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Fiscal Policy in the COVID-19 Era[1]

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This paper analyses the COVID recession and the large fiscal policy response by modelling scenarios using a macro-econometric model. The COVID recession mainly arose from lower household consumption of certain services under COVID social distancing. The fiscal response to compensate for income losses in those service industries meant that unemployment was around 2 percentage points lower for 3 years than otherwise would have been the case. However, there was over-compensation: for every $1 of income the private sector lost under COVID, fiscal policy provided $2 of compensation. Following the end of social distancing, the aftereffects of over-compensation and over-prolonged loose monetary policy are modelled to have generated excess demand that temporarily added up to 3 percentage points to the annual inflation rate. Also, three forms of over-compensation in the JobKeeper program that led the fiscal response created disincentive effects and inequities. The primary lesson for future pandemics is that fiscal policy should compensate, but not over-compensate, for income losses, both in aggregate and at the program level. The secondary lesson is that monetary policy needs to take more account of the stimulus already provided by the fiscal response, so that interest rates do not remain very low for too long.

Keywords: fiscal policy, COVID, econometric modelling, macroeconomic outlook, JobKeeper.

1. Introduction

In March 2020 COVID-19 reached Australia, affecting health outcomes. On top of the voluntary social distancing by individuals to reduce their risk of becoming infected, the government introduced international and domestic restrictions to limit the spread of COVID to and within Australia. These COVID-related developments led to recession and the government responded to that recession with a highly expansionary fiscal policy.

The two goals of this paper are first to analyse how the COVID-related developments led to recession and second to analyse the appropriateness of the government's fiscal policy response so that it can be improved in future pandemics. With the benefit of hindsight, which government policy

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advisers did not have in March 2020, we now have a better understanding of both the nature of a COVID-type economic shock and the effects of a particular fiscal response.

This paper analyses the effects of COVID-related developments as a whole, without distinguishing between voluntary and mandatory social distancing. That distinction is important if the policy focus is on the appropriate level of mandatory social distancing, as in Eichenbaum *et al*. (2021). However, our policy focus is on the appropriate fiscal response to pandemics, so like Jordà and Nechio (2022) and de Soyres *et al*. (2022), we can take the level of social distancing as given.

The shape of the COVID recession is different from the previous recessions of the last 40 years (Figure 1). This recession began with the largest and quickest decline in real GDP, with GDP down by 7 per cent after just two quarters. This was followed by an unusually quick recovery, with the loss in GDP largely unwound only two quarters later.

Thus, the main COVID recession followed a deep V shape rather than the shallow U shape of the two preceding recessions. As we shall see, this V shape was generated when real GDP fell and rose with changes in social distancing during COVID that drove consumer spending on certain services. This was repeated on a smaller scale in the September quarter 2021 in response to the delta variant of COVID-19 (Figure 1). In contrast, the U shapes of the two previous longer and shallower recessions were generated when protracted periods of low housing and/or business investment were involved in effecting adjustments in capital stocks.

To more fully analyse the reasons for the unusual V-shaped recession(s) and the appropriateness of the fiscal policy response, this paper uses a macro-econometric model of Australia (Murphy, 2020) to construct several scenarios (Figure 2).

The *no COVID* scenario simulates the hypothetical situation in which there is no COVID-19 pandemic. This involves removing both the COVID shocks to the economy and the expansionary fiscal and monetary policies that were introduced in response. This results in the economy growing relatively smoothly. Other shocks to the economy, such as from the war in the Ukraine, are not removed so growth is not completely smooth.

The *COVID* scenario simulates another hypothetical situation. In this case there is a COVID pandemic, but the expansionary fiscal and monetary policies that were introduced in response are removed. Compared to the *no COVID* scenario, there is a loss in real GDP of 9 per cent in 2020q2 declining to a loss of 4 per cent by 2021q4 (Figure 2), these losses being a result of COVID and the associated social distancing.

The final scenario is not counterfactual, but rather shows the actual path of GDP to 2022q2 and a forecast thereafter. It therefore reflects both COVID and the actual expansionary fiscal and monetary policies that were introduced in response. Compared to the *no COVID* scenario, in this *COVID plus*

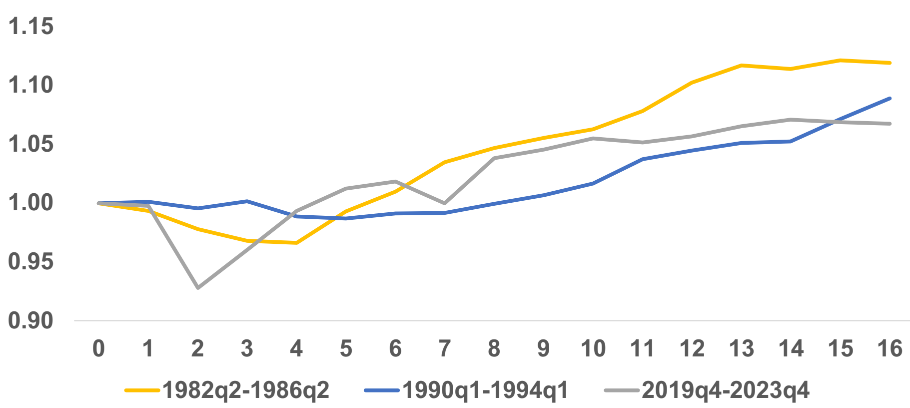

Figure 1. *Real GDP in Three Recessions (Scaled to Unity in each Starting Quarter)*

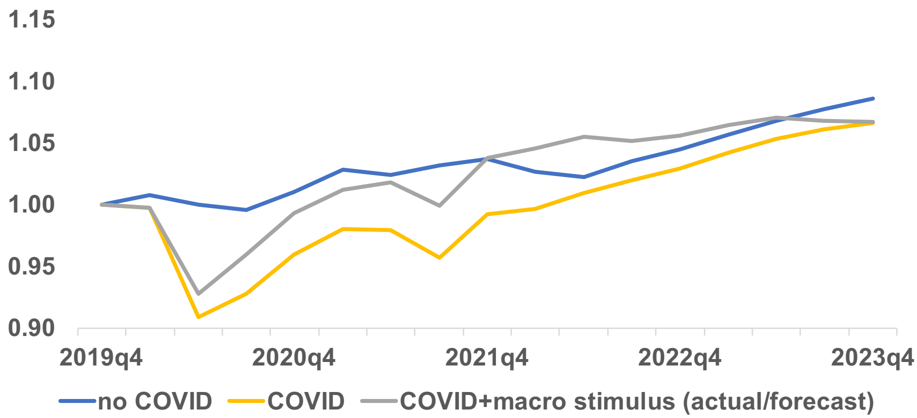

Figure 2. *Real GDP under Three Scenarios (Scaled to Unity in 2019q4)*

macro stimulus scenario there is a loss in real GDP of 7 per cent in 2020q2 declining to no loss at all by 2021q4 (Figure 2). The path for real GDP appears as both the *2019q4–2023q4* line in Figure 1 and the *actual/forecast* line in Figure 2.

The smaller and more ephemeral GDP losses under the macro stimulus show that it was successful in reducing the depth and length of the recession brought about by COVID, which is the first major finding of this study. At the same time, the second major finding of this study is that the fiscal expansion included in the macro stimulus was excessive. For every $1 of real income that the private sector lost due to COVID, fiscal policy provided $2 of compensation. This fiscal over-compensation contributes to high inflation in 2022–24. Similarly, Jordà and Nechio (2022) find that Australia was one of five out of 17 OECD countries where there was over-compensation, and that this 'aggressive fiscal support' contributed to inflation.

Inflation outcomes in our scenarios are as follows. In the *no COVID* scenario, inflation rises to achieve the Reserve Bank's target rate of 2–3 per cent, from 2021q2 onwards (Figure 3). In the *COVID* scenario, the suppression of household spending during COVID results in lower inflation to 2022q2. However, the release of that suppression with the end of social distancing results in higher inflation from 2022q3 to 2023q4, with inflation peaking at 4.2 per cent in 2022q4. In the *actual/forecast* scenario, the excessive macro stimulus drives inflation 3 percentage points higher to a peak of 7.2 per cent. Here, consumer price inflation is measured using the national accounts price deflator for household consumption, because it is less volatile than the CPI.

Thus, the macro stimulus adds 3.0 percentage points to inflation during 2022. Further scenario analysis shows that 2.4 percentage of this is attributable to the fiscal response to COVID and 0.6 percentage points to monetary policy being more expansionary in the 2021–22 financial year than would normally be the case, given the then prevailing macroeconomic conditions.

The outbreak of inflation that occurred in 2022 was not generally foreseen in 2021. In June 2021, the average forecast from a panel of 21 economists was for inflation in 2022 of 2.1 per cent (Martin, 2021). In November 2021, the Reserve Bank's inflation forecast for 2022 was 2.25 per cent (Reserve Bank of Australia, 2021). Finally, in December 2021, the Treasury's inflation forecast (Australian Government, 2021b) was 2.75 per cent for 2021–22 and 2.5 per cent for 2022–23.

In contrast, in late 2021 this study did foresee an outbreak in inflation and has been consistent in that forecast. In October 2021 in a seminar paper (Murphy, 2021b), inflation was forecast to reach a peak of 6.2 per cent. This was updated to 6.5 per cent in March 2022 in the first submission of this paper and to 7.2 per cent when this paper's scenarios were finalised on 22 November 2022. The

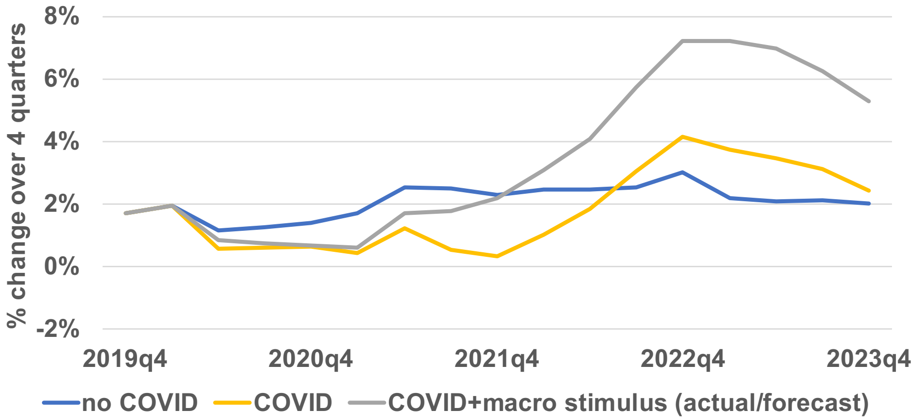

Figure 3. *Consumer Price Inflation under Three Scenarios*

outcome for consumer price inflation in 2022, published in the December quarter national accounts released on 1 March 2023, was similar at 6.9 per cent.

The key to this more accurate inflation forecasting was detailed modelling of the effects of the excessive fiscal expansion and the exit from COVID. These factors do not seem to have had the same influence on the inflation forecasts of other Australian forecasters.

Compared to other Australian macro models, the model used in this paper has three advantages in analysing the COVID recession and the fiscal policy response. First, it contains more industry detail to better capture how COVID impacted unevenly across the economy. Second, following model development work in 2020 and 2021, it contains more fiscal detail to better differentiate the economic effects of the programs included in the fiscal policy response, such as JobKeeper and accelerated depreciation. Third, following model development work in 2022, it models the macroeconomic impacts of COVID in detail.

This paper also provides a separate economic analysis of the JobKeeper program. This is for four reasons. First, JobKeeper led the fiscal response, accounting for $90 billion out of the total fiscal stimulus of $429 billion that was introduced in 2020 and 2021. Second, an economic analysis of JobKeeper is needed so that it can be modelled correctly in the macro scenarios of this paper. Third, while JobKeeper was not by itself responsible for the over-compensation for COVID income losses, it provides a case study of how over-compensation occurred. Fourth, this over-compensation led to undesirable disincentive effects and windfall gains.

JobKeeper involved three different forms of over-compensation. First, it originally over-compensated most part-time workers who had been stood down, creating a disincentive for them to find active employment elsewhere. Second, JobKeeper payments commonly extended for about 3 months after the turnover of a business had recovered to normal, providing business owners with a windfall. Third, it was often more profitable for smaller businesses not impacted by COVID social distancing to nevertheless constrain their activity sufficiently to become eligible for JobKeeper than to operate as normal, creating a disincentive to fully maintain production and active employment.

The rest of this paper is organised as follows. Section 2 contains a brief literature review covering the main topics of this paper. Section 3 provides an overview of the model that is used, focussing on its general suitability for generating the various scenarios. Section 4 contains the separate analysis of the JobKeeper program. Section 5 explains how COVID and the fiscal response are captured in the model in generating the scenarios. Section 6 presents and compares the outcomes of the *COVID* and *COVID plus macro stimulus* scenarios with the *no COVID scenario*. Section 7 draws conclusions for the appropriate fiscal policy response to future pandemics.

2. Literature Review

This section provides a brief literature review for the main topics of this paper. It begins with the literature on the COVID recession and the fiscal response and then turns to the literature on JobKeeper.

2.1. COVID Recession and the Fiscal Response

The literatures on the nature of the COVID recession and the effects of the fiscal response are now discussed in turn.

Carlsson-Szlezak *et al*. (2020), writing at the onset of the COVID recession in the USA, show that previous 'epidemics such as SARS, the 1968 H3N2 ("Hong Kong") flu, 1958 H2N2 ("Asian") flu, and 1918 Spanish flu' all led to V-shaped rather than U-shaped or L-shaped recessions. They suggest that this is because the shocks to the economy were largely transient, there being no serious disruption to the economy's supply side, including capital formation and the labour supply. As was seen in Figure 1, the Australian COVID recession broadly followed the V-shape predicted by Carlsson-Szlezak *et al*. (2020).

McKibbin and Fernando (2020) use the G-cubed global model to simulate five main alternative COVID-19 scenarios. They introduce several types of shocks to model the economic impacts of COVID-19. In each country in the model, these shocks reduce the labour supply (through disease), total factor productivity, household consumption and business investment, and also change the pattern of consumption. In the first four scenarios the shocks are all temporary and tied to the course of the COVID-19 pandemic, leading to recessions in each country that could be broadly characterised as V-shaped. It is only in the fifth scenario that the negative shock to business investment is permanent, leading to an ongoing loss of output.

The McKibbin and Fernando (2020) paper provides a useful checklist of potential economic shocks from COVID-19. This paper will show that, in Australia's case, it turned out that the most important of these shocks were to the level and pattern of consumption. Besides the shocks considered by McKibbin and Fernando, the modelling here also shows that Australia experienced a significant permanent loss of labour supply from an interruption to immigration.

Eichenbaum *et al*. (2021) are concerned with both the economic effects of epidemics and government containment policies. They use a small macroeconomic model for the USA in which disease transmission is modelled, and individuals maximise their own intertemporal utility. Uninfected individuals voluntarily socially distance, by cutting back on consumption and work (thus inducing a recession), to reduce their chances of becoming infected. Thus, voluntary social distancing shifts labour supply and consumer demand curves to the left.

