



Australian Government  
Productivity Commission

Partial equilibrium model

Migrant Intake into Australia  
*Technical Supplement C*

April 2016

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### **The Productivity Commission**

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# Partial equilibrium model

The terms of reference for this inquiry ask the Productivity Commission to examine the scope to use alternative methods for determining Australia's migrant intake including a specific scenario in which entry charges would be the primary basis for selection of migrants, subject to migrants meeting health, character and security requirements.

The Commission has developed a partial equilibrium model to help explore the impacts of alternative methods 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.

A preliminary version of the model was used for the draft report. Substantial improvements have been made to the model since the draft report, reflecting feedback received in two workshops (a technical workshop in December 2015 and a policy workshop in February 2016), in submissions and from a referee report.

This model has been used to explore how the composition of Australia's permanent migrant intake might change under visa charging scenarios. It also provides illustrative estimates of the potential fiscal impacts. This model is used to complement the qualitative analysis of alternative immigration policies elsewhere in the report.

This technical supplement explains the key features of the partial equilibrium model, namely:

- background to the model (section C.1)
- modelling framework (section C.2)
- parameterising the model (section C.3)
- fiscal impacts (section C.4)
- policy scenarios and results (section C.5).

## C.1 Background to the model

### A partial equilibrium approach

When evaluating the impacts of pricing/charging scenarios on Australia's permanent migration intake, issues that need to be considered include:

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- the extent to which migrant demand for Australian visas is responsive to price, among many types of heterogeneous migrants
  - the factors that influence migrants' decision to move to Australia
  - compositional shifts in the mix of migrants
  - impacts of the scenarios on Australian governments' budgets
  - the settings associated with each price/charge scenario (for example, which qualitative criteria will be retained, who will be eligible, what entitlements will migrants have and which quotas will be in place).

Reflecting these issues, a partial equilibrium model has been developed to shed light on a specific policy issue relevant to the inquiry. It uses a demand and supply framework (for Australian visas), where prospective migrants are characterised as maximising their private net benefit with respect to their migration decision. By considering the tradeoff between the benefits they receive from having a visa and the costs associated with obtaining that visa, reflecting policy settings of Australia.

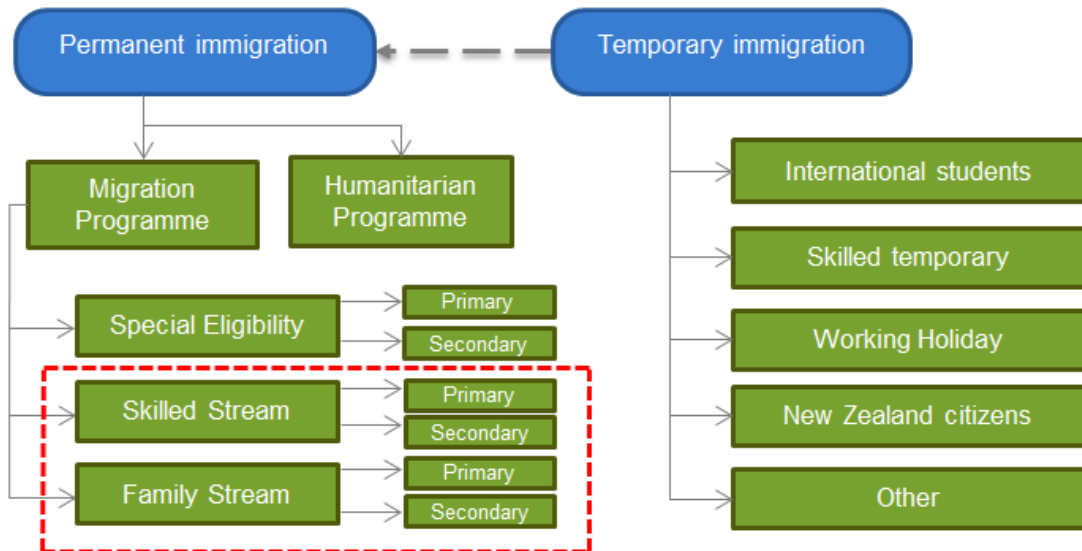
The theoretical framework for this partial equilibrium model is based on the spatial equilibrium framework described by Takayama and Judge (1971). First order conditions for the model are presented in attachment 3 of this technical supplement. There is a wide body of literature applying this framework to various policy environments from airport regulation to agricultural, water, and environmental issues. The Commission is not aware of Australian applications of this framework to explore immigration charging, although immigration charging in Australia has been discussed by a number of authors (for example, Dobes 1990a, 1990b; Harrison 1989, 1990; Kasper 2002; Soon 2001). The most comparable application of this framework is in a paper which explores the demand for green cards (visas) in the United States and the impacts on government revenues and migrant welfare from replacing all or part of the US immigration system with a revenue maximising auction (Bruns 2012).

## **Scope of the model**

The partial equilibrium model considers only permanent immigration, reflecting the weaker case for using a price-based mechanism for allocating temporary visas (chapter 14). 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 C.1.

Figure C.1 **Scope of the Commission's partial equilibrium model<sup>a</sup>**

The red dotted line outlines the scope of the model



<sup>a</sup> Primary applicants apply for visas and can add family members (secondary applicants) to their application.

This model is intended to represent an annual intake of migrants. All values are expressed in real terms (in 2015 dollars).

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 model is therefore subject to a number of 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
- that descendants of immigrants are not considered in modelling
- that immigrants are assumed to stay in Australia for the remainder of their life<sup>1</sup>
- uncertainty around the fiscal impacts of immigrants.

<sup>1</sup> Some immigrants subsequently emigrate from Australia and return to their country of origin or migrate to another country. This is relevant to the impacts of immigration but very difficult to represent in a model focused on Australia.

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The impacts of these and other uncertainties on model results have 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.

## Key data sources

The 2011 *Australian Census and Migrants Integrated Dataset* (ACMID) (ABS 2014) contains detailed information on over one million recent permanent immigrants and is the key data source used to parameterise the model (the profile of immigrants in ACMID is provided in figure C.2). ACMID links the 2011 Census of Population and Housing with the Australian Government's Settlement Database.<sup>2</sup> ACMID has information on people who responded to the 2011 Census of Population and Housing 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 (2013), Bruns (2012) and Gallup World Poll (IOM 2011).

## C.2 Modelling framework

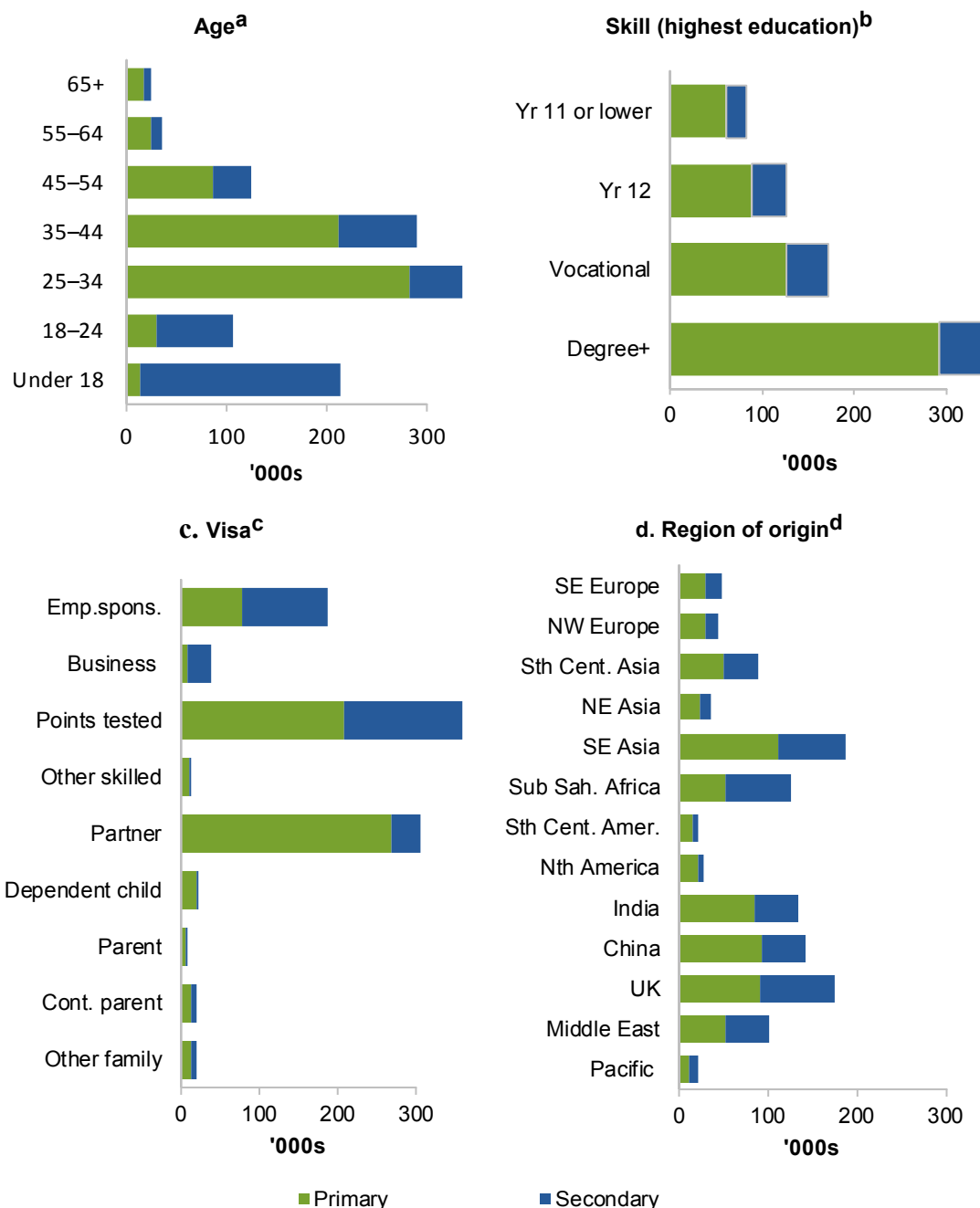
The model is based on a demand and supply framework where there is a separate 'market' for Australian visas for different types of potential migrants. Migrants have been categorised based on four key characteristics: their region of origin, visa, skill (highest level of educational attainment) and age. These characteristics were chosen because they are related to immigrants' labour market outcomes and their potential fiscal impacts, as well as to current selection criteria, and sufficient data were available. For each of these four characteristics, a small number of subcategories were chosen (outlined in table C.1). Regions of origin were aligned with the ABS (2008) classification, with key immigrant source countries such as India, China and the United Kingdom specified separately. 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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<sup>2</sup> Custodianship of the Settlement Database was shifted from the Department of Immigration and Border Protection (DIBP) to the Department of Social Services (DSS) prior to the release of ACMID.

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

Immigrants who arrived in Australia from 1 January 2000 to Census night 2011  
Primary and secondary applicants



<sup>a</sup> Age at Census night rather than age upon arrival in Australia. <sup>b</sup> This chart is restricted to immigrants aged 25–64 on Census night. 'Vocational' includes certificate III or IV and diplomas and advanced diplomas. <sup>c</sup> Only includes visas in the skill and family streams under the Migration Programme. <sup>d</sup> 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 C.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. A tenth category was included in the model representing potential migrants who are currently ineligible. The model includes markets for each combination of region of origin, visa, skill and age — a total of 3640 markets.<sup>3</sup> A potential migrant's characteristics are fixed in the modelling framework (that is, they cannot shift markets).

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

| <i>Region of origin<sup>a</sup></i> |  | <i>Visa</i>  |                                    | <i>Skills (highest education)</i> |                               | <i>Age<sup>b</sup></i> |                    |
|-------------------------------------|--|--------------|------------------------------------|-----------------------------------|-------------------------------|------------------------|--------------------|
| <i>Label</i>                        | <i>Description</i>                               | <i>Label</i> | <i>Description<sup>c</sup></i>     | <i>Label</i>                      | <i>Description</i>            | <i>Label</i>           | <i>Description</i> |
| R1                                  | Southern and Eastern Europe                      | V1           | Employer sponsored                 | S1                                | Year 11 or lower <sup>d</sup> | 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 <sup>e</sup>       | 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)    |              |                                    |                                   |                               |                        |                    |

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

<sup>3</sup> 3640 = 13 regions of origin x 10 visa categories x 4 skill levels x 7 age groups.



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In the representation of each market there is a:

- demand curve, which represents potential migrants' willingness to pay for the benefits of migrating to Australia permanently<sup>4</sup>
- 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, subject to quotas. The modelling framework abstracts from the particular mechanism used to allocate visas, such as an auction.

### **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 currently set at 190 000 per year, but it also includes limits on specific types of visas. 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 C.3 illustrates an example of a binding and a non-binding quota. In this example, there are two visas, for migrants of types 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 C.4). The net benefit of migrating (willingness to pay less migration costs) equalises across both visa markets.

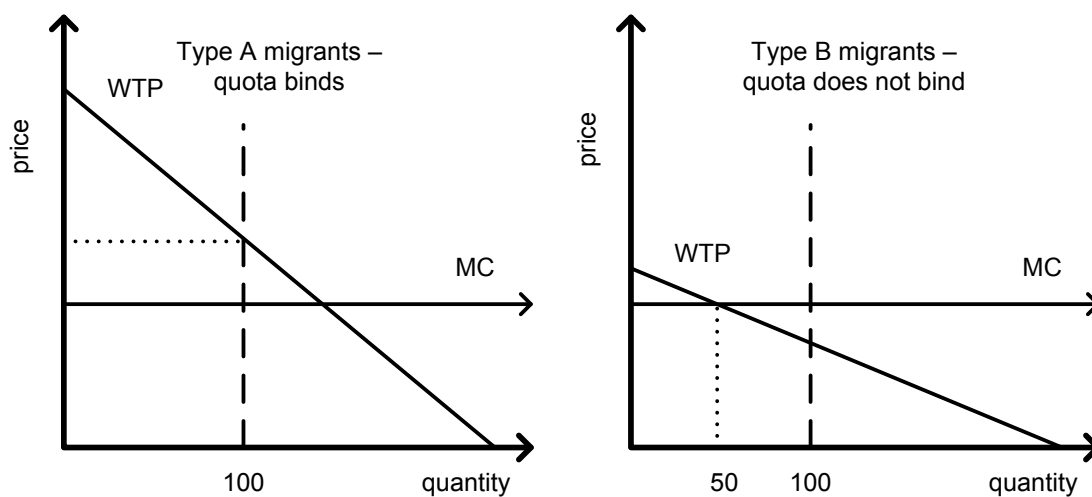
Immigration charges can be represented in the model in two equivalent ways. A charge can be set (figure C.5, panel a) and will reduce the number of migrants. Alternatively a quota can be set where visas are allocated to potential migrants with the highest net benefit. If the quota binds (there is excess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

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<sup>4</sup> 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.

uncertain if a quota is set, while the number of applicants will be uncertain if a charge is set.

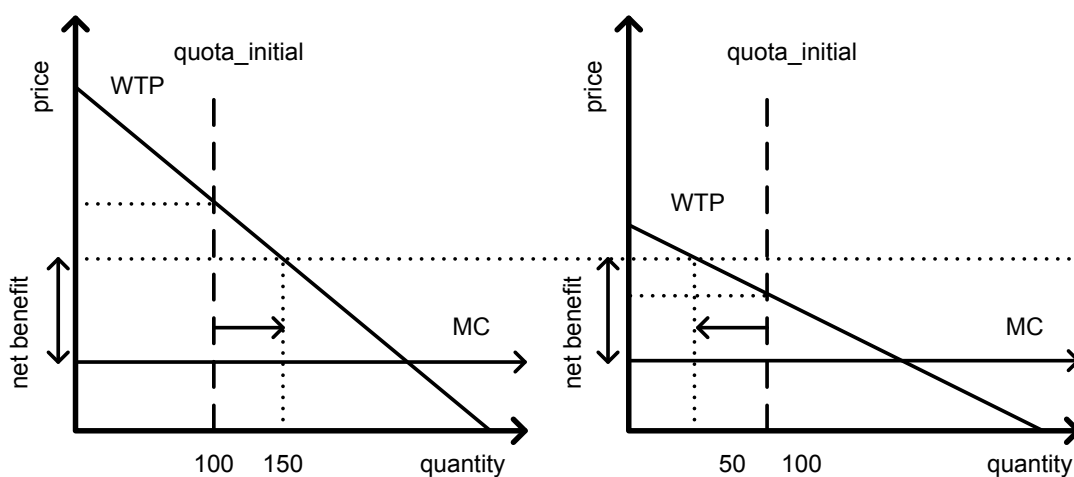
Figure C.3 Binding and non-binding quotas



WTP = willingness to pay

MC = migration costs

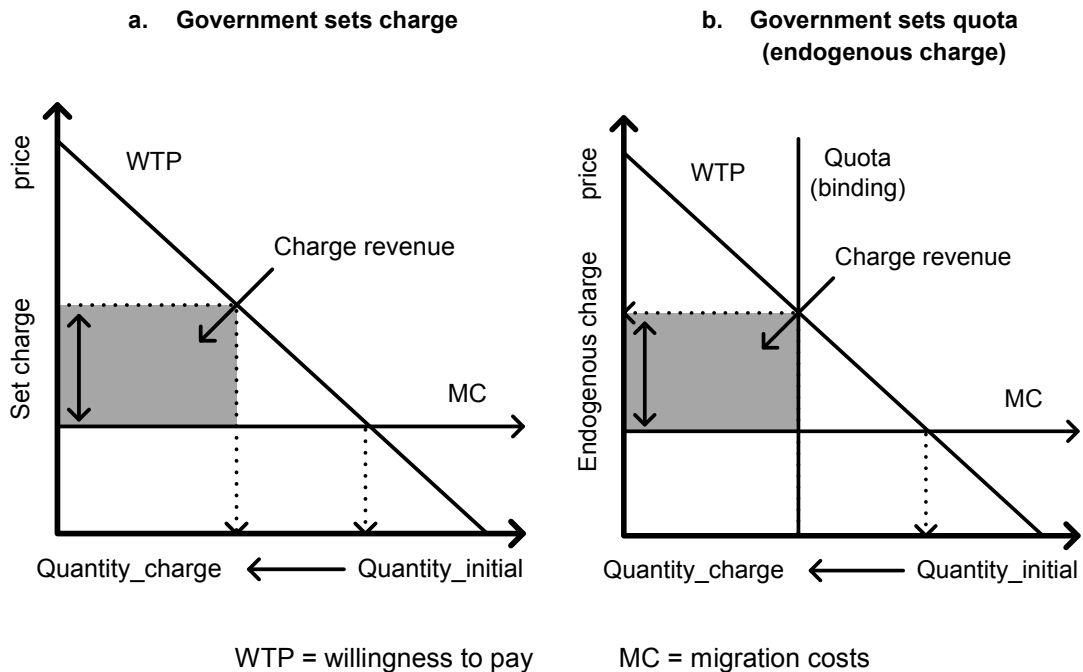
Figure C.4 Reallocation of visas with an overall quota



WTP = willingness to pay

MC = migration costs

Figure C.5 Two methods of setting immigration charges



In each market, demand is specified for primary applicants only. To estimate the number of secondary applicants linked with primary applicants in each market, ratios of secondary to primary applicants have been constructed.<sup>5</sup> Secondary-to-primary applicant ratios are fixed within each market and represent an average for this type of migrant. These ratios vary across markets. In the modelling framework, it is necessary to link secondary applicants to primary applicants by region of origin, visa category, skill level and age.

- Secondary applicants are in the same visa category as their primary applicant and are assumed to be from the same regions of origin. ACMID has been used to estimate ratios of secondary to primary applicants for each region of origin/visa combination.
- Secondary applicants aged over 25 are assumed to be in the same age group as their primary applicant. For each region of origin/visa combination secondary applicants aged under 25 are split evenly among primary applicants aged 25–44 years.

Both primary and secondary applicants are included in quotas. For example, an employer-sponsored, degree educated, 25–34 year old primary applicant from China will account for two places under a quota if their secondary-to-primary applicant ratio is 1 (i.e. this type of primary applicant would, on average, bring 1 secondary applicant if they migrated to Australia).

<sup>5</sup> 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.

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The mathematics of the model, and its optimality conditions, are detailed in attachment 3 to this technical supplement.

## **C.3 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 migrants to the United States and by 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 from each type of migrant has two components.

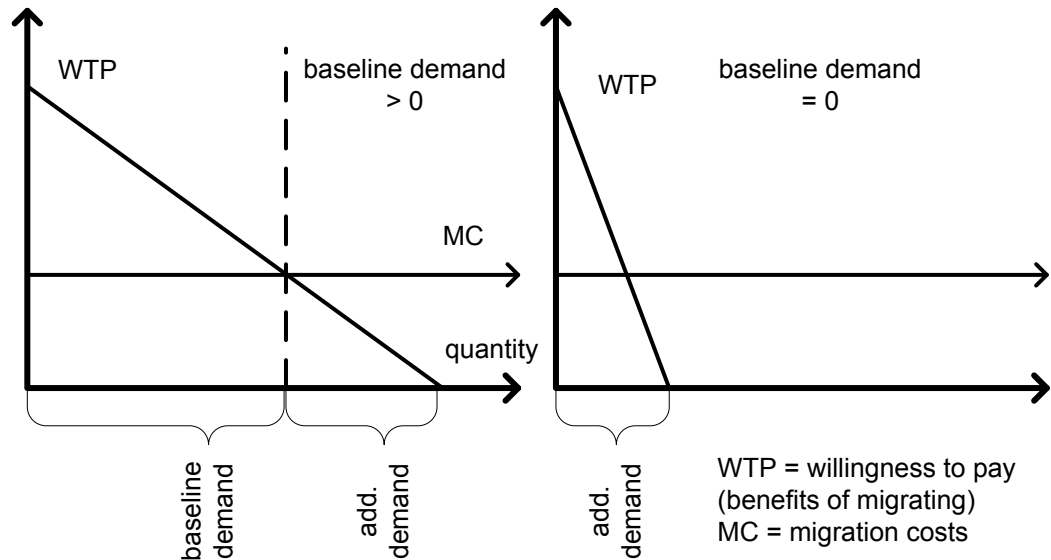
1. Baseline demand, which represents the current migrant intake and is set equal to the number of visa grants
2. Additional demand, which represents potential migrants who would like to migrate to Australia but have had their visa application rejected or have not applied. This includes prospective migrants who currently do not meet the qualitative criteria under existing permanent visa programs (figure C.6).

