Australian Government
Productivity Commission

Partial equilibrium model

Migrant Intake into Australia
Draft Report
Technical Supplement B

November 2015

Draft

DRAFT REPORT

This draft report supplement is no longer open for consultation. For final outcomes of this project refer to the inquiry report supplements.

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

Partial equilibrium model

The terms of reference for this inquiry asked the Productivity Commission to examine an immigration system where the allocation of visas would primarily be determined by a charge, subject to health, character and security requirements.

The Commission has developed an illustrative partial equilibrium model to explore the impacts of the greater use of charges to determine Australia's migrant intake, relative to the current system where the intake of migrants is determined primarily by a mix of qualitative criteria, quotas and imposts and where price is not the principal means to allocate visas.

The model is at a preliminary stage of development for the draft report and will be revised for the final report. This model has been used primarily to explore how the composition of Australia's permanent migrant intake might change under a different immigration policy scenario. It also provides illustrative estimates of the potential associated fiscal impacts. This model is used to complement the qualitative analysis of immigration charges elsewhere in the draft report.

The purpose of this appendix is to explain the key features of the partial equilibrium model, namely:

- the scope of the model

- key data sources

- the modelling framework

- parameterisation

- analysis of fiscal impacts

- policy scenario and results.

Scope of the preliminary model

The partial equilibrium model considers only permanent immigration, reflecting the weaker case for using a price-based mechanism for allocating temporary visas (chapter 12). The model excludes the Humanitarian Programme, as specified in the terms of reference. It focuses on the skill and family streams within the Migration Programme, given that the third stream (the special eligibility stream) is very small. The model considers both primary and secondary applicants. A stylised representation of the scope of the model is shown in figure B.1.

Figure B.1   **Scope of the Commission's partial equilibrium model^a**

Figure B.1   **Scope of the Commission's partial equilibrium model[a]**
The red dotted line outlines the scope of the model
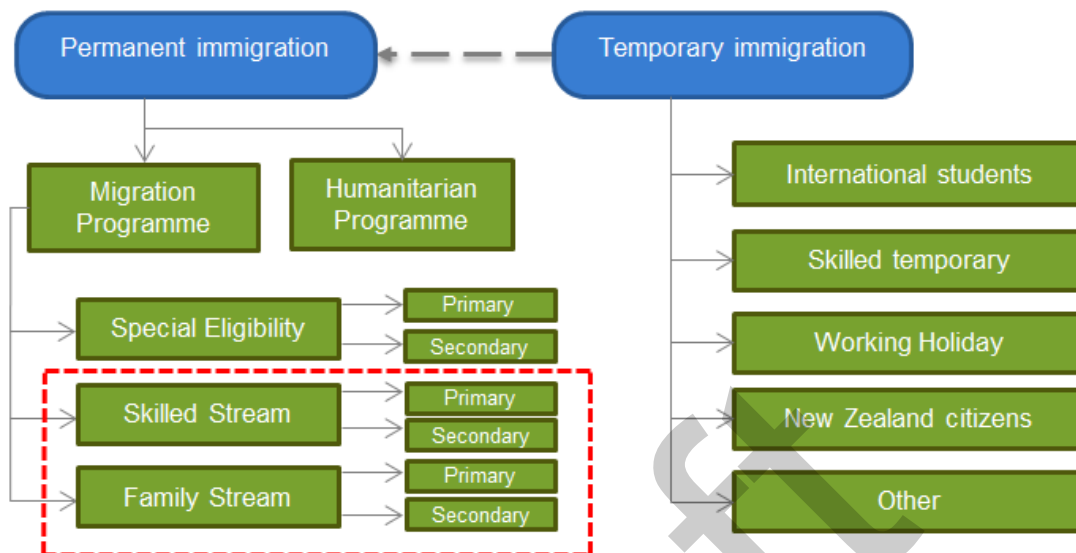
a Primary applicants apply for visas and can add family members (secondary applicants) to their application.

This draft model is intended to represent Australia's annual migrant intake. All values are expressed in real terms ($2015).

There is considerable uncertainty about how much potential migrants would be willing to pay for an Australian visa and their sensitivity to changes in visa charges. There is no precedent for a visa allocation system that is primarily based on price. Moreover, many factors influence migration decisions and no model can capture all of these factors. There is also limited information on the weighting of different factors by different types of migrants. The preliminary model is therefore subject to a number of key caveats including:

- limited information on the non-income benefits of migration to potential migrants

- limited information on the wealth of potential migrants, restricting examination of their willingness to pay for an Australian visa

- a focus on markets for Australian visas only. Various other markets — such as labour markets in Australia and in source countries — are taken as given

- uncertainty around the fiscal impacts of immigrants. Further work on the fiscal impacts of immigrants will be undertaken for the final report.

The impacts of these and other uncertainties on model results has been explored using multivariate sensitivity analysis. A large number of parameters have been varied simultaneously across many simulations to produce a range of estimates. Results from the modelling are, therefore, best thought of in terms of ranges rather than point estimates.

The theoretical framework for this partial equilibrium model is based on the spatial equilibrium framework described by Takayama and Judge (1971). There is a wide body of literature applying this framework to various policy environments from airport regulation to agricultural, water, and environmental issues. The Commission has not located Australian applications of this framework to explore immigration charging, although immigration charging in Australia has been discussed by a number of authors (for example, Harrison 1989, 1990). The most similar application of this framework is a paper which explores the demand for green cards (visas) in the United States and impact on government revenues and migrant welfare from replacing all or part of the US immigration system with a revenue maximising auction (Bruns 2012).

Key data sources

The 2011 Australian Census and Migrants Integrated Dataset (ACMID) (ABS 2014) is the key data source used to parameterise the model as it contains detailed information on over one million recent permanent immigrants (the profile of immigrants in ACMID is provided in figure B.2). ACMID links the 2011 Census with the Department of Immigration and Border Protection's (DIBP's) Settlement Database.[1] ACMID has information on people who responded to the 2011 Census and had a permanent visa record on the Settlement Database with a date of arrival in Australia between 1 January 2000 and 9 August 2011.

Other important data sources are the World Bank (nd) and academic papers including Barro and Lee (2010), Productivity Commission (2013a), Bruns (2012) and Gallup World Poll (IOM 2011).

Modelling framework

The model is based on a demand and supply framework where there is a separate 'market' for Australian visas for different types of potential migrants. Migrants have been categorised based on their region of origin, visa, skill and age. These categories were chosen because they are related to immigrants' labour market outcomes and their potential fiscal impacts, as well as current selection criteria. For each of these four characteristics, a small number of subcategories were chosen (outlined in table B.1). Regions of origin were aligned with the ABS (2008) classification, with key immigrant source countries such as India, China and the United Kingdom separated. New Zealand was excluded because New Zealand citizens, subject to meeting health, security and character requirements, automatically receive a temporary visa (Special Category Visa subclass 444) with full work rights on arrival in Australia. These visas have no time limit and are uncapped.

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[1] Custodianship of the Settlement Database was shifted from the DIBP to the DSS prior to the release of ACMID.

Figure B.2   **Profile of immigrants in ACMID**

Immigrants who arrived in Australia from 2000 to Census night 2011
Primary and secondary applicants

a. Age[a]

b. Skill (highest education)[b]

c. Visa[c]

d. Region of origin[d]

■ Primary ■ Secondary
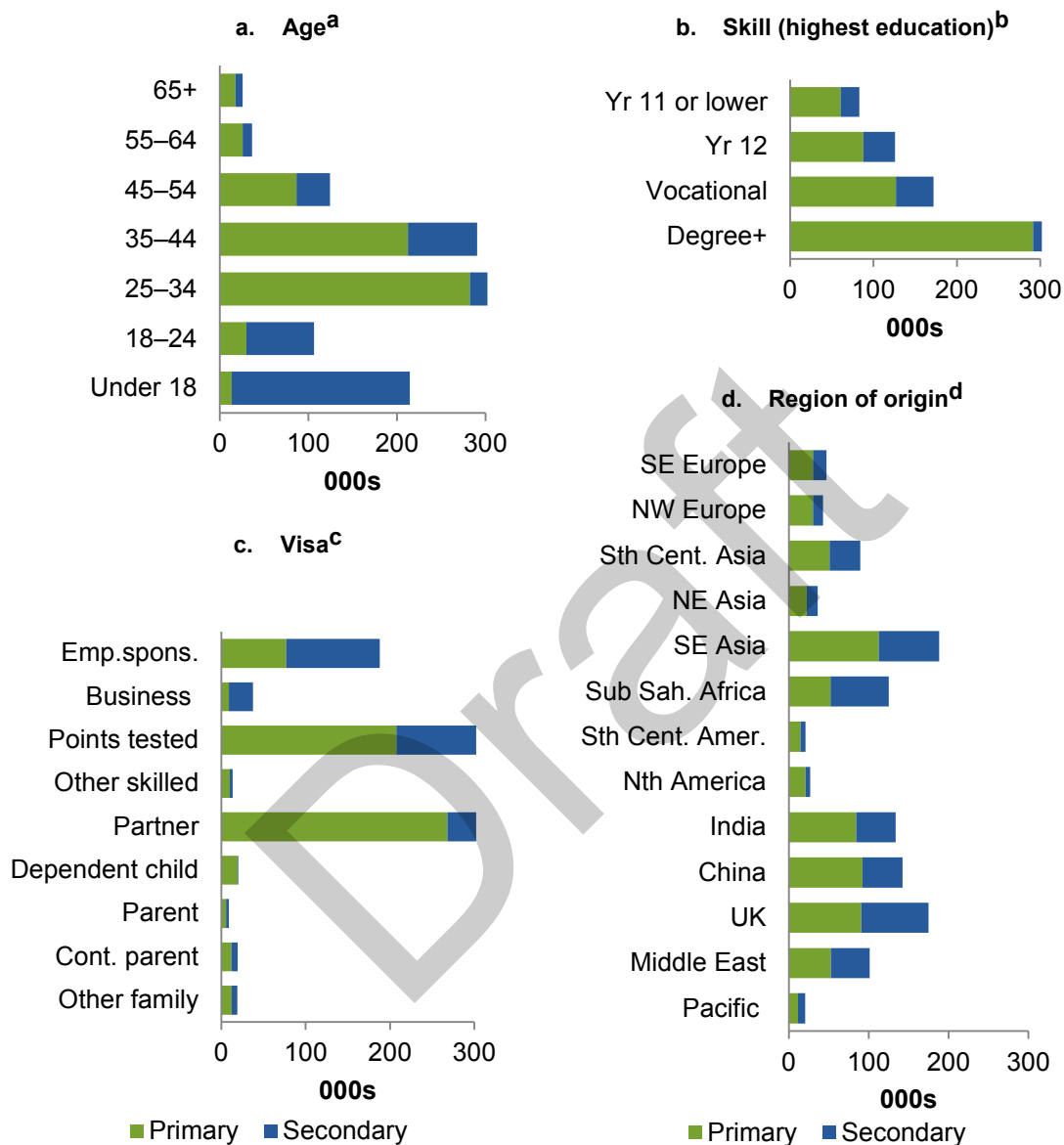
[a] Age at Census night rather than age upon arrival in Australia. [b] This chart is restricted to immigrants aged 25–64 on Census night. 'Vocational' includes certificate III or IV and diplomas and advanced diplomas. [c] Only includes visas in the skill and family streams under the Migration Programme. [d] Based on region of birth information. Full descriptions of regions of origin displayed in this figure and used in the model are presented in table B.1. The Pacific region of origin excludes immigrants born in New Zealand. The Middle East category includes North Africa.

