



Making the Most of the Skills and Experience of Migrants and Refugees

Technical Appendix

Department of Local Government, Racing and Multicultural Affairs

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Overall Methodology

This appendix describes the methodology used to estimate the economic and social costs of skills under-recognition for migrants and refugees residing in Queensland. It explains the quantitative methods used in the Research Report. The focus is on the method used to estimate the economic and social costs of skills under-recognition using econometric techniques and the approach used to estimate the economy-wide impacts of increased skills recognition in Queensland. The economy wide modelling is based on the Deloitte Access Economic Regional General Equilibrium Model (DAE RGEM.) A customised version of the model was developed for the purposes of this Research Report.

The methodology for this Research Report was developed in consultation with a Project Reference Group that brought together representatives from Queensland Government agencies, namely; Queensland Treasury; Jobs Queensland; Department of Small Business, Employment and Training; Department of Communities, Disability Services and Seniors and the Department of Racing, Local Government and Multicultural Affairs.

There are three parts to defining the quantitative task:

- 1) Defining what is in scope of the study and key terms.
- 2) Defining the cohort, or what it means to be a migrant or refugee with under recognised skills for the purpose of this study; and
- 3) Defining the costs of labour market states associated with skill underutilisation. Costs may be social or economic; quantifiable or non-quantifiable; monetisable or non-monetisable.

1) What is in scope of the study?

For the purposes of quantifying the economic and social costs of skill under-recognition the cohort of interest is defined as follows:

- Migrants and refugees residing in Queensland who obtained their highest Post School Qualification (PSQ) prior to arrival in Australia
- Migrants and refugees in the above group that are in the Queensland labour force. So this is migrants and refugees that are employed and unemployed migrants and refugees actively seeking work.

Key Terms

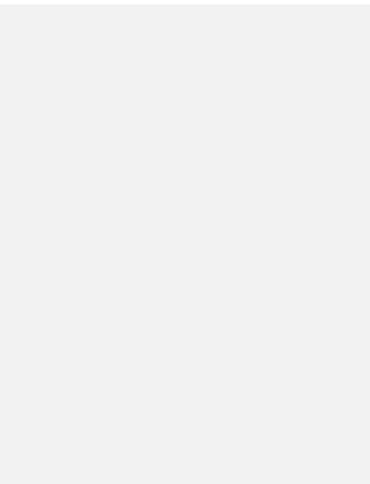
Table 1.1 gives a summary of key terms and the more targeted definitions adopted for the modelling, as well as an overview of important limitations.

Table 1.1: Definitions of key terms and limitations of the quantitative modelling.

Key Term	Broad Definition	Definition for Quantitative Modelling	Limitations
Migrant or refugee	People born outside Australia who now live in Queensland. Refugees will be defined as migrants who are in Australia on a humanitarian visa.	The datasets used are based on survey data where respondents self-report country of birth and refugee status. Costing data is available for permanent residents only, so the quantitative modelling will exclude temporary migrants with work rights.	
Overseas skills or qualifications	Occupational skills or post-school qualifications (PSQ) obtained outside Australia.	For the purposes of the economic modelling, formal qualifications are used as a proxy for skills to assess skills underutilisation.	A broader definition of skills that includes skills obtained outside of formal education or training would be preferred, however the data available restrict what can be modelled.

Labour force

The standard ABS definition of labour force is used. This is the population over the age of 15 that is employed (in paid employment for one hour or more per week) or unemployed (not currently employed but seeking work.)



Due to limitations in the available data, the quantitative aspects of this research will focus on migrants or refugees who are currently part of the labour force in Queensland.

By only including migrants and refugees in the labour force in scope, marginally attached workers who have become discouraged from job searching due to difficulties with skill recognition are not included in the analysis. Qualitatively, this group may be considered when seeking first person perspectives.

Skills underutilisation

Skill-related underutilisation of the productive capacity of the labour force, where workers or those seeking work have skills they aren't using either because their current job is lower skilled or because they are unemployed.

The skills underutilised cohort is defined in terms of two sub-cohorts for the costing analysis:

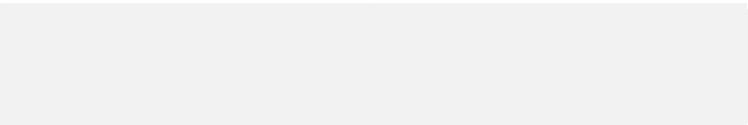
- a) **Unemployed:** this sub-cohort is identified based on their labour market status.
- b) **Employed, but not fully utilising skills:** this sub-cohort is identified based on having formal qualifications of a level higher than usual for their occupation. This sub-cohort is said to be experiencing skill-related inadequate employment.

The International Labour Organisation (ILO) defines skill-related inadequate employment as a labour market state where workers want to change their current employment to use their occupational skills more fully, and are unable to do so. Given data limitations, for this work skills-related inadequate employment is defined in terms of a level of education-occupation mismatch rather than self-reported desire to change jobs.

For the employed cohort, the method of constructing the skills underutilisation variable is based on highest formal qualification obtained overseas. Particularly for skilled trades, there may be no overseas equivalent to Australian regulatory or industry bodies that provide formal recognition of practically acquired skills. The analysis is therefore likely to underestimate costs relating to under-recognition of these skills.

Skill-related inadequate employment

Workers have occupational skills they are not fully using in their current employment.



Skill (under) recognition

Skill recognition refers to an individual being able to work in their skilled occupation. This is a multi-step process that may involve having skills formally recognised or certified equivalent to an Australian qualification by government agencies, acquiring the certification or registration required to perform their occupation in Queensland, and/or having a qualification recognised by employers in the local labour market.

For the costing, regression analysis will be used to determine the proportion of skill underutilisation attributable to skill under-recognition.

To determine the size of the cohort, the skill under recognised cohort will be defined as those who:

- Report their skills are underutilised in their current job and have applied to have their overseas skills recognised

In the data, it is not possible to distinguish qualifications that are not recognised because they are truly not equivalent to an Australian standard and those that are not recognised for other reasons like structural barriers within the system or a perception of inferior quality. Consideration of the regulatory environment and health and safety concerns will be a component of the report, but will not form part of the quantitative modelling.

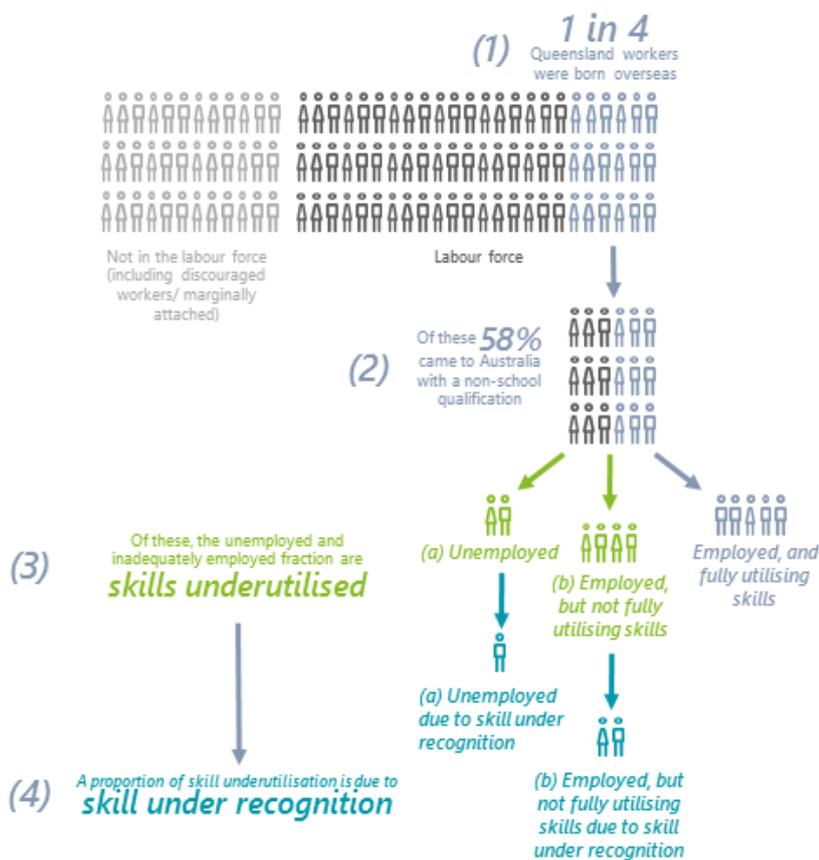
Skill under-recognition broadly refers to the situation where a migrant has skills

- or qualifications that are not recognised at any stage of the above process.
- Report their skills are underutilised and have not applied to have their overseas skills recognised
- Are unemployed and have applied to have their skills recognised

2) Defining the cohort

The target cohort are migrants and refugees who live in Queensland and experience skill under-recognition. This group can be conceptualised as shown in Figure 1.1, starting from the Queensland working age population and working down.

