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DISCUSSION PAPER SERIES

IZA DP No. 18216

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ABSTRACT

Firm Productivity and Ethnic Wages

We estimate relative wage discrimination for ethnic and migrant groups in New Zealand, using linked employer-employee and firm-level productivity data, and comparing each group's contribution to output with their share of their firm's wage bill. We find that wage discrimination is relatively favourable for European migrants and Asian/MELAA employees, and relatively unfavourable for Māori, Pacific, and NZ-born European employees, with variation across NZ-born, recent migrants, and longer-term migrants. We present pooled and firm-fixed effects estimates of discrimination, highlighting distinct within-firm and between-firm patterns.

JEL Classification: J15, J30, J42, J71
Keywords: earnings, productivity, ethnicity

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1 Introduction

Prior studies of ethnic wage disparities in Aotearoa New Zealand have focused on whether ethnic differences in worker and job characteristics can account for observed differences in pay (Benison & Maré, 2025; Cochrane & Pacheco, 2022; Genç, 2017; Treasury, 2018). This paper contributes to a small New Zealand literature that uses linked employer-employee and productivity data to gauge the contribution of inter-firm variation to ethnic and migrant pay differences (Fabling et al., 2022; Fabling & Maré, 2024; Maré & Fabling, 2025), asking whether some groups are paid less because they work in low wage or low-productivity firms, or whether disparities are due to unequal pay within firms? In this paper, we estimate relative wage discrimination measures that reflect whether the productive contribution of different ethnic and migrant groups' effective labour input is reflected in wages.

Linked employer-employee and production data have been used in international studies to estimate wage discrimination, initially focusing on gender discrimination. By combining information on groups' wage bill shares and contributions to production, the approach provides an estimate of discrimination even when each group's effective labour input is unobserved or imperfectly measured (Hellerstein et al., 1999; Hellerstein & Neumark, 2006). A group may have a relatively low average wage due to factors such as low human capital, low hours, or employment in low-productivity occupations. Rather than trying to control for these differences, the Hellerstein et al approach asserts that in the absence of discrimination, such factors should have the same proportional effect on output and on the firm's wage bill. Relative discrimination is estimated as the difference in output and wage bill effects, when compared to the difference for a chosen benchmark group. We estimate the effect of relative wage discrimination for European, Māori, Pacific, and Asian/MELAA workers. We also examine variation between New Zealand-born workers, recent migrants, and longer-term migrants within these groups.

Sin et al (2022) use the same approach to examine the gender wage gap in New Zealand. They conclude that gender differences in productivity explain at most 4.5 of a 20-28 percent gender gap. Fabling et al (2022) have estimated relative discrimination in New Zealand by country of birth groups, allowing for variation by length of residence. They find evidence of relative discrimination in favour of skilled migrants and Australian-born migrants, and relative discrimination against high-skilled NZ-born workers (Fabling et al., 2022. Table 8).

While there are international wage-productivity studies of wage discrimination affecting migrants (Bartolucci, 2014; Kampelmann & Rycx, 2016), there are relatively few examining ethnic wage discrimination. Hellerstein & Neumark (2007) simultaneously estimate discrimination based on gender, race, marital status, education, age, and occupation, reporting discrimination against women and against college-educated workers of around 20 percent, but weakly significant discrimination in favour of Black workers of 5 to 10 percent.

Two recent New Zealand papers examine whether the distribution of different ethnic groups across high- and low-paying firms can account for ethnic pay gaps. Benison and Maré (2025), using household survey data linked to separately estimated firm fixed effects, and Maré and Fabling (2025), using linked employer-employee data, both find that differential sorting of ethnic groups across well-paying or poorly-paying firms can account for only a small proportion of observed ethnic pay gaps. Fabling and Maré (2024) examine firm-related factors contributing to the relative pay of Māori employees. Having controlled for worker and firm characteristics, they find that Māori are employed disproportionately in firms that pay relatively poorly (2% below average) and that have slightly lower than average (by 1%) multi-factor and labour productivity, suggesting slight wage discrimination against Māori employees.

In the current paper, we find evidence of relative wage discrimination in favour of European migrants and Asian employees relative to NZ-born European, Māori, and Pacific employees. Controlling for sorting across firms, a different pattern emerges, with evidence of relative wage discrimination against Pacific migrants and Māori. In the following section, we document our empirical approach to estimating relative wage discrimination and we summarise the data that we use in section 3. After describing patterns of wage and productivity variation across ethnicities in section 4, we present estimates of relative wage discrimination for various ethnic and migrant groups, and for subgroups of firms, in section 5, followed by a summary and discussion of findings in section 6.

2 Identification and estimation

Following Hellerstein et al (1999), we identify wage discrimination by comparing the contribution to output attributable to different groups of workers with the share of the total wage bill received by each group. Both output and wage bill effects are associated with groups' effective labour input. Even though effective labour input is likely to be measured inaccurately, in the absence of discrimination, any mismeasurement should affect estimated labour input and effective wage bill

shares proportionally. Similarly, the proportionality of effective labour input and wage bill shares should be maintained even if there are group-differences in unmeasured job or worker characteristics such as occupational mix, hours worked, skill level, or effort. Our estimate of wage discrimination thus controls for differences in the mix of jobs and skills, which may themselves be affected by discrimination and racism.

We focus on a measure of wage discrimination derived from parameter estimates from two related equations – an output equation to identify the relative level of effective labour input provided by each group, and a wage bill equation, to identify the relative wage per effective labour input. Gross output (Y_{it}) for firm *i* in year *t* is modelled as a translog function of labour (L_{it}), capital (K_{it}), and intermediate inputs (M_{it}), where output and inputs are separately deflated. Lower-case variable names $(y_{it}; l_{it}; k_{it}; m_{it})$ denote logged values and parameters are represented as β, with distinguishing subscripts, as shown in equation (1). The translog function is a second order approximation to an arbitrary functional form (Christensen et al., 1973). Equation (1) constrains production parameters to be common across industries and years, but includes industry-specific intercepts and industry-specific time trends, denoted Z_{it}, and an error term ϵ_{it}.

$$\begin{aligned} y_{it} = {} & \beta_0 + \beta_m m_{it} + \beta_k k_{it} + \beta_l \tilde{l}_{it} \\ & + \beta_{mm} m_{it}.m_{it} + \beta_{mk} m_{it}.k_{it} + \beta_{ml} m_{it}.\tilde{l}_{it} + \beta_{kk} k_{it}.k_{it} + \beta_{kl} k_{it}.\tilde{l}_{it} + \beta_{ll} \tilde{l}_{it}.\tilde{l}_{it} \\ & + \beta_Z Z_{it} + \epsilon_{it} \end{aligned} \qquad (1)$$

Labour enters the output equation as a composite index of total 'effective labour input' for firm *i* $\left(\tilde{l}_{it} = \ln \tilde{L}_{it}\right)$. The index allows for different groups to provide different relative amounts of effective labour input. The effective labour input provided by a unit of FTE employment is normalised to be one for a chosen reference group (denoted group 0). A unit of FTE employment supplied by another group (*j*) could provide effective labour greater than 1 or less than 1. Equation (2) shows the parameterisation of effective labour input for a firm. S_j is the share of FTE employment accounted for by group-*j* workers share $\left(S_j = L_j/L\right)$ and ϕ_{j} captures whether each unit of FTE employment from group *j* provides higher effective labour input $\left(\phi_{\mathrm{j}} > 0\right)$ or lower labour input $\left(\phi_{\mathrm{j}} < 0\right)$ than provided by group-0 workers.

$$\tilde{L} = L\left(S_0 + \sum_{j=1}^{J}\left[\left(1 + \phi_{\mathrm{j}}\right).S_j\right]\right) \qquad (2)$$

The analogous firm-level wage bill equation (with error term η_{it} and parameters γ) is shown as equation (3). A firm's wage bill is allowed to depend not only on the amount of labour input but also on other production inputs.

$$w_{it} = \gamma_0 + \gamma_m m_{it} + \gamma_k k_{it} + \gamma_l \tilde{l}_{it} + \gamma_{mm} m_{it}.m_{it} + \gamma_{mk} m_{it}.k_{it} + \gamma_{ml} m_{it}.\tilde{l}_{it} + \gamma_{kk} k_{it}.k_{it} + \gamma_{kl} k_{it}.\tilde{l}_{it} + \gamma_{ll} \tilde{l}_{it}.\tilde{l}_{it} + \gamma_Z Z_{it} + \eta_{it}. \quad (3)$$

Effective labour input is again denoted $\tilde{l}_{it}$ but the parameters within the composite index can differ from those in equation (2). As shown in equation (4), FTE provided by group *j* can attract a higher $(\psi_j > 0)$ or lower $(\psi_j < 0)$ share of the wage bill than is attracted by the same amount of FTE from group-0.

$$\tilde{L} = L\left(S_0 + \sum_{j=1}^{J}\left[(1+\psi_j).S_j\right]\right) \quad (4)$$

Identifying relative wage discrimination is based on the difference $\delta_j = (\psi_j - \phi_j)$. If this difference is positive, group *j* FTE has a stronger proportional effect on the wage bill than it has on labour input (and hence on output). For the reference group $(\psi_0 - \phi_0) = 0$, so for all other groups, δ_j is measured relative to the productivity-wage impacts for group 0. If $(\psi_j - \phi_j) > 0$ we infer that there is relative wage discrimination in favour of group *j* (relative to group 0). If $(\psi_j - \phi_j) < 0$ we infer that there is relative wage discrimination against group *j* (relative to group 0).

Equations (1) and (3) are jointly estimated using non-linear least squares seemingly unrelated regression (Zellner, 1962, 1963). Because multiple observations of the same firm do not provide completely independent information, we estimate standard errors clustered by firm (Froot, 1989). Inputs are measured relative to sample means, so translog parameters identify curvature around mean inputs. A consequence of this de-meaning is that output and wage bill elasticities of inputs, evaluated at mean inputs, are captured by the linear terms in equations (1) and (3) ($\beta_l, \beta_k, \beta_m$ for output and $\gamma_l, \gamma_k, \gamma_m$ for wage bill).