Source: ABS (*Microdata: Australian Census and Migrants Integrated Dataset, 2011*, Cat. no. 3417.0.55.001).

Visa subclasses that are similar were aggregated to create nine visa categories. The model includes markets for each combination of region of origin, visa, skill and age — a total of 3640 markets.[2] Sufficient data were available to parameterise these markets. The modelling framework is flexible and allows for this set of characteristics to be broadened.

Table B.1   **Characteristics of potential migrants in partial equilibrium model**

Region of origin[a]		Visa		Skills (highest education)		Age[b]	
Label	Description	Label	Description[c]	Label	Description	Label	Description
R1	Southern and Eastern Europe	V1	Employer sponsored	S1	Year 11 or lower[d]	A1	0–17
R2	North-West Europe (excluding the United Kingdom)	V2	Business innovation and investment	S2	Year 12	A2	18–24
R3	Southern and Central Asia	V3	Points tested skilled migration	S3	Vocational[e]	A3	25–34
R4	North-East Asia	V4	Other skilled	S4	Degree or higher	A4	35–44
R5	South-East Asia	V5	Partners			A5	45–54
R6	Sub-Saharan Africa	V6	Dependent children			A6	55–64
R7	South and Central America	V7	Parent			A7	65+
R8	North America	V8	Contributory parents				
R9	India	V9	Other family				
R10	China	V10	Ineligible				
R11	United Kingdom						
R12	Middle East and North Africa						
R13	Pacific (excluding Australia and New Zealand)						

a Region of origin is based on region of birth. South and Central America includes the Caribbean. **b** Age represents age on arrival in Australia. **c** The ineligible category (and all other categories) excludes potential migrants who do not meet current health, security, and character requirements. **d** Includes certificate II or lower. **e** Vocational education includes certificate III and IV and diplomas and advanced diplomas.

[2]   3640 = 13 regions of origin x 10 visa categories x 4 skill levels x 7 age groups.

In each market there is a:

- demand curve, which represents potential migrants' willingness to pay for the benefits of migrating to Australia permanently[3]

- supply curve, which represents the costs incurred by migrants in moving to Australia, including government visa charges.

In each market, Australian visas are allocated to potential migrants with the highest net benefits from migrating, subject to an overall quota.

Illustrative mechanisms in the model

In the modelling framework, potential migrants choose to migrate when their willingness to pay exceeds their marginal cost of migrating (expected benefits outweigh their expected costs) subject to a quota. Australia's Migration Programme is set at 190 000, but it also includes limits on specific types of migrants. Some limits are binding — in that there is excess demand for some visas — while some are not. These limits are represented as quotas in the model. Figure B.3 illustrates a binding and a non-binding quota. In this example, there are two visas, for migrants of type A and B, and quotas of 100 for each type. The quota for type A migrants is binding since willingness to pay exceeds migration costs beyond the 100th migrant. The quota for type B migrants is non-binding since migration costs exceed willingness to pay from the 50th migrant.

The model can be used to represent the effects of maintaining or relaxing specific or overall quotas. If specific quotas are removed but overall quotas are maintained, visas are reallocated to potential migrants with a higher net benefit from migrating. For example, if initial quotas of 100 for types A and B migrants were replaced with an overall quota of 200 then visas would be reallocated from type B to type A migrants since type A migrants tend to have a higher willingness to pay at each quota (figure B.4). The net benefit of migrating (willingness to pay less migration costs) equalises across both visa markets.

Immigration charges can be represented in the model in two equivalent ways. A charge can be set (figure B.5, panel a) and will reduce the number of migrants. Alternatively a quota can be set where visas are allocated to potential migrants with the highest net benefit. If the quota binds (there is excess demand) an endogenous charge will result (figure B.5, panel b). In the illustration in figure B.5, the visa price is the same as the set charge with both methods of charging. In practice, the market determined price will be uncertain if a quota is set, while the number of applicants will be uncertain if a charge is set.

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[3] In this technical supplement (and its figures), willingness to pay refers to willingness to pay for the benefits of migrating. The net benefit of migrating is defined as willingness to pay less the costs of migrating.
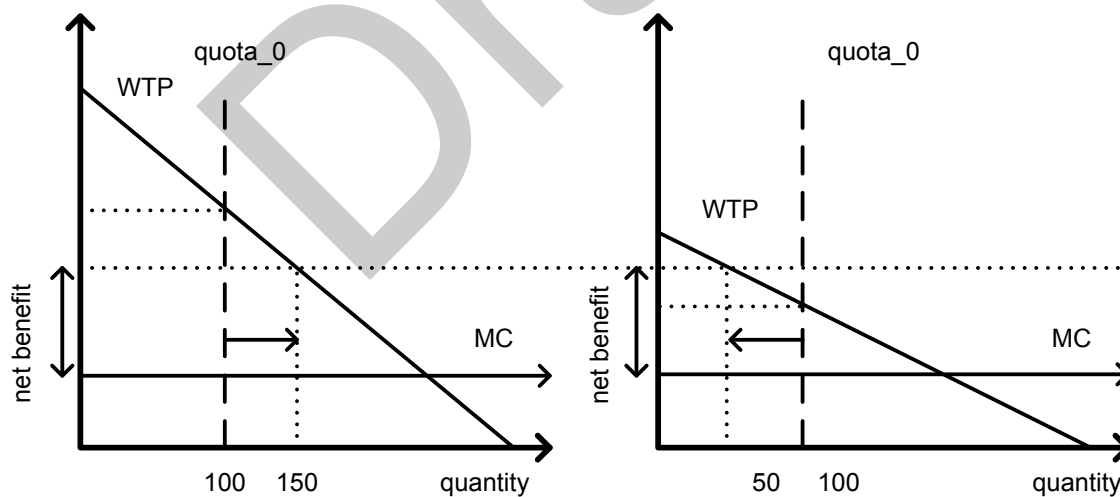
Figure B.3 **Binding and non-binding quotas**
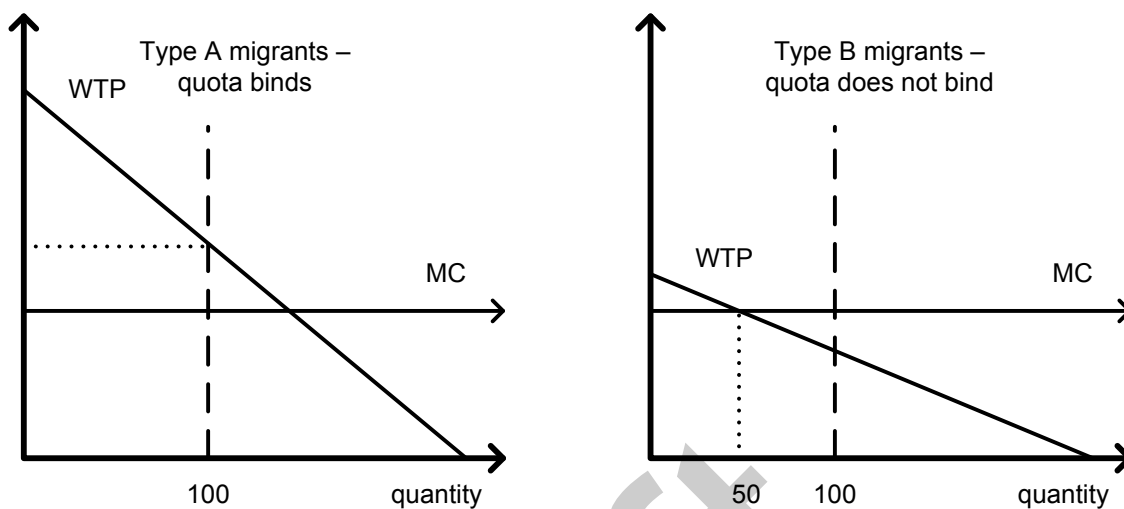
WTP = willingness to pay (benefits of migrating)   MC = migration costs
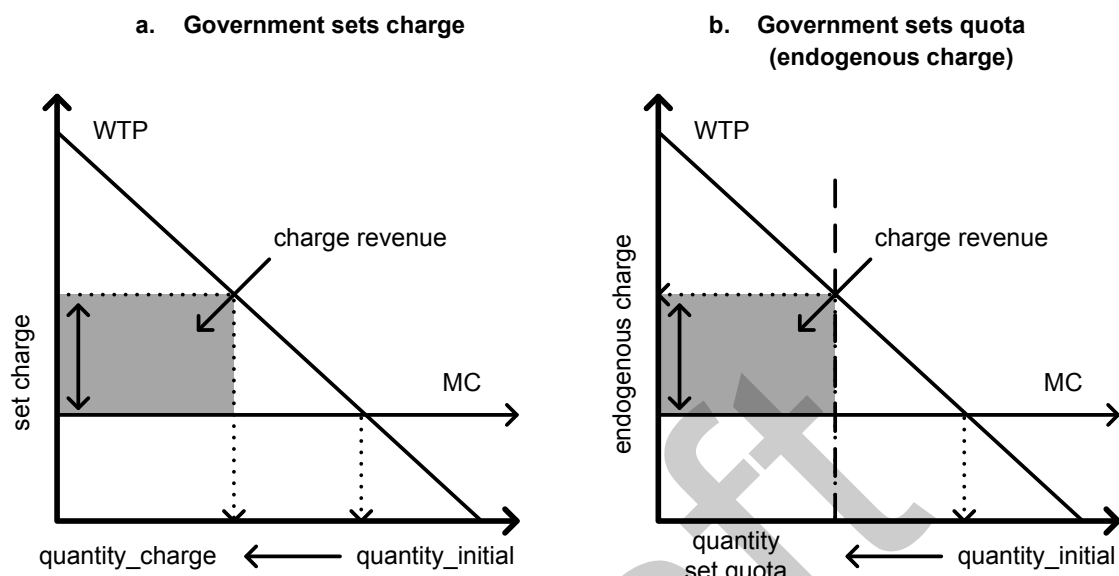
Figure B.4 **Reallocation of visas**

