

Immigration and 'Brain Waste'

an analysis of APEC immigrants in New Zealand

Abstract

We analyse 'brain waste', or underutilisation of immigrant skills in the New Zealand labour market, with specific reference to immigrants from APEC member countries. Using census data, we find wide variation across APEC countries in the likelihood that a typical immigrant from these countries with a tertiary qualification works in a skilled occupation, consistent with brain waste. Our exploration of the drivers of brain waste reveals that GDP per capita of the country of origin of immigrants, its distance from New Zealand, expenditure on education and colonial links to New Zealand are

negatively related to brain waste. After accounting for these drivers, there is no evidence that brain waste is mitigated among immigrants from APEC member countries. Our study highlights the need for efforts to facilitate utilisation of immigrant skills in the region, such as cooperation among APEC members in standardising certification requirements and dissemination of information on skills demand and supply and the nature and quality of the education system.

Keywords immigration, skills, mismatch, APEC, New Zealand

Eyal Apatov is a senior analyst at Oranga Tamariki–Ministry for Children. Eyal's work focuses on evaluation and analysis using quasi-experimental methods over large data sets. He has an MCom in economics from the University of Auckland, and has worked in research positions for various public and private sector organisations. Asha Sundaram is a senior lecturer

at the Department of Economics, University of Auckland. She has an MPhil in economics from the University of Oxford and a PhD in economics from Syracuse University, United States. Her research spans the fields of international trade and development. She has consulted for organisations like the World Bank and the Asian Development Bank.

The idea that has underpinned the formation of organisations like APEC is that diversity in country size, endowments and level of development gives rise to comparative advantage in production, providing opportunities for gains from international trade. Trade models of comparative advantage typically do not account for mobility of labour, which is considered a fixed, country-specific endowment. However, recent developments in travel and communications have led to increasing movement of labour across countries, spawning a large literature that studies the economic impacts of immigrants on host economies.

Labour mobility across borders can bring economic gains in a multitude of ways. Immigrants can be a key resource for businesses, facilitate transfer of skills and knowledge across borders, spur innovation in firms by increasing diversity of ideas (Docquier, Özden and Peri, 2014; Ottaviano and Peri, 2013; Hanson and Slaughter, 2016), help establish trade relationships, thereby fostering international trade (Genç, 2014), and help nations address labour and skill shortages. This is particularly true for APEC member economies like Japan, Canada, the United States, New Zealand and Australia, where demographic transition has resulted in ageing populations (OECD, 2020).

It is, therefore, no wonder that organisations like APEC, which seek to deepen connectivity and regional integration to ensure economic development for member nations, have begun exploring ways to maximise benefits stemming from international movement of labour. The APEC Connectivity Blueprint for 2015–25 and the 2015 APEC Human Resources Development ministerial statement emphasise the need to effectively manage labour mobility. The APEC Business Advisory Council encourages research targeted at boosting labour mobility, which it views as important for business competitiveness (Brooks, Posso and Abdullaev, 2015). This focus on labour mobility, albeit recent, signals a recognition by members of its salience for achieving APEC's goals.

Though immigrants bring skills and diversity with them, their assimilation into

Our results suggest that GDP per capita of the origin country, its distance from New Zealand, spending on education ... and colonial links are negatively related to brain waste

the host economy may not be seamless. The rich literature on labour market outcomes for immigrants has acknowledged the presence of 'brain waste', a phenomenon where immigrants are employed in occupations that are not commensurate with their skills and level of education (Mattoo, Neagu and Özden, 2008; Poot and Stillman, 2010; Peters and Sundaram, 2015), resulting in immigrant skills being underutilised. A skills mismatch might also lead to inefficient levels of investment by firms, with implications for productivity and growth.

In this article we explore underutilisation of skills in New Zealand of immigrants, with a focus on immigrants from APEC countries. We ask if immigrants who possess tertiary education are matched to skilled occupations in New Zealand. To do this, we utilise data from New Zealand's 2013 census and estimate a linear probability model which relates the probability that an immigrant in New Zealand works in an occupation we classify as skilled or highly skilled, conditional on their age, years spent in New Zealand, whether they hold at least a tertiary qualification (a bachelor's degree or above NZQA Level 7), and their country of birth.¹

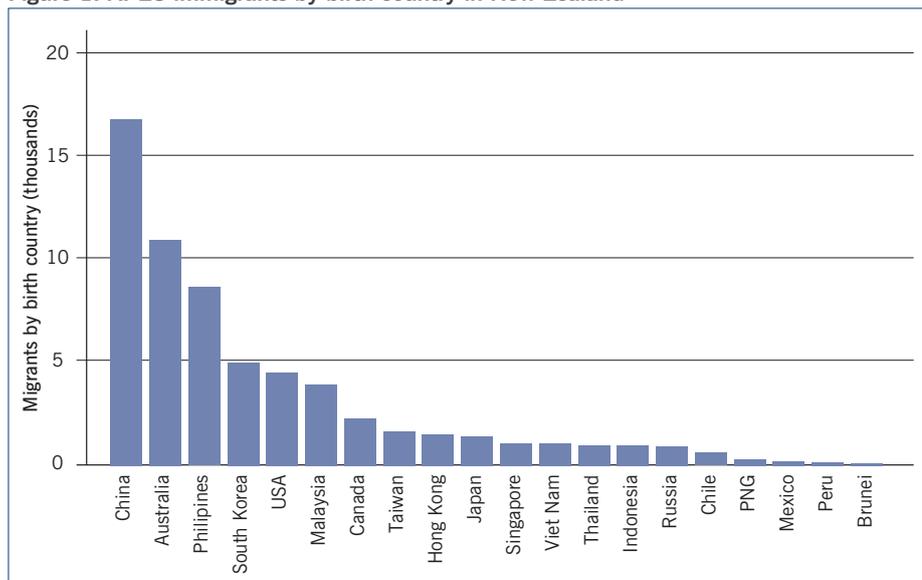
For each origin country, we use these estimates to calculate the predicted probability that a typical immigrant of average age and years in New Zealand (for each decade of arrival between the 1960s and 2010s) would work in a skilled occupation if they hailed from that origin country and possessed a tertiary qualification. We then attribute variation across origin countries in these predicted probabilities to brain waste. The idea is that in the absence of brain waste, an individual with similar characteristics and educational qualifications would have similar probabilities of working in a skilled occupation, irrespective of origin country. This exercise also allows us to examine patterns in brain waste among immigrants from APEC countries.