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.<sup>6</sup> For example, there are age limits for some skill visa streams. The baseline demand quantity is represented as a quota in each market. These quotas are consistent with the current immigration system targeting a mix of migrant types.

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<sup>6</sup> In such markets, demand could become positive under a charge system if, for example, age restrictions were removed.

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



### 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. Information from ACMID and the DIBP was used to estimate the composition of baseline demand.

ACMID was used 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
- age profile of primary applicants for each visa category. The age variable in ACMID is age on Census night in 2011 rather than age on arrival in Australia. The age profile of immigrants who arrived in 2011 was used to further split baseline demand
- skill level (highest educational attainment) by age group and visa category for primary applicants.<sup>7</sup> These estimates were used to further split baseline demand by skill. For each region of origin and visa category, primary applicants were split across four skill categories.

<sup>7</sup> Data was used for immigrants who arrived in Australia between 2009 and Census night 2012 to get a larger sample, which enables output by skill, age and visa. A smaller sample might lead to cells being suppressed in TableBuilder.

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An adjustment was made to reflect changes in the mix of permanent immigrants by visa class since 2011 (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.

Ratios of secondary to primary applicants were used to estimate the number of secondary applicants associated with demand from primary applicants. The characteristics of secondary applicants attached to different types of primary applicants were estimated (discussed in more detail above).

A final adjustment was made where the number of each type of primary applicant was adjusted proportionately to ensure that baseline demand among primary applicants and their attached secondary applicants equals 190 000. Baseline demand represents current demand for Australian visas with current charges among migrants who meet current selection criteria.

### Additional demand

It is uncertain how much additional demand there would be for Australian visas if current immigration restrictions were relaxed or removed given 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.<sup>8</sup> 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 World Poll 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 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

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<sup>8</sup> The poll included interviews dating from 2005 in more than 150 countries representing over 98 per cent of the world’s population.

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least two years of training. There are health, security and character requirements.<sup>9</sup> 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, and, 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 evidence 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.

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 United States resulting in an estimate of 5 million people. 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, particularly if the application process is streamlined and low cost.

The quantity of demand with zero fees is parameterised using information on the quantity of demand with low fees (US\$1730) for the Diversity Visa Lottery. Demand with zero fees could be higher.

The method outlined above is also likely to underestimate the quantity of 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

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<sup>9</sup> 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.

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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 average annual 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 (similar to the approach used by Bruns). This is equivalent to an annual additional demand estimate of 250 000. This estimate represents total demand for permanent visas (primary and secondary applicants) and is on top of baseline demand.

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 below).

## **Demand — price intercept**

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

### **Income factors**

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. In the Commission’s framework, a migrant’s expected lifetime income is estimated based on the average income for each particular migrant type. The distribution of income for a particular type of migrant is not considered in the modelling due to data limitations.

Bruns set the maximum willingness to pay for a US green card to the net present value (NPV) of lifetime income differences, taking into account the likely convergence in incomes between the United States and their country of origin over time:



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$$D_i = \sum_{t=0}^{t_R} \left(\frac{1}{1+r}\right)^t \left(\frac{1}{1+g}\right)^t (YA_i - YO_i) .^{10}$$

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

- gross domestic product (GDP) per worker was estimated using the weighted average (by size of recent migrant intakes) of GDP per worker in purchasing power parity terms across countries in each region, and was sourced from the World Bank (nd)
- projected growth in real GDP per capita for 2015–2020 was used as a proxy for future income growth across the remaining lifetimes of each migrant intake. Projected growth for 2015–2020 was estimated using the weighted average (by size of recent migrant intake to Australia) for each country within a region for which data were available (IMF 2016). Rates of future convergence ( $g$ ) were set at the difference in future income growth between each region of origin and Australia.

The labour market outcomes of migrants vary with their human capital and demographic characteristics. The Commission examined the determinants of labour force participation, employment and income by running a series of regression models, using ACMID unit record data. Access to the unit record data was made possible by virtue of an in-posting arrangement with the Australian Bureau of Statistics (ABS).

The results from these regressions were then used to calculate expected labour force participation and income for different types of migrants in the partial equilibrium model. Expected outcomes were calculated for each combination of region, visa category, skill, age and primary/secondary status. Regressions were conducted separately for males and females, so a weighted average of coefficients is used in calculating expected outcomes used in the partial equilibrium model. Results from these regressions and the econometric methodology used are outlined in attachment 1 of this technical supplement.

The value of lifetime income a potential migrant would expect to earn in Australia was estimated adapting Bruns' approach. Each type of migrant was assigned predicted weekly income from the ACMID regressions. Weekly income was converted into annual income. Since income estimates are from 2011 these estimates were inflated to reflect income levels in 2015. Expected income was adjusted by predicted participation rates from the ACMID regressions, and then discounted. 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 and be in the 30–34 age cohort for five years, then age into the 35–44 cohort and remain in that cohort for 10 years, and then age into subsequent age cohorts. Migrants are assumed to have the average labour

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<sup>10</sup>  $D_i$  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 country of origin and the United States,  $YA_i$  is the wage in the United States and  $YO_i$  is the wage in their country of origin.

market outcomes of the cohort that they age into. Migrants are assumed to live to 85 years, a similar life expectancy to that of the Australian population.

The method for estimating the value of lifetime income that a potential migrant would expect to earn in Australia is illustrated below for migrants aged 25–34 years. Putting the steps outlined above together, the value of lifetime income in Australia for migrants aged 25–34 years ('a3') from region of origin 'r', visa category 'v' and skill level 's' are represented in the model as:

$$\begin{aligned}
 V_{inc_{Aust}} = & \sum_{t=1}^5 \left( \frac{1}{1+r} \right)^t part_{r,v,s,a3} YA_{r,v,s,a3} + \sum_{t=6}^{15} \left( \frac{1}{1+r} \right)^t part_{r,v,s,a4} YA_{r,v,s,a4} \\
 & + \sum_{t=16}^{25} \left( \frac{1}{1+r} \right)^t part_{r,v,s,a5} YA_{r,v,s,a5} + \sum_{t=26}^{35} \left( \frac{1}{1+r} \right)^t part_{r,v,s,a6} YA_{r,v,s,a6} \\
 & + \sum_{t=36}^{55} \left( \frac{1}{1+r} \right)^t part_{r,v,s,a7} YA_{r,v,s,a7}^{11}
 \end{aligned}$$

Labour market outcomes for potential migrants in their source countries are relevant because it is assumed in the modelling framework that willingness to pay for an Australian visa is driven by income differentials. There is limited information on labour market outcomes in source countries, and these limitations — as well as definitional and collection differences — limit comparability of the data. In addition, labour market outcomes in source countries might not reflect outcomes for people who wish to migrate to another country (including Australia). Reflecting these difficulties, the value of lifetime income to migrants in their source country is estimated by multiplying the value of lifetime income in Australia by the ratio of GDP per worker in purchasing power parity terms in a migrant's source region and Australia. This implies that the distribution of income by age and skill is the same in migrants' source countries as in Australia.

$$V_{inc_{source}} = V_{inc_{Aust}} \frac{GDPW_{source}}{GDPW_{Aust}}.^{12}$$

<sup>11</sup>  $V_{inc_{Aust}}$  refers to the NPV of the lifetime income that a potential migrant would expect to earn in Australia. 'r' is the discount rate taking into account growth differentials,  $part_{r,v,s,a}$  is the participation rate for a particular type of migrant, and  $YA_{r,v,s,a}$  is average income in Australia for a particular type of migrant. 't' refers to time period. That is,  $t = 1$  refers to the first year that an immigrant lives in Australia.

<sup>12</sup>  $V_{inc_{source}}$  refers to the NPV of the lifetime income a potential migrant would expect to earn in their source country.  $V_{inc_{Aust}}$  refers to the NPV of the lifetime income a potential migrant would expect to earn in Australia.  $GDPW_{source}$  refers to GDP per worker on a purchasing power parity basis in a migrant's region of origin.  $GDPW_{Aust}$  refers to GDP per worker on a purchasing power parity basis in a migrant's region of origin.

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The value of the income differential is the value of lifetime income in Australia less the value of lifetime income in a migrant's source region. As discussed above, income differentials are used to parameterise demand curves.

Income differentials for adult secondary applicants (typically spouses) have been incorporated into the willingness to pay of primary applicants. Income differentials for secondary applicants were estimated using the same method as for primary applicants.

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

- 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.<sup>13</sup> 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 the average of income for Australians aged 25–44 years. Earning potential in the child's region of origin is assumed to be irrelevant to an Australian-based parent.
- 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 immigrants aged 18–24 years on permanent visas.

A different approach was used to estimate the willingness to pay for partner visa applicants. As for other visa categories, income differentials were estimated for primary applicants in this category. Income earned by secondary applicants was not considered. Instead, the earning potential of the primary applicant's Australian-based partner was considered. This approach was taken because it is assumed that a partner visa applicant and their Australian-based partner are evaluating two choices; living together in Australia or in the partner visa applicant's country of origin. An income differential for the Australian-based partner was estimated and added to the willingness to pay of the primary applicant. The income differential is set at what an Australian-based partner would expect to earn in Australia less what they would expect to earn in the primary applicant's region of origin.<sup>14</sup>

For scenarios where current waiting periods remain in place, the value of government payments and services are not incorporated into willingness to pay. This is because recent immigrants are assumed to have factored these waiting periods into their decision to

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<sup>13</sup> Includes Australians adopting a child from overseas.

<sup>14</sup> Expected income in Australia is age-specific and estimated using the Census. Expected income in the primary applicant's region of origin is estimated as the ratio of GDP per worker in Australia to GDP per worker in the appropriate region of origin, multiplied by expected income in Australia.

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migrate to Australia.<sup>15</sup> The quantity of each type of immigrant in the AMCID dataset is used to parameterise the model.

For scenarios where extended waiting periods apply, the value to migrants of government payments and services due to additional waiting periods was estimated and subtracted from willingness to pay (for both primary applicants and their attached secondary applicants). The value of these payments to migrants is set equal to the cost of provision (table C.3), and then discounted by a migrant's discount rate (a private discount rate).

### Non-income factors

Non-income factors such as safety, culture, 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 using a uniform distribution 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 Australia in recent decades. Non-income factors effectively provide a 'willingness to pay uplift' for each type of migrant (figure C.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.<sup>16</sup> 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

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<sup>15</sup> This argument also applies to potential migrants.

<sup>16</sup> To the extent that migrants cannot borrow to fund migration costs (including charges) demand for visas could be overstated.

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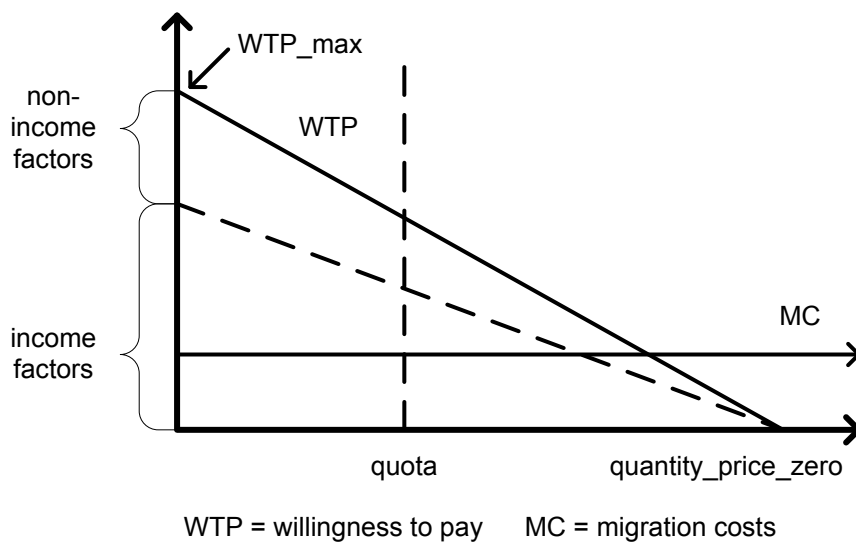
with the relative importance of non-income factors (but there is insufficient information to examine this association).

Because of these factors, wealth is not explicitly considered in the model. That said, recent immigrants have demonstrated that they had sufficient means to pay for current visa charges and other costs of migrating to Australia. This is implicit in the parameterisation of the model with the ACMID data set. The cost of capital migrants face to pay an immigration charge is considered in the model and set at the private discount rate. This reflects the cost of borrowing for potential migrants who have insufficient wealth to pay a charge and the opportunity cost for potential migrants who use their wealth to pay the charge. The cost of borrowing to pay the charge would likely be higher than the opportunity cost of migrants using their wealth to pay the charge. However, this is beyond the scope of the model.

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

Willingness to pay is comprised of income and non-income factors



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## Constructing demand curves

Demand curves are estimated for each type of migrant. These curves represent a ranking of migrants by willingness to pay, from highest willingness to pay to zero willingness to pay for an Australian visa. Two approaches have been used to construct demand curves:

- a 'type A' approach for markets where potential migrants have high income differentials (typically migrants from low or middle income regions)

- 
- a ‘type B’ approach for some markets where potential migrants have low income differentials (typically migrants 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.

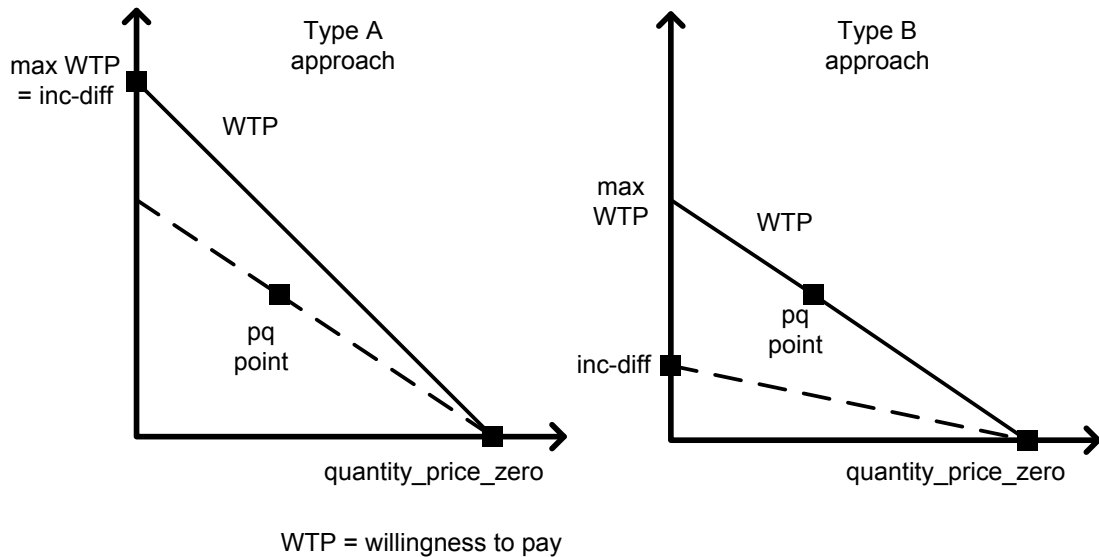
For some developed regions, GDP per worker is similar or higher than in Australia (type B regions). Therefore, using the income differential method, estimates of maximum willingness to pay for an Australia visa will be small or negative. Despite small or negative differentials in prevailing wages, migration by type B migrants 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 these 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, for type B migrants the current quantity of demand matches the current quota. This assumption is consistent with a low rejection rate for visa applications from migrants from high income 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 C.8).

- For type A migrants, estimates of the income differential (the y-intercept) and demand when the cost of migrating is zero (the x-intercept) are used.
- For type B migrants, 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 C.8 **Demand curve parameterisation**

Types A and B regions



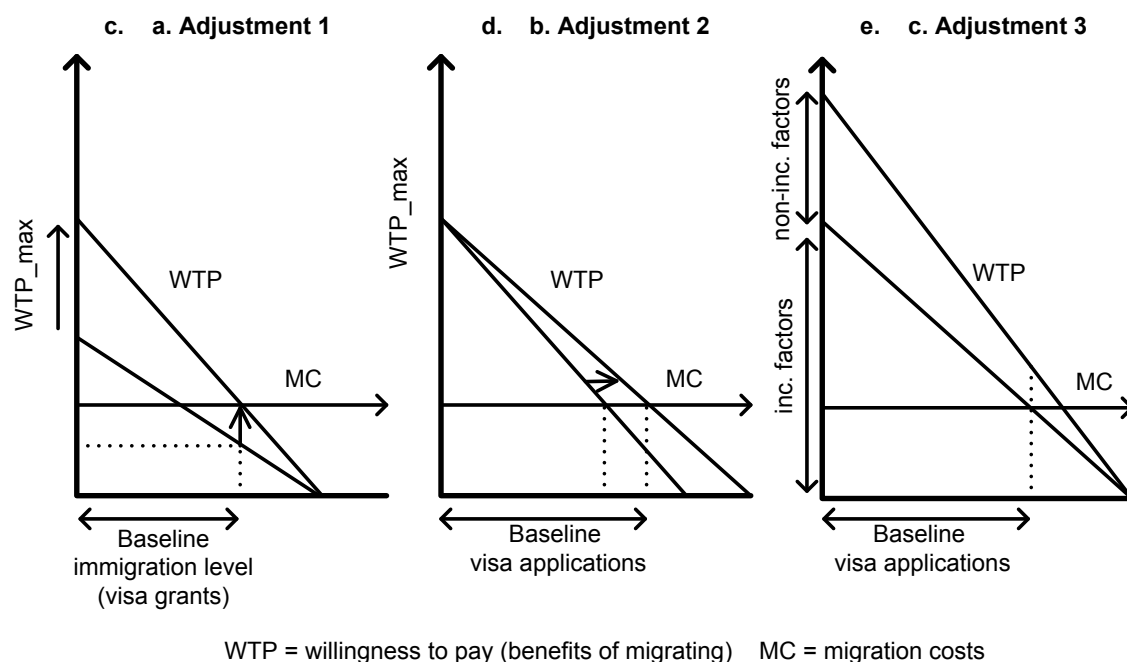
Three further adjustments were made to the willingness to pay curves. To:

1. 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 potential migrants 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 (figure C.9, panel a)
2. 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) (figure C.9, panel b)<sup>17</sup>
3. account for non-income factors. An uplift in willingness to pay of 50 per cent has been applied in each market (figure C.9, panel c).<sup>18</sup>

<sup>17</sup> Over the period from 2004-05 to 2014-15 the ratio of visa applications to grants for primary applicants was as follows across visa categories: employer sponsored (1.18); business innovation and investment (1.40); points tested skilled migration (1.13); other skilled (1.46); partners (1.23); dependent children (1.27); parent (3.79); contributory parent visa (1.51); and other family (2.18).

<sup>18</sup> In some markets, non-income factors are accounted for through adjustment 1 as well as through adjustment 3.

Figure C.9 Further adjustments



An additional adjustment has been made for the partner and dependent child visa categories. Given that these visas are currently given priority over other family visa categories, and current fees are low, it is assumed that the number of migrants in these categories is unlikely to grow substantially under alternative policy scenarios. Therefore, two quotas have been put in place in the model to limit the number of partner visas and dependent child visas to no more than respective baseline visa applications.

## 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 (applicable in the baseline and hybrid policy scenarios)
- transport costs (set at \$5000 per applicant and varied in sensitivity analysis). It is assumed that all potential migrants are offshore. In reality, many permanent visa applications are made onshore (while already in Australia on temporary visas) but at some point in time these migrants would have faced transport costs migrating to Australia
- migration agent costs, which are used as a proxy for the costs migrants face to comply with requirements of the current system.



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- For the baseline and hybrid scenarios, ranges estimated by visa class by the Office of the Migration Agents Registration Authority (OMARA 2015) were been used for central estimates and for sensitivity analysis.
  - For price-based scenarios, migrants are assumed to face much lower costs complying with requirements of a price-based system. Compliance costs have been sensitivity tested between zero and the lower bound estimate of migration agent fees for the partner visa category (OMARA 2015) (estimates for the partner visa category are lowest among the large permanent visa categories, suggesting that applications for these visas are more straightforward).

Estimates of current visa charges for the nine categories included in this model are outlined in table C.2.

## C.4 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: the NPV of lifetime tax collections *plus* charge revenue *less* the NPV of lifetime fiscal costs. The net fiscal impact is estimated as a NPV of revenue and expenditure over immigrants' lifetimes using the same approach as for income differentials (outlined above) where migrants age into successive age cohorts. Estimated net fiscal impacts include both primary and secondary applicants. For the draft report, only primary applicants were considered. Results are presented as changes in the net fiscal impact of a single year cohort relative to current arrangements (the baseline scenario).

**Table C.2 Estimates of current visa charges by visa category**

| Visa category                         | Method for estimating current visa charges   | Visa charges <sup>a</sup>       |                                 |                               |                 |
|---------------------------------------|--|---------------------------------|---------------------------------|-------------------------------|-----------------|
|                                       |  | Primary                         | Secondary                       |                               | Second install. |
|                                       |  |                                 | 18+                             | <18                           |                 |
| 1. Employer sponsored <sup>b</sup>    | 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+<br>\$2 305=<br>\$7 085 | \$2 390+<br>\$1 150=<br>\$3 540 | \$1 195+<br>\$575=<br>\$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 (subclass 309) 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 (subclass 101) are used since this class had the majority of grants in 2014-15 in this category.  | \$2 370                         | \$1 185                         | \$595                         | –               |
| 7. Parent <sup>c</sup>                | 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 <sup>c,d</sup> | Based on Contributory Parent visa (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 <sup>e</sup>          | 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         |

<sup>a</sup> 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. <sup>b</sup> Small employer nomination charges have not been considered. <sup>c</sup> There are assurances of support for parent and contributory parent visas. For parent visas, these are \$5000 for primary applicants and \$2000 for adult secondary applicants (bond held for 2 years). For contributory parent visas, these are \$10 000 for primary applicants and \$4000 for adult secondary applicants (bond held for 10 years). <sup>d</sup> There are discounts for holders of a subclass 173 visa (contributory parent (temporary)) and applications lodged pre-2003. These discounts are not considered. <sup>e</sup> A financial hardship exemption from the second instalment is not considered in the model.