Figure 1.1: For the quantitative modelling, the population in scope will be migrants and refugees in the labour force with an overseas-obtained PSQ.



Source: ABS Census of Population and Housing 2016, ABS Continuous Survey of Recent Migrants 2016

3) Defining the costs

The economic and social costs of skill under-recognition primarily relate to productivity lost because the target cohort are in a suboptimal labour market state. A list of costs of skill under-recognition is given in Table 1.2.

Table 1.2: Preliminary list of costs of skill underutilisation and working definitions.

Costs of skill underutilisation	Cost Type	Definition	Included in estimate of direct cost
Personal income/revenue foregone	Economic	Personal income lost to individuals.	Yes
Government income/revenue foregone	Economic	Federal tax revenue foregone as a result of reduced personal income.	Yes
		State tax revenue foregone as a result of reduced personal income (reduced payroll taxes)	
Superannuation	Economic	Investment returns foregone based on reduced super contributions as a function of reduced employment income.	Yes
Public housing expenditure	Social and monetisable	The cost to the State and Federal governments of providing public housing to migrants and refugees whose skills are underutilised.	Yes
Concession costs	Social and monetisable	The monetary value of concessions available to low income earners or those unemployed in Queensland.	Direct concessions to households are included in transfer payments; the value of some state concessions is not captured.
Transfer payments	Social and monetisable	The cost of transfer payments to migrants and refugees whose skills are underutilised.	Yes
Health and mental health	Social and potentially monetisable	The additional cost to the health system to treat migrants and refugees with health conditions caused or exacerbated by skills being underutilised.	Health costs are included, analysis of mental health costs was found to not be significantly different.
Impact on family and/or dependents	Social and non-monetisable	Costs related to the impact of skill under-recognition on the family and/or dependants of migrants and refugees.	No
Community cohesion	Social and non-monetisable	Costs related to reduced community cohesion when migrants and refugees experience isolation/reduced connectedness as a result of skill under-recognition.	No
Increased cost to fill skills shortages	Economic/social and non-monetisable	Increased hiring costs incurred by employers who require skilled labour, related to undersupply.	No
Foregone productivity	Economic	Forgone productivity is the potential increase in real output per hour worked that could result if migrants or refugees were employed in jobs more suited to their skills.	Captured as wages foregone.
Reduced innovation and workforce diversity	Economic/social and non-monetisable	The costs of reduced workforce diversity including reduced innovation.	No

Social impacts that could be quantified and/or monetised were captured qualitatively. To summarise, the economic and social impact analysis is undertaken in three stages as outlined below:

- 1) Estimating the **number of underutilised migrants and refugees associated with under-recognition** of overseas PSQs in Queensland;
- 2) Estimating the **costs of under-recognition of skills** (Table 5.2 above) based on direct and indirect quantifiable costs to individuals and government as a result of being underutilised relative to highest overseas qualifications; and
- 3) Modelling the **economy wide impacts of increased skills recognition for migrants and refugees** in Queensland applying a scenario based approach that measures the potential economic gains of increased recognition

Literature Scan

To inform the economic and social impact analysis, a literature and data scan of databases containing peer reviewed journals, as well as grey literature from government departments and relevant peak bodies was undertaken.

While the research question concerns a very specific cohort in terms of labour market status, demographics, and educational attainment, the search strategy was designed to capture studies with related methodologies in other populations. Of particular interest were the costs of inadequate employment in Australia, methods of assessing the economic impacts of migration, and research on labour market outcomes for migrants and refugees. A comprehensive list of search terms can be found in Table 1.3.

Table 1.3: Literature scan search terms and information sources.

Cost of skill underutilisation	Search terms	Sources of information
Foregone productivity	((lab*r AND productivity) OR productivity) AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate
Income/revenue foregone	(income OR *employment) AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate
Public housing expenditure	("public housing" OR homeless*) AND (migration OR migrant* OR refugee*), "public housing" AND "supply cost*" AND (Queensland OR Australia*)	Proquest, Google scholar, Business Source Ultimate, Queensland government budget papers
Costs of skill recognition	("skill recognition" OR qualif*) AND cost AND (migration OR migrant* OR refugee*)	Google, Department of Immigration and Border Protection, Commonwealth Department of Education and Training, Trade Recognition Australia, industry group websites Google
Concession costs	("low income" OR "public transport" OR "health" OR "education") AND concession AND (migration OR migrant* OR refugee*)	(State government budget papers, state government websites on concession eligibility were also searched generally for information on concessions.)
Job seeker programs	("job seeker program" OR "*employment program") AND (migration OR migrant* OR refugee*)	Google, Commonwealth budget papers
Expenditure by charities and NGOs	("no*profit OR charity OR "community organisation" OR NGO) AND cost*AND (migration OR migrant* OR refugee*)	Google
Increased costs to fill skill shortages	(recruitment OR hiring) AND cost* AND *employment AND (migration OR migrant* OR refugee*) ↳ Changed to (recruitment OR hiring) AND cost* AND un*employment AND "migrant workers"	Proquest, Google scholar, Business Source Ultimate, Google.
Transfer payments	("government support" OR "transfer payments" OR welfare OR "cost to taxpayer") AND Australia* AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate, Google.

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Health and mental health	(health OR "mental health") AND *employ* AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate, Google.
Impact on family and/or dependants	(family OR spouse OR child* OR dependant) AND *employment AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate, Google.
Reduced innovation and workforce diversity	(work*ce OR *cultur* OR *lingu*) AND divers* AND (cost OR benefit) AND (migration OR migrant* OR refugee*)	Proquest, Google scholar, Business Source Ultimate, Google.

Immigration policy and skill recognition

Reviews of Australia’s immigration policy are perennial. Most recently, the Productivity Commission published a 2016 report on Australian’s migrant intake (Productivity Commission, 2016) that examined variation in employment outcomes and included a review of the overseas qualification recognition process. This review found that domestic policies including skill recognition can be a key barrier to the integration of immigrants into the labour market. Among the recommendations was that governments give priority to improving the recognition of overseas obtained qualifications where those qualifications were of comparable quality to an Australian qualification.

Similar work was undertaken by the Joint Standing Committee on Migration in 2006 when a review into the process of overseas skill recognition and licensing was undertaken. The report and submissions emphasise the issues experienced by migrants with overseas qualifications including difficulties navigating a complex system and adverse employment outcomes compared to their Australian peers (Joint Standing Committee on Migration, 2006.)

Other policy reviews have concluded there is a net economic benefit to migration (Productivity Commission, 2006) and that first and second generation humanitarian migrants have made significant contributions to Australia (Hugo, 2011.)

The prevalence and study of inadequate employment in Australia

An overview of the literature on inadequate employment is complicated by the inconsistent use of terminology; both skills-based and time-based measures are referred to interchangeably as underemployment. A specific kind of skills-based inadequate employment related to mismatch between formal qualifications and occupational attainment, often called overeducation in the literature, is the focus of the majority of studies. However, given the overlap between all its forms, any research examining the costs of any form of inadequate employment was considered.

Since the ABS does not publish a measure of skills-based inadequate employment following the Labour Force Survey, studying inadequate employment related to skills first involves defining who is inadequately employed. Given the confines of available data, formal qualifications become a necessary proxy for skills. A review of methods used to define overeducation (Kler, 2005) assessed three methods: worker self-assessment, objective job analysis based on matching occupational codes to official minimum education requirements, and statistical methods based on deviations from the centre of the educational distribution in an occupation. All three methods have drawbacks; the pros of the statistical measure are avoiding bias in self-reporting and allowing for the tendency for educational requirements to shift over time.

In a follow up study of overeducation amongst recent immigrants to Australia, Green et. al (2007) used Longitudinal Survey of Immigrants to Australia (LSIA) data and a random effects panel probit model where probability of overeducation is a function of personal characteristics (English language proficiency, marital status, financial resources, pre-migration employment history), visa category, and time in Australia. Results showed immigrants from English-speaking backgrounds (ESB) were less likely to be over educated than those from non-English speaking backgrounds (NESB) and the Australian born. The study used two cohorts and three waves of data to track each cohort longitudinally. The results were consistent over time for both groups.

