14 December 2021

Budget Policy Division
The Treasury
Langton Crescent
PARKES ACT 2600
Via email: Prebudgetsubs@treasury.gov.au

Dear Treasury,

FRINGE BENEFITS TAX (FBT) – Pre-Budget Submission FY22/23

The Australian Hotels Association (AHA) proposes structural reform of Fringe Benefit Tax (FBT) as set out below.

> The AHA recommends the Government enable all taxpayers who carry on a business (as per EY scenario 1):
>
> - Be allowed to claim a tax deduction and GST inputs on meal and beverage entertainment
> - Together with allowing a credit for the related GST and not requiring any FBT for the business owner or their employees.

In the EY modelling **attached**, the AHA supports exempting all businesses as per Scenario 1. The potential direct costs are estimated by EY to range from $171m to $286m (report attached), but would deliver the following positive impacts over three years:

- Impact on GDP – ranging from $539m to $850m
- Impact on employment FTE – ranging from 3,844 to 4,230
- GDP per dollar of cost to government – ranging from $1.89 to $3.25

Fairness

The current structure of FBT:

- Stifles expenditure in hospitality businesses, thus suppressing employment in the hospitality and accommodation sectors – sectors hard hit by COVID
- Is unfair and favours large scale sophisticated employers at the expense of smaller employers.

At the expense of smaller businesses, FBT favours large scale businesses which have had the:

- Expertise to devise work arounds aimed at defeating the intent of the FBT scheme
- Scale and financial ability to re-develop their business premises as first-class hospitality venues

The arguments against suspending FBT are often based on the "equity principle". Unfortunately, the equity principle of FBT has been circumvented largely by those who it was intended to capture. Many large-scale firms provide employee benefits 'in house' which would otherwise attract FBT, e.g.,

- Board room lunches
- Baristas
- Car parking

This circumvention gives those firms with the scale to avoid FBT an unfair advantage over smaller to medium enterprises which do not have the required scale or capacity.

Stimulus

Exempting businesses and workers from FBT on meals, entertainment and accommodation will provide a much-needed stimulus creating instant jobs to a sector hard-hit by the pandemic. Exempting all business from FBT will increase the number of functions and events held in hospitality businesses. This will:

- Enable employers to provide more hours and more stable employment
- Increase GDP
- Remove the current inequity between businesses of different size

The hospitality and accommodation sectors play a vital role in providing jobs, especially to females and younger Australians. Females comprise 60% of the hospitality workforce, and persons aged under 24 years comprise 36%.

Yours faithfully,

STEPHEN FERGUSON
NATIONAL CEO

Economic impacts of stimulus for the Accommodation and Food Services Sector

Report to the Australian Hotels Association

3 December 2021

EY

Building a better
working world

1.   Introduction

In June 2020, Ernst & Young (EY) was engaged by the Australian Hotels Association (AHA) to provide an assessment of the potential economic impacts of select stimulus measures on the Accommodation and Food Services (AFS) sector in Australia during the COVID-19 global pandemic. The results of EY's work, including the assumptions and qualifications made in preparing the report, are set out in EY's report dated 20 July 2020. That work commenced on 10 June 2020 and was completed on 20 July 2020.

The July 2020 report assessed the potential economic impacts of selected stimulus measures aimed at the AFS sector during the COVID-19 economic downturn. At that time, two potential options to support the sector through the crisis were proposed by AHA:

  ▸ Suspending Fringe Benefits Tax (FBT) on meal entertainment expenditure for three years.

  ▸ Extending the Job Keeper support program for a period of six-months, from October 2020 to March 2021.

In December 2021, EY was reengaged by AHA to provide a summary of our July 2020 findings with regard to fringe benefit tax suspension, including the framework, including data and assumptions.

In this paper, two scenarios are considered:

  ▸ **Scenario 1:** examines a three-year suspension of FBT expenses for meal entertainment prescribed for *all* businesses in the sector over the period 2020/21 to 2022/23.

  ▸ **Scenario 2:** examines a three-year suspension of FBT expenses for meal entertainment prescribed for small to medium enterprises (SMEs) in the sector over the period 2020/21 to 2022/23, where an SME is defined as any business with an annual turnover less than $50 million.[1]

The results of this analysis are presented below.

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[1] Following the convention adopted in the Prosperity Advisers report "FBT on Meal Entertainment Hospitality Reignition Study for the AHA", 29/05/2020.

