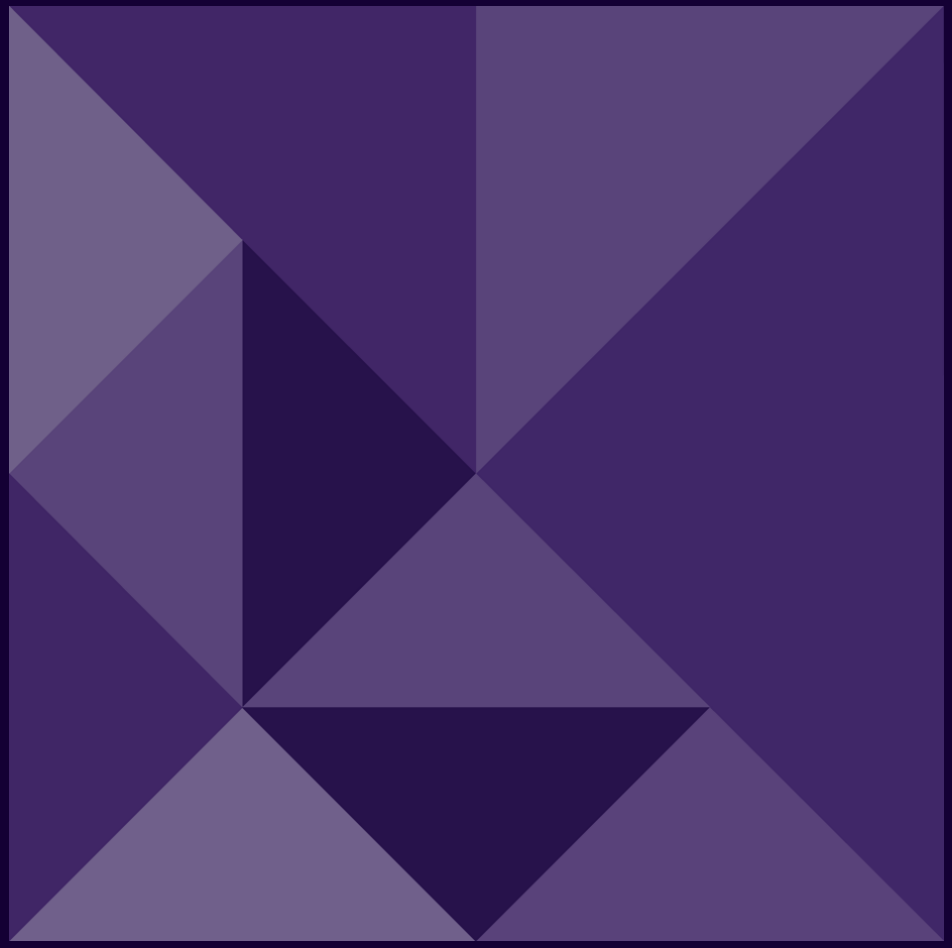
ACIL ALLEN

11 March 2021

Report to Industry Super Australia

Economic impact of increasing the Super Guarantee Rate



About ACIL Allen

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Our purpose is to help clients make informed decisions about complex economic and public policy issues.

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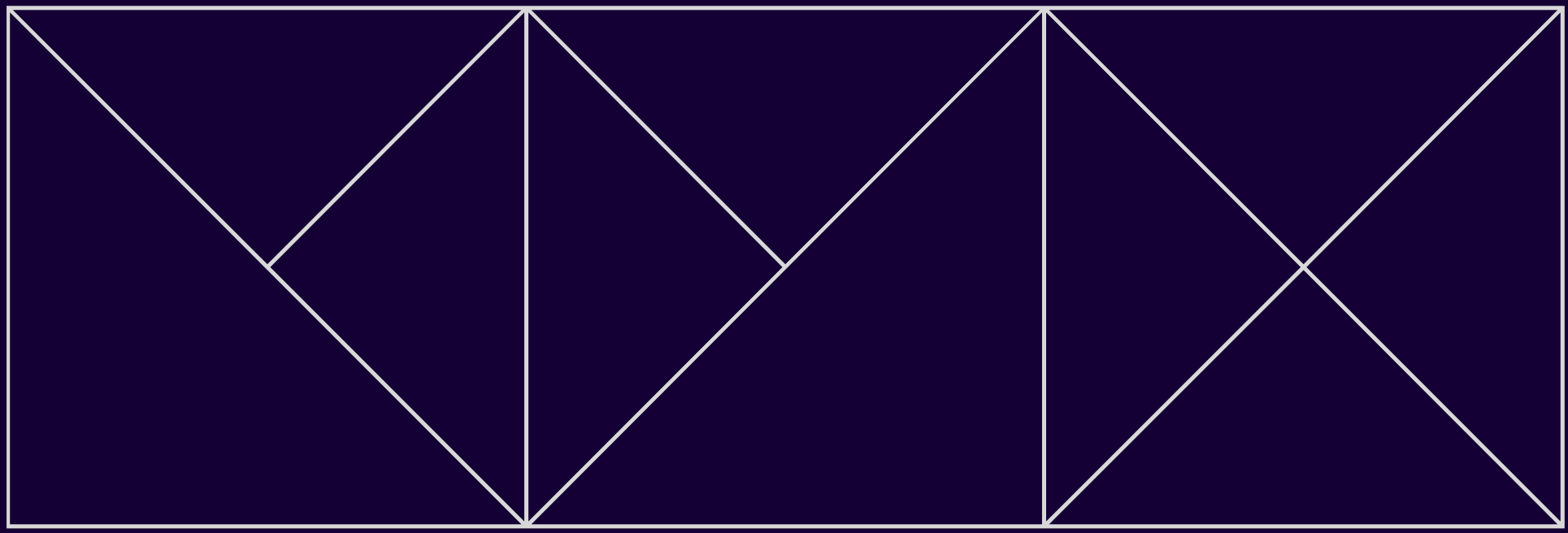


This report examines the impact on the Australian economy of the legislated increase in the Super Guarantee (SG) Rate from 9.5% to 12%. Increasing the SG rate will lead to a ***bigger economy*** ($12 billion bigger in 2040) than will occur without the increase in the SG rate. Increasing the SG rate will also lead to ***more jobs, higher real wages, and higher real incomes*** for Australians than will occur without the increase in the SG rate.

Policy makers and economic commentators have been concerned for some time about Australia's national saving level. Australia's national net saving — the total of saving by households, businesses, and governments – has averaged around 6% of GDP since the GFC. At the heart of the debate is whether Australia saves enough to sustain the strong investment required for the economy to grow. In the past, Australia has been heavily reliant on foreign savings to fund the investment needed for economic growth. However, in the future, Australia may not be able to rely as much on foreign investment to underwrite Australia's prosperity, particularly against a backdrop of the sustained effects on the world economy associated with the COVID-19 pandemic.

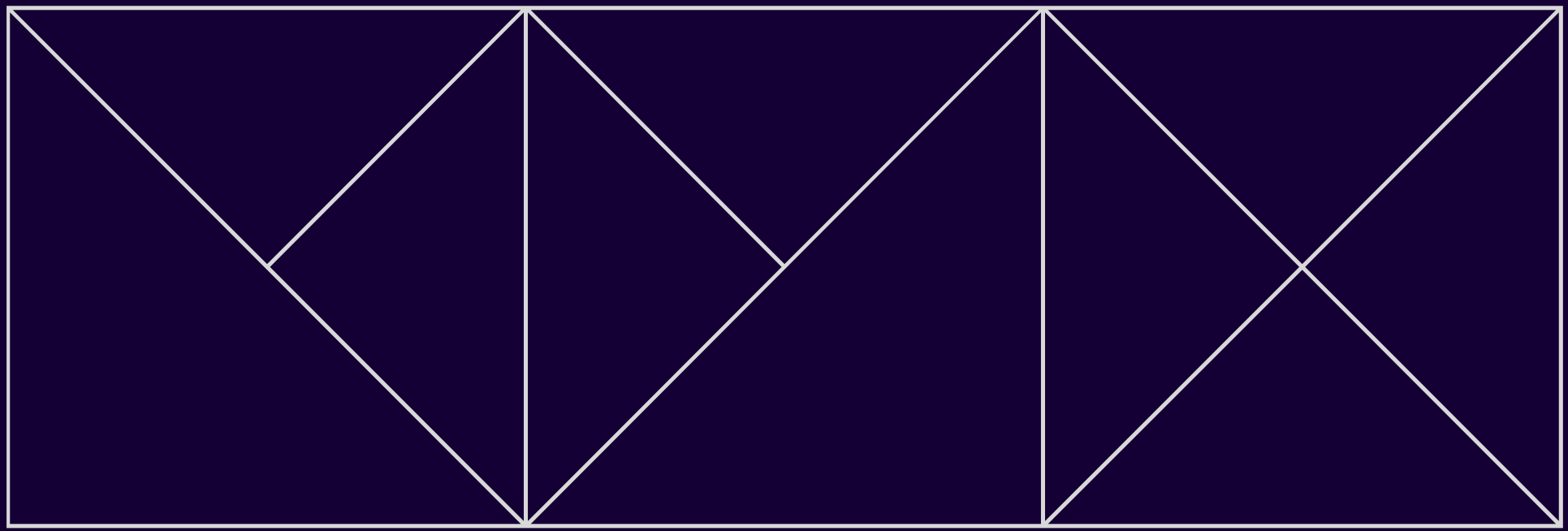
As a consequence, long term economic growth will need to be stimulated through a number of other factors, with productivity growth being the biggest contributor to growth and living standards. A high national saving level is important for funding investments to facilitate productivity and economic growth. Household saving — currently as high as 20% of gross disposable income — is critical to building the stock of national saving levels, with superannuation funds being a critical source for facilitating the nation's business investment.

Increasing the SG rate will increase household saving, and this saving will be invested in productive capacity by Australian businesses. We model the impact of this additional saving and investment and find that the Australian economy will grow faster as a result. By 2040, GDP will be around $12 billion bigger than it will be without the increase in the SG rate. The addition to national income will be even larger. Exports will grow as a result of improvement in international cost competitiveness and net exports, or the trade balance (exports minus imports) will also increase.

Contrary to much of what has been said in the public debate on the rise in the SG rate, apart from a very small and very short-lived effect, there is no trade-off between higher superannuation contributions and higher wages. In fact, an increase in the SG rate, because it will lead to more capital accumulation and a bigger economy, will lead to higher real wages.

1

Introduction



1.1 What this report does

This report examines the impacts on the Australian economy of increasing the Superannuation Guarantee (SG) rate from 9.5% to 12%, legislated to increase in five annual increments of 0.5% starting this year and continuing through to 2025.

The purpose of this report is to provide an analytical account of why increasing the SG rate will be beneficial for the Australian economy and the well-being of Australians. We aim to advance the current debate, some aspects of which, especially discussions about possible trade-offs between increases in superannuation contributions and increases in wages, take a narrow and short term view, and in so doing miss the beneficial impact of additional household saving on long run growth of the economy and incomes.

Why focus on economic growth now? Growth is always important, but particularly so following the COVID-19 pandemic, which has seen Commonwealth Government net debt grow to around 50% of GDP. As the Treasurer has said, the Government's strategy is to reduce this debt ratio not through higher taxes, but by growing the economy through productivity enhancing reforms.[1] An important contributor to increasing growth will be a process of capital accumulation brought about by higher national saving. Increasing household saving via an increase in the SG rate is a means of increasing national saving.

The focus on this report is on the macroeconomic impacts i.e. on the major economic aggregates Gross Domestic Product (GDP), national income, investment, consumption, exports, imports, employment, and real wages. We project the economic impact over a period of 19 years, to 2040.

The impacts are estimated using the Tasman Global Computable General Equilibrium model of the Australian economy.

1.2 What this report does not do

This report does not inquire into what SG rate is required for Australians to achieve adequate (or better than adequate) retirement incomes, why some people do not want to run down their accumulated superannuation saving in retirement, the relative performance of different types of funds, or the efficiency, governance, or taxation of the superannuation system. These are interesting and important subjects and have been covered at length in various reports[2], but they are beyond the scope of this report.

1.3 The rest of this report

Chapters 2 and 3 provide the context for the analysis in this report. In Chapter 2, we discuss trends in Australian saving rates and compare Australia to other countries. In Chapter 3, we discuss the Australian superannuation system – its history, the policy context, and trends in key data.

In Chapter 4 we discuss our modelling approach, with the modelling results presented in Chapter 5. In Chapter 6, we present the findings of the analysis.

[1] The Hon. J Frydenberg (2020), Ministerial Statement on the Economy, The economic impact of the crisis, Parliament House, Canberra, 12 May 2020.

[2] See, for example, *Retirement Income Review* (2020), the Royal Commission into the *Misconduct in the Banking, Superannuation and Financial Services* (2019), the Productivity Commission's *Competition in the Australian Financial System* (2018) and the Financial System Inquiry (2014).\

Saving in Australia – The Big Picture

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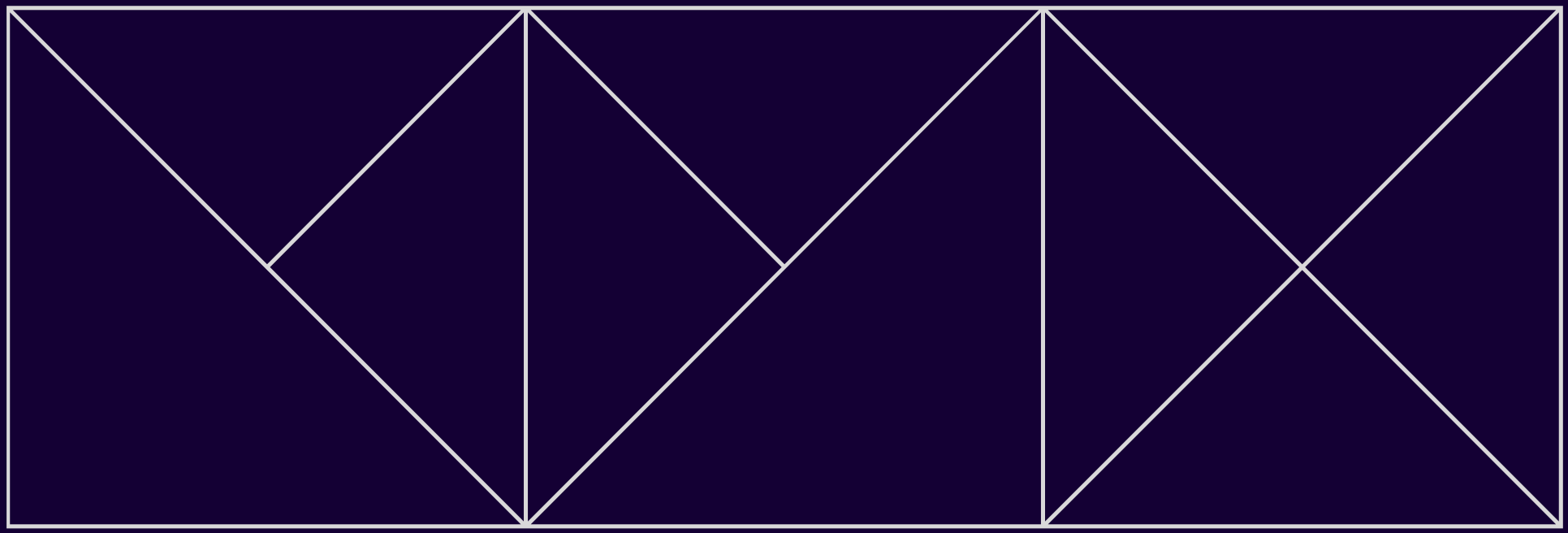


2.1 Australian national saving

Policy makers and economic commentators have been concerned for some time about Australia's national saving level. At the heart of the debate is whether Australia saves enough to sustain the strong investment required for the economy to grow. In the past, Australia has been heavily reliant on foreign savings to fund the investment needed for economic growth. However, in the future, Australia may not be able to rely as much on foreign investment to underwrite Australia's prosperity, particularly against a backdrop of the sustained effects on the world economy associated with the COVID-19 pandemic.