The problem is that infected individuals do not bear the full costs of infecting others, and this negative externality means that they socially distance less than is socially optimal. To address this, a well-designed government containment policy would mandate the right amount of additional social distancing that achieves the optimal trade-off between a deeper recession and fewer fatalities. Eichenbaum *et al*. (2021) represent mandatory social distancing using the modelling device of a consumption tax. This shifts the consumer supply curve to the left, on the implicit assumption that mandatory social distancing restricts supply rather than demand.

This study echoes Eichenbaum *et al*. (2021) in finding that COVID caused negative shocks to household consumption demand and supply and labour supply. However, our use of a larger model means that we can take other COVID-related shocks into account as well, such as shocks to international movements of people.

Eichenbaum *et al*. (2021) distinguish between voluntary and mandatory social distancing because they wish to reach policy conclusions on the optimal amount of mandatory social distancing. However, we wish to reach policy conclusions on another important policy issue, the response of fiscal policy to COVID. Like other studies of the fiscal response discussed below, this allows us to take the total amount of social distancing as given, without distinguishing between the two forms. Eichenbaum *et al*. (2021) acknowledge that their small model was not suitable for studying the fiscal response to COVID, a response they characterise as aiming to 'mitigate the economic hardships suffered by households and businesses'.

Like Eichenbaum *et al*. (2021), Goolsbee and Syverson (2021) focus on the relative contributions of voluntary and mandatory social distancing to the COVID recession experienced by the USA in 2020. They use a more data-oriented approach based on mobile phone records of individuals living in different areas of the USA with different levels of mandatory social distancing. Goolsbee and Syverson (2021) found that voluntary social distancing was more important, while Eichenbaum *et al*. (2021) found that mandatory social distancing was, or at least should be, more important. So, the issue of the relative importance of mandatory and voluntary social distancing does not appear to be fully resolved. This reinforces the case for focussing on the total level of social distancing in this study.

Turning to the literature on the economic effects of the fiscal response to COVID, Jordà and Nechio (2022) of the Federal Reserve Bank of San Francisco undertook a study of 17 OECD countries. Of these countries, five pursued 'aggressive fiscal support' (which is referred to as 'over-compensation' in this study) meaning that fiscal support was so strong that real household disposable income moved above trend during COVID, despite the loss of income from COVID itself. The five countries are the United States, with the most aggressive fiscal support, followed by Canada, Australia, Ireland and Norway. Real disposable income fell below trend under COVID in the remaining 12 OECD countries included in the study.

Jordà and Nechio (2022) find from their modelling that this aggressive fiscal support in the United States added 2.5 percentage points to wage and price inflation, compared to a situation where the extent of fiscal support was calibrated to maintain real disposable income on trend. A separate cross-country study by de Soyres *et al*. (2022) of the US Federal Reserve similarly found that domestic fiscal stimulus added 2.5 percentage points to inflation in the United States. This study finds similar results for Australia, consistent with the fact that it ranks third after only the United States and Canada for aggressive fiscal support or over-compensation.

The main findings of this study for Australia, based on detailed macro-econometric modelling, are consistent with the above international literature. First, the macroeconomic effects of the pandemic are largely explained by social distancing. Second, macroeconomic stability is best maintained by calibrating the fiscal stimulus to the income losses caused by social distancing, thus avoiding over-compensation.

The Secretary of the Treasury, Steven Kennedy (2022), discusses Australia's more aggressive fiscal support in responding to the pandemic and presents an alternative view. While Kennedy's speech does not include any economic modelling, it provides some insight into the thinking behind Australia's fiscal response. Kennedy (2022) draws 'a distinction between a recession and a crisis', where a crisis is a 'situation where there is uncertainty or unquantifiable risk that manifests in large falls in confidence and demand'. Given 'the high degree of uncertainty prevailing at the time…the question on policymakers' minds was…how much do I need to spend to prevent the worst from happening'.

2.2. JobKeeper

In Australia, JobKeeper was the largest program of fiscal support in responding to the pandemic. Treasury (2020) notes that the JobKeeper program had three main objectives, which were to: (i) keep workers in an unbroken relationship with the businesses who employ them; (ii) help those businesses remain viable and (iii) provide workers and business owners with some compensation for their income losses from COVID social distancing. Treasury (2020) provides evidence that JobKeeper had some success in achieving all three objectives.

Regarding the first objective, Bishop and Day (2020) estimate the boost to employment from JobKeeper during the first 4 months of its operation. They use the fact that casual workers could only be eligible for JobKeeper if they had longer tenure of at least 12 months with their employer. They observe that from February 2000 to May 2000, employment for shorter-tenure casuals fell by 33 per cent whereas employment for longer-tenure casuals fell by only 26 per cent. Bishop and Day (2020) extrapolate this difference of 7 percentage points to all employed people who could be eligible for

JobKeeper, of which there were 10.26 million, to estimate that JobKeeper reduced employment losses by about 700,000 persons.

Borland and Hunt (2023) consider that the Bishop and Day estimate of 700,000 persons likely represents an upper bound on the employment impact of JobKeeper. The estimate extrapolates employment effects for casual employees to permanent employees whereas 'the relative instability of casual employment suggests it would be more affected by JobKeeper'. Further, the estimate counts 'JobKeeper recipients working zero hours as employed'. This is significant because in previous work Borland and Hunt 'estimate that during the initial downturn caused by COVID-19, up to one half of the impact of JobKeeper on employment came from workers on zero hours being counted as employed'.

Regarding the third objective of income compensation, Murphy (2021a) in June 2021 noted that there were three forms of over-compensation under JobKeeper. Under one form of over-compensation, many smaller businesses had a profit incentive to restrain their output and active employment to qualify for JobKeeper. In October 2021, Treasury (2021) showed that this potential negative side effect of JobKeeper occurred in practice. In reaching this conclusion, Treasury used the requirement that a sales decline of over 30 per cent was required to be eligible for JobKeeper.

> The share of businesses with turnover declines of slightly more than the 30 per cent (50,000 businesses with sales declines between 30 and 35 per cent) was much larger than the share with declines slightly smaller than 30 per cent (20,000 businesses with declined (*sic*) between 25 and 30 per cent). This provides evidence that a number of businesses may have adjusted their operations to qualify for the second phase of JobKeeper. Treasury (2021, p.34)

The profit incentive for this negative behaviour under JobKeeper is analysed in Section 4 as part of an analysis of the three forms of over-compensation under JobKeeper.

3. Description of Model

This section provides an overview of the model that is used and its suitability for generating the various scenarios. It begins with a general description of the model and then focuses on the fiscal detail, modelling of COVID and the nature of the fiscal and monetary policy rules.

3.1. General Description of Model

The Australian macro-econometric model used to generate the various scenarios is described in Murphy (2020). While the model was developed from scratch, it can be considered as the latest model in a series of models that includes the AMPS model (Murphy *et al.*, 1986), MM (Murphy, 1988) and MM2 (Powell & Murphy, 1997).

These Murphy models are New Keynesian, having the three important features of a Keynesian short run, neoclassical long run and forward-looking behaviour in financial markets. New Keynesian DSGE models began emerging later, beginning with Rotemberg and Woodford (1997), and possess these same three features, although with some differences in the detail.

For the purposes of this paper, the most significant difference between the macro-econometric model used here and New Keynesian DSGE models is in the modelling of aggregate household consumption. The model used here includes the National Asset Target (NAT) consumption equation introduced and described in Murphy (2020), whereas DSGE models assume that households base their consumption decisions on intertemporal optimisation. Both approaches imply that Ricardian equivalence holds in the long run.

Regarding the short run, the NAT consumption equation includes a link from current income to consumption, which is important in this study in modelling the stimulus to household consumption from the government payments to households and businesses made under COVID. This link can also be present in DSGE models when their pure intertemporal optimisation approach to modelling consumption is modified in certain ways, for example, by assuming that some households instead live 'hand-to-mouth' (Coenen *et al.*, 2012).

The macro-econometric model uses error correction models (ECMs) to introduce dynamics flexibly equation-by-equation around equilibrium relationships that are based on economic theory. Several dynamic parameters may appear in an individual equation, depending on the results of econometric testing. This contrasts with theory-driven DSGE models, where optimisation problems of economic agents are solved to obtain equations that incorporate both equilibrium relationships and dynamics. This typically leads to fewer dynamic parameters than would be obtained under the ECM approach. At the other end of the spectrum, data-driven VAR models include system-wide dynamics, allowing for flexible dynamics both within and across equations.

These differing approaches to dynamics illustrate a more general difference in approach between the three types of macro models. Macro-econometric models, such as the model used here, aim to balance principles from macroeconomic theory with econometric analysis of historical data. DSGE models generally place more weight on the theory while VAR models usually place more weight on the data. In the author's view, all three types of models have their place, depending on the purpose. In a similar vein, Blanchard (2018) distinguishes five types of macro models for five different purposes.

This study involves both forecasting (*actual/forecast* scenario) and policy analysis (*COVID* and *no COVID* scenarios). The balance that macro-econometric models offer between the data consistency that is important for forecasting and the theory consistency that is important for policy analysis, is useful in this situation.

There has been a revival in macro-econometric modelling in Australia. There are two other broadly comparable Australian macro-econometric models that have been developed recently, EMMA at the Treasury (Bullen *et al*., 2021) and MARTIN at the Reserve Bank of Australia (Ballantyne *et al*., 2020). The recent development of these three models suggests that macro-econometric models continue to play a useful role.

Indeed, the RBA has recently adopted MARTIN as its core macroeconomic model. Ballantyne *et al*. (2020) state that their experience from working with DSGE models over the years shows that 'while DSGE models are useful tools for addressing some specific policy questions, they have too many drawbacks to serve as the RBA's core macroeconomic model'.

Compared to the other two Australian macro-econometric models, the macro model used here has finer industry and fiscal detail and it models the macroeconomic effects of social distancing under COVID. As we shall see, the finer industry detail helps capture the uneven impacts across the economy of COVID social distancing, while the fiscal detail helps differentiates the economic effects of the various programs included in the fiscal policy response, as discussed below.

Industry detail is included in the model only to the extent that it is expected to improve policy analysis and forecasting at the macro level. This led to the model recognising six broad industries (Table 1). For clarity, the Australian Bureau of Statistics (ABS) names for the constituent industry divisions for each broad industry are shown in the final column of the table.

In the first five industries, output is produced using a combination of intermediate inputs, labour, structures capital, machinery and equipment capital, and a fixed factor. The fixed factor accounts for a relatively high share of value added in agriculture, where it represents agricultural land, and mining, where it mainly represents mineral resources.

Table 1. *Macro Model Industries*

Model industry	Model code	ABS industry divisions
Agriculture	*A*	Agriculture, forestry and fishing
Mining	*B*	Mining
Manufacturing	*C*	Manufacturing
Government services	*G*	Public administration and safety; education and training; health care and social assistance
Other private services	*S*	All industries not included elsewhere
Housing services	*T*	Residential property operators

In the remaining industry, housing services, output is produced using a combination of intermediate inputs, housing capital, housing land and capitalised ownership transfer costs, which include stamp duty on conveyances. This last input recognises that households invest in moving house so that their housing characteristics, such as size and location, better match their changing circumstances, thus adding to the value of housing services.

Of the six broad industries, other private services is the largest, accounting for 54 per cent of gross value added in 2019, prior to the COVID-19 pandemic. It is also the industry that was most affected by social distancing under COVID. By separately identifying this industry, the model better captures the uneven effects of COVID across the economy. In the other two models, other private services are combined with other industries that were less affected by COVID.

The main features of the 2019 version of the macro model have already been described in more detail in Murphy (2020) and so are not discussed further here. However, in new model development work in 2020 and 2021, the model's fiscal detail was further developed for this paper. This new, finer level of fiscal detail is discussed separately below in Section 3.2.

In further model development work for this paper, in 2022 the effects of COVID were modelled, primarily using indicators of geographic mobility. This work was also needed so that the model could track reasonably the macroeconomic fluctuations of 2020 and 2021. This modelling of the effects of COVID is discussed in Section 3.3.

The fiscal and monetary policy responses to COVID are simulated against the backdrop of the model's fiscal and monetary policy rules. Those macro policy rules are outlined in Section 3.4.

In the latest 2022 version of the macro model, there are 60 estimated equations. The estimation method used is Ordinary Least Squares (OLS) regression. The estimation period generally starts in the September quarter 1985, but more recent start dates are used in cases where structural change is considered to be an issue. The estimation period usually ends in the most recent quarter for which there is a full set of data, which was the June quarter 2022 at the time of finalising the modelling on 22 November 2022.

3.2. Fiscal Detail of Model

In the macro model, the government budget refers to the budgets of all three levels of the government (federal, state and local) consolidated together. Following the development work in 2020 and 2021, there are model levers for changing fiscal policy in all of the areas shown in Table A1. This is greater fiscal detail than in the Reserve Bank model described in Ballantyne *et al.* (2020) and the Treasury model discussed in Bullen *et al.* (2021).

The modelling of the COVID fiscal expansion involves adjustments to most of these fiscal levers, as discussed in Section 5 and detailed in Table A4. While the model is mainly intended for macro analysis, generally a change to a fiscal lever has the main behavioural effect that would be expected from a public economics perspective.

To model the COVID fiscal expansion in a realistic way, it was also necessary to re-classify two of the key programs – JobKeeper and Boosting Cash Flow. As explained in Section 5.2, the ABS classified these two programs as pure production subsidies whereas behaviourally they operated partly or wholly as business transfers.

3.3. Modelling COVID

Here we explain how COVID effects have been added to the model and then discuss the estimation results after those effects are incorporated. These COVID effects are used in simulating the effects of COVID in Sections 5 and 6.

General Approach

As discussed in the literature review, in the modelling of Eichenbaum *et al.* (2021), voluntary social distancing shifts consumer demand and labour supply to the left, while mandatory social distancing shifts consumer supply to the left. In fact, while some forms of mandatory distancing such as industry shutdowns shift consumer supply to the left as assumed by Eichenbaum *et al.* (2021), other forms of mandatory distancing, such as stay at home orders, are more similar in effect to voluntary social distancing, shifting consumer demand and labour supply to the left.

In any case, as explained earlier, this study does not need to distinguish between voluntary and mandatory distancing. This means that we only need to capture the extent to which, in practice, both forms of social distancing considered together shifted consumer demand, consumer supply and labour supply to the left.

The leftward shifts in both consumer demand and consumer supply mean that the quantity of consumption necessarily falls, but the direction of impact on consumer prices can only be determined with quantitative modelling. As we shall see, there are also other COVID effects to be modelled beyond consumer markets and labour supply, that were not considered in the simple model of Eichenbaum *et al*. (2021).