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2. Analysis of the AFS sector and the proposed FBT suspension

Australia's AFS sector comprises a wide range of businesses, including accommodation services such as hotels, motels and serviced apartments, as well as restaurants, cafés, takeaways, pubs, bars and clubs. The sector is large and makes a significant contribution to the Australian economy. In the year ending June 2019, the AFS industry directly contributed an estimated $43 billion of gross value added[2] and in the year ending June 2020 directly employed around 900,000 people and 800,000 in the food and beverage services industry.[3]

Fringe benefits and the AFS sector

A fringe benefit is defined[4] by the Australian Taxation Office as the provision of a benefit to an employee in a form other than salary or wages. The tax base of Fringe Benefits Tax with respect to meal entertainment is defined[5] as follows:

▸ providing entertainment by way of food or drink

▸ providing accommodation or travel connected with such entertainment, or

▸ paying or reimbursing expenses incurred in obtaining something covered by the above points.

Table 1 shows the taxable value on which FBT were calculated in aggregate for Australia, as well as for meal entertainment. In 2017/18 the taxable value of meal entertainment was $397 million out of a total fringe benefits taxable amount of $8,356 million representing 4.75% of the total.

Although meal entertainment forms a relatively small portion of the total fringe benefits taxable value (which also includes items such as company cars) the taxable amount for meals (which represents the dollar value of expenses subject to FBT) is not insignificant and is close to $400 million.

Table 1: Fringe benefits and meal entertainment taxable values, 2009/10-2017/18[6]		
	Total fringe benefits taxable amount	Meal entertainment - Gross taxable value
2009/10	$7,625	$339
2010/11	$7,951	$386
2011/12	$8,050	$398
2012/13	$8,677	$371
2013/14	$9,117	$359
2014/15	$9,155	$368
2015/16	$9,146	$375
2016/17	$8,767	$394
2017/18	$8,356	$397

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[2] Source: Australian Bureau of Statistics, 5204.0 - Australian System of National Accounts 2018-19, 'Table 5: Gross Value Added (GVA) by Industry', https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5249.0Main+Features12018-19?OpenDocument. Accessed 30/06/2020.

[3] Source: Australian Industry and Skills Committee, 2020, 'Hospitality', https://nationalindustryinsights.aisc.net.au/industries/tourism-travel-and-hospitality/hospitality. Accessed 30/06/2020.

[4] Australian Taxation Office, https://www.ato.gov.au/General/fringe-benefits-tax-(fbt)/. Accessed 19/06/2020.

[5] Source: Australian Taxation Office, available at: https://www.ato.gov.au/non-profit/your-workers/in-detail/fbt-and-christmas-parties-for-tax-exempt-bodies/?page=3. Accessed 03/02/2021.

[6] Taxation statistics, 2009-2018, https://data.gov.au/data/dataset/taxation-statistics-2016-17/resource/ddf6b851-1a59-4b4f-a2f1-802d26b26db2. Accessed 19/06/2020.

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Scenario design

In our July 2020 report, The Australian Hotels Association proposed that the Commonwealth Government consider a temporary suspension of FBT for meal, beverage and accommodation expenses to provide support for the sector. This option aimed to provide short to medium term stimulus as both the domestic economy and international tourism rebounds.

Two scenarios were considered: [7]

▸ Scenario 1 examines a three-year suspension of FBT expenses prescribed for all businesses in the sector.

▸ Scenario 2 examines an FBT exemption which applies to small and medium enterprises only.

Both options were proposed to operate for a three-year period from 2020/21 to 2022/23.

2.1   Estimated impacts of each scenario

The FBT exemption scenarios for meal and beverage entertainment and accommodation expenses drive a range of responses and economic impacts through the economy. The FBT exemption scenarios are based on the data presented above in relation to base expenditure on meal and beverage entertainment and accommodation expenses and a detailed methodology presented in Appendix A.

These impacts can be characterised across three key areas:

1. The magnitude of the FBT exemption;

2. The estimated increase in demand for meal and beverage entertainment and accommodation expenses resulting from the reduction in FBT; and

3. The economywide impacts of the increase in demand for AFS as measured by the impact on Gross Domestic Product (GDP) and employment.

The magnitude of the FBT exemption

As with any tax, the FBT drives a wedge between value and cost, reducing the quantity demanded and supplied in the relevant market. For economic stimulus purposes the FBT exemption is, by design, aimed at eliminating this wedge, reducing the price of meal entertainment to stimulate demand. On the other hand, the reduction in FBT revenue collected is a direct cost to government.