In the general population, overeducation has also been linked to reduced overall job satisfaction and greater dissatisfaction with hours worked (Fleming and Kler, 2008.)

Migration and employment outcomes

Using Household Income and Labour Dynamics in Australia (HILDA) data and a logit regression, Thapa (2004) finds the probability of unemployment for male migrants remains consistently higher than for an average Australian-born man. Significant predictors of unemployment are low educational attainment, being a recent arrival, migrant status and being from a non-English speaking country of origin. Skilled visa holders are more likely to be employed than other migrants (Junankar and Mahuteau, 2008), while refugees are up to 30% less likely to find a job (Cobb-Clarke, 2003.)

Overall, on average there is little difference between migrants and the Australian-born in terms of wages however when the migrant cohort is split into migrants from English-speaking backgrounds (ESB) and non-English speaking backgrounds (NESB) multiple studies show wage differences:

- Using 2001 Census data, Chiswick et. al (2008) show that from men in full time employment, immigrants have average hourly income that is three percentage points higher for ESB and six percentage points lower for NESB compared to the Australian-born. This wage disadvantage persists across the income distribution for NESB immigrants, except at the lowest incomes.
- Using pooled HILDA data and a statistical decomposition of the wage gap between immigrants and the Australian-born across the income distribution, Cai and Liu (2014) find two effects, a composition effect (differences in productivity characteristics) and a wage structure effect (differences in return to productivity characteristics in the labour market), that differ by gender and country of origin. Both effects are favourable for immigrants from ESB, but not for immigrants from NESB. For males from NESB, the two effects offset each other, so this group have comparable wages to their Australian-born counterparts; females from NESB are disadvantaged.
- Using HILDA data and a panel instrumental variable estimation method, Breunig et. al (2013) estimate wages as a function of personal characteristics (age, marital status, region of residence, time in Australia, and indicator variables for Indigenous status and migrant status), education and experience for men and women. They find NESB immigrants face a statistically significant wage disadvantage on arrival in Australia, which improves over time though more slowly than the wage gains for their ESB counterparts. The magnitude of this effect is sensitive to the model estimation method but ranges from 19.6%-23% for NESB immigrant men and 12.5%-19.6% for NESB immigrant women.

Other measures of labour market outcomes like job quality are also divided by linguistic background. Using LSIA data, Junankar and Mahuteau (2008) studied the impact of changes to immigration and social security policy on the quality of jobs held by recent migrants. Results are in line with the results for wages, where higher levels of education and being from an ESB was predictive of holding a quality job.

The evidence on the role of overseas qualifications in determining labour market outcomes is mixed. One study, using data from the Aspects of Literacy Survey 1996 and a standard probit model to control for education and experience (Parasnis et. al, 2008) found no evidence of a beneficial impact of Australian qualifications on probability of unemployment. More recent work using data from the LSIA assessed the relationship between wages and country of educational attainment using an interval regression approach (Tani et. al, 2013.) This analysis shows education obtained in predominantly English-speaking countries, though not specifically in Australia, results in higher hourly wages on average than equivalent qualifications from the rest of the world.

Evidence of costs of inadequate employment and unemployment

Given inadequate employment and unemployment are on a continuum, the social and economic costs are expected to be similar, though different in magnitude. Reviewing the literature, Wilkins and Wooden (2011) collate evidence of associations between inadequate employment and adverse economic outcomes like lower wages, as well as reduction in subjective measures of wellbeing like life and job satisfaction. They note both the similarities to the costs of unemployment and the difference in severity.

A wider search of the literature for the costs of both labour market states yielded no costs in addition to the preliminary list. A summary of each cost identified and the best evidence base is outlined herein.

Income foregone

The anticipated largest cost of skill under-recognition is lost personal income for migrants and refugees who are unemployed or inadequately employed as a result of having under recognised skills.

Green et. al (2007) quantified the difference in income related to overeducation in three groups of Australian migrants: ESB, NESB migrants from Asian countries, and NESB migrants from other countries. Log of wages is expressed as a function of excess and required education (based on qualifications and occupational classification) and personal characteristics (English language proficiency, marital status, financial resources, pre-migration employment history, time in Australia) and estimated using random effects ordinary least squares. They find surplus education is positively associated with earnings but earns a lower rate of return than required education. Because this study uses an occupation-dependent measure of overeducation, unemployed migrants are dropped from the sample so this methodology underestimates the true gap in wages between the Australian born and the skill underutilised migrant population.

Public housing expenditure

In Queensland, government housing is provided by the Department of Housing and Public Works using state and Commonwealth funds. Eligibility is determined on multiple factors, including residency status, assets, and income. Reliance on public housing is therefore linked through these criteria to income and through income to labour market status.

A 2012 study of the housing characteristics of recent migrants found that 6% of permanent migrants were renting from public housing authorities. Migrants were more likely than their Australian-born counterparts to be renting (from both public and private landlords) as recent arrivals, however this gap narrowed over time. A majority of humanitarian migrants were renting and despite being geographically clustered in capital cities, 90% of renters paid less than \$300 per week in rent. On this basis, the authors infer a greater probability of renting from a government housing authority (Khoo et. al, 2012.) An older study on the housing experiences of humanitarian migrants in Australia estimated the housing costs to State and Federal budgets to be \$1,884 per refugee (Beer and Foley, 2003.)

Generalising from public housing reliance to other housing outcomes, Campbell et. al (2014) use HILDA data and logistic regression analysis to determine whether correlations between labour market status and housing insecurity persist after controlling for other individual and household characteristics. Time-based inadequate employment is correlated with housing insecurity not only through reduced income but also through an increased prevalence of casual or contract employment that creates income volatility. This work does not consider migrant status as an explanatory variable, but migrants and refugees are included in the HILDA sample (Campbell et. al, 2014.)

Transfer payments and concession costs

Transfer payments are payments from the government to households. A full review of the complex Australian transfer payment system was not undertaken. In general, benefits available to Australians that are in the labour force include income support for the unemployed (Newstart, Youth allowance, some recipients of Parenting payments) and income supplements for low and medium income families (Parenting payment, Family Tax Benefit payments.) Unemployed or

inadequately employed people with a disability may be eligible for disability support pension payments. Some income support payments also entitle recipients to additional supplementary payments such as rent assistance. Non-humanitarian migrants are unable to access these benefits until they have been permanent residents in Australia for two years.

Evidence on welfare reliance among migrants and refugees is mixed. A 2000 study using limited data (1996 Census data matched at an aggregate level to Department of Social Services (DSS) records) found that overall, migrants had lower rates of receiving welfare payments than the Australian born however for some groups, like refugees with low English proficiency, welfare receipts were higher. Welfare dependence was higher for migrants who had recently arrived in Australia, and declined with period of residence (Birell and Jupp, 2000.)

More recently, 2016 DSS data reported in *The Australian* shows welfare recipients by country of birth. Based on population share, some migrant groups are overrepresented in receipt of social security payments, but so are the Australian born (who make up 77% of unemployment benefit recipients but only 71% of the population), and this analysis does not control for other personal characteristics that determine welfare dependence (Morton, 2016.)

Whether or not migrant status is a relevant factor, inadequate employment and unemployment are clearly associated with increased transfer payments and concessions through lower income.

Physical health, mental health and wellbeing

Establishing causality between labour market status and health is difficult due to feedback between variables, and the possibility for both labour market and health outcomes to be pre-determined by other, unobserved characteristics. However, in the general population, the association between health (including mental health and overall wellbeing) and labour market status is well established.

Several studies explore the link between health and employment outcomes for Australian migrants using data from the LSIA. Using a multivariate logistic regression to control for confounding factors like age, skills, education and English language proficiency, poor physical health was associated with reduced economic participation. Mental health status negatively impacted the economic participation of male migrants, but was not statistically significant in female migrants (Khoo, 2010.)

A second Australian study using three waves of the same LSIA cohort found that 49% of migrants reported using their skills rarely if at all in their current employment, including 47% of migrants with high English proficiency. Adjusting for individual characteristics, not using occupational skills at wave 1 was associated with a lower scores on the mental health scale in wave 3 but the reverse was not true: there was no difference in scores at wave 1 or 2 between those who did and didn't use their job skills at wave 3. In this way, the study somewhat overcomes the problem of attributing causality (Reid, 2012.)

Internationally, a Canadian study of skilled immigrants working in low-skilled jobs as taxi drivers, convenience store workers or petrol station attendants found skill underutilisation was associated with increased work stress, reduced job satisfaction, and poor mental and physical health (Subedi, 2016.)