We also estimate fixed-effect versions of equations (1) and (3), to isolate within-firm discrimination from discrimination arising from the non-random sorting of ethnic groups across firms with idiosyncratic wage or productivity levels. This is implemented by measuring inputs (as well as wage bill and output) relative to their firm-specific means. Translog parameters then capture curvature at a point relevant for each firm, rather than at overall means (identifying the average across firms of marginal products rather than the marginal product at mean inputs). Fixed effect estimation reduces the influence of inter-firm sorting, but also magnifies the impact of temporal correlations. If firm-level economic shocks are associated with increased employment of a particular ethnic group, this may cause fixed effects estimates of discrimination to be misleading.

We focus on estimates for all firms combined, but also present estimates for subsets of firms, based on location, use of skilled workers, and the presence of working proprietors – to allow for heterogeneity of production technologies, wage structures, and discrimination.

3 Data

Equations (1) and (3) are estimated using data from the Fabling-Maré labour and productivity datasets, derived from Statistics New Zealand's Integrated Data Infrastructure and the Longitudinal Business Database, respectively (Fabling, 2024; Fabling & Maré, 2015, 2019). We restrict analysis to the 2005-2022 (March) financial years due to lower coverage of employee ethnicity in earlier years, and the most recently available productivity data.[1] Productivity variables are calculated only for firms in the private-for-profit market sector, defined as industries where for-profit participants are dominant (ie, excluding the health, education and government sectors).[2] The market sector accounts for 68 percent of total FTE employment over our period of interest.

Effective labour input and the firm-level wage bill are derived by aggregating monthly pay-as-you-earn tax filings to the financial year. The wage bill is deflated by the Consumer Price Index (to the March 2022 year), and the labour headcount is adjusted to create a full-time equivalent (FTE) measure that adjusts labour input for low earnings workers, multiple job holders, and starting and ending jobs.[3] Working proprietor (WP) labour input is added to this total, with corresponding WP earnings imputed using the firm-year mean worker wage.

The impact of including WPs is minimal due to two population constraints imposed to improve the measurement of employee ethnicity shares. First, we restrict the population to firms with at least 10 FTE employees so that year-on-year variation in shares is not dominated by a small number of employee changes. Second, since IDI ethnicity data are not full coverage, we drop firm-year observations where we don't observe employee ethnicity (plus age and sex) for at least 75 percent of total labour input (L, which includes WPs). Although ethnicity data are available for most employees, using total FTE as the denominator excludes firm-years where WPs constitute more than 25 percent of total labour input. Combined, these firm-level restrictions exclude 27

[1] We use the October 2023 instance of these databases.
[2] We exclude firms during transition years – ie, when entering or exiting the population.
[3] Unreported robustness tests where we focus on the wage bill for "full-time" mid-job spell workers produce similar patterns, with higher mean wages across the firm distribution.

percent of market sector FTE, with the firm size restriction having the greatest impact.[4] Panel (a) of Figure 1 show the variation in coverage over time. Coverage of FTE has increased over time, ranging between 70 percent and 74 percent. Coverage of workers has also increased, to almost 76% in 2021.

For most firms, the coverage of ethnicity data is high. The mean (10th percentile) firm-year coverage rate of observed ethnicity is 96% (87%), much higher than the 75 percent minimum quality threshold that we impose. Given these coverage rates, we consider the ethnic breakdown of observed workers to be broadly representative of all employees in the market sector. The high coverage of employee ethnicity is partly due to our reliance on level one ethnicity data, which are collected by many government agencies for administrative purposes. The level one classification distinguishes six broad ethnic groups, which we combine into four:

- European (including "Other" ethnicities which, based on Census, are primarily people who identify as "New Zealanders");
- Māori;
- Pacific Peoples; and
- Asian/MELAA[5] (combined, since the latter is too small to support separate parameter estimates, although MELAA employment is reported separately in Table 1).

Individuals can identify with more than one ethnic group. We employ inverse response count-weighting for individuals with multiple ethnicities, to ensure that all individuals are given equal weight, and that employment shares add to one. For example, a full-time worker identifying as both European and Māori, would contribute 0.5 FTE to total employment for each ethnic group.[6]

In some specifications, we distinguish workers by birthplace and recency of migration as well as by ethnicity. The Māori ethnic group is not disaggregated in this way because of the relatively small proportion of Māori who are foreign-born (2.8%). Country of birth and time of arrival into New Zealand are identified from (potentially multiple) Census responses, Department of Internal Affairs birth registry, and visa and border crossing data (following Fabling et al., 2022). Due to left-censoring of visa and border data, we define recent migrants as workers who have arrived in New Zealand to live less than eight years prior to their observed employment.

[4] We don't lose observations from missing productivity data, because we use the complete productivity dataset (Fabling, 2024). As a proportion of total L, these data are predominantly based on AES/IR10 returns (86%) and GST returns (12%). The remaining 2% are modelled from labour input. Appendix Table 1 summarises the sources of productivity data used in our analytical sample - in terms of firm-year observations and total labour input.

[5] MELAA refers to Middle-Eastern, Latin American and African ethnicities.

[6] Weighting is not intended as a reflection of ethnic identity or attachment. For instance, Houkamau & Sibley (2019, p. 131) find that "Māori with multiple ethnic identities may not necessarily have a weaker sense of cultural identity compared with those identifying as solely Māori".

Panel (b) of Figure 1 shows coverage rates for each of five ethnic groups (European and 'Other ethnicity' are combined). Coverage is at least 69% for each group, with relatively high coverage for Māori (average of 76%) and Pacific Peoples (average of 86%). Average coverage rates are shown in Table 1 – both as a proportion of total employment, and as a proportion of the market sector that is the focus of this study.

Table 1 also shows the annual average number of employees (2.3m) and annual FTE in total (1.6m), and for each of 5 ethnic groups (inversely weighted by number of ethnicity responses). Two thirds of FTE in our sample is accounted for by people of European ethnicity (top row of bottom panel), with smaller shares of Asian/MELAA (14%), Māori (11%), and Pacific Peoples (8%). The MELAA share is only around 1 percent, which is why we combine MELAA with people of Asian/MELAA ethnicity in our later analysis. Variation over time in these shares is shown in Figure 2, with the strongest change being the increase in the share of FTE from Asian/MELAA workers – from 8 percent in 2005 to 19 percent in 2021. The lower panel of Table 1 shows that the average proportion of FTE from foreign-born workers is 32 percent, although this is considerably higher for Asian/MELAA (92%), MELAA (88%) and Pacific Peoples (62%). Furthermore, around half of FTE for foreign-born MELAA (54%) and Asian/MELAA (47%) is from recent migrants.

When estimating equations (1) and (3). we maintain a consistent reference group for all estimates – New Zealand-born workers of European ethnicity. This choice is made on statistical grounds – 'New Zealand-born European' is the single largest group, accounting for 53% of overall FTE, and provides the most stable and precisely estimated benchmark against which to compare estimates for other groups.

4 Ethnic wage and productivity variation

Our approach to identifying discrimination from ethnic wage and productivity variation focuses on how firm-level wage bills and output relate to the ethnic employment mix in the firm. In this section, we document the variation in ethnic FTE shares across firms and industries, and how this relates to relative wages and productivity. This provides contextual information, prior to the estimation of discrimination effects, which is presented in section 5.

4.1 Representation of ethnic groups across firms

Table 2 shows the mean earnings per FTE for each of four ethnicity-based groups and three groups defined by migrant status. European employees earn an average of $80,400 per FTE, which is 8

percent above overall mean earnings per FTE ($74,600). Longer-term migrants are the only other group with above average earnings, by 4 percent. Mean earnings per FTE for NZ-born employees is almost the same as the overall mean. Recent migrants and Asian/MELAA employees have mean earnings 8 to 10 percent below average, whereas relative earnings are considerably lower for Māori (–17%) and Pacific (–22%) employees. To determine whether mean earnings differences are related to differences in effective labour input or discrimination, we rely on variation across firms in the proportion of labour input from different ethnic and migrant groups.

The remainder of Table 2 documents the considerable variation in ethnic employment composition across firms, summarising the patterns of within-firm representation for the main ethnic and migrant-status groups. The table shows the mean share of FTE employment for each group, and documents how representation varies by percentiles of firms, ordered by group representation. European workers account for 66 percent of overall FTE employment but in 10 percent of firms, this share is 32 percent or less, and in 25 percent of firms, the share is 89 percent or more. Concentration across firms is even more pronounced for smaller groups. For instance, Pacific Peoples account for 8 percent of FTE employment, but 35 percent of firms have no Pacific employees. In contrast, Pacific workers are over-represented (account for more than 8 percent of firm employment) in 18 percent of firms.

Some of the concentration reflects the fact that the industry mix of employment differs across groups. Overall industry patterns are shown in the first three columns of Table 3, which show the overall share of firms, of FTE employment, and of wage bill accounted for by each of 16 industries. By comparing each industry's share of the national wage bill with its share of FTE employment provides a summary measure of average pay within each industry, shown in the fourth column. Industries are ordered by relative pay – average pay in Mining is highest, at 68 percent above the overall mean; and the average pay in the lowest paid industry (Accommodation and Food) is 36 percent below. Columns (5) to (8) show the share of industry employment accounted for by each of four ethnic groups. Compared with an overall FTE share of 66%, European employment is most concentrated in the highly paid, but small, Mining industry (82% share) and in the relatively highly-paid Professional, Scientific and Technical Services industry (77% share). Māori and Pacific employment is over-represented in some high-pay industries (Mining, and Electricity Gas & Water) and also in some low-pay industries such as Agriculture, Forestry & Fishing, and Admin & Support Services. For Asian/MELAA workers, who account for 15% of overall FTE employment, over-representation is highest in the low-paid Accommodation and Food

Services industry (29% of industry FTE), but also in the well-paid Finance & Insurance industry (19% of industry FTE).

Over-representation in high-wage industries does not necessarily translate into commensurately high wages for all groups. The final four columns of Table 3 summarise the within-industry relative pay for each ethnic group – whether the average wage for each group is higher or lower than the industry average. Average pay for European workers is higher than the industry average in all industries. In contrast, mean pay levels for other groups are all below the industry average, with the exception of the low share of Asian/MELAA workers in the Mining industry, who earn 15 percent above the industry mean. Māori and Pacific workers have particularly low relative pay within relatively highly paid industries.

