms in New Zealand and provides rich information on labour market earnings, employment industries, and the geographical location of jobs. The EMS dataset follows the individual employment movements and earnings of over two million workers. The empirical analysis we pursue in this note focusses on the period June 1999 to March 2022, aggregated into a quarterly frequency. We choose workers between the ages of 15 and 64, whose incomes or salaries are their main source of income in a given quarter.

To create our quarterly series, we count a person as being employed if they hold a paid job at any time in the quarter of interest. We then construct a number of measures, all of which are calculated as a share of employed people in the current quarter (figure 1):

- The **reallocation rate** is calculated as the sum of entry and exit rates. The entry rate measures the share of currently employed workers who were either unemployed or outside of the labour force in the previous quarter (that is, the share of employed people who have entered our dataset in the current quarter). The exit rate captures all workers who were in paid employment in the previous quarter, and are either unemployed or outside of the labour force in the current quarter (that is, the number of workers that have dropped out of our dataset between the previous and current quarters).
- The **job-to-job transition rate** measures the share of employed people who moved from paid employment in the previous quarter to paid employment with another firm in the current quarter. Job-to-job transitions can be further split into two sub-components: $J2J\_between + 2{*}J2J\_within$.
  - The **job-to-job between-industry rate** calculates the share of employed workers who move from employment with one firm in the previous quarter, to employ-

[3]This data covers the entire New Zealand population that paid Pay-as-You-Earn (PAYE) income tax in the given period. Since taxes are applied from the first dollar in New Zealand, this measure captures all people in paid employment. More details on the data are presented in Appendix A.

Figure 1: Job flows in the New Zealand labour market (1999Q2-2022Q1)



Source: StatsNZ IDI, authors' calculations.
Notes: The reallocation rate fell following the onset of the COVID-19 pandemic as both entry and exit rates remained low after the initial shock. The transition rate fell during the GFC and has been rising slowly but steadily since then. Following the COVID-19 shock, there was a fairly significant rebound in this rate. While the within-industry rate was initially negatively impacted by the onset of the COVID-19 pandemic, it rebounded fairly quickly to more normal levels. The rebound in the between-industry rate has been driving the elevated transition rate in the New Zealand economy.

ment at a new firm in a different industry in the current quarter. For example, if a person is employed in the retail industry in 2021Q1, and are working in the wholesale industry in 2021Q2, our measure will record the person as a between-industry job-to-job flow in 2021Q2.[4] This rate is constructed per industry, by summing over job-to-job between-industry inflows and outflows as a share of total average industry employment over the quarter.

– The **job-to-job within-industry rate** calculates the share of employed workers who move from employment with one firm in the previous quarter, to a new firm in the same industry in the current quarter.[5] This rate should capture 2 movements: the leaving of the first job (separation) and the starting of a new job (accession). That is, this rate should be doubled in order to be analogous to the between-industry rate, which counts both inflows (accessions) and outflows (separations).

We analyse the relationship of these labour market flows with two measures of quarterly income. First, using the same administrative data source, we track nominal quarterly incomes of workers to measure industry-level income growth. We also use the industry-level Labour

[4]Constructing these series on a quarterly basis could lead us to miss short unemployment spells for these workers. For example, in the most extreme case, you could have left your retail sector job in January, and only found a job in the wholesale sector in June, and still be counted as a job-to-job flow for the quarter.

[5]We use permanent enterprise numbers to identify which firms workers are attached to, meaning that our data will not, for example, capture workers that are moving between branches of the same company.

Cost Index (LCI) published by Stats NZ. Unlike the LCI, the EMS-based income measure will not control for the quality of work, meaning it follows the worker and not the job.[6] Finally, we seasonally adjust our input data and de-trend the job transition data.[7]

We treat each of the 18 high-level industries as individual units in our panel regressions.[8] In addition, we use a weighted average, based on relative employment levels, to combine them into 6 distinct groups for the initial data analysis. The groupings reflect how different industries were broadly affected by the COVID-19 pandemic and the health restrictions put in place to contain it.

4. COVID-19 and the New Zealand labour market

The impact of COVID-19 on the labour market differed quite significantly from the Global Financial Crisis (GFC), which was the last major global shock in the 21st century (MBIE (2021); Barrero et al. (2021), Barrero et al. (2020)). The aggregate New Zealand labour market remained relatively resilient over this period, largely showing unusually low exit rates (figure 2). Job-to-job transition rates initially dipped in response to the COVID-19 shock, likely due to an increase in uncertainty and from the support of the New Zealand government's Wage Subsidy scheme. In addition, while within-industry transition rates returned to normal fairly quickly, the labour market continued to experience elevated between-industry labour flows over 2021. That is, COVID-19 has appeared to be a relatively persistent reallocation shock to the New Zealand labour market.[9]

However, the impact of economic shocks is often borne unequally across the economy, with typical recessions seeing manufacturing and construction generally faring more poorly (Causa

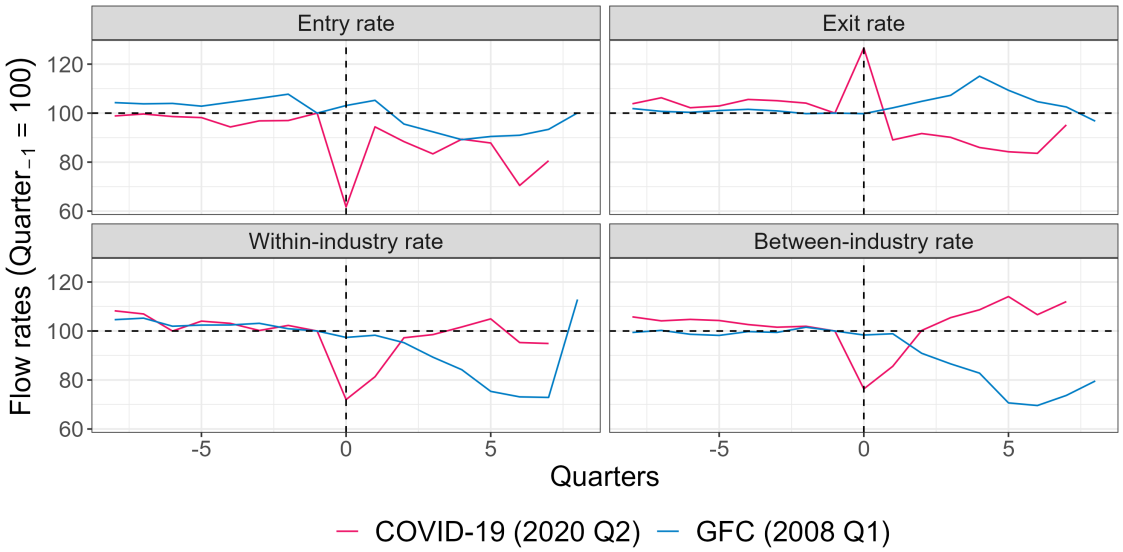
[6]While we cannot currently control for the number of hours worked in the EMS-based measure, we proxy for this by using a full-time equivalent (FTE) measure of income. The full-time equivalent measure is based on the simplifying assumption that anyone earning above the full-time earnings of a minimum wage employee, can be considered to be employed full-time. This might increase measurement error in our EMS-based income growth measure, however, Fabling and Maré (2015) find that it is a superior approach when considering wages (among other economic topics).

