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**Article**

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ORIGINAL ARTICLE

Open Access



# Skill composition of immigration flows and the measurement of education-occupation mismatch

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## Abstract

Recent papers have found that often immigrants are overqualified relative to native-born workers when comparing an individual's education to the 'average' education in their occupation. We show that these results are sensitive to differences in the education distribution between immigrants and the native born. Using data for New Zealand, which has an immigration policy that favours skilled immigrants, we find that this approach leads one to conclude that immigrants are, on average, overqualified for their occupation. However, once we account for the fact that immigrants are on average more skilled than natives, we find that immigrants are, in fact, less overeducated than natives.

**JEL classification:** F22, J21, J61

**Keywords:** Immigration, Occupation, Skill transferability, Job-worker mismatch, Discrimination, New Zealand

## 1 Introduction

It is commonly observed that the average level of education of immigrants in many occupations is greater than the average level of education of native-born workers in the same occupations. Occupation-education mismatch can affect the economic integration of immigrants in the host country and the returns to education and experience (Chiswick & Miller, 2008). It can also lead to efficiency losses or even lower economic growth (Ramos et al. 2009). The basic idea is that for each occupation, there is a required level of education at which job performance will be optimal, given technology. If workers do not have the required level of education, there is a mismatch in the worker to job assignment. The literature on this topic is commonly referred to as testing the prevalence and impact of overeducation/required education/undereducation (ORU).

Immigrant overskilling has been identified using micro level data in Australia, North America and Europe.<sup>1</sup> The majority of studies on immigrant overskilling use the 'realised match' method which compares an individual's education level to the 'average' level of education in their occupation and then see how this varies by characteristics, such as immigrant status (see Groot and Van den Brink 2000, Rubb 2003 and McGuinness 2006 for reviews of the general literature on occupation-education mismatch).<sup>2</sup> It is typically found that immigrants have higher levels of overskilling than natives and that this declines only slowly with time spent in the host country. Our main

contribution is that we show that, in a context where migrants are more educated on average than natives, this finding disappears if one adds in controls for broadly defined differences in educational levels between the two groups. The simple intuition for this finding is that overskilling is by definition relatively more common among workers with higher levels of education, and thus, what appears to be in our context greater overskilling among immigrants is, in fact, driven by the higher levels of educational achievement found among immigrants and by higher overskilling rates among both more educated natives and immigrants, as opposed to any genuine differences in overskilling between migrants and natives conditional on education levels.

More specifically, we use data from the 1996, 2001 and 2006 New Zealand censuses to examine differences between each immigrant's actual years of education and the estimated average years of education in the narrowly defined occupation in which they work. Because of the skill-based migration system used in New Zealand, immigrants are, on average, much more educated than the New Zealand-born (NZ-born). For example, in 2006, 34 % of immigrants have a bachelor's degree or higher versus 18 % of the NZ-born. On the other hand, only 10 % of immigrants have no qualifications versus 20 % of the NZ-born.

Ignoring these large differences in the educational distribution between immigrants and the NZ-born leads us to conclude that male immigrants are generally overqualified for their occupation until they have been in the country for around 8 years. However, once we account for the fact that the migrant and native qualifications distributions differ (with migrants in New Zealand on average more educated than natives) and that average education-occupation mismatch is education-level specific, we find that migrants are in fact on average undereducated. Given that a number of previous studies have also examined countries with skill-based migration systems, our results suggest that the ubiquitous finding of immigrant overskilling might be overstated.

We therefore make a second contribution to the literature and extend the standard empirical model estimated in papers using the realised match approach by estimating models of over- and undereducation that are fully stratified by qualifications. Hence, we ask the question: 'does the average immigrant work in a more or less skilled occupation than the average NZ-born individual with the same characteristics and the same qualifications?'. We believe that this is the question that the literature has always intended to ask, but was not, in fact, asking. Taking this approach, we find that the extent of undereducation of migrants is far greater than that of overeducation and that both overeducated and undereducated migrants become more similar to comparable native-born with increasing years of residence in New Zealand. Notable overeducation is only present among those with a bachelor degree.

In the next section, we discuss the various causes of a migrant's job-skill mismatch, as well as briefly outline the New Zealand immigration system and show why an empirical model of overeducation should control for educational levels. In Section 3, we outline how we constructed our census dataset and provide some descriptive statistics. Section 4 reports on our main regression findings. The final section concludes.

## **2 Background**

### **2.1 Theories of education-occupation mismatch**

There are a large number of phenomena that can lead to an education-occupation mismatch. Some of these phenomena apply equally to immigrants and native-born workers.

Others are specific to migrants. A number of previous papers have extensively reviewed the literature on education-occupation mismatch, so we will remain brief here.<sup>3</sup>

The starting point is that for any given job, productivity is maximised when the worker possesses a level of skills that is required for that job, but neither more nor less. Such skills are a combination of formal education and training, natural ability and practical experience. In what follows, we focus exclusively on observed education when measuring mismatch, while realising that ability and experience can substitute for a lack of education. Indeed, some of our results are directly the consequence of such substitutions taking place.

One reason for potential mismatch is that firms and workers face imperfect information. Both parties engage in search until the benefits of further search no longer outweigh the costs. In the resulting equilibrium of realised matches, some workers will be overeducated for the job they have accepted, while others may be undereducated. Given that migrants are less well informed about the host labour market than the native born, we expect there to be more mismatch among the former. However, better information, job mobility and post-arrival human capital investments will enable migrants to gradually improve the match between their human capital and the available jobs. Consequently, education-occupation mismatch among migrants is likely to decrease over time.

A second reason for potential mismatch is career progression combined with the rise in the average education level of workers. Given the upward trend in post-compulsory education in most countries, workers who retire are on average less educated than workers who enter the labour market. Additionally, on-the-job training throughout a career can partially substitute for a lack of formal qualifications. Hence, most workers obtain towards the end of their career a position for which the typical level of formal education has become higher than what they acquired, i.e. they become increasingly undereducated. For immigrants, on-the-job training is even more important than for the native born, because their home country human capital is likely to be imperfectly transferable to the host country. Consequently, they may start out being overeducated, with this declining with duration of residence.

A third reason is that formal education may simply be a signal of innate ability rather than of skill specific to the job. If so, mismatch could increase over time if, among recruits with the same entry education level, those who are unsuccessful are demoted to lower-level jobs, while those with high productivity are promoted. What matters for migrants is how host country employers interpret foreign qualifications. Those who have been educated in countries very dissimilar to the host country may be considerably overeducated in their first job if employers cannot ascertain the value of the qualification.<sup>4</sup> The subsequent employment record in the host country will signal true ability and will diminish overeducation, unless non-recognition of foreign qualifications creates permanent barriers. At the same time, positive selection in terms of ability and motivation may permit immigrants to obtain jobs for which they do not have the formal qualifications.

## **2.2 The New Zealand immigration system<sup>5</sup>**

Over the past 30 years, there have been substantial changes to New Zealand's immigration policy, though with a maintained focus on selecting migrants with skills valued in

the New Zealand labour market and who are also likely to settle well in New Zealand. Until 1987, skilled migration policy favoured migrants from traditional source countries—primarily the UK, Western European and North America, with some additional low skill migration from the Pacific Islands. Preference was given to those in occupations that had been included on the ‘occupational priority list’ (OPL). The OPL was drawn up in consultation with various sectors in which skill shortages were identified. The Immigration Act 1987 removed the traditional source country preference and rationalised the OPL system, requiring a firm employment offer for residence applications made on occupational grounds.

The Immigration Amendment Act 1991 represented a fundamental shift in selection policy, replacing the OPL with a point-system (the General Skills Category). Applicants were granted points for employability, age and settlement factors and had to meet certain character and health requirements. Those with the highest scores were selected with the aim of meeting an annual numerical migration target. The policy was maintained until 2003, with modifications to put more weight on English language ability (in 1995 and 2002), on having a job offer (1995) and on having a job offer relevant to the applicant’s qualifications and experience (2002). In 2003, the policy was replaced by the ‘Skilled Migrant Category’ policy, also based on the awarding of points for job offers, work experience, qualifications and age, with additional recognition of partners’ employment and experience, NZ qualifications and employment outside Auckland. In 2007, the point schedule was modified to award points for employment, qualifications and experience in specified areas of anticipated future growth, for study in New Zealand and for partners’ skills and experience.<sup>6</sup>

New Zealand currently approves around 44,000 people each year for permanent residence, equivalent to about 1 % of the New Zealand population (although the inflow has in some years been largely offset by a net outflow of natives). Over the past 15 years, permanent residence approvals have fluctuated between 30,000 and 55,000 per year. Skilled and business migrants currently account for about half of residence approvals, a figure that has varied between around one-half and three-quarters over at least the past 15 years. Family-related approvals account for about 80 % of the remainder, with the balance being approvals reflecting humanitarian and international responsibilities.

A significant direction of change in immigration policy over recent years has been the expansion of temporary migration approvals. Temporary permit approvals have grown markedly; over one quarter of a million people per year are currently approved for entry under temporary work or student permits, up from around 45,000 in the 1990s. The number of people arriving on work-related temporary permits has increased consistently. This growth reflects a strengthened policy focus on labour-market-focused temporary migrants who can bring skills and experience in occupations and areas identified as suffering from skill shortages. Relevant temporary migration policies include long-term business visas, talent visas, job-search visas, the re-establishment of a list of priority occupations and an expansion of approvals for working holidays. These visas are typically valid for a maximum of 2 years with many providing the opportunity to then apply for permanent residency.