Table 2 shows the estimated magnitude of the FBT exemption under each of the scenarios considered (year-on-year). The magnitude of the FBT exemption in 2021/22 was$260 million under Scenario 1 and $169 million under Scenario 2 (this figure being lower because of a tightening of the FBT exemption to exclude large businesses).

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[7] Scenario 1 is corresponding to option 1a in the 20th July 2020 report and scenario 2 is corresponding to option 1b in the 2020 report.

Table 2: Summary of potential direct costs to Government by scenario, $m		
Year	Scenario 1	Scenario 2
2020/21	$286	$193
2021/22	$260	$169
2022/23	$263	$171

Source: EY estimates

Impact on direct AFS industry output

Each scenario considers the impact of reducing FBT for meal entertainment to stimulate direct economic activity in the AFS sector. A reduction in FBT reduces the price of meal entertainment, thereby increasing demand for taxed activities. The reduction in price is a function of the estimated magnitude of the FBT exemption, the overall level of expenditure and the price elasticity of demand[8].

That said, in the short term (year 1 of the exemption) it was assumed that businesses were likely to be less responsive to pure price signals than usual, and to have a stronger focus on the real and perceived safety risks of staff gatherings. To capture this effect in financial year 2020/21 we assume the stimulatory effects of the FBT exemption are halved.

The assumed increase in demand for AFS resulting from the FBT exemption is summarised in Table 3 below. The projected increase in demand for AFS was greatest under Scenario 1, reflecting the high level of FBT exemption. Overall, following the initial conservative assumption regarding uptake, the increase in AFS activity was estimated at $525 million per annum under Scenario 1 and $397 million per annum under Scenario 2 in 2021/22.

Table 3: Impact on sector output, $m			
		Scenario 1	Scenario 2
Impact on sector output, $m	2020/21	$214	$162
	2021/22	$525	$397
	2022/23	$530	$401

Source: EY estimates

In addition to the short-term assumptions regarding business responsiveness, the modelling assumes a short-term increase in labour supply during 2020/21, returning to pre-pandemic conditions for 2021/22 and 2022/23.

Estimated economy wide impacts

The direct boost to economic activity in the AFS sector also has flow-on impacts to the broader economy, through purchases made from suppliers and wages paid to employees. To capture these impacts at the economy wide level we have undertaken computable general equilibrium (CGE) modelling. This model, detailed in Appendix C, measures the net impact of changes on an economy. It was used to measure the net change in response to a given event, such as increased expenditure

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[8] A key assumption in the analysis is the assumed price elasticity of demand which has been derived from analysis presented in Okrent, Abigail M., and Julian M. Alston. The Demand for Disaggregated Food-Away-From-Home and Food-at-Home Products in the United States, ERR-139, U.S. Department of Agriculture, Economic Research Service, August 2012. Available at https://www.ers.usda.gov/webdocs/publications/45003/30438_err139.pdf?v=5049.9, last accessed 26/6/2020. The assumed price elasticity of demand is 1.34.

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in the AFS sector. The key economic metrics are expressed in terms of changes to GDP and economywide employment, summarised in Table 4 below.[9]

Table 4: Scenario impacts to GDP and employment by financial year		Scenario 1	Scenario 2
Impact on GDP, $m	2020/21	$539	$408
	2021/22	$850	$644
	2022/23	$855	$647
Impact on employment, FTE	2020/21	3,844	2,911
	2021/22	4,209	3,188
	2022/23	4,230	3,204

Source: EY estimates

Taking into account the direct impacts of the FBT exemption on the AFS sector, and the flow on impacts across the economy, there was a projected increase in both real GDP and employment in each year of each scenario. The projected impacts are directly linked to the magnitude of the FBT exemption and the assumed behavioural response. That is, the greater the exemption the higher the estimated economic benefits in terms of increased real GDP and employment (noting the conservative assumptions in the first year of the FBT exemption).

Benefits to outlays

To assess the relative merits of the FBT exemption it wasuseful to compare the level of government outlay (Table 2) with the projected increase in real GDP (Table 4). The ratio of the increase in real GDP to government outlay is presented in Table 5. These results show that:

- ▸ Each scenario shows economic returns which are greater than the overall cost to Government.