The focus of our research is on the question of whether these pay differences between and within industries are accompanied by similar differences in productivity in the firms where different groups work. Before presenting our main empirical estimates, we illustrate the raw relationship between group FTE shares within a firm and firm level wages and productivity. Figure 3 plots firm-level productivity and mean wages in a firm against the proportion of the firm's FTE employment accounted for by workers of European ethnicity. Panel (a) shows the relationship for multifactor productivity (mfp[7]), plotted as a non-parametric curve (kernel-weighted local polynomial). The bold line shows the linear relationship across firms between the 25th and 75th percentile of European shares. As shown in Table 2, this corresponds to firms with between 57 percent and 89 percent of FTE employment coming from European workers. The line is upward sloping, indicating that when the European share is higher, productivity is also higher. This reflects both between-firm variation (firms with higher European shares are more productive), and within-firm variation (firms have a high European share in years when productivity is high). The slope of the bold line is 0.23, indicating that an increase in the European share equal to one percent of total FTE is associated with about 0.25% higher mfp.

Panel (b) of Figure 3 shows the analogous graph for average (log of) wages. A higher European share of FTE employment is associated with a higher average wage. The slope is 0.14, implying that a one percentage point increase in the European share is associated with a 0.14 percent higher wage. Combining the productivity and wage slopes, the effect on wage is smaller than the effect on productivity, by 0.09 percent. In the context of the economics of discrimination literature cited above (eg Hellerstein & Neumark (2006)), such a pattern would be interpreted as

[7] mfp is estimated as the residual from a doubly-deflated translog gross-output production function with firm fixed effects and industry-trends (industry trends and firm fixed effects included in mfp measure).

discrimination against European workers, as their contribution to output is not matched by a commensurate increase in wage. Such a conclusion is, however, premature, without the more careful estimation that follows in section 5.

The results from Figure 3 are summarised in Table 4, together with analogous results for other ethnic and migrant groups, estimated from group-specific interquartile ranges of FTE shares. Higher shares of Māori, Pacific, or NZ-born workers are each associated with lower mean wages, and also with lower productivity. For Māori and NZ-born groups, the lower productivity is more than outweighed by lower wages, with a net effect for these groups of –0.60 and –0.48 respectively. For Pacific workers, the productivity effect (–0.96) is more negative than the wage effects (–0.10), with a positive net effect of 0.86. The Asian/MELAA worker share is associated with higher productivity (0.40) and even higher wages (0.85), with a net wage effect of 0.45. The pattern for migrant workers is similar to the pattern for Asian/MELAA workers.

5 Estimates of relative wage discrimination

While these patterns illustrate that varying ethnic or migrant shares of FTE can have related differently to wages and productivity, obtaining indicators of wage discrimination from this variation requires more careful analysis. As outlined in section 2, an indicator of wage discrimination is calculated by comparing each group's contribution to output relative with the group's share of wage bill (equations (1) and (3)). This ratio is measured relative to the benchmark ratio for the numerically largest group (NZ-born European), so by construction, discrimination is normalised to zero for this group.

5.1 Basic specification

Table 5 presents estimates of relative output effects (ϕ from equation (1)), relative wage bill effects (ψ from equation (3)), and relative wage discrimination ($\psi - \phi$).[8] Each column is for a different grouping of ethnicity/migrant groups, using a common benchmark group (NZ-born European). The first column reports estimates for a three-way grouping (NZ-born European, European Migrants, all non-European groups combined). The results suggest that there is relative wage discrimination (panel c) in favour of European migrants (0.421), and in favour of non-

[8] Appendix Table 3 reports the production function and wage bill equation coefficients and standard errors. Only main input effects are reported. Because inputs are measured relative to overall means, the main effects can be interpreted as output and wage bill elasticities with respect to inputs evaluated at means.

European workers (0.133). Compared with the output and wage bill contributions of NZ-born European FTE labour input, European migrant labour input makes a greater relative contribution per FTE to the wage bill (0.590) than to output (0.170), indicating discrimination in their favour. Similarly, non-European workers' relative contribution (per FTE) to the wage bill (–0.072) is lower than that of NZ-born European, indicating a lower average wage (per FTE), but the relative contribution per FTE to output is even lower (–0.205), indicating wage discrimination in their favour.

It is important to note again that it is only the relative size of the per-FTE output and wage bill effects that is interpretable. The magnitude of the individual effects will be affected by heterogeneity and mismeasurement of effective labour input, because it relies on an FTE employment measure rather than (unobserved) actual effective labour input. Heterogeneity and mismeasurement have the same proportional effect on estimated output and wage bill coefficients, so do not bias the estimates of wage discrimination.

The second column of Table 5 separates the non-European group by ethnicity into three (Māori, Pacific, and Asian/MELAA). The estimate of wage discrimination in favour of non-European workers shown in Column 1 is driven primarily by discrimination in favour of Asian/MELAA workers (0.188). The ratios of output to wage bill effects for Māori and Pacific workers are not statistically different (p-value>0.1) from the ratio for NZ-born European workers.

The remaining columns of Table 5 provide separate estimates for recent (first arrived to live in New Zealand less than 8 years earlier) and longer-term migrants within ethnic groups. European migrants only are disaggregated in all column (3). Column (4) additionally distinguishes effects for NZ-born, recent migrants, and longer term migrants within the Pacific and Asian/MELAA ethnic groups.[9] The results in column (3) show that there is statistically significantly[10] stronger discrimination in favour of recent European migrants (0.526) than there is in favour of longer-term European migrants (0.255).

Estimates of wage discrimination for Pacific workers and Asian/MELAA workers separated by migrant status are presented in column (4). For NZ-born Pacific workers, relative discrimination is not significantly different from that of NZ-born European workers. There is, however, significant stronger relative discrimination against longer term Pacific migrants (–0.214) compared with recent Pacific migrants (0.594). The difference (–0.808) reflects a greater difference in relative

[9] Column 3 is the specification that will be used to examine relative wage discrimination for subgroups of firms. For some subgroupings, the specification in column 4 results in a relatively high proportion of firms with no workers of a particular ethnic/migrant group.

[10] Estimates of relative discrimination between migrant subgroups within each ethnic group are shown in Appendix Table 2.

output effects than in relative wage bill effects. For Asian workers, there is no statistically significant difference in relative discrimination between migrant subgroups (See Appendix Table 2), although there is positive discrimination in favour of Asian migrants compared with NZ-born Europeans.

5.2 Within-firm variation (firm fixed effects)

The estimates in Table 5 reflect both cross-sectional (between firm) variation and variation over time within firms. Estimated discrimination in favour of a group could reflect that the group is over-represented in firms where the groups relative share of the wage bill is stronger than their relative contribution to output. It could also reflect that, within firms, increases in the group's effective labour input is associated with a stronger proportional rise in the wage bill than in output. In order to shed light on the strength of these two patterns, we estimate equations (1) and (3) allowing for firm-specific intercepts (firm fixed effects), as outlined in section 2. The resulting estimates are based only on within-firm variation, with output and wage bill elasticities of inputs evaluated at firm-specific (rather than overall) mean levels of inputs.

Firm fixed effect estimates are presented in Table 6, analogously to the estimates in Table 5.[11] Estimated relative wage discrimination in favour of European migrants (again compared with the benchmark of NZ-born European workers) is somewhat reduced compared with the estimates in Table 5, but is still positive at around 0.30 for recent European migrants and 0.15 for longer term European migrants. Both the relative output effects (ϕ) and relative wage bill effects (ϕ) are substantially lowered by the inclusion of firm fixed effects, suggesting that European migrants are over-represented in firms where their contributions to both output and the wage bill are high.

In contrast, estimated relative wage discrimination in favour of Asian/MELAA workers is stronger than in Table 5, at around 0.53, with significant differences (0.102, see Appendix Table 2) between recent and longer term Asian/MELAA migrant groups (weaker discrimination in favour of recent Asian/MELAA migrants). The impact of including fixed effects on estimates for Asian/MELAA workers is greater for output than for wage bill effects. The lower relative output effects suggest that Asian/MELAA workers are disproportionately employed in firms where they are relatively productive.

The most substantial changes in estimated relative discrimination in Table 6 when compared with Table 5 are for Māori and Pacific workers. The within-firm variation in Table 6 shows relative

[11] Appendix Table 4 reports the production function and wage bill equation coefficients and standard errors.

discrimination against Māori of around –0.4, and against Pacific workers of around –0.14. In both cases, the inclusion of fixed effects has a greater impact on (increasing) estimated relative output effects than on relative wage bill effects, implying that Māori and Pacific workers are disproportionately employed in firms where their contribution to output is weakest. Among Pacific workers, estimated relative wage discrimination in favour of NZ-born Pacific workers and discrimination against longer-term Pacific migrants are both strengthened when estimated with firm fixed effects. Longer-term Pacific migrants are concentrated in firms where their relative effect on output is low relative to their wage bill share and the opposite is true for NZ-born Pacific workers. Results for recent Pacific migrants are imprecisely estimated - Pacific recent migrants account for less than 1% of FTE employment, and 80% of firms have no Pacific recent migrants.

5.3 Estimates by firm-type

The estimates presented in Table 5 and Table 6 are mean effects across all firms. In this section, we extend that analysis by providing separate estimates by firm location, industry, skill-mix, and the presence of working proprietors. Table 7 summarises the relative sizes of the sub-groups that we consider, together with mean earnings per worker and output per worker for the firms within each sub-group.

Seventy-one percent of firms operate within a metropolitan area, where mean earnings and output per worker are above the national mean level. European and Māori ethnic groups are under-represented in these firms, as are NZ-born workers generally.[12] In contrast, Pacific and Asian/MELAA workers and migrants are over-represented in metropolitan firms.

We divide firms into three groups based on their skill-intensity, as captured by the proportion of their labour input accounted for by workers with degree qualifications. High skill-intensity firms (with 25% or more graduates) account for 36 percent of firms, and pay higher-than average earnings per worker. Asian/MELAA and migrant workers account for a higher-than average share of employment in these firms, with lower-than average shares of workers being NZ-born, European, Māori, and Pacific. NZ-born and Māori workers account for a disproportionately large average share of employment in low skill-intensity firms.