We find evidence of significant variation in the probability of working in a skilled occupation conditional on having a tertiary qualification for immigrants from APEC member countries in New Zealand, suggestive of brain waste. For some immigrants from APEC countries like Japan, China and Korea, there is evidence that brain waste is lower for immigrants who arrived in earlier decades, at least as far back as in the 1990s.

Additionally, drawing on economic theory and using regression analysis on data on all immigrants in New Zealand, we explore potential drivers of brain waste. Our results suggest that GDP per capita of the origin country, its distance from New Zealand, spending on education (capturing education quality) and colonial links are negatively related to brain waste. Once these origin country characteristics are accounted for, there is little evidence that APEC membership mitigates brain waste among immigrants in New Zealand. To conclude, we draw policy implications from our findings. We suggest the need for better coordination of certification requirements, and information sharing on skills demand and supply and education systems, institutions and quality, to aid APEC's integration and development efforts.

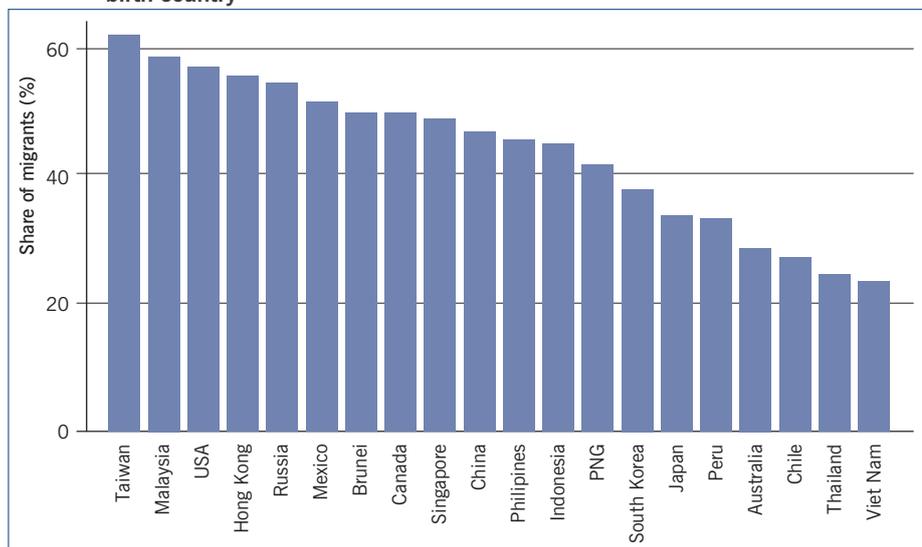
The article is structured as follows. First, we provide a broad context for immigration in APEC countries. The following section zooms in on immigration in New Zealand from APEC countries, using data from the

Figure 1: APEC immigrants by birth country in New Zealand



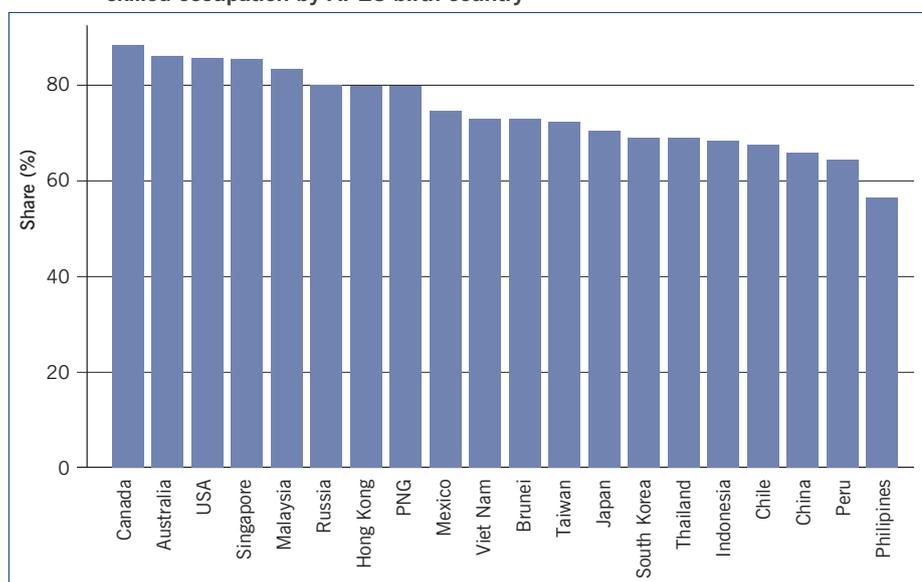
Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

Figure 2: Share of immigrants in New Zealand with a tertiary qualification by APEC birth country



Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

Figure 3: Share of immigrants in New Zealand with a tertiary qualification working in a skilled occupation by APEC birth country



Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

2013 New Zealand census, and offers a comparison of immigrants of APEC origin with those from non-APEC countries, noting differences by demographics and occupation. Section three looks at brain waste among immigrants in New Zealand, with special reference to APEC member countries. We then explore the potential drivers of brain waste. The final section concludes and discusses policy implications.