This study has considered two alternative approaches to modelling these effects of social distancing under COVID. Both approaches involve first identifying which of the estimated equations in the macro-econometric model were affected by COVID. The first approach uses the residuals of these COVID-affected equations, while the second approach adds explanatory variables that measure social distancing under COVID.

Under the first approach, the parameters of the COVID-affected equations are estimated using pre-COVID data. It is then assumed that any prediction errors from those equations in the COVID period are due to social distancing under COVID. The main limitation of this approach, which was used in an earlier version of this study, is that COVID-period residuals will reflect not only COVID, but also the usual factors that give rise to residuals in the COVID-affected equations. However, the shocks from COVID were so large, generating extreme outliers in the residuals, that the COVID effects clearly dominate, making this first approach appear reasonable, although not ideal.

Under the second approach, the parameters of the COVID-affected equations are estimated using data that includes the COVID period. This requires that explanatory variables are added that measure social distancing under COVID. The main limitation of this approach is that the economic effects of the pandemic need to run their course before we can be confident that we have captured the COVID effects robustly. At the time of the final modelling, in late 2022, we were nearing that situation, so we switched to the second approach.

Implementing the second approach has involved a large amount of model development work to capture the COVID effects, as now discussed. Reassuringly, the results obtained using the second approach are similar to those obtained previously using the first approach, confirming that the first approach was reasonable given the information that was then available.

As Brodeur *et al*. (2021) point out, the literature on COVID commonly measures social distancing using indicators of geographic mobility. For our macroeconomic model, we need a measure of domestic geographic mobility for modelling domestic effects and a measure of international geographic mobility for modelling international trade in services associated with movements of people. Data on passenger movements at Australian airports conveniently provides both types of indicators.

The indicator used for domestic geographic mobility is based on passenger movements for domestic and regional airlines (Figure 4). During COVID, these domestic passenger movements were negatively affected by fear of contracting COVID, government travel restrictions, state border closures and other government restrictions. The government restrictions on travel and other activities introduced in late March 2020 saw domestic passenger movements fall to close to zero from April 2020 (Figure 4). That was part of a national lockdown that continued from end-March 2020 until mid-May 2020. A series of partial recoveries in domestic air travel were then interpreted by COVID outbreaks that led to a lockdown in Victoria in 2020Q3 and lockdowns in NSW and Victoria in 2021Q3.

The indicator used for international geographic mobility is based on passenger movements for international airlines (Figure 4), which during COVID were heavily affected by Australian Government travel restrictions. To limit the spread of COVID to Australia, in March 2020 overseas travel was largely banned, except for Australians returning from overseas, resulting in international passenger movements, like domestic passenger movements, falling to close to zero from April 2020 (Figure 4).

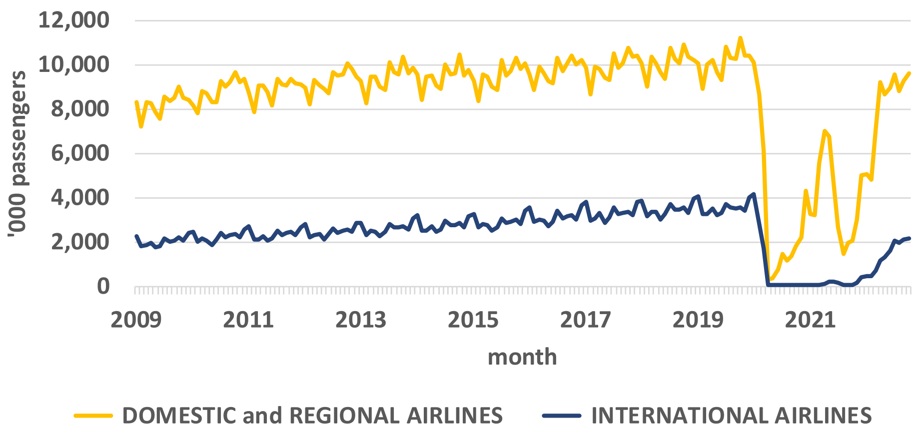

Figure 4. *Australian Airport Passengers*

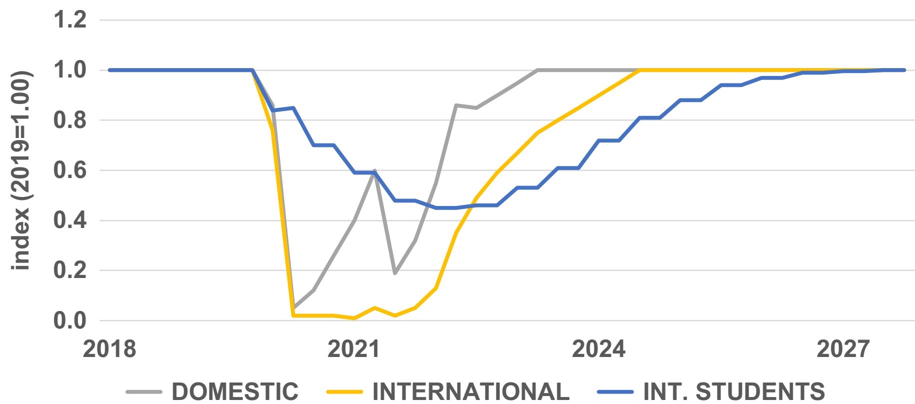

Figure 5. *Geographic Mobility Indices Source: Bureau of Infrastructure and Transport Research Economics (2022).*

These international restrictions began to be eased in November 2021 and were fully lifted in July 2022 (Figure 4).

To construct the pair of geographic mobility measures, passenger movements are assumed to be normal in 2019, the year immediately before COVID. These normal levels of passenger movements are then projected forward using historical trend growth rates, calculated as the respective compound annual growth rates from 2009 to 2019. The mobility indices are then calculated as the ratio of actual to normal passenger movements. Finally, these mobility indices are converted from a monthly to quarterly frequency for use in the macro-econometric modelling. The resulting pair of geographic mobility indices, *COVID_DOM* and *COVID_INT*, is shown in Figure 5. These indices take a value ranging from zero to unity, where zero represents complete immobility and unity represents normal mobility.

Figure 5 also shows forecasts for these geographic mobility indicators. At the time of writing, the latest readings, for 2022Q3, were 0.86 for *COVID_DOM* and 0.54 for *COVID_INT*. It is assumed that

COVID_DOM returns to a normal value of 1.00 by 2023Q2, as fears of COVID dissipate and airlines restore capacity. It is assumed that *COVID_INT* returns to normal by 2024Q3, in line with forecasts by the International Air Transport Association.

While domestic air travel was impacted by most lockdowns, some activities were only affected by the most comprehensive lockdown, which was the national lockdown during part of 2020Q2. Thus, to complement the geographic indictors in capturing the impacts on the economy of social distancing under COVID, a dummy variable is used for the national lockdown quarter, *COVID_202*. It was decided not to include a further dummy variable for the lockdown in Victoria and NSW in 2021Q3, *COVID_213*, because the statistical evidence for its inclusion was less strong and we want to avoid over-fitting the data.

Finally, because of timing issues, COVID had more complex effects on the export of education services than are captured by *COVID_INT*. When international students decide not to enrol because of the international border closure, fee income is typically lost not for one quarter, but for 1–4 years, depending on the length of the course. These more slowly developing but protracted effects are taken into account in constructing *COVID_EDU* (Figure 5), as the fourth and final variable used to capture the economic effects of COVID. This variable is constructed using a highly stylised model of international student enrolments.

Three methods were used to identify which of the 60 estimated equations of the model were affected by COVID and hence needed to be extended to incorporate one or more of the four COVID effects. The final outcome, in which COVID effects appear in 18 equations, is summarised in Table A2.

The first method was to consider economic theory. As noted above, from the work of Eichenbaum *et al*. (2021), we would expect negative COVID effects on consumer demand, consumer supply and labour supply, which account for 10 of the estimated equations in the macro-econometric model. Consumer demand is represented by the equation for aggregate consumption, *HCONZ*, and the five equations for its components. Consumer supply is represented in the three price equations for domestic sales of services. Finally, labour supply is represented by the labour force participation rate equation.

The other two methods involved statistical testing. That testing confirmed the presence of COVID effects in the 10 equations suggested by economic theory and they also identified a further eight equations with COVID effects.

The second method was to estimate the parameters of the model's equations using pre-COVID data, and then use the estimated equations to construct residuals for the COVID period. Outliers in those residuals were possible evidence of a COVID effect that needed to be modelled.

The third method was to add the main COVID variable, *COVID_DOM*, to all 60 estimated equations and then re-estimate using data that includes the COVID period. A significant coefficient on *COVID_DOM* was possible evidence of a COVID effect of some type.

Having identified the 18 estimated equations that should include COVID effects, the nature of those effects was developed using economic theory and further statistical testing. Table A2 shows which of the four COVID effects are included in each of the 18 equations and the associated *t*-statistics.

Government shutdowns were an important source of COVID effects. There were government shutdowns of the following providers of consumer services: providers of food and beverage services (on-premise provision), gyms and indoor sports services, cinemas, entertainment venues, casinos and places of worship. Travel was also limited, with non-essential travel banned and international travel mainly limited to Australians returning from overseas, as noted earlier. All of these shutdowns and restrictions negatively affected different areas of the other private services industry (i = SN). The risk of contracting COVID also deterred the use of some consumer services, including visits to medical centres, which are part of the government-type services industry (i = G).

Thus, the shutdowns applied to a series of narrowly defined industries, which covered only a proportion of the more broadly defined industries identified in the model, particularly industries G and

SN. Hence, typically only a proportion, w, of economic activity in a model industry was suppressed when a shutdown was in operation.

This provides the basis for a suppression equation, which relates the actual level of an activity to its normal level. In particular, the observed level of an activity, Y, will equal the normal level of the activity, Y^n, reduced by applying the relevant COVID mobility factor, U, to the share w of the activity that may be subject to shut down. We treat $-w$ as a parameter to be estimated.

Suppression equation

$$Y_t = [w \bullet U_t + (1 - w)] \bullet Y_t^n$$

If there is complete immobility, $U = 0$, so actual activity is equal to the proportion $1-w$ of normal activity. If there is normal mobility, $U = 1$, so actual activity equals its normal level.

In the estimated equations of the macro-econometric model, a first-order ECM is typically used to model the adjustment of a variable to its equilibrium value, Y^*. This adjustment process is assumed to refer to the normal value of the variable, Y^n, rather than the suppressed value, Y. This is because economic considerations and initial statistical testing suggest that variations in mobility, U, have a contemporaneous effect on activity, as shown in the suppression equation, rather than a delayed effect operating via an equilibrium variable.

Underlying ECM equation

$$\Delta log Y_t^n = b_1 \cdot \Delta log Y_t^* - b_2 \cdot \left(log Y_{t-1}^n - log Y_{t-1}^*\right)$$

or,

$$log Y_t^n = b_1 \cdot \Delta log Y_t^* + b_2 \cdot log Y_{t-1}^* + (1 - b_2) \cdot log Y_{t-1}^n$$

The next step is to take the natural logarithm of the suppression equation and re-arrange it to make normal activity the subject.

$$log Y_t^n = log Y_t - log\,[1 - w \cdot (1 - U_t)]$$

We then use the logged suppression equation to eliminate normal activity from the ECM equation so that the estimating equation only involves observed variables.

Non-linear estimating equation

$$log Y_t = b_1 \cdot \Delta log Y_t^* + b_2 \cdot log Y_{t-1}^* + log\,[1 - w \cdot (1 - U_t)] + (1 - b_2) \cdot \{log Y_{t-1} - log\,[1 - w \cdot (1 - U_{t-1})]\}$$

This equation is non-linear in the suppressed proportion parameter, w. If w is sufficiently small, then we can use the following first order approximation around $w = 0$.

Approximation

$$log\,[1 - w \cdot (1 - U_t)] \approx -w \cdot (1 - U_t)$$

to obtain a simpler, linearised estimating equation.

Linearised estimating equation

$$log Y_t = b_1 \cdot \Delta log Y_t^* + b_2 \cdot log Y_{t-1}^* - w \cdot (1 - U_t) + (1 - b_2) \cdot \{log Y_{t-1} + w \cdot (1 - U_{t-1})\}$$

In practice, we are able to use the linearised version in most cases, except for the four equations for exports and imports of services (Table A2), where it is necessary to use the non-linear version because the suppressed proportion, w, is high. In both the non-linear and linearised equations, $-w$ is treated as a parameter to be estimated.

Estimation Results

In discussing the estimation results, we begin with the 10 equations where COVID effects would be expected based on the work of Eichenbaum *et al.* (2021). We then discuss the remaining eight equations where COVID effects have been identified.

The modelling of consumption demand, both in aggregate and at the industry level, is based on the logic of the linearised estimating equation presented above.

In the aggregate consumption function, both domestic immobility, *1-COVID_DOM*, and the national lockdown, *COVID_202*, are highly significant (Table A2). Using the estimation results, the overall immobility effect on aggregate consumption, *CCOVID*, is as follows.

$$CCOVID_t = c_5 \cdot COVID\_202_t + c_7 \cdot (1 - COVID\_DUM_t)$$

In the absence of COVID, *COVID_202* = 0 and *COVID_DOM* = 1, so this immobility effect on consumption disappears.

The consumer demand system allocates total household consumption across the six industries in the model. This involves modelling consumer demand for the products of the first five industries (i = A,B,C,G,T) and then obtaining consumer demand for other private services residually (i = SN).

For consistency, in this consumer demand system, we use the constructed consumption immobility variable, *CCOVID*, to capture COVID effects (Table A2). This ensures that the two COVID variables making up *CCOVID* have the same relative importance in determining consumer demand at the industry level as they do at the aggregate level. The estimation results imply that COVID effects shifted the composition of aggregate consumption away from other private services and towards the other five industries. These shifts towards the other five industries are all highly significant (Table A2). This pattern of results is consistent with the observation above that social distancing mainly impacted on the other private services industry.

The labour force participation rate is negatively affected by the same two COVID variables, *COVID_-DOM* and *COVID_202*, that negatively affect consumption. Again, these effects are highly statistically significant (Table A2).

COVID effects on consumer supply operate through the three price equations for domestic sales of services. In each case, the equilibrium price based on marginal cost, P^*, is adjusted upwards for the effect of COVID on domestic immobility to obtain a new equilibrium price, P^{**}. This new equilibrium price is substituted into the ECM to determine the actual price.

$$logP_t^{**} = logP_t^* + d \cdot (1 - COVID\_DUM_t)$$

This equation captures the overall effect of COVID on the market clearing price. On the one hand, suppression of demand leads to lower output and marginal cost, thus reducing P^* and thereby indirectly reducing P^{**}. On the other hand, suppression of supply directly raises P^{**} through the second term in the above equation. The overall effect on price will be determined by the relative magnitude of these demand and supply shifts, as foreshadowed earlier.

In the estimated price ECMs for services, the coefficient on the COVID variable (represented by d in the above equation) is statistically significant in two out of three cases. The effect is retained in the sole insignificant case because it is correctly signed.