Source: DIBP (2015).

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A real social discount rate of 3 per cent is used, which is much lower than the private discount rates used to estimate potential migrants' willingness to pay for an Australian visa.<sup>19</sup> A much lower rate is used because of differences in risk.

- Many potential migrants face considerable uncertainty about their future earning potential in Australia (i.e. high risk). The income they could earn if they remained in their country of origin is likely to be more certain. The Commission has estimated the average income for different types of immigrants rather than the distribution of income for different types of immigrants. If estimates of the distribution of income for each type of immigrant were available then a certain and equally desirable income level (certainty equivalent) could be estimated to take into account risk aversion (individuals tend to be risk averse). Due to a lack of information, a higher discount has been used to proxy for risk aversion. The central value used (10 per cent) is consistent with Bruns (2012).
- There are positive and negative fiscal impacts of an annual intake of immigrants including: upfront charge revenue; revenue raised from immigrants over their lifetimes; and government expenditure over immigrants' lifetimes. These impacts are uncertain so governments (and ultimately taxpayers) bear risk from an annual cohort of immigrants. Some immigrants will pay more tax and/or use fewer government services than expected, whereas some immigrants will pay less tax and/or use fewer government services than expected. The large size of the annual intake (190 000) reduces risk. In addition, this risk can be spread across millions of taxpayers. Private and social discount rates used in the model are sensitivity tested. Estimates of fiscal costs take into account waiting periods immigrants face to access government payments and services.

The model estimates fiscal impacts only where they are 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 the model have two components: personal income tax and the goods and services tax (GST). Other taxes paid by migrants are not modelled. Annual tax revenue is estimated by:

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<sup>19</sup> Private discount rates used are a real rate of 10 per cent plus convergence between a potential migrant's region of origin and Australia.

- 
- 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 income 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
  - adjusting estimates of tax paid upwards to reflect taxes missing in this analysis. The Commission has estimated that personal income tax and GST account for 56 per cent of total tax raised.

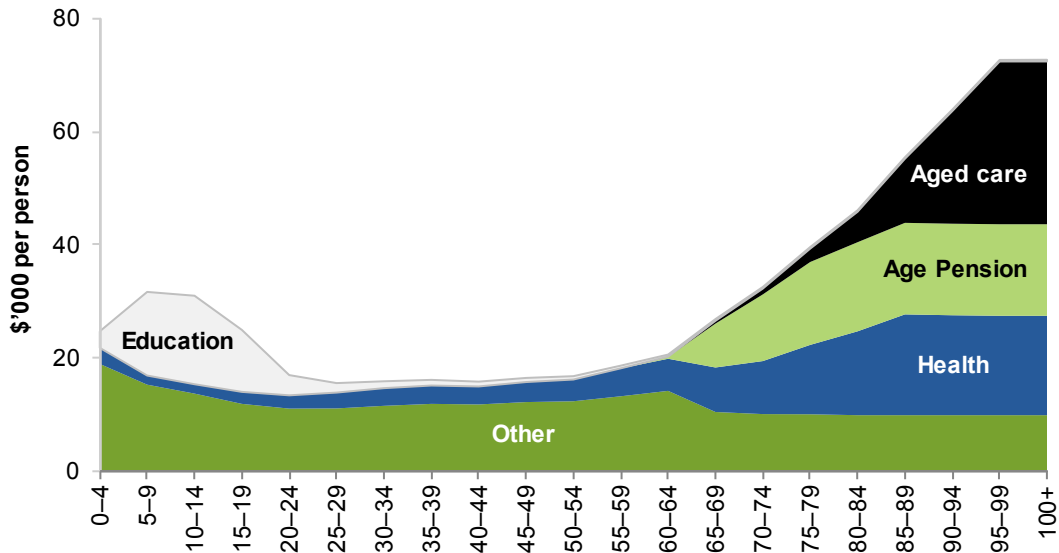
The 2015-16 tax schedules are not updated for future years and the proportion of wage income paid as GST is assumed to be fixed.

## **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 2013) estimated how government expenditure varies by age (figure C.10). This work has been used to estimate government expenditure for immigrants in each of the age categories in the model. Expenditure for each age group was split into 10 categories (table C.3). These estimates reflect average government expenditure across the whole population within age categories. For immigrants in a given age group, patterns of usage of government services may differ from patterns of usage for other Australian-born people (figure C.10). However, these differences are not considered in the model.

Figure C.10 **Age-related government expenditure**

All governments, \$000s per person, 2011-12



Source: Productivity Commission (2013).

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, waiting times were applied across the ten expenditure categories where appropriate (table C.3). The effect of these waiting periods on willingness to pay is not considered in the model because demand curves are parameterised using the observed quantity of immigrants who choose to migrate to Australia and the estimated costs they face. It is assumed that migrants are aware of the Newly Arrived Resident's Waiting Period and factor this into their decision about whether to migrate. The Commission has modelled a price-based proposal (discussed in chapter 14) with extended waiting periods of:

- 20 years for the Age Pension and the Disability Support Pension<sup>20</sup>
- 10 years for the remaining categories in table C.3 with the exception of the 'other' category where waiting periods do not apply because the benefits of much of this expenditure are non-excludable (that is, roads).

<sup>20</sup> The Disability Support Pension is covered by the Disability (Commonwealth) category in table C.3.

**Table C.3 Estimated annual government expenditure per person, by category**

\$ 000s

|                                       | <i>Wait period<sup>a</sup></i> | <i>Age group</i> |              |              |              |              |              |            |
|---------------------------------------|--------------------------------|------------------|--------------|--------------|--------------|--------------|--------------|------------|
|                                       |                                | <i>Under 18</i>  | <i>18–24</i> | <i>25–34</i> | <i>35–44</i> | <i>45–54</i> | <i>55–64</i> | <i>65+</i> |
| 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 emp. services <sup>b</sup> | 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      |

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

Source: Productivity Commission (2013).

Expenditure by category is used to estimate the proportion of government payments and services that immigrants in each age group have access to (table C.4). 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.

**Table C.4 Estimated proportion of government payments and services permanent immigrants have access to, by age group and years from arrival**

| Age group | 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 C.3.

## 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.

## C.5 Policy scenarios and results

### Policy scenarios

#### Baseline 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 Programme was set at 190 000 visas per year. Therefore the baseline in the model represents an annual intake of 190 000 permanent migrants under the Migration Programme. 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 explained above).

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## Price-based proposal

The Commission was asked to examine a proposal for a particular price-based immigration system. Under the assessed system, permanent visas (outside the Humanitarian Programme) would be allocated by a uniform charge (applying to both primary and secondary applicants) and immigrants would be subject to significantly extended waiting periods before becoming eligible for government payments and services. The proposal would replace current administrative selection mechanisms and the current suite of visa charges, although health, character and security checks would be retained. The current level of permanent immigration would be maintained. The Commission has modelled this scenario (as well some variants) to help explore the likely effects of price-based immigration systems.

## Hybrid scenarios

The terms of reference direct the Commission to examine alternative methods for allocating visas. The Commission has examined primarily price-based allocation scenarios (chapter 14) as well as ‘hybrid’ charging options, which make greater use of charging but maintain the selection criteria of the current immigration system (chapter 15). The Commission has modelled four hybrid scenarios, in which additional charges (on top of current visa charges) apply to adult migrants only:

- a uniform infrastructure contribution levy of \$25 000
- a uniform infrastructure contribution levy of \$50 000
- a uniform infrastructure contribution levy of \$100 000
- variable social services access charges, set based on a migrant’s age and skill level and their projected net fiscal impact, up to a maximum of \$250 000.<sup>21</sup>

Under all of these hybrid scenarios current waiting periods would also be retained.

The selection criteria of the current immigration system cannot be represented directly in the model and so their effects are proxied in the model through the use of caps. There is a

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<sup>21</sup> The net fiscal impact of a particular type of migrant (by their region, visa category, skill level, age and applicant status (primary/secondary)) is calculated as the NPV of estimated tax paid by that type of migrant over their lifetime (which varies by their region, visa category, skill level, age and applicant status) less the NPV of estimated government expenditure on that type of migrant over their lifetime (drawing on age-variable estimates in table C.3). Charges are levied in the model by age and skill, resulting in 28 separate charges (7 age groups by 4 skill levels). Charges are set at the weighted average of the negative of the net fiscal impact for each age–skill combination (weighted using the composition of the migrant intake in the baseline scenario). Where the weighted average is positive (i.e. migrants of a particular age–skill combination tend to have positive net fiscal impacts), charges have been set at zero. Where the weighted average is negative and less than \$250 000 (more negative than \$250 000), the charges in the model have been set at that level. In the model, a primary applicant pays their access charge as well access charges for their secondary applicants, which are based on the skill/age of their secondary applicant. Children are not charged an access fee.



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range of qualitative criteria currently in place related to character, health, age, skills (including English-language skills), financial capacity and other characteristics. In the model, caps have been put in place for each of the nine visa categories to represent the effects of selection criteria and the mix of immigrants that the Australia Government targets. Caps have also been put in place by skill level for each of the four skill stream visa categories represented (16 additional caps). All caps are determined by the baseline intake (which represents the current immigration system) among the group capped. Where there is excess demand among a group at a particular charge level, visas are allocated to migrants who have the highest willingness to pay within that group. However, the number of immigrants in a group subject to a cap (for example, a visa category) cannot increase if there is excess demand at a particular charge level even if immigration decreases for another group which provides space within the overall cap of 190 000.

## **Sensitivity analysis — parameter variation**

Different immigration policy scenarios would likely change the composition of Australia's migrant intake. How the composition of Australia's migrant intake might change under such scenarios is subject to considerable uncertainty. This is particularly the case for price-based scenarios, 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 was undertaken with a focus on the key and most uncertain parameters. Sensitivity analysis was conducted by simultaneously varying all parameters outlined in table C.5. Most parameters were varied using uniform distributions between lower and upper bounds. For many of these uniform distributions, lower bounds were set at 50 per cent lower than the central case and 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. Partial sensitivity analysis, where sensitivity analysis is conducted varying just subsets of parameters used for full sensitivity analysis (table C.5), has been conducted. Results from partial sensitivity analysis for the price-based proposal are presented in attachment 2 to this technical supplement.

**Table C.5 Sensitivity analysis undertaken**

| <b>Uniform distributions</b>                              |   |   |  |
|---|---|---|--|
| <i>Parameter</i>  | <i>Lower bound</i>  | <i>Central estimate (median)</i>                            | <i>Upper bound</i>   |
| Additional annual demand for permanent Australian visas   | 125 000 visas   | 250 000 visas   | 375 000 visas  |
| Proportion of additional demand in ineligible category    | 0.2 per cent  | 0.5 per cent  | 0.8 per cent   |
| Age profile of ineligible migrants <sup>a</sup>           | Ineligible migrants are aged less than 55 years                         | Based on age profile of immigrants in ACMID                 | Ineligible migrants are aged 45 years or over  |
| Migration agent fees — price-based scenarios              | \$0   | Central estimate (varies by visa category)                  | Lower bound estimate for partner visa category by the OMARA (2015)   |
| Migration agent fees — hybrid scenarios                   | Lower end of fee range by visa class estimated by OMARA (2015)          | Average of lower and upper bounds estimated by OMARA (2015) | Upper end of fee range by visa class estimated by OMARA (2015)   |
| Transport costs   | \$2 500 per applicant   | \$5 000 per applicant                                       | \$7 500 per applicant  |
| Real private discount rate <sup>b</sup>                   | 5 per cent  | 10 per cent   | 15 per cent  |
| Real social discount rate                                 | 1.5 per cent  | 3 per cent  | 4.5 per cent   |
| Willingness to pay uplift (per cent of income factors)    | 0 per cent  | 50 per cent   | 100 per cent   |
| Participation rates <sup>c</sup>                          | Central estimate less the difference between the median and upper bound | Central estimate (varies by migrant type)                   | Central estimate plus 10 per cent of the gap closed between the central estimate and 100 per cent participation <sup>e</sup> |
| Future skill level of child migrants <sup>d</sup>         | Average educational attainment of primary applicants aged 25–34         | Average of lower and upper bounds                           | Educational attainment of Australian population aged 25–34   |
| <b>Normal distributions</b>                               |   |   |  |
| <i>Parameter</i>  | <i>Mean</i>   |   | <i>Standard deviation</i>  |
| Income a migrant would earn in Australia <sup>c</sup>     | Central regression estimate (varies by migrant type)                    |   | 10 per cent of the mean  |
| Income a migrant would earn in source region <sup>c</sup> | Central regression estimate (varies by migrant type)                    |   | 10 per cent of the mean  |
| Government expenditure                                    | Central estimate (by age group and type of expenditure)                 |   | 10 per cent of the mean  |

<sup>a</sup> For this sensitivity test, a draw is taken from a uniform distribution between 0 and 1. Values closer to 0 lead to a younger age distribution of ineligible migrants while values closer to 1 lead to an older age distribution. <sup>b</sup> The private discount rate also includes a parameter reflecting expected difference in income growth between Australia and a migrant's source country. <sup>c</sup> Sensitivity testing for participation and income is undertaken for both primary and secondary applicants. <sup>d</sup> For this sensitivity test, a draw is taken from a uniform distribution between 0 and 1. Values closer to 0 lead to child migrants having future skill levels closer to recent immigrants while values closer to 1 lead to future skill distributions closer to the Australian population. <sup>e</sup> For migrant types with central estimates of below 50 per cent, the range between the median and each bound is set at 10 per cent of the central estimate.

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## Results

The results for price-based and hybrid scenarios described above are presented relative to current arrangements (the baseline scenario). Under price-based scenarios, 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. All results are intended to represent Australia's stable long-run equilibrium migrant intake. Results are expressed in real terms (2015 dollars).

### Results — price-based proposal

The results suggest that, were the price-based proposal examined by the Commission to be implemented, in the long run it could have significant effects on the composition of Australia's migrant intake. Results also suggest that this proposal could raise a large amount of revenue and have a large and positive net fiscal impact, contingent on immigrants facing extended waiting periods to access government payments and benefits (chapter 14).<sup>22</sup> Under this proposal:

1. an immigration charge in the order of \$45 000 to \$65 000 per applicant (median estimate: \$55 000) is consistent with maintaining Australia's current migrant intake level, and results in increased charge revenue in the order of \$9 billion
2. the composition of the migrant intake could change significantly the:
  - (a) number of primary applicants is projected to increase and the number of secondary applicants is projected to decrease, a shift away from family migration towards singles migrating (figure C.11. panel a)
  - (b) composition of the migrant intake is projected to shift away from skill stream immigrants towards family stream and currently 'ineligible' immigrants (figure C.11. panel b)<sup>23</sup>
  - (c) average educational attainment of the migrant intake is projected to decrease (figure C.11. panel c)
  - (d) average age of the migrant intake is projected to decrease. There is a large projected increase in immigrants aged 25–34 years and a projected decrease in immigrants aged 35–44 years (figure C.11. panel d)
3. charge revenue raised, as well as compositional changes and changes to waiting periods, are projected to have significant fiscal impacts (figure C.11, panel e). Namely:
  - (a) the NPV of tax revenue raised from a single cohort of migrants over their lifetimes is projected to fall by around \$5 billion

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<sup>22</sup> The public acceptability and practicality of extended waiting periods are discussed in detail in chapter 14.

<sup>23</sup> 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.

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- (b) the NPV of expenditure on a single cohort of migrants over their lifetimes is projected to fall by around \$15–20 billion
  - (c) the proposal is projected to raise additional charge revenue of around \$9 billion
  - (d) these three effects result in a net fiscal impact of the policy in the order of \$20–25 billion.

The main mechanisms and drivers underpinning changes to the composition of Australia's migrant intake are explained below.

- The number of primary applicants is projected to increase at the expense of secondary applicants. This is because under the price-based proposal it is much more expensive for family groups to migrate to Australia relative to singles, because each applicant is charged the same price.
- Skill stream migration is projected to decrease (figure C.11, panel b). 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 also 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, skill migrants currently face relatively low migration charges (generally less than \$5000 per primary applicant). Therefore, an immigration charge in the order of \$55 000 represents a material price increase relative to current charges.
- Family stream migration is projected to increase (figure C.11, panel b). This result is driven by high willingness to pay among partner visa applicants, and to a lesser extent among dependent child visa applicants. The number of contributory parent visas is projected to rise in most simulations. This reflects the fact that contributory parent visa applicants already pay charges greater than \$40 000 so an immigration charge in the order of \$55 000 is not a material increase for many applicants.
- The number of previously ineligible migrants — those who do not meet the criteria under the current immigration system — increases (figure C.11, panel b). This represents a potentially quite large (and uncertain) pool of interested applicants globally.
- In most simulations, the average age of immigrants is projected to decrease, illustrated by a large increase in the number of immigrants aged 25–34 years and a large decrease in the number of immigrants aged 45–54 years (figure C.11, panel d). This result is because immigrants aged 25–34 years tend to have longer remaining working lives in Australia and will hence have higher willingness to pay for an Australian visa. In addition, extended waiting periods to access government payments and benefits under the proposal will be a stronger deterrent for older migrants since waiting periods are 20 years for the Age Pension and Disability Support Pension. The Age Pension cannot be accessed until age 65 and the likelihood of claiming the Disability Support Pension increases with age.

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The main mechanisms and drivers of the projected lifetime fiscal impacts of immigrants are explained below.

- Tax revenue is projected to decrease. The average age of the migrant intake is projected to decrease, which, other things equal, would increase the NPV of tax revenue raised from a single cohort of immigrants. However, this positive effect is more than offset by other compositional effects. The composition of the migrant intake shifts away from skill stream towards the family stream and those currently ineligible. The composition also shifts away from developed countries and towards developing countries, and the average educational attainment decreases. Immigrants in the skill stream from developed countries and/or with high educational attainment tend to have stronger labour market outcomes (higher participation rates and higher incomes) and hence are likely to pay more tax over their lifetimes.
- Fiscal costs are projected to decrease primarily because immigrants face extended waiting periods to access government payments and benefits under this proposal.
- 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. Increased charge revenue and decreased fiscal costs are projected to more than offset reduced tax revenue resulting in a substantial positive net fiscal impact.

### Some variants of the price-based proposal

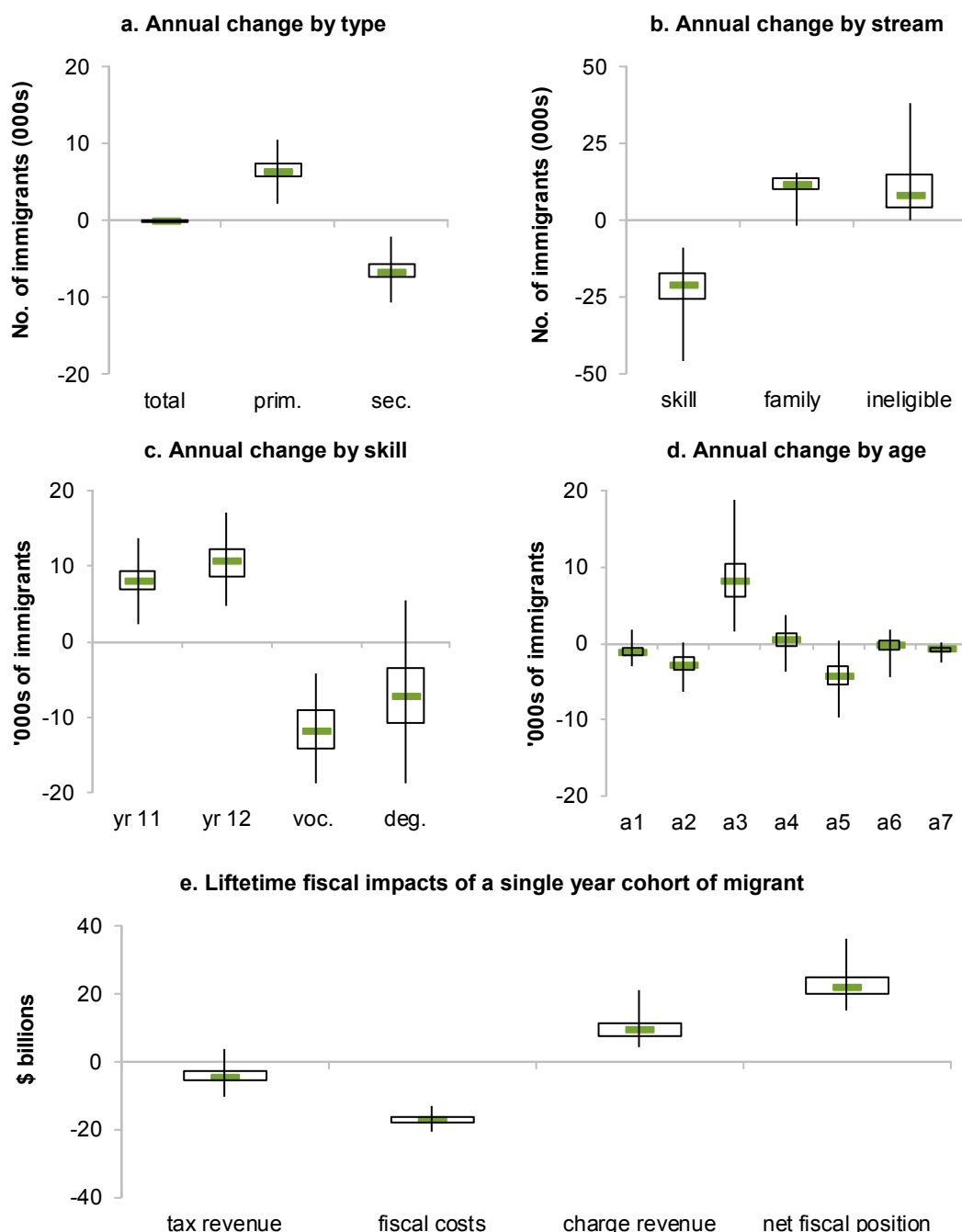
Modelling suggests that the composition of Australia's migrant intake would be broadly similar under the proposed price-based system with current or extended waiting periods. Composition by type, stream, skill and age of applicant would be similar (figure C.12).