[7]The seasonal adjustment is done using the x13 function from the RJDemetra package in R, allowing for the automatic detection of outliers (additive outliers, temporary change outliers, and level shifts). The quality of seasonal adjustment is considered adequate, as we fail to reject the null hypothesis of no seasonality in residuals at the 95% level of confidence. The de-trending of the transitions data is done using a standard two-sided Hodrick-Prescott filter with the signal-to-noise ratio fixed at 1600. The de-trended data are confirmed to be stationary.

[8]We use the Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06) at the 1-digit level (see Table A.1 in Appendix A). We exclude the "unclassified" group which consists of all paid workers that do not have specified sectors. We also combine Agriculture, Forestry and Fishing, and Mining industries into one group to ensure data confidentiality requirements are met.

[9]Andrews et al. (2021a) find that while this has been productivity-enhancing for the United Kingdom and Australia, the opposite appears to have held for New Zealand. They partially attribute this to the impact of the government's Wage Subsidy scheme, which supported a large portion of the domestic labour force. In Andrews et al. (2021b) they find for Australia, that a job retention scheme can protect productivity in the economy in the face of a significant shock, but it needs to be targeted towards productive, but credit-constrained firms to reduce the risk of negative distortive effects (for example, the "zombiefication" of the economy.)

Figure 2: COVID-19 can be characterised as a reallocation shock for the labour market



Source: StatsNZ IDI, authors' calculations.
Notes: This graph shows seasonally-adjusted data for the 8 quarters preceding and following the onset of the GFC and COVID-19 shocks (with the period prior to the shock indexed to 100). While the first COVID-19 lockdown was imposed in the last few days of 2020Q1, we consider this too late in the period to significantly affect the data. Therefore, 2020Q2 is chosen as period 0 for the shock. Period 0 of the GFC shock is recorded as 2008Q1, consistent with the relevant peak in the New Zealand business cycle (as measured by Hall and McDermott (2016)). Following the initial shock, entry and exit rates remain lower than pre-COVID-19 levels, within-industry rates return to normal, and between-industry rates remain elevated.

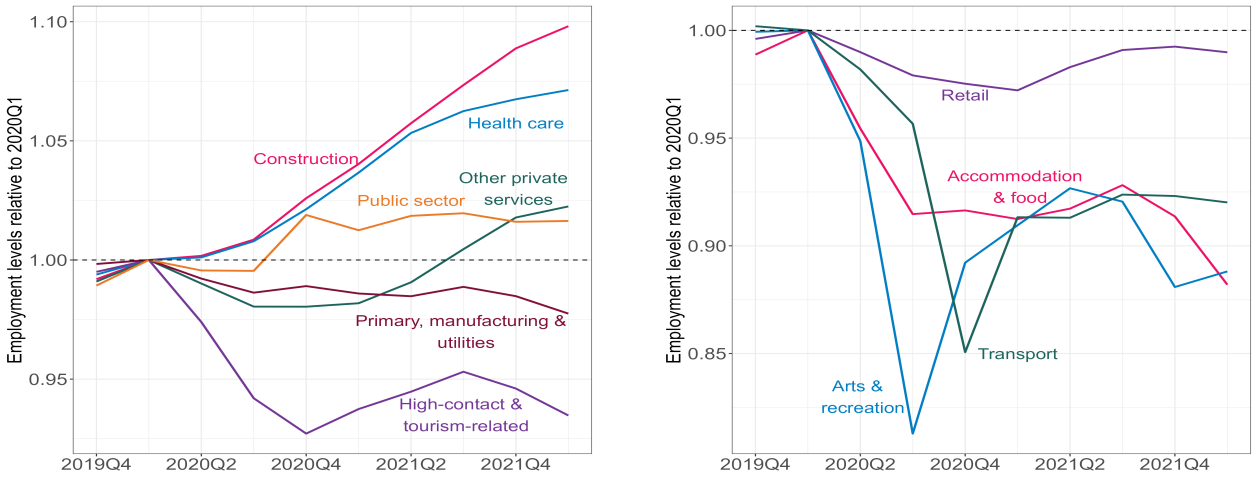
et al., 2021). Instead, employment in the high-contact and tourism-related industries in New Zealand, came under significant pressure during the pandemic period. Figure 3 shows that even 2 years after the initial COVID-19 outbreak in New Zealand, employment levels in the worst-affected industries remain below pre-COVID-19 levels. This is particularly acute in the arts and recreation industry - including workers in the creative and performing arts, sports and recreation facilities, and amusement parks - where seasonally-adjusted employment levels at the start of 2022 were still around 10% below levels seen in 2020Q1.