We now turn to the remaining eight equations in the model in which the COVID effects now appear, beyond the areas identified in the simple model of Eichenbaum *et al.* (2021).

The international travel ban, reflected in the measures of international geographic mobility (Figure 5), disrupted international travel and international study. This resulted in much lower travel-related international trade during COVID (Figure 6). As noted earlier, the proportion of trade in services that was suppressed under COVID was high, so it was necessary to use the non-linear form of the estimating equation.

The impact of COVID on international tourism is taken into account in the model by the inclusion of the international geographic immobility effect, *1-COVID_INT*, in the four equations for exports and imports of services (Table A2). Foreign expenditure of Australian tourists is included mainly in *IMSN*, while Australian expenditure of foreign tourists is included mainly in *EXSN*. *IMG* is a very small category and so is not included in Figure 6.

The impact of COVID on export income from international students is taken into account in the model by the inclusion of the international student variable, *COVID_EDU*, in the two equations for exports of services. International student fees account for most of *BEXG*, while their living expenses in Australia are included in *EXSN*, alongside the Australian expenditure of foreign tourists.

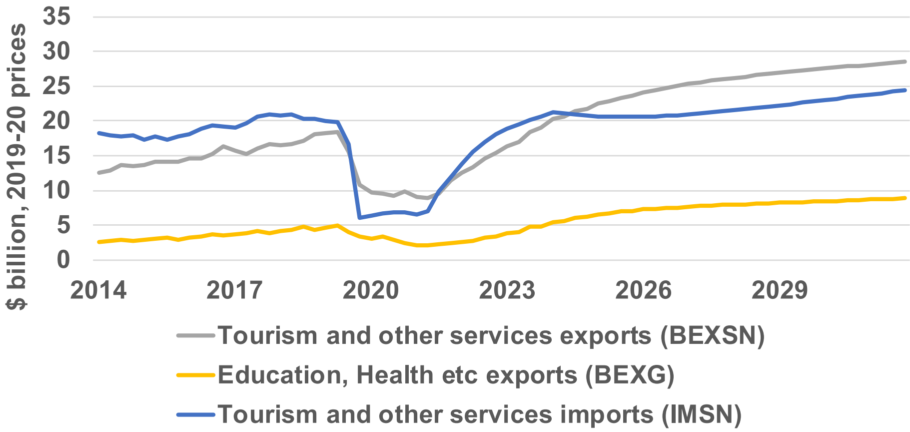

Figure 6. *Travel-Related Trade*

All six COVID effects appearing in these four equations for trade in services are highly significant (Table A2).

In the early stages of COVID, viewing of properties was suppressed resulting in fewer transactions and hence lower investment in ownership transfer costs, *CFOTC*. This is modelled through the inclusion of the domestic geographic immobility effect, *1-COVID_DOM*, in that investment equation (Table A2). This COVID effect is highly significant.

Finally, COVID changed some labour market dynamics.

When industries were shut down under COVID, there were almost synchronised similar percentage falls in output and employment, as might be expected. This contrasts with the more gradual response of employment to output that characterises traditional business cycles. The more rapid employment response under COVID was taken into account by modelling the speed of adjustment of employment to depend on the domestic geographic immobility effect, *1-COVID_DOM*, in the two industries most affected by COVID restrictions (i = G,S). The estimated boosts to these speeds of adjustment under COVID are highly significant (Table A2).

Wages is the other area where COVID changed labour market dynamics. In the model, the wage variable is average compensation of employees, as reported in the national accounts. Further, in the national lockdown of 2020Q2, the employment losses were disproportionately in lower-wage jobs: part-time employment fell 9 per cent while full-time employment fell 4 per cent, quarter-on-quarter. This had the compositional effect of increasing the average wage per employee, as measured in the national accounts, even if wage rates per hour did not change. This compositional effect is captured in the wage equation by modelling wage movements to depend on the movement in and out of lockdown using the COVID variable, *COVID_202*.

Thus, there are clear economic explanations for the appearance of direct COVID effects in the 18 estimated equations covered by Table A2. There are no direct effects of COVID in the remaining 42 estimated equations. However, there are indirect effects, because the directly affected variables interact with other variables in economic relationships throughout the model.

3.4. Fiscal and Monetary Policy Rules

The macro model follows standard practice by including default rules for how fiscal and monetary policy are conducted. The fiscal policy rule is used to ensure that fiscal policy is always sustainable; this is necessary so that outcomes in different scenarios can be validly compared. The monetary policy rule is used to target inflation. The way these rules are used is important in reasonably modelling the effects of COVID and the fiscal response to it.

Under the fiscal policy rule, the effective average rate of personal income tax, *POLLAB*, is the swing fiscal policy instrument that adjusts automatically and gradually to achieve a long run target, *RPUBLIT*, for the ratio of net public debt to smoothed nominal GDP. Adherence to this debt target ensures long-run fiscal sustainability. See Murphy (2020) for full details of the rule.

In the short-term, this rule for *POLLAB* is over-written to take into account the personal income tax policies that are part of each scenario, as described in Section 5.2. Specifically, the stage 2 personal income tax cuts were brought forward from 2022–23 to 2020–21 as part of the fiscal response to COVID, while the stage 3 personal income tax cuts, scheduled for 2024–25, are common to all scenarios. The rule for *POLLAB* then comes into force from 2025–26 onwards.

By the time the fiscal policy rule is in force, the level of public debt is already very different between the scenarios, making it unrealistic to impose a uniform public debt target. Instead, in each scenario, the target ratio of public debt to GDP, *RPUBLIT*, used from 2025–26 onwards, is set equal to the actual ratio at the end of 2024–25.

For monetary policy, a Taylor rule is used in which the short-term interest rate, *RS*, adjusts relative to a neutral rate to achieve a long-term inflation target of 2.5 per cent, while also targeting a sustainable unemployment rate. Murphy (2020) provides details for the original rule, which has been further developed for this study. The original rule is similar to the rule in the RBA's MARTIN model (Ballantyne *et al.*, 2020), except here most parameters are estimated rather than calibrated, and the neutral interest rate is based on the 10-year bond rate.

In view of the near zero cash rate target from November 2020 to May 2022, the original rule was further developed to allow for a zero lower bound (ZLB) on *RS*. This involved using a different functional form in which interest rate reductions become smaller at lower interest rates, as well as introducing a switch that imposes a fixed floor on *RS*.

This monetary rule with a ZLB can account for the cash rate being close to the ZLB in the 2020–21 recession year. However, a dummy variable, *COVID_2122*, had to be added to the rule to take into account that the cash rate remained close to the ZLB in the 2021–22 financial year, despite unemployment falling and inflation rising to be near their target values. This occurred as part of the monetary policy response to COVID announced by Lowe (2020). The dummy variable is highly significant, with a *t*-statistic of −5.34. This COVID monetary policy response can be simulated or removed by switching this dummy variable on or off.

At the same, under the high unemployment and low inflation of 2020–21, monetary policy was constrained by the ZLB in the stimulus it could provide. By allowing for that constraint on monetary policy, the model provides a better assessment of the fiscal response to COVID.

4. JobKeeper

This section provides a separate economic analysis of the JobKeeper program. This analysis is used to determine how best to model JobKeeper in the macro scenarios of this paper presented in Sections 5 and 6. JobKeeper is also used here as a case study of how over-compensation for COVID income losses occurred. At the macro level, over-compensation in the overall fiscal response contributed to inflation, as shown in Section 6, while at the program level over-compensation led to disincentive effects and windfall gains, as shown below.

As set out in Section 2.2, compensating for COVID income losses was one of the three objectives of the JobKeeper program. For discussion of how JobKeeper performed in achieving its other two objectives, see Treasury (2020), Treasury (2021) and Borland and Hunt (2023).

4.1. Design of the JobKeeper Program

The general nature of the JobKeeper program was that it paid businesses with a sufficient loss of turnover under COVID social distancing a flat amount per employee similar to the national minimum wage for full-time adult workers. Payments were made for both stood down (inactive) employees

Table 2. *JobKeeper Payment Rates ($ per Fortnight per Employee)*

JobKeeper version	JK1.0	JK2.0	JK3.0
Duration	April–Sep 2020	Oct–Dec 2020	Jan–March 2021
Full-time employee	$1500	$1200	$1000
Part-time employee	$1500	$750	$650
JobSeeker rate	$1116	$816	$716

Note: The JobSeeker rates reported in the table include the Coronavirus Supplement.

and active employees. The payments for stood down (inactive) employees were passed on to them as a superior alternative to the JobSeeker payment available to the unemployed. The payments for active employees compensated business owners for their loss of profits from lower turnover under COVID social distancing.

The JobKeeper program was in place for 1 year, from the June quarter 2020 to the March quarter 2021. As the program progressed, payment rates and other arrangements changed such that three versions of the program can be distinguished, referred to here as JK1.0, JK2.0 and JK3.0 (Table 2).

The first version of JobKeeper, JK1.0, provided payments to businesses who projected a decline in turnover for the June quarter 2020[1] of a specified minimum percentage. The payment was at a flat rate of $1500 per fortnight per eligible employee, similar to the national minimum wage for full-time workers.[2] Under JK1.0, JobKeeper payments were made in the June and September quarters 2020.

The minimum turnover decline that was required to be eligible was 50 per cent for larger businesses and a less demanding 30 per cent for smaller businesses. A business was considered larger if its annual turnover exceeded $1 billion.

The first aim of the program was to keep workers in an unbroken relationship with the businesses who employed them, hence the name JobKeeper. To achieve this, stood down full-time employees were paid at a higher rate if they remained with their existing employer to receive JobKeeper than if they left to become unemployed and receive JobSeeker. A substantial gap between the two payment rates was maintained through all three versions of the program (Table 2). The idea of keeping inactive employees on the payroll was to increase the likelihood that they could return to their previous job rather than be a jobseeker once COVID social distancing was lifted.

JobKeeper was less tailored to its second aim of helping businesses remain viable. Because businesses were only permitted to retain the JobKeeper payments that they received with respect to *active* employees, JobKeeper provided no support for the finances of the most hard-pressed businesses. These businesses were in hibernation and all of their employees were *inactive*.

The remainder of this section is concerned with the third and final aim of JobKeeper, which was to provide some compensation for the income losses from COVID social distancing. JobKeeper aimed to both compensate stood down workers for their loss of labour income and business owners for their loss of profits under COVID.

We shall see wide variations in rates of compensation as measured by compensation as a percentage of lost income. For stood down workers, compensation for lost wages was initially based on the minimum full-time wage, whereas actual wages vary widely. For business owners, compensation for lost profits depended on the percentage of their employees who were *active*, whereas the profit losses depended on the percentage of employees who were *inactive*.

[1]There was also an option to use a monthly turnover test instead of a quarterly turnover test.

[2]The JK1.0 payment rate of $1500 per fortnight is equivalent to $750 per week. This is similar to the national minimum wage for full-time adult workers, which was $740.80 per week when JobKeeper was introduced, rising to $753.80 per week on 1 July 2020 (Fair Work Commission, 2020).

Active workers were typically paid their usual wage[3] and hence did not suffer an income loss. Appropriately, they were not compensated by JobKeeper.

For modelling purposes, the JobKeeper payments made to inactive workers are best regarded as worker transfer payments. This is because those workers received JobKeeper (via their employer) as an alternative to receiving JobSeeker from Centrelink. Treasury (2021) reaches the same conclusion. In contrast, the ABS treated the JobKeeper payments made to inactive workers as a wage subsidy and classified those workers as employed.

4.2. Compensation of Inactive Workers

As just noted, JobKeeper payments made to inactive workers were a worker transfer. Treasury (2021, p. 29, figure 15) estimates that, under JK1.0, about 20 per cent of total JobKeeper payments were these worker transfers. Here we consider the extent to which these transfers compensated those workers for lost wages. This varied considerably between full-time and part-time workers.

As noted above, JobKeeper payments were initially set at a similar rate to the national *minimum* wage for full-time adult workers. This ensured that no full-time workers were significantly over-compensated by JobKeeper. Compensation rates for different types of workers can be assessed using the Australian Bureau of Statistics (ABS) Employee Earnings and Hours survey of employing organisations (ABS, 2022).[4] For a full-time worker usually on median earnings of $1592 per week, JobKeeper of $750 per week (or $1500 per fortnight) compensated for 47 per cent of his or her lost earnings.

Under JK1.0, part-time workers received the same JobKeeper payment as full-time workers of $750 per week, despite their lower usual earnings. This JobKeeper rate was close to the 60th percentile of the distribution of weekly earnings for part-time workers (ABS, 2022). Hence, about 60 per cent of part-time workers on JobKeeper were over-compensated for their loss of earnings under JK1.0. These over-compensated part-time workers were better off remaining inactive in their existing job and receiving JobKeeper than in finding an active job with an alternative employer and receiving their usual pay. Thus, JK1.0 acted as a disincentive for the majority of inactive part-time workers on JobKeeper to become economically active.

The second and third versions of JobKeeper, JK2.0 and JK3.0, aimed to address this over-compensation by introducing a lower payment rate for part-time employees compared to full-time employees (Table 2). For example, under JK2.0, part-time workers received $375 in JobKeeper on a weekly basis, down from $750. This reduced the proportion of part-time workers who were over-compensated from 60 per cent to 25 per cent (ABS, 2022). Under JK3.0 this fell further to about 20 per cent of part-time workers on JobKeeper (ABS, 2022).

JK2.0 and JK.30 also phased down JobKeeper payment rates for full-time workers (Table 2). However, the coronavirus supplement included with JobSeeker was phased down at the same time, so that JobKeeper remained more generous than JobSeeker for full-time workers. This supported the main aim of the JobKeeper program of keeping inactive workers in an unbroken relationship with their employers.

4.3. Compensation of Business Owners

Business owners were able to retain the JobKeeper payments made with respect to their active employees. In addition, some businesses continued to receive JobKeeper payments even after their operations had returned to normal. We consider these extra duration payments first and then analyse the payments received for active employees.

[3]An exception to this occurred if the JobKeeper payment exceeded the usual wage. In that case, the active worker received the JobKeeper payment rather than the usual wage. This over-compensation of the worker reduced the compensation of the business owner by the same amount. This form of over-compensation was addressed in the move from JK1.0 to JK2.0, as discussed in Section 4.2.

[4]We use the May 2021 survey because it is closest to the timing of the JobKeeper program, the previous survey being in May 2018.

Extra Duration Payments

Under the program arrangements, JobKeeper payments commonly extended for some months after the turnover of a business had recovered to normal.

For example, under JK1.0, businesses who expected to suffer the minimum required loss of sales during the first 3 months of the program, 2020q2, were provided with JobKeeper payments for 6 months, that is, for 2020q2 and 2020q3. Treasury (2021, p.1) provided the following explanation for the guarantee that JobKeeper payments would continue for six months irrespective of whether the support was needed for that long.