As expected, the net fiscal impact is much smaller with current waiting periods (in the order of \$5–10 billion rather than \$20–25 billion) (figures C.11 and C.12). This is driven by higher government expenditure on a cohort of migrants with current rather than extended waiting periods. The modelled charge is considerably higher (in the order of \$70 000 rather than \$55 000 per applicant) with current waiting periods as willingness to pay for an Australian visa is higher because migrants have access to government payments and benefits sooner. However, increased charge revenue is offset by higher expenditure. The projected reduction in tax revenue is similar in both scenarios.

The Commission has modelled additional scenarios, for both the price-based proposal and price-based proposal with current waiting periods, where the same single charge is applied while retaining current selection criteria. Results are discussed in box C.1.

Figure C.11 **Modelled impacts of the price-based proposal<sup>a,b,c</sup>**

Change, relative to current arrangements



**a** The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. 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 NPVs of fiscal impacts of a cohort of migrants who are granted a permanent visa in a single year. **c** 'voc.' = vocational education, 'deg.' = degree or higher, 'a1' = under 18, 'a2' = 18–24 years, 'a3' = 25–34 years, 'a4' = 35–44 years, 'a5' = 45–54 years, 'a6' = 55–64 years and 'a7' = 65+.

Source: Productivity Commission estimates.

### Box C.1 Pricing variants with current section criteria

To put the modelled net fiscal benefits of the price-based proposal for immigration in context, as noted in chapter 14 the Commission has examined two scenarios in which the same single charge is applied to immigrants as under the price-based proposal, but the current visa stream caps and eligibility criteria are retained:

- variant a: charges from each simulation (1000 simulations in total) for the price-based scenario (with extended waiting periods) (figure C.11) are implemented as charges for scenario a. Values for all other parameters are the same in each simulation for both scenarios with the exception of migration agent costs.<sup>24</sup> This scenario results in estimated net fiscal gains of around \$25–30 billion per year (panel a below).
- variant b: charges from each simulation (1000 simulations in total) for the price-based proposal variant with current waiting periods (figure C.12) are implemented as charges for scenario b. Values for all other parameters are the same in each simulation for both scenarios with the exception of migration agent costs. This scenario results in estimated net fiscal gains of around \$15–20 billion per year (panel b below).

These gains largely reflect the effects of an overall reduction in the intake, as in the modelling ineligible migrants or migrants in other categories are not allowed in these scenarios to replace displaced immigrants from particular visa categories.

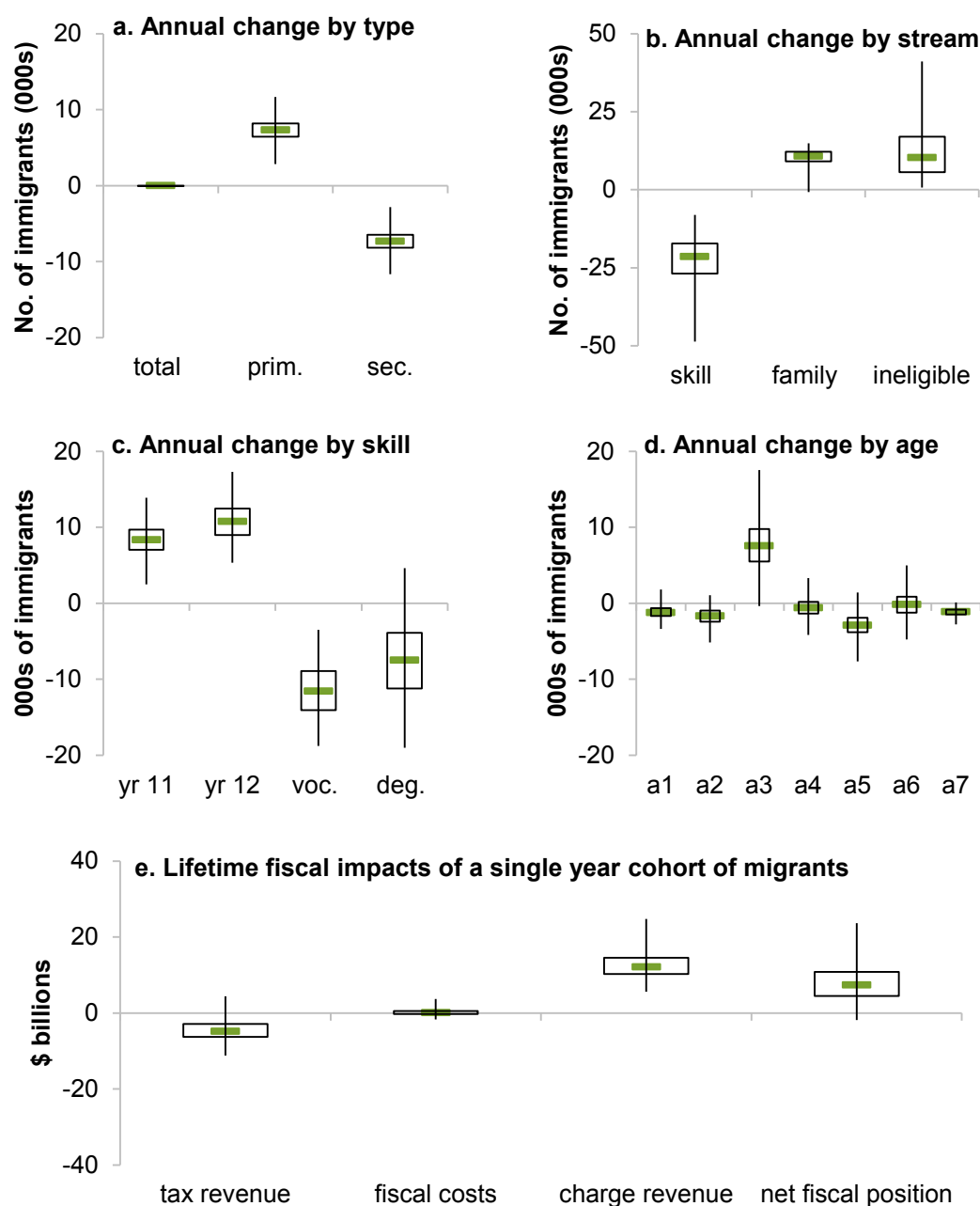
#### Lifetime fiscal impacts of a single year cohort of migrants, pricing variants with current selection criteria, change relative to current arrangements



<sup>24</sup> For variants a and b, migration agent costs are drawn from the current distribution of costs because current criteria remain in place rather than the lower cost distribution used for the proposed price-based system (distributions discussed in table C.5).

Figure C.12 **Modelled impacts of the price-based proposal with current waiting periods<sup>a,b,c</sup>**

Change, relative to current arrangements



<sup>a</sup> The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. 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. <sup>b</sup> Estimates of fiscal impacts represent the NPVs of fiscal impacts of a cohort of migrants who are granted a permanent visa in a single year. <sup>c</sup> 'voc.' = vocational education, 'deg.' = degree or higher, 'a1' = under 18, 'a2' = 18–24 years, 'a3' = 25–34 years, 'a4' = 35–44 years, 'a5' = 45–54 years, 'a6' = 55–64 years and 'a7' = 65+.

Source: Productivity Commission estimates.



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## Results — uniform levy scenarios

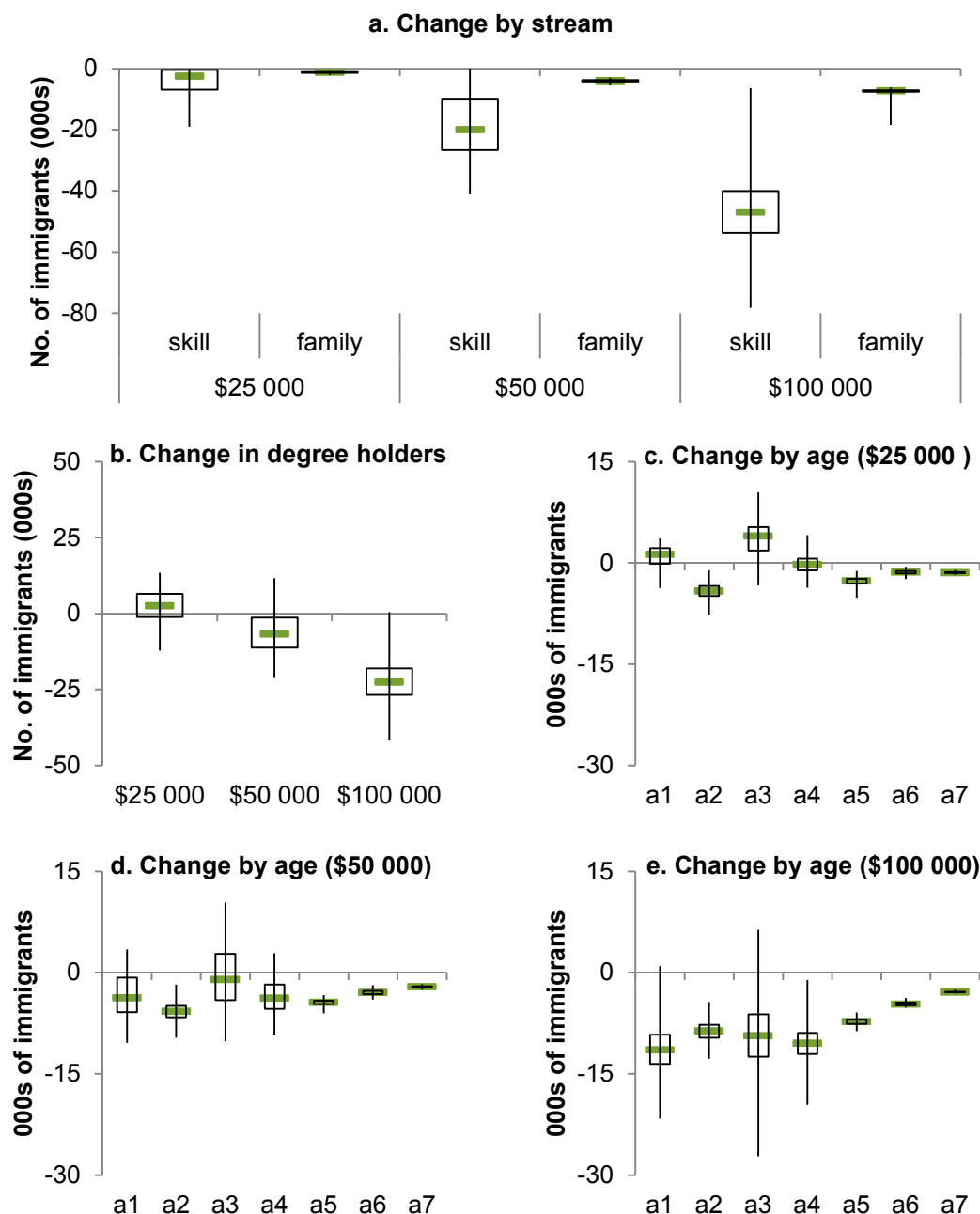
As discussed above the four hybrid scenarios consist of three uniform levies (set at \$25 000, \$50 000 and \$100 000) and social security access charges.

As modelled, the Commission's estimates suggest that imposing a uniform charge would tend to have the following general effects.

- *Age*: a larger number of migrants in the 25–34 age group offset by slight declines in other age brackets (less pronounced than under the price-based proposal, for all modelled charge levels other than \$100 000 where the number of immigrants is projected to fall for all age groups). This result is driven by younger migrants tending to have higher willingness to pay given they would have longer remaining working lives in Australia than older migrants (figure C.13, panels a, b and c).
- *Skills*: a proportionately greater reduction in skill stream relative to the family stream migrants and a reduction in educational attainment at higher levels of the charge (although again, less than in the case of the price-based proposal examined in chapter 14). This result is driven by low estimates of willingness to pay among current skill stream migrants from developed countries. This also explains the drop in educational attainment as skill stream migrants tend to have high educational attainment (figure C.13, panels a and b).
- *Intake level*: significant reductions in the intake at higher levels of the charge (table C.6). This result is because estimates of willingness to pay are low among some types of current immigrants. Caps used in the modelling framework limit the extent to which migrants with higher willingness to pay can displace migrants with lower willingness to pay who enter in the baseline scenario.

The median estimated net fiscal impacts range from around \$3 billion per year, in the case of the \$25 000 charge, to over \$20 billion per year in the case of the \$100 000 charge (figure C.14).

**Figure C.13 Modelled impacts of various uniform levies<sup>a,b</sup>**  
Annual change relative to current arrangements



**a** The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. 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** 'a1' = under 18, 'a2' = 18–24 years, 'a3' = 25–34 years, 'a4' = 35–44 years, 'a5' = 45–54 years, 'a6' = 55–64 years and 'a7' = 65+.

Source: Productivity Commission estimates.

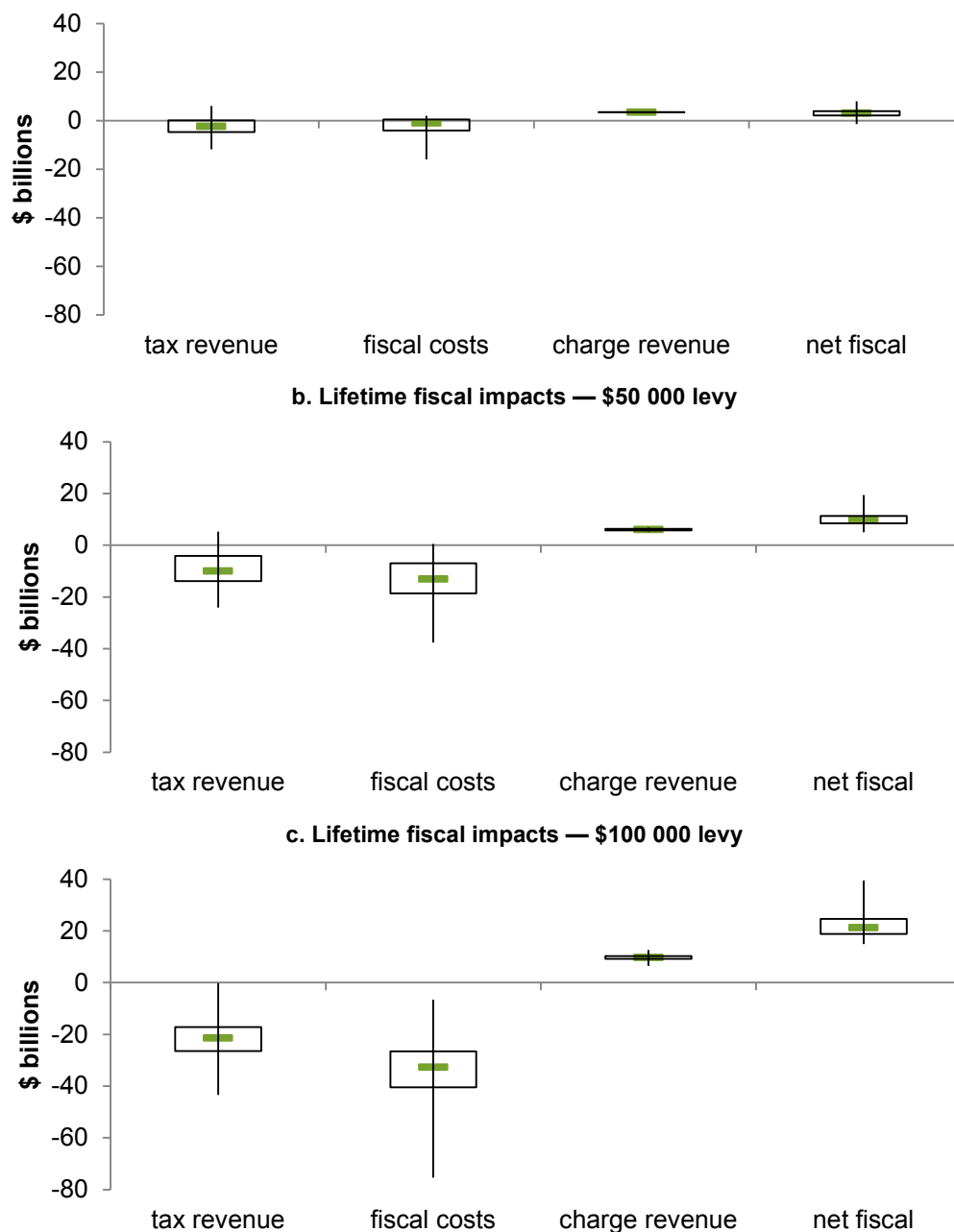
**Table C.6      Modelled impacts of various uniform levies**

Annual intake of migrants, median estimates (000s of immigrants)

|                           | <i>Baseline</i> | <i>\$25 000</i> | <i>\$50 000</i> | <i>\$100 000</i> |
|---------------------------|-----------------|-----------------|-----------------|------------------|
| <b>Visa grants</b>        |                 |                 |                 |                  |
| Total                     | 190.0           | 181.0           | 161.6           | 134.0            |
| Primary                   | 107.8           | 101.0           | 92.5            | 80.6             |
| Secondary                 | 82.2            | 80.0            | 69.1            | 53.4             |
| <b>Stream composition</b> |                 |                 |                 |                  |
| Skilled                   | 130.4           | 122.5           | 106.1           | 81.9             |
| Family                    | 59.6            | 58.5            | 55.5            | 52.0             |
| <b>Skill composition</b>  |                 |                 |                 |                  |
| Year 11                   | 35.6            | 33.7            | 31.3            | 27.8             |
| Year 12                   | 37.4            | 41.4            | 38.0            | 33.2             |
| Vocational                | 41.0            | 36.8            | 32.3            | 25.3             |
| Degree+                   | 76.0            | 69.1            | 60.0            | 47.7             |
| <b>Age composition</b>    |                 |                 |                 |                  |
| U18                       | 44.8            | 44.9            | 40.0            | 33.1             |
| 18–24                     | 20.7            | 15.5            | 13.8            | 11.2             |
| 25–34                     | 64.3            | 66.4            | 61.2            | 54.7             |
| 35–44                     | 38.6            | 38.0            | 34.7            | 28.6             |
| 45–54                     | 12.9            | 10.3            | 8.4             | 5.5              |
| 55–64                     | 5.5             | 4.1             | 2.3             | 0.6              |
| 65+                       | 3.2             | 1.8             | 1.0             | 0.2              |

*Source:* Productivity Commission estimates.

**Figure C.14 Modelled fiscal impacts of various uniform charges<sup>a,b</sup>**  
 Lifetime fiscal impacts (present value), change relative to current arrangements



<sup>a</sup> Charge additional to existing visa charges. Children are not charged. <sup>b</sup> These estimates represent the fiscal impacts of a cohort of migrants who are granted a permanent visa in a single year. Estimates are NPVs over migrants' remaining years of life in Australia from when they are granted a visa. The results reported in this table are interquartile ranges (quartiles 1 and 3) based on the distribution of each measure from 1000 sensitivity model runs, varying a number of parameters in the model. Parameter values were varied for all 3640 migrant types in the model using Monte Carlo selections.

*Data source:* Productivity Commission estimates.

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## Results — variable social services access charges

As modelled, the Commission's estimates suggest that imposing variable social services access charges would have the following effects relative to current arrangements.

- *Age*: a significant increase in migrants aged 25–34 years (in the order of 15 000 per year) offset by a large decline in those aged 45–54 years and slight declines in other age brackets. This result is more pronounced than under the price-based proposal (figure C.11, panel d and figure C.15, panel d).
- *Skills*: a proportionately greater reduction in family stream relative to skill stream migrants and a slight increase in the average educational attainment level of the intake (figure C.15, panels b and c).
- *Intake level*: a reduction of around 10–15 000 migrants per year, mainly in older cohorts, from an annual starting number of 190 000 (figure C.15, panel a).

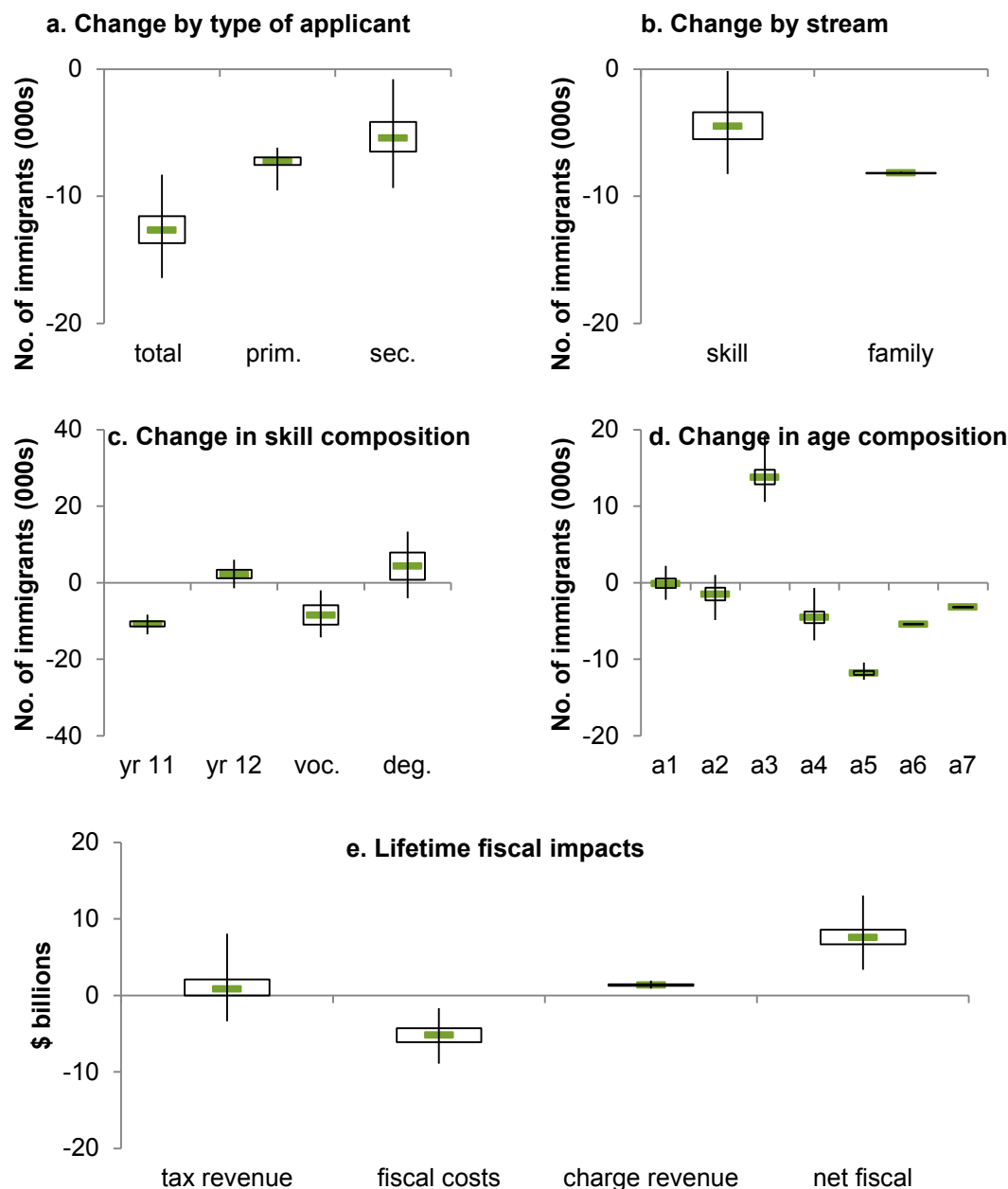
These results reflect the nature of the variable charging system modelled. Many younger immigrants face zero or quite modest charges because they are estimated to have a positive net fiscal impact, but the charges would become increasingly prohibitive for older people.<sup>25</sup> In the scenario modelled, very few older people continue to migrate to Australia and so do not pay any visa charges. Results suggests a proportionately greater reduction in family stream migration because most older migrants are in this stream and family stream migrants tend to have lower educational attainment.