APEC immigrants in New Zealand

APEC boasts some of the largest immigrant-receiving countries, like the US, Canada and Australia. Taken as a percentage of population in 2018, Australia hosts the largest proportion of immigrants (30%), followed by New Zealand (23%), Canada (22%), the US (16%), Malaysia (11%), Russia (8%) and Thailand (5%).² All APEC countries saw a significant increase in the stock of immigrants between 1990 and 2019, except for Russia. Immigrants from APEC origin countries form a substantial and rising share of immigrants in New Zealand: from 21% in 1990 to 31% in 2019.

Figure 1³ shows the distribution of immigrants in New Zealand from the APEC region by birth country (or country of origin). The top five countries of birth for APEC immigrants in New Zealand are China, Australia, the Philippines, the US and Malaysia.⁴ Figure 2 focuses on the share of immigrants from APEC countries in New Zealand with a tertiary qualification. It shows wide variation in educational attainment among immigrants based on country of origin. The top five origin countries for immigrants with a tertiary qualification are Taiwan, Malaysia, the US, Hong Kong and Russia, while the bottom five are Peru, Australia, Chile, Thailand and Vietnam, with China somewhere in the middle.

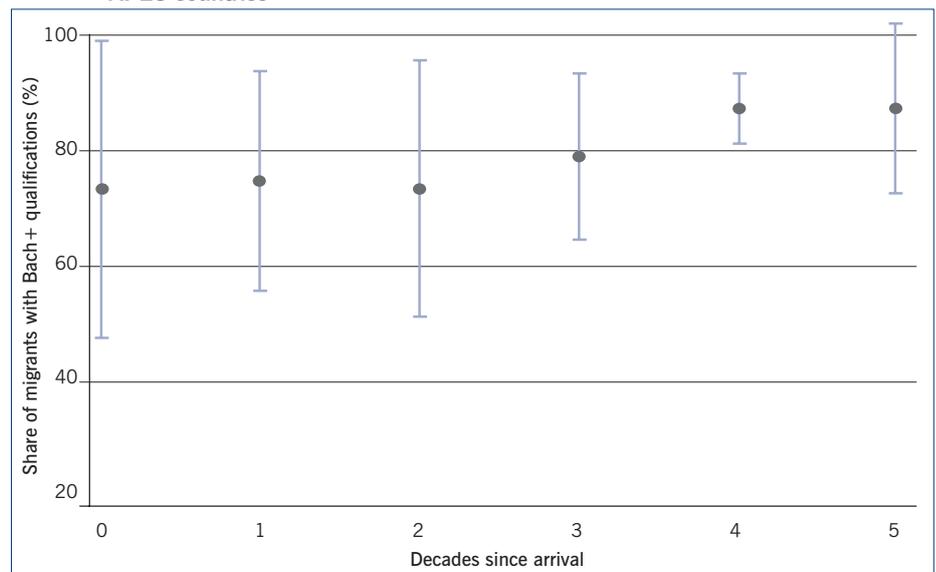
Figure 3 plots the share of immigrants with advanced degrees who also report working in an occupation classified as skilled. It presents evidence consistent with brain waste. The proportion of immigrants with a tertiary qualification who report working in a skilled occupation differs across APEC origin countries. More than 80% of immigrants with a tertiary qualification from Canada, Australia, the US, Singapore and Malaysia report working in a skilled occupation, while this number

is less than 70% for China and Peru, and less than 60% for the Philippines. Of course, these observed differences are not necessarily an indication of brain waste. They may simply reflect differences in the profiles of immigrants from different APEC origin countries, in, for example, age, labour market experience and time spent in New Zealand to assimilate. We analyse brain waste more carefully below by accounting for some of these differences across origin countries.

Figure 4 displays the mean and standard deviation of shares of immigrants with a tertiary qualification working in skilled occupations across APEC origin countries by decade of arrival in New Zealand. We note two points. First, the share of immigrants with a tertiary qualification working in skilled occupations rises as immigrants spend more time in New Zealand. Second, the dispersion (across countries) of the share of immigrants with a tertiary qualification in skilled occupations tends to fall as the time spent in New Zealand rises, pointing to convergence in outcomes for skilled immigrants across APEC origin countries. This is suggestive of falling underutilisation of immigrant skills as immigrants assimilate better into the New Zealand labour market, and is consistent with international evidence on brain waste.⁵ A key exception to this pattern are those who migrated to New Zealand five decades ago or earlier, for whom the dispersion is wider. We speculate that this is a result of the cohort's relatively older age (associated with changes in employment preferences towards retirement), differences in the educational/professional requirements for migrating to New Zealand in that period, and the relatively small size of the group (see Table 1).