> Guaranteed support for six months was designed to provide certainty to businesses. The time-frame was linked to the health advice that restrictions could need to be in place for six months and the ongoing evolution of the pandemic was highly uncertain. It was understood that this risked making payments to businesses that recovered quickly and may not need support by the end of this period.

In practice, the national lockdown extended for 2 months instead of the 6 months that had been expected, leading to substantial extra duration payments. Specifically, under JK1.0, $27 billion out of $70 billion in JobKeeper payments, or 39 per cent, were received by businesses who would not have qualified for their payments if the program had been based on actual turnover Treasury (2021, p. 2 and 49).

Extra duration payments continued under JK2.0 and JK3.0 because the program switched from the forward-looking eligibility test of JK1.0 to a backward-looking eligibility test. For example, under JK2.0, businesses that continued to experience the minimum required loss of turnover in 2020q3 received JobKeeper payments in 2020q4.

The duo of Federal-state programs that replaced JobKeeper, the COVID disaster payment for workers and the COVID business support, addressed this design issue by avoiding extra duration payments. The duration of payments under these two programs was linked to the duration of the applicable lockdowns. Any future JobKeeper program should make the same link to avoid extra duration payments.

For modelling purposes, it is necessary to classify these extra duration payments. Once a business had returned to normal operations and hence had no inactive employees, it was able to retain further JobKeeper payments in full, so there was no worker transfer component. Further, unlike under a wage subsidy, the business could not increase the amount of these payments by hiring additional employees, because JobKeeper was only payable with respect to existing employees. Rather, the extra duration payments were a windfall to the business that is best classified as a business transfer payment.

We now put the extra duration payments to one side for the purpose of analysing the JobKeeper payments made when businesses were experiencing at least the minimum loss of turnover specified by the program.

Compensation for Lost Profits: Economy-wide

Businesses who were eligible for JobKeeper because they had a sufficient loss of turnover were compensated for the associated loss of profits by being able to retain the JobKeeper payments made with respect to their active employees. Here, we analyse whether these payments under or over compensated business owners for lost profits. One problem with overcompensation in this case is that it provides businesses with a profit motive to constrain their output and active employment to become eligible for JobKeeper, even if they are unaffected by COVID.

This compensation of business owners for lost profits is investigated by examining the revenue and expenses of an 'average' business. This type of analysis of JobKeeper was first presented by Murphy (2021a) in June 2021 and then by Treasury (2021) in October 2021. The analysis here is more illuminating because, besides considering the economy as a whole, it also considers the individual industries in which JobKeeper was most prevalent. We begin by taking the economy-wide perspective.

Table 3. *Revenue and Expenses of an 'Average' Business ($'000 per Year)*

Operating level	0%	50%	70%	100%
Revenue	0	721	1010	1443
JK1.0 payment for active labour	0	106	149	0
Labour costs	0	−212	−297	−424
Other variable costs	0	−381	−533	−761
Profit	0	235	329	258
JK1.0 income transfer to inactive labour	212	106	64	0

Business revenues and costs are taken from the ABS (2021a) 2018–19 input–output tables.[5] These revenues and costs are then re-expressed on a 'per business' basis by dividing by the number of economically active businesses at 30 June 2019 sourced from ABS (2020a). This gives the revenue and expenses shown in the final column of Table 3. Using ABS (2021c) employment data, average employment 'per business' is calculated to be 5.4 persons.

The profit of the business is calculated as revenue plus any JobKeeper payment for active employees less labour costs less other variable costs. It corresponds to gross operating surplus in the national accounts,[6] which in turn broadly matches the accounting concept of EBITDA. For the average business, annual profit is $258,000, as seen in the final column of the table.

If this business is eligible for JobKeeper, under JK1.0 it received $212,000 on an annual basis. This is based on employment of 5.4 persons and the JK1.0 payment rate of $1500 per fortnight per employee. As discussed above, this JobKeeper payment can be divided into a payment to the business with respect to active employees, and an income transfer to inactive employees, as shown in the two JK1.0 rows of Table 3.

In the table, a business that suspends operations while social distancing is in place is represented in the column for an operating level of 0%. All of the employees are inactive, so they receive all of the JobKeeper payments. The business owners receive no compensation for losing their entire profit of $258,000 on an annual basis. Because a business may have expenses that are usually funded out of EBITDA, such as interest payments on debt, this business may face a risk of bankruptcy, potentially stranding its capital.

As noted earlier, larger businesses were eligible for JobKeeper provided their turnover fell within a ceiling set at 50 per cent of normal (i.e. pre-COVID-19) turnover. The profit situation for a business operating at that ceiling is shown in Table 3 in the column for an operating level of 50%. It shows that business revenue, labour costs and other variable costs are at 50 per cent of normal levels. It also shows that the business receives 50 per cent of the JobKeeper payment, or $106,000 on an annual basis, while the remaining 50 per cent must be paid to the inactive employees as compensation for lost wages. The business pays the usual wage to employees who are active, but pays the JobKeeper rate to employees who are inactive.

As shown in Table 3, this business makes a profit of $235,000, while operating at 50 per cent of normal levels compared to its profit in normal circumstances of $258,000. The reason that profit falls by only $23,000 is that the potential loss in profit of 50 per cent, or $129,000, is largely covered by compensation from JobKeeper of $106,000. Hence, the business is compensated for 82 per cent of potential lost profits, but overcompensation is avoided.

[5]The housing services sector is excluded because, as a non-employing sector, it was not eligible for JobKeeper. In measuring labour costs, compensation of employees in each industry is upscaled to take into account the labour contribution of the self-employed, a necessary adjustment because the self-employed were eligible for JobKeeper.

[6]After the adjustments described in the preceding footnote.

We now turn to the case of a smaller business operating at 70 per cent of normal turnover, which is its eligibility ceiling for JobKeeper. Its profit situation is shown in the table in the column for an operating level of 70%. Using the same approach as before, we find that the loss of profit from COVID of $77,000 is over-compensated by the JobKeeper paid for active employees of $149,000. Thus, the business is over-compensated by receiving 193 per cent of potential lost profits. This over-compensation means that many smaller businesses that were not affected by COVID nevertheless had a profit motive to limit operations to 70 per cent of normal to enjoy unusually high profits under JobKeeper.

This highlights the two extremes in compensation of business owners for lost profits under Job-Keeper. At one extreme, businesses forced to completely suspend operations experienced the largest loss of profits yet received no compensation. At the other extreme, smaller businesses able to operate at the turnover ceiling permitted under JobKeeper could receive over compensation of about $2 for each $1 of lost profits. These anomalies arose mainly because the compensation of business owners depended on the percentage of their employees who were active, whereas profit losses depended on the percentage of employees who were inactive.

Breakeven Ceiling and Individual Industries

A convenient way of checking for over-compensation of business owners under JobKeeper in different situations is to calculate a breakeven ceiling, cp. This is defined as the ceiling, expressed as a proportion of usual turnover, at which profit is the same irrespective of whether a business operates at that ceiling with JobKeeper or at full operations without JobKeeper.

The formula for the breakeven ceiling is derived by setting usual profit, π, equal to profit obtained operating at a given eligibility ceiling for JobKeeper. At that reduced level of operation, turnover and variable inputs, and hence profit, are scaled down by the ceiling proportion, cp, on the assumption that active employees are paid their usual wage. In addition, the business generally retains a proportion of JobKeeper, being the proportion, cp, of the total JobKeeper payment, jk, that is attached to active employees.

$$\pi = cp \cdot \pi + cp \cdot jk$$

The above formula assumes that the usual wage rate exceeds the JobKeeper payment rate, but that was not always the case, as discussed in Section 4.2. If instead the JobKeeper payment, jk, exceeds usual labour costs, lab, then a business operating under JobKeeper is required to make a top up payment to active employees to raise their wage rate to the JobKeeper rate. This reduces profit by the amount of the top up payment.

$$\pi = cp \cdot \pi + cp \cdot jk - cp \cdot (jk - lab) = cp \cdot \pi + cp \cdot lab$$

Taking both of these cases into account, the profit equality can be written as follows.

$$\pi = cp \cdot \pi + cp \cdot minimum(jk, lab)$$

This can be solved for the following simple formula for the breakeven ceiling proportion.

$$cp = \pi / (\pi + minimum(jk, lab))$$

Using the data for the average business (Table 3) in this formula gives a breakeven ceiling of 55 per cent of normal turnover, which is reported in the JL1.0 column of Table 4.

$$cp = 258/(258 + 212) = 0.55$$

This breakeven ceiling of 55 per cent can be compared with the actual eligibility ceilings for smaller and larger businesses. It falls above the eligibility ceiling for larger businesses of 50 per cent of normal turnover, making it is slightly more attractive for larger businesses to operate normally. However, it falls below the eligibility ceiling for smaller businesses of 70 per cent, making it much more profitable to constrain operations to stay within this high eligibility ceiling and retain JobKeeper than to operate

Table 4. *Breakeven Ceilings for Versions of JobKeeper (% of Turnover)*

	JK1.0 (%)	JK2.0 (%)	JK3.0 (%)
Accommodation and food services	20	28	31
Arts and recreation services	32	41	46
Average business	55	63	67

at normal capacity without JobKeeper. This is consistent with the profit outcomes reported in Table 3.

These calculations regarding compensation of business owners refer to economy-wide averages and so may not be typical of the industries that were more dependent on JobKeeper. The most dependent industries were Accommodation & Food Services and Arts & Recreation services, where JobKeeper payments were equivalent to 45 per cent and 49 per cent respectively of compensation of employees in the June quarter 2020 (ABS, 2021b), higher than for any other industry division.

The breakeven ceilings for these two industries are very low, at only 20 per cent of normal turnover for Accommodation and Food services and 32 per cent of normal turnover for Arts and Recreation services (Table 4). This means that, in these two industries, even larger business operating at their eligibility ceiling of only 50 per cent of normal turnover were over-compensated for loss of profits by JobKeeper. These larger businesses received compensation of over $2 for each $1 of lost profits, while smaller businesses operating at their higher eligibility ceiling received even greater over-compensation.

The breakeven ceilings are very low in these two industries because, by paying a fixed dollar amount per employee, JobKeeper was very generous to low wage, labour-intensive industries. Conversely, it offered low compensation for lost profits to business owners in high wage, capital-intensive industries. The phasing down in JobKeeper rates of payment under JK2.0 and JK3.0 (Table 2) reduced the extent of over-compensation for lost profits, so breakeven ceilings rose (Table 4).

If business owners respond to the profit incentive from over-compensation by reducing production to become eligible for JobKeeper, it has two harmful economic effects. First, it reduces national income. Second, it is inequitable, because most full-time workers who become inactive were only partially compensated by JobKeeper for their lost wages, as seen in Section 4.2, whereas business owners who artificially restrict production are over-compensated for lost profits.

This brings us to the issue of how to classify for modelling purposes the JobKeeper payments made to businesses for their active employees. One possibility is to follow the ABS by classifying such payments as a wage or production subsidy. Under a standard wage subsidy, additional employment is rewarded with additional payments. This stimulates employment and economic activity and reduces output prices.[7]

The JobKeeper payments received by businesses differed from this standard wage subsidy because of the eligibility ceiling. Below the eligibility ceiling, additional active employment was rewarded with additional payments to the business, like a wage subsidy. However, above the eligibility ceiling, all JobKeeper payments were withdrawn. As shown above, this meant that JobKeeper could act as a disincentive to operate above the ceiling, in what Treasury (2021, p.13) describe as an 'anti-production subsidy'.

This 'anti-production subsidy' aspect would partly nullify the activity-stimulating effect of JobKeeper as a production subsidy. To recognise that, in this paper, our preferred approach is to assume that the JobKeeper payments that businesses received for their active employees are one-half production subsidy and one-half business lump sum transfer.

[7]This is before considering possible offsetting effects on economic activity from how a wage subsidy is financed.

4.4. Assessment

Improving JobKeeper

If there is a JobKeeper program in a future pandemic, the design should be changed in two ways to reduce the risk of over-compensation, with the associated disincentive effects and windfall gains.

First, as much as possible, the program should only be available to businesses that are not able to operate normally because of a pandemic. It would be limited to the particular industries or regions where social distancing applies and, importantly, would be removed as soon as social distancing is lifted. As noted earlier, eliminating extra duration payments would have saved around 39 per cent of program expenditure.

Second, the payments should be redesigned to reduce the unevenness in compensation for lost profits. The original program favours low wage businesses over high wage businesses, and businesses operating near the eligibility ceilings over businesses only able to operate at low levels or forced to suspend operations entirely.

Modelling JobKeeper

Based on the above analysis, we can summarise our preferred approach to classifying JobKeeper payments for modelling purposes as follows. Three different types of JobKeeper payments are distinguished. First, extra duration payments are a windfall to business owners and hence are a business transfer (39 per cent of total). Second, payments for inactive employees act as a replacement for JobSeeker and hence are a household transfer (20 per cent of total). Third, payments for active employees are, on balance, classified as one-half production subsidy and one-half business transfer because their operation as a production subsidy is partly nullified by the disincentive effect of the eligibility ceiling (remaining 41 per cent of total). In round numbers this means that, under our preferred treatment, JobKeeper is classified as 20 per cent production subsidy, 60 per cent business transfer and 20 per cent household transfer, as reported later in Table 6.

5. Modelling COVID-19 and the Fiscal Policy Response

This section explains the model settings used to simulate COVID and the fiscal response for the purpose of generating the *no COVID*, *COVID* and *COVID plus fiscal* scenarios. In some contexts, the discretionary monetary response to COVID also has a significant effect so there is also a *COVID plus fiscal plus monetary* scenario. This latter scenario takes all three types of shocks into account and hence is also an *actual/forecast* scenario. Both names are used interchangeably. Section 6 uses the results of these scenarios to assess the macroeconomic effects of COVID, the fiscal policy response and, more briefly, the monetary policy response.

The *actual/forecast* scenario is based on actual events, including the COVID pandemic and the discretionary fiscal and monetary policy responses. It uses actual historical data through to the June quarter 2022 and then simulates a forecast or projection from the September quarter 2022 onwards.

The remaining scenarios are counter-factual scenarios. The first of these is a *no COVID* scenario, in which all three types of shocks are removed. That is, there is no COVID pandemic and hence no fiscal or monetary policy response. The economy follows a relatively stable path under this *no COVID* scenario, which is therefore used as a control scenario.

The three types of shocks are then introduced sequentially to finally arrive at the *actual/forecast* scenario. The order in which these shocks are introduced has some influence on how the differences in outcomes between the *actual/forecast* scenario and the control or *no COVID* scenario are attributed to the three types of shocks, partly because of the ZLB on interest rates. Thus, the order in which the shocks are introduced needs to be considered.

COVID is introduced as the first shock because the fiscal and monetary policies that are simulated are best understood as responses to COVID. COVID began shocking the economy in 2020q1, so the COVID scenario is simulated starting from that date. Allowing for COVID gives us the *COVID* scenario. In Section 6, the macroeconomic effects of COVID are assessed from differences in outcomes between the *COVID* scenario and the *no COVID* scenario.