As a consequence, long term economic growth may need to be stimulated through a number of supply-side factors, such as population growth, participation levels, and/or productivity — the 3Ps.[3] While population growth has been a key contributor to real GDP growth in the past, it is unlikely that it will play a major role in the near to medium term given restrained net migration levels. Participation levels – or the proportion of the population aged 15 years and older that is actively engaged in the workforce — are likely to have a dampening effect on economic growth as the population ages.

The long run driver of economic growth and living standards will come through productivity enhancements.[4] While increases in productivity can be achieved through different means, such as improvements in business practices, streamlined government regulation and an increasingly skilled workforce, a key driver will be through increases in the capital stock. When Australian businesses invest, this adds to the nation's stock of capital which, combined with labour, technology, and land, are the factors of production that together produce the economy's output of goods and services.

A high national saving level is therefore important for funding the investments to facilitate economic growth. This chapter reviews Australia's national saving level, the key sectors comprising national saving, and how this compares with overseas levels. It shows that household saving is critical to national saving levels. While the largest element of household saving is in housing, superannuation is the second largest asset on the household balance sheet. These funds have been an important source of facilitating the nation's business investment – and therefore a driver of economic growth -– and will be increasingly so as the SG increases from its current rate of 9.5% to 12%.

National saving as a share of GDP declined in the quarter century before the 1990s, remained relatively flat in the period until the GFC in 2007-08, and has risen slightly since — see Figure 2.1. Net saving averaged around 5% of GDP in the decade before the GFC and has averaged around 6% since the GFC.

It is useful to segment national saving by the household, business, and government sectors, as their levels of saving are driven by different factors. Much of the movement in the national saving rate has been due to changes in the saving rate of the general government sector (see Figure 2.2). In the decade prior to the GFC, the general government sector's expenditure and budgets were largely funded through gross saving driven by growth in tax receipts, such that the sector was in a net lending position. During the GFC, the national general government returned to being in a net borrowing position as government expenditure supported the Australian economy.

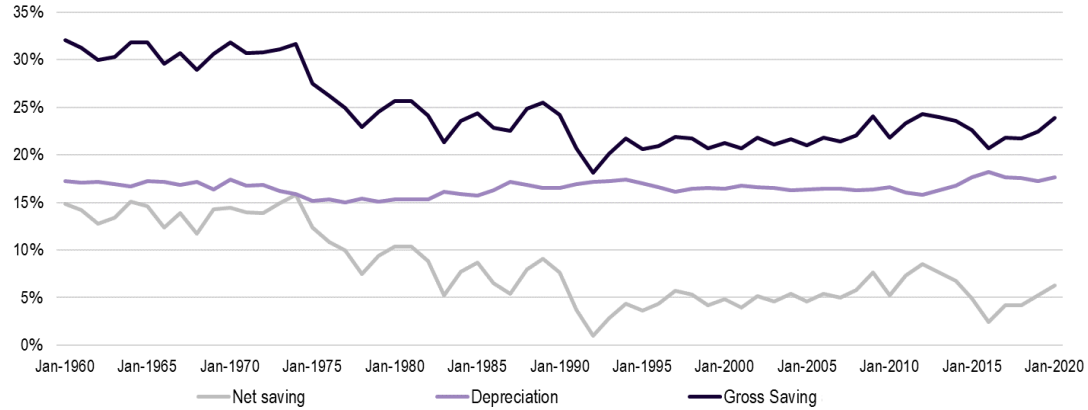
[3] The Hon. J Hockey, *2015 Intergeneration Report: Australia in 2055*, Commonwealth of Australia (IGR 2015).

[4] IGR 2015.

In the years after the GFC, the net saving position started improving but has subsequently deteriorated as a consequence of the COVID-19 recession and with Australian governments supporting and stimulating the economy through measures such as increasing the unemployment allowance (previously Newstart, now *JobSeeker* allowance), introducing a wage subsidy through *JobKeeper*, and other cash support payments to households and businesses.

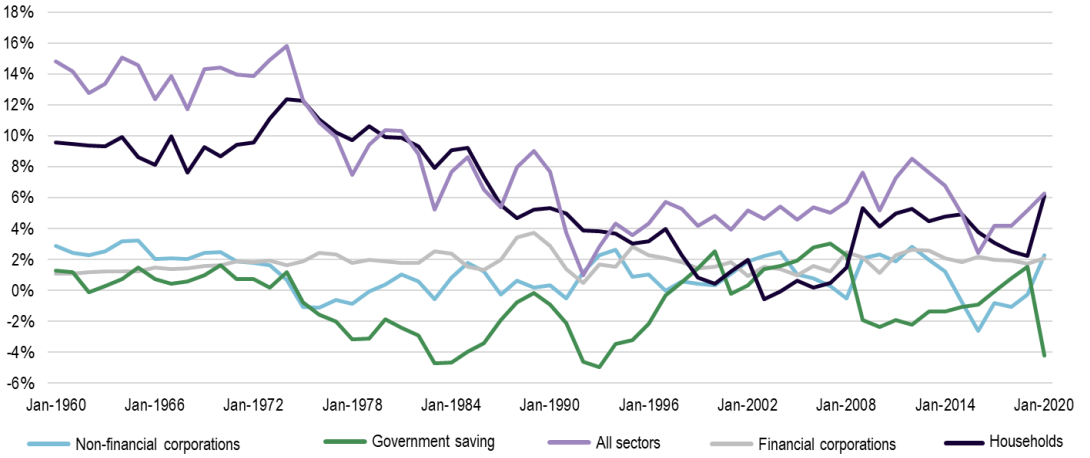
Such a fall in general government saving has not been seen since the early 1990s recession. These trends raised considerable concern at the time, with Vince FitzGerald's *National Saving: A Report to the Treasurer* (1993) arguing that raising national saving should be a policy focus, primarily through (but not exclusively) on raising public saving.[5]

Figure 2.1 Gross and net national saving (% of GDP)



Source: ABS, Australian System of National Accounts, Catalogue No. 5204.0, Table 8. National Capital Account

Figure 2.2 Net saving by sector (% of GDP)



Source: ABS, Australian System of National Accounts, Catalogue No. 5204.0, Table 8. National Capital Account

[5] FitzGerald, VW 1993, *National Saving: A Report to the Treasurer*, Australian Government Publishing Service, Canberra

Box 2.1 provides a brief summary of the fiscal support provided by Commonwealth and State/Territory governments during the COVID-19 pandemic.

Box 2.1 Summary of COVID-19 pandemic and Australian Government responses

The COVID-19 pandemic (Coronavirus) caused countries all around the world to close their borders and quickly put in place other containment measures such as social distancing, limiting indoor and outdoor gatherings, closing venues, and public health measures to limit the spread of the virus. The scale of the macroeconomic support measures is unprecedented and far outweighs the size of the response to the Global Financial Crisis (GFC). Economic support measures began in mid-March 2020.

The Westpac-Melbourne Institute Index of Consumer Sentiment plunged 17.7 % in April 2020, the single biggest monthly decline in the forty-seven year history of the survey, taking it beyond GFC levels and only seen during the deep recession of the early 1990s and early 1980s.

Business confidence also saw its largest decline on record in April 2020 at its weakest level and the business conditions index also declined sharply in aggregate and across the bulk of industries (NAB business survey).

As a consequence, there was the largest globally synchronised contraction in economic activity since the Great Depression, and Australia's first recession in nearly 30 years. Australia's economy fell 7.0% and employment hours fell 9.8%, in the June quarter. These were the largest falls since measurement began in 1959.

To respond to these challenges, significant monetary, fiscal, regulatory, and financial stability measures were put in place in Australia in order to buffer the economic downturn. Federal and State/Territory governments responded with payments to assist households and businesses to carry out economic activity.

The largest fiscal support came from the JobKeeper and Boosting Cash Flow for Employers policies. The JobKeeper payment, of $1500 per fortnight per eligible employee, was a wage subsidy paid by the Federal Government to businesses significantly impacted by COVID-19 (on various GST turnover conditions), with over 960,000 organisations and over 3.5 million individuals covered. As the Prime Minister and Treasurer stated at the time, "This measure was about keeping the connection between the employer and the employee and keeping people in their jobs even though the business they work for may go into hibernation and close down for six months."

The Boosting Cash Flow payment of between $20,000 to $100,000 was for eligible businesses and not-for-profit (NFP) organisations. In addition, the Newstart Allowance, paid for unemployed individuals, was temporarily increased by $550 per fortnight as a supplement.

The Federal Government's budget deficit increased to around $A197.7bn or 9.9% of GDP, which was the largest budget deficit since the end of WWII.

State and Territory governments also supported households and businesses via stimulus packages that removed various fees and charges, waived payroll tax, rent relief, support funds for specific sectors.

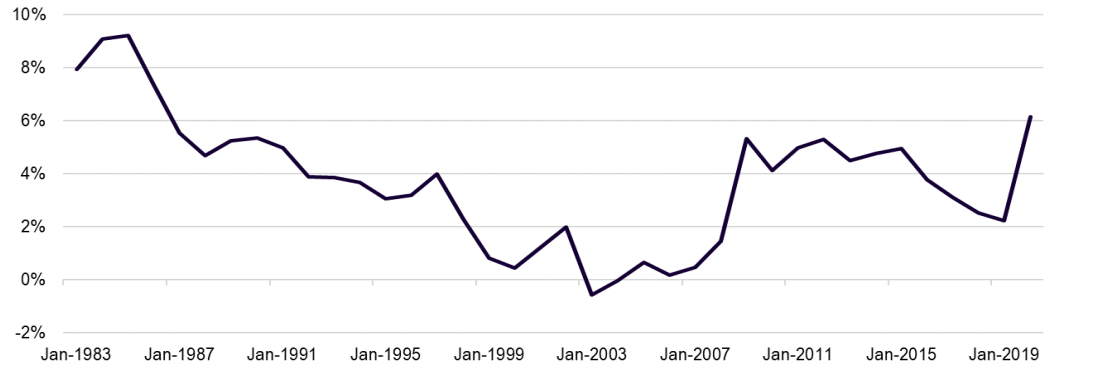
Sources: Westpac-Melbourne Institute, 15 April 2020 "Consumer confidence collapses as Coronavirus hits hard", NAB Monthly Business Survey, 14 March 2020, "A huge hit to the business sector from coronavirus" https://business.nab.com.au/wp-content/uploads/2020/04/NAB-Monthly-Business-Survey-March-2020-2.pdf, The Hon. Scott Morrison and The Hon. Josh Frydenberg, Joint Media Release, "$130 billion JobKeeper payment to keep Australians in a job", 30 March 2020, https://ministers.treasury.gov.au/ministers/josh-frydenberg-2018/media-releases/130-billion-jobkeeper-payment-keep-australians-job, The Hon. J Frydenberg and Senator the Hon. Simon Birmingham, Mid-Year Economic and Fiscal Outlook 2020-21, December 2020:

2.2 Household saving

Turning to the household sector, saving has tended to be positive, with the exception of the period coming into the 2000s decade when the household saving ratio collapsed such that the ratio was negative (Figure 2.3).[6] A number of factors have contributed to this trend including the low interest rate and low inflation environment which increased the availability of credit, a sustained period of economic growth, Australians experiencing steady employment and lower unemployment, rising asset prices, deregulation of the financial sector and competition by non-major bank lenders.

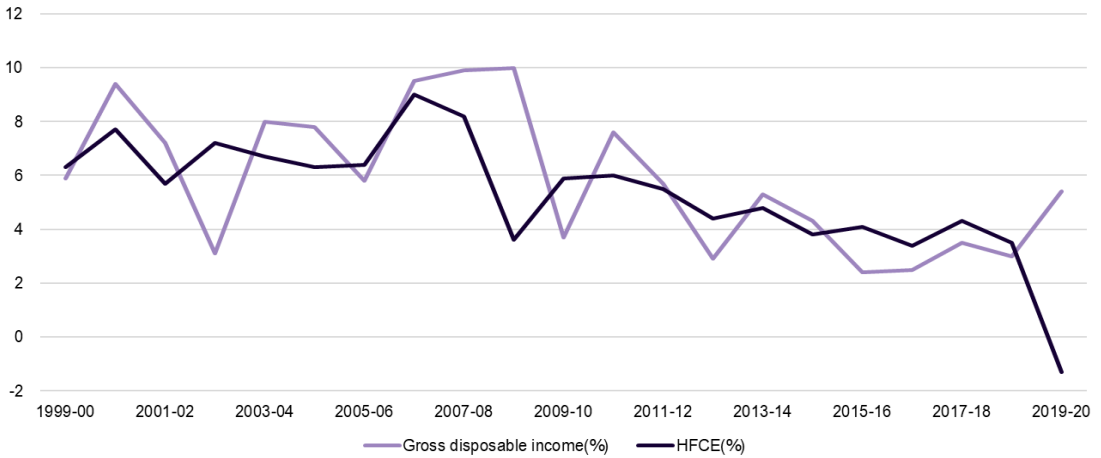
More recently, the household saving ratio reached a high of 22.1% during the COVID-19 pandemic (in the June 2020 quarter), a rate not seen since the early 1970s. Much of the sharp increase in the household saving rate was due to restrictions on household activity and reduced ability to spend — consumption fell by 1.3% in 2019-20 while gross disposable income rose moderately by 5.4%, with many employees receiving social assistance benefits such as *JobKeeper* and *JobSeeker* (see Figure 2.4).

Figure 2.3 Household saving ratio, % of GDP (annual)



Source: ABS 2020, 5204.0 — Australian System of National Accounts, 2019-20, Table 1

Figure 2.4 Gross disposable income and household final consumption expenditure (% growth)



Source: Australian Bureau of Statistics, Australian System of National Accounts 2019-20 Financial Year

[6] In broad terms, household saving is the residual of household disposable income after spending on goods and services. For further explanation of the saving measure, including adjustments to the conventional saving measure, see V. FitzGerald and T. Shamlian "Australia's National Saving Revisited: Where do we stand now?", Allen Consulting Group, Chapter 2.

2.3 Household balance sheet

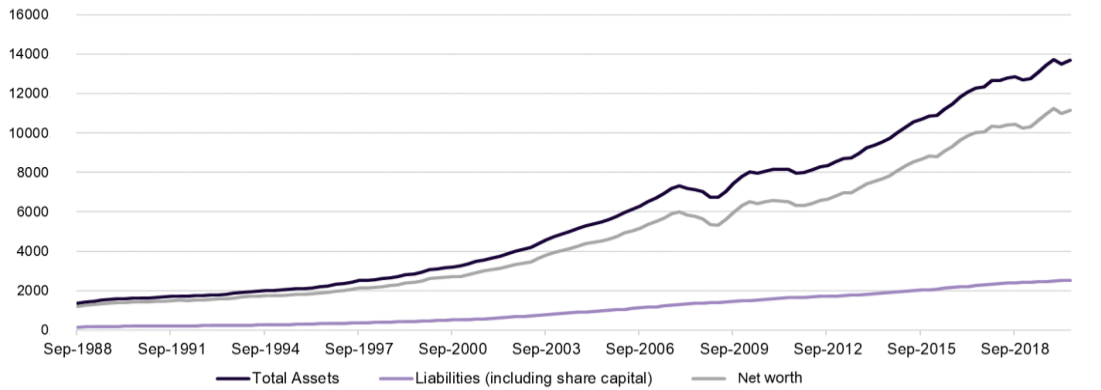
Related shifts can also be seen in the household balance sheet through changes in the assets and liabilities position.[7]

Household net worth (Figure 2.5) increased in value to be around $11,102 billion in June 2020. Net worth grew on average by around 5.2% per year in the recovery period following the GFC; this compares with the very high growth rates of around 10% each year in the decade prior to the GFC.

Much of this was driven by asset price growth, while liabilities remained relatively steady.