Just over half of firms have a working proprietor (WP) and they pay lower than average wages. Employment shares are fairly similar across firms with and without WPs. There are, however, distinct patterns of ethnic and migrant group employment depending on whether the

[12] The ethnic and migrant group shares differ from those in Table 3. The shares here are unweighted averages of firm shares (ie: not FTE-weighted)

firm has a European WP. European and NZ-born workers are over-represented in firms with at least one European WP. All other ethnic or migrant groups account for a disproportionately high share of employment in WP-firms with no European WPs, with a particularly high over-representation of recent migrant workers.[13]

5.3.1 Basic specification

Table 8 reports estimated relative output effects (ϕ), relative wage bill effects (ψ) and relative wage discrimination ($\psi - \phi$) for each of the subsets of firms. The 'all firms' rows replicate the estimates in column (3) of Table 5 and estimates for other subsets are reported for the same grouping of ethnic and migrant groups.

The pattern of relative wage bill effects is fairly uniform across all of the firm types, showing relatively high favourable wage bill effects for European migrants, and negative effects associated with Māori, Pacific and Asian/MELAA employment shares. In contrast, there is a good deal of variability across firm types in estimated relative output effects, although statistically significant estimates generally have the same sign as the 'all firms' estimate. The relative output effects are less precisely estimated than the wage bill effects, with standard errors (ranging from 0.03 to 0.35) generally 3 to 10 times as large as the standard errors on the corresponding relative wage effect estimates (0.01 to 0.06).

The imprecision of the output effect estimates is reflected in the estimates of relative wage discrimination. Recent European migrants experience the strongest overall relative wage discrimination in their favour and point estimates suggest favourable wage discrimination within all firm types. The firm type estimates suggest that favourable wage discrimination for recent European migrants is strongest in firms operating in metropolitan areas (0.69) and in skill-intensive firms (0.62). Longer-term European migrants also appear to benefit from strong positive wage discrimination within skill-intensive firms (0.64).

Asian/MELAA workers experience overall positive wage discrimination, which appears to be stronger outside main urban areas, among firms without a working proprietor and in skill-intensive firms. Relative wage discrimination against Asian/MELAA workers is evident only within firms with a non-European working proprietor. Despite no statistically significant overall relative wage discrimination for Pacific workers (relative to NZ-born Europeans), there appears to be discrimination in their favour within non-metropolitan firms and working proprietor firms. For

[13] Fabling and Maré (2024) look in greater detail at outcomes within Māori-led firms, with a focus on outcomes for Māori workers.

Māori workers, the degree of relative wage discrimination is not statistically different from zero within any firm type.

A similar pattern of estimates is seen for subgroups of firms based on industry (See Table 9). Estimated relative wage effects show a fairly consistent pattern across industries, whereas there is greater variation in estimated relative output effects. The output effect estimates for Primary sector firms (AB: Agriculture, Forestry, Fishing and Mining) are particularly imprecisely estimated, with statistically insignificant and implausibly large estimates ranging from –1.4 to 8.0.[14] There are relatively few statistically significant estimates of relative wage discrimination by industry. Among European migrants, there appears to be favourable wage discrimination within the Retail, Accommodation and Food Industries (GH) for long-term migrants, and in a grouping of service industries labelled in Table 9 as 'Other Service' (Wholesale; Transport, Postal & Warehousing; Rental, Hiring & Real Estate; Admin & Support; Arts and Recreation). There is favourable estimated relative wage discrimination in favour of Pacific and Asian/MELAA workers in the Information, Finance & Insurance, and Professional Services industries (JKM). The only statistically significant estimates of unfavourable relative wage discrimination are for Pacific workers in the Retail, Accommodation and Food Services industries (–0.24) and in Manufacturing, Utilities, and Construction (–0.17).

5.3.2 Within-firm variation (firm fixed effects)

As was the case for the 'all firms' estimates, the inclusion of firm fixed effects leads to markedly different estimates of relative wage discrimination across firm-type subgroups. Table 10 and Table 11 provide fixed effects estimates analogous to the estimates by firm-type and industry in Table 8 and Table 9. Table 10 shows fairly consistent estimates of relative wage effects across different firm types, but substantial across-type variation in relative output effects. Relative wage discrimination effects are particularly strong in firms with no working proprietors, contributing to overall positive wage discrimination for European migrants and Asian/MELAA workers, and to overall negative (unfavourable) relative wage discrimination against Pacific and Māori workers.

Unfavourable wage discrimination for Māori and Pacific workers appears to be relatively strong among firms that operate in a metropolitan area. In contrast to the strong overall relative wage discrimination against Māori workers (–0.39), wage discrimination appears to favour Māori in firms with a non-European WP (0.44), in high skill intensity (0.34) and low skill-intensity (0.30)

[14] The estimated output elasticity of labour for primary sector firms (β_L in equation (1)) is small and statistically insignificant (0.04; se=0.14)), leading to unstable estimates for group coefficients (ϕ_j)

firms, and in firms with no metropolitan presence (0.31). Similarly, Pacific workers experience positive wage discrimination in non-metropolitan firms (0.21), medium skill-intensity firms (0.44) and in firms with a European WP (0.13), despite overall unfavourable relative wage discrimination (–0.14). For Asian/MELAA workers, despite strong overall favourable relative wage discrimination, the estimates show negative relative wage discrimination among firms with at least one non-European WP.

The industry patterns in Table 11, based on estimation that includes firm fixed effects, highlight distinctive patterns across industries. Relative wage effects are consistently small (–0.03 to 0.03) in the low-wage Retail, Accommodation and Food Services industries, consistent with low wage variability in those industries. The overall relative wage discrimination patterns across ethnic/migrant groups of workers (panel c) are accentuated in the patterns within 'other service' industries (Wholesale; Transport, Postal & Warehousing; Rental, Hiring & Real Estate; Admin & Support; Arts and Recreation), with strong discrimination in favour of European migrants and Asian/MELAA workers, and against Māori and Pacific workers. However, the estimates for firms in those industries is a consequence of some extremely large, and possibly implausible output effect estimates. The estimates in panel (a) of Table 11 imply that, in those industries, NZ-born European workers provide over twice the effective labour input per FTE as provided by longer term European migrants (ϕ=–1.2; $e^{1.2}$-1=2.3), and Māori workers provide over twenty times the effective labour input per FTE of NZ-born European workers (ϕ=3.3; $e^{3.3}$-1=26). As is the case for estimates without fixed effects, output estimates for Primary industries are also extreme, ranging from –2.5 to 2.9, due to unstable production function estimates (see footnote 14). For industries with more plausible relative output effect estimates, relative discrimination is positive for Māori, Pacific, and Asian/MELAA workers in the Manufacturing, Utilities and Construction industries. For Pacific workers, relative discrimination is also positive in the Information, Finance & Insurance, and Professional Services industries, and negative in Retail, Accommodation and Food Services.

6 Summary and discussion

Our analysis of ethnic pay gaps in Aotearoa New Zealand using firm-level data has confirmed patterns of wage disparity that are well-documented from worker-level analyses using data from household surveys (Benison & Maré, 2025; Cochrane & Pacheco, 2022). In firms where a relatively high share of employees identifies with an ethnicity other than European, wage payments are relatively low, consistent with these groups being paid at a lower (per FTE employee) rate than

European employees. The implied wage differences (from column (3) of Table 5) are –18% for Māori employees (log difference of –0.196), –11% for Pacific employees (–0.118) and –3% for Asian/MELAA employees (–0.026).

Worker-level analyses generally adjust observed ethnic wage differences for ethnic differences in worker and job characteristics. Adjusted wage differences are interpreted as discriminatory under the assumption that differences in effective labour input are fully captured by observed characteristics. The current paper relies on a different assumption – that ethnic differences in effective labour input have the same proportional effect on both wages and output. We find that groups with low average wage effects, as reported in the previous paragraph, also have relatively low contributions, per FTE employee, to output. We infer that relative wage bill effects (ψ) and relative output effects (ϕ) are both biased due to imperfect controls for effective labour input per FTE employee. However, the difference between them ($\psi - \phi$) provides a valid measure of relative wage discrimination.

We use output and wage bill effects for NZ-born European employees (the numerically largest group of employees) as benchmarks against which to judge relative wage discrimination. For Māori and Pacific employees, estimated wage discrimination is not statistically significantly different compared with the benchmark. In contrast, there is evidence of relative wage discrimination in favour of European migrants (48%; log difference=0.39) and Asian/MELAA employees (20%; log difference=0.18).[15] When distinguishing NZ-born, recent migrants, and longer term migrants, we find that the strongest favourable relative wage discrimination is for recent European and Pacific migrants. These estimates arise from two distinct underlying patterns. For recent European migrants, their output effect is similar to non-migrant Europeans but their wage effect is positive. For Pacific migrants, the estimated output and wage effects are both negative, but the output effect is substantially larger in magnitude.

Our main estimates in Table 5 are identified from differences in ethnic employment composition both between firms and within firms over time. We also report estimates of relative wage discrimination identified only from temporal variation within firms, by including firm fixed effects when estimating wage bill and output equations (Table 6). The difference between the two sets of estimates reflects the sorting of ethnic groups into firms where their contribution to output is relatively high or relatively low compared with their share of the wage bill. The fixed effects estimates differ markedly from the main estimates in some respects. Estimated relative wage bill

[15] European migrants: col (2) of Table 5; Asian/MELAA/MELAA: col (3) of Table 5.

effects are less strongly positive for European migrants, but similar for other groups. This suggests that European migrants are disproportionately sorted into firms that pay European migrants well but that within-firm changes in the proportion of employees accounted for by European migrants is associated with less substantial increases in wage bill.

The fixed effects estimates of relative output effects are starkly different from those in the main estimates. Consistent with the lowered wage bill effects associated with European migrants, relative output effects are also considerably reduced, suggesting that European migrants are sorted into firms where they are not only paid relatively well, but also where they contribute relatively strongly to output. In contrast, Māori and Pacific employees appear to be strongly sorted into firms where their contribution to output is relatively weak. Fixed effects estimates show that within-firm increases in the proportion of workers who identify as Māori are associated with strong increases in the relative contribution of Māori workers to output. The combined effect of negative relative wage bill estimates for Māori and positive relative output effects is that there is strong estimated relative wage discrimination against Māori. Table 6 also shows relative wage discrimination against Pacific employees, and discrimination in favour of European migrants and Asian/MELAA workers.