4.1. The sectoral reallocation of employed workers

We next investigate whether these increases or decreases in employment levels across industries were due to changes in inflows, outflows, or a combination of the two. Disaggregating the total between-industry rate into between-industry inflows and outflows by industry grouping, illustrates the dynamics behind industries where employment has expanded or contracted in the face of the COVID-19 shock (figure 4). We note that:

- The growth of average employment in the construction industry was driven both by lower outflow rates and higher inflow rates, relative to the 5-year pre-COVID-19 average. This reflects how strongly this industry grew over this period, supported by considerable growth in house prices and policy changes that further supported an increase in residential investment, such as lower interest rates and relaxed medium-density

Figure 3: Employment relative to 2020Q1 has diverged across industries



(a) Total market (b) High-contact and tourism-related

Source: StatsNZ IDI, authors' calculations.
Notes: These graphs show relative seasonally-adjusted employment levels, with the levels in the period immediately prior to the COVID-19 shock indexed to 1 (2020Q1). The impact of COVID-19 on the labour market has been disparate. For example, the construction and healthcare industries showed relative employment growth, while high-contact and tourism-related industries exhibited employment losses.

Figure 4: Between-sector job-to-job flows relative to a pre-COVID average

Source: StatsNZ IDI, authors' calculations.
Notes: This graph shows relative employment levels, with the average level for the 5 years preceding the onset of the COVID-19 shock indexed to 1. This controls for the normal amount of churn observed between industries. It shows that the elevated aggregate between-industry transition rates are fairly broad-based.

residential standards.

- The growing healthcare industry initially saw a significant increase in inflows, reflecting the governments health response to the pandemic. However, the slowdown in employment growth over the second half of 2021 was driven by an increase in outflows. This

may reflect a number of events, including the wage negotiations that occurred over this period, the impact of the Governments mandatory vaccination policy, and increased precautionary behaviour by healthcare workers.[10]

- The decline in employment in high-contact and tourism-related industries is evident in how outflows clearly and persistently exceed inflows for this group. This reflects how health restrictions and stringent border controls negatively affected these industries over the pandemic period.
- The public sector exhibited relatively resilient inflow rates and low outflow rates over 2020 - possibly reflecting the significant resources required for New Zealands COVID-19 response and some precautionary behaviour from workers searching for more secure employment. However, there was a fairly large increase in relative outflows over the second half of 2021. This explains the initially growing, and then stagnating, employment levels.
- The remaining industries show relatively elevated inflows and outflows from the start of 2021. That is, the increased churn in labour markets after the initial impact of the COVID-19 pandemic has been fairly broad-based.

We have highlighted which industries have experienced expanding or contracting levels of employment. We now ask the question of where workers have been moving to. This helps to understand the extent of skills transferability between industry groupings. Given the differences in flows over 2020 and 2021, we first visualise gross flows of job-to-job transitions across the labour market. Figure 5 shows gross job-to-job flows over 2020 and 2021, scaled by the average employment in each industry group at the start of the year. It shows that there were a larger proportion of workers in tourism-related and high-contact industries, primary and secondary sectors (excluding construction), and other private services changing jobs in both 2020 and 2021. It is interesting to note, for example, that while some flows out of tourism-related and high-contact industries find employment at other similarly-affected firms, a large portion were more likely to flow into other industries.

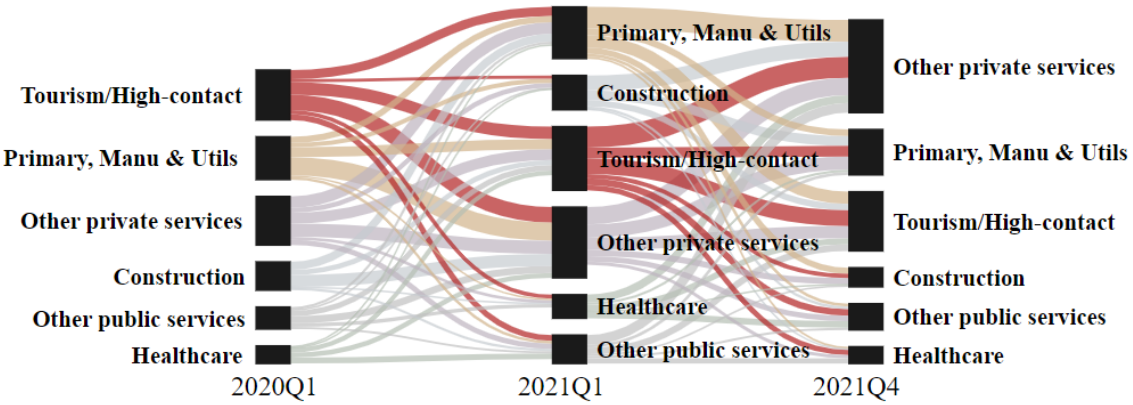
Overall, we notice a fairly high level of churn across the labour market. We now aim to understand how this differs from pre-COVID-19 norms by considering the annual average between-industry outflow rates relative to a 5-year pre-COVID-19 average ("normal") (figure 6).[11] It should be noted that two of our industry groupings (healthcare and construction) each consist of a single industry each, while the remainder of the groupings are constructed using employment-weighted averages of their constituent industries. This makes it possible to have between-industry outflow rates within the latter industry groupings, but not in the healthcare and construction sectors.

Our findings are tabulated below in Table 1:

[10]The Governments mandatory vaccination policy required that all health workers receive their first vaccination dose by 30 October and be fully vaccinated by 1 December 2021.

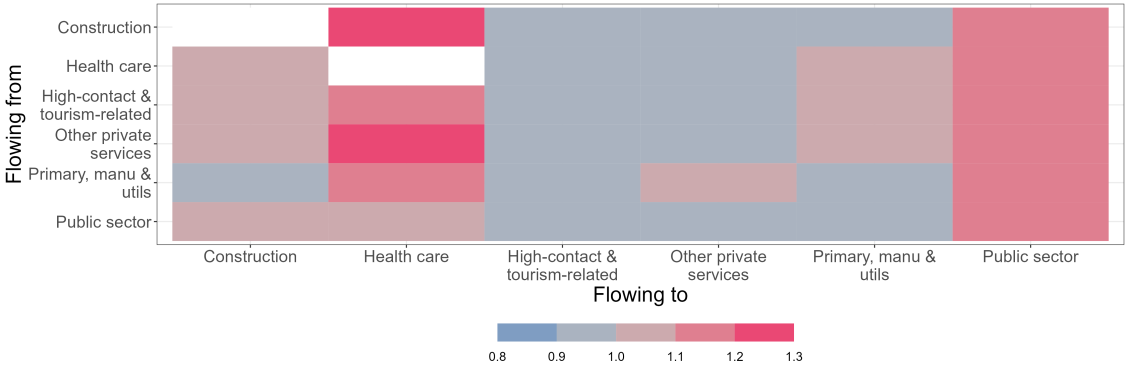
[11]Similar graphs at the industry level can be found in figure A.1 in Appendix A.