The modelling suggests that fiscally-reflective charges of the type modelled could generate a fiscal benefit in the order of \$7–9 billion per year. This includes small increases in charge revenue of just \$1 billion per year and tax revenue in the order of \$0–2 billion per year, due to the younger age profile of the migrant intake. The bulk of the fiscal gains comes from a reduction in government expenditures resulting from a decline in the overall number of immigrants (figure C.15, panel e).

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<sup>25</sup> As discussed earlier, charges are capped at \$250 000 per applicant.

Figure C.15 **Modelled impacts of fiscally-reflective charges<sup>a,b,c</sup>**  
Annual change, relative to current arrangements



**a** The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. 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 NPVs of fiscal impacts of a cohort of migrants who are granted a permanent visa in a single year. **c** 'voc.' = vocational education, 'deg.' = degree or higher, 'a1' = under 18, 'a2' = 18–24 years, 'a3' = 25–34 years, 'a4' = 35–44 years, 'a5' = 45–54 years, 'a6' = 55–64 years and 'a7' = 65+.

Source: Productivity Commission estimates.

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## Attachment 1 — Labour market parameters

Expected labour market outcomes for migrants with different characteristics were estimated using the unit record Australian Census and Migration Integrated Dataset (ACMID). Regression models were used to estimate the association between participation, employment and wages and a range of human capital characteristics. The results of these models were then used to ‘predict’ the labour market outcomes expected for migrants with different characteristics, as required for the partial equilibrium model. The role of these predicted labour market outcomes in the partial equilibrium model is discussed above.

### Employment and participation models

Bivariate probit models were estimated to examine factors associated with both employment and participation, with models run separately for male and female migrants.

The probit model assumes a continuous latent variable  $w_i^*$  that is indicative of individual  $i$ ’s true binary employment or participation status,  $w_i$ . This latent variable can be described as a function of a vector of independent variables ( $\mathbf{z}_i$ ), parameters ( $\delta$ ) and a normally distributed residual term with a mean of 0 ( $\varepsilon_i$ ).

$$w_i^* = \alpha + \mathbf{z}_i\delta + \varepsilon_i \quad [1]$$

$$\text{where: } w_i = \begin{cases} 1 & \text{if } w_i^* > 0 \\ 0 & \text{if } w_i^* \leq 0 \end{cases}$$

The probability of employment (or participation) is then given by:

$$\Pr(w_i = 1|\mathbf{z}_i) = \Pr(w_i^* > 0|\mathbf{z}_i) = \Phi(\mathbf{z}_i\delta) \quad [2]$$

where  $\Phi(\cdot)$  is the standard normal cumulative distribution function.

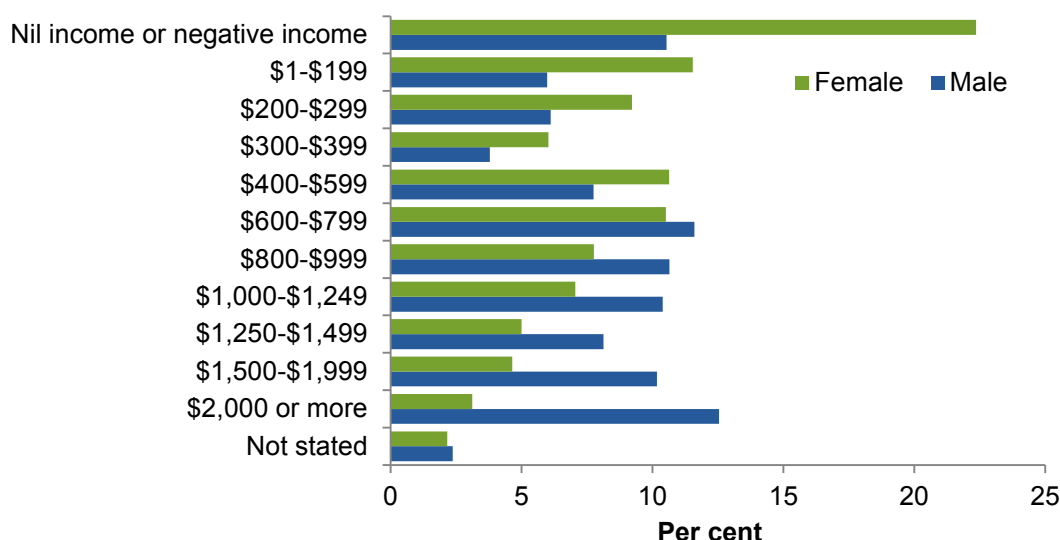
The employment and participation models were robust to the choice of estimation techniques. As well as the probit model, employment and participation models were also estimated using a logit link function. The choice of model type has a negligible effect on estimates, with predicted male participation rates found to be around 0.1 percentage points lower on average under the logit specification.

### Labour income model

The income regression is more complex given the need to take into account the non-continuous nature of the income variable and the possibility of selection bias. As with the employment and participation models, separate labour income models were estimated for males and females.

Information about individual's total weekly personal income in ACMID is drawn from the 2011 Census. In the Census unit record, income is a categorical variable indicating an income range for each individual. The distribution of income reported by male and female migrants in ACMID aged between 15 and 65 years is shown in figure 1.1.

Figure 1.1 **Total migrant personal income, by sex<sup>a</sup>**  
2011



<sup>a</sup> Migrants aged between 15 and 65 years.

Source: Productivity Commission estimates using Australian Census and Migration Integrated Dataset (ABS Cat. no. 3417.0.55.001).

In order to estimate the relationship between migrant characteristics and their reported income, it is necessary to use an 'interval regression' approach. Interval regression is a variation of the ordered probit model, where ordered categories describe 'groupings' of an underlying, continuous variable. Assuming that  $y_i^*|x$  satisfies the conditions of the classical linear model, regression coefficients may be interpreted as if the continuous dependent variable had actually been observed (Wooldridge 2002). If there are  $J$  cutoff points for income categories ( $a_1 < a_2 < \dots < a_J$ ), then the model estimated is shown by:

$$y_i^* = x_i\beta + \vartheta_i \quad [3]$$

$$\text{where: } y_i = \begin{cases} 0 & \text{if } y_i^* \leq a_1 \\ 1 & \text{if } a_1 < y_i^* \leq a_2 \\ 2 & \text{if } a_2 < y_i^* \leq a_3 \\ \vdots & \\ J & \text{if } y_i^* > a_J \end{cases}$$

The probability of an individual having income in a particular range can be calculated in a way similar to equation [2]. However, it is the unobserved, continuous variable that is of



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interest — expected income ( $y_i^*$ ) can simply be described as a function of characteristics  $x_i$  and the estimated parameters,  $\beta$ :<sup>26</sup>

$$E(y_i^*|x_i) = x_i\beta \quad [4]$$

### Sample selection bias

Both the observation of labour income, and the amount of income received is affected by the employment of the individual. Regression coefficients may be biased if factors affecting the likelihood of observing income are not taken into account. Since labour income is only observed among those who are employed, it is the income expected given individual characteristics and employment that is of interest. In terms of equations [2] and [3]:

$$E(y_i^*|x_i, w_i = 1)$$

In order to obtain unbiased estimates of factors associated with labour income, the sample selection process also needs to be modelled. A two-step approach is used to take into account the possible correlation between the residual terms in the selection and income equations. This is an established econometric procedure for dealing with bias resulting from self-selected samples (Heckman 1979).

The two-step model involves first estimating the probability of observing income — that is, probability of employment — using a probit model as described in equation [2] as a selection equation. From the probit selection equation, the ratio of the probability distribution function to the cumulative distribution function can be calculated, and included as a regressor ( $\lambda_i$ ) in the principal, labour income equation.<sup>27</sup> Expected income can now be written as:

$$E(y_i^*|x_i, w_i = 1) = x_i\beta + \gamma\lambda_i \quad [5]$$

It is these expected values that are estimated using the interval regression model that accounts for sample selection. The  $\gamma$  value indicates the presence of sample selection bias.

### Labour income

A further potential complication arises from the fact that total weekly personal income in ACMID is comprised of income derived from employment, as well as income from other sources.

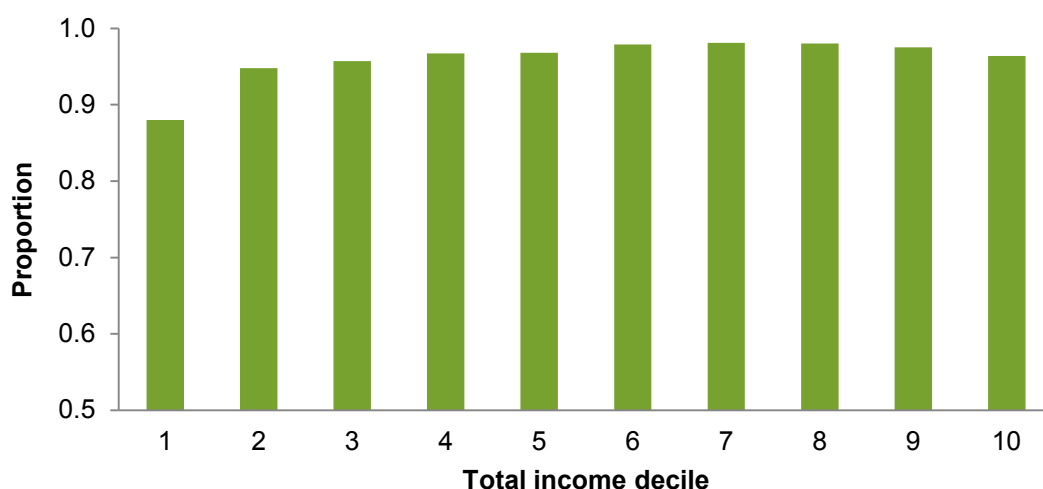
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<sup>26</sup> Note that the ordered probit model does not explicitly include intercept terms. For an explanation of this refer to Wooldridge (2002).

<sup>27</sup> This additional regressor is often referred to as the inverse Mills ratio.

Migrants who are not employed are treated as having zero employment income. It is assumed that all income declared by people who are employed results from their employment. While this is not ideal, most of the income reported by employed migrants does result from their employment. Separate analysis of the Personal Income Tax and Migration Integrated Dataset shows that between 88 and 98 per cent of the total income reported by employed migrants is employment related (figure 1.2).

**Figure 1.2 Employment income as a proportion of total income**  
Employed permanent migrants, 2009-10



<sup>a</sup> Migrants aged between 15 and 65.

Source: Productivity Commission estimates using ABS *Personal Income Tax Migration Integrated Dataset*, Cat no. 3418.0.

## Independent variables

A range of demographic, human capital, visa-related and labour market independent variables were included in the regression models. The selection of variables was guided by previous research into migrant labour market outcomes by Wooden (1991) and Cobb-Clark (2000) (table 1.1).

The use of ACMID allows more detailed examination of a number of factors affecting labour market outcomes, because of the variables included and the size of the data. These include detailed information about visa types, English-language proficiency, educational attainment, state of residence and region of birth. Occupation is also included for the income regressions.

**Table 1.1 Australian migrant labour market outcomes models and independent variables**

| <i>Wooden (1991)</i>   | <i>Cobb-Clark(2000)</i>                        | <i>PC labour market outcome models</i>  |
|--|--|---|
| <b>Model description</b>   |  |   |
| Multinomial logit of employment and participation                            | Bivariate probit of employment                 | Bivariate probit and logit models of participation and employment<br>Interval regression of personal income |
| <b>Data source</b>   |  |   |
| ABS' Monthly Population Survey, migrant supplement, 1987                     | Longitudinal Survey of Immigrants to Australia | ABS Australian Census and Migration Integrated Dataset, 2011  |
| <b>Independent variables (default categories denoted by square brackets)</b> |  |   |
| <b>Age</b>   |  |   |
| 18-24; 25-34; [35-44]; 45-54; 55-64  | Age  | Age   |
|  | Age squared                                    | Age squared   |
| <b>Marital status</b>  |  |   |
| Single<br>[Married]  | Married<br>[Not married]                       | Married in a registered marriage<br>Married in a de facto marriage  |
| <b>Children</b>  |  |   |
| No dependents<br>[Dependents]  | na   | Children (women only)<br>[No children] (women only)<br>Number of children (women only)                      |
| <b>Visa category</b>   |  |   |
| Refugee  | [Business skills/Employer nominated]           | Employer sponsored  |
| [Non-refugee]  | Preferential family                            | Business innovation and investment<br>[Points tested skilled migration]                                     |
|  | Concessional family                            | Other skilled   |
|  | Independent                                    | Partners  |
|  | Humanitarian                                   | Dependent children  |
|  |  | Parent  |
|  |  | Contributory parent   |
|  |  | Other family  |
|  |  | Humanitarian  |
|  |  | Other   |
| <b>English</b>   |  |   |
| na   | [Only or best]                                 | [Speaks English at home]  |
|  | Well/very well                                 | Speaks English very well or well  |
|  | Badly/not all                                  | Speaks English not very well or not at all  |
|  |  | Not stated  |

(continued next page)

**Table 1.1** (continued)

| <i>Wooden (1991)</i>                        | <i>Cobb-Clark(2000)</i>                                       | <i>ACMID labour market outcome models</i>  |
|---|---|--|
| <b>Education</b>                            |   |  |
| Degree                                      | Postgraduate  | Post Grad Degree/Grad Dip/<br>Grad Certificate   |
| Diploma/certificate                         | High school   | Bachelor Degree/Advanced<br>Diploma/Diploma  |
| Trade qualification                         | Less than 10 years<br>Currently enrolled<br>[Technical/Trade] | Certificate III or IV<br>[Year 12]<br>Year 11 or below<br>Not stated/inadequately<br>described |
| <b>Pre-migration occupation</b>             |   |  |
| Managerial                                  | Professional/Management                                       | na   |
| Professional/Paraprofessional               | Trade/Skilled   |  |
| Tradesperson                                | Unskilled   |  |
| Machine operator/Labourer<br>[Not employed] | [Not employed]  |  |
| No job prior to migration                   | na  | na   |
| <b>State</b>                                |   |  |
| [NSW]                                       | NSW   | [NSW]  |
| Vic   | Vic   | Vic  |
| Qld   | [Qld]   | Qld  |
| SA  | SA  | SA   |
| WA  | WA  | WA   |
| Tas   | Other   | Tas  |
| ACT/NT                                      |   | ACT<br>NT  |
| <b>Birthplace/region of origin</b>          |   |  |
| [UK/Ireland]                                | Oceania/Other Africa  | Oceania (excl. Aust. and NZ)   |
| New Zealand                                 | Mid-East/North Africa   | North-West Europe  |
| Other English speaking                      | Asia  | Southern and Eastern Europe  |
| S. Europe                                   | North/South/Central America                                   | North Africa and the Middle East   |
| Other Europe                                | [Europe/USSR]   | South-East Asia  |
| Asia  |   | North-East Asia  |
| Other                                       |   | [Southern and Central Asia]<br>Americas<br>Sub-Saharan Africa<br>Not stated                    |

(continued next page)

**Table 1.1** (continued)

| <i>Wooden (1991)</i>                   | <i>Cobb-Clark(2000)</i>    | <i>ACMID labour market outcome models</i>   |
|--|----------------------------|---|
| <b>Period of arrival</b>               |                            |   |
| 1961–65                                | na                         | Arrived prior to 2000   |
| 1966–71                                |                            | Arrived in 2000 or 2001   |
| 1971–75                                |                            | Arrived in 2002 or 2003   |
| 1976–79                                |                            | Arrived in 2004 or 2005   |
| 1980–82                                |                            | Arrived in 2006 or 2007   |
| 1983–85                                |                            | Arrived in 2008 or 2009   |
| [1986–87]                              |                            | [Arrived in 2010 or 2011]<br>Year of arrival not stated   |
| <b>Occupation (income model only)</b>  |                            |   |
| na                                     | na                         | Managers<br>Professionals<br>Technicians and Trades Workers<br>Community And Personal Service Workers<br>Clerical And Administrative Workers<br>Sales Workers<br>Machinery Operators and Drivers<br>Labourers<br>Not stated or inadequately described |
| <b>Other</b>                           |                            |   |
| Family in Australia prior to migration | na                         | na  |
| na                                     | Visited prior to migration | na  |
| na                                     | Unemployment rate          | na  |
| na                                     | na                         | Index of relative socioeconomic disadvantage  |

However, ACMID has some limitations relative to the *ABS Monthly Population Survey* supplement used by Wooden (1991) and the *Longitudinal Survey of Immigrants to Australia* used by Cobb-Clark (2000). In particular, the absence of information about dependent children for male migrants means that this is not taken into account as a factor that is expected to affect labour market participation (though not necessarily employment or income). Similarly the lack of information about occupation prior to migration or the presence of immediate family upon arrival means that these are not taken into account in assessing labour market outcomes after arrival, despite their expected effect on employment (Cobb-Clark 2000).

**Table 1.2 Descriptive statistics, male and female migrants in AC MID estimation dataset<sup>a</sup>**

Proportions, means and standard deviations

| <i>Variable</i>   | <i>Male</i> | <i>Female</i> |
|---|-------------|---------------|
| Labour force status   |             |               |
| Not in the labour force   | 17.1        | 36.9          |
| Unemployed  | 5.7         | 6.3           |
| Employed  | 77.2        | 56.7          |
| Total weekly income intervals (employed people only) <sup>b</sup> |             |               |
| \$1-\$199   | 6.9         | 15.3          |
| \$200-\$299   | 7.0         | 12.2          |
| \$300-\$399   | 4.3         | 8.0           |
| \$400-\$599   | 8.9         | 14.1          |
| \$600-\$799   | 13.3        | 13.9          |
| \$800-\$999   | 12.2        | 10.3          |
| \$1,000-\$1,249   | 11.9        | 9.3           |
| \$1,250-\$1,499   | 9.3         | 6.6           |
| \$1,500-\$1,999   | 11.7        | 6.2           |
| \$2,000 or more   | 14.4        | 4.1           |
| Mean age (standard deviation)                                     | 34.9 (10.4) | 34.6 (10.2)   |
| Marital status  |             |               |
| Married in a registered marriage                                  | 59.0        | 63.2          |
| Married in a de facto marriage                                    | 6.8         | 7.0           |
| Not married   | 34.2        | 29.7          |
| Children <sup>c</sup>   |             |               |
| Have children   |             | 58.0          |
| Mean number of children (standard deviation)                      |             | 2.0 (1.1)     |
| Highest educational attainment                                    |             |               |
| Post Grad Degree/Grad Dip/Grad Certificate                        | 16.7        | 13.8          |
| Bachelor Degree/Advanced Diploma/Diploma                          | 34.4        | 39.1          |
| Certificate III or IV   | 12.3        | 6.0           |
| Year 12   | 17.3        | 20.0          |
| Year 11 or below  | 13.7        | 15.3          |
| Not stated/inadequately described                                 | 5.6         | 5.8           |
| English proficiency   |             |               |
| Speaks English at home  | 29.9        | 26.4          |
| Speaks English very well or well                                  | 59.7        | 58.8          |
| Speaks English not very well or not at all                        | 9.9         | 14.3          |
| Not stated  | 0.5         | 0.5           |

(continued next page)

**Table 1.2** (continued)

| <i>Variable</i>                             | <i>Male</i> | <i>Female</i> |
|---|-------------|---------------|
| Visa type                                   |             |               |
| Employer sponsored                          | 16.5        | 14.0          |
| Business innovation and investment          | 3.5         | 3.7           |
| Points tested skilled migration             | 41.3        | 31.5          |
| Other skilled                               | 1.5         | 1.0           |
| Partners                                    | 21.9        | 37.4          |
| Dependent children                          | 1.1         | 0.8           |
| Parent                                      | 0.1         | 0.2           |
| Contributory parent                         | 0.9         | 1.5           |
| Other family                                | 1.9         | 1.6           |
| Humanitarian                                | 11.3        | 8.4           |
| Secondary applicant                         | 27.0        | 38.3          |
| Region of birth                             |             |               |
| Oceania (excl. Aust. and NZ)                | 1.7         | 1.8           |
| United Kingdom                              | 16.2        | 12.4          |
| North-West Europe (excl. UK)                | 4.2         | 3.8           |
| Southern and Eastern Europe                 | 3.8         | 4.6           |
| North Africa and the Middle East            | 9.4         | 7.3           |
| South-East Asia                             | 13.2        | 20.1          |
| China                                       | 11.1        | 14.2          |
| North-East Asia (excl. China)               | 3.3         | 5.2           |
| India                                       | 13.5        | 9.7           |
| South and Central Asia (excl. India)        | 8.7         | 6.6           |
| North America                               | 2.4         | 2.4           |
| South and Central America (incl. Caribbean) | 1.8         | 2.0           |
| Sub-Saharan Africa                          | 10.2        | 9.1           |
| Not stated                                  | 0.6         | 0.7           |
| Offshore application                        | 62.4        | 68.0          |
| State                                       |             |               |
| New South Wales                             | 34.3        | 34.8          |
| Victoria                                    | 27.5        | 26.7          |
| Queensland                                  | 14.3        | 15.1          |
| South Australia                             | 6.6         | 6.3           |
| Western Australia                           | 14.1        | 13.8          |
| Tasmania                                    | 0.8         | 0.8           |
| Northern Territory                          | 0.7         | 0.8           |
| Australian Capital Territory                | 1.6         | 1.7           |
| Other territories                           | < 0.1       | < 0.1         |

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**Table 1.2** (continued)

|  | <i>Male</i> | <i>Female</i> |
|--|-------------|---------------|
| Occupation   |             |               |
| Managers   | 12.8        | 8.1           |
| Professionals  | 28.3        | 31.5          |
| Technicians and Trades Workers   | 20.3        | 4.9           |
| Community And Personal Service Workers   | 5.7         | 15            |
| Clerical And Administrative Workers  | 7.2         | 18.8          |
| Sales Workers  | 5.6         | 9.2           |
| Machinery Operators and Drivers  | 7.5         | 1.2           |
| Labourers  | 10.6        | 9.5           |
| Not stated or inadequately described   | 2.1         | 1.8           |
| Mean index of relative socioeconomic disadvantage<br>(divided by 100) (standard deviation) | 10.0 (0.8)  | 10.0 (0.8)    |
| Year of arrival  |             |               |
| Arrived prior to 2000  | 5.7         | 5.0           |
| Arrived in 2000 or 2001  | 11.8        | 11.4          |
| Arrived in 2002 or 2003  | 14.3        | 14.1          |
| Arrived in 2004 or 2005  | 18.1        | 17.1          |
| Arrived in 2006 or 2007  | 20.5        | 20.4          |
| Arrived in 2008 or 2009  | 18.0        | 19.5          |
| Arrived in 2010 or 2011  | 7.9         | 9.1           |
| Year of arrival not stated   | 3.7         | 3.5           |
| Total of observations  | 495 707     | 550 826       |

<sup>a</sup> Migrants aged between 15 and 65. <sup>b</sup> Income figures only for those migrants reporting income greater than zero. <sup>c</sup> Number of children information is only available for female migrants.