- ▸ Each of the scenarios presented have key timing impacts. The economic returns are lower in the first year of commencement (FY21), before increasing in the remaining two years (FY22 and FY23). This reflects a likely moderated response by businesses due to social distancing concerns and a general cautiousness on cost control.

- ▸ For Scenario 2, limiting the exemption to small and medium enterprises has a lower economic return for the costs incurred by government, reflecting the lower rate of company tax paid by SMEs.

Table 5 summarises the increase in GDP per dollar of total cost to government, noting that the total cost to government differs from the direct FBT cost outlined in Table 2, owing to changes in related tax collections as detailed in the Prosperity Advisers QLD[10] report and summarised in Appendix A. The increase in GDP per dollar of cost to government was as high as $3.26 for Scenario 1, and $3.81 for Scenario 2 in 2021/22.

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[9] The scenarios identified involve direct costs to government, occurring through reduced FBT revenues. We assumed that the direct costs would be met through the raising of debt, consistent with announcements by the Government on how existing stimulus measures were being financed. Under these financing arrangements, there is no equivalent reduction in government expenditure elsewhere in the economy or increase in aggregate tax takings factored in the analysis.

[10] Small and Medium Enterprise (SME) is defined as businesses with under $50 million annual turnover as per the Prosperity Advisers report "FBT on Meal Entertainment Hospitality Reignition Study for the AHA".

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Table 5: GDP per dollar of cost to government		Scenario 1	Scenario 2
GDP per dollar of cost to government	2020/21	$1.89	$2.11
	2021/22	$3.26	$3.81
	2022/23	$3.25	$3.79

Source: EY estimates

A summary of all the above impacts from Table 3 to Table 5 is provided in Table 6 below:

Table 6: Scenario summary potential results by financial year		Support option	
		Temporary FBT exemption	
		Scenario 1	Scenario 2
Impact on sector output, $m	2020/21	$214	$162
	2021/22	$525	$397
	2022/23	$530	$401
Impact on GDP, $m	2020/21	$539	$408
	2021/22	$850	$644
	2022/23	$855	$647
Impact on employment, FTE	2020/21	3,844	2,911
	2021/22	4,209	3,188
	2022/23	4,230	3,204
GDP per dollar of cost to government	2020/21	$1.89	$2.11
	2021/22	$3.26	$3.81
	2022/23	$3.25	$3.79

Source: EY estimates

Detailed scenario design methodology can be found in Appendix A, with additional documentation on the EYGEM model provided in Appendix C.

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Appendix A   Approach to option design

The first step in estimating the economy wide impacts is determining the direct impact of each of the measures. A range of data sources and models were drawn upon to develop first round estimates of the potential increase in output for the AFS sector as a result of FBT exemptions. While each scenario draws on similar input data, the specifics of each scenario call for tailored estimation approaches. Each of the estimation methodologies are outlined in the subsections below.

Once the direct impacts of each scenario were estimated, the second step was to develop economy wide estimates of the impacts using EY's in-house computable general equilibrium (CGE) model, the EYGEM model. EYGEM is a large scale, dynamic, multi-region, multi-commodity CGE model of the Australian and world economy. CGE models are used extensively by (for example) the Australian Government to assess the economy-wide impacts of major policy changes and economic developments. A detailed description of the EYGEM model is presented in Appendix C.

The direct outputs of each of the estimation exercises described below were used to calibrate a series of economic 'shocks' that were applied to the EYGEM model. The results of these shocks are described in Section 1.4.

Scenario 1 and 2

Each of these stimulus scenarios call for a three-year suspension of fringe benefits tax on meal and beverage entertainment and accommodation expenses from financial year 2020/21 to financial year 2022/23. Differentiating the scenarios is the scope of the suspension, with Scenario 1 calling for the suspension to be applied to all businesses regardless of size, while Scenario 2 calls for the suspension to be restricted to SME only.

Estimation of the direct industry response, the cost to Government, and the economy wide impact follows a three step process where we first estimate the existing and forward level of FBT collection, second we estimate the direct behavioural response to the effective tax reduction, and third we apply the increased industry output to the EYGEM model. The detailed approach is as follows:

1. The 2016/17 taxation statistics which were the most recent available as at 20 July 2020 from the Australian Taxation Office[11] provides the fringe benefits tax paid on meal entertainment, at $387,185,184 for the financial year 2017/18.