Table 1 looks at the characteristics of immigrants in New Zealand from APEC and non-APEC countries to offer a comparative perspective. While both APEC and non-APEC immigrants tend to be in their early 40s on average, APEC immigrants are more likely to hold a tertiary qualification than non-APEC immigrants. However, there is no demonstrable difference in the distribution of APEC and non-APEC immigrants across high-level occupations, with both

Figure 4: Share of immigrants in New Zealand with a tertiary qualification working in a skilled occupation by decade of arrival: mean and standard deviation across APEC countries



Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

groups equally likely to work in managerial and professional occupations as in production-related occupations. This is consistent with the idea of brain waste, since a cohort with a larger proportion of tertiary degree holders does not appear to work disproportionately in occupations requiring advanced degrees.

The remaining rows of Table 1 look at potential drivers of brain waste, like language ability and time spent in New Zealand in assimilating into the local labour market. Though both APEC and non-APEC immigrants in New Zealand report speaking English, fewer APEC immigrants speak English than non-APEC immigrants. APEC immigrants are more recent arrivals and are likely to have arrived after 1990. They have therefore spent fewer years in New Zealand relative to non-APEC immigrants.

Most APEC immigrants are from north-east Asia, followed by South East Asia, Oceania (Australia) and the Americas. Non-APEC immigrants are most likely to be from western Europe (including the UK), Oceania (including the Pacific Islands), southern and central Asia (including the Indian sub-continent) and sub-Saharan Africa (including South Africa). A majority of APEC immigrants report their ethnicity to be Asian, followed by European. Among non-APEC immigrants, the majority report European ethnicity, followed by Asian and Pacific peoples.

Brain waste

Using a linear probability model, we estimate the likelihood that immigrants work in skilled occupations in New Zealand, conditional on their origin country, age, number of years in New Zealand and whether they have a tertiary qualification. For each decade of arrival, we define a typical immigrant as one whose age and years spent in New Zealand equal those of all immigrants that arrived in that decade. For each origin country and decade of arrival, we then calculate the predicted probability that this typical immigrant would work in a skilled occupation, if they held a tertiary qualification. If the predicted probability differs vastly across countries, this is consistent with brain waste, or underutilisation of immigrant skills in the domestic labour market.

Figures 5a–c present the predicted probabilities conditional on holding a tertiary qualification by decade of arrival for APEC origin countries in Asia and in the Americas, and for key non-APEC countries respectively. We first note broad patterns emerging. First, predicted probabilities are higher for immigrants who arrived in earlier decades, but this trend only holds until the 1990s. For immigrants who arrived before the 1990s, arriving in an earlier decade is often associated with lower predicted probabilities of obtaining a skilled job. One possible explanation for this break in the trend is that prior to 1987, immigration

Table 1: Characteristics of immigrants from APEC and non-APEC countries in New Zealand (shares)

		Non-APEC	APEC	
Immigrants		156,339	63,066	
Age	Average	44	41	
Qualifications	Below secondary school	25%	24%	
	Secondary and higher education	41%	32%	
	Bachelor's and honours	25%	34%	
	Master's and PhD	9%	10%	
Occupation	Managers	21%	21%	
	Professionals	26%	26%	
	Technicians and trades workers	19%	20%	
	Community and personal service workers	5%	6%	
	Clerical and administrative workers	6%	6%	
	Sales workers	6%	7%	
	Machinery operators and drivers	8%	5%	
	Labourers	9%	10%	
	Speak English		97%	91%
	Decade of arrival	1960s or earlier	7%	3%
1970s		10%	6%	
1980s		12%	11%	
1990s		16%	23%	
2000s		43%	44%	
2010s		12%	12%	
Years in New Zealand	Average	17	15	
Birth region	North Africa and the Middle East	2%	0%	
	North-east Asia	0%	42%	
	North-west Europe	45%	0%	
	Oceania and Antarctica	19%	18%	
	South East Asia	1%	27%	
	Southern and central Asia	15%	1%	
	Southern and eastern Europe	3%	0%	
	Sub-Saharan Africa	12%	0%	
	The Americas	2%	12%	
Ethnicity (multiple)	European	60%	31%	
	Māori	0%	1%	
	Pacific peoples	12%	1%	
	Asian	25%	67%	
	MELAA	4%	2%	
	Other	1%	1%	

Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

policy in New Zealand gave explicit preference to British immigrants, followed by immigrants from Scandinavia and northern Europe. Following the establishment of the points-based system, the country of origin did not matter and the system encouraged migration of individuals whose skills could contribute to the development of New Zealand. We therefore expect to see greater assimilation over time for skilled immigrants who migrated after 1987.⁶

Focusing on APEC immigrants in New Zealand, the countries with the highest predicted probabilities of obtaining a

skilled job conditional on a tertiary qualification are the US and Canada, with probabilities of between 70% and 80%, and increasing for immigrants who arrived in previous decades. These probabilities are comparable to probabilities for the UK, a large immigrant-sending country that is not part of APEC. Predicted probabilities are not much lower for immigrants from Malaysia, Hong Kong and Singapore, at around 70%. Immigrants from Mexico have predicted probabilities of obtaining a skilled job conditional on a tertiary qualification of between 60% and 70%, with immigrants who arrived in earlier

decades seeing higher probabilities. Predicted probabilities for immigrants from Australia, Indonesia and Thailand are under 60%. This is true also of immigrants from China, Japan and Korea, but for immigrants from these origin countries, arrival in an earlier decade (in the 2000s and 1990s) is associated with much higher probabilities, consistent with improving labour market outcomes over time. Finally, predicted probabilities are lowest for immigrants from the Philippines, Vietnam, Peru and Chile, at around 50% and under. These probabilities are lower than those for India and South Africa, both emerging economies that are not APEC members.^{7, 8}

Drivers of brain waste

In this section we explore potential drivers of brain waste. Using regression analysis, we study the relationship between the predicted probabilities for each origin country by decade of arrival shown in figures 5a–c above, and origin country characteristics for the relevant decade that are likely to be correlated with brain waste. Note that we associate a lower predicted probability with greater brain waste.