Visas are allocated to migrants with the highest net benefit

WTP = willingness to pay (benefits of migrating)   MC = migration costs

Figure B.5 **Immigration charges**

Two methods

a. **Government sets charge**

b. **Government sets quota (endogenous charge)**

WTP = willingness to pay (benefits of migrating)   MC = migration costs

In each market, demand is specified in terms of primary applicants. Each primary applicant is assumed to bring a fixed number of secondary applicants, based on data from recent years on the proportion of primary and secondary applicants for each region of origin/visa combination (for example, how many secondary applicants an employer-sponsored migrant from China brings to Australia on average).[4] In the model, the number of secondary applicants attached to each primary applicant is fixed rather than endogenously determined. For example, in a market where the proportion of primary applicants is 50 per cent, each primary applicant is assumed to attach one secondary applicant to their application. Secondary applicants are assumed to have the same region of origin and enter under the same visa category as the primary applicant. The age of secondary applicants is modelled using the age profile of immigrants in each visa category (data from ACMID). The skill of secondary applicants is not considered. This preliminary model does not consider gender nor other family status variables. Some of these aspects might be considered for the final report.

4 Primary applicants apply for visas and can add family members (secondary applicants) to their application. Secondary applicants add to the count of the visa type of the primary applicant.

Parameterising the model

This section outlines how demand and supply curves were parameterised for the model. The approach used follows Bruns (2012) who constructed equilibrium demand curves by estimating price and quantity intercepts for different types of potential US migrant and assuming demand was linear between those two points. The quantity intercept represents the number of people prepared to migrate if the cost of migrating was zero and the price intercept represents maximum willingness to pay to migrate. The approaches used to estimate the quantity and price intercepts of demand curves are explained below. Supply curves, which represent the costs to a migrant of migrating, are assumed to be constant in each market, but vary across markets. The approach used to parameterise the cost of migrating for each type of migrant is also explained below.

Demand — quantity intercept

In the modelling framework, the demand for Australian visas for each type of migrant has two components:

1. baseline demand, which represents the current number of visa grants

2. additional demand, which represents potential migrants who would like to migrate to Australia but have not applied, including because they currently do not meet the qualitative criteria under existing permanent visa programs (figure B.6).

Figure B.6 **Additional demand**
Markets with and without baseline demand

WTP = willingness to pay (benefits of migrating)
MC = migration costs
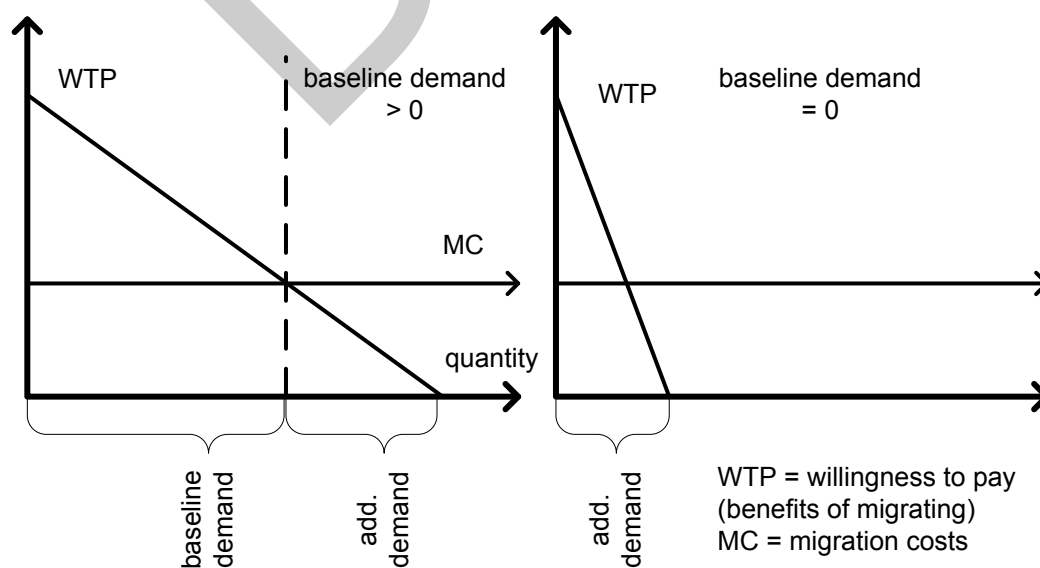
Baseline demand is estimated based on the composition of recent immigrants (discussed in more detail below) and is zero in some markets because of age and other restrictions.[5] For example, there are age limits for some skill visa streams. Baseline demand is represented as a quota in each market; these quotas are consistent with the current immigration system targeting a mix of migrant types.

Estimating baseline demand in each market

In 2014-15, the Australian Government set the size of the Migration Programme at 190 000. Therefore, total annual baseline demand is set at 190 000.

ACMID was used to apportion baseline demand across different types of migrants as follows.

- To estimate the proportion of recent permanent primary applicant immigrants for each combination of region of origin and visa category. Baseline demand was split across regions of origin and visa categories using these proportions.

- To then estimate the highest educational attainment by region of origin for primary applicants. These estimates were used to further split baseline demand. For each region of origin and visa category primary applicants were split across four skill categories (based on educational attainment).

- To then estimate the age profile of primary applicants for each visa category. The age variable in ACMID is age on 2011 Census night rather than age on arrival in Australia. Some adjustments were made so that these estimates better reflect age upon arrival. For each region of origin, visa and skill combination, primary applicants were split across age groups using these estimates from ACMID.

- Total baseline demand was apportioned across primary and secondary applicants. ACMID was used to estimate the ratio of secondary to primary applicants for each region of origin/visa combination. For example, in ACMID the ratio of secondary to primary applicants for immigrants from South-East Europe who were on employer-sponsored visas is 1.2. The number of secondary applicants attached to each primary applicant was fixed, based on these ACMID estimates.

- A further adjustment was made to reflect changes in the mix of permanent immigrants by visa class since 2011 given some changes in the mix of permanent visas over this period (for example, contributory parent visas now account for a greater proportion of permanent visas). DIBP data from 2014-15 were used to calibrate the number of immigrants represented in the baseline in each visa category.

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[5] In such markets, demand could become positive under a charge system if, for example, age restrictions were removed.

Additional demand

It is uncertain how much additional demand there would be for Australian visas if current immigration restrictions were relaxed or removed, and there is no directly relevant information. In the absence of such information, two studies were used to parameterise additional demand:

- a Gallup World Poll (IOM 2011) on migration intentions

- information from Bruns (2012) on the US Diversity Visa Lottery.