Fiscal policy and monetary policy, as the two arms of macroeconomic policy, have overlapping effects. Thus, their appropriate settings are interdependent. Monetary policy is adjusted more frequently than fiscal policy, making it more flexible and better able to adjust to the other arm of policy. For that reason, the fiscal response to COVID is introduced first, followed by the monetary policy response.

Introducing the fiscal policy response to COVID generates the *COVID plus fiscal* scenario. All fiscal policy decisions that were announced during the 2020 and 2021 calendar years are considered as part of this fiscal policy response. In Section 6, the macroeconomic effects of COVID, combined with the fiscal policy response, are assessed from differences in outcomes between the *COVID plus fiscal* scenario and the *no COVID* scenario.

Finally, the monetary policy response to COVID is introduced to generate the *COVID plus fiscal plus monetary scenario*, or more simply the *actual/forecast* scenario. As was explained in Section 3.4, that monetary policy response to COVID is considered to have taken place during the 2021–22 financial year, when monetary policy was more expansionary than predicted by the Taylor rule that links monetary policy to inflation and unemployment. In Section 6, the macroeconomic effects of COVID, combined with the responses from both arms of macroeconomic policy, are assessed from differences in outcomes between this *actual/fiscal* scenario and the *no COVID* scenario.

All four scenarios use the same inputs in all other areas, such as for underlying productivity growth and world commodity prices. Because these other inputs are the same in all scenarios, they have little influence on our estimates of the macroeconomic effects at the margin of COVID social distancing and the fiscal and monetary policy responses. Hence these other inputs are not detailed here to conserve space.

The four scenarios were finalised on 22 November 2022 using historical national accounts data up to the June quarter 2022. As more data is released, the *actual/forecast* scenario will obviously change when updated. However, the other three scenarios will also change in a similar way, so that the deviations between the scenarios will be largely unaffected. This is because those deviations reflect the effects at the margin of COVID social distancing and the fiscal and monetary policy responses, which will not change significantly with new data. In Section 6 we focus on these deviations not only because they will not become dated, but also because it is these COVID and macro policy effects that are the main concern of this paper.

The remainder of this section is in two sub-sections. The first sub-section explains how COVID is captured in inputs to the model. The second sub-section outlines the government's fiscal and monetary policy responses and how those responses are captured in inputs to the model. These inputs are summarised in the Appendix I in Tables A3 and A4 respectively.

5.1. COVID-19 Inputs

There are four types of COVID effects that distinguish the *no COVID* and *COVID* scenarios. First, and most importantly, geographic mobility effects associated with voluntary and mandatory social distancing under COVID had a wide range of macroeconomic impacts, as set out in Section 3.3. Second, the international travel ban under COVID disrupted net overseas migration (NOM), in a further effect from geographic mobility. Third, in addition to these direct domestic effects, COVID also affected the Australian economy indirectly by changing the international economic environment. Four, in the COVID era, there are unusually large residual errors that remain in two equations and that are likely to be mainly due to COVID.

Table A3 summarises how the COVID effects have been captured in model settings, arranged in panel of rows for different types of shock. The 'without COVID' column show the model settings in the *No COVID* or control scenario, while the 'with COVID' column shows the model settings in the *COVID* and subsequent scenarios. The 'time period of COVID effect' column identifies the time period over which the two settings differ from each other.

Most COVID model inputs eventually converge to the same 'normal' values, both with and without COVID, because the time period of COVID effects is limited (Table A3). The main exception is that there is a permanent loss of population under the COVID case, relative to the without COVID case, because of the temporary suspension of immigration under COVID.

The various panels of Table A3 are now discussed in turn, beginning with the geographic mobility effects.

Geographic Mobility Effects

In Section 3.3, we explained how geographic mobility variables reflecting social distancing under COVID were constructed and where they appear in the model. Four indicators of immobility under COVID were found to cause shifts in 18 out of the model's 60 estimated equations. The four COVID variables are *COVID_DOM*, *COVID_INT*, *COVID_EDU* and *COVID_202*. Table A2 showed the equations where each COVID variable appears.

In Table A3, the first three COVID variables measure geographic mobility and are set to their normal values of unity in the *No COVID* scenario. In the *COVID* scenario they are set to their actual and projected values under COVID, which range from 0 (no mobility) to unity (normal mobility). These historical and projected values were discussed in Section 3.3 and are displayed in Figure 5. Table A3 identifies the time periods over which each variable departs from its normal value. Lower levels of geographic mobility led to lower levels of economic activity.

The final social distancing variable is a dummy variable for the national lockdown of 2020q2. Hence, in 2020q2, it is set equal to zero in the *No COVID* scenario and unity in the *COVID* scenario (Table A3). The national lockdown led to lower levels of economic activity.

Net Overseas Migration

The international travel ban reflected in the variable *COVID_INT* displayed in Figure 5 disrupted *NOM*. *NOM* became negative (Figure 7) as potential new residents were barred from entering Australia while some Australian residents were allowed to return home. *NOM* is forecast to gradually recover to be at a normal level from 2024–25 onwards. This normal, annual level of 218 thousand persons is based on the average level over the decade prior to the pandemic.

In contrast, in a hypothetical no COVID situation, it is assumed that *NOM* would have been maintained at the same normal level throughout (Figure 7). This would have avoided a total loss in *NOM* of 512 thousand persons. This loss in NOM implies a permanent loss in the level of the population relative to the *no COVID* scenario (Figure 8). This population projection is generated by a population model based on assumptions for *NOM*, fertility and mortality.

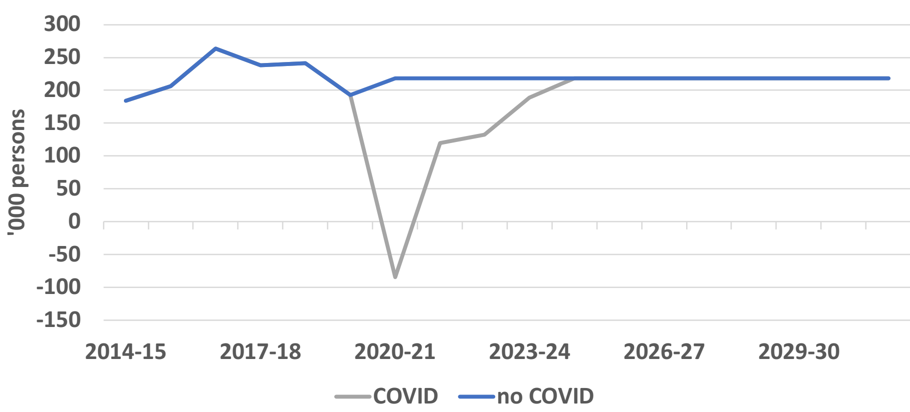

Figure 7. *Net Overseas Migration ('000 Persons per Year)*

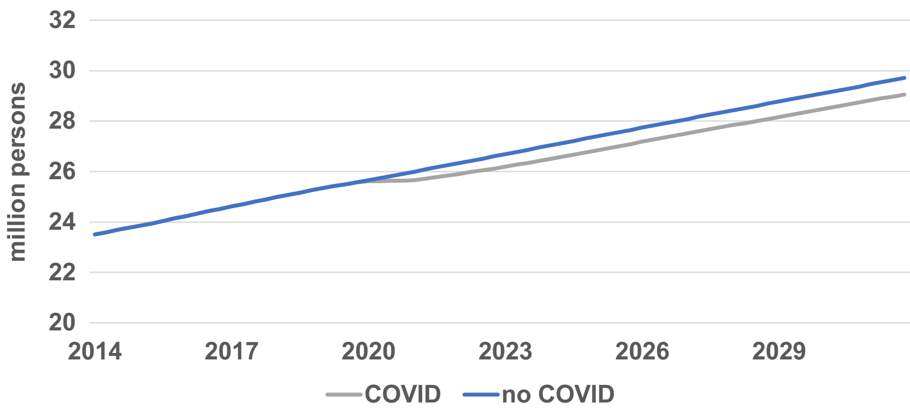

Figure 8. *Population*

While COVID has resulted in a permanent loss in population, the economic significance of this should not be overstated. While a lower population means lower employment and GDP, we shall see in Section 6 that this has relatively little effect on living standards as measured, for example, by GDP *per capita*.

Further, the latest ABS population data shows that *NOM* has recovered sooner than was generally expected when these scenarios were developed, and is now likely to be at a normal level from 2022–23 onwards. This would limit the population loss from COVID to about 350 thousand persons.

COVID-19 Effects on Australia via the International Economy

Turning to the third type of shock, besides affecting the Australian economy directly, COVID affected the Australian economy indirectly through its linkages with a weakened international economy. Globally, the COVID recession in 2020 led to low inflation. However, in 2021 this reversed to high inflation. The reasons suggested for this inflation reversal include highly expansionary fiscal policy fuelling demand and a COVID-related loss of labour supply constricting supply. In any case, higher global inflation to some extent is being imported into Australia. In the modelling it is assumed, perhaps optimistically, that world prices for our imports gradually moderate to eventually follow the same price trend as in the *no COVID* scenario (Table A3).

This same pattern of low and then high inflation led central banks to reduce short-term interest rates in the first half of 2020 before beginning to increase them in 2022. In the *COVID* scenarios, it is projected that the model's foreign short-term interest rate continues to gradually adjust upwards towards a neutral rate. In the *no COVID* scenario, this interest rate adjustment process begins sooner, from the higher pre-COVID base at the beginning of 2020 (Table A3).

Other Domestic

The inclusion of geographic mobility effects in 18 of the estimated equations of the model greatly improved their tracking of the COVID era. However, in two cases, even with improved tracking, some smaller outliers remained. These outliers can plausibly be attributed to imperfections in the modelling of the COVID effects. On that basis, the residuals of the two equations, for household consumption and the labour force participation rate, are treated as representing COVID effects during the COVID era (Table A3).

5.2. Fiscal and Monetary Response Inputs

This sub-section explains how fiscal policy and monetary policy in the COVID era has been represented in inputs to the model. Full information can be found in Table A4.

COVID-era fiscal policy is defined as fiscal policy measures announced during 2020 and 2021. The pre-COVID starting point for fiscal policy was set out in the 2019–20 MYEFO issued in December 2019 (Australian Government, 2019). The fiscal policy announcements during 2020 and 2021 are conveniently set out in the 2020–21 Budget (Australian Government, 2020), the 2021–22 Budget (Australian Government, 2021a) and the 2021–22 MYEFO (Australian Government, 2021b), which was released in December 2021. These measures and their budget costs have been collated and then summarised in Table 5.

The 2021–22 MYEFO (Australian Government, 2021b) provides its own summary of the budget cost of fiscal policy measures announced during 2020 and 2021. However, the MYEFO summary only includes economic and health support measures announced in response to the pandemic, which it calculates had a total budget cost of $337 billion, with $314 billion for economic support and $23 billion for health support. Our modelling differs by also including the non-pandemic policy measures of $92 billion announced in the same timeframe, bringing the total cost to $429 billion, as shown in Table 5. The table itemises the main economic support measures, while the health support measures and non-pandemic policy measures are both included under 'other policy measures'.

The reason that we include all of the policy measures announced over this period in the modelling, not just those explicitly stated to be introduced in response to the pandemic, is because all of the measures can have a macroeconomic impact. The estimated $92 billion in non-COVID policy measures is large by historical standards, and the unfunded nature of these measures presumably reflects a willingness by policy makers to engage in additional fiscal expansion in the context of the pandemic, over and above the measures specifically linked to the pandemic.

Economic Classification of Economic Support Payments

The most important step in representing the COVID-era fiscal era measures in the model is to decide on an economic classification for each measure. The main issues arise in classifying the various economic support payments. Table 6 lists the five types of support payments, and how they are classified under three alternative classification schemes. The first classification scheme is that used by the ABS in preparing the national accounts. The second scheme is our preferred classification based on our economic analysis of each measure. The third scheme is the scheme adopted in the modelling. In cases where it is practical to adjust the ABS data in a consistent way to use the preferred scheme, we do that in the modelling. In cases where it is impractical to make the adjustments, we use the ABS scheme. Fortunately, in value terms, we are able to use the preferred scheme in the modelling for most of the economic support payments.

Table 5. *Budget Cost of COVID-Era Fiscal Policy Measures ($billion)*

Policy measure	19–20	20–21	21–22	22–23	23–24	24–25	Total
JobKeeper	35	55	0	0	0	0	90
COVID disaster payment and business support	0	0	21	0	0	0	21
Accelerated depreciation until 2022–23	0	5	17	17	3	6	49
Boosting cash flow for employers	15	20	0	0	0	0	35
JobSeeker supplements	6	15	2	2	2	2	29
Bring forward of stage 2 income tax cuts	0	7	17	2	0	0	26
Other policy measures	3	52	47	35	28	15	180
Total	58	155	104	55	33	24	429

Sources: Australian Government (2020, 2021a, 2021b).

Table 6. *Economic Classification of Economic Support Payments*

Classification program	ABS	Preferred	Modelled
JobKeeper	Production subsidy	20% production subsidy; 60% business transfer; 20% household transfer	20% production subsidy; 80% business transfer
Boosting cash flow	Production subsidy	Business transfer	Business transfer
Business support	Production subsidy	50% production subsidy; 50% business transfer	Production subsidy
COVID-19 disaster	Household transfer	Household transfer	Household transfer
JobSeeker supplements	Household transfer	Household transfer	Household transfer

JobKeeper is the policy measure with the largest Budget cost of $90 billion (Table 5). The ABS (2020b) ABS decided to classify all of JobKeeper as a production subsidy, as shown in the ABS column of Table 6. Using reasoning from the 2008 international system of national accounts (SNA2008), the ABS argued that because JobKeeper is a payment made to businesses and that the amounts of the payments are related to production values, it should be classified as a production subsidy.

In Section 4 it was found that, on closer examination, three separate components of JobKeeper can be distinguished. After analysing those components, in Section 4.4 our preferred treatment of JobKeeper was to classify it as 20 per cent production subsidy, 60 per cent business transfer and 20 per cent household transfer (Table 6). Compared to the ABS assumption that JobKeeper is simply a production subsidy, our preferred treatment recognises that some payments were simply passed on to workers as a replacement for JobSeeker, continuing payments to businesses after the national lockdown was lifted were largely a windfall, and the eligibility ceiling has a disincentive effect.

It was not practical to re-classify 20 per cent of JobKeeper as a household transfer. This is because the ABS assumption that JobKeeper payments for inactive employees are wage payments to employees, rather than transfer payments to the unemployed, is ingrained in too much of the ABS data. This includes data on compensation of employees in the national accounts and employment in the labour force survey.