Figure 5: Gross job-to-job flows since the onset of COVID-19

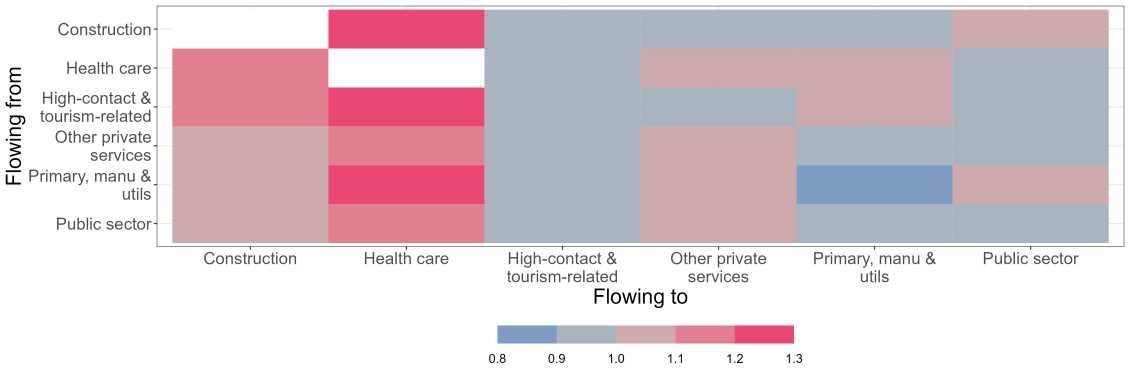


Source: StatsNZ IDI, authors' calculations.
Notes: This graph shows gross job-to-job flows between industry groups. The first set of flows are divided by average employment in each industry group at 2020Q1, while the second set of flows are divided by average employment in 2021Q1.

Figure 6: Post-COVID-19 job-to-job transitions relative to a 5-year pre-COVID-19 average



(a) 2020



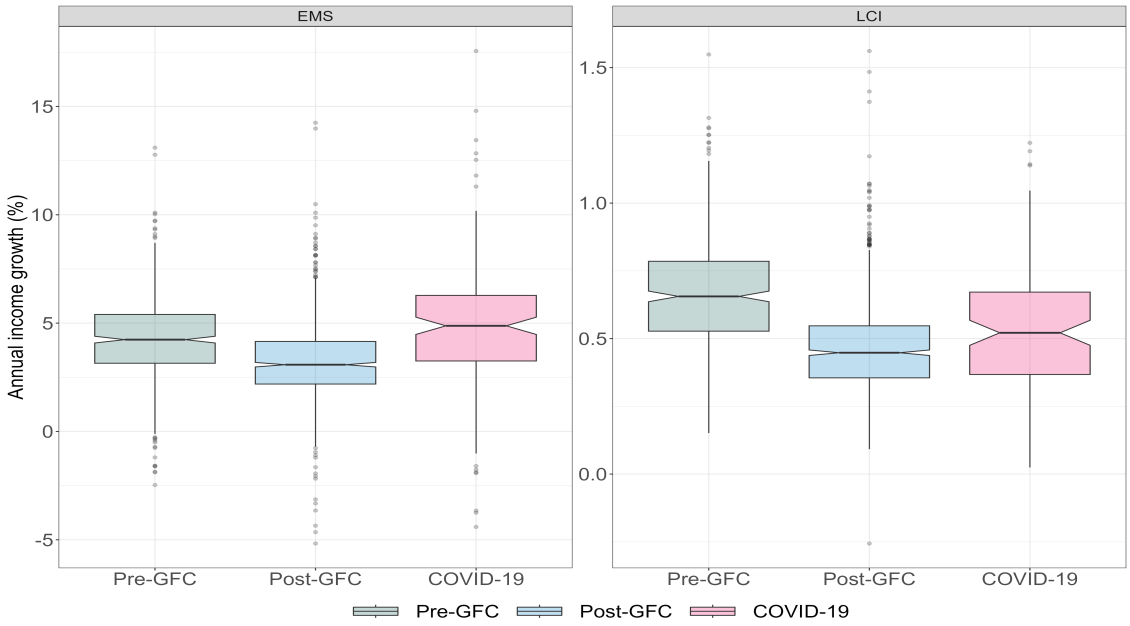
(b) 2021

Source: StatsNZ IDI, authors' calculations.
Notes: Shades of pink reflect higher-than-normal transitions, while shades of blue reflect lower-than-normal transitions. To understand where workers in certain industries have moved to, read the table in rows. For example, in 2020, workers from the public sector (last row), have tended to move into construction, healthcare, and other public sector roles more readily than previously (higher than 5-year pre-COVID-19 average). To understand where workers in certain industries are coming from, read the table in columns.

Table 1: Changes in job-to-job transitions since the onset of the COVID-19 pandemic

Industry	Inflows	Outflows
Construction	Elevated flows into the industry were driven by relatively more workers flowing from all other industries over most of the pandemic period. There were particularly higher flows from health care, high-contact and tourism-related, and other private service industries over 2021.	Workers were more likely to flow into healthcare and the public sector over 2021. These relative transitions into the public sector softened slightly over 2021.
Healthcare	Flows into the health care industry were broad-based, with noticeably higher-than-normal flows from construction, high-contact and tourism-related, and primary and secondary sectors over 2021.	Workers were more likely to flow into construction, the public sector, and primary and secondary sectors over 2020. Over 2021, the flows into the construction industry strengthened and elevated flows into the private sector are visible.
High-contact and tourism-related	Labour market flows into these industries were persistently below average across all industry groupings and both years. That is, the reduced inflow into the high-contact and tourism-related industries was broad-based.	Workers were more likely to flow to healthcare, the public sector, construction, and primary and secondary sector industries in 2020 (compared to the pre-COVID-19 average). By 2021, these outflows were concentrated in the healthcare and construction industries.
Public sector	Flows into the public sector were elevated across all sector groupings over 2020, but generally weaker and less broad-based over 2021.	Workers were more likely to leave for other public sector industries, healthcare, and construction industries in 2020. They were generally more likely to leave the public sector in 2021, with elevated flows to other private services (in addition to healthcare and construction).