Economic theory suggests that immigrants compare the gain in remuneration with the cost of migration and decide to migrate if the former dominates the latter. Remuneration depends on the individual's skill and the skill price (return to skill), which differs across countries. An individual with a given amount of skill can earn more if the skill price in the destination country is higher than in the origin country. The implications of this simple framework are twofold. First, assuming that the skill price in the destination country is higher, more skilled individuals are more likely to emigrate from the origin country. In other words, immigrants are positively selected on skills. This is because, for given skill prices, the gain from migrating is larger at a higher skill level.⁹

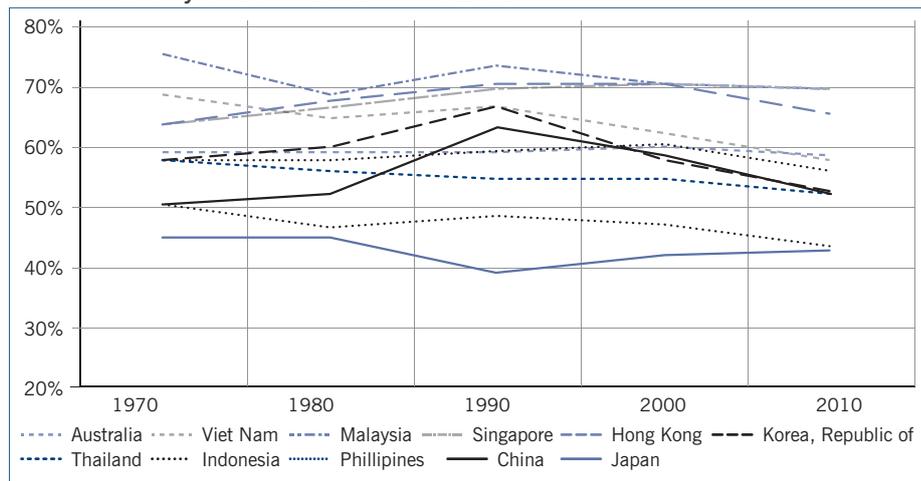
Next, the closer the destination and origin countries are in skill price (for instance, they may be at the same level of development) and the greater the distance (geographic, cultural or institutional) between them, the higher the skill level of immigrants from that origin country. The reason is that the gain from migrating is

smaller and the cost of migration larger. As in the case of skill, a similar argument applies to innate ability and motivation. Given that ability and motivation are important determinants of outcomes in the labour market, the level of development of the origin country and its distance from New Zealand can both drive brain waste by determining immigrant selection into New Zealand. We note that immigrants who are pushed to leave their home countries due to political or civil conflict (such as refugees) may be selected on different characteristics compared to immigrants looking for better economic or personal prospects. Our analysis of the drivers of brain waste recognises this difference and accounts for the presence of conflict in origin countries.¹⁰

Second, educational quality or perceived educational quality can differ widely across origin countries. Employers in New Zealand might perceive the same educational qualification from two different countries differently. Besides, employers may have imperfect information about the quality and content of educational qualifications and the skills they confer, particularly if the origin country has an education system unlike New Zealand's. Quality assurance institutions like the New Zealand Qualifications Authority can ease these information barriers to a certain extent, but may not eliminate them, contributing to brain waste. Third, several skilled occupations come under the ambit of professional regulatory bodies that issue certification requirements. Immigrants may need to recertify in order to practice their profession in New Zealand, and often recertification may prove onerous, exacerbating brain waste. Finally, cultural and institutional differences can prevent immigrants from assimilating seamlessly into the labour market. Immigrants may not be aware of the job search process and cultural and social etiquette around interviews, and they may face language barriers, at least in the initial years after migration.

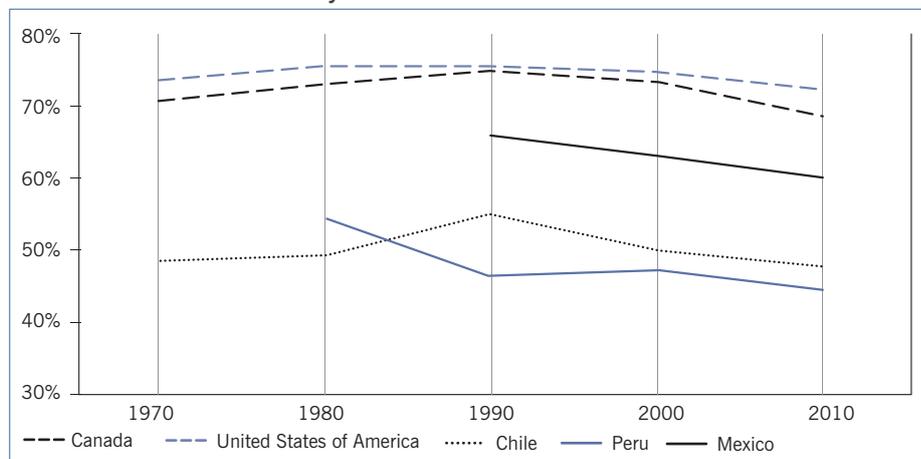
Using proxy measures to capture several of these factors, we ask if they are correlated with brain waste. We consider GDP per capita and geographic distance as determinants.¹¹ Additionally, we include an indicator variable for whether there is