Within-firm estimates clearly differ from the overall estimates, though it is not clear which set of estimates provides the most reliable indicator of relative wage discrimination by ethnicity. The overall estimates include the effects of sorting across firms as well as wage discrimination, whereas the fixed effects estimates may be biased by the endogeneity of ethnic employment shares. Endogeneity bias may result if ethnic employment shares are adjusted in response to output shocks. If an ethnic group's share of employment increases in years when the firm's (revenue) productivity is high, fixed effects estimates of relative output effects will be biased upwards. Our findings from fixed effects estimation suggest strong relative wage discrimination against long-term Pacific migrants (c. –50%) and Māori (c. –40%) employees, and strong relative wage discrimination in favour of Asian employees (c. 50%). A careful analysis of endogeneity is a priority for further research.

We investigate heterogeneity in relative wage discrimination by estimating effects separately for subsets of firms defined by industry, location, skill-intensity, and the presence of working proprietors. Relative wage effects vary somewhat across subsets but show a fairly consistent pattern of higher wages per FTE employee for European migrants and lower wages per FTE employee for Māori and Pacific employees, whether estimated with firm fixed effects or not. Variation in estimated relative wage discrimination across subsets of firms and between fixed

effect and basic specifications is due largely to variation in estimated relative output effects that are based on a production function equation. The resulting discrimination estimates are somewhat mixed, but suggest that for Māori, Pacific and Asian/MELAA employees, favourable discrimination is stronger in non-metropolitan firms – or equivalently, less strong in metropolitan firms. Discrimination in favour of European migrants is strongest in skill-intensive firms, and for recent European migrants, in metropolitan firms.

When estimated with the inclusion of fixed effects, relative output effects by industry group are, in many cases, imprecisely estimated or are implausibly large. This is reflected in a mixed pattern of estimates for relative wage discrimination among subsets of firms. Although the magnitudes of effects change in the presence of fixed effects, Māori, Pacific, and Asian/MELAA employees still appear to face weaker positive, or stronger negative discrimination in metropolitan areas.

Estimated within-firm relative wage discrimination effects are most pronounced among firms with no working proprietors. These firms pay relatively high average wages and account for just under half of all firms (see Table 7). Estimated discrimination in non-WP firms is strongly in favour of European migrants and Asian/MELAA workers, and unfavourable for Māori and Pacific employees. One potential explanation of the stronger discrimination patterns in non-WP firms is that in the absence of working proprietors, managers may be more able to exercise wage discrimination and discrimination in hiring without taking into account the associated loss in output.

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These results are not official statistics. They have been created for research purposes from the IDI which is carefully managed by Stats NZ. For more information about the IDI, 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 data's ability to support Inland Revenue's core operational requirements. 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.

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Tables and Figures

Table 1: Employment coverage by ethnicity and migrant type

		Emp	FTE Total	FTE European	FTE Māori	FTE Pacific	FTE Asian/ MELAA	FTE MELAA
Employment								
• Mean annual (000)		2,315	1,606	1,114	161	98	201	21
• Growth (2005-21)		21%	31%	11%	19%	53%	241%	122%
• Coverage (% of total)		53%	49%	47%	52%	64%	54%	53%
• Coverage (%market sector)		73%	72%	71%	76%	86%	72%	74%
FTE shares	% of sample		100%	66%	11%	8%	14%	1%
Foreign born	% of sample		32%	13%	0%	5%	13%	1%
	% of group		32%	20%	3%	62%	92%	88%
Recent migrant	% of sample		12%	4%	0%	1%	6%	1%
	% of foreign		38%	34%	7%	24%	47%	54%

Notes: Emp is a count of employees. FTE is full-time equivalent employment. Recent migrants are migrants that first arrived to live in New Zealand 8 or fewer years prior to observed employment.

Table 2: Relative earnings and representation of ethnic and migrant groups

	European	Māori	Pacific	Asian/ MELAA	NZ born	LT migrant	Recent migrant
Earning per FTE ($000)	$80.4	$61.7	$57.8	$67.1	$74.7	$77.3	$68.9
• relative pay	8%	-17%	-22%	-10%	0%	4%	-8%
Mean FTE share	66%	11%	8%	15%	68%	21%	11%
Representation , by percentile of firms							
10th percentile	32%	0%	0%	0%	36%	3%	0%
25th percentile	57%	2%	0%	1%	57%	8%	1%
50th percentile	77%	6%	1%	7%	75%	16%	6%
75th percentile	89%	12%	6%	18%	87%	27%	15%
90th percentile	95%	24%	18%	38%	94%	39%	30%
Percent of firms where group is:							
• Over-represented	63%	32%	18%	31%	60%	38%	37%
• Not represented	1%	11%	35%	20%	1%	5%	21%

Note: percentiles of firm-year observations. Relative pay = (Group earnings–Mean earnings)/Mean earnings. Mean earnings = $74,600 ($ March 2022 year)

Table 3: Industry shares

	Mean share			Relative pay	Share of industry FTE				Within-industry relative pay			
	firms	FTE	Wage bill		European	Māori	Pacific	Asian/ MELAA	European	Māori	Pacific	Asian/ MELAA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
B: Mining	0.4%	0.5%	0.9%	68%	82%	12%	1%	4%	2%	-16%	-21%	15%
K: Finance & Insurance	1.7%	5.5%	7.8%	41%	71%	5%	5%	19%	8%	-21%	-31%	-18%
D: Elec, Gas, Water	0.6%	1.6%	2.2%	33%	72%	12%	5%	11%	7%	-26%	-27%	-4%
M: Prof, Scient, Technical	11.8%	9.3%	12.3%	32%	77%	4%	2%	17%	3%	-16%	-26%	-9%
J: Info media & Telecom	1.3%	2.9%	3.7%	30%	73%	5%	4%	17%	6%	-15%	-30%	-13%
F: Wholesale	10.1%	8.1%	8.8%	8%	73%	7%	8%	12%	7%	-20%	-29%	-11%
I: Transp Postal, Wareh	5.4%	8.1%	8.5%	5%	66%	13%	10%	10%	7%	-15%	-21%	-8%
E: Construction	13.0%	9.2%	9.6%	3%	71%	14%	6%	9%	4%	-12%	-13%	-1%
C: Manufacturing	19.6%	22.2%	22.4%	1%	63%	13%	11%	13%	8%	-15%	-19%	-9%
L: Rental, Hiring , RealEst	1.0%	0.8%	0.8%	-3%	67%	10%	9%	13%	7%	-15%	-21%	-9%
S: Other Services	3.2%	1.5%	1.3%	-16%	70%	9%	7%	14%	4%	-10%	-14%	-8%
R: Arts & Recr	1.0%	1.0%	0.9%	-17%	61%	10%	8%	22%	8%	-13%	-10%	-12%
A: Agric Forest Fish	6.1%	3.4%	2.7%	-19%	56%	19%	10%	15%	9%	-11%	-15%	-9%
N: Admin & Support	4.6%	6.4%	4.9%	-23%	51%	14%	16%	18%	11%	-15%	-17%	-4%
G: Retail	11.1%	13.8%	9.8%	-29%	69%	9%	5%	17%	2%	-9%	-8%	-2%
H: Accomm & Food	9.1%	5.6%	3.5%	-36%	54%	10%	8%	29%	3%	-10%	-8%	0%
Total	100.0%	100.0%	100.0%	0%	66%	11%	8%	15%	8%	-17%	-22%	-10%

Notes: 'Relative pay' is calculated as (share of wage bill)/(share of FTE) -1. Industries are shown in descending order of relative pay (column 4).

Table 4: Interquartile wage and productivity slopes

	European	Māori	Pacific	Asian/ MELAA	NZ born	LT migrant	Recent migrant
Slopes							
• wage (ψ)	0.14	-1.51	-0.10	0.85	-0.54	0.84	0.57
• Productivity (ϕ)	0.23	-0.91	-0.96	0.40	-0.06	0.18	0.26
Difference in slopes							
• ($\psi - \phi$)	-0.09	-0.60	0.86	0.45	-0.48	0.65	0.31

Note: Wage is measured as the mean log of FTE-weighted mid-spell wage. Productivity is measured as multifactor productivity (mfp) from a doubly-deflated gross output translog production function with firm fixed effects and industry trends (mfp=residual + industry trends).

Table 5: Ethnic patterns of relative wage and output effects

		(1)	(2)	(3)	(4)
		Relative output effects (ϕ)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	0.170*	0.162*	0.357***	0.336***
	Recent migrant			-0.052	-0.043
Māori		-0.205***	-0.237**	-0.232**	-0.242**
Pacific	NZ-born		-0.147**	-0.147**	-0.213
	LT migrant				0.139
	Recent migrant				-0.862***
Asian/MELAA	NZ-born		-0.216***	-0.209***	-0.133
	LT migrant				-0.156**
	Recent migrant				-0.259***
Output R^2		0.777	0.777	0.777	0.777
		(a) Relative Wage bill effects (ψ)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	0.590***	0.551***	0.612***	0.597***
	Recent migrant			0.474***	0.488***
Māori		-0.072***	-0.197***	-0.196***	-0.202***
Pacific	NZ-born		-0.118***	-0.118***	-0.115***
	LT migrant				-0.075***
	Recent migrant				-0.268***
Asian/MELAA	NZ-born		-0.028***	-0.026***	0.404***
	LT migrant				0.053***
	Recent migrant				-0.112***
Wage R^2		0.950	0.951	0.951	0.951
		(b) Relative wage discrimination ($\psi - \phi$)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	0.421***	0.389***	0.255**	0.261**
	Recent migrant			0.526***	0.531***
Māori		0.133***	0.039	0.036	0.040
Pacific	NZ-born		0.028	0.029	0.098
	LT migrant				-0.214**
	Recent migrant				0.594***
Asian/MELAA	NZ-born		0.188***	0.183***	0.537
	LT migrant				0.209***
	Recent migrant				0.148***