The Gallup World Poll found that about 630 million adults desire to move to another country.[6] In this poll, 150 million people nominated the United States as their preferred destination (the most popular destination) and 26 million nominated Australia. However, 26 million is likely to overstate the number of adult migrants that would come to Australia if there were no immigration quotas and minimal qualitative criteria. Of the 630 million adults in the Gallup who expressed a 'desire' to move, only about 48 million were actually planning to move. And less than half of those planning to move were actually preparing to move (19 million). People who expressed a 'desire' to migrate often face substantial travel costs and have important networks at home that they might be unwilling to leave, both potentially significant obstacles to migrating (UNDP 2009).

Bruns (2012) examined the Diversity Visa Lottery in detail to parameterise demand curves in his study. This lottery is open to residents of countries that historically have not been a key source of migrants to the United States. Applicants must have completed high school (or equivalent) or worked for at least two of the last five years in an occupation requiring at least two years of training. There are health, security and character requirements.[7] In 2015, about 50 000 green cards were issued under this lottery but there were over 9 million applications (14 million including dependents). Application costs are minimal. Applicants are only required to fill out an online form and provide a photograph. There is no application fee. If successful, an applicant can obtain a green card for $1730. Bruns (2012) noted that in 2010, nearly 15 million people entered this lottery but estimated that 30 million would have entered if there were no restrictions on country of origin.

The Gallup poll estimated that 150 million adults 'desired' to move to the United States while Bruns (2012) estimated that about 30 million people (adults and their dependents) would have applied for the green card lottery if it were open to all countries. This suggests that only 20 per cent of those who desired to move to the United States were prepared to go through a minimal application process and pay $1730 for the remote chance of getting a green card.

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[6] The poll included interviews dating from 2005 in more than 150 countries representing over 98 per cent of the world's population.

[7] Applicants must not have: illegally entered the United States or overstayed a visa in the past; put multiple entries into the lottery in any one year; or provided incorrect or false information in their application.

In the Gallup Poll, 26 million adults expressed a desire to migrate to Australia. To estimate the number of primary and secondary applicants prepared to go through a minimal application process for an Australian visa, the Gallup poll estimate of 26 million was discounted using the 20 per cent parameter for the US resulting in an estimate of 5 million people. No information on the number of people prepared to go through a minimal application process for an Australian visa is available. An estimate of 5 million is likely to underestimate additional demand because it is assumed that:

- many potential migrants may be deterred from participating in a lottery system but might consider applying for a visa under a different rationing mechanism

- only people who nominated Australia as their preferred destination would consider migrating to Australia whereas people who nominated other countries as their preferred destination might consider applying for an Australia visa if the application process is streamlined and low cost

- demand with low fees ($1730 for the Diversity Visa Lottery) is the same as demand with zero fees whereas demand with zero fees could be higher.

The method outlined above is also likely to underestimate demand for a policy scenario where there are no qualification requirements, since there is a qualification requirement to enter the Diversity Visa Lottery. It is also assumed that the number of people who 'desire' to migrate to Australia has not changed much since the Gallup poll was taken (despite changes in Australia's economic, political or social environment relative to source regions).

An estimate of 5 million people wanting to come to Australia represents pent up demand rather than annual flows. If quotas or qualitative criteria were relaxed or removed there could be a temporary surge in demand for Australian visas. It could be a number of years before demand stabilised. The model abstracts from the issue of pent up demand and is intended to represent stable demand in the long run. Therefore, an adjustment has been made to represent the number of potential migrants who 'age into' the cohort that typically migrates to Australia. About 5 per cent of migrants arrive in Australia aged 25. Therefore, it is assumed that there is 5 per cent additional demand for Australian visas each year. This is equivalent to an annual additional demand estimate of 250 000 (similar to the approach used by Bruns). This estimate represents total demand for permanent visas (primary and secondary applicants).

Additional annual demand for visas of 250 000 was apportioned as follows.

- Additional demand was split across regions of origin, based on the country of birth of immigrants who arrived between 2000 and Census night 2011 (from ACMID).

- For each region of origin, additional demand was apportioned across skill categories based on the skill profiles of these regions rather than the skills of recent immigrants from those regions (country-specific data from Barro (2010) was aggregated into regional data). This approach was taken because many potential migrants who want to come to Australia do not meet current qualitative requirements.

- Half of the additional demand was apportioned across current visa categories (using shares of recent immigrants by visa category from ACMID). The remaining half of the additional demand was placed in a 10th category (a generic 'currently ineligible' category). The proportion of additional demand from migrants who are currently ineligible is unknown. Therefore, the split of additional demand between current visa categories and the ineligible category has been sensitivity tested over a wide range (discussed in more detail in the sensitivity analysis section below).

Demand — price intercept

The price intercepts of demand curves represent the maximum willingness to pay for Australian visas for each type of migrant represented in the model. Maximum willingness to pay is comprised of income and non-income factors.

Income factors

In the preliminary model, income factors are based on the difference between a migrant's expected lifetime income in Australia and in their country of origin, following Bruns's (2012) approach. Only income differences for primary applicants have been taken into account. Potential income earned by secondary applicants, such as spouses, has not been considered, which is likely to understate willingness to pay.

Each type of migrant was assigned the average income difference depending on their characteristics (regions of origin, visa category, skill level and age). The distribution of income for particular types of migrants has not been considered explicitly.

The maximum willingness to pay is the net present value (NPV) of lifetime income differences, taking into account the likely convergence in incomes between a migrant's destination and their country of origin over time:

$$D_i = \sum_{t=0}^{t_R} (\frac{1}{1+r})^t (\frac{1}{1+g})^t (YD_i - YO_i)\,{}^{8}$$

Bruns's approach has been adapted to estimate the maximum willingness to pay for income differentials in each market for Australian visas. For Australia and each region of origin in the model.

- Initial income was estimated as GDP per worker using the weighted average (by size of recent migrant intake) of GDP per worker in purchasing power parity terms across countries in each region, sourced from the World Bank (nd)

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[8] D_i refers to the NPV of the difference in wages, 't' is time, t_R is time to retirement, r is the discount rate, g is the rate of convergence of wages between a migrant's destination and their country of origin, YD_i is the wage in the migrant's destination and YO_i is the wage in their country of origin.

- Per capita economic growth rates (g) were used as a proxy for future income growth and estimated using the weighted average (by size of recent migrant intake) of per capita economic growth during the past decade for each country within a region (The World Bank nd).[9] The rate of future convergence was set at the rate of convergence between per capita GDP growth for each region and for Australia during the past decade.

In addition, expected incomes in both Australia and source regions were adjusted for educational attainment, age, and the probability of unemployment. These adjustments are outlined below.

Previous work has shown how higher skills and educational attainment are associated with wage premiums (Forbes, Barker and Turner 2010). The Commission has used unit record data from the 2009-10 Personal Income Tax and Migrants Integrated Dataset (PITMID) to examine factors affecting total earnings, labour earnings and taxes paid by permanent migrants in Australia.

PITMID was developed by the Australian Bureau of Statistics with support from the Australian Taxation Office (ATO), the DIBP and the Department of Social Services (DSS). The dataset was compiled by linking individual taxpayer records from the ATO and migrant settlement records from the Settlement Database. PITMID includes information on personal income earned in the 2009-10 financial year by immigrants aged at least 15 years who arrived in Australia after 1 January 2000. The dataset only includes people who lodged a tax return. People who earned less than the tax free threshold ($6000 in 2009-10) were not necessarily required to lodge a tax return, and so are likely to be excluded from the analysis.

The Commission ran a series of regressions using PITMID to examine how different human capital and demographic characteristics are related to the incomes earned by permanent immigrants. These regressions were used to predict incomes for each type of potential migrant in the partial equilibrium model.

Comprehensive and consistent data on income by skill level are not available for each region of origin in the model, so it has been assumed that ratios of incomes by skill level and age to overall income are the same in each region of origin as they are in Australia according to the Census. Relative income ratios (constructed from table B.2) have been applied to GDP per worker to estimate the income a migrant would expect to earn in their region of origin.

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[9] Recent economic growth might not be a good proxy for future growth.

Table B.2 **Mean weekly income for recent immigrants by highest educational attainment and age, 2011[a]**

	25–34	35–44	45–54	55–64	65+	Total
Year 11 or lower	$434	$487	$451	$351	$307	$439
Year 12	$564	$665	$615	$462	$348	$591
Vocational	$730	$925	$963	$697	$428	$842
Degree+	$907	$1 111	$1 128	$882	$506	$994
Total	$784	$938	$891	$605	$388	$837

a All estimates are for immigrants who have arrived in Australia since 2000, and are based on age at the time of the 2011 Census rather than age on arrival. Mean income estimates for the 65+ age group are based on migrants aged 65–74. A different approach, outlined on the next page, was used to estimate income for immigrants aged under 18 or 18–24 years.

Source: Commission estimates using ACMID (ABS, *Microdata: Australian Census and Migrants Integrated Dataset, 2011*, Cat. no. 3417.0.55.001).

Ageing of migrants is represented in the model. Migrants who enter Australia in a particular age group are assumed to enter at the median age for that age group. For example, a migrant in the 25–34 age group is assumed to enter Australia aged 30, age into the 35–44 cohort and remain in that cohort for 10 years. Migrants are assumed to have the average labour market outcomes of the cohort that they age into. Migrants are assumed to have a similar life expectancy to that of the Australia population.