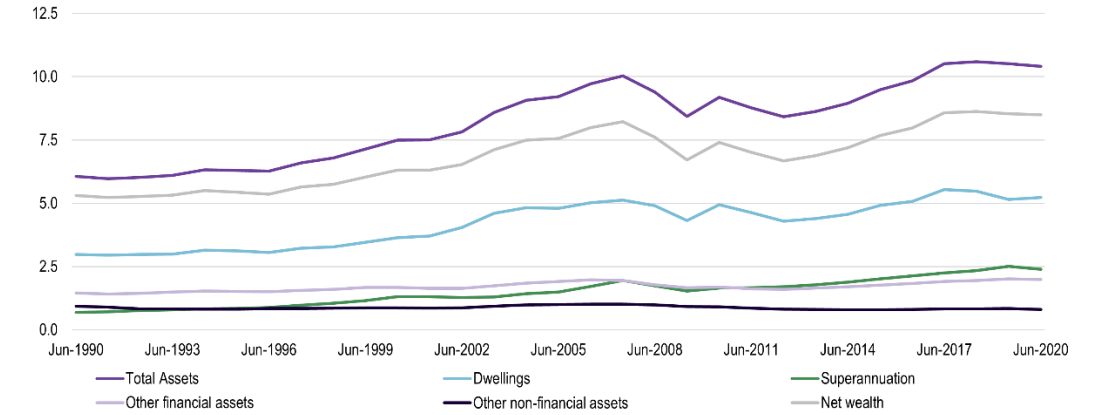
Figure 2.6 shows that over the past three decades, the rate of growth of household assets has been quite variable. Residential dwelling assets have grown from around 2.9 times to 5.2 times that of gross disposable income. Over the past few decades, households' saving in assets has been heavily directed towards superannuation which has grown even faster from 0.7 times to 2.4 times that of gross disposable income. Chapter 3 discusses in more detail how superannuation has grown in Australia.

Figure 2.5 Household assets and liabilities ($b, current dollars)



Source: ABS, Australian National Accounts: Finance and Wealth, Cat. No. 5232.0, Table 35. Household Balance Sheet

Figure 2.6 Household assets (ratio to household disposable income)



Source: ABS, 5232.0 Australian National Accounts: Finance and Wealth, Table 35. Household Balance Sheet, Current prices ($ billion), ACIL Allen analysis

[7] There is normally a strong correlation between the household saving ratio and changes in net worth, or changes in the household balance sheet. Household saving can also be measured as changes in net worth, or the difference between assets and liabilities. Household wealth consists of: Household Assets which comprise financial assets (such as bank deposits, direct equity holdings and superannuation balances), and non-financial assets (which include housing, and durable items such as motor vehicles); Less Liabilities which largely comprises residential mortgages, as well as loans for credit cards and personal loans.

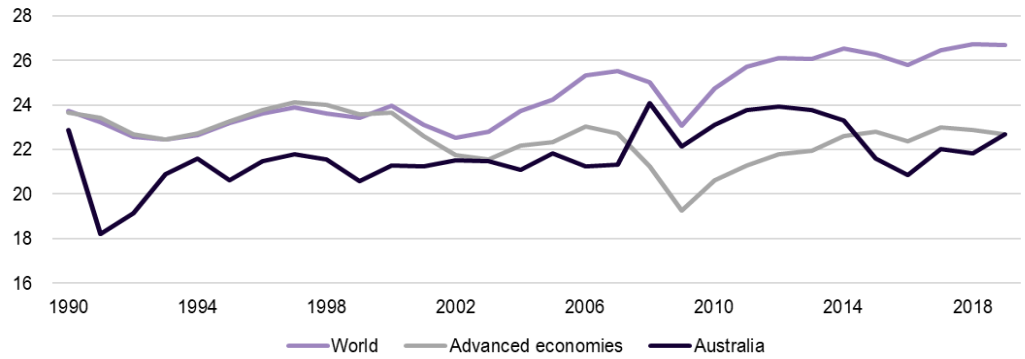
2.4 Trends in global saving rates

The global saving rate has changed over time (Figure 2.7). More recent saving rates have continued to increase steadily to 26.6 % of world GDP, such that it is the highest level ever recorded (IMF 2020).

The global saving rate conceals considerable diversity among countries and regions.

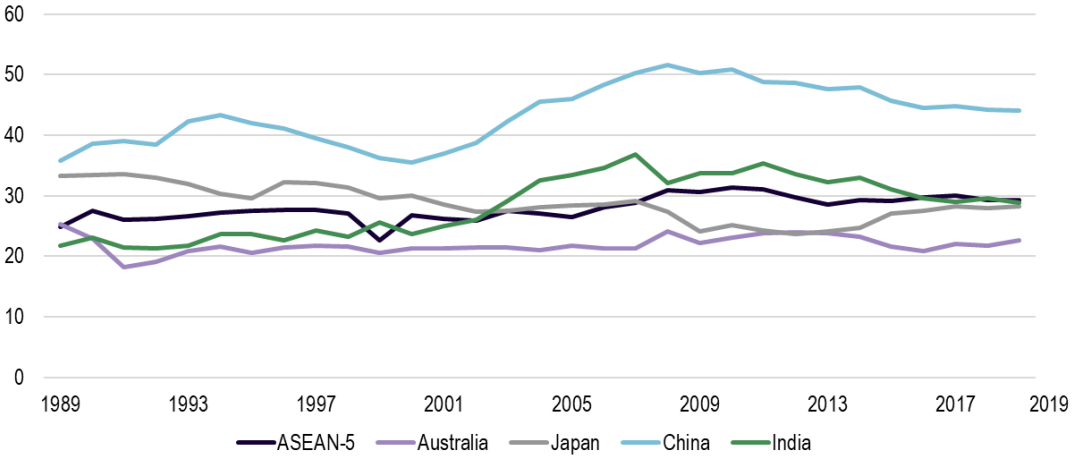
Saving rates in Asia (Figure 2.8) have historically been higher than those in other regions, by a considerable magnitude. Particularly remarkable is the very high saving levels in China, currently estimated to be around 44% of China's GDP in 2020, coming off the peak of 51% seen in 2008. The composition of national saving in China has changed overtime and households, instead of corporates, are now the main drivers. Household saving in China has been trending up since the early 1990s and peaked at 25% in 2010 and moderated more recently (IMF 2018).[8] China's household saving is 15 percentage points higher than the global average (around 7% in late 2018).

Figure 2.7 Global saving rate (% of GDP)



Source: International Monetary Fund, World Economic Outlook Database, October 2020, accessed 25 January 2020

Figure 2.8 Asia's gross national saving rate (% of GDP)



Note: "ASEAN-5" comprises Indonesia, Malaysia, Philippines, Singapore, and Thailand

Source: International Monetary Fund, World Economic Outlook Database, October 2020, accessed 25 January 2020

[8] IMF Working Paper, Asia Pacific Department, "China's High Savings: Drivers, Prospects, and Policies", Prepared by Longmei Zhang, Ray Brooks, Ding, Haiyan Ding, Hui He, Jing Lu, and Rui C. Mano, December 2018.

There are a number of factors that have contributed to this. Demographic changes induced by the one-child policy is seen as the major contributor to higher household and national saving in China (IMF 2018). Rising income inequality and the transformation of the social safety net is also a major contributor, with housing reform being a minor contributor. Rapid aging is likely to have a dampening effect on saving in China moving forward.

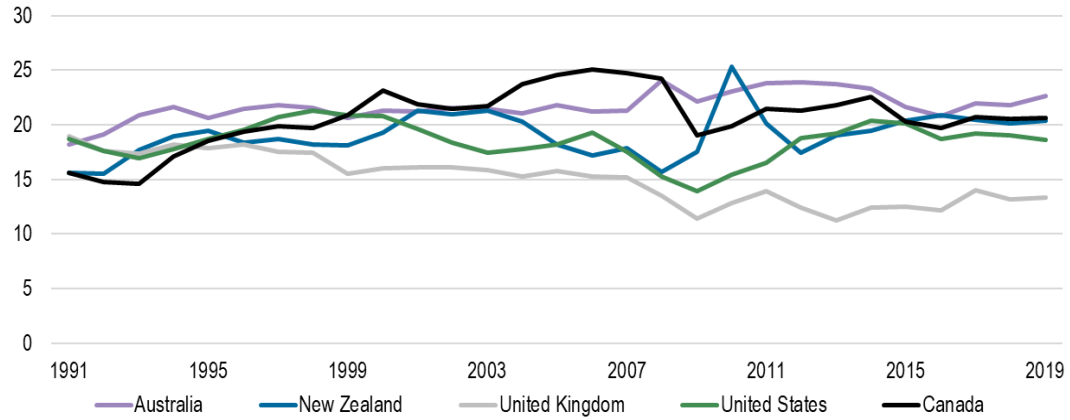
Like China, the gross saving ratio in India has also increased strongly, rising from around 25% of their GDP in the 2000s to be nearly one-third by the late 2010s, driven by increases across all sectors.

Other countries in the ASEAN-5 region (comprising Indonesia, Malaysia, Philippines, Singapore, and Thailand) have also been high savers; the average saving ratio fell sharply after the 1997-98 Asian financial crisis, but the ratio has rebounded subsequently to be one-third of their GDP.

As a consequence, the Asian region has historically been a large supplier of saving to the rest of the world.

Compared with other advanced English-speaking countries, Australia has a higher national saving rate (Figure 2.9), but it is lower than the fast growing Asian economies.

Figure 2.9 Australia and English speaking countries, (% of GDP)

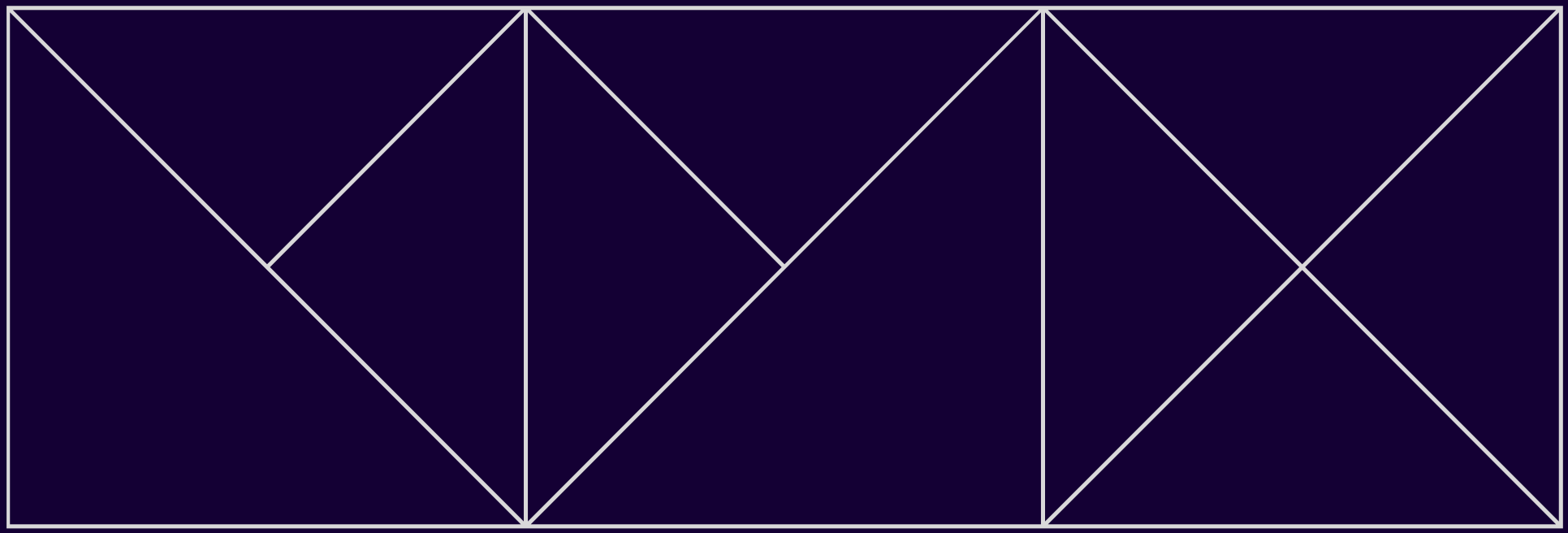


Source: International Monetary Fund, World Economic Outlook Database, October 2020, accessed 25 January 2020

3

The Australian Super System

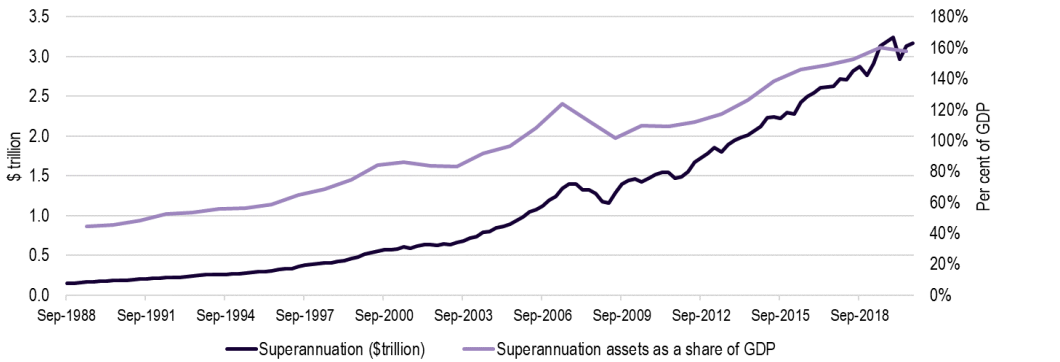
History and policy context, statistics



As Chapter 2 outlined, superannuation is the second largest asset for households and a major pillar of the retirement income system. Superannuation assets grew from $164 billion in 1990 to around $3.2 trillion in 2020, or in GDP terms, superannuation comprised less than 40% of GDP in the early 1990s to now be 1.5 times (or 150% of) the size of Australia's economy (ABS 2020) — see Figure 3.1. The proportion of Australians (over the age of 15) with superannuation coverage increased from 63.9 % in 2003-04 to 71.9 % in 2017-18 (ABS 2019).[9]

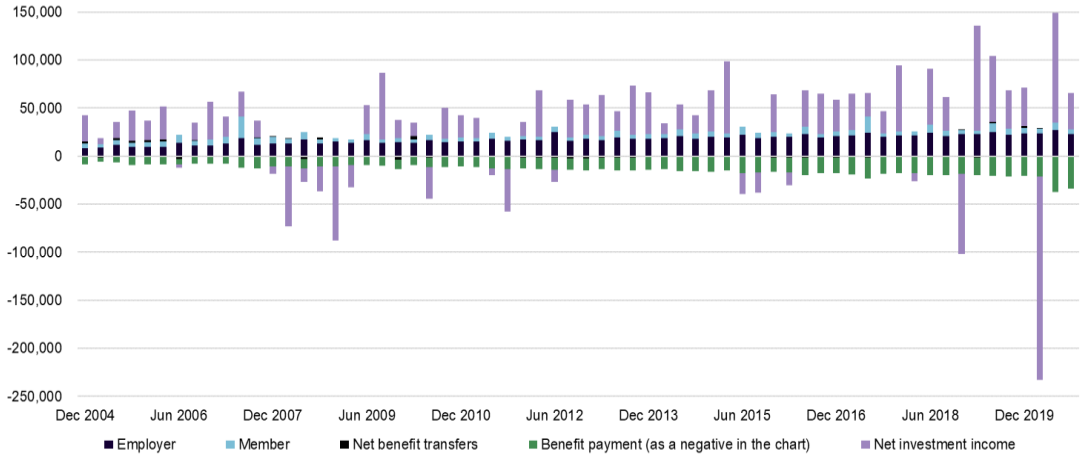
Strong investment returns have been, on average, the main contributor to flows into superannuation – see Figure 3.2.[10] Returns in individual quarters and years have been highly dependent on the volatility seen in equity markets, financial markets generally and the broader economy. The period leading up to the end of 2007 (or beginning of GFC period) saw positive investment contributions, after which there was successive quarters where net investment returns yielded negative returns as a consequence of the GFC. The period subsequent to the GFC saw positive investment returns as markets rebounded.

Figure 3.1 Superannuation assets ($ value current prices, and % of GDP)



Source: ABS Australian National Accounts: Finance and Wealth, Cat. No. 5232.0, Table 35. Household Balance Sheet

Figure 3.2 Net contribution flows ($m)



Source: APRA 2020, Quarterly Superannuation Statistics, Released Tuesday 24 November 2020, accessed 19 January 2021, available at https://www.apra.gov.au/quarterly-superannuation-statistics, Table 1a

[9] This includes persons with a superannuation account balance above zero and/or receiving regular income from superannuation and/or who received a lump sum superannuation payment in the last two years.