### 2.3 An empirical model of overeducation

The standard empirical model of immigrant education-occupation mismatch used in the realised match literature takes the form:

$$\text{YearsEd}_i - \text{OccEd}_{\text{occ}(i)} = \alpha + \beta \text{Immigrant}_i + X_i \gamma + e_i, \tag{1}$$

where  $i$  indexes individuals. The dependent variable is the difference between  $\text{YearsEd}_i$ , individual  $i$ 's actual years of education and  $\text{OccEd}_{\text{occ}(i)}$ , some measure of the 'required' years of education for workers in individual  $i$ 's occupation.<sup>7</sup>  $\text{Immigrant}_i$  is an indicator variable for whether or not individual  $i$  was born in the country being examined. Hence, if immigrants are on average overeducated,  $\beta > 0$ .  $X_i$  is a row vector of other control variables, with coefficient vector  $\gamma$ . The control variables vary across papers in the literature but generally include the variables age or potential experience and demographic characteristics, and  $e_i$  is a mean zero idiosyncratic error term. A number of papers further discretise (1), by changing the outcome variable to an indicator for whether individual  $i$  has more or less than the 'required' years of education in their occupation (e.g. Wald & Fang, 2008; Green et al. 2007).<sup>8</sup>

Equation (1) can be rewritten as:

$$\text{OccEd}_{\text{occ}(i)} = \text{YearsEd}_i - \alpha - \beta \text{Immigrant}_i - X_i \gamma - e_i. \tag{2}$$

This formulation of the model highlights that what is really being estimated in the education-occupation mismatch model is the choice of occupation for individuals with different education levels and other characteristics. What Eq. (2) also highlights is that the standard empirical model restricts the coefficient of years of education in the regression model that explains the selection of occupation in terms of the individual's acquired education to be unity and to be the same for immigrants and the native-born. In other words, the model assumes that for each additional year of schooling, all people, on average, choose an occupation that requires one more year of schooling. A more general model, that can be empirically verified, would specify

$$\text{OccEd}_{\text{occ}(i)} = \delta \text{YearsEd}_i - \alpha - \beta \text{Immigrant}_i - X_i \gamma - e_i. \tag{3}$$

It is straightforward to show that, because of the way 'required' education for an occupation is constructed,  $0 < \delta < 1$ . Since 'required education' is measured as the average education of people in each occupation, individuals with the highest level of qualifications must be employed in an occupation for which 'required education' is less, i.e. they must be overqualified, while those with the lowest level of qualifications can only be underqualified. Even away from the extremes, more qualified individuals are more likely to be overqualified and less qualified individuals are more likely to be underqualified. Hence, if the relationship between years of education and 'required' education in a chosen occupation was unconstrained,  $\delta$  would be between zero and one, as this is a form of regression to the mean.

Rewriting (3) back in the form of (1), we get

$$\text{YearsEd}_i - \text{OccEd}_{\text{occ}(i)} = (1 - \delta) \text{YearsEd}_i + \alpha + \beta \text{Immigrant}_i + X_i \gamma + e_i. \tag{4}$$

This is the same as saying that, if education was included separately as a RHS variable, its coefficient would be between zero and one. Hence, if immigration status is correlated with educational levels, as is the case not only in any country with a skill-based migration system but also in many countries that mainly have low-skilled migrants (e.g. the USA), an omitted variable bias arises. In the case where immigrants are, on average, more skilled than natives, omitting the direct control for education leads to an upward



bias in  $\beta$ , the coefficient on immigrant status, since education has a positive partial effect. This bias makes immigrants look more overeducated than they really are. In a country with mainly low-skilled immigrants, this bias will go in the other direction, making immigrants look more undereducated than in reality.

In our empirical work, we show that, in the case of New Zealand where immigrants are generally more skilled than natives, excluding education as a control variable leads to a large positive bias in the measurement of overeducation among immigrants.<sup>9</sup> We suspect this is also the case in the previous work that has examined overeducation among immigrants in other countries with skill-based migration system.

### 3 Data and descriptive results

#### 3.1 Data and variable definitions

This paper uses unit record data on the entire usually resident New Zealand population from the 1996, 2001 and 2006 censuses.<sup>10</sup> The census collects information on each individual's country of birth and their year of first arrival in New Zealand. We restrict our analysis throughout to individuals aged 25–64 with non-missing year of first arrival, if foreign-born. We focus on this age group to exclude most students and individuals who are retired. For obvious reasons, our sample is restricted to individuals who are employed and report a valid occupation.<sup>11</sup> We further restrict our sample to individuals who are wage/salary employees in their main occupation since 'required' education is an ill-defined concept for the self-employed.

We gauge occupational mismatch by comparing each individual's actual education to the 'typical' education for a NZ-born individual in the occupation in which they are employed. This is done separately by gender and census and for narrowly defined occupations at the five-digit level of classification.<sup>12</sup> There are 561 five-digit occupations in 1996 and 565 in 2001 and 2006.<sup>13</sup> Over 200 of these occupations have more than 1000 individuals working in them. Another 200 have between 200 and 1000 individuals working in them. Only around 60 occupations have less than 100 individuals employed in them. In order for us to be able to calculate the 'typical' education for a NZ-born individual in each occupation, we have aggregated a small number of occupations (around ten in each year) that have less than 30 individuals working in them or that do not have both NZ-born and immigrants in the occupation.

We use two definitions of the 'typical' education for a New Zealand-born individual employed in each occupation; the first definition uses the modal qualification, which we only use for descriptive tables, while the second calculates the mean years of education. Our census data record the highest qualification obtained by each individual using the following classification: (i) no qualification; (ii) level 1 school qualification (e.g. school certificate); (iii) level 2 school qualification (e.g. sixth-form certificate); (iv) level 3 or 4 school qualification (e.g. university entrance, higher school certificate, bursary or scholarship); (v) overseas school qualification; (vi) level 1, 2 or 3 post-school certificate; (vii) level 4 post-school certificate; (viii) level 5 post-school diploma; (ix) level 6 post-school diploma; (x) bachelor degree; (xi) higher degree (e.g. honours, masters or PhD); and (xii) not elsewhere included.

When calculating the modal qualification in each occupation, we use the following more aggregate classification: (i) no qualification; (ii) school qualification; (iii) post-

school certificate; (iv) post-school diploma; (v) bachelor degree; and (vi) higher degree. Everyone with an overseas school qualification is included in the school qualification group. We assign individuals in the 'not elsewhere included' category to the post-school certificate category.<sup>14</sup>

In order to calculate the mean years of education for individuals, we convert the above information on the highest qualification to estimate the total number of years spent by each individual in education.<sup>15</sup> While this approach is somewhat ad hoc, it is consistent with the way in which the New Zealand education system operates, even though the nature of assessment has changed over time (e.g. the shift to a National Certificate of Educational Achievement (NCEA) in years 11, 12 and 13 at secondary schools). The advantage of using this approach as opposed to focusing on a comparison between qualifications is that a 'completed years of education' measure permits a straightforward quantification of the extent of under- or overeducation for individuals with different characteristics.

For foreign-born individuals who have no qualifications, overseas school qualifications or post-school qualifications that cannot be classified by Statistics New Zealand to an equivalent New Zealand qualification, we calculate years of education by using the data collected by Barro & Lee (2001) on worldwide educational attainment. Specifically, we use this data to estimate the average years of education for individuals of a particular gender, birth cohort and country of birth for each of these educational levels. This is done to adjust for the effective years of education contained in an overseas degree.<sup>16</sup> This is important because if the effective years of education are lower than the nominal years, the extent of overeducation (undereducation) could be overestimated (underestimated).<sup>17</sup> We also control in our multivariate modelling for region-of-origin fixed effects which will account for further quality differences between different immigrant groups, but not for differences between immigrants and the NZ-born, as well as for an estimate of the number of years of education a foreign-born individual has undertaken in New Zealand, which again is only useful for understanding differences between immigrants.<sup>18</sup>

### 3.2 Sample characteristics

Table 1 presents the sociodemographic characteristics of NZ-born and immigrants in the 1996, 2001 and 2006 censuses separately by whether they are (i) non-employed, (ii) self-employed or missing occupational status, and (iii) employed in a wage/salary job with a valid occupation. The latter represents our analysis sample, and the former are included to check for differences between those included and those excluded. Our analysis population consists of 2.37 million NZ-born and 0.65 million immigrants. Hence, immigrants account for 21.5 % of the analysis sample.

Individuals in the analysis sample generally have similar characteristics as those excluded although they do have more education and higher incomes. For the NZ-born, the excluded population is split roughly evenly between those not employed, who are predominately female and, on average, less educated than the analysis sample, and those self-employed or missing occupational status, who are predominately men with similar qualifications to those in wage/salary employment. Among immigrants, roughly 60 % of the excluded population are non-employed reflecting lower employment rates



**Table 1** Summary statistics

	New Zealand-born				Immigrants			
	Not employed	Self-employed or missing occupation	Dropped from analysis (first two columns)	Analysis sample	Not employed	Self-employed or missing occupation	Dropped from analysis (first two columns)	Analysis sample
Female	67.0 %	36.2 %	51.9 %	51.0 %	65.4 %	39.8 %	55.1 %	48.8 %
Mean Age	43.9	44.8	44.3	41.1	44.7	44.9	44.8	42.0
Mean years in New Zealand	N/A	N/A	N/A	N/A	15.9	19.6	17.4	17.8
No qualification	41.9 %	22.9 %	32.6 %	23.1 %	24.2 %	13.7 %	20.0 %	12.8 %
School certificate	14.2 %	15.8 %	15.0 %	15.6 %	4.0 %	4.4 %	4.2 %	5.2 %
6th form/UB/higher school	11.1 %	13.8 %	12.4 %	14.8 %	4.4 %	5.5 %	4.8 %	6.1 %
Overseas school qual	0.2 %	0.2 %	0.2 %	0.2 %	24.5 %	21.3 %	23.2 %	17.8 %
Post-school certificate	9.0 %	15.8 %	12.3 %	13.7 %	7.3 %	11.8 %	9.1 %	12.0 %
Post-school diploma	7.0 %	11.0 %	9.0 %	12.8 %	7.3 %	9.7 %	8.3 %	12.5 %
Bachelor degree	4.3 %	8.3 %	6.3 %	10.2 %	10.7 %	13.0 %	11.6 %	16.2 %
Higher degree	1.4 %	3.2 %	2.3 %	4.3 %	5.4 %	8.2 %	6.6 %	11.3 %
Not elsewhere included	10.9 %	8.9 %	9.9 %	5.4 %	12.2 %	12.3 %	12.2 %	6.3 %
Mean years of education	11.58	12.34	11.95	12.44	11.47	12.33	11.81	12.81
Mean year of NZ education	N/A	N/A	N/A	N/A	1.38	2.30	1.75	2.60
Non-family	26.4 %	16.2 %	21.4 %	21.5 %	19.5 %	14.7 %	17.6 %	18.2 %
Couple without children	21.3 %	29.4 %	25.3 %	27.4 %	23.0 %	26.1 %	24.3 %	27.2 %
Couple with children	33.9 %	49.2 %	41.4 %	43.1 %	45.8 %	54.3 %	49.2 %	48.6 %
Single with children	18.4 %	5.3 %	11.9 %	8.0 %	11.7 %	4.9 %	9.0 %	6.0 %
Employed	N/A	N/A	49.1 %	100 %	N/A	N/A	40.1 %	100 %
Self-employed in main job	N/A	79.9 %	39.2 %	0 %	N/A	74.6 %	29.9 %	0 %
Mean weekly work hours	N/A	42.36	N/A	38.42	N/A	40.51	N/A	38.32
Multiple jobs	N/A	12.5 %	6.1 %	8.7 %	N/A	10.1 %	4.0 %	6.8 %