Putting the steps outlined above together, expected income differences for 25–34 year old ('a3', the third age category) migrants from region of origin 'r', visa category 'v' and skill level 's' are represented in the model as:

$$
\begin{aligned}
D_{r,v,s,a3} = &\sum_{t=1}^{5} \left(\frac{1}{1+r}\right)^t (1 - ur_{r,v,s,a3})(YA_{r,v,s,a3} - YO_{r,v,s,a3}) \\
&+ \sum_{t=6}^{15} \left(\frac{1}{1+r}\right)^t (1 - ur_{r,v,s,a4})(YA_{r,v,s,a4} - YO_{r,v,s,a4}) \\
&+ \sum_{t=16}^{25} \left(\frac{1}{1+r}\right)^t (1 - ur_{r,v,s,a5})(YA_{r,v,s,a5} - YO_{r,v,s,a5}) \\
&+ \sum_{t=26}^{35} \left(\frac{1}{1+r}\right)^t (1 - ur_{r,v,s,a6})(YA_{r,v,s,a6} - YO_{r,v,s,a6}) \\
&+ \sum_{t=36}^{55} \left(\frac{1}{1+r}\right)^t (1 - ur_{r,v,s,a7})(YA_{r,v,s,a7} - YO_{r,v,s,a7}) \,^{10}
\end{aligned}
$$

[10] $D_{r,v,s,a}$ refers to the net present value of the difference in income for a particular type of migrant, r is the discount rate taking into account growth differentials, $ur_{r,v,s,a}$ is the unemployment rate for a particular type of migrant, $YA_{r,v,s,a}$ is income in Australia for a particular type of migrant and $YO_{r,v,s,a}$ is income in region of origin for a particular type of migrant.

> Since income estimates are from 2011 these estimates have been adjusted to reflect income levels in 2015 using ordinary time earnings for a full time worker in 2015 from ABS (2015).

Real income growth over time is not explicitly considered in the model. However, the difference in income growth in Australia and in regions of origin is considered. The model abstracts from any potential impacts of migration on wages in Australia.

Different approaches were used to estimate income earned by immigrants aged under 18 or 18–24.

- For the under 18 category, all primary applicants were assumed to be in the dependent child visa category. It is assumed that the parents or guardians of these children already live in Australia and would pay any immigration charge.[11] Therefore, parental income is relevant to willingness to pay for an Australian visa. Income earned in Australia for this age category has been set to be equal to income for those aged 25–34 (assuming that the child's parents have the same labour market outcomes as migrants aged 25–34). Earning potential in the child's region of origin is irrelevant to an Australian-based parent, so income in the region of origin has been set to zero.

- For the 18–24 category, expected income earned in Australia and expected income earned in the region of origin have both been set equal to estimates for 25–34 year olds because many immigrants aged 18–24 are studying full time and have limited earning potential. This assumption has also been made because limited data are available on labour market outcomes for 18–24 year olds immigrants on permanent visas.

A different approach was used to estimate the value of income factors for potential migrants who consider applying for a Contributory Parent Visa. This approach takes into account the value of government payments and services available in Australia, and is not applied to potential migrants from developed regions because migrants from these regions are likely to already have access to extensive government payments and services (such as an age pension, aged care, and healthcare). The Australian Government Actuary (2008) estimated that the lifetime costs to governments of Contributory Parent Visa holders was between $232 000 and $284 000 per entrant. A midpoint of this range has been used to proxy the value of government payments and services available in Australia. For Contributory Parent Visa applicants from middle income and low income regions, the value of income factors has been set at the value of government payments and services available in Australia rather than the expected income differential (which is much smaller).[12]

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[11] Includes Australians adopting a child from overseas.

[12] High income regions include: Southern and Eastern Europe, North-West Europe (excluding the United Kingdom), North-East Asia, and North America. Low and middle income regions include: Southern and Central Asia, South East Asia, Sub-Saharan Africa, Latin America and the Caribbean, India, China, Middle East and North Africa and Pacific (excluding Australia and New Zealand.

This approach was not applied to potential migrants considering applying for a Parent Visa because it is assumed that they have limited willingness pay, given they are applying for a Parent Visa rather than the more expensive and expedited Contributory Parent Visa.

Non-income factors

Non-income factors such as safety, climate and lifestyle are important factors for potential migrants. The importance of these factors to potential migrants can be expected to vary by their characteristics, such as their region of origin. Information on non-income factors is limited. For these reasons, non-income factors are incorporated into the model and sensitivity tested. The central estimates of the value of non-income factors for each type of migrant is set at 50 per cent of the value of income factors. These central estimates of non-income factors are sensitivity tested with lower bounds of 0 per cent and 100 per cent of income factors. Non-income factors are treated in a similar manner to income factors and are represented as differences between Australia and source regions. It is assumed that these differences are greater than or equal to zero, consistent with large positive net overseas migration in recent decades. Non-income factors effectively provide a 'willingness to pay uplift' for each type of migrant (figure B.7). Therefore, the central estimate of maximum willingness to pay for an Australian visa for each type of migrant is:

$$WTP_{r,v,s,a}^{max} = 1.5(D_{r,v,s,a})$$

Wealth

Wealth can influence willingness to pay. For some potential migrants, the difference between the lifetime income they could expect to earn in Australia and in their region of origin could be large, but they might not have sufficient wealth to cover the costs of migrating. There is limited data on the wealth of immigrants in Australia. It has been assumed that capital markets function well, so potential migrants can borrow to fund migration costs. Potential migrants might not necessarily borrow from the financial sector; they might borrow from family, friends, or their community. They might borrow from someone in their region of origin, in Australia, or from another country. Wealth is a non-income factor and the amount of wealth a potential migrant has might be associated with the relative importance of non-income factors (but there is insufficient information to examine this association). Wealth is not explicitly considered in this version of the model. That said, recent immigrants have demonstrated that they had sufficient means to pay for visa charges and other costs of migrating to Australia. This is implicit in the parameterisation of the model with the ACMID data set. Further analysis of potential migrants' wealth will be explored for the final report subject to data availability.

Figure B.7   **Willingness to pay uplift**

Willingness to pay is comprised of income and non-income factors
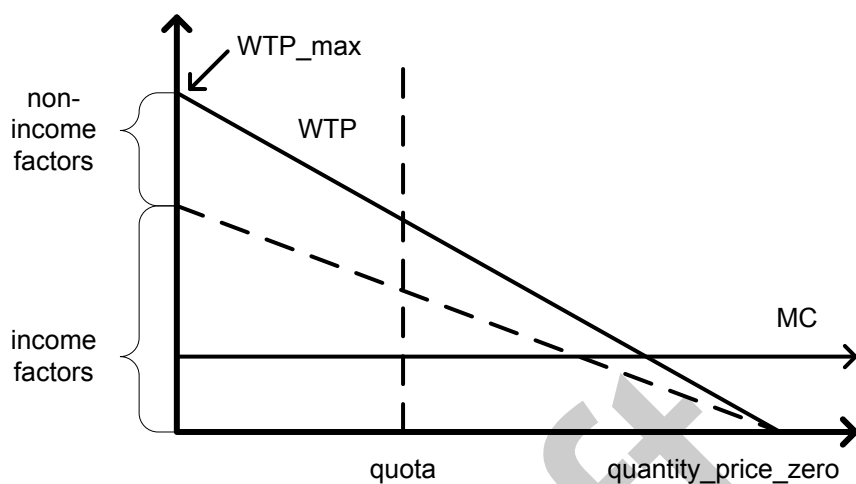
WTP = willingness to pay (benefits of migrating) MC = migration costs

Constructing demand curves

Two approaches have been used to construct demand curves:

- a 'type A' approach for markets where potential migrants are from low or middle income as well as some markets where migrants are from high income regions

- a 'type B' approach for some markets where potential migrants are from high income regions.

In the type A approach, GDP per worker in these regions of origin is lower than it is in Australia. Therefore, using the income differential method outlined above, estimates of maximum willingness to pay for an Australian visa will be positive.

For some developed regions, GDP per worker is higher than in Australia (type B regions). Therefore, using the income differential method, estimates of maximum willingness to pay for an Australia visa will be negative. Despite this negative differential in prevailing wages, migration from type B regions is occurring. Since it is assumed that migrants maximise their utility and would only migrate to Australia if their willingness to pay was positive, a different approach is used to estimate maximum willingness to pay. For each type of migrant from these regions, it is assumed that the benefits of migrating to Australia are equal to the estimated costs of migrating for the marginal migrant. That is, in type B regions demand matches the current quota. This assumption is consistent with a low rejection rate for visa applications from these regions (and based on an assumption that few potential migrants from these regions are deterred from applying because of current qualitative criteria).

Demand curves for both type A and type B regions are generated by assuming linear demand between two points (figure B.8):

- for type A regions estimates of maximum willingness to pay (the y intercept) and demand when the cost of migrating is zero (the x intercept) are used

- for type B regions estimates of the current cost and quota (current price/quantity point) and demand when the cost of migrating is zero (the x intercept) are used.