[10] Net inflows into superannuation assets are the sum of contributions (employer and personal) plus net benefit transfers less benefit payments.

A more stable (less variable) contributor to superannuation flows over recent decades has been employer contributions associated with the increasing SG coverage. More recent quarters have seen net contribution outflows from the industry be negative as a consequence of lower contributions (lower wages and/or lower total hours worked) coupled with high benefit payments associated with the Early Release Scheme (APRA 2021).

The pre-eminence of superannuation as the preferred financial vehicle for household saving is the product of various government reforms, including:

- The 1985 Accord negotiations, when it was agreed that a 3% wage increase that was deemed due on productivity grounds should be paid as a superannuation benefit. However, there was no universal coverage as many employers did not fulfill their obligations under awards and not all workers were covered (Treasury 2018 p. 3).
- In 1992, superannuation contributions became compulsory to help broaden coverage. The rate increased from 3% to 9 % by July 2002, thereby leading to a rapid rise in the coverage of employees in superannuation.
- In 2004, the Coalition Government introduced the superannuation co-contribution scheme, under which the Government contributed up to $1.50 for each dollar of personal superannuation contributions made by low to middle income earners.
- In 2006, choice of fund legislation was introduced to allow employees the right to choose the fund into which their compulsory SG is paid. Where employees do not nominate a fund and the default fund is not specified in a relevant award, employers select a default fund to which they contribute (Treasury 2018, p. 6).
- Since 2005, members can also require the trustee of their fund to transfer their accumulated benefit to another fund, allowing members to consolidate multiple superannuation accounts. The Productivity Commission estimates that one third of accounts (about 10 million) are unintended multiple accounts (PC 2018, p. 2).
- In 2014, MySuper products were introduced (following a recommendation of the Murray *Financial System Inquiry* report) so that employees who have not selected a super fund are assigned a default MySuper product, which resulted in simple and cost-effective default superannuation products for employees. The default products were designed as basic funds without unnecessary features and fees. MySuper products collectively hold over 15 million (over half of all) member accounts (PC 2018, p. 11).
- In 2016, the Government introduced the *Superannuation Tax Reform* package, which introduced a $1.6 million transfer balance cap which limits the total amount that can be transferred into tax-free earnings retirement phase, requiring those with incomes greater than $250,000 to pay 30% tax on concessional contributions and lowering the annual non-concessional contributions cap to $100,000 for those with balances less than $1.6 million.
- In 2018, the *Protecting Your Super* reforms were introduced to 'impose a fee cap to limit erosion' on balances less than $6,600, with trustees prevented from charging administration and investment fees exceeding 3 % of the balance each year (Treasury 2018, p. 16).

— The beginning stages of the COVID-19 pandemic in March 2020 also saw the Federal Government allow Australians in financial stress to access their superannuation through the *Early Release Scheme.* This amount was capped at $10,000 in the first financial year, and a further $10,000 in 2020-21. The withdrawals were tax-free and available to those eligible for the coronavirus supplement such as sole traders. APRA estimates that around $35.9 billion of superannuation payments were made since inception of the program, to a total number of 4.7 million members, with the average payment made over the period since inception is $7,643 overall (APRA 2021).[11]

— Similar to a number of other countries, Australia's provides concessional tax treatment for both contributions and earnings, but earnings are tax free on retirement and most withdrawals from superannuation are free of tax.

In addition, there have also been a number of reviews that have assessed the efficiency, governance, transparency, and regulatory frameworks of the superannuation system. These include: *Retirement Income Review* (2020), the Royal Commission into the *Misconduct in the Banking, Superannuation and Financial Services* (2019), the Productivity Commission's *Competition in the Australian Financial System* (2018) and the Murray Inquiry's *Financial System Inquiry* (2014).

3.1 Asset allocation of superannuation funds

It is also important to consider the asset allocation of superannuation funds in terms of their exposure to risk, return, and liquidity requirements.

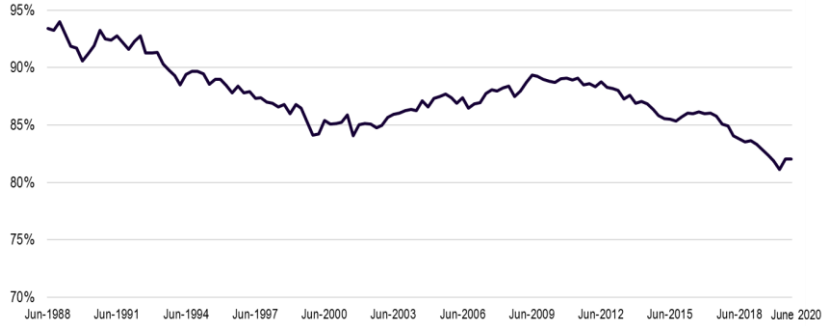
Figure 3.3 shows that Australian superannuation funds hold 82% of assets in Australia, with the remainder being invested overseas. This proportion has been trending down over the decades from 92 % in the early 1990s and crept up slightly following the GFC as international asset markets were less liquid and carried more risk.

The pool of superannuation funds is large and growing and will grow further as the SG rate is increased from 2021 to 2025 from 9.5% to 12%. As discussed in Chapter 4 we estimate that over the period 2022 to 2040, a total of $9.4 billion will be added to superannuation saving from the increase in the SG rate.

This will play a very important role in Australia's investment, productivity, and economic growth path. As the Retirement Income Review also noted:

"This stock of superannuation assets, which is the fourth largest in the world, is important to funding the economy and delivering retirement incomes. The investment of superannuation assets will play a significant role in the recovery of the Australian economy from the downturn initiated by the COVID-19 Pandemic".

Figure 3.3 Superannuation assets in Australia (% of total)

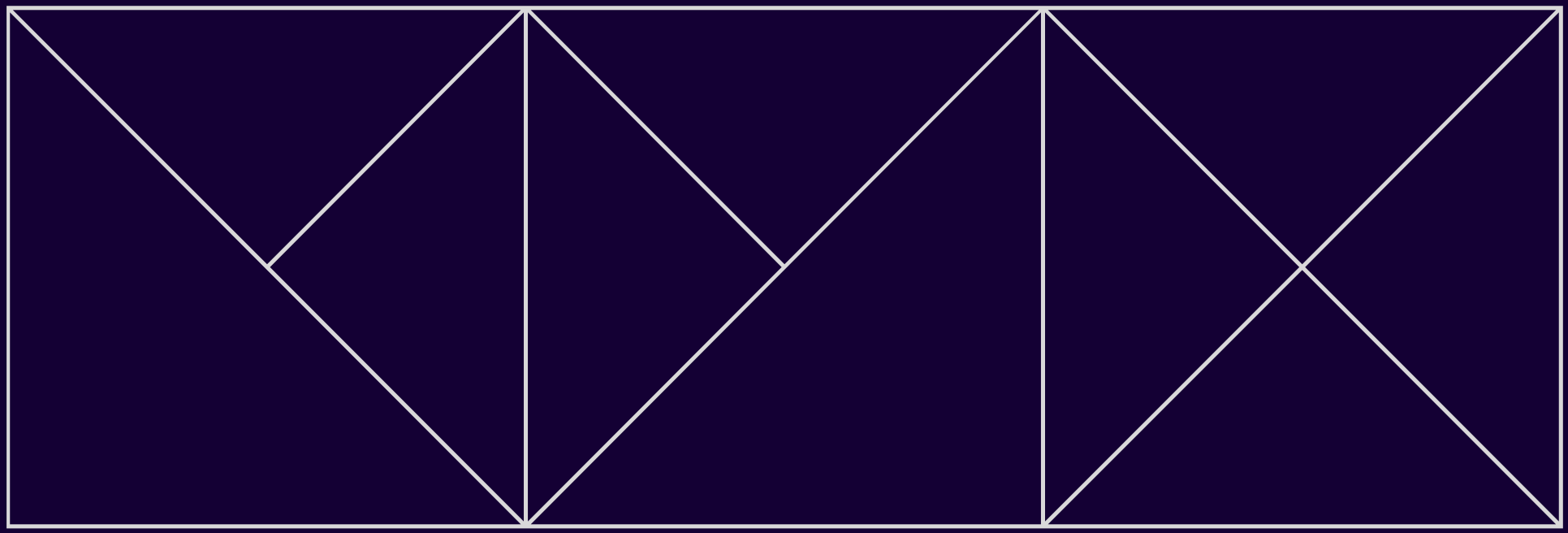


Source: ABS Australian National Accounts: Finance and Wealth, Cat. No. 5232.0, TABLE 35. Household Balance Sheet

[11] APRA 2021, *COVID-19 Early Release Scheme - Issue 35,* Published Wednesday 6 January 2021

4

Our Modelling Approach



4.1 CGE Modelling and Tasman Global

We analyse the impact of increasing the SG rate to 12% using the Tasman Global Computable General Equilibrium (CGE) model of the Australian economy. A CGE model captures the interlinkages between the markets of all commodities and factors, taking into account resource constraints, to find a simultaneous equilibrium in all markets. Tasman Global consists of 76 industries, with industries linked to each other through input-output relationships (e.g. the finance industry buys electricity from the electricity industry and sells financial services to every other industry in the economy).

This chapter discusses the modelling approach taken with the Tasman CGE model; Chapter 5 presents the results of the modelling.

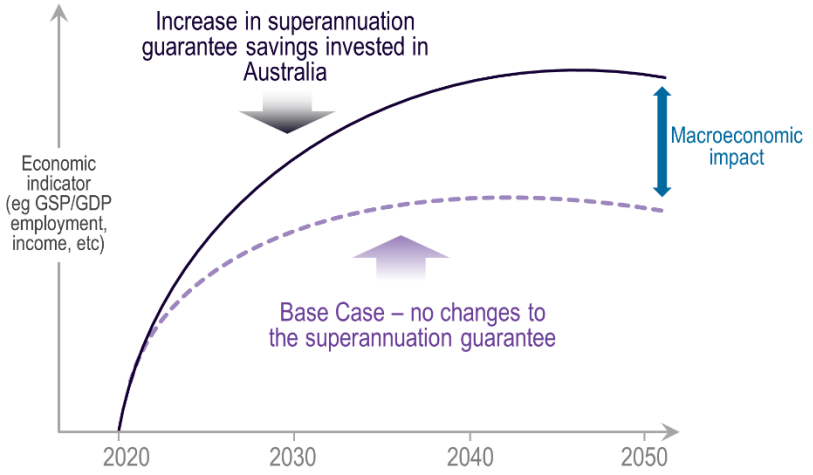
A global CGE model extends the interdependence of the markets across world regions and finds simultaneous equilibrium globally. A dynamic model adds onto this the interconnection of equilibrium economies across time periods. For example, investments made today determine the capital stocks of tomorrow and hence future equilibrium outcomes depend on today's equilibrium outcome, and so on. This feature is particularly relevant to the analysis in this report, which studies the impact on the economy of year-by-year additional household saving that, via business investment, accumulates into business capital.

An important feature of CGE models is that everything adds up. What this means is that sales from industry X to industry Y are equal to purchases by industry Y from industry X, and that exports of all goods and services from region A to region B are equal to imports of goods and services in region B from region A. Another feature of CGE models is that resource constraints are respected. This means, for example, that a boost to a particular industry that creates new jobs in that industry must result in fewer jobs (than there would otherwise be) in other industries, or there must be an explicit and modelled recognition that the additional jobs are filled by people who are unemployed or not in the labour force.

The impact on each variable of interest is calculated by first estimating a path over time for economy without an increase in the SG rate (the base case), and then estimating a path over time for the economy with the increase in the SG rate (the policy case). For each variable of interest, the difference in the paths in each time period is the estimated impact of the policy (See Figure 4.1). The policy case is generated by adding to the stock of household saving the additional saving that will be brought about by increasing the SG rate. This additional saving is distributed throughout the economy (and overseas) as additional investment, and the model estimates the economic impact.

A detailed description of the Tasman Global Model is in Appendix A.

Figure 4.1 CGE modelling base and policy case



4.2 How does an increase in the SG rate affect the economy?

An increase in the SG rate affects the economy by increasing the amount of saving by Australian households. When people put money into superannuation, this is a form of saving. Most of this money is then made available for Australian businesses to invest[12] with some being made available to foreign businesses. When Australian businesses invest, this adds to the nation's stock of capital which, combined with labour, technology, and land, are the factors of production that together produce the economy's output of goods and services.

This account is essentially the Solow-Swan neoclassical model of economic growth which, despite many extensions and refinements over the past 60+ years[13], is still the orthodox economic explanation of how economies grow in the long run, abstracting from the impacts of recessions and booms, which have different causes, and occur over short time frames.

The following three equations set out the relationships between the important economic variables that make up the macroeconomy.

$$GDP = C + I + (X-M) \quad (1)$$

$$S = GDP - C \quad (2)$$

$$S-I = X-M \quad (3)$$

It is important to note that these three equations are not theories about how the economy works, or tendencies which the economy reaches after a period of time. They are all accounting identities that are true *by definition*.

Equation (1) says that Gross Domestic Product (GDP), which is the value of goods and services produced in the economy, is equal to the amount spent on consumption of goods and services (C), the amount spent on investment goods and services (I),[14] plus goods and services that are exported (X), minus goods and services that are imported (M). The expression (X-M) is net exports, or the trade balance.

Income is either consumed or it is saved. Equation (2) defines saving (S) to be the difference between GDP and consumption (C)[15]. GDP is the total value of goods and services produced in the economy, and so is a measure of the nation's income.[16]

Combining equations (1) and (2), equation (3) says that the excess of saving over investment is identically equal to net exports.

Summarising, an increase in the SG rate increases the amount of saving done by households out of a given level of income. Most of this additional saving goes to Australian businesses to invest. This leads to increases in the amount of production of goods and services in the economy i.e. GDP increases. If the increase in saving is more than the increase in investment, then net exports will increase. This could be achieved in a number of different ways, but it is likely that imports will increase because imports tend to increase when GDP increases and because higher investment means more spending by businesses on equipment, nearly all of which is imported,

[12] The money is made available to businesses as either debt or equity. For this analysis, the division between debt and equity does not matter.

[13] Modern versions of the theory add innovation, entrepreneurship and knowledge as factors influencing the growth of economies in the long run.

[14] Consumption and investment here represent the amounts spent by both the private sector (households and businesses) and the public sector.

[15] Saving here is a flow concept. It means how much of the nation's income is saved in a period of time, usually taken to be a year. In popular discussions, saving is sometimes taken to mean a household's total assets at a point in time. This is a stock concept.

[16] Another measure is national income, discussed in Chapter 5, which accounts for the earnings on Australian assets owned by foreigners, the earnings on foreign assets owned by Australians and changes in the prices of goods and services produced in Australia vis a vis prices in other countries.

in the Australian case. Given that net exports increase, and imports increase, this means that exports increase by more than imports. This occurs because of an increase in competitiveness by Australian exporters, brought about because increased investment lowers their costs.

There are two impacts on consumption which go in opposite directions. The first impact is that for a *given level* of income, more of it will be saved, which reduces consumption. The second impact is that because of the higher levels of investment brought about by greater saving, incomes will be higher, which then increases consumption.

4.3 How much additional saving from an increase in the SG rate?

Not everybody will make additional superannuation contributions as the SG rate increases. People who already contribute above the 9.5% SG rate are not expected to be affected by increases in the SG rate. In 2020, SG contributions accounted for about 60% of total superannuation contributions ($71 billion out of $121 billion) [17]

Based on projected wages data, we estimate that over the period 2022 to 2040, a total of $11.8 billion will be added to household saving from the increase in the SG rate, assuming that 30% of the additional superannuation saving will be offset by falls in other saving (see section 4.6 below) and that superannuation contributions are taxed at 15%.