**Table 1** Summary statistics (*Continued*)

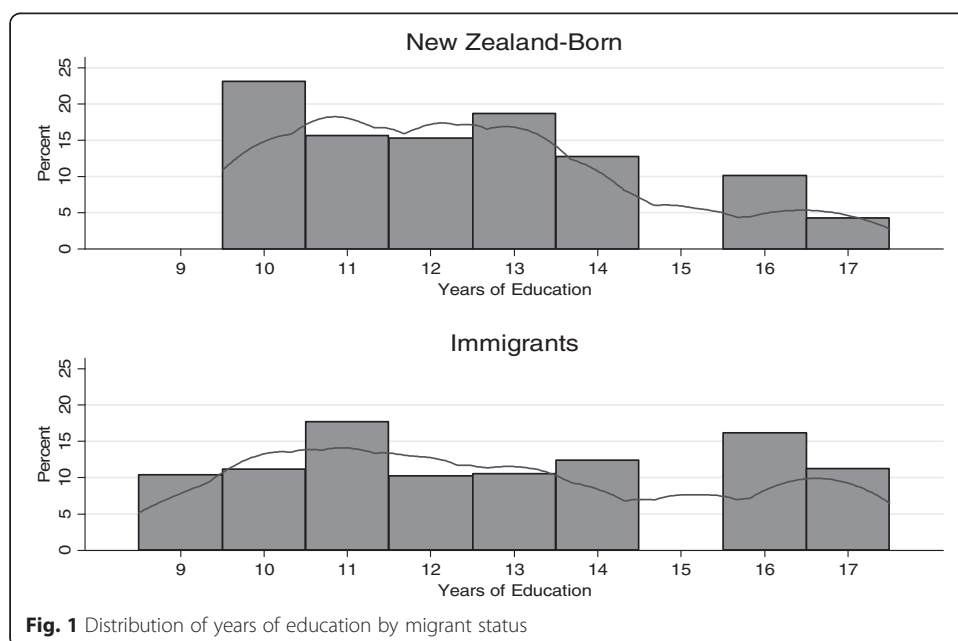
Mean individual income	13,224	42,942	27,814	39,022	11,519	35,926	21,314	40,608
Year = 1996	36.5 %	32.0 %	34.3 %	30.4 %	31.2 %	27.5 %	29.7 %	26.1 %
Year = 2001	33.8 %	33.3 %	33.6 %	33.5 %	33.4 %	32.1 %	32.9 %	30.9 %
Year = 2006	29.7 %	34.7 %	32.1 %	36.1 %	35.4 %	40.4 %	37.4 %	43.0 %
Percentage of population	22.7 %	21.8 %	44.5 %	55.5 %	29.2 %	19.6 %	48.7 %	51.3 %
Number of individuals	967,416	932,952	1,900,368	2,370,054	368,916	247,317	616,233	648,408

Notes: Income is in 2006 dollars. All counts underlying the figures in this table are randomly rounded to base 3  
 N/A not applicable

among immigrants than among the NZ-born, especially in 1996 and 2001. Non-employed immigrants are also predominately female and, on average, less educated than both the self-employed and those in the analysis sample. Overall, the difference in years of education between the analysis sample and those excluded from our remaining analysis is larger for immigrants (1.0 versus 0.5 years of education) suggesting that higher-skilled immigrants leaving wage/salary employment because of a lack of job opportunities at their skill level is not more common than the same occurring for the NZ-born.<sup>19</sup>

Focusing on just the analysis sample, immigrants and the NZ-born have very similar characteristics other than that immigrants are much more qualified than the NZ-born, with 27.5 % of migrants having university degrees versus 14.5 % of the NZ-born. This is reflected throughout the qualification distribution, with few migrants having no qualifications compared to the NZ-born. This occurs because, as noted in the previous section, New Zealand operates a structured immigration system that focuses mainly on higher-skilled migrants. However, overall, immigrants have on average only about 0.4 years more education than the NZ-born. As illustrated in Fig. 1, which presents a histogram and kernel density of imputed years of education for immigrants and the NZ-born in the analysis sample,<sup>20</sup> this occurs because the NZ-born are much more likely to have upper level school qualifications (13 years of education) and non-university post-school qualifications (12–14 years of education) than migrants who have a much more bimodal distribution with either foreign school qualifications (9–12 years of education) or university qualifications (16–17.5 years of education).

Table 2 presents the aggregated qualification distribution for immigrants and the NZ-born separately for each census year. The upskilling of both the NZ-born and recent immigrant cohorts is very clear from this table. It is also noticeable that the qualification gap between immigrants and the NZ-born has been growing over time. For example, in 1996, the share of immigrants with university degrees was 9 % greater than the share of NZ-born with degrees. By 2001, this gap had increased to 12 % and then



**Fig. 1** Distribution of years of education by migrant status

**Table 2** The distribution of qualifications for employed immigrants and New Zealand-born

1996	2001		2006		Pooled			
	NZ-born	Immigrants	NZ-born	Immigrants	NZ-born	Immigrants		
Country of birth								
No qualifications	27.6 %	19.8 %	22.2 %	11.6 %	20.2 %	9.5 %	23.1 %	12.8 %
School qualifications	27.4 %	21.5 %	33.7 %	36.2 %	30.4 %	28.4 %	30.6 %	29.0 %
Post-school certificate	20.3 %	25.5 %	17.1 %	14.1 %	19.8 %	16.8 %	19.1 %	18.2 %
Post-school diploma	13.6 %	13.0 %	13.5 %	13.0 %	11.5 %	11.8 %	12.8 %	12.5 %
Bachelors degree	7.5 %	11.0 %	9.4 %	14.4 %	13.1 %	20.6 %	10.2 %	16.2 %
Higher degree	3.6 %	9.1 %	4.1 %	10.8 %	5.0 %	12.9 %	4.3 %	11.3 %
Years of education	12.25	12.30	12.40	12.69	12.64	13.21	12.44	12.81
Years of New Zealand education	N/A	2.80	N/A	2.81	N/A	2.33	N/A	2.60
Number of individuals	720,567	169,155	793,071	200,436	856,413	278,820	2,370,051	648,411

Notes: All figures are rounded to base 3. See the paper for the conversion from qualifications to years of education  
N/A not applicable

to 15 % by 2006. Just looking at mean years of education reveals that immigrants had only slightly more education, on average, than the NZ-born in 1996, while by 2006 they had 0.6 more years of education.

### 3.3 Descriptive evidence on under-/overeducation

Table 3 presents basic evidence on the degree of under- and overeducation among immigrants and the NZ-born. To examine whether occupation-education matching improves with time spent in New Zealand, we classify individuals as being NZ-born, a recent migrant or an earlier migrant. Recent migrants are all individuals who first arrived less than 5 years ago. We measure mismatch in three ways. In the first panel, we define individuals as being underqualified, perfectly qualified and overqualified by comparing their qualification level

**Table 3** Under/overeducation by immigrant status and gender

	Male			Female		
	NZ-born	Recent migrant	Earlier migrant	NZ-born	Recent migrant	Earlier migrant
(a) Measured compared to modal qualification in same occupation						
Under qualified	18.8 %	14.6 %	18.4 %	17.8 %	8.5 %	13.6 %
Perfectly qualified	44.4 %	33.1 %	40.3 %	48.0 %	33.2 %	43.4 %
Over qualified	36.8 %	52.3 %	41.3 %	34.2 %	58.3 %	43.0 %
(b) Measured compared to average years of education +/- 0.5 in same occupation						
Under qualified	42.0 %	33.0 %	43.2 %	42.8 %	34.3 %	44.7 %
Perfectly qualified	20.8 %	15.0 %	18.9 %	24.9 %	14.2 %	20.7 %
Over qualified	37.2 %	52.0 %	37.8 %	32.3 %	51.5 %	34.6 %
(c) Actual years of education minus average years of education in same occupation						
Mean	0.00	0.67	-0.12	0.00	0.83	-0.06
Median	-0.10	0.70	-0.20	-0.20	0.70	-0.30
Number of individuals	1,161,186	83,451	248,487	1,208,868	70,860	245,610

Note: Pooling 1996, 2001 and 2006 data. All figures are rounded to base 3. Recent migrants have lived in New Zealand for less than 5 years

to the modal qualification held by a NZ-born individual of the same gender employed in the same occupation in the year of observation. In the second panel, we instead compare an individual's imputed years of education to the mean years of education for NZ-born of the same gender employed in the same occupation in the year of observation. Individuals are then defined as under(over)-qualified when their actual years of education is more than 0.5 years less (more) than the comparison years of education.<sup>21</sup> All remaining individuals are perfectly qualified. Finally, in the third panel, we use the same information as in the second panel but present the mean and median in the difference between actual years of education and the mean years of education for the reference group.

These results show that both male and female recent migrants are more likely to be overqualified than the NZ-born. However, as discussed above, these results at least partially reflect that each successive cohort of NZ-born are better educated on average than earlier ones, while recent migrants are younger and, on average, better educated than the average NZ-born and earlier migrants are older and worse educated than the average NZ-born. To illustrate this point further, we present in Table 4 the mean years of overeducation for individuals with different characteristics, focusing on the variation across age and qualification level.