Figure B.8 **Demand curve parameterisation**

Types A and B regions

WTP = willingness to pay (benefits of migrating)   MC = migration costs
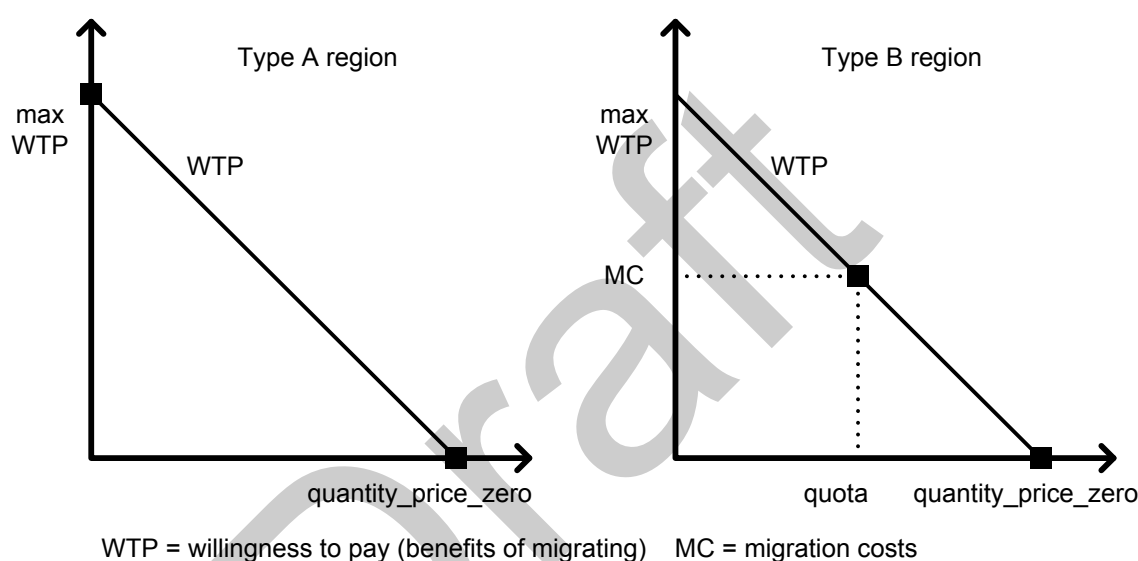
Three further adjustments were made to willingness to pay curves:

1. to ensure that the net benefit of migrating to Australia is at least zero for all immigrants (potential migrants who chose to migrate to Australia). Using the approach outlined above, the costs of migrating exceeds the value of income factors for some immigrants in some markets. This is inconsistent with immigrants maximising their utility. Therefore, willingness to pay curves for these migrants have been rotated upward so that the net benefit of migrating for the immigrant with the lowest willingness to pay is zero (B.9, panel a)

2. to account for excess demand. The number of applicants exceeds the number of visa grants for most visa categories (excess demand). There is considerable variation in excess demand across categories. It is assumed that all applicants would have a net benefit if they migrated to Australia. For this reason, demand curves have been rotated

outward in each market (separate factors are used for each visa category, listed in the footnote below) (B.9, panel b)[13]

3. to account for non-income factors, an uplift in willingness to pay of 50 per cent has been applied in each market (B.9, panel c).[14]

Figure B.9   **Further adjustments**

WTP = willingness to pay (benefits of migrating)   MC = migration costs
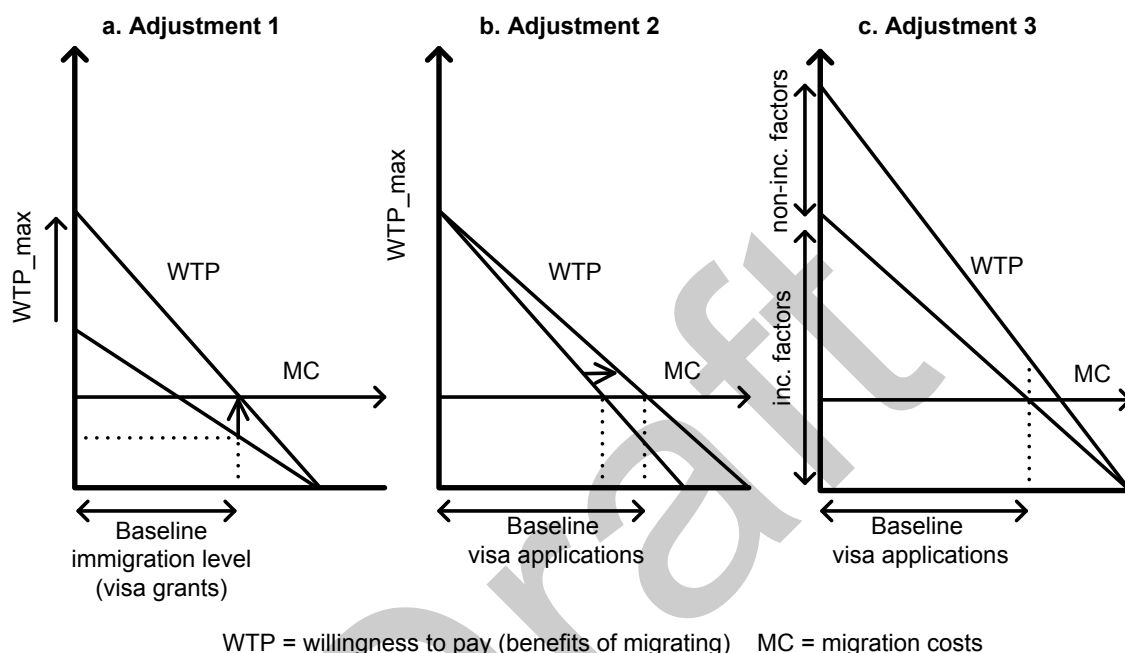
Supply curves

Supply curves (the costs of migrating to Australia) have been parameterised for each type of migrant. It is assumed that all migrants within a given market (same region of origin, visa class, skill level and age group) face the same costs (the supply curve is flat). It is also assumed that the primary applicant pays all costs associated with secondary applicants. Migration costs represented in the model comprise:

- estimates of current visa charges (only applicable in some policy scenarios)

- transport costs (set at $5000 per applicant and varied in sensitivity analysis). For this preliminary model, it is assumed that all potential migrants are offshore. In reality,

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[13] Over the period from 2004-05 to 2014-15 the ratio of visa applications to grants for primary applicants were as follows across visa categories: Employer Sponsored (1.19); Business Innovation and Investment (1.38); Points Tested Skilled Migration (1.12); Other Skilled (1.48); Partners (1.20); Dependent Children (1.35); Parent (3.49); Contributory Parent Visa (1.5); and Other Family (1.97).

[14] In some markets, non-income factors are accounted for through adjustment 1 as well as through adjustment 3.

many permanent visa applications are made onshore (while already in Australia on temporary visas)

- migration agent costs (ranges estimated by visa class by the Office of the Migration Agents Registration Authority (2015) have been used for central estimates and for sensitivity analysis).

Estimates of current visa charges for the nine categories included in this model are outlined in table B.3.

Fiscal impacts

The modelling framework has been used to provide illustrative estimates of the potential fiscal impacts of changes in the overall intake and composition of migrants resulting from greater use of immigration charging. The net fiscal impact is estimated as: tax revenue + charge revenue – fiscal costs. The net fiscal impact is estimated as a net present value of revenue and expenditure over immigrants' lifetimes using the same approach as for income differentials (outlined above) where migrants age into successive age cohorts. A real discount rate of 3 per cent is used; it reflects a social discount rate (Harrison 2010), and is much lower than the private discount rates used to estimate potential migrants' willingness to pay for an Australian visa.[15] Estimates of fiscal costs take into account waiting periods that immigrants currently face to access government payments and services.

The model only estimates fiscal impacts directly related to immigrants. As such, it does not account for indirect or second round impacts. For example, the model does not account for the potential impact of an immigration charge on immigrants' future expenditure (including remittances), how such expenditure might change employment levels and incomes in Australia, and any resulting impact on tax revenue. The model provides no guidance on whether fiscal impacts might differ depending on whether a migrant has sufficient wealth to pay an immigration charge and, if they borrow, whether the fiscal impacts might differ depending on who they borrow from or whether the lender is located in Australia or overseas.

Tax revenue

Tax revenue estimates in this preliminary version of the model have two components: personal income tax and GST. Other taxes paid by migrants are not modelled. Annual tax revenue is estimated by:

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[15] Private discount rates used are a real rate of 10 per cent plus convergence between a potential migrant's region of origin and Australia.

Table B.3   **Estimates of current visa charges by visa category**

Visa category	Method for estimating current visa charges	Visa charges[a]			
		Primary	Secondary		Second install.
			18+	<18	
1. Employer sponsored[b]	Charges for the Employer Nomination Scheme and Regional Sponsored Migration Scheme (subclasses 186 to 187) have been used.	$3 600	$1 800	$900	–
2. Business Innovation and Investment	The main permanent visa for the Business Investment and Innovation is the visa subclass 888. To obtain this visa, a person must hold one of three qualifying temporary or provisional visas (with the most common visa being the provisional visa subclass 188). Therefore, the costs of the 188 and 888 visas have been added together.	$4 780+ $2 305= $7 085	$2 390+ $1 150= $3 540	$1 195+ $575= $1 770	–
3. Points tested skilled migration	Charges for the Skilled – Independent visa (189 subclass) are used since they comprised 95 per cent of grants in 2014-15.	$3 600	$1 800	$900	–
4. Other skilled	The visas in this category are distinguished talent visas (charges for subclasses 124 and 858) are used. These are the only subclasses in the Other Skilled category that still exist.	$3 655	$1 830	$915	–
5. Partners	Charges for the Partner visa (309 subclass) are used since this class had the most grants in 2014-15	$6 865	$3 435	$1 720	–
6. Dependent children	Charges for the Child visa (101 subclass) are used since this class had the majority of grants in 2014-15 in this category	$2 370	$1 185	$595	–
7. Parent[c]	This category includes the Parent and Aged Parent visas (subclasses 103 and 804). Charges are the same for both of these categories.	$3 870	$1 935	$970	$2 065
8. Contributory parent[c,d]	Based on Contributory Parent (subclass 143). In 2014-15. Most grants were in the 143 subclass. The second instalment payment varies dramatically based on a number of concessional rates. It is assumed that applicants would be ineligible for these concessions.	$3 695	$1 245	$625	$43 600
9. Other family[e]	Based on the Carer visa (subclass 116), which comprised the majority of grants in 2014-15 in this category	$1 595	$800	$400	$2 065

a Surcharges for applicants who do not have functional English are not considered. A number of other surcharges or exemptions are not considered. Some visas have both a base charge and second instalment payable before visa grant. **b** Small employer nomination charges have not been considered. **c** There are assurances of support for parent and contributory parent visas. For parent visas, these are $5 000 for primary applicants and $2 000 for adult secondary applicants (bond held for 2 years). For contributory parent visas, these are $10 000 for primary applicants and $4 000 for adult secondary applicants (bond held for 10 years). **d** There are discounts for holders of a 173 visa (Contributory Parent (Temporary)) and applications lodged pre-2003. These discounts are not considered. **e** A financial hardship exemption from the second instalment is not considered in the model.