*Note: Observations=273,435. Significance indicators *** (0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. [0] denotes reference group.*

Table 6: Ethnic patterns of relative wage and output effects (fixed effects estimates)

		(1)	(2)	(3)	(4)
		(a) Relative output effects (ϕ)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	-0.190***	-0.158***	-0.097*	-0.100*
	Recent migrant			-0.226***	-0.240***
Māori		-0.334***	0.258***	0.258***	0.291***
Pacific	NZ-born		0.013	0.013	-0.506***
	LT migrant				0.474***
	Recent migrant				-0.059
Asian/MELAA	NZ-born		-0.570***	-0.568***	-0.759***
	LT migrant				-0.612***
	Recent migrant				-0.526***
Output R^2		0.656	0.656	0.656	0.656
		(b) Relative Wage bill effects (ψ)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	0.054***	0.053***	0.041***	0.041***
	Recent migrant			0.069***	0.070***
Māori		-0.080***	-0.129***	-0.129***	-0.127***
Pacific	NZ-born		-0.128***	-0.128***	-0.186***
	LT migrant				-0.103***
	Recent migrant				-0.103***
Asian/MELAA	NZ-born		-0.043***	-0.043***	-0.027**
	LT migrant				-0.034***
	Recent migrant				-0.051***
Wage R^2		0.935	0.935	0.935	0.935
		(c) Relative wage discrimination ($\psi - \phi$)			
European	NZ-born	[0]	[0]	[0]	[0]
	LT migrant	0.245***	0.211***	0.138**	0.141**
	Recent migrant			0.295***	0.310***
Māori		0.253***	-0.386***	-0.386***	-0.417***
Pacific	NZ-born		-0.141**	-0.141**	0.320***
	LT migrant				-0.577***
	Recent migrant				-0.045
Asian/MELAA	NZ-born		0.527***	0.525***	0.733***
	LT migrant				0.578***
	Recent migrant				0.476***

*Note: Observations=273,435. Significance indicators *** (0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. [0] denotes reference group.*

Table 7: Earnings, output and employment by type of firm

	Share of firms	Earnings per FTE (000)[g]	Output per wkr (000)[g]	(unweighted) Mean FTE share						
				European	Māori	Pacific	Asian/ MELAA	NZ-born	LT migrant	Recent migrant
Total	100%	$65	$176	70%	10%	6%	14%	70%	19%	11%
Has metro location										
• No	29%	90%	94%	76%	14%	3%	7%	81%	11%	9%
• Yes	71%	105%	102%	67%	8%	7%	17%	65%	22%	13%
Skill (grad+) demand										
• 0%-10% degree	33%	94%	105%	72%	16%	7%	5%	81%	13%	6%
• 10%-25% degree	31%	94%	99%	69%	10%	7%	13%	69%	20%	11%
• 25%-100% degree	36%	112%	97%	69%	5%	4%	23%	59%	24%	17%
Working Proprietors										
• None	48%	109%	104%	70%	9%	6%	15%	67%	21%	12%
• Has a WP	52%	92%	97%	71%	11%	6%	13%	72%	17%	11%
• Has European WP	48%	93%	99%	74%	11%	5%	10%	75%	16%	9%
• Has non-European WP	9%	87%	83%	49%	14%	7%	30%	58%	23%	19%

Note: [g]denotes annual geometric mean (percentages show level relative to overall mean). Shares are unweighted averages across firms. Per-worker earnings and output are calculated as unweighted averages of firm-level ratios.

Table 8: Ethnic patterns of relative wage and output effects by firm type

	N	European migrants		Māori	Pacific	Asian/ MELAA
		Long-term	Recent			
			(a) Relative output effects (ϕ)			
All firms	273,435	0.357***	-0.052	-0.232**	-0.147**	-0.209***
Outside main urban	79,455	-0.109	0.029	-0.283***	-0.876***	-0.310***
Employs in main urban	193,983	0.420***	-0.161	-0.115	-0.059	-0.247***
0-10% degree+	91,572	-0.016	-0.055	-0.176**	-0.203**	-0.146*
10%-25% degree+	84,141	0.676**	0.047	-0.406*	0.239	-0.156*
25%-100% degree+	97,725	0.111	-0.284**	-0.323	-0.547***	-0.336***
Has no WP	130,341	0.634**	-0.095	-0.390*	0.050	-0.339***
Firm with WP	143,097	0.063	-0.006	-0.122**	-0.240***	-0.062**
Has European WP	130,719	0.048	0.028	-0.110**	-0.150***	-0.111*
Has non-Euro WP	25,371	0.453***	0.056	0.170	-0.297*	0.099*
			(b) Relative wage bill effects (ψ)			
All firms	273,435	0.612***	0.474***	-0.196***	-0.118***	-0.026***
Outside main urban	79,455	0.140***	0.214***	-0.184***	-0.178***	-0.067***
Employs in main urban	193,983	0.630***	0.533***	-0.241***	-0.156***	-0.068***
0-10% degree+	91,572	0.144***	0.397***	-0.140***	-0.076***	-0.022
10%-25% degree+	84,141	0.450***	0.278***	-0.218***	-0.056***	-0.047***
25%-100% degree+	97,725	0.750***	0.335***	-0.317***	-0.270***	-0.094***
Has no WP	130,341	0.699***	0.390***	-0.310***	-0.195***	-0.063***
Firm with WP	143,097	0.344***	0.419***	-0.136***	-0.074***	-0.030***
Has European WP	130,719	0.302***	0.409***	-0.136***	-0.064***	0.049***
Has non-Euro WP	25,371	0.463***	0.460***	-0.057***	-0.073***	-0.032***
			(c) Relative wage discrimination ($\psi - \phi$)			
All firms	273,435	0.255**	0.526***	0.036	0.029	0.183***
Outside main urban	79,455	0.250*	0.185	0.099	0.698***	0.243***
Employs in main urban	193,983	0.210	0.694***	-0.126	-0.097	0.179***
0-10% degree+	91,572	0.160**	0.452***	0.036	0.127	0.124
10%-25% degree+	84,141	-0.226	0.231	0.188	-0.295	0.109
25%-100% degree+	97,725	0.639***	0.620***	0.005	0.277	0.242***
Has no WP	130,341	0.065	0.485**	0.080	-0.244	0.276***
Firm with WP	143,097	0.281***	0.425***	-0.014	0.165***	0.033
Has European WP	130,719	0.254***	0.381***	-0.025	0.086	0.160***
Has non-Euro WP	25,371	0.010	0.404**	-0.227	0.224	-0.132**

*Notes: 'Main urban' denotes level-1 functional urban area (Auckland; Christchurch; Wellington; Hamilton; Tauranga; Dunedin). Significance indicators ***(0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. WP refers to Working Proprietor. All estimates based on the specification used in column (3) of Table 5.*

Table 9: Ethnic patterns of relative wage and output effects by industry

	N	European migrants		Māori	Pacific	Asian/ MELAA
		Long-term	Recent			
			(a) Relative output effects (ϕ)			
All firms	273,435	0.357***	-0.052	-0.232**	-0.147**	-0.209***
Primary (AB)	17,979	-1.364	0.149	7.292	1.906	8.008
Mfrg, Util, Constr (CDE)	90,954	0.396***	0.237	-0.101	0.151	-0.115**
Other service (FILNR)	56,400	0.644***	-0.364	-0.321***	-0.277***	-0.145**
Retail/Accom,Food (GH)	55,278	0.073	0.376***	-0.103	0.409***	0.017
Info, Finins, Prof (JKM)	52,824	1.564**	0.338	-0.442	-0.654***	-0.255*
			(b) Relative wage bill effects (ψ)			
All firms	273,435	0.612***	0.474***	-0.196***	-0.118***	-0.026***
Primary (AB)	17,979	0.203***	0.355***	-0.119***	-0.123***	-0.054***
Mfrg, Util, Constr (CDE)	90,954	0.497***	0.464***	-0.176***	-0.021	-0.027***
Other service (FILNR)	56,400	0.604***	0.398***	-0.301***	-0.263***	-0.139***
Retail/Accom,Food (GH)	55,278	0.291***	0.324***	-0.145***	0.172***	0.021**
Info, Finins, Prof (JKM)	52,824	1.057***	0.850***	-0.350***	-0.277***	-0.013
			(c) Relative wage discrimination ($\psi - \phi$)			
All firms	273,435	0.255**	0.526***	0.036	0.029	0.183***
Primary (AB)	17,979	1.567	0.206	-7.411	-2.029	-8.061
Mfrg, Util, Constr (CDE)	90,954	0.101	0.227	-0.075	-0.173*	0.088
Other service (FILNR)	56,400	-0.040	0.762***	0.020	0.014	0.006
Retail/Accom,Food (GH)	55,278	0.218***	-0.052	-0.042	-0.237**	0.004
Info, Finins, Prof (JKM)	52,824	-0.507	0.512	0.093	0.378**	0.242*

*Notes: 'Main urban' denotes level-1 functional urban area (Auckland; Christchurch; Wellington; Hamilton; Tauranga; Dunedin). Significance indicators ***(0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. WP refers to Working Proprietor. All estimates based on the specification used in column (3) of Table 5.*

Table 10: Ethnic patterns of relative wage and output effects by firm type (fixed effects)