Over- and undereducation by age simply reflects a long-term trend of increasing participation in post-compulsory education (and an increase in the legal school leaving age). As the average level of education of young workers who enter the labour market is always more than of older workers who retire, the young are likely to be overeducated and the older workers undereducated. The same applies to migrants: actual education minus required education decreases with age. The difference between those aged 24-29 and 60-64 is fairly similar for recent migrants (1.0 years) as for the NZ born (0.8 years).

The next panel in Table 4 demonstrates that the incidence of over or undereducation is closely linked to the level of education itself. It is impossible to be underqualified with a PhD or overqualified if you have no qualification. Thus, those with no qualifications are the most undereducated, while those with a higher degree are the most

**Table 4** Years of overeducation for individuals with different characteristics

	Overall	NZ-born	Recent migrants	Earlier migrants
Male	0.02	0.00	0.67	-0.12
Female	0.03	0.00	0.83	-0.06
Aged 24-29	0.47	0.43	0.82	0.52
Aged 30-39	0.18	0.12	0.84	0.13
Aged 40-49	-0.07	-0.10	0.61	-0.11
Aged 50-59	-0.31	-0.30	0.32	-0.40
Aged 60-64	-0.45	-0.40	-0.21	-0.63
No qualifications	-1.75	-1.59	-3.54	-2.72
School qualifications	-0.65	-0.51	-1.66	-1.02
Post-school certificate	0.46	0.61	-0.22	-0.10
Post-school diploma	0.58	0.57	0.78	0.58
Bachelors degree	2.15	2.04	2.71	2.23
Higher degree	3.12	3.06	3.47	3.02

Note: Pooling 1996, 2001 and 2006 data. Recent migrants have lived in New Zealand for less than 5 years

overeducated. This is equally true for recent and earlier migrants as for the NZ-born. In fact, the extent of overeducation among those with a higher degree is roughly the same across all three groups. This is a key result that will come out of our regression analysis as well. However, migrants with no qualification are much less educated than the typical level of education for their jobs (3.5 years of undereducation for recent migrants and 2.7 years for earlier migrants) than the NZ-born with no qualification (1.6 years). It is likely that a greater substitution of experience for education among migrants and positive self-selection in the decision to migrate contribute to this difference. This also occurs because compulsory schooling is typically much shorter in migrant origin countries than in New Zealand.

These differences between immigrants and the NZ-born in terms of education-occupation mismatch may be related to factors that apply to both migrants and non-migrants (such as that the incidence of mismatch is likely to be to greater in more peripheral labour markets with less job mobility or due to the trend of increasing average education levels generally), potential segmentation of the labour market in immigrant-type and native-born type jobs, and factors that could be specific to migrants (such as non-transferability of skills or discrimination). Such effects are impossible to disentangle without multivariate analysis, to which we now turn in the next section.

#### 4 Multivariate regression analysis

We start by estimating an extended version of the standard empirical model used in the literature as illustrated in (1). Specifically, we use OLS to estimate the following regression model separately for men and women with data pooled from all three censuses.<sup>22</sup>

$$\text{YearsEd}_{it} - \text{MeanYearsEd}_{\text{NZ}_{occ(it)}} = \sum_{j=1}^{50} \delta^j (\text{YearsNZ}_{it} = j) + X_{it}\gamma + \alpha_t + e_{it}, \quad (5)$$

where  $i$  indexes individuals and  $t$  indexes time. The dependent variable is the difference between  $\text{YearsEd}_{it}$ , an individual's actual years of education and  $\text{MeanYearsEd}_{\text{NZ}_{occ(it)}}$ , the mean years of education for the NZ-born in the same occupation, gender and census year. Our regression analysis focuses on this continuous measure of under-/overeducation as it permits a straightforward quantification of the extent of under- or overeducation for individuals with different characteristics.

The main independent variables are  $\text{YearsNZ}_{it} = j$ , which are indicator variables for whether the number of years that an individual has lived in  $\text{NZ} = j$ , with  $j = 50$  also including immigrants residing in NZ for more than 50 years. Hence, the coefficients on these variables,  $\delta^j$ , are semi-parametric estimates of the difference in under-/overeducation for immigrants residing in NZ for a particular amount of time compared to that for the NZ-born. We also include as controls  $X_{it}$ , a row vector of other control variables discussed further below, with coefficient vector  $\gamma$  and time fixed effects,  $\alpha_t$ .  $e_{it}$  is a mean zero idiosyncratic error term.

We include in  $X_{it}$  variables that the literature has identified as being related to educational-occupational mismatch, as well as variables that account for other migrant characteristics. The first set of variables include a quadratic in potential experience (measured as age minus years of education minus five), marital status (currently



married/de facto, previously married, never married, missing), family type (couple with no children, couple with children, single with children, non-family), the number of hours worked in their main job, whether they work multiple jobs, an indicator for whether hours worked is missing, an indicator variable for whether they live in an urban area, and a series of indicator variables for geographic location (140 labour market areas (LMAs)—as defined by Papps and Newell, 2002).

The second set include controls for (i) arrival cohort with indicators for having arrived before 1957, in 1957–1966, in 1967–1976, in 1977–1986, in 1987–1996 and in 1997–2006; (ii) estimated years of New Zealand education and (iii) indicators for region of birth (15 regions, see Tables 5 and 6 for details).<sup>23</sup> These indicator variables are all defined so that the coefficients can be interpreted as the difference between an immigrant with that particular characteristic and the average immigrant.<sup>24</sup> Using this approach, the coefficients on the years in NZ indicator variables can still be interpreted as the over-/undereducation of the average immigrant who has lived that number of years in New Zealand.

Importantly, having data from three censuses allows us to control for the entry cohort of each migrant. As discussed in Borjas (1985), assimilation profiles from a single cross section of data will give misleading results if either immigrant selection on unobservables varies by arrival cohort or there is selective return migration. Being able to control for entry cohort alleviates some of these concerns. It is also worth noting that it is not a priori clear how immigrant unobservables or return migration decisions are related to occupational choice and the degree of overeducation experienced. Furthermore, controlling for region of birth as well as other pre-determined characteristics, such as potential experience and education, accounts for any selection into return migration that is related to these observable characteristics and hence changes the composition of the immigrant sample over time in New Zealand.

Figures 2 (men) and 3 (women) plot out the  $\delta^j$  coefficients from this regression for the first 20 years in New Zealand (labelled 'standard model').<sup>25</sup> These results indicate that 'average' male recent migrants are 0.2 years more educated than equivalent NZ-born, with no differences in overeducation for male migrants that have been resident in New Zealand for more than 7 years. On the other hand, the difference for 'average' female migrants in New Zealand less than 9 years and equivalent NZ-born is close to zero.

We next extend this regression model by adding a further control for each individual's education level. As discussed in Section 2.3, this is necessary to produce unbiased estimates of overeducation among migrants. Specifically, we add control variables for whether individuals have school qualifications or post-school qualifications versus having no qualifications to the previous specification. As noted above, we use an aggregated measure of education here instead of years of education to avoid potential bias caused by correlated measurement error between a control variable and the dependent variable. Years of education for the three broad education groups used here range from 3 to 11 years for the no qualification group; 6–13 years for the school qualification group and 7–17.5 years for the post-school qualification group. Given the wide range of the dependent variable for each category and that the groups overlap, correlated measurement error should not be an issue here.<sup>26</sup>

The  $\delta^j$  coefficients from this regression model are also presented in Figs. 2 and 3 (labelled 'controlling for broad quals'). These results illustrate the importance of controlling

**Table 5** The relationship between years of overeducation and individual characteristics by qualification for men

	No quals	School quals	Post-school certificate	Post-school diploma	Bachelor degree	Higher degree
Potential experience	-0.006** (0.001)	-0.066** (0.001)	-0.014** (0.001)	-0.028** (0.002)	-0.008** (0.002)	0.004 (0.002)
Pot Exp-squared/100	-0.007** (0.001)	0.083** (0.002)	0.025** (0.002)	0.030** (0.003)	-0.010** (0.004)	-0.045** (0.005)
Currently married/de facto	-0.152** (0.006)	-0.213** (0.007)	-0.133** (0.008)	-0.117** (0.013)	-0.098** (0.014)	0.018 (0.022)
Previously married	-0.019** (0.005)	-0.000 (0.008)	0.047** (0.008)	0.018 (0.015)	0.012 (0.019)	0.075** (0.027)
Couple with no children	0.037** (0.006)	0.047** (0.007)	0.054** (0.008)	-0.027* (0.013)	-0.054** (0.015)	-0.083** (0.022)
Couple with children	0.041** (0.005)	0.041** (0.006)	0.058** (0.007)	-0.040** (0.012)	-0.049** (0.013)	-0.082** (0.020)
Single parent	0.017** (0.006)	0.057** (0.009)	0.064** (0.009)	-0.003 (0.018)	0.019 (0.022)	-0.027 (0.034)
Lives in urban area	-0.034** (0.004)	-0.105** (0.006)	-0.089** (0.006)	-0.205** (0.011)	-0.292** (0.015)	-0.213** (0.023)
Hours worked at main job	0.001** (0.000)	0.000* (0.000)	0.001** (0.000)	-0.004** (0.000)	-0.011** (0.000)	-0.014** (0.000)
Has multiple jobs	-0.110** (0.007)	-0.017** (0.007)	-0.204** (0.007)	-0.117** (0.010)	-0.098** (0.011)	-0.331** (0.014)
Australia	0.866** (0.014)	0.102** (0.013)	0.293** (0.013)	-0.046 (0.024)	-0.162** (0.023)	-0.030 (0.032)
Pacific Islands	0.061** (0.004)	0.454** (0.007)	-0.137** (0.009)	0.224** (0.018)	-0.217** (0.022)	-0.095* (0.041)
British Isles	0.105** (0.005)	-0.113** (0.005)	0.059** (0.004)	-0.097** (0.007)	-0.251** (0.010)	-0.068** (0.009)
Western Europe	0.327** (0.023)	-0.231** (0.017)	0.017 (0.015)	-0.078** (0.025)	-0.058 (0.030)	0.005 (0.031)
Northern Europe	0.973** (0.073)	0.603** (0.058)	0.402** (0.051)	-0.176 (0.120)	-0.077 (0.097)	0.104 (0.098)
Southern Europe	-0.840** (0.063)	-0.478** (0.061)	-0.035 (0.062)	-0.037 (0.107)	-0.160 (0.130)	-0.222 (0.120)
South-Eastern Europe	0.326** (0.045)	0.132** (0.032)	0.146** (0.033)	0.151* (0.066)	0.247** (0.042)	0.297** (0.065)
Eastern Europe	0.533** (0.072)	0.137** (0.038)	0.123** (0.040)	0.404** (0.067)	0.204** (0.058)	0.194** (0.061)
North Africa/Middle East	-1.504** (0.042)	-0.538** (0.033)	-0.436** (0.041)	0.199** (0.059)	0.132** (0.038)	-0.162** (0.049)
South-East Asia	-1.367** (0.016)	-0.163** (0.015)	-0.295** (0.019)	0.248** (0.029)	0.299** (0.017)	0.274** (0.032)
North-East Asia	-0.757** (0.018)	-0.187** (0.013)	-0.426** (0.021)	0.266** (0.030)	0.442** (0.017)	0.307** (0.025)
Northern America	-0.636**	0.228**	-0.160**	0.314**	0.396**	0.320**