Source: DIBP (2015).

- applying the 2015-16 personal income tax scales to the expected wage for a particular type of migrant

- applying a parameter to the expected wage for each type of migrant to represent GST paid. This parameter is set at 6.2 per cent of wage based on analysis undertaken in the Commission's recent tax and transfer project (PC 2015). This is assumed to be fixed across different types of migrants.

The 2015-16 tax schedules are not updated for future years and the proportion of wage income paid as GST is assumed to be fixed.

Fiscal costs

Fiscal costs have been estimated based on the age of potential migrants upon arrival in Australia. In its *An Ageing Australia* report, the Commission (PC 2013b) showed how government expenditure varies by age (figure B.10). This work has been used to estimate government expenditure for each of the age categories in the model. These estimates reflect average government expenditure across the whole population. For a given age group, the pattern of government services use by immigrants may differ from the use of other Australians and the average patterns described in figure B.10. However, these differences are not considered in the model.

Under the Migration Programme, newly arrived immigrants face the Newly Arrived Resident's Waiting Period (discussed in more detail in chapter 7). In the model, expenditure for each age group was split into 10 categories and waiting times were applied where appropriate (table B.4). The Commission plans to model a scenario where benefits are more restricted for the final report.

Expenditure by category is used to estimate the proportion of government payments and services that immigrants in each age group have access to (table B.5). An analogous approach to the approach used for estimating the value of government expenditure received by immigrants over their lifetime has been used to estimate the value of waiting periods, which is deducted from the estimate of lifetime expenditure. Any future changes to waiting periods are not considered in the model.

Charge revenue

Charge revenue is estimated by multiplying the charge paid by each type of migrant by the corresponding number of migrants. Charge revenue is not discounted because it is assumed that the Australian Government receives this revenue when a migrant arrives in Australia.

Figure B.10   Age-related government expenditure

All governments, $000s per person, 2011-12
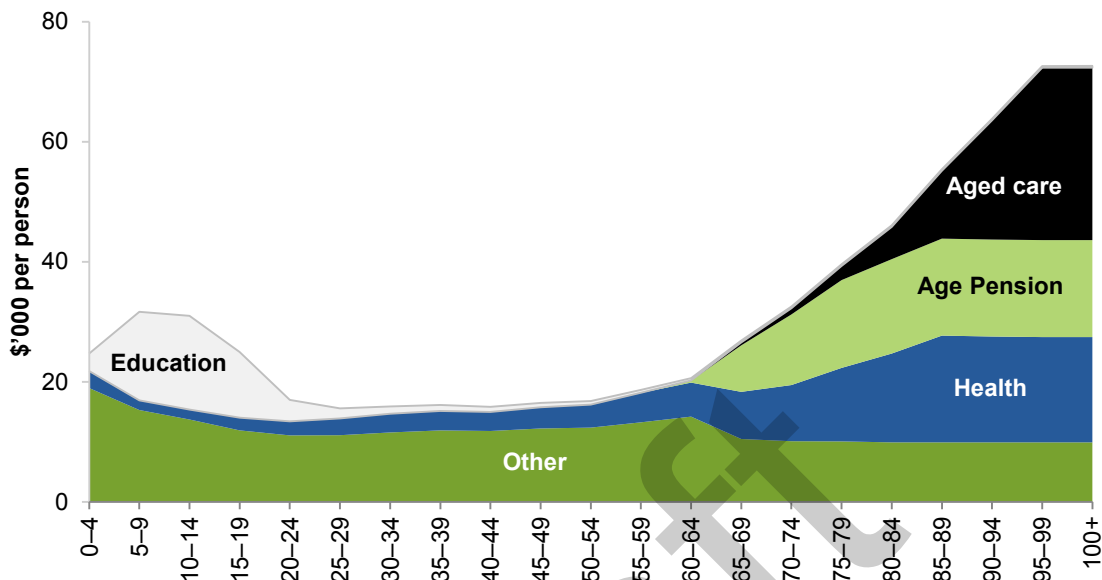
Source: Productivity Commission (2013b).

Table B.4   Estimated annual government expenditure per person, by category

$ 000s

	Wait period[a]	Under 18	18–24	25–34	35–44	45–54	55–64	65+
Age pension	10 years	0.00	0.00	0.00	0.00	0.00	0.17	13.47
Family payments	–	3.85	0.51	0.57	0.50	0.22	0.04	0.00
Aged care	–	0.02	0.02	0.02	0.02	0.02	0.02	3.86
Disability (state and territory)	–	0.20	0.08	0.10	0.16	0.24	0.41	0.00
Disability (Commonwealth)	10 years	0.22	0.09	0.12	0.18	0.27	0.47	0.00
Disability[b] emp. services	2 years	0.05	0.02	0.03	0.04	0.06	0.10	0.00
Govt. payments	2 years	2.11	1.10	1.18	1.38	1.44	1.59	1.08
Education	–	11.99	3.91	1.59	1.01	0.73	0.45	0.32
Health	–	2.24	2.54	3.22	3.49	4.07	5.59	12.49
Other	–	10.03	10.35	10.47	10.76	11.48	11.95	10.24
Total		30.71	18.63	17.30	17.54	18.52	20.79	41.46

[a] Waiting periods are applied to all or none of expenditure in each category. **[b]** Recipients of disability employment services are required to be on income support (which has a two year waiting period).

Source: Productivity Commission (2013b).

Table B.5	**Estimated proportion of government payments and services permanent immigrants have access to, by age group and years from arrival**		
Years since arrival	*0–2 years*	*2–10 years*	*10 years or more*
Under 18	0.92	0.93	1.00
18–24	0.94	0.94	1.00
25–34	0.92	0.93	1.00
35–44	0.91	0.92	1.00
45–54	0.90	0.92	1.00
55–64	0.89	0.92	1.00
65+	0.65	0.97	1.00

Source: Productivity Commission estimates based on table B.4.

Policy scenario and results

Policy scenario

A 'baseline' has been developed to represent the current level and composition of Australia's migrant intake. In 2014-15, the size of the Migration Program was set at 190 000. Therefore the baseline in the model represents an annual intake of 190 000 permanent migrants under the Migration Program. These migrants have been apportioned by region of origin, visa class, skill and age group based on the composition of Australia's recent migrant intake (as discussed above).

For the draft report, the Commission has modelled a single market clearing charge scenario where a charge provides the primary basis for the selection of migrants. This scenario has been developed in line with the terms of reference for this inquiry, which ask the Commission to examine:

> … the scope to use alternative methods for determining intakes — including through payment — and the effects these would have. This should include examination of a specific scenario in which entry charges for migrants are the primary basis for selection of migrants, such that:
> - there would be no requirements relating to skills and family connections
> - qualitative requirements relating to health, character and security would remain
> - all entrants would have the right to work
> - entrants would have limited access to social security or subsidised education, housing or healthcare
> - the charge could be waived for genuine confirmed refugees, whose entry would remain subject to current constraints.

Sensitivity analysis — parameter variation

Greater use of charges to determine Australia's migrant intake, relative to the current system, would likely change the composition of this intake. Estimating how the composition of Australia's migrant intake might change under such a scenario is subject to considerable uncertainty given that there is no precedent for such a system. In particular, it is uncertain:

- how much potential migrants would be willing to pay for an Australian visa

- how responsive different types of potential migrants would be to an entry charge.

For these reasons, sensitivity analysis has been undertaken with a focus on the key and most uncertain parameters. Sensitivity analysis has been conducted by simultaneously varying all parameters outlined in table B.6 according to a uniform distribution between their lower and upper bounds. Most lower bounds were set at 50 per cent lower than the central case and most upper bounds were set at 50 per cent higher.

Given limited information on the willingness to pay for Australian visas by potential migrants, results are presented as ranges from varying key parameters rather than as point estimates.

Preliminary results

Results for the scenario outlined above are presented relative to the baseline. Relaxing or removing qualitative criteria could mean there is a temporary surge in demand for Australian visas due to pent up demand. It could take a number of years for demand to stabilise. These results are intended to represent Australia's stable long-run equilibrium migrant intake. Results are expressed in real terms (2015 dollars).