2. In July 2020 the most recent national accounts from the Australian Bureau of Statistics[12] provide data on total fringe benefits tax collections on a quarterly basis to March 2020. EY calculations based on this data indicate an increase in total FBT collections of 2.54% from 2017/18 to 2019/20. This increase in FBT takings is used to estimate meal entertainment and accommodation FBT in 2019/20 of $397,058,203.

3. Weekly revenue data provided by AHA for AusVenueCo[13] showed the level of revenue decline experienced from 2018/19. This data is used to calibrate a projection of meal entertainment and accommodation FBT takings to 2022/23, suggesting reductions in these FBT takings from 2018/19 of 23% in 2019/20, 26% in 2020/21, 11% in 2021/22, and 0% in 2022/23. This FBT profile was used as the base for calculations in Scenario 1.

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[11] Source - Taxation statistics 2016–17 Fringe benefits tax: Selected items by industry and taxable status, 2017-18 FBT return year. Available at https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Taxation-statistics/Taxation-statistics-2016-17/?page=18#Fringe_benefits_tax, last accessed 26/6/2020. Note that while this publication is primarily for financial year 2016/17, selected data including on Fringe Benefits Tax is provided for financial year 2017/18.

[12] Source - 5206.0 Australian National Accounts: National Income, Expenditure and Product, Table 22. Available at https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5206.0Mar%202020?OpenDocument, last accessed 26/6/2020.

[13] AusVenueCo operate 170 pubs, bars and taverns across Australia in all states and territories with the exception of Tasmania.

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4. The report 'FBT on Meal Entertainment Hospitality Reignition Study for the AHA' dated 29 May 2020 by Prosperity Advisers QLD indicates that 75.74% of meal entertainment and accommodation FBT is collected from SMEs. This proportion is used to reduce the base of FBT takings calculated previously and provides the FBT base for Scenario 2.

5. Own price elasticities for the categories "Food Away from Home and Alcohol" and "Full-Service Restaurant" were drawn from Okrent and Alston[14], at 0.71 and 1.96 respectively. Noting the wide range in these two elasticities and that the nature of the FBT expenses under investigation is likely to include a combination of these categories we choose a midpoint of 1.335.

6. The own price elasticity is applied to reduction in the effective tax collection calculated above for Scenarios 1 and 2. We made the assumption that over the short-term business is likely to be less responsive to pure price signals than usual, and to have a stronger focus on the real and perceived safety risks of staff gatherings, and so for financial year 2020/21 we halve the own price elasticities estimated above.

7. The resulting profile of industry output increase is then used as an output shock for the accommodation and food services sector in the EYGEM model.

8. The Prosperity Advisers QLD report (refer 4. above) provides estimates of the total direct (that is, before behavioural changes) loss of revenue to government as a result of suspension of FBT, with a total loss of $1.12 for every $1 of FBT suspension in Scenario 1, and a total loss of $1.02 for every $1 of FBT suspension in Scenario 2, reflecting differences in the rate of corporate tax applied for each entity. Additionally, the report indicates that each additional dollar of expenditure spent on meal entertainment results in an increase in tax revenue of $0.34. These ratios were applied to the reduced FBT base and the estimated increase in AFS output respectively to calculate the total cost to government.

On the basis of the process above, we estimate a direct potential increase in output in the AFS sector as described in Table 6 below.

Table 6: Potential Increase in AFS activity, $m, Scenarios 1 and 2		
	Scenario 1	Scenario 2
2020/21	$214	$162
2021/22	$525	$397
2022/23	$530	$401

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[14] Okrent, Abigail M., and Julian M. Alston. The Demand for Disaggregated Food-Away-From-Home and Food-at-Home Products in the United States, ERR-139, U.S. Department of Agriculture, Economic Research Service, August 2012. Available at https://www.ers.usda.gov/webdocs/publications/45003/30438_err139.pdf?v=5049.9, last accessed 26/6/2020

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Appendix B   Meal entertainment gross taxable value by industry

Table 9 below shows the gross taxable value of fringe benefits tax – meal entertainment by 1-digit ANZSIC industry[15]. This is a representation of the value of fringe benefits provided to employees in each industry, in the form of meal entertainment.