**Table 5** The relationship between years of overeducation and individual characteristics by qualification for men (*Continued*)

	(0.024)	(0.017)	(0.021)	(0.026)	(0.016)	(0.020)
Central/South America	1.053**	0.074**	0.190**	-0.190**	-0.181**	-0.268**
	(0.034)	(0.020)	(0.026)	(0.040)	(0.025)	(0.026)
Southern/Central Asia	-0.946**	-0.980**	-0.448**	0.067	0.070	-0.028
	(0.053)	(0.037)	(0.045)	(0.070)	(0.058)	(0.076)
Sub-Saharan Africa	-1.079**	-0.658**	-0.023	-0.122**	-0.366**	-0.343**
	(0.038)	(0.016)	(0.014)	(0.019)	(0.019)	(0.024)
Years of NZ Education		0.043**	0.055**	-0.012**	-0.010**	-0.009**
		(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Arrived Before 1957	-0.293**	0.054	-0.818**	0.126*	0.301**	0.063
	(0.028)	(0.042)	(0.038)	(0.061)	(0.085)	(0.105)
Arrived 1957–1966	-0.179**	0.050*	-0.717**	0.116**	0.295**	0.200**
	(0.016)	(0.025)	(0.023)	(0.039)	(0.057)	(0.071)
Arrived 1967–1976	-0.042**	0.009	-0.527**	0.098**	0.209**	0.087
	(0.010)	(0.017)	(0.015)	(0.028)	(0.038)	(0.048)
Arrived 1977–1986	0.063**	0.004	-0.286**	0.023	0.096**	-0.060
	(0.010)	(0.013)	(0.012)	(0.023)	(0.027)	(0.032)
Arrived 1987–1996	0.152**	0.014	0.221**	-0.069**	-0.053**	-0.114**
	(0.015)	(0.012)	(0.014)	(0.024)	(0.016)	(0.019)
Arrived 1997–2006	0.196**	-0.046**	1.027**	-0.112**	-0.122**	0.039
	(0.023)	(0.017)	(0.018)	(0.030)	(0.020)	(0.026)
Year is 2001	-0.092**	-0.053**	-0.017**	0.051**	0.059**	0.271**
	(0.003)	(0.004)	(0.005)	(0.007)	(0.009)	(0.013)
Year is 2006	-0.205**	-0.118**	-0.152**	-0.194**	-0.036**	0.222**
	(0.003)	(0.005)	(0.004)	(0.008)	(0.009)	(0.014)
R-squared	0.32	0.18	0.14	0.05	0.07	0.08
Observations	335,568	404,739	338,283	159,315	163,032	92,187

Notes: Standard errors in parenthesis. All regressions also include controls for years in New Zealand (a series of indicator variables), geographical location and whether marriage status or hours of work are missing. All immigrant specific characteristics are defined so that the coefficients can be interpreted as the difference in the outcome between a particular group of immigrants and average immigrant in the sample

\*Significant at 5 %; \*\*significant at 1 %

for education levels when examining under-/overeducation. We now find that the ‘average’ recent male immigrant has 0.4 years *less* education than a comparable NZ-born male in the same occupation, with this declining to 0.3 years *less* education for male migrants in NZ for more than 10 years. Results are practically identical for women. Hence, the results from the standard empirical model estimated in the literature are not only biased but also lead in our application to misleading conclusions.<sup>27</sup>

In our final regression models, we extend the empirical approach taken in the realised match literature by estimating models of over-/undereducation that are fully stratified by qualifications. In particular, we estimate separate regression models, by gender, for individuals whose highest qualification is (i) no qualification, (ii) a school qualification, (iii) a post-school certificate, (iv) a post-school diploma, (v) a bachelor degree or (vi) a higher university degree. Hence, we are now asking the question: ‘does

**Table 6** The relationship between years of overeducation and individual characteristics by qualification for women

	No quals	School quals	Post-school certificate	Post-school diploma	Bachelor degree	Higher degree
Potential experience	-0.003** (0.001)	-0.061** (0.001)	-0.012** (0.001)	-0.037** (0.001)	-0.019** (0.001)	-0.009** (0.002)
Pot Exp-squared/100	-0.007** (0.001)	0.081** (0.001)	0.024** (0.002)	0.043** (0.003)	0.023** (0.004)	0.000 (0.006)
Currently married/de facto	-0.104** (0.007)	-0.105** (0.007)	-0.021 (0.011)	-0.220** (0.013)	-0.215** (0.014)	-0.142** (0.024)
Previously married	-0.044** (0.006)	-0.005 (0.006)	0.053** (0.009)	-0.007 (0.011)	-0.035* (0.014)	0.032 (0.022)
Couple with no children	0.039** (0.007)	0.057** (0.007)	0.066** (0.011)	0.133** (0.013)	0.127** (0.015)	0.115** (0.024)
Couple with children	0.044** (0.007)	0.059** (0.007)	0.029** (0.011)	-0.068** (0.012)	-0.093** (0.014)	-0.067** (0.023)
Single parent	0.006 (0.005)	-0.010 (0.006)	0.038** (0.009)	-0.018 (0.010)	-0.089** (0.014)	-0.041 (0.023)
Lives in urban area	0.044** (0.005)	-0.010 (0.005)	0.034** (0.008)	0.016 (0.009)	-0.042** (0.013)	-0.061** (0.023)
Hours worked at main job	-0.004** (0.000)	-0.007** (0.000)	-0.008** (0.000)	-0.015** (0.000)	-0.020** (0.000)	-0.018** (0.000)
Has multiple jobs	-0.086** (0.006)	0.007 (0.005)	-0.160** (0.008)	-0.021** (0.008)	-0.000 (0.010)	-0.141** (0.016)
Australia	0.847** (0.015)	0.090** (0.010)	0.221** (0.016)	-0.074** (0.019)	-0.376** (0.021)	-0.214** (0.034)
Pacific Islands	-0.027** (0.006)	0.327** (0.007)	-0.227** (0.010)	0.206** (0.016)	-0.222** (0.022)	0.063 (0.047)
British Isles	0.274** (0.005)	0.038** (0.004)	0.121** (0.007)	-0.136** (0.007)	-0.391** (0.011)	-0.180** (0.010)
Western Europe	0.308** (0.023)	-0.040** (0.015)	0.050* (0.020)	0.012 (0.023)	-0.209** (0.030)	-0.058 (0.035)
Northern Europe	0.597** (0.072)	0.290** (0.045)	0.369** (0.071)	0.003 (0.073)	-0.177* (0.081)	0.269** (0.100)
Southern Europe	-0.739** (0.075)	-0.276** (0.061)	-0.027 (0.094)	-0.135 (0.120)	-0.123 (0.104)	-0.736** (0.124)
South-Eastern Europe	-0.455** (0.046)	-0.033 (0.030)	0.103* (0.051)	0.286** (0.064)	0.106** (0.041)	0.232** (0.067)
Eastern Europe	0.715** (0.078)	0.050 (0.034)	0.088 (0.054)	0.472** (0.056)	0.337** (0.047)	0.554** (0.059)
North Africa/Middle East	-1.580** (0.076)	-0.635** (0.043)	-0.304** (0.064)	0.258** (0.073)	0.188** (0.045)	-0.084 (0.076)
South-East Asia	-1.139** (0.014)	-0.121** (0.012)	-0.072** (0.018)	0.346** (0.025)	0.534** (0.014)	0.410** (0.033)
North-East Asia	-1.052** (0.017)	-0.162** (0.012)	-0.211** (0.023)	0.577** (0.024)	0.425** (0.016)	0.538** (0.028)
Northern America	-0.976** (0.017)	-0.017 (0.012)	-0.130** (0.023)	0.150** (0.024)	0.596** (0.016)	0.553** (0.028)

**Table 6** The relationship between years of overeducation and individual characteristics by qualification for women (*Continued*)