	N	European migrants		Māori	Pacific	Asian/ MELAA
		Long-term	Recent			
			(a) Relative output effects (ϕ)			
All firms	273,435	-0.097*	-0.226***	0.258***	0.013	-0.568***
Outside main urban	79,455	-0.081	0.108	-0.399***	-0.255**	-0.612***
Employs in main urban	193,983	-0.025	-0.282***	0.821***	0.451***	-0.483***
0-10% degree+	91,572	0.161**	-0.071	-0.396***	-0.153***	-0.967***
10%-25% degree+	84,141	0.173	0.394***	-0.063	-0.555***	-0.081
25%-100% degree+	97,725	0.082	-0.263**	-0.541***	-0.082	-0.490***
Has no WP	130,341	-0.477***	-0.482***	0.978***	0.422***	-0.627***
Firm with WP	143,097	-0.007	0.036	-0.081*	-0.116**	-0.058
Has European WP	130,719	0.012	0.030	-0.047	-0.209***	-0.183***
Has non-Euro WP	25,371	-0.161	0.280	-0.564***	0.139	1.043***
			(b) Relative wage bill effects (ψ)			
All firms	273,435	0.041***	0.069***	-0.129***	-0.128***	-0.043***
Outside main urban	79,455	-0.003	0.034***	-0.090***	-0.047***	-0.000
Employs in main urban	193,983	0.053***	0.081***	-0.153***	-0.150***	-0.052***
0-10% degree+	91,572	0.024***	0.096***	-0.093***	-0.074***	0.017***
10%-25% degree+	84,141	0.055***	0.084***	-0.125***	-0.115***	-0.002
25%-100% degree+	97,725	0.026***	0.037***	-0.204***	-0.240***	-0.111***
Has no WP	130,341	0.043***	0.058***	-0.184***	-0.190***	-0.085***
Firm with WP	143,097	0.036***	0.069***	-0.092***	-0.080***	-0.004
Has European WP	130,719	0.032***	0.071***	-0.086***	-0.077***	0.001
Has non-Euro WP	25,371	0.028*	0.061***	-0.122***	-0.084***	-0.038***
			(c) Relative wage discrimination ($\psi - \phi$)			
All firms	273,435	0.138**	0.295***	-0.386***	-0.141**	0.525***
Outside main urban	79,455	0.078	-0.074	0.310***	0.208**	0.611***
Employs in main urban	193,983	0.078	0.362***	-0.974***	-0.601***	0.431***
0-10% degree+	91,572	-0.136*	0.168*	0.303***	0.079	0.984***
10%-25% degree+	84,141	-0.119	-0.311**	-0.062	0.439***	0.079
25%-100% degree+	97,725	-0.056	0.300***	0.337**	-0.158	0.379***
Has no WP	130,341	0.520***	0.540***	-1.162***	-0.612***	0.542***
Firm with WP	143,097	0.043	0.033	-0.011	0.036	0.054
Has European WP	130,719	0.020	0.041	-0.038	0.132***	0.184***
Has non-Euro WP	25,371	0.188	-0.219	0.442***	-0.223	-1.081***

*Notes: 'Main urban' denotes level-1 functional urban area (Auckland; Christchurch; Wellington; Hamilton; Tauranga; Dunedin). Significance indicators ***(0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. WP refers to Working Proprietor. All estimates based on the specification used in column (3) of Table 6.*

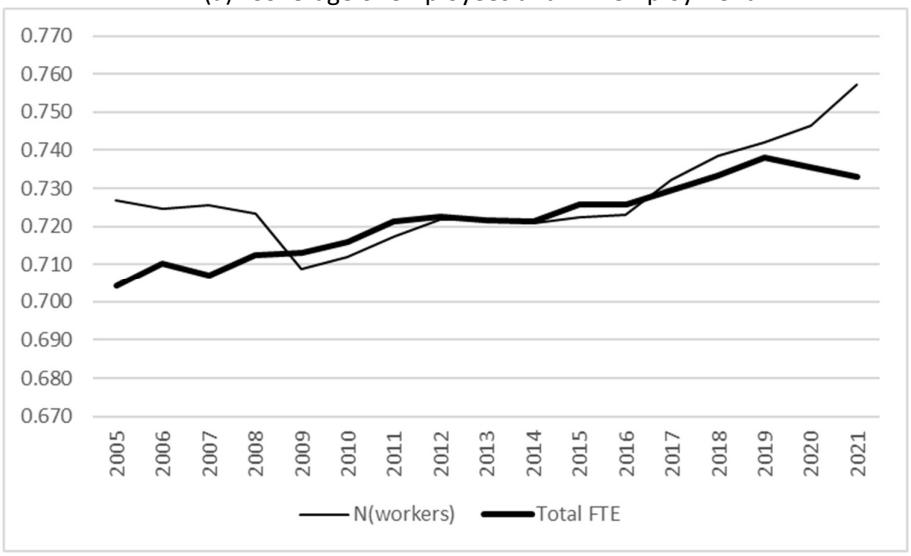
Table 11: Ethnic patterns of relative wage and output effects by industry (fixed effects)

	N	European migrants		Māori	Pacific	Asian/ MELAA
		Long-term	Recent			
			(a) Relative output effects (ϕ)			
All firms	273,435	-0.097*	-0.226***	0.258***	0.013	-0.568***
Primary (AB)	17,979	-2.75***	9.970***	6.610***	2.666*	15.34***
Mfrg, Util, Constr (CDE)	90,954	0.012	0.113	-0.297***	-0.380***	-0.172***
Other service (FILNR)	56,400	-1.172***	-0.462***	3.224***	0.110	-0.853***
Retail/Accom,Food (GH)	55,278	-0.041	0.067	0.085	0.397***	-0.021
Info, Finins, Prof (JKM)	52,824	0.183	-0.155	-0.476***	-0.796***	-0.255***
			(b) Relative wage bill effects (ψ)			
All firms	273,435	0.041***	0.069***	-0.129***	-0.128***	-0.043***
Primary (AB)	17,979	0.052**	0.025	-0.150***	-0.062***	-0.030***
Mfrg, Util, Constr (CDE)	90,954	0.071***	0.125***	-0.121***	-0.135***	-0.019***
Other service (FILNR)	56,400	0.030***	0.054***	-0.105***	-0.197***	-0.054***
Retail/Accom,Food (GH)	55,278	0.020***	0.030***	-0.030***	0.022**	0.011**
Info, Finins, Prof (JKM)	52,824	0.015	0.057***	-0.293***	-0.211***	-0.136***
			(c) Relative wage discrimination ($\psi - \phi$)			
All firms	273,435	0.138**	0.295***	-0.386***	-0.141**	0.525***
Primary (AB)	17,979	2.804***	-9.945***	-6.760***	-2.728*	-15.37***
Mfrg, Util, Constr (CDE)	90,954	0.059	0.011	0.177**	0.245***	0.153**
Other service (FILNR)	56,400	1.202***	0.516***	-3.329***	-0.306*	0.800***
Retail/Accom,Food (GH)	55,278	0.062	-0.038	-0.116	-0.375**	0.032
Info, Finins, Prof (JKM)	52,824	-0.168	0.212	0.183	0.584***	0.119

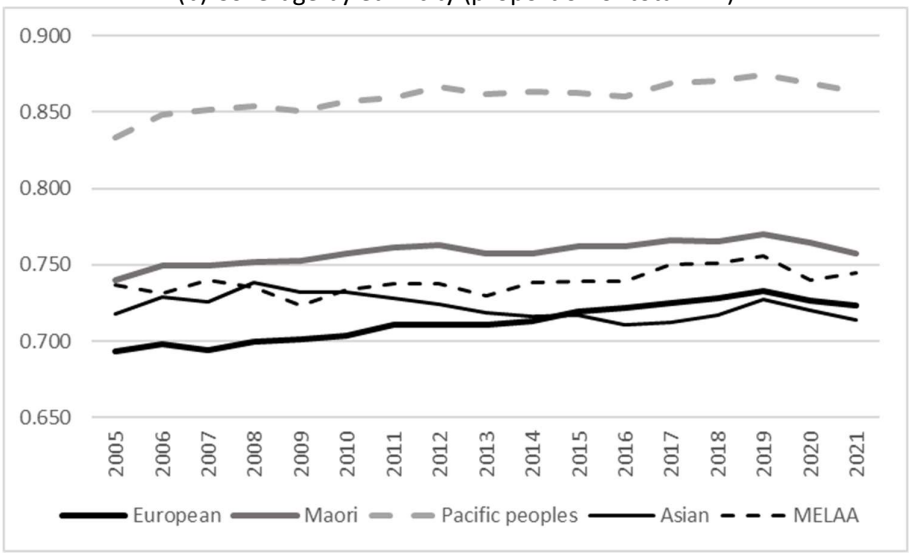
*Notes: 'Main urban' denotes level-1 functional urban area (Auckland; Christchurch; Wellington; Hamilton; Tauranga; Dunedin). Significance indicators ***(0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects. WP refers to Working Proprietor. All estimates based on the specification used in column (3) of Table 6.*

Figure 1: Coverage of analytical sample (% of market sector)

(a) Coverage of employees and FTE employment

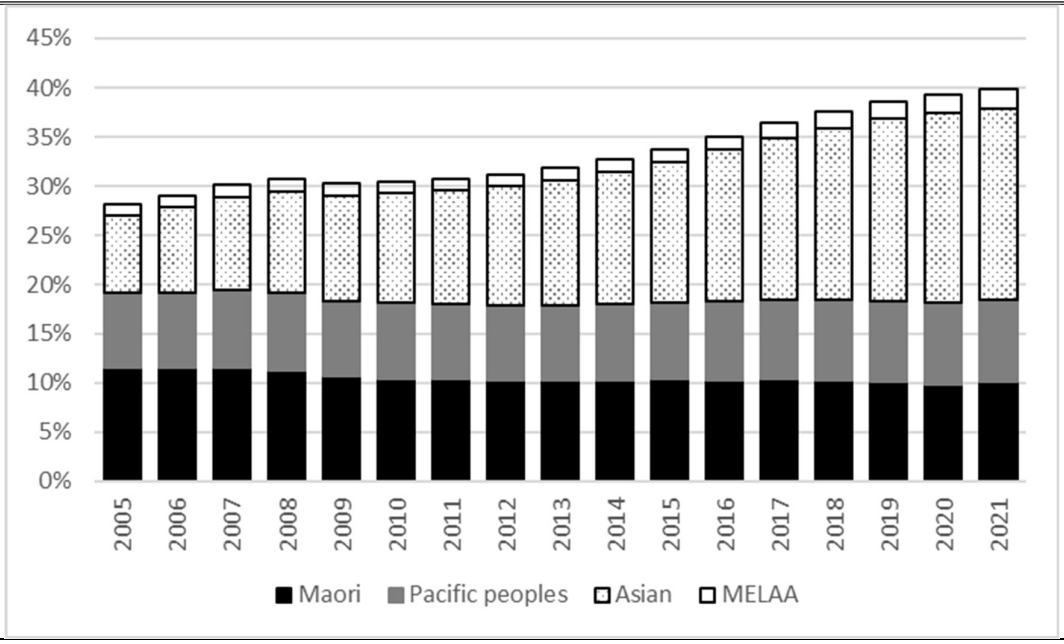


(b) Coverage by ethnicity (proportion of total FTE)