Results for the migrant population are comparable to the general population: adverse labour market outcomes are associated with worse overall health, particularly mental health. The largest health costs of skill under-recognition are therefore costs associated with poor mental health and reduced life satisfaction. One study quantified the cost of reduced life satisfaction due to unemployment in the general population. Using the HILDA data, the cost of reduced life satisfaction was estimated to be the amount of income required for an unemployed person to be at the same risk of reduced life satisfaction as an observationally equivalent employed person (Carroll, 2005.) Results were reported by gender. For an unemployed man, \$42,100 additional annual household disposable income was required. For an unemployed woman, \$86,300 was required.

Impact on family

No literature was found specifically examining the impacts of inadequate employment on the families of migrants and refugees. Pedulla and Newman (2011) review the family and community impacts of inadequate employment in the general population. They find multiple studies linking unemployment and inadequate employment to marital strain, particularly when it affects the male partner. Poor labour market outcomes may also have a negative impact on parenting, with higher parental stress levels linked to a reduction in nurturing behaviours. Reduction in household income and increased housing insecurity are associated with lower educational attainment by children.

While many studies established associations between inadequate employment or unemployment and negative impacts on family, no work was found that quantified the costs.

Foregone productivity

Productivity describes the efficiency with which quantities of inputs are converted to quantities of outputs. In Australia, migrants make a significant contribution to labour productivity growth. In a research paper for Department of Immigration and Border Protection (DIBP), Parham et. al (2014) use earnings as a measure of individual productivity to compare the productivity of migrants and non-migrants and of migrants from different visa classes using data from HILDA and the Continuous Survey of Australian Migrants (CSAM.) They find that on average, migrants are more productive than non-migrants however, productivity is linked to English proficiency and post-school qualifications. At a population level, they use ABS quality-adjusted labour input methodology to assess the contribution of migration to workforce skills and productivity growth over the period 2006 – 2011. Migrants account for about 0.17 of a percentage point of annual labour productivity growth over the period. This contribution is attributable to an increase in the skills and qualifications of migrants rather than time spent in the workforce.

Similar results have been found internationally. Studying the impact of changes in the distribution of immigrants across 20 Organisation for Economic Co-operation and Development (OECD) countries, Aleksynska and Tritah (2015) find immigration has a positive impact on gross national income mediated through increased total factor productivity (TFP.) Another recent study used a panel vector error correction model with data for 33 countries to assess the impact of refugee immigration on long-run TFP. This work found a positive long-run relationship with TFP with unidirectional causality from increased refugee immigration to improvements in TFP (Herzer, 2017.)

Innovation and workforce diversity

Another benefit of immigration is the role of immigrants in increasing innovation in their new home countries, promoting job creation and increasing productivity. Jensen (2014) reviews the international literature on immigration and innovation, examining the evidence at three levels: individuals, firms, and universities. At the individual level, in the United States, immigrants account for 24% of patents, which is twice their share of the population. At the firm level, also in the United States, linked employee-employer datasets and an index of entrepreneurial activity show immigrant populations drive entrepreneurship. Analysis from Germany (Brunow and Blien, 2014) and The Netherlands (Ozgen et. al, 2014) also show that increased cultural diversity enhances productivity at the firm level. None of these studies quantified the impact.

Economy-wide modelling

Six studies have modelled the economy-wide impacts of changes to skilled migration in Australia using a Computable General Equilibrium (CGE) model. None of these studies explicitly model an increase in skill recognition, however many are based on a shock to skilled labour supply. None explicitly consider humanitarian migration, though humanitarian migrants are included in the total migrant figures.

- 1) In 2006, as part of the Economic Impacts of Migration and Population Growth report for the Productivity Commission, the Centre for Policy Studies simulated a 50% increase in skilled migration using the MONASH Model. The scenario models a positive shock to labour supply, differentiated by sector, and traces the impact over

20 years. Employment and wages rise, and the economy as a whole expands with an increase in real gross domestic product (GDP.) Over the long term, real wages and income per capita fall by the end of the simulation, though the decline is small. Distributional effects are also important: lower wages mean workers are disadvantaged, while owners of capital gain. Within the labour market, different occupations also experience different outcomes. For occupations that experience an increase in supply of labour following an increase in migration, wages fall.

- 2) Extending this analysis using the same model, Giesecke (2006) simulated the response of the labour market to an increase in the supply of skilled labour. Model specification allowed estimation of employment rate by level of skill, with the model determining the distribution of employment across industries and occupations. The results show overall growth in the economy and positive employment outcomes though the small increase in income for existing residents is offset by distributional effects. Overall, real wages fall in the long run, with a small increase in low skill real wages offset by a larger decrease in real wages for high skilled workers. The majority of the benefits accrue to owners of capital, rather than the labour force.
- 3) DIAC-TERM is another CGE model from the Centre for Policy Studies tailored for analysis of net overseas migration and Australian labour market outcomes (Tran et. al, 2012.) The model specifically includes 15 regions (the Australian Capital Territory (ACT) and each of the other states and territory, split by capital city/other), eight occupations, nine visa categories and seven age groups to allow detailed modelling of the impacts of migration on labour markets. This model set up allows analysis of scenarios relating to specific classes of migration. The paper analyses the impact over ten years of a) a one off increase in the intake of temporary skilled migrants, b) a permanent 10% increase in permanent skilled visas, c) a permanent 10% increase in all visas. Scenario b) is most similar to the research question. This simulation finds a persistent increase in labour supply, employment, investment and real GDP. The sectors that benefit most, as measured by increased output, are construction, manufacturing and services. Regional distribution of the positive effects reflects the distribution of the migrant population, with New South Wales, Western Australia and Victoria seeing the largest gains in employment and real output.
- 4) At the state level, the Centre for International Economics modelled the contribution of skilled migrants to the New South Wales economy (CIE, 2013) using a scenario of no further skilled migrant intake. The results over five years were a decrease in the size of the labour force by 288,000 people and a 0.5% decrease in gross state product (GSP) growth. A case study of Wagga Wagga Base Hospital also demonstrates the importance of skilled migration to regional workforces; in Wagga, migrant nurses make up 30% of the nursing staff.
- 5) In 2015, the Migration Council Australia commissioned Independent Economics to examine the economic impact of migration over a 35-year period to 2050 (Migration Council Australia and Independent Economics, 2015) again using the negative case: the baseline was a continuation of current migration trends, and the scenario was no migration from 2015. Migration had a positive flow on impact to all sectors of the economy, from population growth to labour market participation, employment, wages and household incomes, skill level of the workforce, and net productivity. Over the period, the economy wide impact was estimated to be \$1.6 trillion contributed to GDP, a 5.9% contribution to the increase in growth of per capita GDP, and a 21.9% contribution to the increase in real wages for lower skilled workers.
- 6) As part of the 2016 Migrant intake into Australia report, the Productivity Commission used a CGE model to simulate the economy wide impacts of changes in demographic structure that could be achieved through migration over a 45-year period. This model estimated current trends in net overseas migration will contribute 7%

to GDP growth and result in higher labour force participation. Increasing skilled migration resulted in a large increase in GDP per person.

The results of the CGE simulation are reported relative to a base case of no change in migration. All studies are consistent in demonstrating that an increase in labour supply through migration expands the economy, but workers benefit less than owners of capital in some of the more detailed scenarios. The impact on real wages is positive in the short run and marginal in the long-run as labour supply expands, though the magnitude of the result is dependent on the simulation period.

Economic and social impact analysis

Estimating the number of underutilised migrants and refugees associated with skills under-recognition in Queensland

The first phase in the economic methodology estimated the prevalence of skills underutilisation associated with under-recognition of overseas qualifications of migrants and refugees in Queensland. This has six steps:

Step 1: Identify the size of the migrant and refugee cohort with an overseas PSQ obtained before arrival in Australia, living in Queensland and in the labour force. This analysis focused on recent migrants over the 10 years to November 2016 that was identified by conducting cross-sectional analysis of the Characteristics of Recent Migrants Survey (CORMS) dataset by Deloitte Access Economics.

Step 2: Identify the percentage of the cohort in the labour force that is underutilised from a skills perspective (i.e. highest overseas PSQ not used in current job.)

Step 3: Identify within this cohort those that have applied to have their qualifications formally recognised but have not been able to find work in their highest overseas qualification based on their current job as well as those who are unemployed. This will also identify those that have not applied to have their skills recognised.