4.4 The Wages Question

In the public debate around increasing the SG rate, no issue has been more prominent than whether an increase in the SG rate will result in employees' nominal wages being reduced by an equivalent or near-equivalent amount. The argument by those who say wages will be reduced is essentially that what employers care about is the total cost of employing an employee, where the total cost is the wage, non-wage benefits that the employee receives (such as superannuation), taxes on employment (e.g. payroll tax) and other costs. If the total cost of employment that the employer is prepared to pay for an employee is (say) $100, so the argument runs, then if the employer has to pay another $10 in superannuation because the SG rate increases, then the employer will reduce the employee's wage by $10, leaving the cost of employment unchanged. In practice, because of legal, institutional, and other constraints, it is difficult for employers in most cases to actually reduce nominal wages, so the argument is modified to saying that wages will rise by $10 less than they would have absent the increase in the SG rate.[18]

Among those who have made an argument along these lines is the Grattan Institute, who via an econometric model of wage determination found that:

80 % of the cost of increases in super is passed to workers through lower wage rises within the life of an enterprise agreement, typically 2-to-3 years. And the longer-term impact is likely to be even higher.[19]

[17] Source: APRA

[18] In theory, employers could alternatively increase the prices they charge their customers by a sufficient amount so that the cost of employment in real terms is unchanged, but this alternative is not widely canvassed in the current debate, probably because Australia's inflation rate is very low and is likely to remain so for some time.

[19] https://grattan.edu.au/report/no-free-lunch/

Similarly, a study commissioned by the Retirement Income Review found that:

changes to the SG causally lower wages growth. The authors found pass-through was between 70 and 100 %.[20]

In contrast, other studies find no pass through from changes in the SG rate to wages.[21] The Retirement Incomes Review criticised the econometric methodology in these studies on a variety of grounds.

This report is not the place to extensively referee the merits of different econometric approaches. More fundamental than the differences in econometric methodology is the underlying difference between the two camps about how labour markets work.

Implicitly, those who say that an increase in the SG rate will lead to a reduction in wages have in mind a competitive model of the labour market, where market forces determine that employees are paid according to the going rate and neither employers nor employees have any ability, either individually or institutionally (through employer associations or unions) to affect wages. In this view of the world, there is a trade-off between superannuation paid by employers and wages paid by employers. This is a textbook result and is uncontroversial, provided one accepts the premise that labour markets are competitive, or approximately competitive.

On the other hand, those who deny that an increase in the SG rate will lead to a reduction in wages implicitly have in mind a monopsony theory of labour markets. A monopsony occurs when there is just a single buyer in a market. It is analogous to a monopoly, where there is a single seller in a product market. In a labour market setting, there is just one employer, the classic example being the company town. Just as where a monopoly, by exercising its market power, produces less and charges a higher price than would occur in a competitive product market where there are many sellers, a monopsonist employer employs fewer people and pays them a lower wage than would occur in a competitive labour market where there are many employers. In these circumstances, an increase in the SG rate would not only not lead to a reduction in wages, it would lead to more people being employed and perhaps also with higher wages for all employees. This counter-intuitive result arises because at a higher wage + superannuation, more people would offer themselves to be employed, and it would be profitable for the employer to hire them, as well as paying existing employees the higher wage + superannuation, though not as profitable as before the increase in the SG rate.

Whether, or to what extent, labour markets exhibit monopsonistic tendencies. appears to be researched less in Australia than other countries.[22] In the absence of contemporary contrary evidence, for the purpose of this study and this report, we make the conventional assumption that labour markets are competitive. Accordingly, we assume that 80% of the SG increase is passed through as lower wages (or lower wage growth). But – and this the crucial point that has been missed in the debate to date – as far as the impact of an increase in the SG rate on wages is concerned, ***whether labour markets are assumed to be competitive or not, and so whether there is in fact a trade-off, is a minor issue***. This is because the dynamic effects on wages, which we model, where wage growth is determined by economic growth, are much more important than whether or not there is an initial reduction in wages because of the SG increase.

[20] Retirement Income Review Final Report, July 2020, p484. The study is Breunig, R. & Sobeck, K., 2020. *The Economic Incidence of Superannuation,* Canberra: Crawford School of Public Policy, Australian National University.

[21] For example, Taylor, K., 2019. *Does Higher Superannuation Reduce Workers' Wages?,* Sydney: McKell Institute, and Stanford, D. J., 2019. *The Relationship Between Superannuation Contributions and Wages in Australia,* s.l.: The Centre for Future Work at the Australian Institute. Both studies are cited in the Retirement Incomes Review Final Report.

[22] See Manning, Alan (2020) Monopsony in labor markets: a review. Industrial and Labor Relations Review. ISSN 0019-7939, http://eprints.lse.ac.uk/103482/1/MonopsonyILR_Revision.pdf

4.5 Employment

In a CGE modelling exercise there are three possible underlying assumptions that can be made about the labour market. The first assumption is, in effect, unlimited slack in the labour market. All projects and policies can increase employment (in the modelling) by an unlimited amount if the project or policy is big enough. This assumption takes no account of the fact that there is a limited number of people who can be employed, given the size and age structure of the population. The second assumption is that a project or policy leads to zero change in the number of people employed nationally. Some CGE modellers adopt this assumption, but we consider it to be unrealistic. The third assumption, which we adopt, is that the supply of labour increases in response to increases in real wages. This means that a project or policy which leads to an increase in real wages will cause more people to seek employment (or they will seek to work longer hours). In equilibrium, employment in the economy will be higher.

How does an increase in the SG rate affect the number of jobs in the economy? Total employment in the economy is affected by both trend and cyclical factors. The trend factor is mainly related to demographics. In the long term, abstracting from cyclical factors like recessions and booms, the number of jobs is determined by the number of people of working age, and their participation rate in the workforce. In the short term, when the economy can boom and bust, the number of jobs can be highly variable. Higher levels of saving and investment affect the growth of the economy in the long run i.e. over decades. We abstract from short term cyclical factors in this report, because they are not affected in any meaningful way by what happens to the SG rate.

In keeping with our assumption about the labour market discussed above, we allow for the possibility that a permanently higher level of GDP brought about by a higher SG rate will increase the labour force participation rate, and so more people will be employed.

4.6 Key modelling assumptions about superannuation and saving

We make four key assumptions. The *first* assumption is that 30% of the increase in superannuation saving from the increase in SG rate is offset by reductions in other forms of saving. That is, for very additional $100 of superannuation saving that result from an increase in the SG rate, other saving will be reduced by $30. People can save in the superannuation system and outside it (for example, in the form of bank deposits, shares or bonds). The advantage of saving in the superannuation system is that it is generally more lightly taxed than saving outside the system. On the other hand, superannuation is usually not accessible until retirement, which is decades away for young people, whereas saving held outside the system can be accessed at any time. In the aggregate, saving inside and outside superannuation are somewhat substitutable, but not completely. The Retirement Income Review examined the evidence and found the offset to be 20% to 40%.[23] Consistent with this finding, we assume a saving offset of 30%.

The *second* assumption is that 80% of the additional saving is invested in Australia and so 20% of the additional saving is invested overseas. This assumption is consistent with current data on the share of superannuation assets that are foreign assets. This is an important assumption. The greater the percentage that is invested in Australia, the bigger the impact will be on the Australian economy. To see this, suppose that all of the additional saving is invested overseas. Then all the additional investment would by foreign businesses, and it will be other countries' economies that will benefit. Australia will only benefit to the extent that we receive earnings on foreign

[23] Retirement Income Review, p. 208.

assets. This will be reflected in a small increase in national income, but not GDP, because there will be no additional production in Australia.

We conduct sensitivity tests on both of these assumptions, with alternatives of a 20% saving offset (because people who will contribute more into superannuation with an increase in the SG rate probably do not save as much outside superannuation) and 40% of the additional superannuation saving invested overseas (because the funds with a high concentration of SG superannuation contributions tend to have higher foreign exposure).

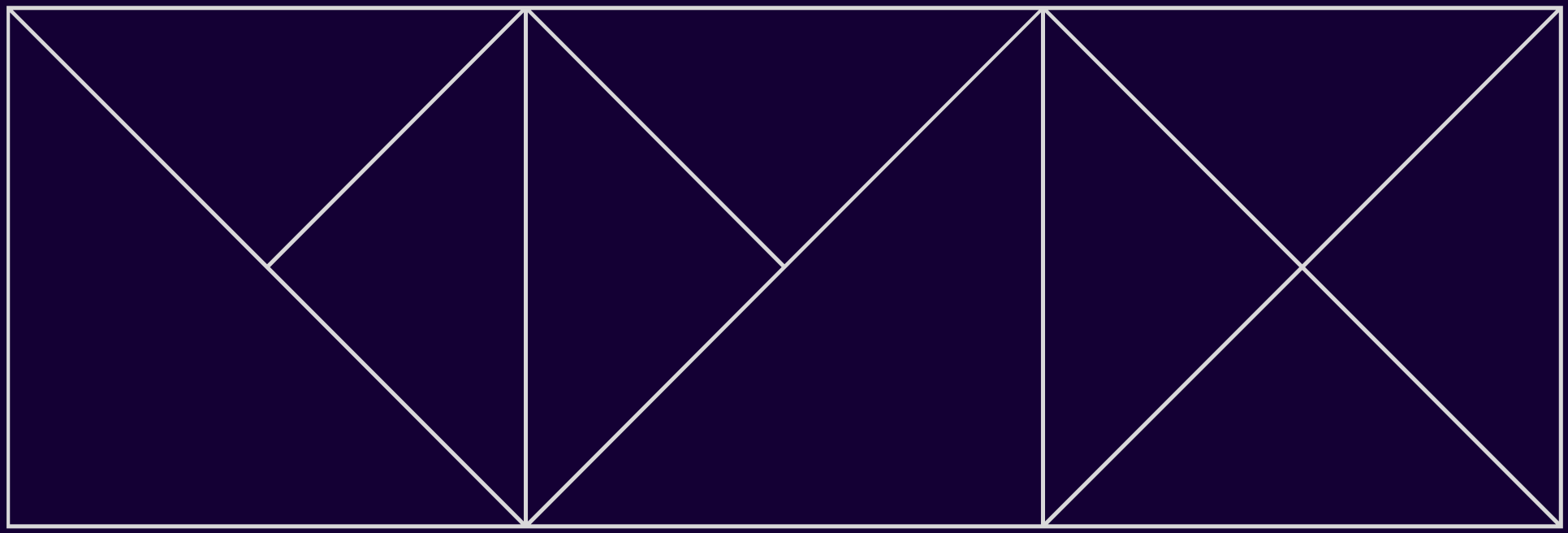
Our *third* assumption, consistent with current data, is that 5% of total superannuation assets are withdrawn every year.[24].

Our *fourth* modelling assumption is that the additional superannuation savings are distributed to each Australian industry according to their current shares of investment. In estimating the economic impacts, the CGE model dynamics reallocate capital to each industry where the rate of investment return exceeds the cost of capital and where investment is needed to replace depreciated capital.

[24] Source: APRA

5

Modelling Results

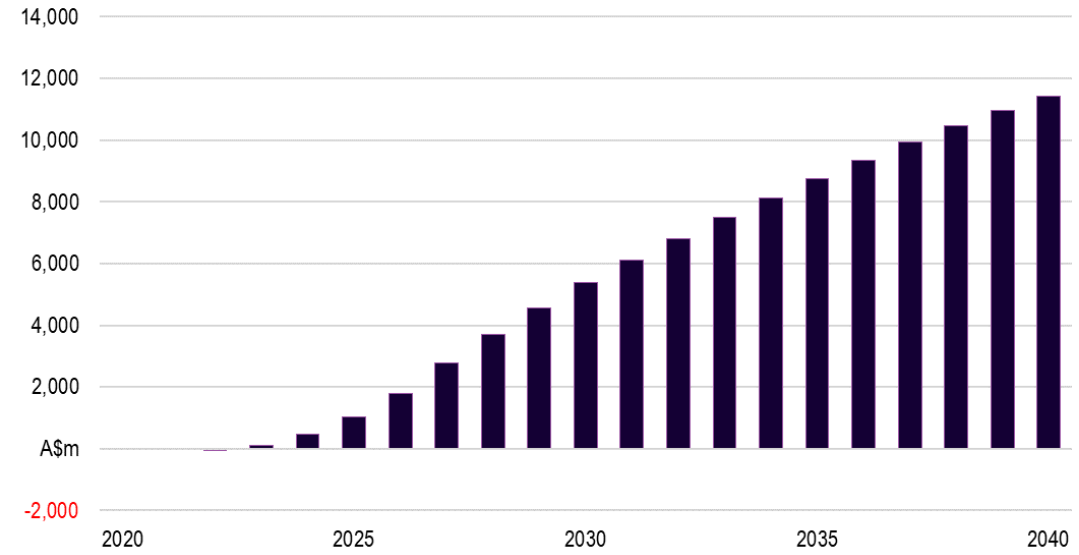


In this chapter, we report the results of the CGE economic modelling. All figures in dollar terms are in real $2020. The years marked on the horizontal axes of each of the charts are financial years, so for example 2040 represents the financial year 2039/40.

Figure 5.1 shows the impact on GDP (the total value of production). Recalling that the SG increase is implemented in five 0.5% increments beginning on 1 July 2021, material increases in GDP begin in 2024 and by 2040 GDP is just under $12 billion higher than it would have been without the increase in the SG rate.[25] [26]

The impacts on GDP are conservative and reflect the fundamental feature of CGE modelling that resources are constrained. In particular, while more capital is made available through a higher level of saving, the number of people available to work does not change (except in a small way), and production of goods and services requires both labour and capital. The additional capital makes production more capital-intensive and improves the economy's competitiveness relative to the rest of the world.

Figure 5.1 GDP (change from baseline, real $2020)



Source: ACIL Allen analysis

[25] There is a very small negative impact on GDP in 2022 (around $54 million, or $2 per person), reflecting a short lag between additional saving and when that additional saving becomes additional productive investment.

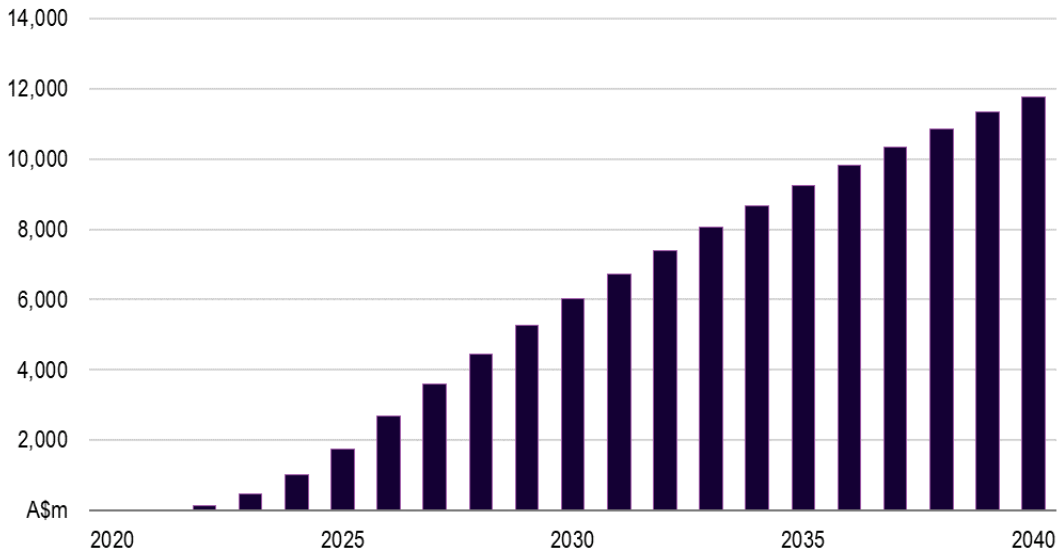
[26] Figure 5.1 shows that the increment in GDP increases over time, but at a decreasing rate. This is because of diminishing returns to capital.

Figure 5.2 shows the impact of national income. The impacts on national income are slightly higher than GDP, due to foreign income flows and terms of trade effects (essentially favourable changes in relative prices) which affect national income but not the aggregate value of production (which is what GDP is). While the quantitative difference between GDP and national income is small, there is an important difference of interpretation.

GDP, in itself, is not a measure of the well-being (or welfare) of the population. In global CGE models such as Tasman Global, the change in real income is equivalent to a theoretically well-defined and rigorous change in consumer well-being.[27] In other words, increasing the SG rate will lead to a substantial improvement in the well-being of the Australian people – all of them (on average), not just those people who will put more money into superannuation.