Figure 7: Median annual income and wage growth have been higher over the COVID-19 period



Source: StatsNZ IDI, authors' calculations.
Notes: These notched box plots show the distribution of annual income growth over three economic periods. The black line in each boxplot represents the distribution median. If the notches do not overlap, this implies that the medians are statistically significantly different from each other.

Overall, this analysis illustrates the higher-than-expected cross-industry labour market mobility during the COVID-19 pandemic period.

5. Investigating the relationship between job transitions and income growth

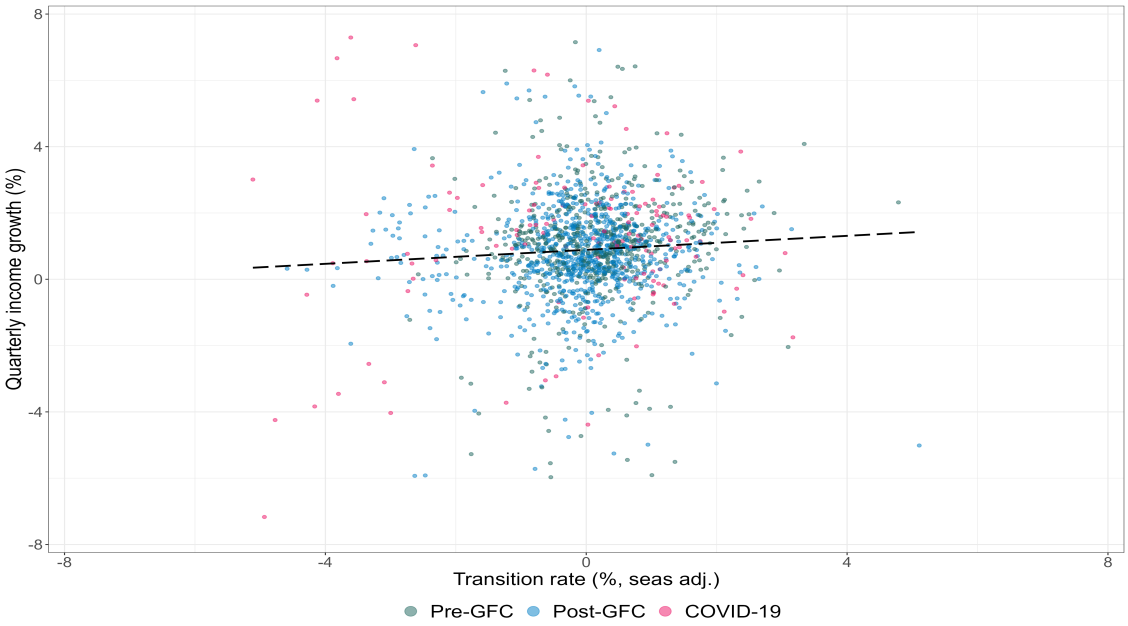
As a final consideration, we investigate the relationship between job-to-job labour flows and income growth. Figure 7 shows the distribution of annual income growth divided into three economic periods: pre-GFC (1997Q3-2007Q4), post-GFC (2008Q1-2020Q1) and COVID-19 (2020Q2-2021Q4). It shows that income growth in the post-GFC period was the lowest on average, for both our EMS-based and LCI measures. We know that the lower income growth in the post-GFC period was correlated with low job-to-job transitions (Ball et al., 2020). Figure 8 suggests that this positive relationship between job-to-job transitions and income growth continues to hold in the COVID-19 period.[12]

We estimate two panel regressions to investigate the relationship between income growth and labour flows more formally (equations 1 and 2).[13] This specification follows the work of Moscarini and Postel-Vinay (2016), which aims to estimate the static short-run relationship

[12]Figure A.2 in Appendix A depicts the similar relationship between job-to-job transitions and LCI wage growth.

[13]Karagedikli et al. (2018) finds that job-to-job flows Granger causes the output gap, wage growth, and non-tradable inflation.

Figure 8: Quarterly income growth shows a positive correlation with the transition rate (EMS-based measure)



Source: StatsNZ IDI, authors' calculations.
Notes: The size of each data point represents the associated industrys contribution to total employment.

between income growth and labour flows. It also updates the findings of Ball et al. (2020) and Coleman and Zheng (2020) for the latest available data. In that regard, we first establish whether reallocation rates and transition rates have differing relationships with income growth. We then break down the transition rate relationship into effects from within-industry and between-industry transitions. Given the extant results in the literature, we expect to find positive coefficients on our job-to-job measures. Ball et al. (2020) suggest that the coefficient on the transition rate should be larger than that on the reallocation rate, while the results of Coleman and Zheng (2020) suggest that we should find a larger coefficient on between- rather than within-industry transitions.

$$\Delta log(W_{it}) = \gamma^a_{it} + \beta^a_1 realloc\_rate_{it} + \beta^a_2 transition\_rate_{it} + \sum_k \rho^a_k X_k + \epsilon^a_{it} \quad (1)$$

$$\Delta log(W_{it}) = \gamma^b_{it} + \beta^b_1 J2J\_within_{it} + \beta^b_2 J2J\_between_{it} + \sum_k \rho^b_k X_k + \epsilon^b_{it} \quad (2)$$

where W_{it} represents one of our two measures of nominal income growth (EMS-based and LCI), i and t represent industry and time respectively, and k is the number of additional control variables. The residual term (ϵ_{it}) in each specification is assumed to be serially correlated and follows an AR(1) structure.[14] All observations are weighted by average industry

[14] All regression results are estimated using the xtgls procedure in Stata. xtgls applies feasible generalised

employment to capture the industry's relative importance in the economy-wide labour market. We use the Hausman test to determine whether to use a random-effects specification (γ_{it} becomes γ_t) or a fixed-effects specification (γ_{it} captures industry fixed-effects). The β and ρ coefficients capture the marginal effects of job flows and control variables on incomes, respectively.