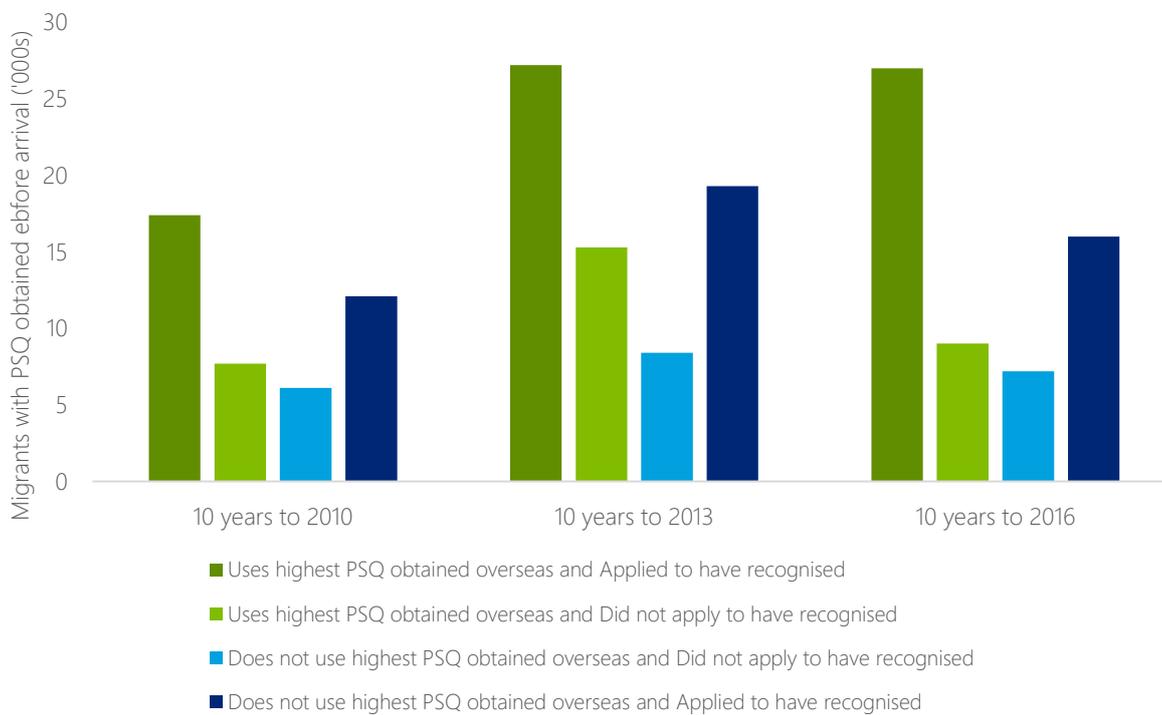
Step 4: Analyse the prevalence of skills underutilisation associated with under-recognition for migrants and refugees based on current job as well as first job to provide an indication of the extent of 'persistence' of this problem as well as understanding the dynamics of this cohort in the labour market over the past 10 years. This will also consider a longer time series of CORMS data to provide insight into how this has changed over time.

Step 5: Develop scenarios to estimate the prevalence of skills underutilisation associated with under-recognition of overseas qualifications and skills. These scenarios provide a range of potential outcomes based on this analysis.

These steps identify the size of the cohort of interest in Queensland based on CORMS over the 10 years to 2016. The following section provides analysis of CORMS datasets in Queensland to highlight trends over time.

These trends include an increase in the absolute level of skills utilisation of migrants and refugees in the 10 years to 2013 and 2016 compared to 2010 when they applied to have their highest PSQ recognised. An estimated 7,200 migrants were underutilised in their current job in the 10 years to 2016 and applied to have their qualifications recognised. This is lower than 8,400 over the 10 years to 2013 but higher than 6,100 over the 10 years to 2010. This confirms that skills underutilisation for migrants and refugees due to lack of skills recognition is an issue in the Queensland workforce – even when migrants and refugees apply to get their skills recognised. As would be expected skills underutilisation is worse for migrants and refugees that do not apply to have their skills recognised.

Figure 2.1: Migrants and Refugees, PSQ and recognition of skills



Source: ABS Characteristics of Recent Migrants Survey CORMS (2010, 2013 and 2016)

The scope of the study includes migrants and refugees (both employed and unemployed) who obtained their highest PSQ obtained overseas prior to arrival in Australia. This is in order to be able to fully pick up the twin elements of skills under recognition and skill underutilisation based on CORMS. Across Australia there are an estimated 34,700 migrants and refugees that were potentially underutilised and out of these 15,300 applied to have their PSQ recognised. A further 19,400 unemployed migrants and refugees did not apply to have their highest PSQ recognised. Due to the high relative standard errors in Queensland data, national shares (i.e. a top down approach) has been used to derive the number of unemployed migrants and refugees who applied to have their high PSQ recognised.

Population adjustment

The modelling focuses on identifying the size of the cohort of refugees and migrants in Queensland that are underutilised from a skills perspective and due to skills under-recognition. Based on the CORMS 2016 survey, there were an estimated 365,300 people born overseas who arrived in Queensland in the 10 years to 2016 of all ages and an estimated 744,000 born overseas that arrived in Queensland of all ages before 2007.

Table 5.3 presents analysis of the population born overseas and year of arrival in Queensland based on the working population profile from the 2016 Census of Population and Housing. This provides an indication of the extent to which those migrants that arrived prior to 2006 may be in the scope of analysis (i.e. aged around an estimated 25 years on arrival.) This year is chosen because the CORMS data shows that migrants that applied to have their overseas qualifications recognised in Australia were almost entirely aged over 25 years of age. By taking the age of the person arriving and their year of arrival it is possible to infer their age when they arrived in Australia and living in Queensland at the time of the 2016 census. This analysis is conducted on mid-points of age and year of arrival of the person as the original data presents this in ranges. Based on our analysis only migrants who arrived between 1986 and 1995 (aged between 50-59 years in 2017) and migrants that arrived 1996-2006 (aged between 40 and 59 years) would potentially be in scope of the study. The estimated age on arrival of this cohort ranges from 29 to 39 years (shaded in orange in Table 5.3) and they could potentially be in scope of

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the analysis as they may have experienced skill under-recognition at some period post arrival in Queensland. However, specific data is not available to identify why and if they may have experienced skills recognition issues.

Based on our analysis of this group, this identified that the size of the cohort of migrants and refugees that are underutilised from a skills perspective in Queensland could be up to **1.3 times higher than the estimates over the 10-year period provided by CORMS**. The data below that is shaded green highlights those persons that arrived and now living in Queensland over the 10 years to 2016, which is broadly in line with the timeframe of data captured by CORMS. The cells shaded in red in Table 2.1 are likely to be out of scope of the analysis due to age upon arrival (below 25 years of age or over 65) along with people in the older age groupings.

Table 2.1: Population born overseas and year of arrival in Queensland

Born Overseas Year of Arrival in Queensland	15-19 years	20-29 years	30-39 years	40-49 years	50-59 years	60-69 years	70 to 100 years and over
Arrived 1900-1945	0	0	0	0	0	0	1,996
Arrived 1946-1955	0	0	0	0	0	10,792	21,069
Arrived 1956-1965	0	0	0	0	11,441	17,955	26,218
Arrived 1966-1975	0	0	0	14,778	26,039	26,321	29,131
Arrived 1976-1985	0	0	11,013	21,362	23,711	25,973	14,381
Arrived 1986-1995	0	10,551	22,096	25,776	34,465	20,396	10,748
Arrived 1996-2005	14,133	28,950	36,340	44,556	29,953	12,348	7,529
Arrived 2006-2015	26,323	89,600	97,556	56,373	24,711	9,804	5,384
Arrived 1 Jan 2016 - 9 August 2016	2,507	11,390	4,255	1,599	824	546	259
Not stated	1,883	7,580	4,775	4,184	4,185	3,633	5,903
Not applicable	251,447	489,548	455,129	477,261	445,590	375,118	353,134

Source: ABS Working Population Profile Census 2016 – accessed using Table Builder

Notes: Green shading is in the scope of the CORMS survey, orange shading indicates potentially in-scope and red out-of-scope

Quantum of skills under recognition and skills underutilisation in Queensland

The CORMS data has been used to estimate the size of the cohort who have applied to have their highest PSQ recognised and where their skills are underutilised. These estimates are shown in Figure 2.2 and to factor in under representation in CORMS, a scaling factor of 1.3 has been applied (as discussed earlier.)