Table 9: Meal entertainment gross taxable value by industry, $			
Industry	Meal entertainment - Gross taxable value ($) 2016 - 2017	Meal entertainment – Gross taxable value ($) 2017 - 2018	Meal entertainment – Gross taxable value ($) 2018 - 2019
Australian Government Departments	5,314,375	5,566,787	5,011,851
All Industries	10,312,648	1,975,571	1,968,536
A. Agriculture, Forestry and Fishing	2,421,318	2,385,785	2,504,930
B. Mining	6,581,805	9,326,039	9,790,997
C. Manufacturing	31,755,096	30,406,825	31,436,539
D. Electricity, Gas, Water and Waste Services	5,881,107	6,559,909	6,470,309
E. Construction	25,476,347	27,201,525	24,264,767
F. Wholesale Trade	44,430,878	44,725,082	42,321,703
G. Retail Trade	11,450,099	10,897,625	10,966,954
H. Accommodation and Food Services	3,302,380	3,041,939	3,215,826
I. Transport, Postal and Warehousing	9,546,945	9,437,075	9,763,483
J. Information Media and Telecommunications	16,729,807	15,350,407	14,510,573
K. Financial and Insurance Services	44,156,187	54,921,469	50,574,383
L. Rental, Hiring and Real Estate Services	15,780,632	15,498,154	24,403,367
M. Professional, Scientific and Technical Services	101,467,326	111,154,272	114,916,641
N. Administrative and Support Services	17,594,412	18,141,158	21,645,827
O. Public Administration and Safety	5,504,813	5,496,604	4,307,891
P. Education and Training	12,013,397	10,842,396	10,552,701
Q. Health Care and Social Assistance	14,229,104	14,211,561	17,310,391
R. Arts and Recreation Services	3,759,024	3,976,345	3,763,002
S. Other Services	9,099,341	8,594,695	9,207,573
U. Other	690,791	1,001,598	219,710

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[15] Source: Taxation statistics, Fringe Benefits Tax, 2016-2017, Snapshot Table 2 - https://data.gov.au/data/dataset/taxation-statistics-2016-17/resource/3c11cbfa-5a11-4d1e-8979-8fce1ff2c4d3. Accessed 19/06/2020.
Source: Taxation statistics, Fringe Benefits Tax, 2017-2018, Snapshot Table 2 - https://data.gov.au/data/dataset/taxation-statistics-2017-18/resource/df73a406-6b5d-416c-87fc-c97438a3fd7d
Source: Taxation statistics, Fringe Benefits Tax, 2018-2019, Snapshot Table 2 - https://data.gov.au/data/dataset/taxation-statistics-2018-19/resource/b06966ad-9827-4139-b55a-6e9ded9a1b1f
Accessed 26/11/2021

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Appendix C   EYGEM Model

Economic impact analysis measures the net impact of changes on an economy. It is used to measure the net change in response to a given event (e.g. such as the loss of an activity, or increased expenditure in a particular sector). The key economic metrics are expressed in terms of changes to gross domestic product, employment and other macro-economic indicators.

The EYGEM model is a large scale, dynamic, multi-region, multi-commodity CGE model of the world economy. The EYGEM model enjoys significant flexibility both at the regional and sectoral level, including the capability to individually identify subregions of Australia, including (but not limited to) at the SA4 or the LGA level as separate economic regions. This capability to identify subnational regions is also readily extended to other international regions.

EYGEM draws on the global CGE modelling framework developed by the Global Trade Analysis Project (GTAP) based at Purdue University in the United States. Their model is described in Hertel (1997), with its antecedent being the Industry Commission's Salter model (Jomini et al 1991). The GTAP model was greatly enhanced by the Australian Bureau of Agriculture and Resource Economics (ABARE) to incorporate dynamic capabilities. The MEGABARE model (ABARE 1996) and its successor, the Global Trade and Environment Model (Pant 2002), were the fruits of ABARE's efforts.

Our model is implemented in modern data science frameworks, including Python and Pandas, and has a user-friendly Excel interface. Our frameworks are specifically designed to improve auditing a paper trail in modelling exercises, reduce the risk of modelling error, and allow for (for example) systematic sensitivity analysis.

Overview of the modelling framework

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

► The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).

► Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas utility function.

► Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.

► Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a Cobb-Douglas utility function.

► All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.

► Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a CES production function.

► Producers are cost minimisers, and in doing so choose between domestic, imported and interstate intermediate inputs via a CRESH production function.

► The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply. This is most often assumed to be 0.15 for central case scenarios, and 0.3 for high side scenarios, depending on the employment market conditions for the region under consideration.

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

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

► Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).

► For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But in relative terms imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.