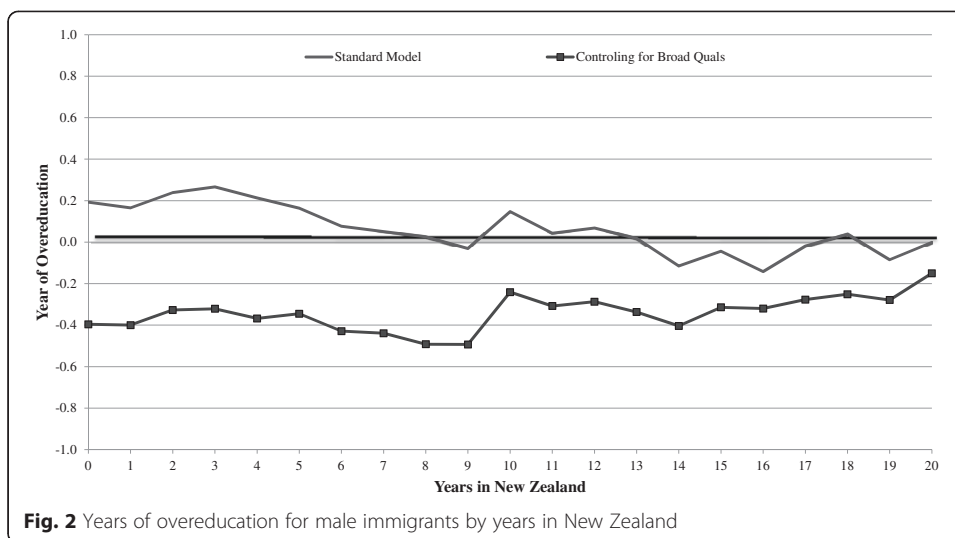
	(0.028)	(0.018)	(0.031)	(0.033)	(0.019)	(0.025)
Central/South America	0.998**	0.231**	0.386**	-0.112**	-0.153**	-0.299**
	(0.043)	(0.019)	(0.034)	(0.033)	(0.022)	(0.027)
Southern/Central Asia	-0.762**	-0.727**	-0.095	0.247**	0.066	-0.127
	(0.059)	(0.035)	(0.055)	(0.064)	(0.054)	(0.083)
Sub-Saharan Africa	-1.234**	-0.979**	-0.175**	-0.176**	-0.450**	-0.329**
	(0.042)	(0.013)	(0.022)	(0.018)	(0.020)	(0.029)
Years of NZ education		0.041**	0.082**	-0.015**	-0.014**	-0.004
		(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Arrived before 1957	-0.056*	0.039	-0.932**	0.265**	0.016	0.210
	(0.026)	(0.034)	(0.051)	(0.055)	(0.089)	(0.127)
Arrived 1957–1966	-0.154**	0.036	-0.797**	0.119**	0.132*	0.065
	(0.015)	(0.020)	(0.030)	(0.036)	(0.058)	(0.086)
Arrived 1967–1976	-0.054**	-0.002	-0.511**	0.040	0.103**	0.062
	(0.010)	(0.013)	(0.019)	(0.025)	(0.038)	(0.058)
Arrived 1977–1986	0.031**	-0.008	-0.219**	-0.002	0.076**	-0.038
	(0.012)	(0.010)	(0.015)	(0.020)	(0.026)	(0.039)
Arrived 1987–1996	0.148**	0.031**	0.354**	0.002	-0.013	-0.105**
	(0.018)	(0.012)	(0.018)	(0.022)	(0.016)	(0.022)
Arrived 1997–2006	0.252**	-0.047**	1.142**	-0.148**	-0.066**	0.037
	(0.026)	(0.016)	(0.025)	(0.028)	(0.020)	(0.027)
Year is 2001	-0.179**	-0.140**	-0.160**	-0.068**	-0.081**	0.050**
	(0.003)	(0.004)	(0.006)	(0.006)	(0.010)	(0.015)
Year is 2006	-0.325**	-0.250**	-0.286**	-0.336**	-0.280**	-0.101**
	(0.003)	(0.004)	(0.006)	(0.007)	(0.010)	(0.016)
R-squared	0.34	0.16	0.12	0.08	0.12	0.08
Observations	295,461	508,374	231,867	224,805	182,577	82,248

Notes: Standard errors in parenthesis. All regressions also include controls for years in New Zealand (a series of indicator variables), geographical location and whether marriage status or hours of work are missing. All immigrant specific characteristics are defined so that the coefficients can be interpreted as the difference in the outcome between a particular group of immigrants and average immigrant in the sample

\*Significant at 5 %; \*\*significant at 1 %

the average immigrant work in a more or less skilled occupation than the average NZ-born individual with the same characteristics and the same qualifications?'.<sup>28</sup>

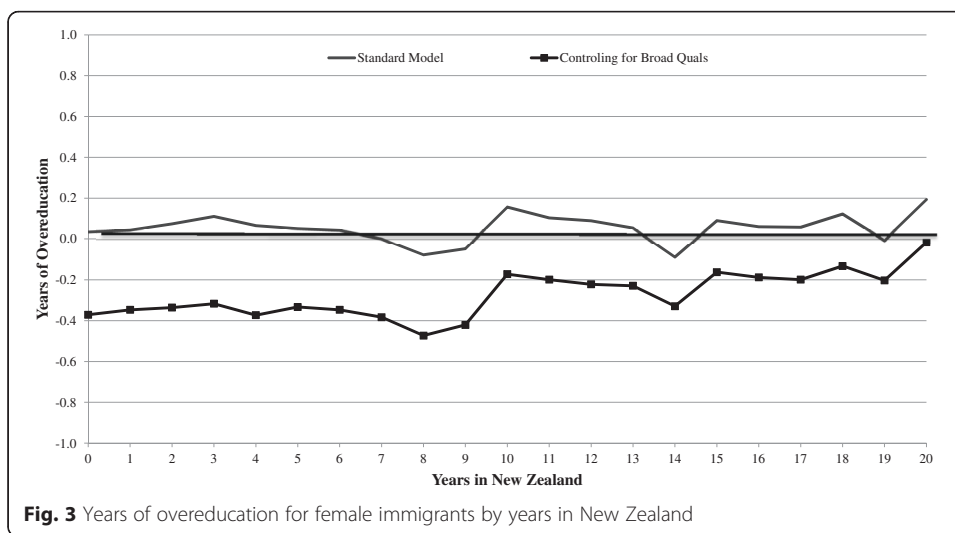
Figures 4 (men) and 5 (women) present the  $\delta^j$  coefficients from this model for each qualification group. First, examining the results for men, we see that the relative degree of under-/overeducation varies a great deal across qualification groups. Immigrant men with bachelor degrees in NZ for less than 5 years are 0.5–0.6 years overeducated, but those that have been in New Zealand for more than 10 year are no longer overeducated. Immigrant men with post-school diplomas and higher degrees are also initially overeducated, although only by around 0.2 years. For both these education groups, by 8 years in NZ, migrants essentially have the same years of education as the NZ-born in their occupations. It is worth noting that this could reflect both better occupational matching among immigrants as they gain experience with the New Zealand labour market and out-migration or withdrawal from the labour force by migrants that are



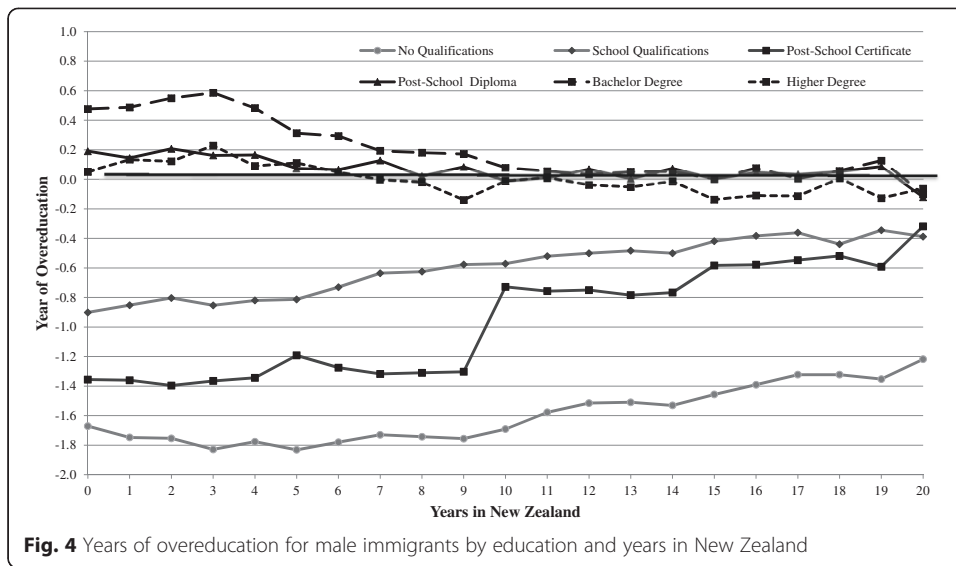
persistently overeducated. Longitudinal data is needed to judge the relative importance of these explanations, but none-the-less, it is striking that high levels of overeducation are only found among male migrants with bachelor degrees.<sup>29</sup>

Male immigrants in the remaining qualification groups are all *undereducated* compared to equally qualified NZ-born men. For each group, the degree of undereducation is the largest when they first arrive in New Zealand, 0.9 years for individuals with school qualifications, 1.4 years for individuals with post-school certificates and 1.7 years for individuals with no qualifications. While these slowly converge towards the years of education among the comparable NZ-born, immigrant men with school qualifications or post-school certificates who have been in NZ for 20 years still work in occupations where the comparable NZ-born have 0.3–0.4 more years of education.<sup>30</sup> For those with no qualifications, migrant undereducation is still 1.2 years after spending 20 years living in New Zealand.<sup>31</sup>

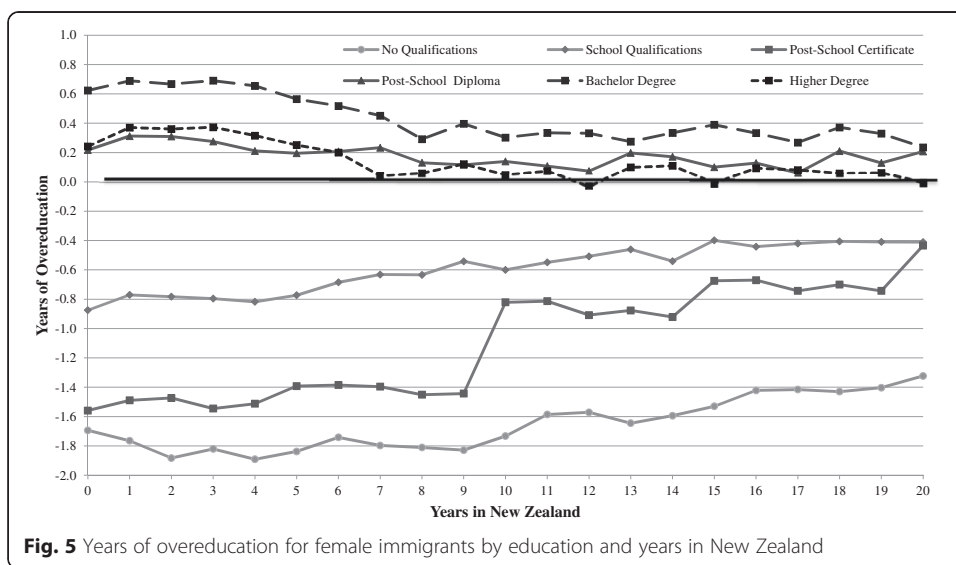
Next, examining the results from women, we also find that migrants with higher degrees, bachelor degrees and post-school diplomas are initially more overeducated, by







0.6–0.7 years for those with bachelor degrees and 0.2–0.4 years for those with higher degrees and post-school diplomas, than comparable NZ-born. For bachelor degrees, this overeducation declines by about half over time and such immigrant women in NZ for 20 years are still 0.3 years more overeducated than comparable NZ-born. For post-school diplomas, there is little convergence over time and the gap remains around 0.2 years for long residences. On the other hand, women with higher degrees are no longer comparably overeducated when living 7 years in NZ. As for men, women with no qualifications, school qualifications and post-school certificates are relatively undereducated compared with NZ-born women, and while the degree of this declines over time, it remains large. In terms of overall scale, the figures for women with these qualifications are very similar to those for men. Again, it should be noted that convergence over time could reflect both better occupational matching among immigrants as they gain experience with the New Zealand labour market and out-migration or withdrawal from the



labour force by more (less) educated migrants that are persistently overeducated (undereducated).