Figure 5a: Brain waste – APEC immigrants with a tertiary qualification from Asia by decade of arrival in New Zealand



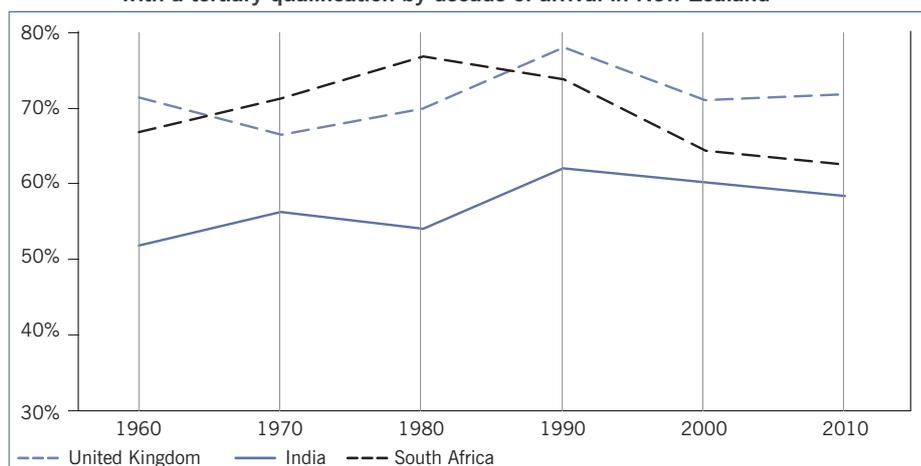
Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

Figure 5b: Brain waste – APEC immigrants with a tertiary qualification from the Americas by decade of arrival in New Zealand



Note: Statistics from country–decade with fewer than six migrants were not included due to confidentiality requirements. Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

Figure 5c: Brain waste – key non-APEC immigrants with a tertiary qualification by decade of arrival in New Zealand



Source: 2013 New Zealand Census, Statistics New Zealand and authors' calculations

conflict in the origin country, and total expenditure on education as a percentage of GDP as a measure of the quality of education in the origin country. For the same educational qualification, better quality of education should be associated

with a higher likelihood for immigrants of obtaining a skilled job.

Finally, we consider the extent to which certification requirements are a barrier to assimilating skilled immigrants into the New Zealand labour market. We begin with

Table 2: Brain waste and its correlates

	OLS	Fixed effects
APEC (=1 if APEC member)	0.054*** [0.030 – 0.078]	0.028 [–0.013 – 0.069]
GDP per capita	0.027*** [0.014–0.039]	0.039** [0.006 –0.072]
Conflict (=1 if conflict)	–0.047** [–0.084 – –0.010]	–0.004 [–0.024 – 0.017]
Education spending (% of GDP)	0.038 [–0.017 – 0.092]	0.031** [0.003 – 0.059]
Common language	–0.040* [–0.080 – 0.000]	
Colonial link	0.087*** [0.050 – 0.123]	
Population	0.033*** [0.025 – 0.041]	–0.07 [–0.162 – 0.022]
Distance	0.064*** [0.040 – 0.087]	
Observations	370	370
Adjusted R-squared	0.773	0.972
Decade fixed effects	Yes	Yes
Country fixed effects	No	Yes

Notes:

Data are sourced from the 2013 New Zealand Census and Statistics New Zealand, and are an unbalanced panel of countries over six decades, 1960–2010s. The dependent variable is the predicted probability of working in a skilled occupation as calculated in the previous section. GDP per capita (PPP, current international dollars), total population and education spending as a percentage of GDP are obtained from the World Bank's World Development Indicators. Conflict data are obtained from the Uppsala Conflict

Data Program. Common language is an indicator variable that equals one if at least 9% of the population speaks English. Colonial link is an indicator variable for whether the country was colonised by New Zealand or the UK. Distance is with reference to the latitude/longitude of the most important cities/agglomerations. The common language, colonial link and distance variables are sourced from the CEPII database. Robust confidence intervals in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

a survey of professional certification requirements. Immigration New Zealand lists 27 professional bodies that provide accreditation for approximately 50 distinct occupations. Examining the application process to obtain New Zealand registration, we find that for all but two of these occupations, registration as a professional is required to pursue the occupation in New Zealand (with pathways to registration varying by occupation). Almost all professional bodies use New Zealand-obtained qualifications and/or work experience as baseline prerequisites for accreditation, with some possibility of 'converting' overseas qualifications and experience to assess against this baseline.

We also find cross-country discrepancies in how overseas qualifications are treated to obtain professional accreditation. This could lead to brain waste for individuals from 'less preferred' countries, if they are

unable to obtain registration and cannot practice in an occupation they are otherwise qualified for. To get a sense of these differences across countries, we identify prescribed overseas qualifications, pre-approval, fast-track registration or any other explicit preferences for professionals from specific countries, including APEC member countries. For each profession, we record 'preferred' countries (including second and third preferences).