As discussed in Chapter 4, GDP, by definition, is equal to the sum of consumption, investment (both including consumption and investment by the public sector) and net exports (exports minus exports). It follows that the change in GDP following an increase in the SG rate is equal to change in consumption, plus the change in investment plus the change in the net exports. We now discuss the impacts on the components of GDP.

Figure 5.2 National income (change from baseline, real $2020)

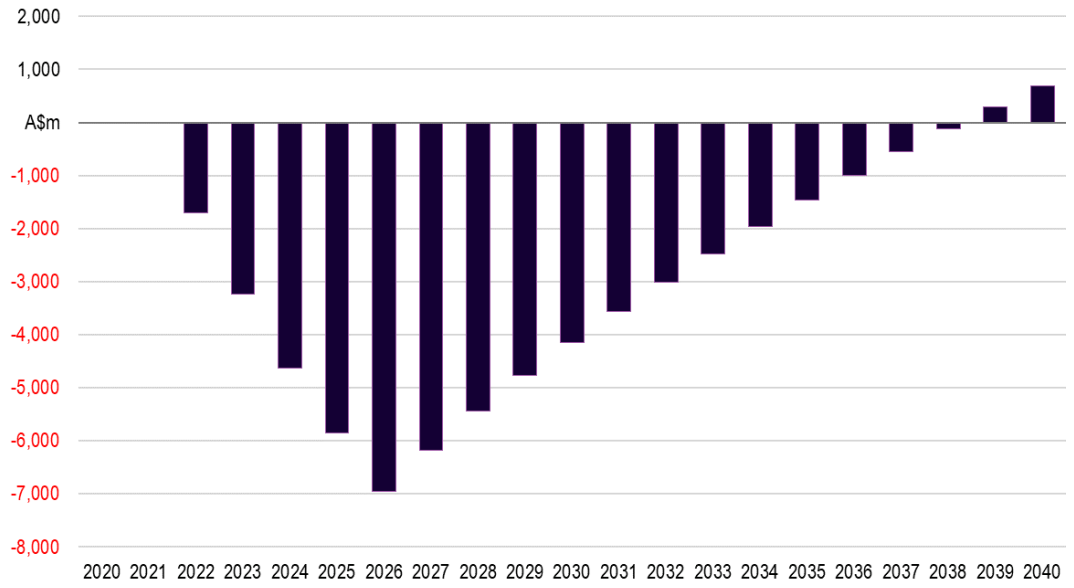


Source: ACIL Allen analysis

[27] Namely, the equivalent variation measure of welfare change resulting from exogenous shocks, using the Slutsky measure of income effects. For an extensive discussion of these issues, see Kevin J. Hanslow, *A General Welfare Decomposition for CGE Models*, GTAP Technical Paper No. 19 January 2000 https://www.gtap.agecon.purdue.edu/resources/download/185.pdf,

Figure 5.3 shows the impact on consumption. As discussed in Chapter 4, there are opposing forces acting on consumption. Early on, the additional saving force is dominant, with a negative impact on consumption so that the cumulative negative impact on consumption peaks in 2026 at $7 billion. Thereafter the negative force is smaller than the positive force – higher level of incomes leading to higher levels of consumption - and the cumulative negative impact on consumption declines in size. In 2039, the cumulative impact is positive, with consumption larger than it would be without the increase in the SG rate.

Figure 5.3 Consumption (change from baseline, real $2020)

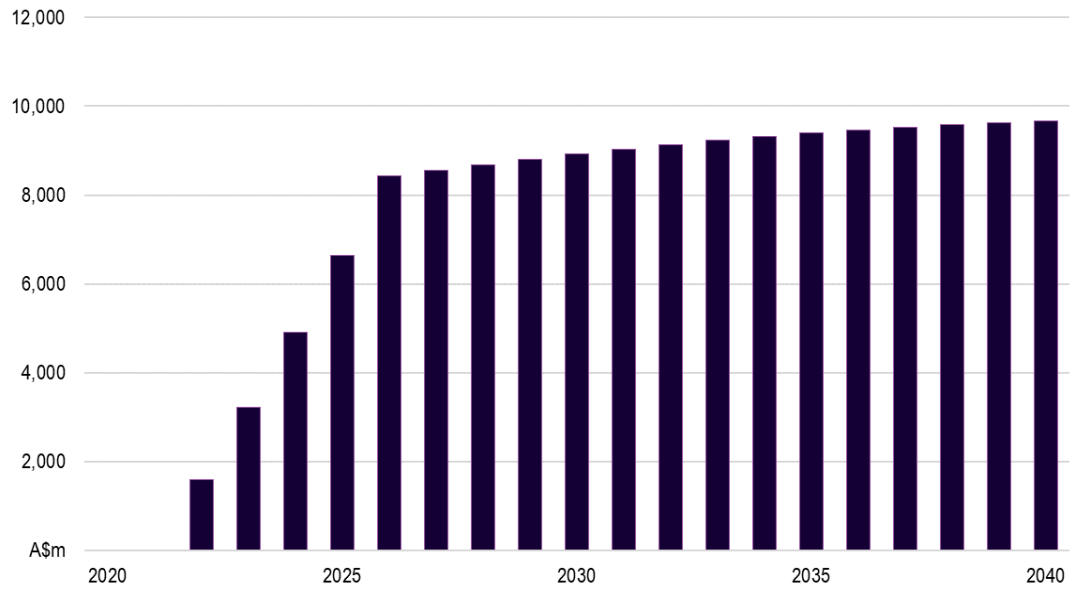


Source: ACIL Allen analysis

It is important to keep the negative impact on consumption in perspective. The modelling result does not show that consumption will fall in absolute terms. What it shows is that it will not grow as fast as it would absent the increase in the SG rate. Consumption in the financial year ended June 2019[28] was $1.450 trillion. In the previous 10 years it had grown at an average rate of 2.7% per year. At that growth rate, and if the SG rate is not increased, by 2025 consumption will be about $1.707 trillion and by 2026 about $1.754 trillion, an increase of $47 billion. The modelling results show that if the SG rate is increased, in 2026 when the negative impact on consumption will be at its peak, there will be a negative impact of $7 billion on consumption. This means that instead of growing by $47 billion in 2026, consumption will grow by $40 billion. This is the peak negative year for consumption. In other years, the negative impact on consumption will be smaller.

The impact on investment is shown in Figure 5.4. The positive impact on investment ramps up to be just under $10 billion by 2040.

Figure 5.4 Investment (change from baseline, real $2020)



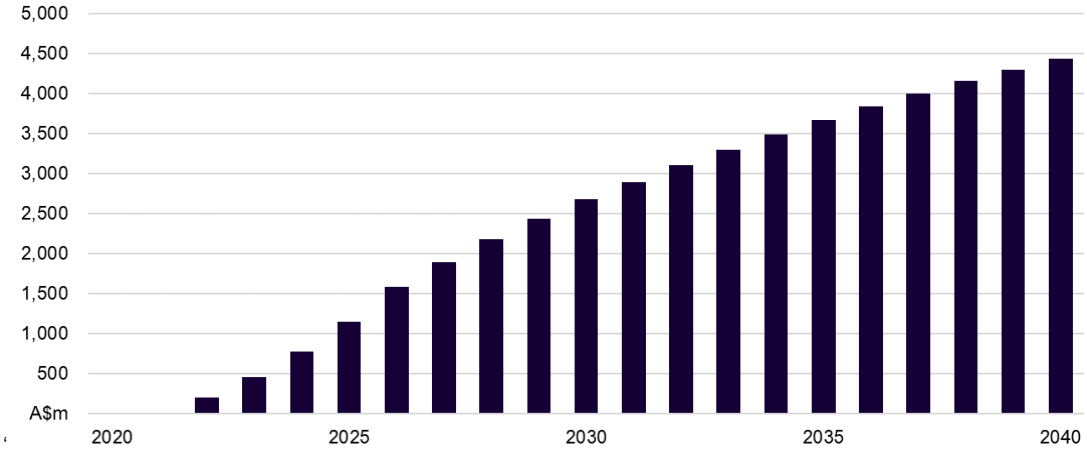
Source: ACIL Allen analysis

[28] The year to June 2020 was aberrant because of COVID-19, so we use figures for the year to June 2019.

Figure 5.5 and Figure 5.6 show the impacts on exports and imports, both of which are higher than they would be in the absence of the increase in the SG rate. The positive impact on exports occurs because the additional capital in the economy lowers the cost of capital, and this improves the competitiveness of Australian exporters in world markets.

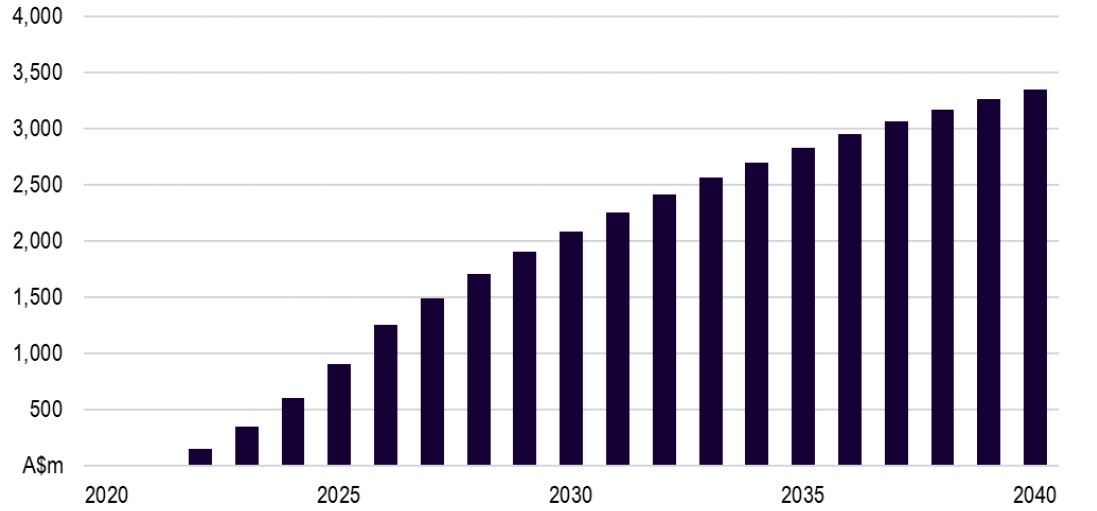
The positive impact on imports occurs because imports increase as national income and GDP increase. There is a bigger positive impact on exports than imports, reflecting the fact, as discussed in chapter 4, that saving increases more than investment.

Figure 5.5 Exports (change from baseline, real $2020)



Source: ACIL Allen analysis

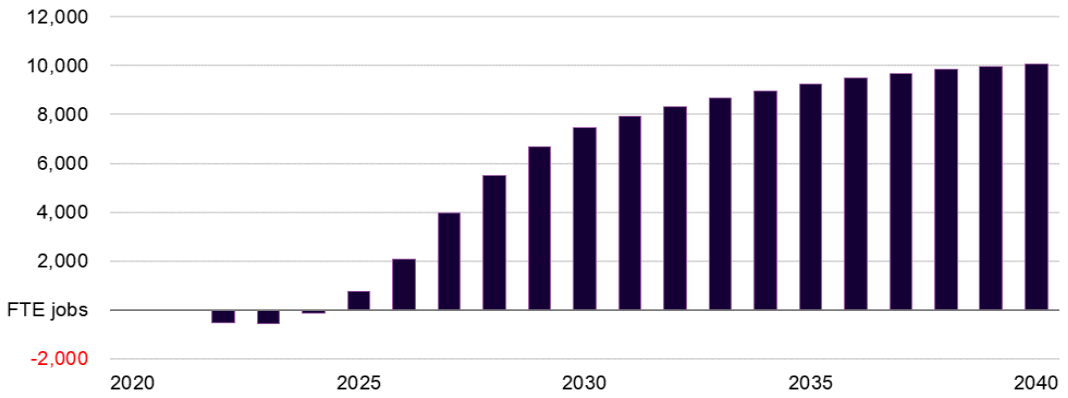
Figure 5.6 Imports (change from baseline, real $2020)



Source: ACIL Allen analysis

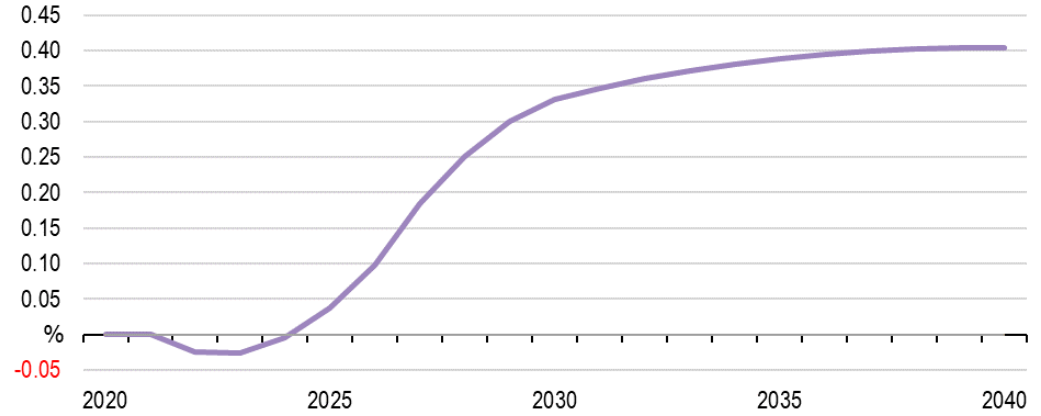
Figure 5.7 shows the impact on employment. By 2040, there is a positive impact on (FTE) jobs of 10,000[29], reflecting additions to the labour force by people responding to the increase in real wages, which is shown in Figure 5.8. There is a very small initial reduction in real wages, reflecting our assumption on the wage/superannuation trade-off discussed in Chapter 4. But there is a much larger permanent positive impact on real wages. As the economy grows due to the additional capital coming from additional saving, productivity grows as the economy's capital to labour ratio increases, firms demand more labour, and this leads to higher real wages. This effect is an order of magnitude (or more) larger than the initial trade-off effect. The dynamic processes that grow the economy shown here, initiated by the increase in the SG rate, are all important, much more important than short-term trade-offs between wages and superannuation.

Figure 5.7 Employment (change from baseline, FTE)



Source: ACIL Allen analysis

Figure 5.8 Real wages (change from baseline %)



Source: ACIL Allen analysis

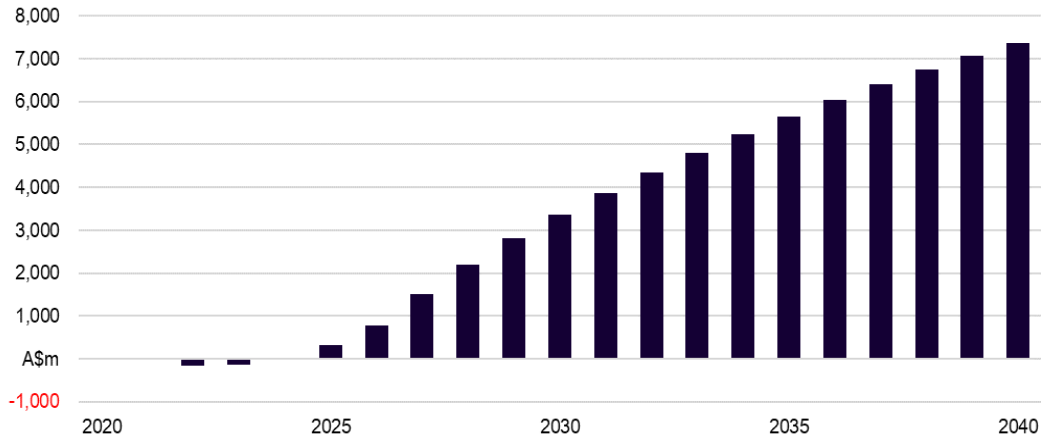
[29] The negative impact on jobs in the early years does not mean that people will lose their jobs following an increase in the SG rate. It means a very slightly smaller number of jobs will be created. The peak negative effect, in 2023, is around 500 jobs. Putting this number in perspective, the total number of jobs in the economy is around 13 million and FTE employment typically increases by around 250,000 per year.