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

Dynamics of EYGEM

EYGEM is a recursive dynamic model that solves year-on-year over a specified timeframe. This has two main advantages. First, dynamics allows a richer specification of the model in that issues such as debt accumulation (which facilitates the ability to model international capital flows) and labour market dynamics are able to be modelled in a more sophisticated manner. Second, scenario analysis using a model such as EYGEM can be greatly enhanced by the ability to alter the baseline, or reference case, to account for key developments or uncertainties.

The model is then used to project the relationship between variables under different scenarios, or states, over a pre-defined period. This is illustrated in Figure 1, where a reference case or 'baseline' forms the basis of the analysis undertaken using EYGEM. The model is solved year-by-year from time 0 which reflects the base year of the model (2020) to a predetermined end year (in this case 2050).

The 'Variable' represented in the figure could be one of the hundreds or thousands represented in the model ranging from macroeconomic indicators such as real GDP to sectoral variables such as the exports of iron and steel from Australia. In the figure, the percentage changed in the variables have been converted to an index (= 1.0 in 2020) and is projected to increase by 2050.

Set against this baseline is, in Figure 1, a 'Policy' scenario. This scenario represents the impacts of a policy change or different assumptions about economic development that results in a new projection of the path of the variable over the simulation time period. The impacts of the policy/assumption change are reflected in the differences in the variable at time T. It is important to

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note that the differences between the baseline and policy scenario are tracked over the entire timeframe of the simulation.
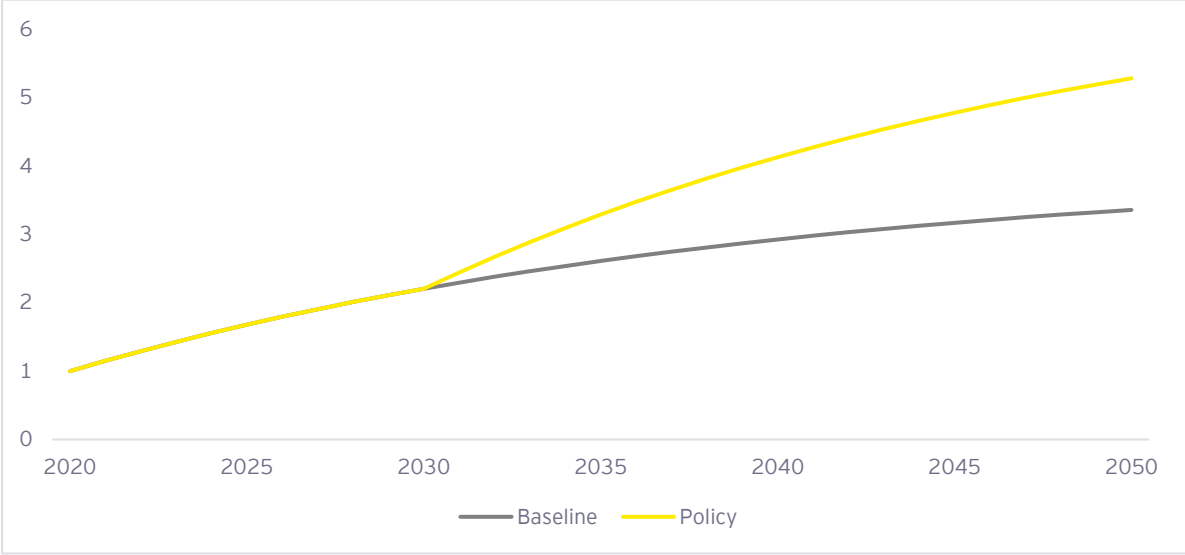
Detailed interdependencies

The model is underpinned by a detailed, global database. The model's database is 'benchmarked' or 'calibrated' so that initial equilibrium solution exists that replicates actual sectoral production, consumption, trade and factor usage. It contains 141 regions and 64 sectors for a base year of 2007, and is the benchmark dataset for applied, global general equilibrium modelling. This database produced by the Global Trade Analysis Project (GTAP) at Purdue University is the most detailed and comprehensive database of its type in the world. Used by some 700 researchers globally, the database is a truly international, collaborative research effort that is fully documented and transparent.

The EYGEM model is primarily based on input-output or social accounting matrices, as a means of describing how economies are linked through production, consumption, trade and investment flows. For example, the model considers:

► direct linkages between industries and countries through purchases and sales of each other's goods and services; and

► indirect linkages through mechanisms such as the collective competition for available resources, such as labour, that operates in an economy-wide or global context.

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