Source: Productivity Commission estimates using ABS *Australian Census and Migration Integrated Dataset*, Cat. no. 3417.0.55.001.

## Regression results

Results for the labour force participation and employment models are presented below (tables 1.3 and 1.4), followed by results from the ‘two-stage’ interval regression model for employment income (table 1.5).



**Table 1.3 Determinants of labour force participation and employment among male migrants**

Coefficients and marginal effects, probit models

|  | <i>Participation</i> |       |   |                              |       |   | <i>Employment</i> |       |   |                              |       |   |
|--|----------------------|-------|---|------------------------------|-------|---|-------------------|-------|---|------------------------------|-------|---|
|  | $\delta$             | SE    |   | <i>Marginal effect (ppt)</i> | SE    |   | $\delta$          | SE    |   | <i>Marginal effect (ppt)</i> | SE    |   |
| Age  | 0.227                | 0.002 | * | 0.634                        | 0.008 | * | 0.102             | 0.003 | * | 0.132                        | 0.008 | * |
| Age <sup>2</sup> /100                      | -2.927               | 0.024 |   |                              |       | * | -1.340            | 0.035 | * |                              |       |   |
| Married in a registered marriage           | 0.202                | 0.008 | * | 3.616                        | 0.155 | * | 0.239             | 0.010 | * | 2.902                        | 0.129 | * |
| Married in a de facto marriage             | 0.213                | 0.016 | * | 3.801                        | 0.274 | * | 0.140             | 0.018 | * | 1.815                        | 0.221 | * |
| Highest educational attainment             |                      |       |   |                              |       |   |                   |       |   |                              |       |   |
| Post Grad Degree/Grad Dip/Grad Cert.       | 0.251                | 0.013 | * | 4.437                        | 0.219 | * | 0.050             | 0.014 | * | 0.610                        | 0.175 | * |
| Bachelor Degree/Advanced Dipl./Dipl.       | 0.225                | 0.009 | * | 4.017                        | 0.170 | * | 0.107             | 0.012 | * | 1.256                        | 0.138 | * |
| Certificate III or IV                      | 0.256                | 0.013 | * | 4.511                        | 0.216 | * | 0.128             | 0.015 | * | 1.479                        | 0.169 | * |
| Year 11 or below                           | -0.225               | 0.009 | * | -4.738                       | 0.197 | * | -0.037            | 0.014 | * | -0.471                       | 0.176 | * |
| Not stated/inadequately described          | -0.202               | 0.012 | * | -4.204                       | 0.263 | * | 0.073             | 0.019 | * | 0.879                        | 0.222 | * |
| English proficiency                        |                      |       |   |                              |       |   |                   |       |   |                              |       |   |
| Speaks English very well or well           | -0.089               | 0.011 | * | -1.484                       | 0.183 | * | -0.059            | 0.014 | * | -0.656                       | 0.155 | * |
| Speaks English not very well or not at all | -0.451               | 0.014 | * | -8.573                       | 0.282 | * | -0.194            | 0.020 | * | -2.382                       | 0.247 | * |
| Not stated                                 | -0.109               | 0.039 | * | -1.841                       | 0.672 | * | -0.117            | 0.050 |   | -1.361                       | 0.629 |   |
| Visa type                                  |                      |       |   |                              |       |   |                   |       |   |                              |       |   |
| Employer sponsored                         | 0.209                | 0.016 | * | 1.085                        | 0.170 | * | 0.308             | 0.019 | * | 1.352                        | 0.124 | * |
| Business innovation and investment         | -0.210               | 0.026 | * | -3.722                       | 0.331 | * | 0.208             | 0.042 | * | 1.031                        | 0.236 | * |
| Other skilled                              | -0.008               | 0.028 |   | -0.136                       | 0.467 |   | -0.024            | 0.033 |   | -0.007                       | 0.336 |   |
| Partners                                   | -0.151               | 0.011 | * | -1.379                       | 0.166 | * | -0.237            | 0.013 | * | -2.070                       | 0.144 | * |
| Dependent children                         | -0.128               | 0.025 | * | -2.233                       | 0.848 | * | -0.214            | 0.037 | * | -1.846                       | 0.697 | * |
| Parent                                     | -0.196               | 0.115 |   | -1.355                       | 1.657 |   | -0.299            | 0.194 |   | -2.780                       | 2.184 |   |
| Contributory parent                        | -0.039               | 0.031 |   | 0.503                        | 0.422 |   | -0.013            | 0.048 |   | 0.443                        | 0.395 |   |
| Other family                               | -0.294               | 0.028 | * | -3.552                       | 0.408 | * | -0.212            | 0.035 | * | -1.821                       | 0.367 | * |
| Humanitarian                               | -0.726               | 0.014 | * | -11.926                      | 0.271 | * | -0.554            | 0.018 | * | -6.786                       | 0.262 | * |

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Table 1.3 (continued)

|  | Participation |       |   |                       |       | Employment |          |       |   |                       |       |   |
|--|---------------|-------|---|-----------------------|-------|------------|----------|-------|---|-----------------------|-------|---|
|  | $\delta$      | SE    |   | Marginal effect (ppt) | SE    |            | $\delta$ | SE    |   | Marginal effect (ppt) | SE    |   |
| Secondary applicant                      | -0.227        | 0.012 | * | -2.303                | 0.159 | *          | -0.242   | 0.014 | * | -2.309                | 0.140 |   |
| Interaction terms                        |               |       |   |                       |       |            |          |       |   |                       |       |   |
| Employer sponsored*Secondary             | -0.299        | 0.020 | * |                       |       |            | -0.385   | 0.026 | * |                       |       |   |
| Bus. innovation & investment*Secondary   | 0.000         | 0.031 |   |                       |       |            | -0.254   | 0.050 | * |                       |       |   |
| Other skilled*Secondary                  | -0.001        | 0.061 |   |                       |       |            | 0.070    | 0.076 |   |                       |       |   |
| Partners*Secondary                       | 0.171         | 0.020 | * |                       |       |            | 0.204    | 0.028 | * |                       |       |   |
| Dependent children*Secondary             | -0.005        | 0.113 |   |                       |       |            | 0.182    | 0.164 |   |                       |       |   |
| Parent*Secondary                         | 0.294         | 0.186 |   |                       |       |            | 0.242    | 0.278 |   |                       |       |   |
| Contributory parent*Secondary            | 0.167         | 0.050 | * |                       |       |            | 0.176    | 0.080 |   |                       |       |   |
| Other family*Secondary                   | 0.246         | 0.040 | * |                       |       |            | 0.179    | 0.057 | * |                       |       |   |
| Humanitarian*Secondary                   | 0.445         | 0.018 | * |                       |       |            | 0.303    | 0.026 | * |                       |       |   |
| Region of birth                          |               |       |   |                       |       |            |          |       |   |                       |       |   |
| Oceania (excl. Aust. and NZ)             | 0.125         | 0.024 | * | 2.128                 | 0.394 | *          | -0.010   | 0.029 |   | -0.118                | 0.346 |   |
| United Kingdom                           | 0.288         | 0.016 | * | 4.609                 | 0.253 | *          | 0.196    | 0.020 | * | 2.000                 | 0.202 | * |
| North-West Europe (excl. UK)             | 0.132         | 0.021 | * | 2.247                 | 0.344 | *          | 0.210    | 0.026 | * | 2.116                 | 0.243 | * |
| Southern and Eastern Europe              | 0.051         | 0.019 | * | 0.902                 | 0.322 | *          | 0.054    | 0.024 |   | 0.608                 | 0.264 |   |
| North Africa and the Middle East         | -0.294        | 0.012 | * | -5.822                | 0.241 | *          | -0.313   | 0.016 | * | -4.487                | 0.239 | * |
| China                                    | -0.229        | 0.011 | * | -4.440                | 0.221 | *          | -0.185   | 0.015 | * | -2.435                | 0.205 | * |
| North-East Asia (excl. China)            | -0.326        | 0.017 | * | -6.531                | 0.374 | *          | -0.259   | 0.024 | * | -3.585                | 0.368 | * |
| India                                    | 0.183         | 0.013 | * | 3.049                 | 0.209 | *          | 0.120    | 0.016 | * | 1.289                 | 0.168 | * |
| South and Central Asia (excl. India)     | 0.057         | 0.013 | * | 0.990                 | 0.220 | *          | -0.017   | 0.016 |   | -0.204                | 0.194 |   |
| North America                            | -0.036        | 0.025 |   | -0.646                | 0.448 |            | 0.033    | 0.030 |   | 0.373                 | 0.337 |   |
| South and Central America (incl. Carib.) | 0.189         | 0.027 | * | 3.139                 | 0.423 | *          | 0.027    | 0.029 |   | 0.312                 | 0.330 |   |
| Sub-Saharan Africa                       | 0.194         | 0.013 | * | 3.220                 | 0.214 | *          | 0.068    | 0.017 | * | 0.758                 | 0.189 | * |
| Not stated                               | 0.200         | 0.038 | * | 3.307                 | 0.582 | *          | 0.159    | 0.052 | * | 1.665                 | 0.490 | * |

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Table 1.3 (continued)

|   | Participation |       |   |                       |       |   | Employment |       |   |                       |       |   |
|---|---------------|-------|---|-----------------------|-------|---|------------|-------|---|-----------------------|-------|---|
|   | $\delta$      | SE    |   | Marginal effect (ppt) | SE    |   | $\delta$   | SE    |   | Marginal effect (ppt) | SE    |   |
| Offshore application  | -0.042        | 0.008 | * | -0.726                | 0.136 | * | -0.051     | 0.010 | * | -0.580                | 0.111 | * |
| State   |               |       |   |                       |       |   |            |       |   |                       |       |   |
| Victoria  | 0.038         | 0.008 | * | 0.670                 | 0.133 | * | -0.002     | 0.010 |   | -0.026                | 0.115 |   |
| Queensland  | 0.083         | 0.010 | * | 1.438                 | 0.175 | * | 0.002      | 0.013 |   | 0.024                 | 0.150 |   |
| South Australia   | -0.015        | 0.012 |   | -0.270                | 0.224 |   | -0.054     | 0.016 | * | -0.661                | 0.200 | * |
| Western Australia   | 0.164         | 0.010 | * | 2.772                 | 0.172 | * | 0.175      | 0.014 | * | 1.854                 | 0.139 | * |
| Tasmania  | -0.125        | 0.032 | * | -2.327                | 0.624 | * | -0.164     | 0.040 | * | -2.175                | 0.587 | * |
| Northern Territory  | 0.369         | 0.042 | * | 5.782                 | 0.578 | * | 0.328      | 0.058 | * | 3.141                 | 0.440 | * |
| Australian Capital Territory                                  | 0.178         | 0.027 | * | 2.979                 | 0.428 | * | 0.142      | 0.033 | * | 1.540                 | 0.325 | * |
| Other territories   | -0.683        | 0.154 | * | -15.021               | 3.995 | * | -0.363     | 0.409 |   | -5.429                | 7.448 |   |
| Index of relative socioeconomic disadvantage (divided by 100) | 0.065         | 0.004 | * | 1.126                 | 0.073 | * | 0.053      | 0.006 | * | 0.617                 | 0.064 | * |
| Year of arrival   |               |       |   |                       |       |   |            |       |   |                       |       |   |
| Arrived prior to 2000   | 0.435         | 0.017 | * | 8.242                 | 0.316 | * | 0.740      | 0.022 | * | 11.305                | 0.306 | * |
| Arrived in 2000 or 2001                                       | 0.412         | 0.013 | * | 7.865                 | 0.258 | * | 0.711      | 0.017 | * | 11.035                | 0.280 | * |
| Arrived in 2002 or 2003                                       | 0.431         | 0.013 | * | 8.193                 | 0.252 | * | 0.706      | 0.016 | * | 10.985                | 0.275 | * |
| Arrived in 2004 or 2005                                       | 0.427         | 0.012 | * | 8.114                 | 0.240 | * | 0.652      | 0.015 | * | 10.444                | 0.270 | * |
| Arrived in 2006 or 2007                                       | 0.408         | 0.012 | * | 7.799                 | 0.234 | * | 0.627      | 0.014 | * | 10.178                | 0.267 | * |
| Arrived in 2008 or 2009                                       | 0.274         | 0.011 | * | 5.480                 | 0.235 | * | 0.501      | 0.014 | * | 8.681                 | 0.270 | * |
| Year of arrival not stated                                    | -0.028        | 0.017 |   | -0.623                | 0.381 |   | 0.347      | 0.024 | * | 6.516                 | 0.411 | * |
| Constant  | -3.837        | 0.058 | * |                       |       |   | -1.379     | 0.078 | * |                       |       |   |
| Number of unweighted observations                             | 368 306       |       |   |                       |       |   | 304 107    |       |   |                       |       |   |
| Pseudo R <sup>2</sup>   | 0.317         |       |   |                       |       |   | 0.132      |       |   |                       |       |   |

<sup>a</sup> Probit model examines probability of employment among those participating in the labour force. Indicates significance at the one per cent level. **PPT** indicates percentage points. \* indicates significance at the 1 per cent level.

Source: Productivity Commission estimates using ABS Australian Census and Migration Integrated Dataset, Cat. no. 3417.0.55.001).

**Table 1.4 Determinants of labour force participation and employment among female migrants**

Coefficients and marginal effects, probit models

|  | <i>Participation</i> |       |   |                       |       |   | <i>Employment</i> |       |   |                       |       |   |
|--|----------------------|-------|---|-----------------------|-------|---|-------------------|-------|---|-----------------------|-------|---|
|  | $\delta$             | SE    |   | Marginal effect (ppt) | SE    |   | $\delta$          | SE    |   | Marginal effect (ppt) | SE    |   |
| Age  | 0.171                | 0.002 | * | 1.005                 | 0.010 | * | 0.087             | 0.003 | * | 0.232                 | 0.010 | * |
| Age <sup>2</sup> /100                      | -2.002               | 0.021 | * |                       |       |   | -1.073            | 0.037 | * |                       |       |   |
| Married in a registered marriage           | -0.074               | 0.006 | * | -2.183                | 0.190 | * | 0.094             | 0.010 | * | 1.519                 | 0.162 | * |
| Married in a de facto marriage             | 0.141                | 0.011 | * | 4.043                 | 0.324 | * | 0.134             | 0.017 | * | 2.117                 | 0.251 | * |
| Has children                               | -0.558               | 0.008 | * | -16.288               | 0.223 | * | -0.111            | 0.013 | * | -1.736                | 0.200 | * |
| Number of children                         | -0.111               | 0.003 | * | -3.293                | 0.092 | * | -0.044            | 0.005 | * | -0.700                | 0.085 | * |
| Highest educational attainment             |                      |       |   |                       |       |   |                   |       |   |                       |       |   |
| Post Grad Degree/Grad Dip/Grad Cert.       | 0.313                | 0.009 | * | 9.640                 | 0.263 | * | 0.032             | 0.013 |   | 0.526                 | 0.215 |   |
| Bachelor Degree/Advanced Dipl./Dipl.       | 0.238                | 0.006 | * | 7.406                 | 0.198 | * | 0.091             | 0.010 | * | 1.438                 | 0.168 | * |
| Certificate III or IV                      | 0.364                | 0.011 | * | 11.087                | 0.309 | * | 0.051             | 0.016 | * | 0.823                 | 0.255 | * |
| Year 11 or below                           | -0.201               | 0.008 | * | -6.558                | 0.249 | * | -0.064            | 0.014 | * | -1.108                | 0.240 | * |
| Not stated/inadequately described          | -0.012               | 0.010 |   | -0.391                | 0.321 |   | 0.091             | 0.018 | * | 1.431                 | 0.272 | * |
| English proficiency                        |                      |       |   |                       |       |   |                   |       |   |                       |       |   |
| Speaks English very well or well           | -0.042               | 0.008 | * | -1.255                | 0.228 | * | -0.085            | 0.012 | * | -1.286                | 0.178 | * |
| Speaks English not very well or not at all | -0.455               | 0.010 | * | -14.350               | 0.321 | * | -0.295            | 0.017 | * | -5.035                | 0.311 | * |
| Not stated                                 | -0.201               | 0.029 | * | -6.192                | 0.920 | * | -0.076            | 0.052 |   | -1.139                | 0.820 |   |
| Visa type                                  |                      |       |   |                       |       |   |                   |       |   |                       |       |   |
| Employer sponsored                         | 0.389                | 0.017 | * | 5.145                 | 0.261 | * | 0.449             | 0.027 | * | 2.722                 | 0.160 | * |
| Business innovation and investment         | -0.064               | 0.029 |   | -1.242                | 0.515 |   | 0.274             | 0.057 | * | 2.832                 | 0.328 | * |
| Other skilled                              | -0.027               | 0.028 |   | -0.034                | 0.662 |   | -0.036            | 0.040 |   | 0.859                 | 0.467 |   |
| Partners                                   | -0.455               | 0.008 | * | -8.713                | 0.241 | * | -0.310            | 0.012 | * | -2.676                | 0.200 | * |
| Dependent children                         | -0.334               | 0.025 | * | -8.568                | 1.373 | * | -0.260            | 0.042 | * | -3.603                | 1.411 |   |
| Parent                                     | -0.672               | 0.110 | * | -16.061               | 2.423 | * | -0.108            | 0.228 |   | -0.686                | 2.184 |   |
| Contributory parent                        | -0.329               | 0.028 | * | -7.383                | 0.649 | * | 0.000             | 0.051 |   | 1.233                 | 0.483 |   |
| Other family                               | -0.403               | 0.024 | * | -8.192                | 0.592 | * | -0.179            | 0.037 | * | -1.822                | 0.485 | * |
| Humanitarian                               | -0.598               | 0.016 | * | -15.244               | 0.375 | * | -0.487            | 0.027 | * | -6.949                | 0.408 | * |