Finally, in line with Nickel et al. (2019) (and similar approaches in the literature), we choose to control for cyclical economic and labour market conditions explicitly.[15] This incorporates wage Phillips Curve elements to our specification. In this regard, we use lagged core inflation, labour market slack (the national unemployment rate), and industry-specific conditions (industry output growth). We expect to find a positive coefficient for inflation, a negative coefficient for the unemployment rate, and a positive coefficient on industry output growth. Finally, we also control for the lockdown-induced spikes in income and labour flow measures by using 2020Q2 and 2020Q3 time dummies. The results are presented in Table 2.

5.1. Results

From the first regression specification, we find that the transition rate has a statistically significant positive coefficient for both measures of income growth. In contrast, the reallocation rate has a statistically insignificant coefficient. Our second regression specification, focusing on within- and between-industry flow rates, finds that it is the job-to-job between-industry transitions, rather than those within industries, that underpin the result from equation (1).

We find that in economic terms, the strength of the relationship differs between our measures of income. We find that a 1 percentage point increase in the between-industry job-to-job transition rate (above trend) is related to quarterly EMS-based income growth of just over 0.1 percentage points. This relationship is slightly weaker when considering the LCI, which only increases by half as much. That is, individual income growth appears to be more sensitive to between-industry transitions than the wage growth associated with a particular position. While this difference in relationship strength may be attributable to issues around the noisiness of the EMS-based measure (which is also reflected in the R-squared metrics), it could also reflect differences in the income measures themselves.[16] For example, consider a worker who is leaving their current position for another in a new industry. This worker, having built up skills during their tenure with their current employer, might be able to secure a reasonable wage increase. This increase is likely to exceed any increase the former employer would advertise the worker's old position for, or otherwise, the worker might have chosen to

least squares (FGLS) which controls for cross-sectional heteroskedasticity and a common AR(1) serial correlation in the variance and covariance matrix. It should be noted that our serial correlation tests weakly suggest the presence of second-order autocorrelation, which is currently unaccounted for. The residuals from our regressions pass the Levin-Lin-Chu, Harris-Tzavalis, Breitung and Im-Pesaran-Shin tests for stationarity at the 95% confidence level.

[15] Key robustness checks on our main specification of interest (equation (2)) are presented in Table **??** in Appendix B. Additional robustness and statistical tests for all equations can be obtained from the authors on request. The main finding regarding the statistically significant relationship between income growth rates and between-sector transition rates is robust to the addition of fixed effects, an alternative measure of economic slack (the output gap), and a different weighting scheme.

[16] The noisiness of the data is partially attributable to the lack of hourly wage data. See Appendix A.

Table 2: Income growth regression results

	EMS		LCI	
	(1)	(2)	(1)	(2)
transition_rate	0.0674***		0.0306***	
	(0.0242)		(0.0065)	
realloc_rate	0.0079		−0.0093	
	(0.0483)		(0.0118)	
J2J_within		0.0207		0.0110
		(0.0464)		(0.0104)
J2J_between		0.1050**		0.0488***
		(0.0413)		(0.0116)
Industry output growth	0.0420***	0.0418***	−0.0005	−0.0007
	(0.0082)	(0.0082)	(0.0016)	(0.0016)
Lagged core inflation	0.6490***	0.6610***	0.2780***	0.2850***
	(0.1060)	(0.1060)	(0.0362)	(0.0373)
Unemployment rate	−0.1040***	−0.0952***	−0.0515***	−0.0459***
	(0.0303)	(0.0313)	(0.0106)	(0.0113)
2020Q2	−3.352***	−3.290***	−0.268***	−0.226***
	(0.3210)	(0.3250)	(0.0658)	(0.0689)
2020Q3	4.2160***	4.2410***	0.0305	0.0503
	(0.3170)	(0.3190)	(0.0630)	(0.0640)
constant	1.0240***	0.9720***	0.6430***	0.6060***
	(0.1970)	(0.2020)	(0.0700)	(0.0720)
R^2	0.244	0.244	0.802	0.793
AR(1) residual coefficient	−0.475	−0.475	0.123	0.146
Industry fixed-effects	No	No	Yes	No
Observations	1,602	1,602	1,476	1,476
Industries	18	18	18	18
Time periods	1999Q3 2021Q1 (89 periods)		2001Q4 2021Q1 (82 periods)	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

stay. In this way, for a given job transition, the EMS measure of income could exceed the LCI wage measure. Disentangling these effects is beyond the scope of this paper and is left to future research.

Stronger industry output growth is positively related to EMS-based income growth, but not higher LCI wage growth. In line with expectations, an increase in the unemployment rate, reflecting greater labour market slack, has a negative relationship with income growth (across measures). A 1 percentage point increase in unemployment is associated with a roughly 0.1 percentage point decline in EMS-based quarterly income growth rates, and about half as much in LCI wage growth. Finally, as expected, and regardless of income measure, higher inflation leads to higher income growth as workers need to be compensated for higher living

costs.

6. Conclusions and further research

In line with international experience, we find that COVID-19 had a large and uneven shock on the New Zealand labour market. For New Zealand, these impacts have been atypical (in comparison to the GFC) and relatively persistent. The labour market's resilience is reflected in high labour market mobility, and the ability of workers to move between industries in the face of changing supply and demand conditions.

In line with previous findings in the literature, we confirm the pro-cyclicality of job transitions in the New Zealand labour market, with increased transitions being associated with higher income growth. However, we find that it is the between-industry job-to-job transitions that underpin this result at the aggregate level.

Given the existence of strong downward nominal wage rigidity in New Zealand (Armstrong and Parker, 2016)), di Giovanni et al. (2022) suggests that demand reallocation shocks may be a significant driver of nominal wage growth in New Zealand. In addition, recent research by Guerrieri et al. (2021) suggests that the optimal monetary policy response in the face of an endogenous cost-push shock should allow inflation to exceed its target. This is especially true for economies with relatively mobile labour, as a looser monetary policy stance may induce faster reallocation. Furthermore, if this reallocation is also productivity-enhancing, it may help temper the inflationary impact of sectoral demand reallocation (Ferrante et al., 2023). This highlights the importance of understanding sectoral demand reallocation for the conduct of optimal monetary policy.