However, it was possible to adjust the ABS data to re-classify some JobKeeper payments as business transfers instead of production subsidies. This was done using ABS (2021b) information on JobKeeper payments by industry. In the modelling approach, 80 per cent of JobKeeper payments were re-classified to being a business transfer, leaving 20 per cent as a production subsidy (Table 6). This is the same production subsidy percentage as under our preferred approach. The only difference with our preferred approach is in the allocation of the transfer between the household and business arms of the private sector.

Businesses also received payments under the 'boosting cash flow for employers' program. It had a Budget cost of $35 billion (Table 5). Employing businesses with an annual turnover of up to $50 million received two payments totalling between $20,000 and $100,000. The exact amount of the payments depended primarily on the amount of tax that a business had withheld from wages and salaries in either the March month or the March quarter of 2020.

This retrospective nature means that businesses could not change the amount they received by changing their behaviour. Consequently, the cash flow boost operated as a lump sum transfer. As such, in our preferred classification it appears as a business transfer payment (Table 6). The aim of this transfer was to assist businesses to stay viable, although it was not targeted specifically at businesses who had been impacted by COVID social distancing.

The ABS (2020b) treated the Boosting Cash Flow program in the same way it treated the JobKeeper program, that is, as a production subsidy. The ABS did not take into account that this program differed fundamentally from the usual production subsidy in that a business could not change the amount that it received by changing its production behaviour. Fortunately, for the modelling, it was possible to adjust the ABS data to re-classify Boosting Cash Flow payments as business transfers instead of production subsidies using ABS (2021b) information on Boosting Cash Flow payments by industry.

Without these re-classifications of JobKeeper and Boosting Cash Flow payments, the ABS data is deeply flawed for economic analysis. This has been confirmed by model simulations. The large over-statement of the production subsidy component in the national accounts leads to the simulation of a large consumer price deflation when the measures were introduced, whereas in reality consumer prices were broadly static. This conflict with reality is avoided under the payment re-classifications used in the modelling in this paper.

When COVID re-emerged with the delta and omicron variants, the JobKeeper program, which expired in March 2021, was replaced with two separate programs that together performed a similar function and operated from June to December 2021. Compensation to inactive employees was paid under a COVID-19 disaster payment, compensation to business was paid under a Business Support program (Table 5), and extra duration payments were sensibly curtailed.

The ABS appropriately classified the COVID-19 disaster payment as a household transfer. Unfortunately, the ABS classified the Business Support program as a production subsidy, even though it included the disincentive effect of an eligibility ceiling, similar to JobKeeper. Applying the same principles as before, 50 per cent of it would be re-classified as a transfer payment. Unfortunately, for the modelling it was not practical to re-classify part of the Business Support program as a business transfer because the ABS did not publish the data necessary to perform this re-classification at the industry level (Table 6).

The fifth and final category of COVID economic support program is JobSeeker supplements. A supplement of $550 per fortnight was paid to Jobseeker and related recipients in the June and September quarters 2020, phased down to $250 in the December quarter and $150 in the March quarter 2021. This was replaced with a permanent supplement of $50 per fortnight from the June quarter 2021, adding about 10 per cent to the original payment rate.

The Budget cost to 2024–25 of these JobSeeker measures was $29 billion (Table 5). Thereafter, the annual budget cost of the permanent 10 per cent increase in payment rate is $2 billion. The ABS appropriately classified these payments as household transfers (Table 6).

Model Inputs

Table A4 shows how the fiscal policy measures costed in Table 5 have been translated into model inputs, with separate panels for government spending measures and tax measures. There is also a third panel, for monetary policy, which is discussed at the end of this section.

The 'with policy expansion' column in Table A4 shows the government spending and tax settings under the fiscal expansion of the COVID era. Those fiscal settings are used in the *COVID plus fiscal* scenario. The 'without policy expansion' column shows the model settings in the hypothetical situation in which there was no fiscal expansion. Those settings are used in the *COVID* scenario and the *no COVID* scenario. The 'time period of COVID effect' column identifies the time period over which each element of the fiscal expansion was in place.

The scenarios are presented in Section 6.

The model classification of the various economic support payments was presented in Table 6. Those payments are translated into model inputs in the 'spending' panel of Table A4.

The fiscal response also included introducing accelerated depreciation for business investment under a series of three programs at a total cost of $49 billion. The final and most generous of these, the temporary full expensing program, allows for full immediate expensing of certain investments undertaken up until 2022–23. It is subject to an eligibility cap of $5 billion in annual turnover. These immediate expensing provisions are modelled on an accrual basis when the assets are purchased (2019–20 to 2022–23), rather than on a cash basis when the reduction in tax liability is realised in the following financial year (2020–21 or 2023–24). This is to better capture the likely timing of the stimulus to investment.

The macro model now fully provides for immediate expensing provisions, including distinguishing between investment in machinery and equipment, which is eligible for immediate expensing, and investment in structures, which is not eligible. Immediate expensing is translated into model inputs in the 'taxes' panel of Table A4.

The fiscal response also brought forward previously planned personal income tax cuts. The stage 2 personal income tax cuts were introduced in 2020–21 instead of 2022–23, while maintaining the original timetable for abolishing the Lower and Middle Income Tax Offset in 2022–23. The budget cost of the bringing forward of the stage 2 tax cuts was $26 billion (Table 5). The fiscal expansion did not involve any change to the stage 3 personal income tax cuts, which are legislated to be introduced in 2024–25 and are included in all scenarios ('taxes' panel of Table A4).

The remaining fiscal policy measures are shown in Table 5 as the single line item 'other policy measures'. These other measures have a combined budget cost of $180 billion. These measures include the health support payments, which are generally temporary, as well as measures not related to the pandemic, some of which have significant ongoing budget costs. For example, the response to the Aged Care Royal Commission entails a permanent, annual cost of about $5 billion. For modelling purposes, these remaining policy measures are assumed to add to government final demand ('spending' panel of Table A4).

Table 5 identifies the Federal Government, but not the state government, fiscal policy measures announced in 2020 and 2021. However, the way model inputs are set in Table A4 means that most state government measures are automatically included in the modelling of the fiscal expansion in the *COVID plus fiscal* scenario, because measures by all levels of government are generally captured in the underlying historical ABS data that are used in the modelling. Similarly, both Federal and state government measures announced in 2020 and 2021 are effectively removed in the *COVID* scenario because it is based on 2019 fiscal policy settings.

Finally, the third panel of Table A4 shows alternative settings for monetary policy. As explained in Section 3.4, the monetary policy rule contains a dummy variable, *COVID_2122*, to take into account that the cash rate remained near zero in the 2021–22 financial year, when it would normally be higher given prevailing macroeconomic conditions. This was part of the COVID monetary policy response announced by Lowe (2020). This monetary policy response is switched off or on by setting *COVID_2122* to zero or unity in 2021–22. The monetary policy response is switched off in most scenarios, but is switched on in the final scenario, known alternatively as the *COVID plus fiscal plus monetary scenario* or the *actual/forecast* scenario.

6. The Scenarios

This section uses the results of the scenarios to assess the macroeconomic effects of COVID both before and after taking into account the fiscal policy response. This allows us to assess both the macroeconomic effects of COVID, and the extent to which the fiscal policy response was successful in neutralising those effects.

In these assessments, we use the *no COVID* scenario as the control scenario; results for other scenarios are reported as deviations from this control scenario. Because the *no COVID* scenario removes both the COVID shocks to the economy and the expansionary fiscal and monetary policies that were introduced in response, the economy grows relatively smoothly, making it a natural choice for the control scenario. Other shocks to the economy, such as from the war in the Ukraine, are not removed so growth is not completely smooth.

Thus, the results from the *COVID* scenario are reported as deviations from the *no COVID* scenario. Reported that way, they show the simulated macroeconomic effects of COVID. Recall that these effects show the combined macroeconomic impacts of voluntary and mandatory social distancing under COVID without distinguishing between the two forms of distancing.

Similarly, results from the *COVID plus fiscal* scenario are also reported as deviations from the *no COVID* scenario. They show the simulated effects of COVID plus the expansionary fiscal policy that was introduced in response to COVID. To the extent that the fiscal expansion was successful in neutralising the macroeconomic impacts from COVID, these effects will be smaller in absolute magnitude than the effects from COVID alone.

Finally, for macroeconomic variables that are affected in a material way by the discretionary expansion in monetary policy in 2021–22, we also report results for the *COVID plus fiscal plus monetary* scenario. Again, results are reported as deviations from the *no COVID* scenario. This allows us to assess the contribution that this discretionary monetary expansion made in responding to both COVID and the fiscal policy expansion.

6.1. Comparing Scenario Outcomes

In considering the outcomes, we distinguish three time periods. The COVID era, in which COVID social distancing suppressed economic activity and the discretionary fiscal expansion was implemented, extends from 2020 to 2021. The post-COVID era, in which there is macroeconomic instability following excessively expansionary macroeconomic policy, extends for 3.5 years, from 2022 to mid-2025. The macroeconomy then stabilises in the normalcy era, which begins from mid-2025. This stabilisation is aided by the fiscal policy rule, which comes into force at the beginning of this era, as mentioned in Section 3.4.

These eras are a simplification, intended to make the model results more accessible. In practice the delineation between the eras is not so distinct, because macro variables do not evolve in a fully synchronised way due to the complex dynamic interactions between them.

The scenarios actually extend to the end of 2060. However, for the purposes of this paper, results are reported only to the June quarter 2032, because by then each scenario has largely converged to its long run equilibrium path. Thus, results for the normalcy era are reported from 2025–26 to 2031–32.

We now compare the outcomes across the scenarios for 11 key variables in Figures 9–19. The figures cover public finances, household finances, economic activity, inflation and monetary policy. In discussing each figure, we begin with the *COVID* scenario to understand the macroeconomic effects of COVID. We then use the *COVID* plus fiscal scenario to assess the extent to which the fiscal policy response neutralised the macroeconomic effects of COVID. Finally, where the effects of the 2021–22 expansionary monetary policy are material, we also report results for the *COVID plus fiscal plus monetary* scenario, that is, the *actual/forecast* scenario.

Public Finances

COVID leads to a recession during the COVID era. This weaker economic activity automatically elevates the ratio of public net borrowing to GDP. This can be seen when the borrowing ratio in the *COVID* scenario is expressed as a deviation from the borrowing ratio in the *no COVID* scenario (Figure 9). Weaker economic activity raises the borrowing ratio for three main reasons. First, the ratio of government final demand to GDP rises because the recession makes GDP lower. Second, the recession raises government transfer payments because unemployment is higher. Third, the recession reduces profits, leading to lower company tax revenue. In short, the automatic stabilisers built into the budget bring forth an automatic increase in the borrowing ratio in the COVID recession.

The massive discretionary fiscal expansion that was detailed in Table 5 is introduced in the *COVID plus fiscal* scenario. Relative to the *no COVID* scenario, this makes the public borrowing ratio extraordinarily high, much higher than the already elevated level seen in the *COVID* scenario (Figure 9).

Temporarily higher public borrowing ratios in the scenarios with COVID leads to permanently higher public debt ratios (Figure 10). From 2025–26 the fiscal policy rule is switched on, as explained in Section 3.4, ensuring that the public debt ratio then stabilises in all scenarios, but at different inherited levels.

In the *COVID* scenario, the COVID economic shock ultimately adds 9 percentage points to the public debt to GDP ratio, compared to the *no COVID* scenario (Figure 10). The fiscal policy expansion adds further to the public debt ratio, taking the final increase to 21 percentage points under the *COVID plus fiscal* scenario (Figure 10). The monetary policy expansion has a partly offsetting effect, reducing the ultimate increase to 19 percentage points, as shown by the *COVID plus fiscal plus monetary* scenario, or

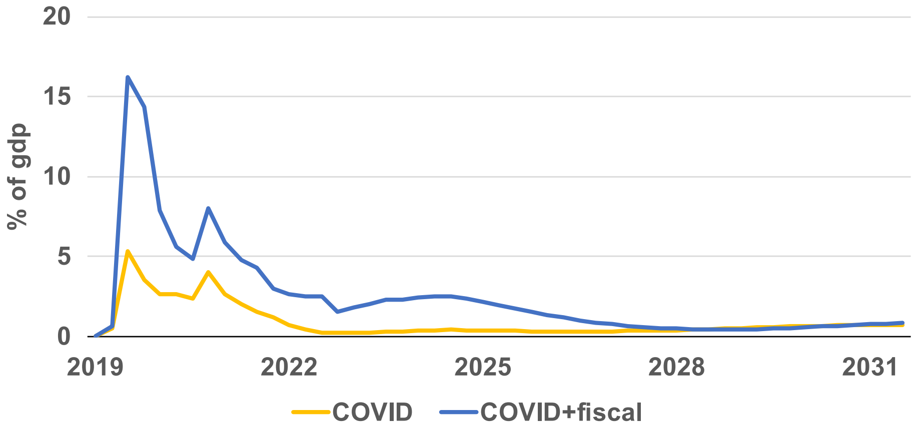

Figure 9. *Public Finances – Public Net Borrowing (Deviations from No COVID Scenario)*

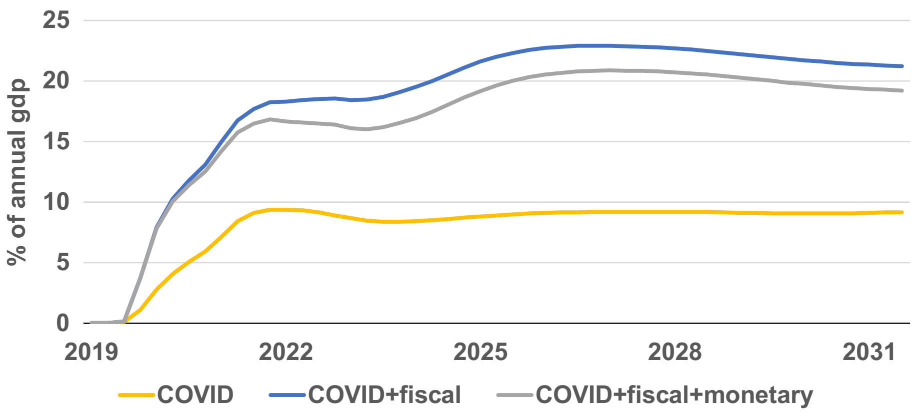

Figure 10. *Public Finances – Public Net Debt (Deviations from No COVID Scenario)*

actual/forecast scenario (Figure 10). This reduction occurs because the monetary expansion lifts prices, thereby increasing the denominator of the public debt to nominal GDP ratio.

Household Finances

COVID and related policies had three dramatic effects on household finances during the COVID era. First, social distancing suppressed consumption of certain services, which forced down household consumption in aggregate, that is, there was forced private saving. Second, this also reduced employment and profits in those constricted services industries, reducing private incomes. Third, the discretionary fiscal expansion, as set out in Section 5.2, added greatly to private incomes, in fact more than offsetting the negative effect from social distancing under COVID. The modelling scenarios quantify all three of these shocks to household finances.