Figure 5.9 shows the impact on GDP if 40% of additional saving goes overseas. The sensitivity here is quite large, with GDP in 2040 higher by $7.4 billion, quite a bit less than when 20% goes overseas ($11.8 billion). This is as expected. With less additional capital invested in Australia, there is less scope for additions to the production of goods and services.

Figure 5.10 shows the impact on GDP if there is a 20% saving offset, not 30%. The impact on GDP of increasing the SG rate is larger, as would be expected, growing by $13.1 billion in this case. With more saving, there is more investment and so more production of goods and services.

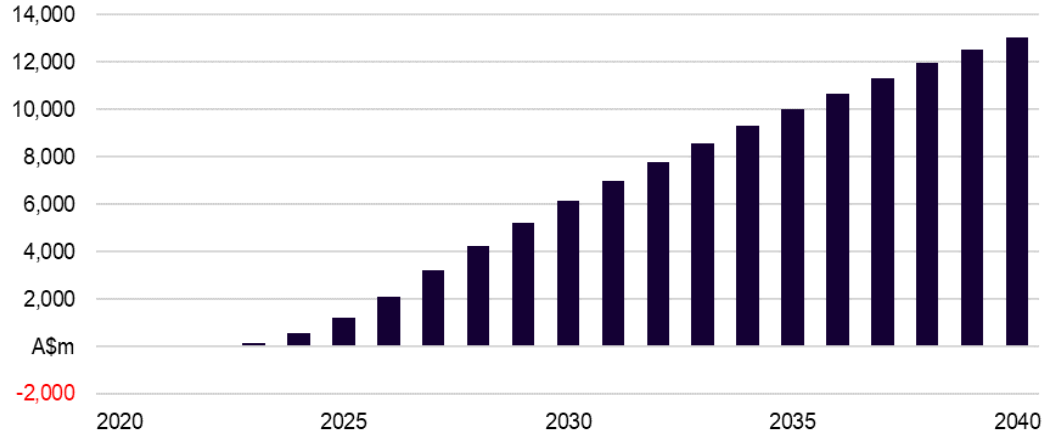
These two sensitivity tests are not comparable to each other.

Figure 5.9 GDP (40% foreign investment, change from baseline, real $2020)



Source: ACIL Allen analysis

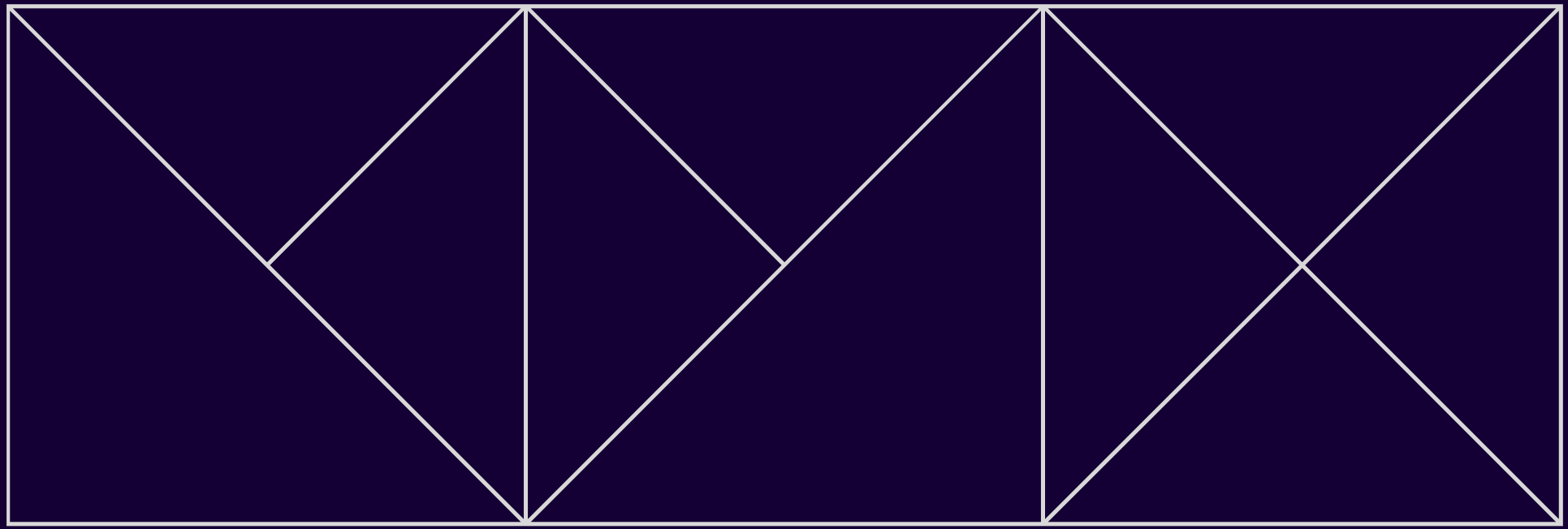
Figure 5.10GDP (20% saving offset, change from baseline, real $2020)



Source: ACIL Allen analysis

Findings

6



6.1 Increasing the SG rate is good for the economy

Increasing the SG rate will lead to a ***bigger economy*** ($12 billion bigger in 2040) than will occur without the increase in the SG rate.

6.2 Increasing the SG rate is good for Australians

Increasing the SG rate will lead to ***more jobs, higher real wages, and higher real incomes*** for Australians than will occur without the increase in the SG rate.

6.3 Is there an optimum SG rate?

The modelling reported here has shown that an increase in the SG rate from 9.5% to 12% will lead to a larger Australian economy and a higher level of well-being for Australians. It is natural to ask, does this mean that an even higher SG rate will lead to even more economic growth and an even higher level of well-being?

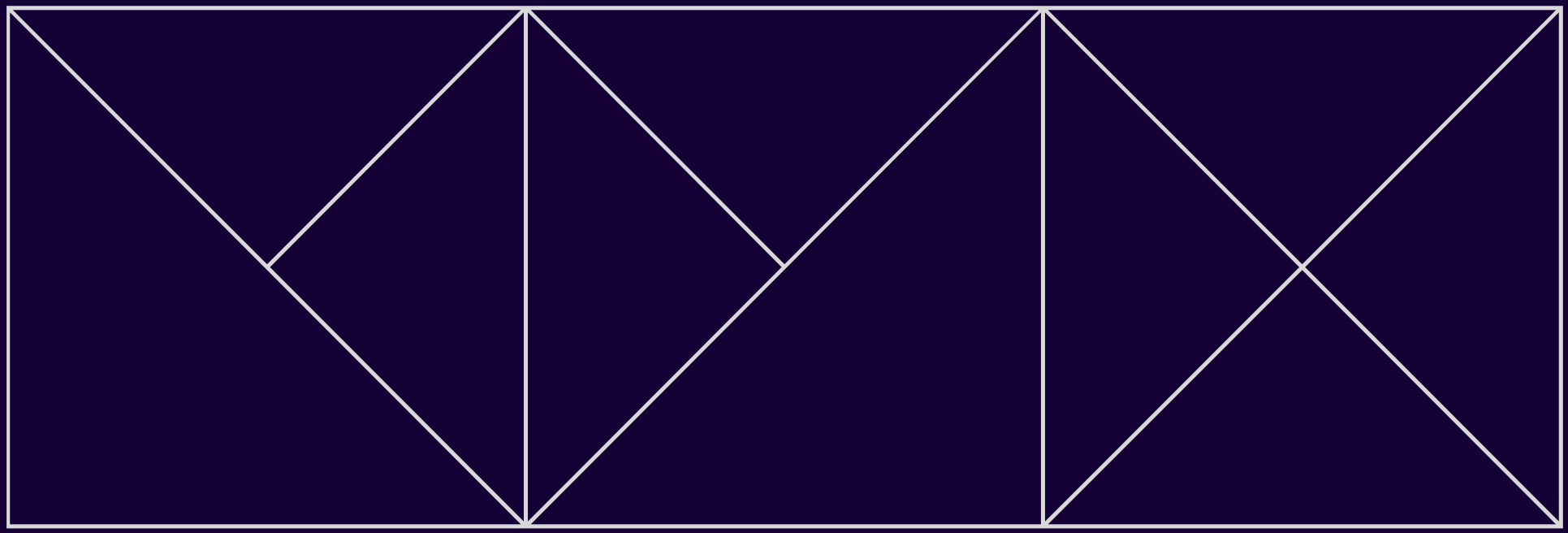
This is not a question we have attempted to answer. As a matter of theory, in the Solow-Swan model of economic growth, and also in other growth models, there is an optimum rate of saving (and investment) in an economy. At this point, known as the steady state, the economy has run out of worthwhile investment opportunities and the only investment needed is to replace worn out capital (depreciation). The Australian economy appears far from this point – there are many worthwhile investment opportunities across a range of industries, from healthcare to mining to renewable energy, among many others.

Indeed, the economy may never reach this point, as new technologies create new investment opportunities (something that is outside the theory). Nonetheless, as the pool of saving by Australians continues to grow, superannuation funds will probably increasingly look overseas for profitable investment opportunities.

It is in this sense that the GDP benefit of ever more superannuation saving may start to slow down. At what point this may happen is a matter for future research. There is no reason to believe that an SG rate of 12% is even close to that point.

Overview of the Tasman Global CGE Model

A



A.1 Overview

Tasman Global is a dynamic, global computable general equilibrium (CGE) model that has been developed by ACIL Allen for the purpose of undertaking economic impact analysis at the regional, state, national and global level.

A CGE model captures the interlinkages between the markets of all commodities and factors, taking into account resource constraints, to find a simultaneous equilibrium in all markets. A global CGE model extends this interdependence of the markets across world regions and finds simultaneous equilibrium globally. A dynamic model adds onto this the interconnection of equilibrium economies across time periods. For example, investments made today are going to determine the capital stocks of tomorrow and hence future equilibrium outcomes depend on today's equilibrium outcome, and so on.

A dynamic global CGE model, such as Tasman Global, has the capability of addressing total, sectoral, spatial, and temporal efficiency of resource allocation as it connects markets globally and over time. Being a recursively dynamic model, however, its ability to address temporal issues is limited. In particular, Tasman Global cannot typically address issues requiring partial or perfect foresight. However, as documented in Jakeman et al (2001),[30] it is possible to introduce partial or perfect foresight in certain markets using algorithmic approaches. Notwithstanding this, the model does have the capability to project the economic impacts over time of given changes in policies, tastes and technologies in any region of the world economy on all sectors and agents of all regions of the world economy.

Tasman Global was developed from the 2001 version of the Global Trade and Environment Model (GTEM) developed by ABARE (Pant 2001)[31] and has been evolving ever since. In turn, GTEM was developed out of the MEGABARE model (ABARE 1996), which contained significant advancements over the GTAP model of that time (Hertel 1997).[32]

A.2 A dynamic model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibria (one before an economic disturbance and one following). A dynamic model such as *Tasman Global* is beneficial when analysing issues for which both the timing of and the adjustment path that economies follow are relevant in the analysis.

In applications of the *Tasman Global* model, a Base Case simulation forms a 'business-as-usual' basis with which to compare the results of various simulations. The Base Case provides projections of growth in the absence of the changes to be examined. The impact of the change to be examined is then simulated and the results interpreted as deviations from the Base Case.

[30] Jakeman, G., Heyhoe, E., Pant, H., Woffenden, K. and Fisher, B.S. (2001), *The Kyoto Protocol: economic impacts under the terms of the Bonn agreement*. ABARE paper presented to the International Petroleum Industry Environmental Conservation Association conference, 'Long Term Carbon and Energy Management - Issues and Approaches', Cambridge, Massachusetts, 15-16 October

[31] Pant, H.M. (2007), *GTEM: Global Trade and Environment Model*, ABARE Technical Report, Canberra, June

[32] Hertel, T. (1997), *Global Trade Analysis: modelling and applications*, Cambridge University Press, Cambridge

A.3 The database

A key advantage of *Tasman Global* is the level of detail in the database underpinning the model. The database is derived from the Global Trade Analysis Project (GTAP) database (Aguiar et al. 2019).[33] This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport, and protection linkages among regions for all GTAP commodities. It is the most detailed database of its type in the world.

Tasman Global builds on the GTAP database by adding the following important features:

- a detailed population and labour market database
- detailed technology representation within key industries (such as electricity generation and iron and steel production)
- disaggregation of a range of major commodities including iron ore, bauxite, alumina, primary aluminium, brown coal, black coal and LNG
- the ability to repatriate labour and capital income
- explicit representation of the states and territories of Australia
- the capacity to represent multiple regions within states and territories of Australia explicitly.

Nominally, version 10.1 of the *Tasman Global* database divides the world economy into 153 regions (145 international regions plus the 8 states and territories of Australia) although in reality the regions are frequently disaggregated further. ACIL Allen regularly models Australian or international projects or policies at the regional level including at the or at the state/territory/provincial level for various countries.

The *Tasman Global* database also contains a wealth of sectoral detail currently identifying up to 76 industries (Table A.1). The foundation of this information is the input-output tables that underpin the database. The input-output tables account for the distribution of industry production to satisfy industry and final demands.

Industry demands, so-called intermediate usage, are the demands from each industry for inputs. For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input.

Final demands are those made by households, governments, investors, and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand.

Each sector in the economy is typically assumed to produce one commodity, although in *Tasman Global*, the electricity, transport and iron and steel sectors are modelled using a 'technology bundle' approach. With this approach, different known production methods are used to generate a homogeneous output for the 'technology bundle' industry. For example, electricity can be generated using brown coal, black coal, petroleum, base load gas, peak load gas, nuclear, hydro, geothermal, biomass, wind, solar or other renewable based technologies – each of which has its own cost structure.

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land, and natural resources) as well as paying taxes or receiving subsidies.

[33] Aguiar, A., Chepeliev, M., Corong, E., McDougall, R., & van der Mensbrugghe, D. (2019). The GTAP Data Base: Version 10. *Journal of Global Economic Analysis, 4(1)*, 1-27. Retrieved from https://www.jgea.org/ojs/index.php/jgea/article/view/77

A.4 Model structure

Given its heritage, the structure of the *Tasman Global* model closely follows that of the GTAP and GTEM models and interested readers are encouraged to refer to the documentation of these models for more detail (namely Hertel 1997 and Pant 2001, respectively). In summary:

- The model divides the world into a variety of regions and international waters.
  - Each region is fully represented with its own 'bottom-up' social accounting matrix and could be a local community, an LGA, state, country, or a group of countries. The number of regions in a given simulation depends on the database aggregation. Each region consists of households, a government with a tax system, production sectors, investors, traders, and finance brokers.
  - 'International waters' are a hypothetical region in which global traders operate and use international shipping services to ship goods from one region to the other. It also houses an international finance 'clearing house' that pools global saving and allocates the fund to investors located in every region.
  - Each region has a 'regional household'[34] that collects all factor payments, taxes, net foreign borrowings, net repatriation of factor incomes due to foreign ownership and any net income from trading of emission permits.
- The income of the regional household is allocated across private consumption, government consumption and saving according to a Cobb-Douglas utility function, which, in practice, means that the share of income going to each component is assumed to remain constant in nominal terms.
- Private consumption of each commodity is determined by maximising utility subject to a Constant Difference of Elasticities (CDE) function which includes both price and income elasticities.
- Government consumption of each commodity is determined by maximising utility subject to a Cobb-Douglas utility function.
- Each region has *n* production sectors, each producing single products using various production functions where they aim to maximise profits (or minimise costs) and take all prices as given. The nature of the production functions chosen in the model means that producers exhibit constant returns to scale.
  - In general, each producer supplies consumption goods by combining an aggregate energy-primary factor bundle with other intermediate inputs and according to a Leontief production function (which in practice means that the quantity shares remain in fixed proportions). Within the aggregate energy-primary factor bundle, the individual energy commodities and primary factors are combined using a nested-CES (Constant Elasticity of Substitution) production function, in which energy and primary factor aggregates substitute according to a CES function with the individual energy commodities and individual primary factors substituting with their respective aggregates according to further CES production functions.
  - Exceptions to the above include the electricity generation, iron and steel and road transport sectors. These sectors employ the 'technology bundle' approach developed by ABARE (1996) in which non-homogenous technologies are employed to produce a homogenous output with the choice of technology governed by minimising costs according to a modified-CRESH production function. For example, electricity may be generated from a variety of technologies (including brown coal, black coal, gas, nuclear, hydro, solar etc.), iron and steel may be produced from blast furnace or electric arc technologies while road transport services may be supplied using a range of different vehicle technologies. The 'modified-CRESH' function differs from the traditional CRESH function by also imposing the condition that the quantity units are homogenous.