Figure 2.2: Potential quantum of skills underutilised migrants and refugees in Queensland



Source: Deloitte Access Economics estimates and ABS Characteristics of Recent Migrants Survey CORMS, November 201

Supply and demand analysis

In summary, the number of migrants and refugees who were underutilised in their current job is estimated to be as follows:

- 6,500 to 9,100 – employed
- 1,950 to 3,250 – unemployed

Taking the mid-point, this estimates 7,800 employed and 2,600 unemployed and **10,400 persons in the labour force in total**. This approach has also been adjusted to account of underrepresentation in CORMS as it only covers the 10-year period to 2016 as previously discussed.

On the demand side, some of the key skill shortages by occupation in Queensland identified by the Department of Jobs and Small Business (skills shortages list completed in 2017) include:

- Design, engineering, science and transport professionals
- Health professionals
- Automotive and engineering trade workers
- Construction trade workers
- Food trades and hospitality
- Business and other professionals

On the supply side, the main field of study for skills migrants and refugees with their highest PSQ obtained before arrival in Australia is as follows:

- 22% management and commerce
- 20% engineering and related technologies
- 19% health
- 8% society and culture
- 7% natural and physical sciences
- 4% education
- 9% all other main fields

Analysis of the main field of study shows that around 60% of migrants have skills in the areas where Queensland has identified key skill shortage areas across the state. This 60% estimate becomes an adjustment factor to scale the size of the cohort to

reflect data on skills shortages in Queensland (demand) and also the skill level of underutilised migrants and refugees in Queensland (supply.)

Table 2.2: Migrants and Refugees with PSQ obtained overseas by Main Field of Study and Visa Type

Characteristics		Skills utilisation in current job		Whether applied to have recognised					
		Current job – Uses highest NSQ	Current job – Does not use highest NSQ	Has applied to have highest NSQ recognised	Has not applied to have highest NSQ recognised				
Main field of study	Natural & physical sciences		5%		6%		7%		4%
	Information technology		9%		10%		11%		9%
	Engineering & related tech.		21%		16%		20%		14%
	Health		19%		4%		19%		8%
	Education		4%		4%		4%		5%
	Management & Commerce		26%		36%		22%		32%
	Society & culture		8%		12%		8%		13%
	All other main fields		7%		13%		9%		15%
Visa	Australian citizen since arrival		47%		38%		44%		38%
	Permanent - Skilled		40%		35%		42%		34%
	Permanent - Family		11%		25%		13%		24%
	Permanent – Humanitarian*		2%		2%		2%		4%

Source: Deloitte Access Economics estimates and ABS Characteristics of Recent Migrants Survey CORMS, November 2016

Applying 60% to the 10,400 (or 6,240 in total) estimated as underutilised provides an overall estimate of **migrants and refugees in the labour force that are estimated to be currently underutilised from a skills perspective and in line with key skill shortage areas.**

Estimating the costs of underutilisation of migrants and refugees associated with skills under-recognition in Queensland

The costs of skills underutilisation for migrants and refugees in Queensland was estimated using a two-step process. Firstly, an econometric model that captures inequality and its impacts on Australian individuals and communities was used to estimate the degree of inequality that migrants with underutilised skills experience in a wide range of social and economic outcomes. Secondly, the estimated differences in outcomes attributable to skill underutilisation were applied to the costs of experiencing each outcome. The costs of each outcome are determined either from Deloitte Access Economics’ own research or from academic literature.

Estimating inequality in outcomes using econometric modelling

The econometric framework for the analysis is a multinomial or binary logit regression that estimates the impact of individuals’ characteristics on their likelihood of having a certain outcome. A multinomial logit framework is applied when a nominal outcome variable is estimated, while a binary logit framework is applied when a binary outcome variable is estimated. This approach allows estimation of the probability that individual i has outcome j, based on their individual characteristics, and ensures the effects of each characteristic on the probability of achieving each outcome can be easily identified. A separate model is estimated for each outcome respectively, which in this case relate to the modelled costs.

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The econometric model uses data from the HILDA survey in a multinomial or binary logit framework to estimate the impact of individuals' attributes and experiences (jointly referred to as their characteristics) on their probability of having a particular economic or social outcome.

The outcomes that will be modelled in order to determine the costs of skills underutilisation are:

- Wage or salary group;
- Rental stress (30% or more of income is spent on rent and utilities);
- Welfare dependence (50% or more of income comes from government payments);
- Self-assessed health;
- Mental health condition (one which is long-term and requires help);
- Expenditure on healthcare;
- Lives in government housing;

The model estimates to what degree someone's probability of having each of the above outcomes is different to that of someone without the same characteristics. This attributes the differences in estimated probabilities of having an outcome to each characteristic of interest. In this case, the effect of being a migrant whose skills are underutilised was estimated.

Migrant status was included through a set of mutually exclusive binary variables representing:

- Refugees (1.8% of the sample);
- Migrants from non-main English speaking countries (11.3% of the sample); and
- Migrants from main English speaking countries (10.8% of the sample.)

The base case against which the above are compared is being born in Australia, which accounts for 76.1% of the estimation sample.

The unemployed subset of the skills underutilised cohort has been identified based on demographic characteristics (born and obtained a PSQ overseas) and labour market status. In other words, by virtue of unemployment we assume skills underutilisation.

For the inadequately employed subset, a measure of over education has been derived for employed individuals in the HILDA dataset at a 2-digit Australian and New Zealand Standard Classification of Occupations (ANZSCO)¹ occupation level. For each 2-digit occupation, the median education level of all individuals in that occupation is determined for each year separately, to allow median educational requirements to change over time. Every person's education level is then compared to the median level for their occupation, and they are determined to be overeducated if their education is two or more levels higher than the median. The education levels are as follows:

- Post Graduate Degree (Doctoral Degree, Master's Degree, Graduate Certificate and Graduate Diploma);
- Bachelor or Honours Degree;
- Diploma or Advanced Diploma;
- Certificate III or IV;
- Year 12; and
- Year 11 and below.

Two measures of skills underutilisation were included in the modelling, overeducation and self-assessed skills utilisation, as explanatory variables.

¹ ABS 2013, Australian and New Zealand Standard Classification of Occupations Version 1.2

Model Outputs

The main outputs of the model (and what they tell us in relation to this study) are:

- The **statistical significance** of each explanatory variable (characteristic) or combination of variables done through the use of interaction terms. Coefficients are the estimated relationships between each explanatory variable and the dependent variable. When a coefficient is statistically significant, it is estimated to be statistically different from zero. This analysis follows common practise and refers to results as statistically significant when they are significant at the 5% level – meaning there is 95% confidence that the estimated coefficient is statistically different from zero. If a coefficient is statistically significant we will determine that the associated characteristic has a real and tangible impact on the relevant outcome variable.
- The **marginal effects** of each explanatory variable on the outcome. Each marginal effect is the estimated change in the probability of having a given outcome that can be directly attributed to a characteristic. These are the main estimates that are of interest in this study and enable the determination of the costs associated with skills underutilisation.

It should be noted that there is limited data available. This occurs across both explanatory and dependent variables, and when both are combined in an econometric model, can produce results that are based on very small and unrepresentative samples of the population. These tend to occur for cohorts that are of strong policy interest (e.g. disadvantaged cohorts.) This results in models either not being able to be estimated, or not being able to identify any statistically significant relationships. To overcome this problem, the models are run using data from 13 of HILDA's 15 survey waves, and individuals from all of Australia's States and Territories.

Running the model on this broad sample to ensure maximum estimation power gives rise to limitations and where possible these have been accounted for:

- 1) **Relevance to Queensland:** By estimating the model on a national sample the relationships between characteristics and outcomes are estimated for people in all States and Territories. Including control binary variables for each State and Territory controls for the fact that the prevalence of each outcome in each state may differ, but it does not control for the fact that the relationships between characteristics and outcome in each state may differ. It is highly unlikely that the relationships themselves will differ between states but we will still estimate the same models on the Queensland sub-sample. We can estimate if the results for the Queensland sample are the same as for the national sample but it is likely that several variables will be excluded and several relationships will be estimated and not being significant in the Queensland model due to the smaller sample size.
- 2) **The effects of time:** Unobserved differences across years (survey waves) that may be linked to variations in outcomes are accounted for through the inclusion of binary wave control variables. These however don't account for the relationships between characteristics and outcomes to change over time. As with the state case discussed above, it is unlikely for the estimated relationships to change significantly over time. It is possible to estimate the model on different subsets of survey waves and compare the results to confirm this, however, these subset estimations will likely suffer from small sample sizes.