Finally, we present in Tables 5 (men) and 6 (women) the coefficients on the other control variables in these models. Location fixed effects and the coefficients for the control variables that account for missing marriage status and hours of work are not reported. Given the large number of significant coefficients, as expected, given the very large number of observations, we only discuss ones that have a general pattern across the qualification groups or are particularly important (such as potential experience). Looking at the coefficients for men, we see that overeducation declines with potential experience for all qualification groups except post-school certificates (where potential experience is only weakly related to overeducation) across most of the relevant range. Calculating the marginal effect of moving from potential experience 17.5 years (the mean) to 18.5 years reveals that this 1 year increase is related to a 0.01-year reduction in overeducation for individuals with no qualifications, a bachelor degree or a higher degree, 0.02 years for individuals with a post-school diploma and 0.04 years for individuals with school qualifications. Married men are generally less overeducated than those that are not currently married. This is also true for men living in urban areas and for those that work multiple jobs.

Examining immigrant-specific characteristics, only a few clear patterns emerge. First, low-skilled Australian immigrants have more years of education than comparable NZ-born. This is also true for low-skilled immigrants from Northern Europe (mainly Scandinavia), North America and to some extent from other parts of Europe. All migrants from South-Eastern (former Yugoslavia, Bulgaria, Romania and Greece) and Eastern Europe are more likely to be overeducated, which might reflect a poor transferability of Soviet-era qualifications. Migrants from South-East Asia and North-East Asia, with post-school diplomas and higher, are also more likely to be overqualified (but more likely to be underqualified at low education levels). Migrants from Sub-Saharan Africa (predominantly South African) are more likely to be undereducated than the NZ-born at most qualification levels. Migrants from Southern and Central Asia (primarily India and Sri Lanka) are also generally more likely to be undereducated.

Interestingly, low-skilled immigrants with more years of education in New Zealand are more likely to be overeducated, while for higher-skilled migrants, the relationship is in the other direction and much weaker in magnitude. There are no clear patterns among the cohort effects, and these generally do not have a strong relationship with overeducation although there are a few notable exceptions (for example, recent cohorts with post-school certificates are much more likely to be overeducated relative to previous cohorts with this qualification).

Turning to the results for women, most of the key findings are remarkably similar. For example, the relationship between potential experience, as well as marital status, and overeducation are almost identical to these relationships for men. We also find that women who work multiple jobs are generally less likely to be overeducated. One small difference is that we do not find a relationship between living in an urban location and overeducation among women. Turning to immigrant characteristics, the same patterns emerge for immigrants from different countries of birth, with low-skilled Australians and Northern Europeans, and all Eastern European more likely to be overeducated. One slightly different result, is that for women, there is a clear pattern of low-skilled

migrants from Asian countries being, on average, undereducated, while high-skilled migrants from these countries are overeducated. Cohort effects are similar for women, with no clear patterns, except for post-school certificates where, like for men, overeducation has become more common among recent cohorts. The relationship between years of education in New Zealand and overeducation is also similar for women as that for men.

## 5 Conclusions

In this paper, we used data from the 1996, 2001 and 2006 population censuses in New Zealand to examine differences between a migrant's actual years of education and the estimated average years of education in the occupation in which they work. We make two important contributions to the literature on immigrant overskilling that uses the realised match approach. First, we show that ignoring the mechanical relationship between educational attainment and education-occupation mismatch will lead to biased estimates of over- or undereducation among migrants whenever the education distribution of migrants differs from that of the natives. In our application, where migrants are on average much more skilled than natives, this bias leads to significant overestimation of the degree of overeducation among immigrants. In fact, we find that migrants are, on average, undereducated relative to New Zealanders of the same education level (probably because they are positively self-selected in terms of unobserved ability or invest more in on-the-job training) and that such undereducation does not appear to change much with increasing years in the country.

Second, we extend the literature by estimating models of over-/undereducation that are fully stratified by qualifications. This approach asks the question: 'does the average immigrant work in a more or less skilled occupation than the average NZ-born individual with the same characteristics and the same qualifications?'. We believe that this is the question that the literature has always intended to ask, but was not, in fact, asking. Taking this approach, we find that most groups of migrants are more likely to be undereducated than similarly qualified natives, again likely due to positive migrant-selection effects, and that both overeducated and undereducated migrants become more similar to comparable native-born with increasing years of residence in New Zealand.

Much of the recent international literature has been concerned with incorporating the overeducation-undereducation framework into estimating the consequences for earnings by means of Mincer-type earnings regression equations. The ORU model (e.g. Chiswick & Miller, 2008; 2010) permits the calculation of the private cost of overeducation and undereducation of immigrants. Our findings clearly have implications for estimating such earnings equations. It suggests that one cannot estimate the (low) returns to overeducation correctly unless the data are split into broad qualifications groups. For example, if there are diminishing returns to additional education, the returns to overeducation in a sample of highly qualified workers are expected to be even less than if the data are pooled. A quantification of this effect would be a fruitful avenue for further research.

## Endnotes

<sup>1</sup>Recent studies include, for Australia: Chiswick & Miller (2010) and Green et al. (2007); Canada: Wald & Fang (2008); Denmark: Nielsen (2011); Ireland: Barrett & Duffy (2008); Italy: Dell'Aringa & Pagani (2010); Spain: Sanromá et al. (2014) and Fernandez & Ortega (2008); Sweden: Joonas et al. (2014); UK: Lindley (2009); 22

European countries: Aleksynska & Tritah (2013) and USA: Chiswick & Miller (2009), Chiswick & Miller (2013).

<sup>2</sup>The other methods used in the overskilling literature are ‘job analysis,’ in which personnel experts specify the level and type of education required for each job title, and ‘worker self-assessment’ in which workers state the typical schooling required for their job. The critique we focus on in this paper is only relevant for the ‘realised match’ approach, although these other methods have their own limitations. Literature reviews by Groot and Van den Brink (2000), Rubb (2003) and McGuinness (2006) find that around a third of papers in the overskilling literature use the realised match approach. However, this method is used in the majority of papers that focus on overskilling among immigrants, likely because the type of datasets that typically have large samples of immigrants do not have the information needed to use either of the other approaches. For example, of the papers referenced in endnote 1, Chiswick & Miller (2010), Nielsen (2011), Dell’Ariaga & Pagani (2010), Sanromá et al. (2014), Fernandez & Ortega (2008), Joonas et al. (2014), Lindley (2009), Aleksynska & Tritah (2013), Chiswick & Miller (2009) and Chiswick and Miller (2013) all use the realised match method.

<sup>3</sup>For the general literature on over- and undereducation, see Hartog (2000), Kiker et al. (2000) and McGuinness (2006). For the specific case of immigrants, see Chiswick & Miller (2009).

<sup>4</sup>Such non-recognition may be due to ‘gatekeeping’ by monopolistic suppliers of professional labour or due to a genuine concern about the maintaining of professional standards and quality of service. Additionally, statistical discrimination (‘stereotyping’ of foreign workers), preference-based discrimination or adverse attitudes could lead to foreign workers being pushed into jobs below their level (e.g. Altonji & Black, 1999; Zegers de Beijl, 2000; Mayda, 2006).

<sup>5</sup>This section draws on Section 4.9 of Winkelmann & Winkelmann (1998), OECD (2004) and the very useful ‘Timeline of policy change’ in Merwood (2008). Data are sourced from Winkelmann (2000), NZ Immigration Service (2001), Merwood (2008) and the statistics at <http://www.mbie.govt.nz/info-services/immigration/migration-research-and-evaluation/trends-and-outlook>

<sup>6</sup>Skilled migration is never tied to a job in New Zealand, i.e. once someone has been approved to migrate, they are free to change jobs or to become unemployed and remain in New Zealand (although they are not eligible for social benefits in their first 2 years in New Zealand). Also, all ‘approved’ overseas qualifications are treated the same in the point system regardless to the country of the qualification.

<sup>7</sup>There are a number of ways to measure ‘required’ education. A typical approach is to take the mode or mean for all native workers in the occupation, perhaps stratified by gender. In all cases, this measure is designed to capture the experiences of an ‘average’ worker in a particular occupation.

<sup>8</sup>Some also include a category for having exactly the required level of education and then estimate an ordered choice model. See for example Lindley (2009) and Chiswick & Miller (2009).

<sup>9</sup>One might be concerned about the impact of correlated measurement error when years of education is included both as part of the dependent variables and as a separate independent variable. We avoid this issue by including education as control variable at an aggregated level. This is discussed at more length in Section 4.

<sup>10</sup>We also have access to the 1986 and 1991 census data, but we do not use these data for two reasons: first, New Zealand underwent a period of comprehensive market-oriented economic reform from 1984 to 1993 which complicates interpretation of any results from the early time period (Evans et al., 1996); second, the 1991 census did not ask foreign-born individuals their year of first arrival in New Zealand. Appropriate 2013 census data were not yet available at the time of writing.