Results suggest that in the long run:

1. an immigration charge in the order of $35 000 to $45 000 per applicant is consistent with maintaining Australia's current migrant intake level

2. while a charging system could generate substantial charge revenue, this could be offset by lower tax revenue and higher fiscal costs relative to the current system because of changes to the composition of Australia's migrant intake

3. moving away from the current system (where selection is focused on skills) to a charging system could reduce the number of skilled immigrants, and increase the number of currently ineligible migrants.[16] While the average age of immigrants increases the age composition does not change as much as the stream composition.

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[16] The ineligible category includes prospective migrants who would not meet the required criteria under existing skill and family visa classes but meet health, security and character requirements.

Table B.6   **Sensitivity analysis undertaken for preliminary model**

Parameter	Lower bound	Central case	Upper bound
Additional annual demand for permanent Australian visas	125 000	250 000	375 000
Proportion of additional demand in ineligible category	0.2	0.5	0.8
Migration agent fees	Lower end of fee range by visa class estimated by the Office of the Migration Agents Registration Authority (2015).	Average of lower and upper bounds estimated by the Office of the Migration Agents Registration Authority (2015).	Upper end of fee range by visa class estimated by the Office of the Migration Agents Registration Authority (2015).
Transport costs	$2 500 per applicant	$5 000 per applicant	$7 500 per applicant
Private discount rate[a]	5 per cent	10 per cent	15 per cent
Social discount rate	1.5 per cent	3 per cent	4.5 per cent
Income in Australia	50 per cent lower than central case	Estimated for each type of migrant	50 per cent higher than central case
Income in region of origin	50 per cent lower than central case	Estimated for each region of origin	50 per cent higher than central case
Willingness to pay uplift (per cent of income factors)	0 per cent	50 per cent	100 per cent
Age profile of ineligible migrants	Ineligible migrants are aged less than 55 years	Based on age profile of immigrants in ACMID	Ineligible migrants are aged 45 years or over

a The private discount rate also includes a parameter reflecting expected difference in income growth between Australia and a migrant's source country.

Preliminary results are highly uncertain with large ranges (particularly for ineligible migrants). The main mechanisms and drivers underpinning changes to the composition of Australia's migrant intake across streams and age groups are explained below.

- Skill stream migration decreases (figure B.11). These migrants — while having high earning capacity in Australia — typically have relatively high wages in their country of origin and come from developed countries where wages are high. For these migrants wage differentials are typically low so an immigration charge can considerably reduce the expected return of migrating to Australia. Therefore, some potential migrants will choose not to migrate, or will migrate elsewhere. Further, skilled migrants currently face relatively low migration charges (generally less than $5000 per primary applicant). Therefore, an immigration charge in the order of $35 000 to $45 000 represents a material price increase relative to current charges.

- Family migration remains relatively unchanged in aggregate (figure B.11). Family migration is driven by non-income factors more than skilled migration. As a result, family migration patterns typically reflect past migration patterns with respect to regions of origin. The greater role of non-income factors for these groups means that they are less likely to be deterred by price. Further, the fact that some family visa classes already pay high charges (for example, greater than $40 000 for contributory
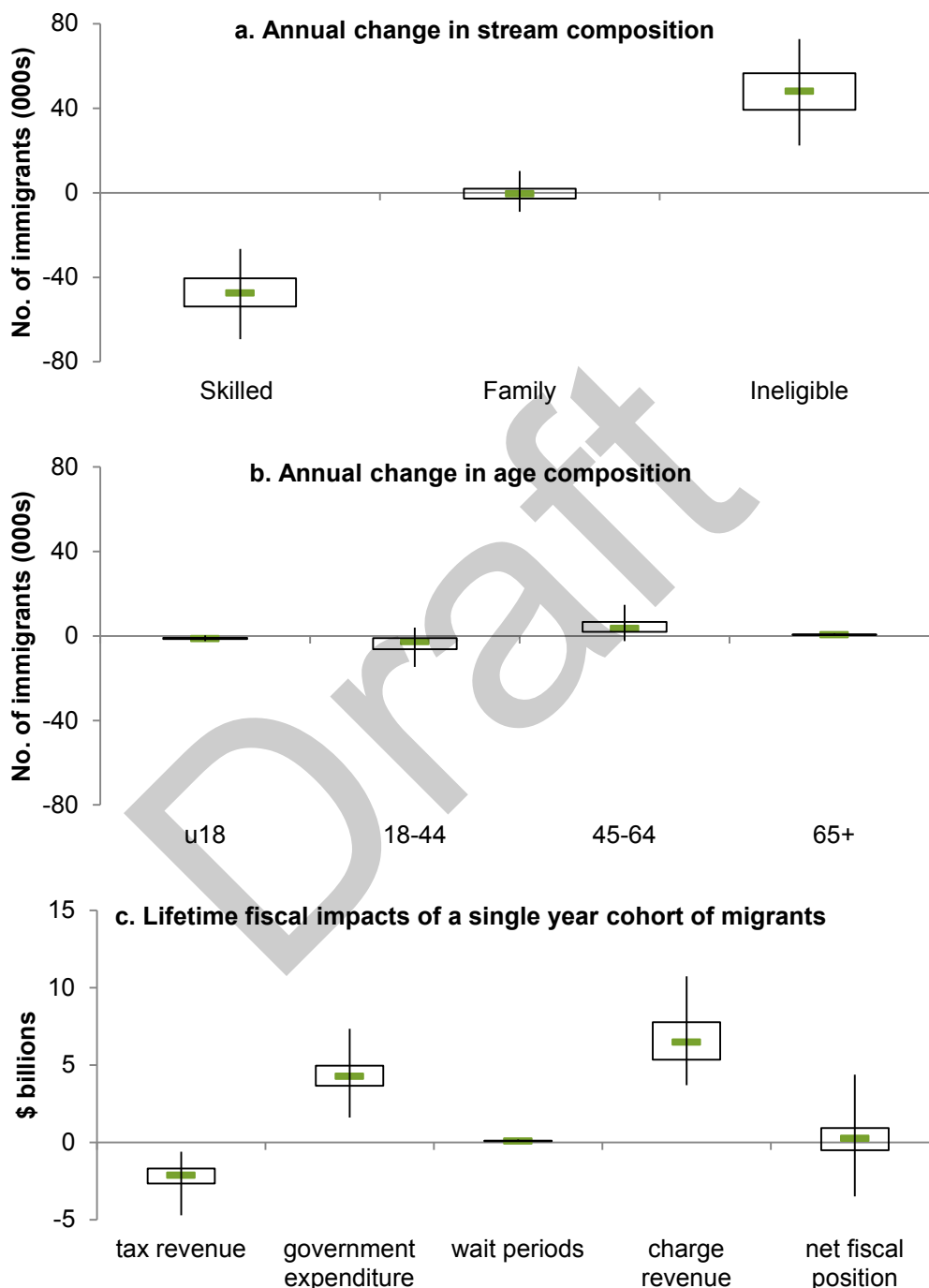
parent visas) means that an immigration charge in the order of $35 000 to $45 000 represents a small change in the cost of migrating to Australia (in some cases, the projected immigration charge might be smaller than the current charge).

- The number of previously ineligible migrants — those who do not meet the criteria under the current immigration system — dramatically increases (figure B.11). This represents a potentially quite large (and uncertain) pool of interested applicants globally.

- In most simulations, the average ages of immigrants increase, illustrated by an increase in the number of immigrants aged 45–64 and a decrease in the number of immigrants aged 25–44 (figure B.11). The projected increase in the average age of immigrants is due to the removal of age restrictions and removal of targeting younger migrants. However, the relative magnitude of the age-related compositional shift is much smaller than the stream-related compositional shift.

Changes in the composition of Australia's migrant intake drive changes in projected lifetime fiscal impacts of immigrants (figure B.11, panel c).

- Tax revenue is projected to decrease because of the decrease in skilled and younger immigrants. Skilled immigrants are more likely than currently ineligible immigrants to earn high wages and pay more tax. Younger immigrants tend to have longer remaining working lives in Australia than older immigrants and hence tend to pay more tax.

- Fiscal costs are projected to increase because immigrants are older on average. Older immigrants have higher discounted lifetime costs than younger post-school aged immigrants.

- For all simulations, the projected value of government expenditure saved due to wait periods is very similar in the baseline and in the single market clearing charge scenario. This is because the same wait periods are applied in both scenarios and even though the composition of the intake changes, there is no change in the average wait period.

- A single market clearing charge is projected to raise considerably more revenue than current visa charges because willingness to pay exceeds current charges for many types of migrants and relaxing current qualitative requirements increases the pool of potential migrants.

- The net fiscal position is a function of tax revenue, fiscal costs and charge revenue. Each component is affected by the composition of immigrants (figure B.11). While a single market clearing charge scenario is estimated to generate substantial charge revenue ($5.3 to $7.8 billion), this revenue is offset by increases in fiscal costs ($3.7 to $5.0 billion) and decreases in tax revenue ($1.7 to $2.7 billion), resulting in a net fiscal impact very near zero (-$0.5 to $0.9 billion).

Figure B.11   **Preliminary estimated impacts of a uniform charge**[a,b]

Market clearing single scenario

a. Annual change in stream composition

b. Annual change in age composition

c. Lifetime fiscal impacts of a single year cohort of migrants

a The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying a number of parameters in the model using Monte Carlo selections from a uniform distribution. The box plot tails show the minimum and maximum of all the runs, the box shows the interquartile range (quartiles 1 and 3). The large dash represents the median. **b** Estimates of fiscal impacts represent the net present value of fiscal impacts of a cohort of migrants who are granted a permanent visa in a single year.

Source: Productivity Commission estimates.

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