The effect of skill underutilisation on outcomes was isolated by including control variables for characteristics such as age, gender, English as a second language, remoteness, marital status, parental status, disability status and education status in a fixed effects logistic regression to control for individual heterogeneity and reduce the impact of pooling the longitudinal sample.

To isolate the direct costs that are specifically related to skills recognition from country of birth effects we take the difference in outcomes between groups one and two (the cost of underutilisation for migrants) and the difference in outcomes between groups three and four (the cost of people born in Australia) and assess the gap between those two differences. If there was no lack of skills recognition within the migrant cohort, the costs of underutilisation for those born in Australia and migrants would be the same. The gap between the two differences therefore represents the cost of under recognition of overseas qualifications. An overview of the methodology for each cost is given in Table 2.2.

Table 2.2: Estimating the costs of skills under utilisation

Costs of skill underutilisation	Definition	Method of estimating per person cost	Data Sources
Foregone productivity	Forgone productivity is the potential increase in real output per hour worked that could result if migrants or refugees were employed in jobs more suited to their skills.	The direct costs will be captured as foregone personal income. Flow on effects will be captured through the economy-wide modelling.	
Personal income/revenue foregone	Personal income lost to individuals.	The difference in average net employment income for the base cohort (Australian born in full employment) and underutilised migrant/refugee cohort.	<ul style="list-style-type: none"> • Pooled HILDA data[#]
Government income/revenue foregone	Federal tax revenue foregone as a result of reduced personal income. State tax revenue foregone as a result of reduced personal income (reduced payroll taxes)	The calculated value of lost taxes (income tax and Medicare levy) based on gross personal income foregone. Queensland’s effective payroll tax rate (an estimation of the payroll tax rate that takes into account employees working for businesses that are exempt) applied to the average difference in gross employment income for each cohort.	<ul style="list-style-type: none"> • Australian Tax Office 2016-2017 individual tax thresholds (for simplicity, tax offsets are not considered) • Pooled HILDA data • Queensland State Budget - Payroll tax revenue • ABS 6306.0 - Employee Earnings and Hours
Public housing expenditure	The cost to State and Federal governments of providing public housing to migrants and refugees whose skills are underutilised.	The cost of public housing in Queensland as a result of skills underutilisation in the cohort.	<ul style="list-style-type: none"> • ABS 2016 Census • Queensland state budget - Public housing expenditure
Concession costs	The monetary value of concessions available to low income earners or those unemployed in Queensland.	Under age pension age, eligibility for state concessions is determined by household income. Using an imputed outcome variable for concession eligibility, the proportion of eligibility for state government concessions	<ul style="list-style-type: none"> • Queensland state budget - Concession expenditure

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		attributable to skills underutilisation is estimated and applied to state government spending on concessions.	
Transfer payments	The cost of transfer payments to migrants and refugees whose skills are underutilised.	The difference in average transfer payments received for the base cohort and underutilised migrant/refugee cohort. Transfer payments are reported per household. For multi person households, transfer payments will be apportioned equally to adult members of the household.	<ul style="list-style-type: none"> • Pooled HILDA data
Physical and mental health	The additional cost to the health system to treat migrants and refugees with health conditions caused or exacerbated by skills being underutilised.	Costs of physical or mental health from the literature will be combined with model outputs on the increased prevalence of physical or mental health conditions associated with skills underutilisation.	<ul style="list-style-type: none"> • Literature on cost of health care in Australia
Reduced innovation and workforce diversity	The costs of reduced workforce diversity including reduced innovation.	The direct cost of reduced innovation and workforce diversity cannot be reliably captured with available data. Indirect or flow on benefits will be captured through the economy-wide modelling.	

Mapping the costs of skill under-recognition to the computable general equilibrium framework

The range of costs associated with skill under-recognition of migrants and refugees (based on statistical analysis of HILDA data and analysis of other data) were incorporated as additional benefit streams into the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM.) DAE-RGEM then predicts the broader economy-wide impacts of greater utilisation of the skills of migrants and refugees as more of this cohort is assumed to have their skills recognised.

The additional benefits (and in some cases cost savings) associated with skill underutilisation were categorised into direct and indirect shocks and model generated impacts known as 'induced' or 'flow-on' effects:

- **Direct benefits:** These benefits are directly associated with higher skills utilisation of migrants and refugees. An example of a benefit is the additional labour income earned by migrants and refugees as they move from a lower skilled to higher skilled jobs;
- **Indirect benefits:** These benefits are indirectly associated with higher skills utilisation of migrants and refugees. A good example of an indirect benefit is reduced expenditure government expenditure (i.e. cost savings) in the provision of certain public services (e.g. health); and
- **Induced effects:** These impacts are model-generated flow-on or induced effects, which are a function of the direct and indirect benefits (appropriately calibrated) and shocked in DAE-RGEM. An example of an induced effect is additional investment/capital accumulation that is induced by the higher skills utilisation of migrants and refugees.

The direct and indirect benefits of greater skills utilisation of migrants and refugees has been mapped to the different agents in the DAE-RGEM for the purposes of this study as follows:

- Individuals/Households;
- Government Sector (State and Commonwealth government); and
- Producers/Businesses.

The estimated direct benefits have been calibrated relative to the model database values and the indirect and induced effects will be determined in the model via the general equilibrium effects. Changes in tax revenue will be induced in DAE-RGEM through changes in labour income and other induced effects such as investment, capital stock, which subsequently affect industry output. The total economy-wide impacts of increased skill utilisation through higher skill recognition will be a function of the direct effects, indirect effects and induced effects.

The benefits of increased skill utilisation have been modelled as a 'once off improvement' that traces its way through the system over time to a long-run steady state equilibrium. The modelling takes into account both skills demand (using skills shortages data) and the quantum of skills under recognition of migrants and refugees in Queensland. A more conservative scenario is run whereby skills shortages identified in Queensland is assumed to be lower than the central case and this is likely to have happened in the past across economic cycles. This implicitly takes into account issues around skills recognition – as there may be cases where skills are not recognised for valid reasons and this is therefore a more conservative estimate of economy-wide impacts.

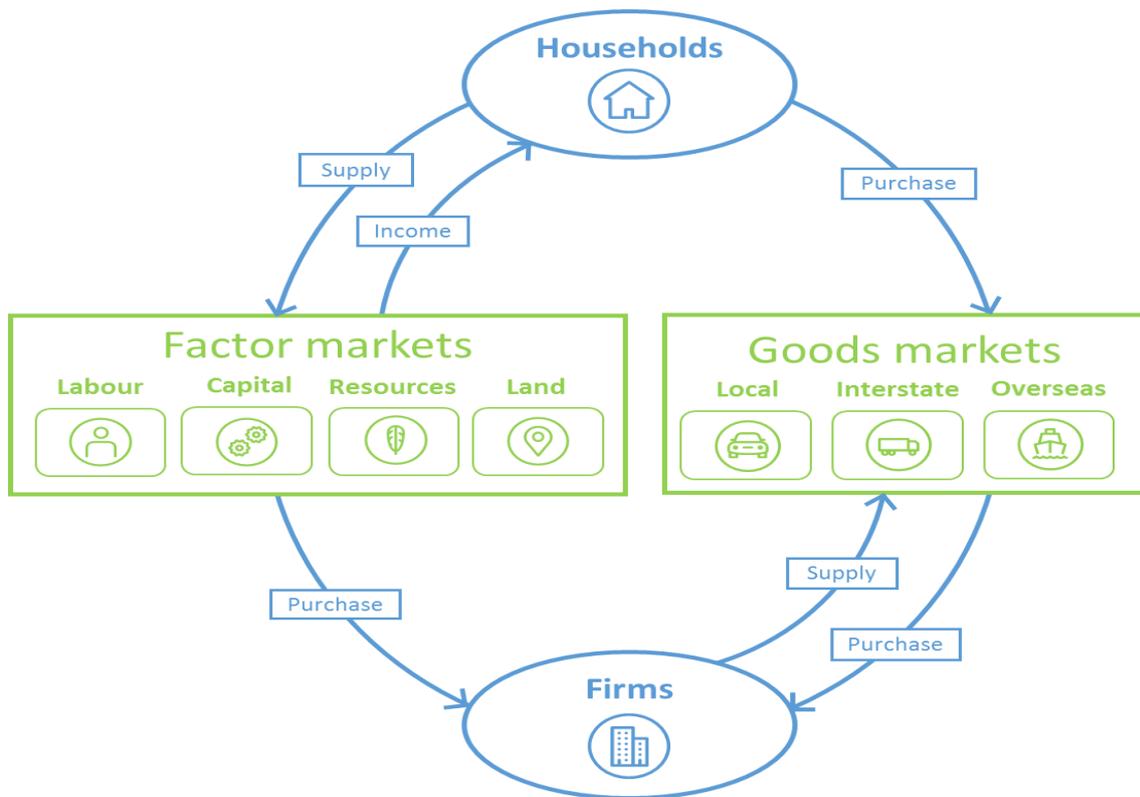
A change (or shock) in any part of the economy has impacts that reverberate throughout the economy. For example, in the current context, higher utilisation of the skills and experiences of migrants and refugees in the workforce will potentially involve higher economic activity, reflected primarily by increased labour productivity of migrants and refugees in the economy. This will also likely reflect higher activity from increased household consumption expenditure as a result of increased incomes. Furthermore, increased labour productivity will also act to drive overall economic growth and outcomes for Queensland as a whole, all else equal.