<sup>11</sup>Occupation is missing for less than 4 % of the employed and the characteristics of these individuals appear generally similar to those of our analysis sample.

<sup>12</sup>Our results are unaffected if we pool men and women when calculating average education in each occupation. These results are included in an unpublished appendix which is available upon request. We have chosen to stratify by gender to allow for men and women to have different levels of seniority, on average, within the same occupations.

<sup>13</sup>Examples of five-digit occupations include Quarry Manager, Water Resources Engineer, Broadcasting Transmitting and Studio Equipment Operator, Human Resources Clerk, Usher and Cloakroom Attendant, Wool Classer, Aircraft Engine Mechanic, Clay Product Plant Operator and Railway Shunter.

<sup>14</sup>Qualifications are collected on the census form using three questions. First, there is a question that asks, 'What is your highest secondary school qualification?' and only allows categorical responses. Next, individuals are asked, 'Apart from secondary school qualifications, do you have another completed qualification?', and respondents can check either 'yes' or 'no'. If they check yes, they are then asked, 'Print your highest qualification, and the main subject'. Individuals are only coded as 'not included elsewhere' if they respond 'yes' to the question about further qualifications and then give a response to the write-in question that Statistics New Zealand cannot categorise into a standard post-secondary level (or they leave it blank). Hence, we are fairly certain that they have some post-secondary qualification. Among the NZ-born in the analysis sample, 5.4 % have qualifications that are 'not elsewhere included', while this is the case for 6.3 % of immigrants. Excluding these individuals entirely leads to a large increase in the average level of overeducation among migrants relative to natives, but our main finding that, further controlling for differences in education levels (at a very aggregate level) between migrants and natives reduces the relative difference in overeducation seen for migrants, is unaffected by this change. These results are included in an unpublished appendix, which is available upon request.

<sup>15</sup>Specifically, individuals who have 'no qualifications' are assumed to have spent 10 years in education if they are NZ-born and between 3 and 11 years in education if they are foreign-born depending on their gender, birth cohort and country of birth, those whose highest qualification is 'level 1 school' 11 years, those whose is 'level 2 school' 12 years, and those whose is 'level 3 or 4 school' 13 years. Individuals whose highest qualification is 'overseas school' are assumed to have spent 6 to 12 years in education depending on their gender, birth cohort and country of birth. Individuals whose highest qualification is 'level 1, 2 or 3 post-school certificate' are assumed to have spent 12 years in education, those with a 'level 4 post-school certificate' 13 years, those with a 'level 5 post-school diploma' 13.5 years, those with a 'level 6 post-school diploma' 14 years, those with a bachelor degree 16 years and those with a 'higher degree' 17.5 years. Individuals whose highest qualification is 'not elsewhere included' are assumed to have spent 7 to

13 years in education depending on their gender, birth cohort and country of birth. The mean estimate across all countries for individuals that have not completed secondary school is 7.5 years, for those that have completed secondary school 10 years and for those with a non-identified tertiary education the mean estimate across all countries is 10.5 years.

<sup>16</sup>A more ideal approach would be to directly adjust for the quality of schooling in each country using a metric such as student performance on an international test (Hanushek & Woessmann, 2012). Unfortunately, this type of data is only available starting in the 2000s and does not typically cover developing countries, which means we cannot use it in our application. Even if we had this data, self-selection among migrants in general makes it difficult to calculate how actual years of education should be converted to effective years.

<sup>17</sup>This is precisely what we find if we use the same assignment rule for years of education for the foreign-born as we use for natives. With this change, immigrants are found to be quite overskilled relative to natives. However, our main finding that further controlling for differences in education levels (at a very aggregate level) between migrants and natives reduces the relative difference in overeducation seen for migrants is unaffected by this change.

<sup>18</sup>We do this by comparing years of education to age at arrival for immigrants and assuming that everyone started their education at age 5. Because of measurement error, the coefficient on this variable is quite likely to be biased downward.

<sup>19</sup>It is not theoretical clear whether there should be a relationship between the likelihood of employment and overeducation. For example, workers might be discouraged by their inability to find a job that meets their qualification level and hence leave the labour force. Alternatively, workers who have difficulties in finding a job might be more likely to take one for which they are overeducated. As long as the relationship between the likelihood of employment and overeducation is the same for natives and immigrants, differential employment rates will not impact our estimates of the relationship between immigrant status and overeducation. We have examined this further by treating non-employment, self-employment and missing occupation as three additional 'occupations' when estimating our main regression models. This leads to a large decline in the average level of overeducation among migrants relative to natives, especially for women, but our main finding that further controlling for education levels at a very aggregate level reduces the relative difference in overeducation seen for migrants is unaffected by this change. The large decline in overeducation could occur because of differential selection into the labour force that is uncorrelated with selection into different occupations or it could relate to differences in the likelihood of being overeducated. Unfortunately, we do not believe that it is possible to disentangle these different reasons using cross-sectional data. We have further examined the importance of selection into employment by estimating Heckman selection-adjusted versions of our main regression models, where household structure is assumed to impact employment decisions but not overeducation conditional on employment. These results, available from the authors, show slightly higher levels of overeducation in an individual's first years in New Zealand but overall are qualitatively similar to our main findings. They are not preferred because the Heckman selection model is only identified by the assumption that household structure does not have a direct impact on overeducation.



<sup>20</sup>Immigrants with 9 or less years of education are grouped together in this figure.

<sup>21</sup>The choice of 0.5 years as the cut-off point is fairly arbitrary but is only used in Table 3. All our regression analyses use a continuous measure of over- and undereducation.

<sup>22</sup>We also estimated models that include occupation fixed effects, hence allowing different occupations to have different degrees of job matching on average. This had no qualitative impact on our results, so we do not present these findings.

<sup>23</sup>In our baseline specification, instead of controlling for estimated years of New Zealand education, we control for whether a foreign-born individual is likely to have gained any qualifications in New Zealand by using information on both age at arrival and the highest qualification; we do this to avoid estimating a mechanical relations between years of New Zealand education and amount of overeducation. This is not relevant for our extended models below, so we use the continuous variable in these. This point is discussed further in the text.

<sup>24</sup>This is implemented by transforming each indicator variable using the following formula:  $D_i^* = (D_i - D_z \times p_i/p_z)$ , where  $D_i$  is the standard 0/1 indicator variable for category  $i$  for a particular individual,  $D_z$  is the standard 0/1 indicator variable for the omitted category and  $p_i/p_z$  is the population share of category  $i$  relative to that for the omitted population group.

<sup>25</sup>For clarity of presentation, we do not graph confidence intervals. However, as will be seen when we present the coefficients on other regressors in Tables 5 and 6, due to our use of a 100 % census sample, our estimates are extremely precise. We do not present the coefficient estimates for the other control variables because, as we discuss below, we believe that the proper regression model should be fully stratified by education. These are available from the authors on request. We present the coefficients from this model in Tables 5 and 6.

<sup>26</sup>The estimated coefficients on the broad education categories indicate that men (women) with school qualifications are, on average, 0.9 (1.0) years more overskilled than men (women) with no qualifications and those with post-school qualifications are, on average, 2.8 (2.7) years more overskilled than men (women) with no qualifications.

<sup>27</sup>This can also be seen by estimating Eq. (4) directly. If we do this, the coefficient on the year of education is estimated to be 0.65 meaning that  $\delta = 0.35$ , which is much less than 1, the value assumed by the standard ORU model. However, this result should be judged with caution as years of education in this specification is on both sides of the regression equation which can lead to a good deal of measurement error bias.

<sup>28</sup>For men, 22 % of the sample has no qualifications, 27 % school qualifications, 23 % post-school certificates, 11 % post-school diplomas, 11 % bachelor degrees and 6 % higher degrees. The equivalent figures for women are 19, 33, 15, 15, 12 and 5 %, respectively. While skilled and business migrants currently account for about half of all residence approvals, less-skilled migrants enter New Zealand via a number of pathways including humanitarian categories (which included a large number of open lottery migrants from the Pacific), family reunification and as spouses of skilled migrants. Our data also include temporary migrants, such as young people on working holidays, who are often less skilled. Furthermore, post-school certificates include those in specific trades which are occasionally on occupational priority lists (for example, chefs) and many migrants in our sample would have entered New Zealand prior to the establishment of the skilled migration system.

<sup>29</sup>While it would be ideal to examine the topic of immigrant overeducation using longitudinal data, as far as we know, this has not yet been done in the literature because to our knowledge, there is not any longitudinal data available that (a) follows immigrants for a long period of time (ruling out immigrant cohort studies which are all short term in nature); (b) contain large samples of immigrants (ruling out the PSID, NSLY and other general longitudinal studies); and (c) are from countries that have skilled migration policies (ruling out register data from the Scandinavian countries where almost all migration is refugees or open access from inside the European Union). The only exceptions are the German Socioeconomic Panel (SOEP) which has been used to examine immigrant assimilation in wages (e.g. Constant and Massey 2003), but the immigrant population in this case is almost exclusively low skilled; and the Household, Income and Labour Dynamics in Australia (HILDA) Survey which has also been used to examine assimilation in employment and wages (e.g. Cobb-Clark et al. 2012) but only has 13 years of data; and US Social Security data which has been used to examine assimilation in earnings (e.g. Lubotsky 2007) but has no information on individual's occupation or years of education.

<sup>30</sup>There is a notable increase in overeducation between years 9 and 10 in New Zealand among individuals with post-school certificates. This occurs because we estimate a large increase in overeducation for the last entry cohort with this level of qualifications. Outcomes for this cohort only impact the estimated level of overeducation in the first 9 years in New Zealand. We believe that this could be occurring because the nature of the qualifications in this category changed in the 1990s and 2000s. The overall pattern of assimilation for this group is unchanged if this cohort effect is added to the profile for years 0 to 9. In this case, the large jump between years 9 and 10 is eliminated.

<sup>31</sup>This is partially because these individuals have less years of schooling, on average, than unqualified New Zealanders due to our use of the Barro-Lee data to adjust years of schooling for immigrants.

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#### **Competing interests**

The IZA Journal of Migration is committed to the IZA Guiding Principles of Research Integrity. The authors declare that they have observed these principles.

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