Due to the Trans-Tasman Mutual Recognition Agreement, almost all professions have a fast-track registration for professionals registered, accredited and/or qualified in Australia. Eleven out of the 27 professions provide a fast-track process or pre-approval for individuals holding qualifications/registrations from or practicing in certain assessed countries. For the remaining 16 professions, and for individuals not qualifying for some explicit

form of fast-tracking, assessments are done on a case by case basis. Almost all professions require English language assessments (IELTS or OET), which may be waived if the individual studied in English or practices in an English-speaking country. Some professions explicitly or implicitly state that they are more likely to recognise qualifications or experience from/in countries that are more similar in institutions to New Zealand. Applicants typically need to list relevant experience or practices similar enough to New Zealand practice for the New Zealand-based assessors to approve.¹²

Given these certification requirements, countries that are frequently mentioned for fast-tracking, pre-approval or waiver other than Australia are the UK, Ireland, US, Canada and South Africa. Countries occasionally mentioned are Hong Kong, Singapore, Japan, Malaysia, Denmark, France, Sri Lanka, Pakistan, Korea and Zimbabwe. This list suggests that immigrants from countries that are former British colonies, Commonwealth countries and/or English-speaking countries are likely to more easily navigate the certification regime for professional qualifications. We hence include indicator variables for whether an origin country was a colony of either the UK or New Zealand and whether more than 9% of the population speaks English to proxy for ease of obtaining certification. Note that with the exception of Japan and Korea, APEC member countries on the list all have colonial links to the UK or are English-speaking.

Finally, we include an indicator for whether the origin country is an APEC member country. The motivation behind including the APEC indicator is to ask if membership of APEC, conditional on other factors enumerated above, is associated with less brain waste (a higher predicted probability of working in a skilled occupation).

Results from the regression analysis are presented in Table 2. The first column presents results from a simple regression that explores the relationship between the predicted probability of working in a skilled occupation conditional on a tertiary qualification (as estimated above) and characteristics of origin countries that are potential drivers of brain waste. The second column estimates a regression that

additionally includes a set of country indicator variables. The idea is to account for unobserved country-specific factors beyond the ones explicitly included, such as culture or immigrant networks, that determine brain waste and may also be related to the key drivers we analyse. Not accounting for such factors may lead us to erroneously attribute their effects to the other drivers we investigate. Finally, both columns include indicators for decade of arrival, to capture shocks to immigrant outcomes specific to each decade.

Because unobserved time-invariant, country-specific factors are accounted for in the second column, the relationships between the drivers of brain waste and the predicted probability of working in a skilled occupation are identified from changes across decades in the drivers. We prefer the estimation in the second column, primarily because it allows us to account for additional unobserved confounders. Note that in the second column, we cannot include drivers that do not change over decades (like distance and colonial links).¹³ Also, since education data are only available from the 1970s, we exclude observations from the 1960s or earlier.

From the first column, GDP per capita and distance are negatively associated and conflict is positively associated with brain waste. This is consistent with immigrants being positively selected on ability and motivation. We expect that the higher the level of development of the origin country and its distance from New Zealand, the higher the ability of individuals who decide to migrate. Conflict may result in negative selection of immigrants. As expected, brain waste is mitigated for immigrants from origin countries with a colonial link to New Zealand. This is consistent with easier certification requirements (and, potentially, cultural and institutional similarities) for immigrants from these countries. Population size in the origin country is negatively correlated with brain waste. We find that the quality of education and common language are positively and negatively correlated, but the coefficients are not statistically significant, suggesting that the relationship is not meaningful in a statistical sense.

Finally, being an APEC member is negatively related to brain waste, and this

APEC member nations have begun to realise the importance of easing immigration of skilled workers and immigrant assimilation across the APEC region.

coefficient is statistically significant. However, this negative relationship between APEC membership and brain waste does not endure in the second column, where the relationship is identified from changes in APEC membership and the predicted probability of working in a skilled occupation due to the presence of country fixed effects. The statistically insignificant coefficient on APEC is consistent with the idea that the result in the first column is driven by unobserved factors related to APEC membership. Education spending is now negatively related to brain waste and the coefficient is now statistically significant, as expected. Conflict and population lose statistical significance.

Overall, results from the analysis suggest that GDP per capita, distance, colonial links and education expenditure (capturing quality of education) are important correlates of brain waste and they are related to brain waste in the expected fashion. Importantly, there is no strong evidence that APEC membership mitigates brain waste among immigrants from member countries.

Conclusions and policy implications

Using data from New Zealand's 2013 census, we show that the predicted likelihood of an immigrant in New Zealand working in a skilled occupation conditional on holding a tertiary degree differs substantially across APEC member countries, indicative of brain waste or underutilisation of immigrant skills.

While immigrants with tertiary degrees from APEC member countries like the US, Canada, Hong Kong, Singapore and Malaysia have a high likelihood of working in skilled occupations in New Zealand, this likelihood is low for immigrants from Indonesia and the Philippines. An analysis of characteristics of origin countries that are correlated with brain waste reveals that the origin country's level of development, its distance from New Zealand, spending on education and colonial links are negatively related to brain waste. After accounting for these potential drivers of brain waste, there is no evidence that APEC membership reduces brain waste.

While APEC's recent focus on labour mobility is a movement in the right direction, our results cast some doubt on whether this focus has translated into concrete action on the ground to maximise gains from immigration. There is scope for cooperation among APEC members in standardising certification requirements and dissemination of information on the nature of the education system and the quality of educational institutions. APEC can look to ASEAN for ways to design mutual recognition agreements that establish common skill and qualifications recognition schemes in the region across professions (Gentile, 2019); this is in addition to ASEAN's broader initiatives in encouraging 'people mobility', a key component of its *Master Plan on Asian Connectivity 2025* (ASEAN, 2016), which includes reducing the gaps between skills supply and demand in the ASEAN region, encouraging intra-ASEAN international students at universities and supporting higher education and skill development across ASEAN member states.