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Table 1.4 (continued)

|  | Participation |       |   |                       |       |   | Employment |       |   |                       |       |   |
|--|---------------|-------|---|-----------------------|-------|---|------------|-------|---|-----------------------|-------|---|
|  | $\delta$      | SE    |   | Marginal effect (ppt) | SE    |   | $\delta$   | SE    |   | Marginal effect (ppt) | SE    |   |
| Secondary applicant                      | -0.296        | 0.009 | * | -4.183                | 0.222 | * | -0.294     | 0.013 | * | -2.619                | 0.187 | * |
| Interaction terms                        |               |       |   |                       |       |   |            |       |   |                       |       |   |
| Employer sponsored*Secondary             | -0.414        | 0.019 | * |                       |       |   | -0.409     | 0.030 | * |                       |       |   |
| Bus. innovation & investment*Secondary   | 0.049         | 0.032 |   |                       |       |   | -0.082     | 0.061 |   |                       |       |   |
| Other skilled*Secondary                  | 0.059         | 0.047 |   |                       |       |   | 0.231      | 0.075 | * |                       |       |   |
| Partners*Secondary                       | 0.408         | 0.017 | * |                       |       |   | 0.346      | 0.029 | * |                       |       |   |
| Dependent children*Secondary             | 0.116         | 0.103 |   |                       |       |   | 0.085      | 0.177 |   |                       |       |   |
| Parent*Secondary                         | 0.388         | 0.129 | * |                       |       |   | 0.138      | 0.265 |   |                       |       |   |
| Contributory parent*Secondary            | 0.198         | 0.036 | * |                       |       |   | 0.213      | 0.068 | * |                       |       |   |
| Other family*Secondary                   | 0.317         | 0.038 | * |                       |       |   | 0.137      | 0.061 |   |                       |       |   |
| Humanitarian*Secondary                   | 0.262         | 0.019 | * |                       |       |   | 0.238      | 0.032 | * |                       |       |   |
| Region of birth                          |               |       |   |                       |       |   |            |       |   |                       |       |   |
| Oceania (excl. Aust. and NZ)             | 0.115         | 0.016 | * | 3.410                 | 0.478 | * | -0.073     | 0.025 | * | -1.177                | 0.421 | * |
| United Kingdom                           | 0.259         | 0.011 | * | 7.509                 | 0.317 | * | 0.264      | 0.018 | * | 3.437                 | 0.224 | * |
| North-West Europe (excl. UK)             | 0.093         | 0.014 | * | 2.778                 | 0.407 | * | 0.191      | 0.023 | * | 2.598                 | 0.289 | * |
| Southern and Eastern Europe              | -0.001        | 0.012 |   | -0.037                | 0.374 |   | 0.010      | 0.020 |   | 0.151                 | 0.307 |   |
| North Africa and the Middle East         | -0.446        | 0.010 | * | -14.199               | 0.330 | * | -0.387     | 0.018 | * | -7.398                | 0.394 | * |
| China                                    | -0.149        | 0.008 | * | -4.618                | 0.249 | * | -0.139     | 0.013 | * | -2.312                | 0.217 | * |
| North-East Asia (excl. China)            | -0.538        | 0.011 | * | -17.180               | 0.353 | * | -0.200     | 0.020 | * | -3.461                | 0.368 | * |
| India                                    | 0.051         | 0.008 | * | 1.547                 | 0.253 | * | -0.104     | 0.013 | * | -1.707                | 0.215 | * |
| South and Central Asia (excl. India)     | -0.258        | 0.009 | * | -8.073                | 0.295 | * | -0.277     | 0.016 | * | -4.992                | 0.304 | * |
| North America                            | 0.053         | 0.017 | * | 1.583                 | 0.502 | * | 0.123      | 0.027 | * | 1.757                 | 0.368 | * |
| South and Central America (incl. Carib.) | 0.031         | 0.016 |   | 0.922                 | 0.496 |   | -0.069     | 0.025 | * | -1.107                | 0.407 | * |
| Sub-Saharan Africa                       | 0.192         | 0.009 | * | 5.642                 | 0.274 | * | 0.056      | 0.015 | * | 0.826                 | 0.226 | * |
| Not stated                               | 0.057         | 0.028 |   | 1.719                 | 0.831 |   | 0.117      | 0.047 |   | 1.671                 | 0.631 | * |

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Table 1.4 (continued)

|   | Participation |       |   |                       |       |   | Employment (a) |       |   |                        |       |
|---|---------------|-------|---|-----------------------|-------|---|----------------|-------|---|------------------------|-------|
|   | $\delta$      | SE    |   | Marginal effect (ppt) | SE    |   | $\delta$       | SE    |   | Marginal effect (ppts) | SE    |
| Offshore application  | -0.010        | 0.006 |   | -0.283                | 0.178 |   | -0.053         | 0.010 | * | -0.828                 | 0.149 |
| State   |               |       |   |                       |       |   |                |       |   |                        |       |
| Victoria  | 0.032         | 0.006 | * | 0.949                 | 0.169 | * | 0.011          | 0.009 |   | 0.177                  | 0.148 |
| Queensland  | 0.122         | 0.007 | * | 3.621                 | 0.211 | * | -0.004         | 0.011 |   | -0.073                 | 0.184 |
| South Australia   | 0.083         | 0.010 | * | 2.486                 | 0.285 | * | 0.028          | 0.015 |   | 0.449                  | 0.246 |
| Western Australia   | 0.092         | 0.008 | * | 2.740                 | 0.223 | * | 0.144          | 0.012 | * | 2.158                  | 0.180 |
| Tasmania  | 0.061         | 0.025 |   | 1.830                 | 0.751 |   | -0.090         | 0.039 |   | -1.541                 | 0.694 |
| Northern Territory  | 0.469         | 0.028 | * | 13.049                | 0.706 | * | 0.574          | 0.050 | * | 6.642                  | 0.381 |
| Australian Capital Territory                                  | 0.208         | 0.018 | * | 6.087                 | 0.506 | * | 0.219          | 0.029 | * | 3.152                  | 0.371 |
| Other territories   | 0.755         | 0.258 | * | 19.636                | 5.420 | * | 0.243          | 0.445 |   | 3.450                  | 5.390 |
| Index of relative socioeconomic disadvantage (divided by 100) | 0.055         | 0.003 | * | 1.620                 | 0.094 | * | 0.061          | 0.005 | * | 0.953                  | 0.081 |
| Year of arrival   |               |       |   |                       |       |   |                |       |   |                        |       |
| Arrived prior to 2000   | 0.528         | 0.013 | * | 16.149                | 0.395 | * | 0.931          | 0.022 | * | 19.139                 | 0.389 |
| Arrived in 2000 or 2001                                       | 0.511         | 0.010 | * | 15.641                | 0.309 | * | 0.923          | 0.016 | * | 19.038                 | 0.350 |
| Arrived in 2002 or 2003                                       | 0.484         | 0.010 | * | 14.876                | 0.295 | * | 0.888          | 0.015 | * | 18.615                 | 0.345 |
| Arrived in 2004 or 2005                                       | 0.449         | 0.009 | * | 13.853                | 0.281 | * | 0.801          | 0.014 | * | 17.475                 | 0.340 |
| Arrived in 2006 or 2007                                       | 0.395         | 0.009 | * | 12.264                | 0.268 | * | 0.716          | 0.013 | * | 16.239                 | 0.336 |
| Arrived in 2008 or 2009                                       | 0.285         | 0.008 | * | 8.944                 | 0.267 | * | 0.556          | 0.013 | * | 13.505                 | 0.338 |
| Year of arrival not stated                                    | 0.147         | 0.015 | * | 4.660                 | 0.461 | * | 0.467          | 0.023 | * | 11.768                 | 0.526 |
| Constant  | -3.068        | 0.045 | * |                       |       |   | -1.304         | 0.074 | * |                        |       |
| Number of unweighted observations                             | 427 329       |       |   |                       |       |   | 266 579        |       |   |                        |       |
| Pseudo R <sup>2</sup>   | 0.250         |       |   |                       |       |   | 0.180          |       |   |                        |       |

<sup>a</sup> Probit model examines probability of employment among those participating in the labour force. Indicates significance at the one per cent level. **PPT** indicates percentage points. \* indicates significance at the 1 per cent level.

Source: Productivity Commission estimates using ABS *Australian Census and Migration Integrated Dataset*, Cat. no. 3417.0.55.001).



**Table 1.5 Determinants of weekly personal income among male and female migrants**  
Interval regression with sample selection equation, logarithm of income ranges as dependent variables

|  | <i>Male</i> |        | <i>Female</i> |        |
|--|-------------|--------|---------------|--------|
|  | $\beta$     | SE     | $\beta$       | SE     |
| Age  | 0.136       | 0.002* | 0.073         | 0.001* |
| Age <sup>2</sup>                             | -0.161      | 0.002* | -0.086        | 0.002* |
| Marital status                               |             |        |               |        |
| Married in a registered marriage             | 0.092       | 0.003* | -0.003        | 0.003  |
| Married in a de facto marriage               | 0.068       | 0.005* | 0.053         | 0.005* |
| Highest educational attainment               |             |        |               |        |
| Post Grad Degree/Grad Dip/Grad Certificate   | 0.228       | 0.005* | 0.155         | 0.005* |
| Bachelor Degree/Advanced Diploma/Diploma     | 0.173       | 0.004* | 0.091         | 0.004* |
| Certificate III or IV                        | 0.075       | 0.004* | -0.042        | 0.006* |
| Year 11 or below                             | -0.063      | 0.006* | -0.029        | 0.006* |
| Not stated/inadequately described            | 0.049       | 0.006* | 0.029         | 0.007* |
| English proficiency                          |             |        |               |        |
| Speaks English very well or well             | -0.090      | 0.004* | -0.014        | 0.004* |
| Speaks English not very well or not at all   | -0.228      | 0.007* | 0.030         | 0.008* |
| Not stated                                   | -0.170      | 0.017* | 0.021         | 0.019  |
| Visa type                                    |             |        |               |        |
| Employer sponsored                           | 0.170       | 0.004* | 0.154         | 0.005* |
| Business innovation and investment           | -0.227      | 0.013* | -0.206        | 0.019* |
| Other skilled                                | -0.106      | 0.008* | -0.093        | 0.010* |
| Partners                                     | -0.122      | 0.004* | -0.026        | 0.004* |
| Dependent children                           | 0.023       | 0.015  | 0.027         | 0.015  |
| Parent                                       | -0.017      | 0.077  | 0.328         | 0.083* |
| Contributory parent                          | -0.064      | 0.018* | 0.076         | 0.023* |
| Other family                                 | -0.198      | 0.011* | -0.008        | 0.012  |
| Humanitarian                                 | -0.197      | 0.009* | 0.072         | 0.012* |
| Secondary applicant                          | -0.181      | 0.004* | -0.104        | 0.005* |
| Interaction terms                            |             |        |               |        |
| Employer sponsored*Secondary                 | -0.233      | 0.007* | -0.144        | 0.007* |
| Business innovation and investment*Secondary | 0.153       | 0.018* | 0.180         | 0.021* |
| Other skilled*Secondary                      | 0.063       | 0.019* | 0.048         | 0.024  |
| Partners*Secondary                           | 0.271       | 0.011* | 0.087         | 0.012* |
| Dependent children*Secondary                 | 0.115       | 0.085  | 0.069         | 0.067  |
| Parent*Secondary                             | 0.142       | 0.097  | -0.106        | 0.097  |
| Contributory parent*Secondary                | 0.190       | 0.032* | 0.093         | 0.030* |
| Other family*Secondary                       | 0.355       | 0.021* | 0.126         | 0.023* |
| Humanitarian*Secondary                       | 0.313       | 0.011* | 0.126         | 0.015* |

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Table 1.5 (continued)

|  | <i>Male</i> |        | <i>Female</i> |        |
|--|-------------|--------|---------------|--------|
|  | $\beta$     | SE     | $\beta$       | SE     |
| Region of birth  |             |        |               |        |
| Oceania (excl. Aust. and NZ)                                     | 0.107       | 0.008* | 0.094         | 0.008* |
| United Kingdom   | 0.218       | 0.005* | -0.036        | 0.006* |
| North-West Europe (excl. UK)                                     | 0.218       | 0.006* | -0.022        | 0.007* |
| Southern and Eastern Europe                                      | 0.105       | 0.007* | -0.038        | 0.007* |
| North Africa and the Middle East                                 | -0.087      | 0.006* | 0.075         | 0.009* |
| China  | -0.188      | 0.005* | -0.101        | 0.004* |
| North-East Asia (excl. China)                                    | -0.237      | 0.008* | -0.129        | 0.007* |
| India  | 0.012       | 0.004* | 0.030         | 0.004* |
| South and Central Asia (excl. India)                             | -0.045      | 0.005* | 0.041         | 0.006* |
| North America  | 0.110       | 0.009* | 0.039         | 0.009* |
| South and Central America (incl. Caribbean)                      | 0.075       | 0.008* | -0.026        | 0.009* |
| Sub-Saharan Africa   | 0.176       | 0.005* | 0.014         | 0.005* |
| Not stated   | 0.057       | 0.017* | -0.045        | 0.019  |
| Offshore application   | 0.004       | 0.003  | 0.000         | 0.003  |
| State  |             |        |               |        |
| Victoria   | -0.056      | 0.003* | -0.071        | 0.003* |
| Queensland   | -0.047      | 0.004* | -0.095        | 0.004* |
| South Australia  | -0.118      | 0.005* | -0.129        | 0.005* |
| Western Australia  | 0.095       | 0.004* | -0.054        | 0.004* |
| Tasmania   | -0.183      | 0.013* | -0.187        | 0.015* |
| Northern Territory   | 0.048       | 0.011* | -0.030        | 0.011* |
| Australian Capital Territory                                     | -0.044      | 0.008* | -0.032        | 0.009* |
| Other territories  | 0.118       | 0.118  | -0.026        | 0.178  |
| Occupation   |             |        |               |        |
| Professionals  | 0.062       | 0.004* | 0.004         | 0.006  |
| Technicians and Trades Workers                                   | -0.291      | 0.004* | -0.427        | 0.008* |
| Community And Personal Service Workers                           | -0.538      | 0.006* | -0.594        | 0.006* |
| Clerical And Administrative Workers                              | -0.236      | 0.005* | -0.261        | 0.006* |
| Sales Workers  | -0.529      | 0.006* | -0.667        | 0.007* |
| Machinery Operators and Drivers                                  | -0.419      | 0.005* | -0.375        | 0.011* |
| Labourers  | -0.513      | 0.005* | -0.577        | 0.007* |
| Not stated or inadequately described                             | -0.300      | 0.009* | -0.346        | 0.012* |
| Index of relative socioeconomic disadvantage<br>(divided by 100) | 0.081       | 0.002* | 0.030         | 0.002* |

(continued next page)

**Table 1.5** (continued)

|                                       | <i>Male</i> |           | <i>Female</i> |           |
|---------------------------------------|-------------|-----------|---------------|-----------|
|                                       | $\beta$     | <i>SE</i> | $\beta$       | <i>SE</i> |
| Year of arrival                       |             |           |               |           |
| Arrived prior to 2000                 | 0.101       | 0.008*    | -0.069        | 0.009*    |
| Arrived in 2000 or 2001               | 0.098       | 0.007*    | -0.096        | 0.007*    |
| Arrived in 2002 or 2003               | 0.088       | 0.007*    | -0.100        | 0.007*    |
| Arrived in 2004 or 2005               | 0.086       | 0.006*    | -0.102        | 0.007*    |
| Arrived in 2006 or 2007               | 0.071       | 0.006*    | -0.097        | 0.007*    |
| Arrived in 2008 or 2009               | 0.007       | 0.006     | -0.111        | 0.006*    |
| Year of arrival not stated            | 0.019       | 0.009     | -0.020        | 0.010     |
| Inverse Mills Ratio                   | 0.105       | 0.018*    | -0.472        | 0.009*    |
| Constant                              | 3.422       | 0.051*    | 5.446         | 0.035*    |
| Number of unweighted observations     | 275 574     |           | 232 387       |           |
| Number of right-censored observations | 43 333      |           | 11 590        |           |
| Log pseudolikelihood                  | - 753 038   |           | - 675 301     |           |

<sup>a</sup> Probit model examines probability of employment among those participating in the labour force. Indicates significance at the one per cent level. **PPT** indicates percentage points. \* indicates significance at the 1 per cent level.

Source: Productivity Commission estimates using ABS *Australian Census and Migration Integrated Dataset*, Cat. no. 3417.0.55.001).

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## Attachment 2 — Partial sensitivity analysis

Partial sensitivity analysis has been undertaken to explore how sensitive the partial equilibrium results are to particular parameters. For partial sensitivity analysis, subsets of parameters outlined in table C.5 above have been varied using distributions presented in that table. Related parameters are grouped in subsets. Other parameters in table C.5 have been held at their central values. Seven tests were undertaken in this analysis using the following subsets of parameters.

1. Parameters related to currently ineligible migrants:
  - (a) additional demand
  - (b) proportion of additional demand among ineligible migrants
  - (c) age profile of ineligible migrants.
2. Parameters related to the costs of migrating:
  - (a) migration agent fees
  - (b) transport costs.
3. Discount rates:
  - (a) private discount rates
  - (b) the social discount rate.
4. Willingness to pay uplift.
5. Labour market outcomes:
  - (a) participation rates
  - (b) income Australians expect to earn in the future
  - (c) income a migrant would expect to earn in Australia
  - (d) income a migrant would expect to earn in their source country.
6. Future skill of child migrants.
7. Government expenditure per person.

Partial sensitivity analysis has been undertaken for the specific price-based proposal explored above. Results for each of the seven tests outlined above are presented alongside results for the price-based proposal. Key results on the composition of Australia's migrant intake by type, stream, skill and age are presented. These results illustrate the effects of varying particular types of parameters in the full sensitivity analysis. Partial sensitivity analysis suggests that projected changes in:

- the number of primary applicants are most sensitive to the discount rate used (test 3), indicated by the range of results being much narrower than for the price-based proposal for all tests except for test 3. This is because many primary applicants are aged 25-34 years and have long remaining working lives so the private (individual) discount

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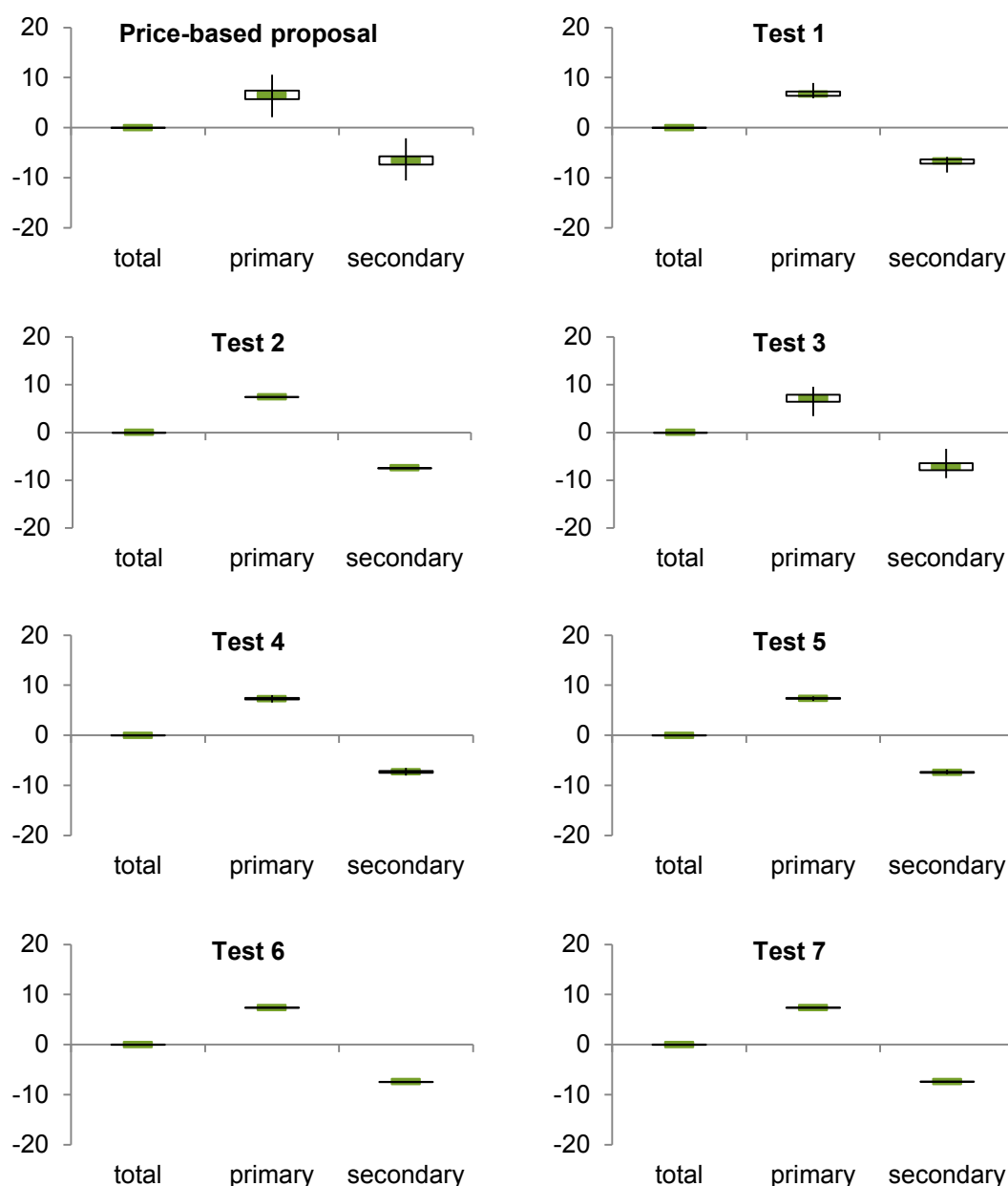
rate used has a large impact on their willingness to pay for Australian visas, both for themselves and their families (secondary applicants). The median projected increase in the number of primary applicants (and offsetting decrease in secondary applicants) is similar to the price-based proposal for each of the seven tests (figure 2.1)

- the stream composition is unsurprisingly most sensitive to parameters related to currently ineligible migrants (test 1), indicated by the range of results being much narrower than for the price-based proposal for all tests except for test 1. Projected median changes are similar for each test (figure 2.2)
- the skill composition is most sensitive to parameters related to ineligible migrants (test 1), the future skill level of child migrants (test 6) and to a lesser extent discount rates (test 3). The skill composition is sensitive to the parametrisation of currently ineligible migrants because the skill profile of ineligible migrants is based on the skill profile in their region of origin rather than the skill profile of recent immigrants (which is the case for parameterising current visa categories) (figure 2.3)
- the age composition is most sensitive to parameters related to currently ineligible migrants (test 1) and to a lesser extent discount rates used (test 3), indicated by the range of results being much narrower than for the price-based proposal for all tests except for tests 1 and 3. Changes by age are sensitive to parameters related to currently ineligible migrants because one such parameter relates to the age distribution of ineligible migrants and the range for the distribution used is large. Changes in age composition are sensitive to the discount rate used because many migrants are aged 25–34 years and have long remaining working lives, so the private (individual) discount rate used has a large impact on their willingness to pay. If discount rates are high then these migrants are more likely to be displaced by older migrants. Projected median changes are similar for each test (figure 2.4).

Overall, this partial sensitivity analysis suggests that results are most sensitive to parameters related to currently ineligible migrants (test 1), discount rates (test 3) and the future skill of child migrants (test 6). The projected composition of the migrant intake does not change much if parameters related to the costs of migrating (test 2) and labour market outcomes (test 5) or the willingness to pay uplift are varied in isolation. However, these three parameters influence willingness to pay and will impact on charge revenue raised and the net fiscal impact of alternative immigration policies. Varying government expenditure estimates in isolation (test 7) would also influence the net fiscal impact.