[34] The term "regional household" was devised for the GTAP model. In essence it is an agent that aggregates all incomes attributable to the residents of a given region before distributing the funds to the various types of regional consumption (including saving).

- There are four primary factors (land, labour, mobile capital, and fixed capital). While labour and mobile capital are used by all production sectors, land is only used by agricultural sectors while fixed capital is typically employed in industries with natural resources (such as fishing, forestry, and mining) or in selected industries built by ACIL Allen.
  - Land supply in each region is typically assumed to remain fixed through time with the allocation of land between sectors occurring to maximise returns subject to a Constant Elasticity of Transformation (CET) utility function.
  - Mobile capital accumulates as a result of net investment. It is implicitly assumed in *Tasman Global* that it takes one year for capital to be installed. Hence, supply of capital in the current period depends on the last year's capital stock and investments made during the previous year.
  - Labour supply in each year is determined by endogenous changes in population, given participation rates and a given unemployment rate. In policy scenarios, the supply of labour is positively influenced by movements in the real wage rate governed by the elasticity of supply. For countries where sub-regions have been specified (such as Australia), migration between regions is induced by changes in relative real wages with the constraint that net interregional migration equals zero. For regions where the labour market has been disaggregated to include occupations, there is limited substitution allowed between occupations by individuals supplying labour (according to a CET utility function) and by firms demanding labour (according to a CES production function) based on movements in relative real wages.
  - The supply of fixed capital is given for each sector in each region.

The model has the option for these assumptions to be changed at the time of model application if alternative factor supply behaviours are considered more relevant.

- It is assumed that labour (by occupation) and mobile capital are fully mobile across production sectors implying that, in equilibrium, wage rates (by occupation) and rental rates on capital are equalised across all sectors within each region. To a lesser extent, labour and capital are mobile between regions through international financial investment and migration, but this sort of mobility is sluggish and does not equalise rates of return across regions.
- For most international regions, for each consumer (private, government, industries, and the local investment sector), consumption goods can be sourced either from domestic or imported sources. In any country that has disaggregated regions (such as Australia), consumption goods can also be sourced from other intrastate or interstate regions. In all cases, the source of non-domestically produced consumption goods is determined by minimising costs subject to a Constant Ratios of Elasticities of Substitution, Homothetic (CRESH) utility function. Like most other CGE models, a CES demand function is used to model the relative demand for domestically-produced commodities versus non-domestically produced commodities. The elasticities chosen for the CES and CRESH demand functions mean that consumers in each region have a higher preference for domestically-produced commodities than non-domestic commodities and a higher preference for intrastate- or interstate-produced commodities than foreign commodities.
- The capital account in *Tasman Global* is open. Domestic savers in each region purchase 'bonds' in the global financial market through local 'brokers' while investors in each region sell bonds to the global financial market to raise investible funds. A flexible global interest rate clears the global financial market.
- It is assumed that regions may differ in their risk characteristics and policy configurations. As a result, rates of return on money invested in physical capital may differ between regions and therefore may be different from the global cost of funds. Any difference between the local rates of return on capital and the global cost of borrowing is treated as the result of the existence of a risk premium and policy imperfections in the international capital market. It is maintained that the equilibrium

allocation of investment requires the equalisation of changes in (as opposed to the absolute levels of) rates of return over the base year rates of return.

- Any excess of investment over domestic saving in a given region causes an increase in the net debt of that region. It is assumed that debtors service the debt at the interest rate that clears the global financial market. Similarly, regions that are net savers gives rise to interest receipts from the global financial market at the same interest rate.
- Investment in each region is used by the regional investor to purchase a suite of intermediate goods according to a Leontief production function to construct capital stock with the regional investor cost minimising by choosing between domestic, interstate, and imported sources of each intermediate good via the CRESH production function. The regional cost of creating new capital stock versus the local rates of return on mobile capital is what determines the regional rate of return on new investment.
- In equilibrium, exports of a good from one region to the rest of world are equal to the import demand for that good in the remaining regions. Together with the merchandise trade balance, the net payments on foreign debt add up to the current account balance. *Tasman Global* does not require that the current account be in balance every year. It allows the capital account to move in a compensatory direction to maintain the balance of payments. The exchange rate provides the flexibility to keep the balance of payments in balance.
- Detailed bilateral transport margins for every commodity are specified in the starting database. By default, the bilateral transport mode shares are assumed to be constant, with the supply of international transportation services by each region solved by a cost-minimising international trader according to a Cobb-Douglas demand function. Emissions of six anthropogenic greenhouse gases (namely, carbon dioxide, methane, nitrous oxide, HFCs, PFCs and SF_6) associated with economic activity are tracked in the model. Almost all sources and sectors are represented; emissions from agricultural residues and land-use change and forestry activities are not explicitly modelled but can be accounted for externally. Prices can be applied to emissions which are converted to industry-specific production taxes or commodity-specific sales taxes that impact on demand. Abatement technologies similar to those adopted in a report released by the Australian Government (2008) are available and emission quotas can be set globally or by region along with allocation schemes that enable emissions to be traded between regions.

A.5 Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for each region represented in the *Tasman Global* database is projected using ACIL Allen's in-house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projected period.

For each of region, the model projects the changes in age-specific birth, mortality, and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example, reducing malaria-related mortality through better medicines, education, governance etc.). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the work force as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and regional participation rates by age by gender. Over the projected period labour supply in most developed economies is projected to grow slower than total population because of ageing population effects.

For the Australian states and territories, the projected aggregate labour supply from ACIL Allen's demographic module is used as the base level potential workforce for the detailed Australian labour market module, which is described in the next section.

A.5.1 The Australian labour market

Tasman Global has a detailed representation of the Australian labour market which has been designed to capture:

- different occupations
- changes to participation rates (or average hours worked) due to changes in real wages
- changes to unemployment rates due to changes in labour demand
- limited substitution between occupations by the firms demanding labour and by the individuals supplying labour, and
- limited labour mobility between states and regions within each state.

Tasman Global recognises 97 different occupations within Australia – although the exact number of occupations depends on the aggregation. The firms that hire labour are provided with some limited scope to change between these 97 labour types as the relative real wage between them changes. Similarly, the individuals supplying labour have a limited ability to change occupations in response to the changing relative real wage between occupations. Finally, as the real wage for a given occupation rises in one state relative to other states, workers are given some ability to respond by shifting their location. The model produces results at the 97 3-digit ANZSCO (Australian New Zealand Standard Classification of Occupations) level.

The labour market structure of *Tasman Global* is thus designed to capture the reality of labour markets in Australia, where supply and demand at the occupational level do adjust, but within limits.

Labour supply in *Tasman Global* is presented as a three-stage process:

1. labour makes itself available to the workforce based on movements in the real wage and the unemployment rate;
2. labour chooses between occupations in a state based on relative real wages within the state; and
3. labour of a given occupation chooses in which state to locate based on movements in the relative real wage for that occupation between states.

By default, *Tasman Global*, like all CGE models, assumes that markets clear. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model).

A.5.2 Labour market database

The *Tasman Global* database includes a detailed representation of the Australian labour market that has been designed to capture the supply and demand for different skills and occupations by industry. To achieve this, the Australian workforce is characterised by detailed supply and demand matrices.

On the supply side, the Australian population is characterised by a five-dimensional matrix consisting of:

- 7 post-school qualification levels
- 12 main qualification fields of highest educational attainment
- 97 occupations
- 101 age groups (namely 0 to 99 and 100+)
- 2 genders.

The data for this matrix is measured in persons and was sourced from the ABS 2011 Census. As the skills elements of the database and model structure have not been used for this project, it will be ignored in this discussion.

The 97 occupations are those specified at the 3-digit level (or Minor Groups) under the Australian New Zealand Standard Classification of Occupations (ANZSCO)

On the demand side, each industry demands a particular mix of occupations. This matrix is specified in units of full-time equivalent (FTE) jobs where an FTE employee works an average of 37.5 hours per week. Consistent with the labour supply matrix, the data for FTE jobs by occupation by industry was also sourced from the ABS 2011 Census and updated using the latest labour force statistics.

Matching the demand and supply side matrices means that there is the implicit assumption that the average hours per worker are constant, but it is noted that mathematically changes in participation rates have the same effect as changes in average hours worked.

A.5.3 Labour market model structure

demand for a particular set of skills and occupations. In contrast, the supply of each set of skills and occupations in a given year is primarily driven by the underlying demographics of the resident population. This creates a market for each skill by occupation that (unless specified otherwise) needs to clear at the start and end of each time period.[35] The labour markets clear by a combination of different prices (i.e. wages) for each labour type and by allowing a range of demand and supply substitution possibilities, including:

- changes in firms' demand for labour driven by changes in the underlying production technology
  - for technology bundle industries (electricity, iron and steel and road transportation) this occurs due to changes between explicitly identified alternative technologies
  - for non-technology bundle industries this includes substitution between factors (such as labour for capital) or energy for factors
- changes to participation rates (or average hours worked) due to changes in real wages
- changes in the occupations of a person due to changes in relative real wages
- substitution between occupations by the firms demanding labour due to changes in the relative costs
- changes to unemployment rates due to changes in labour demand, and
- limited labour mobility between states due to changes in relative real wages.

All of the labour supply substitution functions are modified-CET functions in which people supply their skills, occupation, and rates of participation as a positive function of relative wages. However, unlike a standard CET (or CES) function, the functions are 'modified' to enforce an additional constraint that the number of people is maintained before and after substitution.[36]

[35] For example, at the start and end of each week for this analysis. *Tasman Global* can be run with different steps in time, such as quarterly or bi-annually in which case the markets would clear at the start and end of these time points.

[36] As discussed in Dixon, P.B., Parmenter, B., Sutton, J., & Vincent, D. (1997), *ORANI: A Multisectoral Model of the Australian Economy*, Amsterdam: North Holland, , a standard CES/CET function is defined in terms of *effective units*. Quantitatively this means that, when substituting between, say, X_1 and X_2 to form a total quantity X using a CET function a simple summation generally does not actually equal X. Use of these functions is common practice in CGE models when substituting between substantially different units (such as labour versus capital or imported versus domestic services) but was not deemed appropriate when tracking the physical number of people. Such 'modified' functions have long been employed in the technology bundles of *Tasman Global* and GTEM. The Productivity Commission have proposed alternatives to the standard CES to overcome similar and other weaknesses when applied to internationally traded commodities.

Although technically solved simultaneously, the labour market in *Tasman Global* can be thought of as a five-stage process:

- labour makes itself available to the workforce based on movements in the real wage (that is, it actively participates with a certain number of average hours worked per week)
- the age, gender and occupations of the underlying population combined with the participation rate by gender by age implies a given supply of labour (the potentially available workforce)
- a portion of the potentially available workforce is unemployed, implying a given available labour force
- labour chooses to move between occupations based on relative real wages
- industries alter their demands for labour as a whole and for specific occupations based on the relative cost of labour to other inputs and the relative cost of each occupation.

By default, *Tasman Global*, like all CGE models, assumes that markets clear at the start and end of each period. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model). In principle, (subject to zero starting values) people of any age and gender can move between any of the 97 occupations while industries can produce their output with any mix of occupations. However, in practice the combination of the initial database, the functional forms, low elasticities, and moderate changes in relative prices for skills, occupations etc. means that there is only low to moderate change induced by these functions. The changes are sufficient to clear the markets, but not enough to radically change the structure of the workforce in the timeframe of this analysis.

Factor-factor substitution elasticities in non-technology bundle industries are industry specific and are the same as those specified in the GTAP database[37], while the fuel-factor and technology bundle elasticities are the same as those specified in GTEM.[38] The detailed labour market elasticities are ACIL Allen assumptions, previously calibrated in the context of the model framework to replicate the historical change in the observed Australian labour market over a five year period[39]. The unemployment rate function in the policy scenarios is a non-linear function of the change in the labour demand relative to the reference case with the elasticity being a function of the unemployment rate (that is, the lower the unemployment rate the lower the elasticity and the higher the unemployment rate the higher the elasticity).

A.6 Detailed energy sector and linkage to *PowerMark* and *GasMark*

Tasman Global contains a detailed representation of the energy sector, particularly in relation to the interstate (trade in electricity and gas) and international linkages across the regions represented. To allow for more detailed electricity sector analysis, and to aid in linkages to bottom-up models such as ACIL Allen's *GasMark* and *PowerMark* models electricity generation is separated from transmission and distribution in the model. In addition, the electricity sector in the model employs a 'technology bundle' approach that separately identifies up to twelve different electricity generation technologies:

- brown coal (with and without carbon capture and storage)
- black coal (with and without carbon capture and storage)

[37] *Badri Narayanan G., Betina V. Dimaranan and Robert A. McDougall* (2012), **G**TAP 8 Data Base Documentation - Chapter 2: Guide to the GTAP Data Base, https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=3777 .

[38] Pant (2007).

[39] This method is a common way of calibrating the economic relationships assumed in CGE models to those observed in the economy. See for example Dixon, P.B. and Rimmer, M.T. (2002), *Dynamic General Equilibrium Modelling for Forecasting and Policy*. Contributions to Economic Analysis 256, Amsterdam: North Holland.

- petroleum
- base load gas (with and without carbon capture and storage)
- peak load gas
- hydro
- geothermal
- nuclear
- biomass
- wind
- solar
- other renewables.

To enable more accurate linking to *PowerMark* the generation cost of each technology is assumed to be equal to their long run marginal cost (LRMC) while the sales price in each region is matched to the average annual dispatch weighted prices projected by *PowerMark* – with any difference being returned as an economic rent to electricity generators. Fuel use and emissions factors by each technology are also matched to those projected in *PowerMark*. This representation enables the highly detailed market based projections from *PowerMark* to be incorporated as accurately as possible into *Tasman Global.*

Table A.1 Standard sectors in the Tasman Global Model

1	Paddy rice	**39**	Diesel (incl. nonconventional diesel)
2	Wheat	**40**	Other petroleum, coal products
3	Cereal grains nec	**41**	Chemical, rubber, plastic products
4	Vegetables, fruit, nuts	**42**	Iron ore
5	Oil seeds	**43**	Bauxite
6	Sugar cane, sugar beet	**44**	Mineral products nec
7	Plant- based fibres	**45**	Ferrous metals
8	Crops nec	**46**	Alumina
9	Bovine cattle, sheep, goats, horses	**47**	Primary aluminium
10	Pigs	**48**	Metals nec
11	Animal products nec	**49**	Metal products
12	Raw milk	**50**	Motor vehicle and parts
13	Wool, silk worm cocoons	**51**	Transport equipment nec
14	Forestry	**52**	Electronic equipment
15	Fishing	**53**	Machinery and equipment nec
16	Brown coal	**54**	Manufactures nec
17	Black coal	**55**	Electricity generation
18	Oil	**56**	Electricity transmission and distribution
19	Liquefied natural gas (LNG)	**57**	Gas manufacture, distribution
20	Other natural gas	**58**	Water
21	Minerals nec	**59**	Construction
22	Bovine meat products	**60**	Trade
23	Pig meat products	**61**	Road transport
24	Meat products nec	**62**	Rail and pipeline transport
25	Vegetables oils and fats	**63**	Water transport
26	Dairy products	**64**	Air transport
27	Processed rice	**65**	Transport nec
28	Sugar	**66**	Warehousing and support activities
29	Food products nec	**67**	
30	Wine	**68**	Communication
31	Beer	**69**	Financial services nec
32	Spirits and RTDs	**70**	Insurance
33	Other beverages and tobacco products	**71**	Business services nec
34	Textiles	**72**	Recreational and other services
35	Wearing apparel	**73**	Public Administration and Defence
36	Leather products	**74**	Education
37	Wood products	**75**	Human health and social work activities
38	Paper products, publishing	**76**	Dwellings

Note: nec = not elsewhere classified.

SOURCE: ACIL ALLEN CONSULTING

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