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Appendix A. Microdata details

The primary data source in this analytical note is based on the Employer Monthly Schedule (EMS), in the 2022 June archive under the Integrated Data Infrastructure (IDI). The EMS comprises all paid jobs and earnings from April 1999 to March 2022 in New Zealand. Each job is matched to a unique enterprise in the Business Register (BR) which provides detailed information on industry codes as well as other business demographic information.[17] The linked job-enterprise (or employee-employer) feature in the EMS allows the tracking of person-level job information over time, and to identify job-to-job transitions. The population of interest is primary income jobs in the working age population (between 15 and 64 years of

[17]An enterprise is a business or service entity operating in New Zealand, such as NZ Post. In the EMS, each firm is matched to an Enterprise number (ENT) by Statistics New Zealand. Then, these ENTs are mapped to a Permanent Enterprise Number (PENT) which are enhanced longitudinal business identifiers which fix ENT issues. More information can be found in Fabling (2015).

age) on a quarterly basis in New Zealand.[18] We take the following steps to aggregate and clean the data:

1. **Data aggregation:** All monthly earnings (at least $1) and jobs are summed on a quarterly basis. For example, job-firm earnings in January, February, and March 2020 are summed to the March 2020 quarter. Any jobs without observable enterprise ID or industry codes are excluded. This has a total 206,690,700 unique jobs from June quarter 1999 to March quarter 2021.

2. **Primary income job:** The primary income job is the highest-paid job for a person at a point in time. In other words, each person is restricted to having only one job. If a person earned $1000 from a local caf and $500 from a gardening firm, his or her primary income job is as a caf worker. Our data shows around 7% of the working-age population have 2 or more jobs. The exclusion is expected to have a negligible impact on the regression analysis. After this filter, 180,435,900 jobs remained.

3. **Age restriction:** Any persons who are either less than 15 years of age or more than 64 years of age are excluded. The EMS does not have age information and, therefore, is linked with the person details table in the IDI. This additional table contains birth date, gender and ethnicity information compiled from multiple data sources (e.g. Census, Ministry of Health). Once birth year and month are matched to persons in the EMS, person-level age can be derived by taking month differences between date at work and birth date divided by 12 (months). Persons without a matched birth year and month are excluded.

4. **FTE:** In addition, we derived Full-Time Equivalent (FTE) estimates from Fabling and Maré (2015) to control for unobserved hours worked in the EMS dataset.[19] After this filter, 170,897,700 jobs remained in the final population pool.

Given these choices, we note that our dataset might not be directly comparable to any official labour market statistics produced by Statistics New Zealand.

[18] We have both monthly and quarterly data. But monthly data appear to be highly volatile and noisy and impose some challenges on seasonal adjustments and modelling analysis.

[19] The Ministry of Business, Innovation and Employment (MBIE) is investigating the hours worked data from EIE from Statistics New Zealand. The coverage rate of hours worked information to paid jobs is between 40% and 50% and is expected to improve in the future.

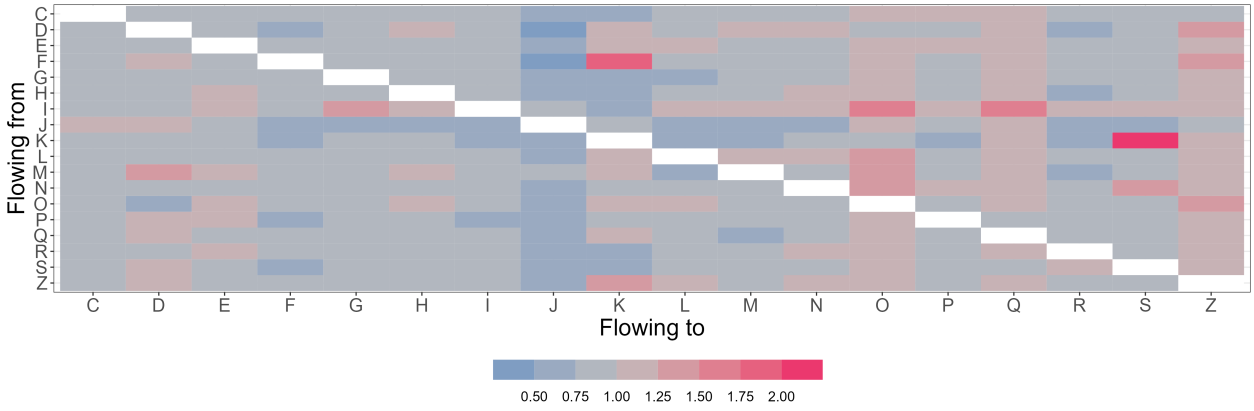
Disclaimer

Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Data and Statistics Act 2022. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers. These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) and/or Longitudinal Business Database (LBD) which are carefully managed by Stats NZ. For more information about the [IDI and/or LBD] please visit `https://www.stats.govt.nz/integrated-data/`. The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes and is not related to the datas ability to support Inland Revenues core operational requirements.

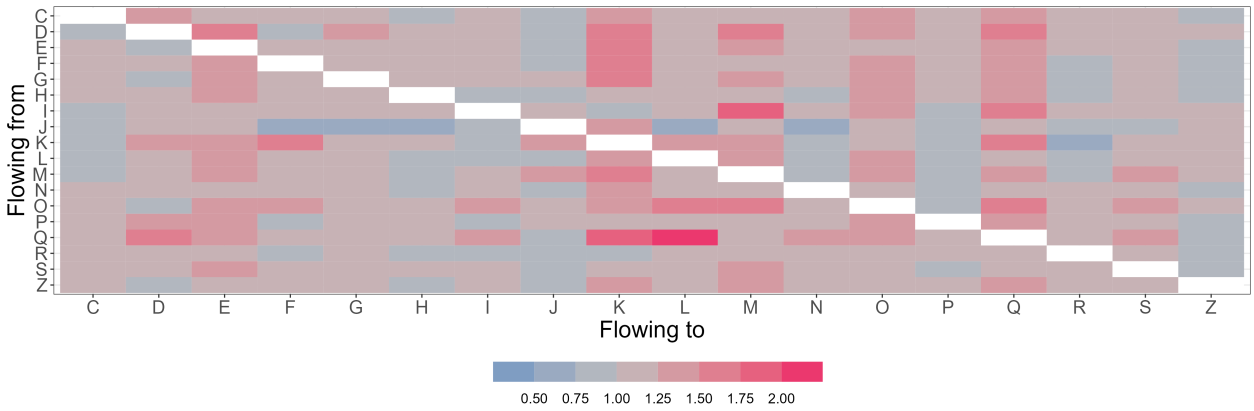
Table A.1: Industry groupings

Group	**Included industries**
The healthcare industry	Q: Health care and social assistance
High-contact and tourism-related industries	G: Retail Trade H: Accommodation and food services R: Arts and recreation services I: Transport, postal and Warehousing
The construction industry	E: Construction
The primary sector, manufacturing, and utilities	A: Agriculture, fishing, and forestry B: Mining C: Manufacturing D: Electricity, gas, water and waste services
The public sector	O: Public administration and safety P: Education and training
Other private services	F: Wholesale trade J: Information media and telecommunications K: Financial and insurance services L: Rental, hiring and real estate services