APEC member nations have begun to realise the importance of easing immigration of skilled workers and immigrant assimilation across the APEC region. The APEC ministerial meeting in the Philippines in 2015¹⁴ highlighted the importance of APEC projects in this area. These include the APEC Labour Market Portal, which collates data on labour market and skills trends from member economies and presents it in one location in a coherent format,¹⁵ and the APEC Occupational Standards Referencing Framework, which enables comparisons of

the skills held by workers across the region by bringing together the components necessary for understanding and assessing these skills.¹⁶ Such projects are a good start, but a firm commitment to ensuring that skilled immigrants are able to identify opportunities and avail themselves of them by smoothly assimilating into the host country labour market will ensure that immigrant skills are harnessed for the benefit of host countries, leading to growth and development in the APEC region.

- 1 We classify the full list of ANZSCO occupations by skill level. Occupations with skill levels 1–3 are defined as skilled occupations in this study. For more information about ANZSCO occupations and skill level, see: http://archive.stats.govt.nz/browse_for_stats/income-and-work/employment_and_unemployment/skills-employed-people.aspx#gsc.tab=0.
- 2 Data from the Population Division of the United Nations Department of Economic and Social Affairs, 2019.
- 3 Statistics New Zealand IDI disclaimer: The results in these figures and tables are not official statistics; they have been created for research purposes from the Integrated Data Infrastructure (IDI) managed by Statistics New Zealand. The opinions, findings, recommendations and conclusions expressed are those of the authors, not Statistics New Zealand. Access to the anonymised data used in this study was provided by Statistics New Zealand in accordance with security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person, household, business or organisation, and the results in these figures/tables have been confidentialised to protect these groups from identification. Careful consideration has been given to the privacy, security and confidentiality issues associated with using administrative and survey data in the IDI. Further detail can be found in the privacy impact assessment for the Integrated Data Infrastructure available from www.stats.govt.nz.
- 4 We note that immigrant numbers from Peru, Chile, Mexico,

Brunei and Papua New Guinea are low, particularly in the case of immigrants arriving in earlier decades. Our estimates of predicted probabilities for these countries in earlier decades are hence based on few observations and must be interpreted with this caveat in mind.

- 5 Additionally, this is in line with earlier findings in New Zealand (Stillman and Maré, 2009), suggesting that entry disadvantage for migrants has been followed by relative improvements in employment rates and (to a smaller extent) wages.
- 6 The finding that the likelihood of obtaining a skilled job with tertiary education is higher for immigrants who arrived earlier is consistent with the idea of assimilation into the New Zealand labour market over time. However, other explanations for this finding are also plausible. For instance, the structure of the labour market may have changed over decades, affecting the likelihood of obtaining a skilled job. A weak labour market characterised by higher levels of unemployment may have lasting effects in later years (due to atrophy of skills and networks, worker discouragement or failure to develop 'soft' skills (DeLong and Summers, 2012)).
- 7 The extent of brain waste among immigrants in New Zealand is similar to that in the US. Mattoo, Neagu and Özden (2008) present a similar analysis for the US and document predicted probabilities of obtaining a skilled job conditional on holding a tertiary qualification as being highest for immigrants from India and South Africa (69%), followed by immigrants from Canada, the UK and Hong Kong (67%, 66% and 65% respectively). Lowest predicted probabilities are in the low 20s for immigrants from countries in Latin America. In comparison, the predicted probability of working in a skilled occupation conditional on holding a tertiary qualification is highest in New Zealand for immigrants from the US and UK (both at 77%) and lowest at around 15% for immigrants from Samoa and Tonga.
- 8 We perform a similar analysis for immigrants with a master's/ PhD degree relative to immigrants with a bachelor's/ honours degree. Interestingly, the predicted probabilities do not increase for immigrants in New Zealand holding a master's degree relative to a bachelor's degree. This is contrary to evidence from the US, where holding a master's or professional degree significantly improves the probability of working in a skilled occupation for migrants. While investigating the exact reason for this difference is beyond the scope of this article, we note this as a fruitful avenue for future research.
- 9 In addition to market-based remuneration, publicly provided services like health and education in the destination country are also an important component of immigrants' decisions to

migrate. Even if there is no difference in skill prices between the origin and destination countries, differences in access to and the quality of public services may motivate immigrants. This type of immigration need not necessarily result in positive selection on skills.

- 10 We acknowledge that conflict is but one push-factor leading immigrants to migrate. More broadly, restrictions on human rights and freedoms are an important determinant of the immigration decision.
- 11 We recognise that geographic distance is an imperfect proxy for institutional and cultural distance, both of which can also impact on the cost of migration. However, the two variables we include to account for certification requirements (an indicator variable for whether more than 9% of the population in the origin country speaks English and if the origin country and New Zealand share a colonial link) can account for cultural and institutional distance to a reasonable extent.
- 12 In many instances these assessments include non-trivial and non-refundable fees. Fees vary by profession, and could range from \$400 to \$1,000 and above. In addition, some professions state that more complicated applications (for instance, those that cannot be fast-tracked) will cost more to assess. Furthermore, some professions require an additional exam to be taken in New Zealand.
- 13 The indicator for whether more than 9% of the population speak English only changes marginally over time and we do not include it in the regression in the second column.
- 14 https://www.apec.org/Meeting-Papers/Annual-Ministerial-Meetings/2015/2015_amn.
- 15 <http://skillsmap.apec.org/home/overview>.
- 16 <https://aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=2066>.

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