In this study the model has been customised to explicitly identify the Queensland economy as well as skilled employment types reflecting high-level ANZSCO groupings. The model also has a customised industry database including agriculture,

manufacturing and a number of service industries that broadly reflects the employment profile of migrants and refugees in Queensland.

Figure 2.3 is a stylised diagram showing the circular flow of income and spending that occurs in DAE-RGEM. To meet demand for products, firms purchase inputs from other producers and hire factors of production (labour and capital.) Producers pay wages and rent (factor income) which accrue to households. Households spend their income on goods and services, pay taxes and put some away for savings. The government uses tax revenue to purchase goods and services, while savings are used by investors to buy capital goods to facilitate future consumption. As DAE-RGEM is an open economy model, it also includes trade flows with other regions interstate and foreign countries.

Figure 2.3: The components of DAE-RGEM and their relationships



Source: Deloitte Access Economics – DAE RGEM

Skills Module in DAE-RGEM

A skills module has been incorporated into DAE-RGEM for the purposes of this study. This includes the classification of skills by occupation and skills levels. The development of this model allows different policy scenarios to be simulated. This has been developed by mapping the Global Trade Analysis Program (GTAP) data on occupations and skills to the ABS classification for occupations and skills. The model allows the representation of labour supply and labour demand by occupation, skills (combines qualification and field) and industry.

Figure 2.4: Representation of skills module in DAE-RGEM



Source: Deloitte Access Economic –DAE RGEM

The model is flexible and has the following features that make it suitable for analysis of skill underutilisation of migrants and refugees:

- Occupation and skill specific wage rates;
- Skill specific market clearing conditions (i.e. supply of skills is equal to the demand for skills); and
- Possibility for migration by occupation and skill.

The skills database provides the initial composition of skills by occupation in each industry. Labour demand by occupation translates into labour demand by skills to minimise cost using the 'Armington' structure, which generates sectoral demand for skills. The regions included in the model database are Queensland, rest of Australia and rest of the World.

Business as usual forecast

The 'business as usual' forecast is developed using long run average economic growth forecasts for Queensland (e.g. real gross state product) and the rest of Australia. This baseline also includes forecasts of labour supply and population growth. The growth rate in industry outputs is consistent with economic growth forecasts and implied rates of industry productivity growth over time. This business as usual forecast of the Queensland economy excludes the economy-wide impacts associated with increasing skill recognition/utilisation of migrants simulated in this study. The economics impacts are modelled incrementally relative to the 'business as usual' time path for economic variables of interest (e.g. real gross state product. employment.)

Applying the shocks in DAE-RGEM

In estimating the economy-wide impacts of increased skills recognition, the emphasis has been on capturing the broader economy wide impacts of increased productivity as migrants and refugees move from lower skilled employed to higher skilled employment and their qualifications gets recognised. In this modelling, migrants and refugees who are unemployed will only be captured implicitly in the model (as indirect effects) as labour supply and labour demand interact together across multiple markets. Changes that occur unemployment rates (by skill type) will include the impacts on non-migrants and refugees who make up a much larger share of the Queensland labour market and changes in the unemployment specifically for migrants and refugees who are skills underutilised cannot explicitly be determined.

The impacts of increased skills recognition in the Queensland economy has been modelled as a productivity improvement as migrants and refugees are assumed to move from lower skilled to higher skilled employment and based on the cost differentials identified by the regression analysis. To ensure there are no attribution issues statistical analysis of HILDA data is used to isolate the component of the wage differential that is attributable to skills under recognition of migrants and refugees. Furthermore, the size of the labour supply shocks has been calibrated as the actual wage differential in skills database is higher (than just the wage differential attributable to skills under recognition) and is due to many other factors

and also includes the non-migrant labour market. Apart from the recognition of different skills the model does not explicitly distinguish migrants from non –migrants. To calibrate the wage differential, the change in the labour supply is multiplied by the direct increase in the weighted average real wage differential (weighted for employed and unemployed from the skills database from Queensland.)

Theory underpinning DAE-RGEM

The Deloitte Access Economics – Regional General Equilibrium Model (DAE-RGEM) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy with bottom-up modelling of Australian regions. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works. However, they can be viewed as a system of interconnected markets with appropriate specifications of demand, supply and the market clearing conditions that determine the equilibrium prices and quantity produced, consumed and traded.

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a ‘regional consumer’ that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending.)
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.
- Household consumption for composite goods is determined by minimising expenditure via a Constant Differences of Elasticities (CDE) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption.) Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a Constant Elasticity of Substitution (CES) production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply which is set at 0.1.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.
- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports.)
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different

regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.

- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded, at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

Below is a description of each component of the model and key linkages between components

Households

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

The representative household interacts with producers in two ways. First, in allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. First, importers compete with domestic producers in consumption markets. Second, other regions in the model can lend (borrow) money from each other.

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a Cobb-Douglas utility function.
- Private household consumption on composite goods is determined by minimising a CDE expenditure function. Private household consumption on composite goods from different sources is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a Cobb-Douglas utility function.
- All savings generated in each region is used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. First, they compete with producers in overseas regions for export markets, as well as in their own region. Second, they use inputs from overseas in their production.

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- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996.)
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a CES aggregator.) Substitution between skilled and unskilled labour is also allowed (again via a CES function.)
- The supply of labour is positively influenced by movements in the wage rate. This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destination based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

International

Each of the components outlined above operate, simultaneously, in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions that must be met, such as global exports and global imports, are the same and that global debt repayment equals global debt receipts each year.

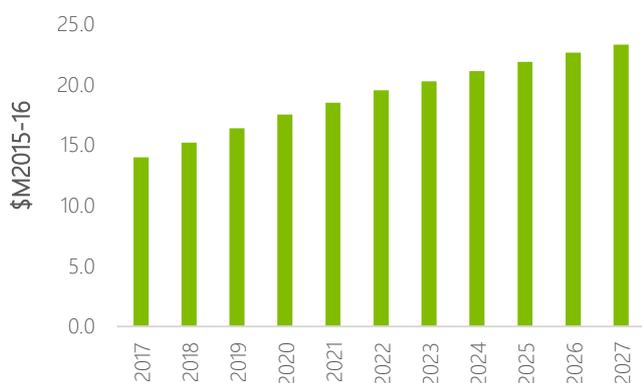
Sensitivity analysis: the economy wide impacts of increased skills recognition with lower skills demand for employers of PSQ held by migrants and refugees

In this scenario, a ‘what if’ analysis is conducted and the skills demand is assumed to halve from 60% to 30% to take into account the potential for a changing skills shortages profile over time. This scenario is designed to factor in that there may be periods of time when the skills profile of migrants and refugees (with a higher PSQ earned overseas) does not line up strongly with the demand for skills of employers in the Queensland labour market. This is hard to predict with certainty as it will depend on economic conditions and which particular industries are expanding/contracting in the economy. Hence a scenario approach is used given the uncertainty and the many factors that underpin skills demand in the economy.

The addition of highly skilled labour (productive workers) in the economy results in an economic dividend for Queensland’s economy – but it is lower than the core scenario due to lower skills demand by employers.

In this case, real GSP increases by \$14 million in 2017 and the flow-on effects of improved skills recognition lead to a predicted increase of around \$23 million by 2027. The increase in real GSP (economic dividend) over the 10-year period is around \$20 million per annum (on average.)

Figure 3.1: Change in Queensland Real Gross State Product \$M 2015-16 (relative to BAU)



Source: Deloitte Estimates

In summary, the economic impacts are driven by the better allocation of labour to a more productive use and subsequent flow-on effects, which is reflected through an increase in real Gross State Product.

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