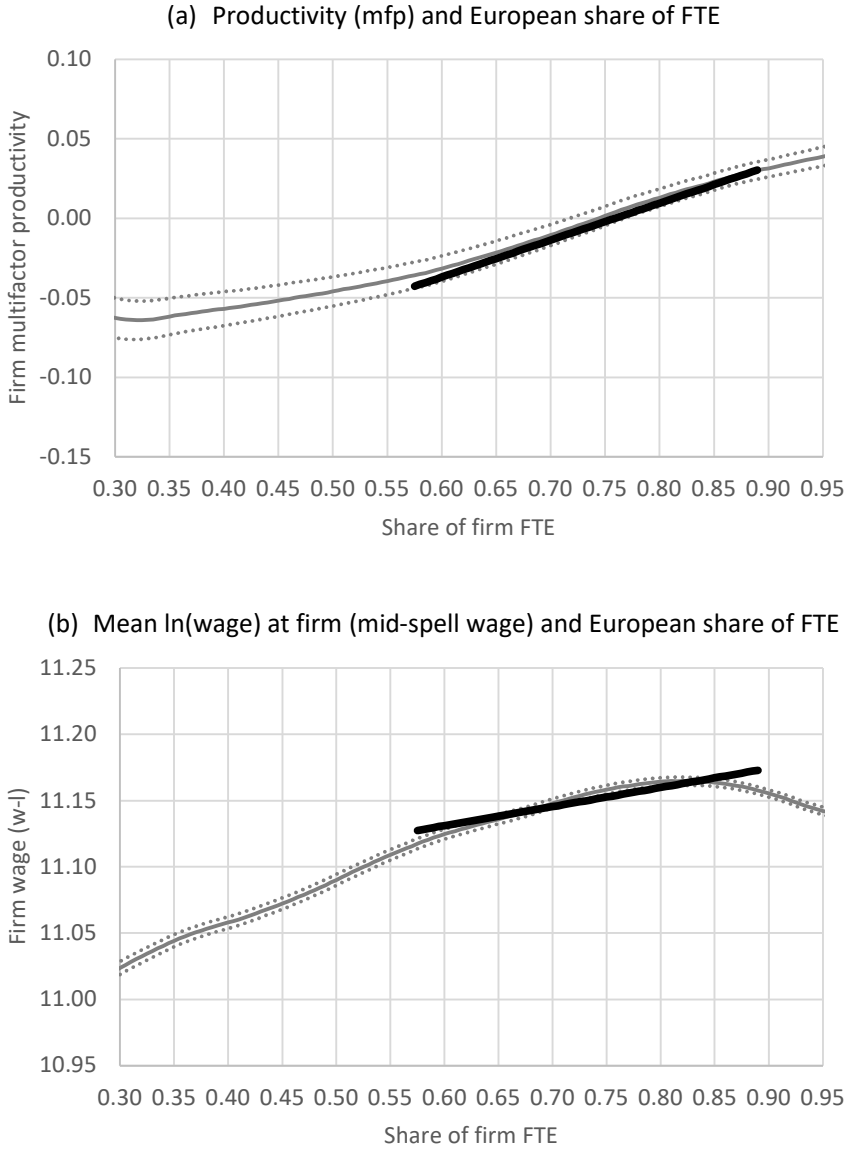
Notes: Calendar year used, rather than March financial year. Coverage is less than 100% due to sample restrictions: i) continuing firms with FTE of jobs≥10; ii) Level 1 ethnicity data non-missing for 75% of employment; iii) workers have non-missing age, sex, and level 1 ethnicity. Coverage by ethnicity based on responses inversely weighted by the number of level 1 ethnicities reported, to ensure that weighted total of responses add to total FTE. The European ethnic group includes individuals identifying as "other ethnicity" (predominantly 'New Zealander')

Figure 2: Composition of analytical sample (share of total FTE by ethnicity)



Notes: Calendar year used, rather than March financial year. Proportions by ethnicity based on proportions of FTE, inversely weighted by the number of level 1 ethnicities reported, to ensure that weighted total responses add to total FTE.

Figure 3: Illustration of inter-quartile wage and productivity slopes
(By European FTE-share in the firm)



Note:

Appendix

Appendix 1:

Appendix Table 1: Sources of production data for analytical sample

		Firm-year observations		Total labour (L)	
	Productivity tier (source)	N	Share of total	Total (000)	Share of total
1	AES/IR10/AES+IR10	214,575	0.785	12,427	0.857
2	GST (firm fixed effects)	37,701	0.138	1,094	0.075
3	GST (industry controls)	15,009	0.055	669	0.046
4	L-based (ffe or ind)	6,153	0.023	317	0.022
	Total	273,435		14,506	

Note: See Fabling (2024). Total labour input is measured on a full-time equivalent (FTE) basis. This table is for the (March) years 2005-2022.

Appendix Table 2: Relative wage discrimination between migrant sub-groups, by ethnicity

	European	Pacific	Asian
		(a) OLS estimates (Table 5)	
LT v Recent migrants	-0.270***	-0.808***	0.061
LT migrant v NZ born	0.261**	-0.312	-0.328
Recent mig v NZ born	0.531***	0.496**	-0.389
		(b) Fixed effects estimates (Table 6)	
LT v Recent migrants	-0.169***	-0.532***	0.102**
LT migrant v NZ born	0.141**	-0.897***	-0.155
Recent mig v NZ born	0.310***	-0.365*	-0.257*

Note: The cells show relative wage discrimination for migrant sugroups within each ethnic group, based on estimates from column 4 of Table 5 (for OLS) and Table 6 (for Fixed Effects).

Appendix Table 3: Output and wage bill equation estimates

		Output Equation				Wage bill equation			
		(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
m		0.514***	0.514***	0.513***	0.513***	0.071***	0.071***	0.071***	0.070***
		[0.006]	[0.006]	[0.006]	[0.006]	[0.002]	[0.002]	[0.002]	[0.002]
k		0.106***	0.106***	0.106***	0.106***	0.022***	0.022***	0.022***	0.021***
		[0.005]	[0.005]	[0.005]	[0.005]	[0.002]	[0.002]	[0.002]	[0.002]
l		0.406***	0.405***	0.407***	0.407***	0.958***	0.960***	0.960***	0.961***
		[0.010]	[0.010]	[0.010]	[0.010]	[0.003]	[0.003]	[0.003]	[0.003]
European	LT migrant	0.170*	0.162*	0.357***	0.347***	0.590***	0.551***	0.612***	0.599***
		[0.087]	[0.084]	[0.114]	[0.113]	[0.016]	[0.015]	[0.021]	[0.021]
	Recent migrant			-0.052	-0.043			0.474***	0.488***
				[0.097]	[0.097]			[0.020]	[0.020]
Māori		-0.205***	-0.237**	-0.232**	-0.242**	-0.072***	-0.197***	-0.196***	-0.202***
		[0.035]	[0.095]	[0.095]	[0.095]	[0.005]	[0.010]	[0.010]	[0.010]
Pacific	NZ-born		-0.147**	-0.147**	-0.213		-0.118***	-0.118***	-0.115***
			[0.074]	[0.075]	[0.179]		[0.009]	[0.009]	[0.028]
	LT migrant				0.139				-0.075***
					[0.109]				[0.017]
	Recent migrant				-0.862***				-0.268***
					[0.162]				[0.023]
Asian/MELAA	NZ-born		-0.216***	-0.209***	-0.133		-0.028***	-0.026***	0.404***
			[0.038]	[0.038]	[0.426]		[0.006]	[0.006]	[0.055]
	LT migrant				-0.156**				0.053***
					[0.076]				[0.013]
	Recent migrant				-0.259***				-0.112***
					[0.052]				[0.008]

*Note: Observations=273,435. Significance indicators *** (0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects.*

Appendix Table 4: Output and wage bill equation estimates (firm fixed effects)

		Output Equation				Wage bill equation			
		(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
m		0.504***	0.500***	0.500***	0.500***	0.015***	0.015***	0.015***	0.015***
		[0.003]	[0.003]	[0.003]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]
k		0.186***	0.189***	0.189***	0.190***	0.010***	0.010***	0.010***	0.010***
		[0.003]	[0.003]	[0.003]	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]
l		0.338***	0.332***	0.333***	0.331***	0.984***	0.984***	0.984***	0.984***
		[0.005]	[0.005]	[0.005]	[0.005]	[0.001]	[0.001]	[0.001]	[0.001]
European	LT migrant	-0.190***	-0.158***	-0.097*	-0.098*	0.054***	0.053***	0.041***	0.041***
		[0.043]	[0.046]	[0.058]	[0.058]	[0.003]	[0.003]	[0.004]	[0.004]
	Recent migrant			-0.226***	-0.236***			0.069***	0.070***
				[0.062]	[0.062]			[0.005]	[0.005]
Māori		-0.334***	0.258***	0.258***	0.291***	-0.080***	-0.129***	-0.129***	-0.127***
		[0.027]	[0.071]	[0.071]	[0.072]	[0.002]	[0.004]	[0.004]	[0.004]
Pacific	NZ-born		0.013	0.013	-0.506***		-0.128***	-0.128***	-0.186***
			[0.068]	[0.068]	[0.110]		[0.004]	[0.004]	[0.008]
	LT migrant				0.474***				-0.103***
					[0.115]				[0.006]
	Recent migrant				-0.059				-0.103***
					[0.150]				[0.008]
Asian/MELAA	NZ-born		-0.570***	-0.568***	-0.759***		-0.043***	-0.043***	-0.027**
			[0.025]	[0.025]	[0.149]		[0.003]	[0.003]	[0.012]
	LT migrant				-0.612***				-0.034***
					[0.035]				[0.004]
	Recent migrant				-0.526***				-0.051***
					[0.033]				[0.003]

*Note: Observations=273,435. Significance indicators *** (0.01) ** (0.05) * (0.10). All effects relative to NZ-born European effects.*