Figure A.1: Job-to-job transitions relative to a 5-year pre-COVID-19 average



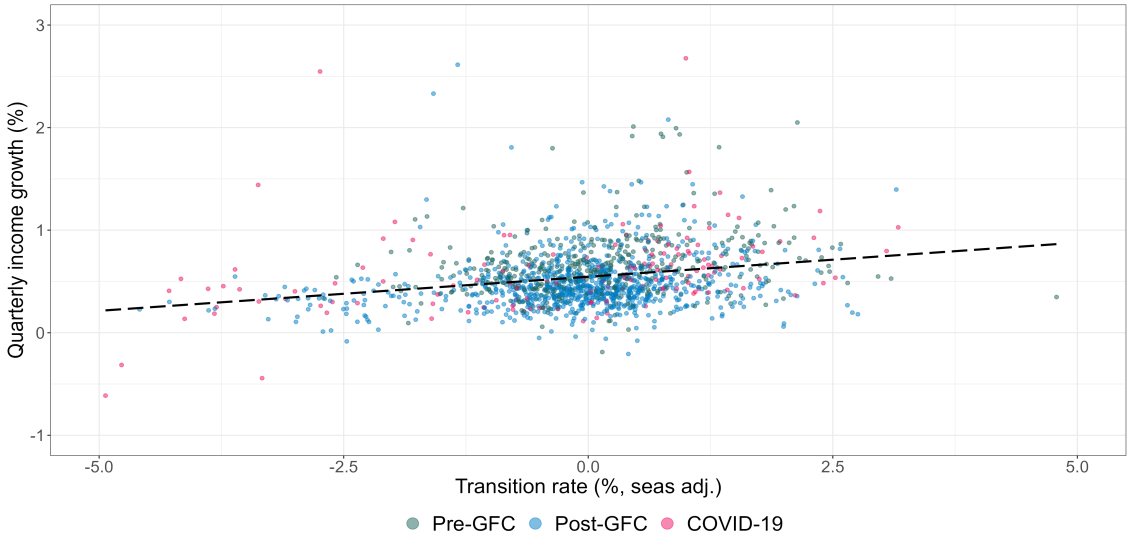
(a) 2020



(b) 2021

Source: StatsNZ IDI, authors' calculations.
Notes: Shades of pink reflect higher than normal transitions (relative transitions greater than 1), while shades of blue reflect lower than normal transitions (relative transitions less than 1).

Figure A.2: Quarterly income growth versus job-to-job transition rates (LCI)



Source: StatsNZ IDI, authors' calculations.
Notes: The size of each data point represents the associated industrys contribution to total employment.

Appendix B. Robustness checks

	EMS				LCI			
	(2)	Fixed effects	Alt. slack	Alt. weights	(2)	Fixed effects	Alt. slack	Alt. weights
J2J_within	0.0207	0.0215	0.0295	0.0201	0.0110	0.0121	0.0134	0.0114
	(0.0464)	(0.0459)	(0.0485)	(0.0465)	(0.0104)	(0.0103)	(0.0108)	(0.0104)
J2J_between	0.105**	0.102**	0.124***	0.104**	0.0488***	0.0506***	0.0578***	0.0490***
	(0.0413)	(0.0410)	(0.0430)	(0.0414)	(0.0116)	(0.0113)	(0.0120)	(0.0117)
Industry output growth	0.0418***	0.0436***	0.0466***	0.0420***	−0.000700	−0.000586	−0.000901	−0.000626
	(0.00819)	(0.00812)	(0.00799)	(0.00815)	(0.00160)	(0.00160)	(0.00165)	(0.00160)
Lagged core inflation	0.661***	0.666***	0.827***	0.661***	0.285***	0.291***	0.367***	0.286***
	(0.106)	(0.104)	(0.0981)	(0.106)	(0.0373)	(0.0358)	(0.0333)	(0.0372)
Unemploment rate	−0.0952***	−0.0949***		−0.0954***	−0.0459***	−0.0440***		−0.0453***
	(0.0313)	(0.0309)		(0.0314)	(0.0113)	(0.0109)		(0.0113)
2020Q2	−3.290***	−3.257***	−3.024***	−3.296***	−0.226***	−0.236***	−0.128**	−0.232***
	(0.325)	(0.322)	(0.295)	(0.326)	(0.0689)	(0.0682)	(0.0646)	(0.0690)
2020Q3	4.241***	4.180***	4.190***	4.243***	0.0503	0.0549	0.0631	0.0530
	(0.319)	(0.314)	(0.306)	(0.317)	(0.0640)	(0.0635)	(0.0650)	(0.0639)
Output gap			0.0216				0.0161∗	
			(0.0258)				(0.00843)	
constant	0.972***	0.929***	0.416***	0.973***	0.606***	0.598***	0.338***	0.602***
	(0.202)	(0.208)	(0.0576)	(0.202)	(0.0720)	(0.0710)	(0.0195)	(0.0719)
R^2	0.244	0.246	0.323	0.244	0.793	0.802	0.796	0.793
AR(1) residual coefficient	−0.475	−0.482	−0.460	−0.474	0.146	0.111	0.146	0.144
Industry fixed-effects	No	Yes	No	No	No	Yes	No	No
Observations	1,602	1,602	1,602	1,602	1,476	1,476	1,476	1,476
Industries	18	18	18	18	18	18	18	18
Time periods	1999Q3 2021Q1 (89 periods)				2001Q4 2021Q1 (82 periods)			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1