Figure 2.1 **Partial sensitivity analysis, composition by type of applicant<sup>a</sup>**

Change in number of immigrants (000s), price-based proposal relative to current arrangements

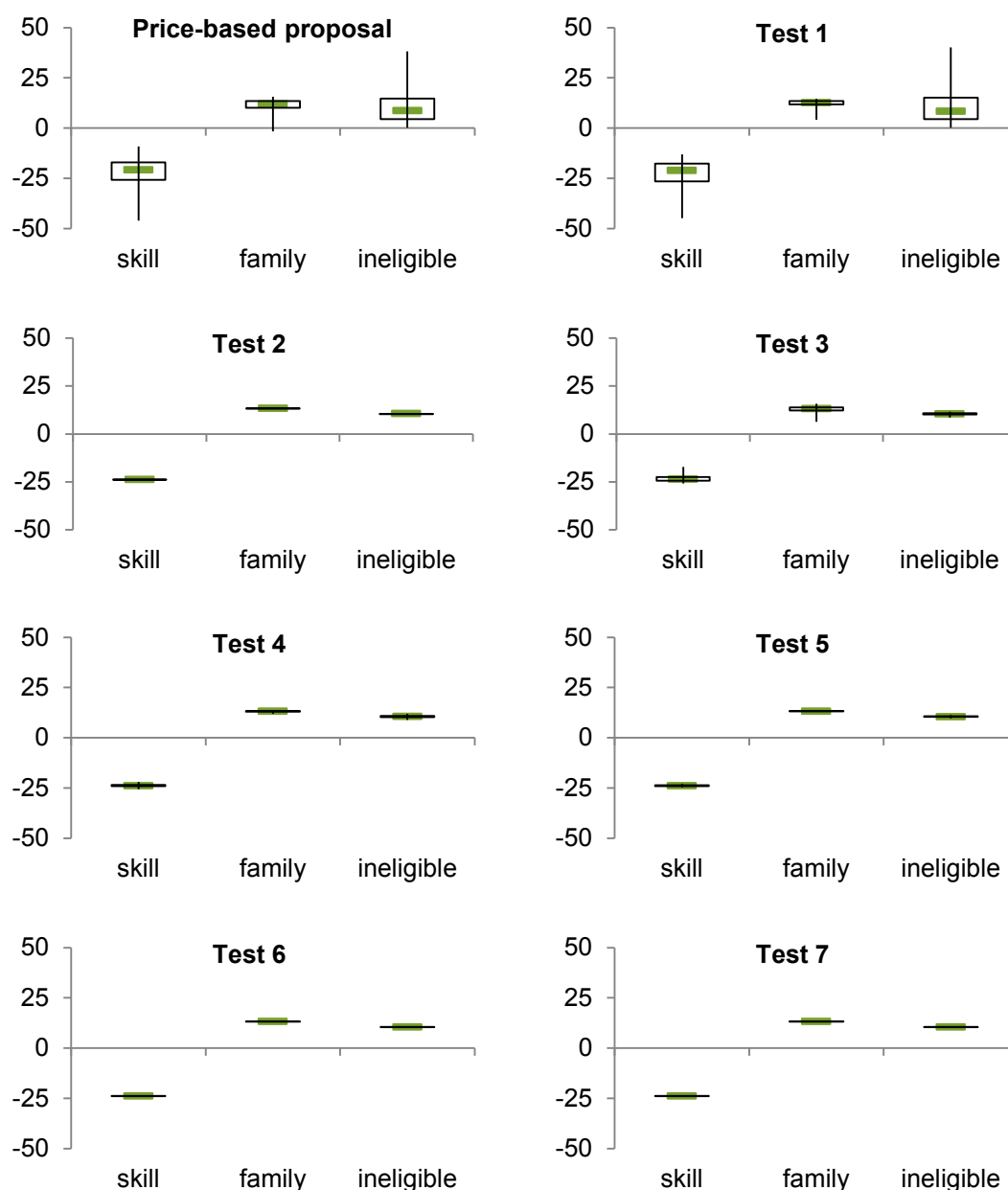


<sup>a</sup> The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. The box plot tails show the minimum and maximum of all the runs, the box shows the interquartile range (quartiles 1 and 3). The large dash represents the median.

Source: Productivity Commission estimates.

**Figure 2.2 Partial sensitivity analysis, stream composition<sup>a</sup>**

Change in number of immigrants (000s), price-based proposal relative to current arrangements

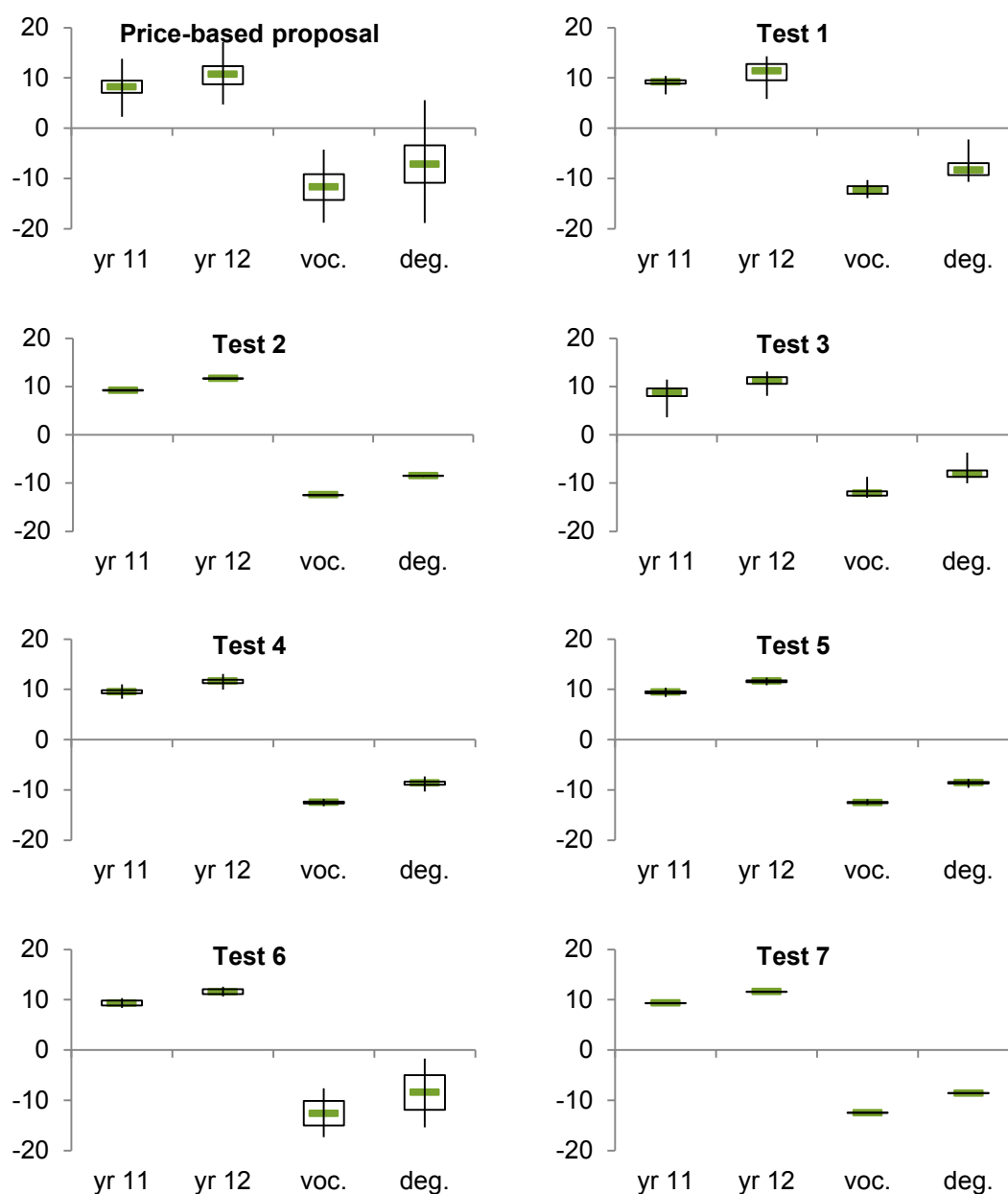


<sup>a</sup> The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. The box plot tails show the minimum and maximum of all the runs, the box shows the interquartile range (quartiles 1 and 3). The large dash represents the median.

Source: Productivity Commission estimates.

Figure 2.3 **Partial sensitivity analysis, skill composition<sup>a,b</sup>**

Change in number of immigrants (000s), price-based proposal relative to current arrangements

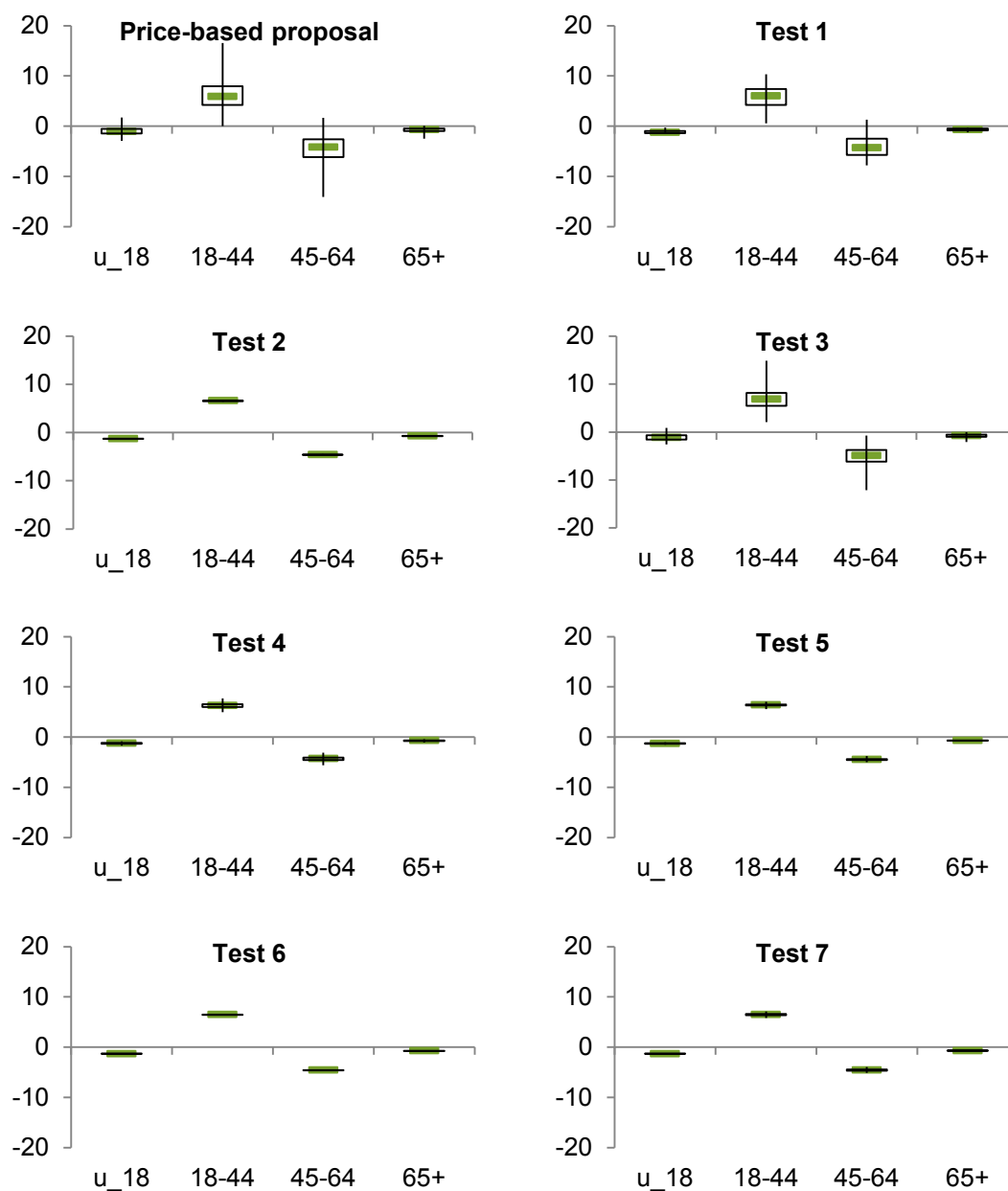


<sup>a</sup> The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. The box plot tails show the minimum and maximum of all the runs, the box shows the interquartile range (quartiles 1 and 3). The large dash represents the median. <sup>b</sup> 'voc.' = vocational education, 'deg.' = degree or higher.

Source: Productivity Commission estimates.

**Figure 2.4 Partial sensitivity analysis, age composition<sup>a,b</sup>**

Change in number of immigrants (000s), price-based proposal relative to current arrangements



<sup>a</sup> The chart shows box plots of the distribution of each measure from 1000 sensitivity model runs, varying parameters in the model using Monte Carlo selections from distributions outlined in table C.5. 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. <sup>b</sup> 'u\_18' = aged under 18 upon arrival, '18-44' = aged 18–44 years upon arrival, '45-64' = aged 45–64 years upon arrival, 'a4' = aged 65 or older upon arrival.

Source: Productivity Commission estimates.



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## Attachment 3 — Mathematics of the model

This appendix illustrates the mathematics behind the partial equilibrium model and goes through the mathematics for the price-based proposal. The model has a demand–supply framework where there is a separate market for permanent Australian visas for different types of potential migrants. In the model, migrants are categorised by their region of origin, visa subclass, skill level (based on highest educational attainment) and age. In this appendix, different types of migrants are denoted by  $i$  for simplicity (a total of  $N$  types). For each type of migrant there is a demand curve (representing willingness to pay for the benefits of migrating to Australia) and a supply curve (representing costs of migrating). In the price-based proposal, visas are allocated to migrants based on highest willingness to pay, subject to a single quota across all markets of 190 000 permanent immigrants (primary and secondary applicants). The model is solved by maximising the objective function, which represents migrants' surplus, subject to four sets of constraints:

The objective function represents the total surplus to immigrants who migrate to Australia where:

- $aD_i$  is the maximum benefits from migrating to Australia for a particular type of migrant (y-intercept)
- $bD_i$  is the slope of the demand curve
- $XD_i$  is demand for visas
- $XS_i$  is supply of visas
- $mc_i$  is a migrant's private migration cost (assumed to be constant for a particular type of migrant so supply curves are flat)
- $sp_i$  represents the secondary-to-primary applicant ratio for a particular type of migrant.

$$\text{Objective function} = \sum_i^N (aD_i + \frac{1}{2} bD_i XD_i) XD_i - mc_i XS_i$$

There is a series of demand–supply balance constraints:

$$\text{Constraint set 1: } XS_i - XD_i \geq 0.$$

There is an overall quota:

$$\text{Constraint 2: } Quota \geq \sum_i^N (1 + sp_i) XD_i.$$

Demand and supply in each market must be non-negative:

$$\text{Constraint set 3: } XD_i \geq 0, \text{Constraint set 4: } XS_i \geq 0$$

The maximisation problem can be setup using the method of Lagrange multipliers where lambda terms represent various Lagrange multipliers:

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$$L(XD, XS, \lambda) = \left[ \sum_i^N \left( aD_i + \frac{1}{2} bD_i XD_i \right) XD_i - mc_i XS_i \right] + \lambda_1 (XS_i - XD_i) + \lambda_2 (Quota - \sum_i^n (1 + sp_i) XD_i) + \lambda_{3i} XD_i + \lambda_{4i} XS_i$$

There are a number of groups of first order conditions. The first group corresponds to first order conditions with respect to demand for visas (total of N conditions):

$$FOC1i (XD_i): aD_i + bD_i XD_i - \lambda_{1i} - \lambda_2 (1 + sp_i) + \lambda_{3i} = 0; \quad XD_i \geq 0; \quad FOC1i \quad XD_i = 0.$$

The second group corresponds to first order conditions with respect to supply of visas (total of N conditions):

$$FOC2i (XS_i): -mc_i + \lambda_{1i} + \lambda_{4i} = 0; \quad XS_i \geq 0; \quad FOC2i \quad XS_i = 0.$$

The third group relates to the Lagrange multipliers for demand–supply balance constraints (total of N conditions):

$$FOC3i (\lambda_{1i}): XS_i - XD_i \geq 0; \quad \lambda_{1i} \geq 0; \quad FOC3i \quad \lambda_{1i} = 0.$$

The following first order condition is a single condition relating to the Lagrange multipliers for the overall quota, where the Lagrange multiplier represents the charge:

$$FOC4 (\lambda_2): Quota - \sum_i^n (1 + sp_i) XD_i \geq 0; \quad \lambda_2 \geq 0; \quad FOC4 \quad \lambda_2 = 0.$$

The fifth and sixth groups of constraints relate to the Lagrange multipliers for non-negativity constraints which ensure demand and supply in each market is non-negative (a total of N conditions):

$$\begin{aligned} FOC5i (\lambda_{3i}): XD_i \geq 0; & \quad \lambda_{3i} \geq 0; \quad FOC5 \quad \lambda_{3i} = 0. \\ FOC6i (\lambda_{4i}): XS_i \geq 0; & \quad \lambda_{4i} \geq 0; \quad FOC6 \quad \lambda_{4i} = 0. \end{aligned}$$

A simple example follows which explores how visas would be allocated under the price-based proposal with different quotas.

## Simple example

In this example there are two types of migrants (types A and B). Visas are allocated to migrants with the highest willingness to pay, subject to an overall quota. The characteristics of these migrants are outlined in table 2.1. For simplicity it has been assumed the ratio of secondary to primary applicants is one for each type of migrant (that is, each primary applicant would bring one secondary applicant).

**Table 2.1 Characteristics of types A and B migrants**

|        | $aD_i$   | $bD_i$ | $mc_i$   | $sp_i$ |
|--------|----------|--------|----------|--------|
| Units  | (\$000s) |        | (\$000s) |        |
| Type A | 170      | -1     | 20       | 1      |
| Type B | 140      | -1     | 40       | 1      |

Two different cases are presented to illustrate the effect of different quotas.<sup>28</sup>

### Case 1 — there is demand from both types of migrants

Drawing on the first order conditions outlined above, if demand is positive among both types of migrants then Lagrange multipliers for non-negativity constraints will equal zero.

$$\text{If } XD_A, XD_B > 0 \rightarrow \lambda_{3A}, \lambda_{3B}, \lambda_{4A}, \lambda_{4B} = 0.$$

This also simplifies the first group of first order conditions:

$$FOC1_i: aD_i + bD_iXD_i - \lambda_{1i} - \lambda_2(1 + sp_i) + \lambda_{3i} = 0$$

$$FOC1_A: 170 - XD_A - \lambda_{1A} - 2\lambda_2 = 0$$

$$FOC1_B: 140 - XD_B - \lambda_{1B} - 2\lambda_2 = 0.$$

This also simplifies the second group of first order conditions:

$$FOC2_i: -mc_i + \lambda_{1i} + \lambda_{4i} = 0; FOC2_A: mc_A = \lambda_{1A} = 20; FOC2_B: mc_B = \lambda_{1B} = 40.$$

Since the Lagrange multipliers on the demand–supply balance constraints are positive then demand equals supply in each market. Presuming that the quota is set to be binding then:

$$FOC4 (\lambda_2): Quota - \sum_i^n (1 + sp_i) XD_i \geq 0; Quota = 2(XD_A + XD_B).$$

The second group of first order conditions can be substituted into the first group which leaves three equations and three unknown variables.

$$FOC1_A: 170 - XD_A - 20 - 2\lambda_2 = 0 \rightarrow XD_A = 150 - 2\lambda_2.$$

$$FOC1_B: 140 - XD_B - 40 - 2\lambda_2 = 0 \rightarrow XD_B = 100 - 2\lambda_2.$$

$$Quota = 2(XD_A + XD_B).$$

Drawing on these three equations the charge ( $\lambda_2$ ) can be expressed in terms of the quota:

<sup>28</sup> There is a third case where demand is zero for both types of migrants when the quota is zero.

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$$Quota = 2(150 - 2\lambda_2 + 100 - 2\lambda_2) = 2(250 - 4\lambda_2) \rightarrow \lambda_2 = \frac{1}{4}(250 - \frac{Quota}{2}).$$

The charge is non-negative. In this example, if the quota is 500 then the charge will be zero. In this example, if the quota is:

- 400 000 annually then the charge would be \$12 500 per applicant
- 300 000 annually then the charge would be \$25 000 per applicant
- 200 000 annually then the charge would be \$37 000 per applicant
- 100 000 annually then the charge would be \$50 000 per applicant.

A quota of 500 000 or larger will not bind (and the charge will be zero for any larger quota).

There is a charge which would be prohibitively expensive for each type of migrant. In this example:

- there is no demand among type A migrants if the charge is \$75 000 or greater per applicant
- there is no demand among type B migrants if the charge is \$50 000 or greater per applicant

As noted above, a charge of \$50 000 per applicant would result from a quota of 100 in this example.

## Case 2 — there is only demand among type A migrants

The expression for the charge is simpler if there is only demand among type A migrants (quota is less than 100):

$$XD_A > 0 \rightarrow \lambda_{3A}, \lambda_{4A} = 0 \rightarrow FOC1_A: 170 - XD_A - \lambda_{1A} - 2\lambda_2 = 0; FOC2_A: mc_A = \lambda_{1A} = 20; \rightarrow FOC1_A: 150 - 2\lambda_2 = XD_A; Quota = 2XD_A; \rightarrow \lambda_2 = \frac{1}{2}(150 - \frac{Quota}{2}).$$

For type B migrants, Lagrange multipliers on the non-negative constraints will be positive. The first order conditions for type B migrants are as follows:

$$FOC1_B: aD_B - \lambda_{1B} - 2\lambda_2 + \lambda_{3B} = 0; FOC2_B: -mc_B + \lambda_{1B} + \lambda_{4B} = 0.$$

These two first order conditions imply that there is a net cost for all type B migrants from migrating to Australia:

$$aD_B - mc_B - 2\lambda_2 = -(\lambda_{3B} + \lambda_{4B}) < 0.$$

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Therefore for this example the expression for the charge depends on the size of the quota:

*for*  $Quota \geq 500$ ,  $\lambda_2 = 0$ ;

*for*  $100 < Quota < 500$ ,  $\lambda_2 = \frac{1}{4} (250 - \frac{Quota}{2})$ ;

*for*  $Quota \leq 100$ ,  $\lambda_2 = \frac{1}{2} (150 - \frac{Quota}{2})$ .

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