In the *COVID* scenario, the first two COVID economic shocks are present. Thus, COVID social distancing lowers private incomes (Figure 11) and household consumption (Figure 12), relative to the

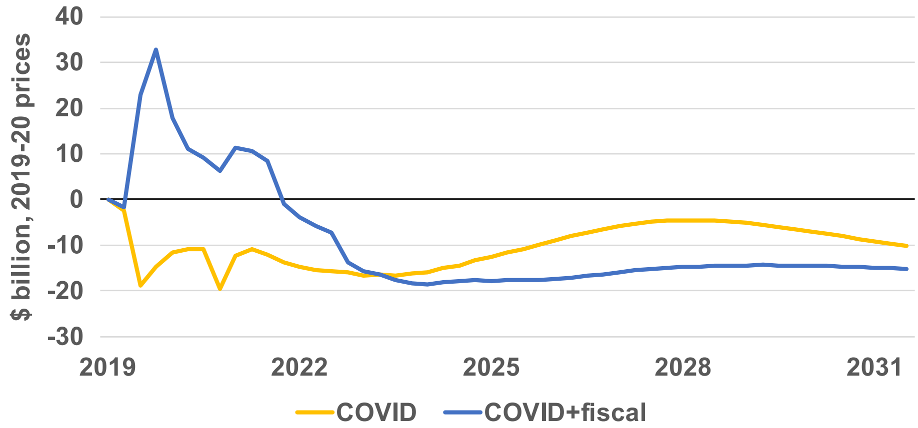

Figure 11. *Real Private Income (Deviations from No COVID Scenario)*

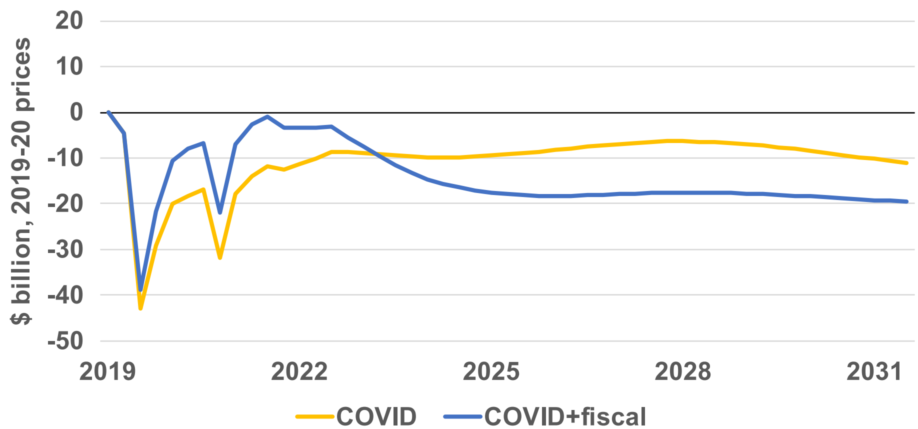

Figure 12. *Real Household Consumption (Deviations from No COVID Scenario)*

no COVID scenario. Further, the income losses experienced by the factors of production in the constricted industries lead the affected households to reduce their consumption, causing the weakness in economic activity to spread to other industries. Overall, in the COVID era (2020 and 2021), real private income is $101 billion lower in the *COVID* scenario relative to the *No COVID* scenario (Figure 11).

The *COVID plus fiscal* scenario adds in the third and final COVID shock to household finances, the massive discretionary fiscal expansion. This expansion more than compensates the private sector for the COVID income loss in the *COVID* scenario. In fact, the income loss of $101 billion in the *COVID* scenario is reversed to an income gain of $110 billion in the *COVID plus fiscal* scenario (Figure 11). That is, the fiscal expansion added $211 billion to private incomes.

Thus, during the COVID era, the fiscal expansion conferred the private sector with over $2 in compensation for every $1 of real income loss from the COVID recession. Such over-compensation goes beyond what is justified on equity grounds, can create disincentive effects, as shown in Section 4.3, and can lead to inflationary pressures, as analysed later in this section.

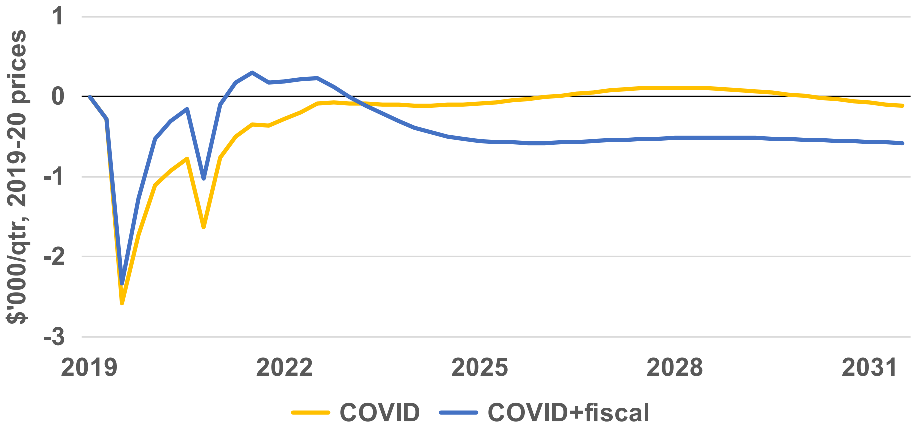

Figure 13. *Real Household Consumption per Head of Population Aged 15–64 (Deviations from No COVID Scenario)*

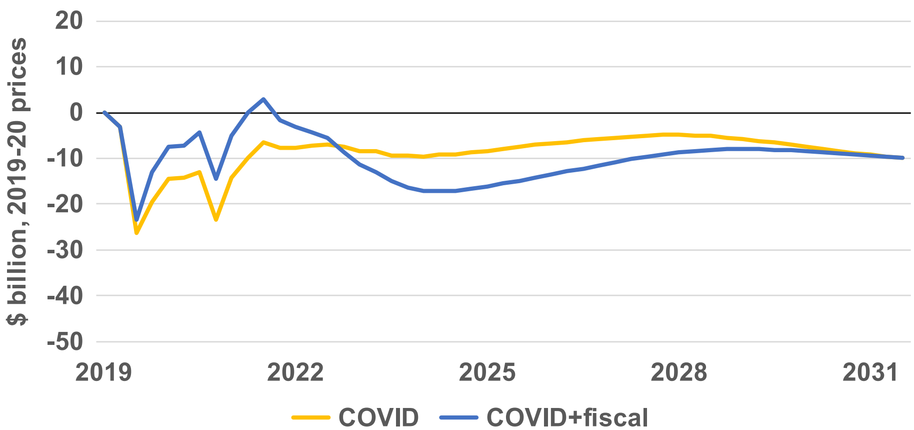

Figure 14. *Real Gross Value Added of Other Private Services Industry (Deviations from No COVID Scenario)*

The addition to real private income of $211 billion from the fiscal expansion reflects both its direct and indirect effects. The direct effects arise from the economic support payments shown in Table 6 and the bringing forward of the stage 2 personal income tax cuts, and account for the majority of the gain. The remainder of the real income gain is due to indirect effects on private incomes from the fiscal expansion via higher employment and profits in the *COVID plus fiscal* scenario compared to the *COVID* scenario.

The extent to which these developments in real private income affect real household consumption depends on how household consumption is modelled. In the model, household shareholders are assumed to 'pierce the corporate veil' (Poterba, 1987) so they take into account the benefit they receive in the form of higher share prices when profits are retained rather than distributed as dividends. This plays a role in the modelling to the extent that some of the transfer payments that businesses received from government under the fiscal expansion were retained. Except in the long run, the model does not assume Ricardian equivalence under which households also pierce the

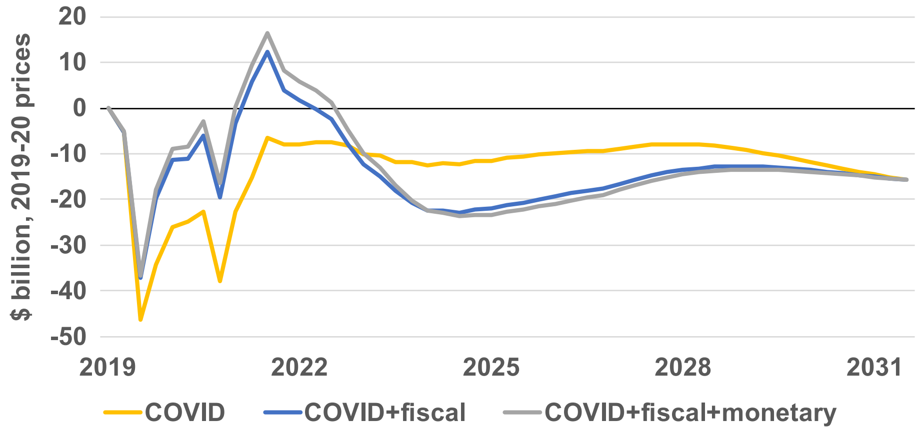

Figure 15. *Real GDP (Deviations from No COVID Scenario)*

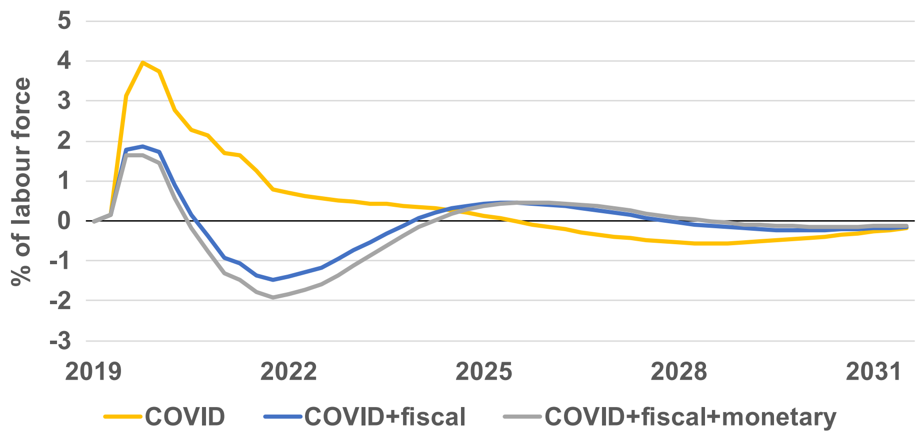

Figure 16. *Unemployment Rate (Deviations from No COVID Scenario)*

government veil to understand the government's intertemporal budget constraint. Consequently, in the model, consumers gradually spend the over-compensation they receive from government, rather than ignore it in the knowledge that they will have to pay later through higher taxes. See Murphy (2020, pp. 259–262) for further details on how consumption has been modelled.

As noted above, the over-compensation of the private sector means that real private incomes were $110 billion above normal levels during the COVID era, as measured by the deviation in income in the *COVID plus fiscal* scenario from *No COVID* scenario (Figure 11). Despite higher real incomes, real household consumption was $119 billion below normal levels in the same period (Figure 12). This unusual outcome reflects the forced private saving brought about by social distancing under COVID.

At the same time, the massive discretionary fiscal expansion was successful in reducing the weakness in household consumption caused by COVID social distancing. Real household consumption was only $119 billion below normal levels in the *COVID plus fiscal* scenario, whereas in the *COVID* scenario household consumption is $182 billion below normal levels in the same period (Figure 12).

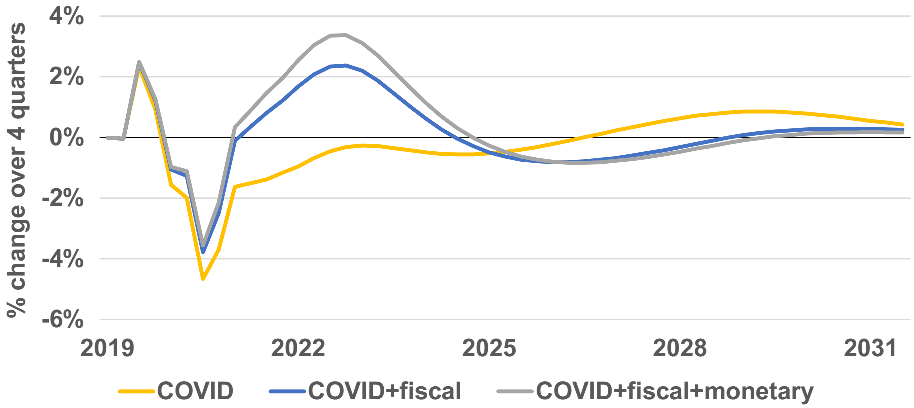

Figure 17. *Wages Inflation (National Accounts Basis) (Deviations from No COVID Scenario)*

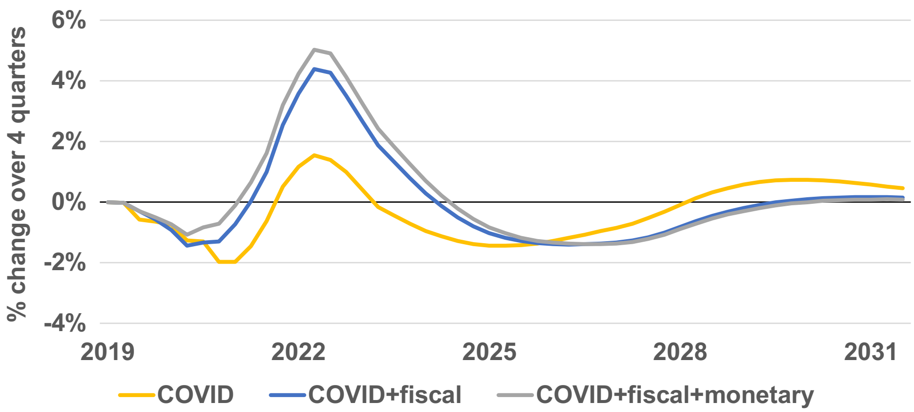

Figure 18. *Consumer Price Inflation (Deviations from No COVID Scenario)*

Moving on from the COVID era to the post-COVID era, the relaxation of COVID social distancing brings an end to forced household saving. This sees real household consumption recover. While consumption remains below the level in the *no COVID* scenario, this is only because the permanent population loss (Figure 8) from reduced migration during the COVID era results in the economy being smaller than under the *no COVID* scenario. When consumption is instead viewed in *per capita* terms, it is seen to fully recover in the *COVID* scenario to deviate very little from the path followed under the *no COVID* scenario (Figure 13).

In the *COVID plus fiscal* scenario, the massive discretionary fiscal stimulus causes the recovery in *per capita* consumption to overshoot the path followed in the *no COVID* scenario (Figure 13). When COVID social distancing eases, consumption can return to normal, but it booms, exceeding the level in the *no COVID* scenario for 2 years into the post-COVID era. This occurs mainly because it takes consumers time to spend the large COVID support payments that they received during the COVID era.

This sets a pattern for the *COVID plus fiscal* scenario in which the combination of the easing of social distancing and the aftereffects of the COVID support payments and other discretionary fiscal stimulus

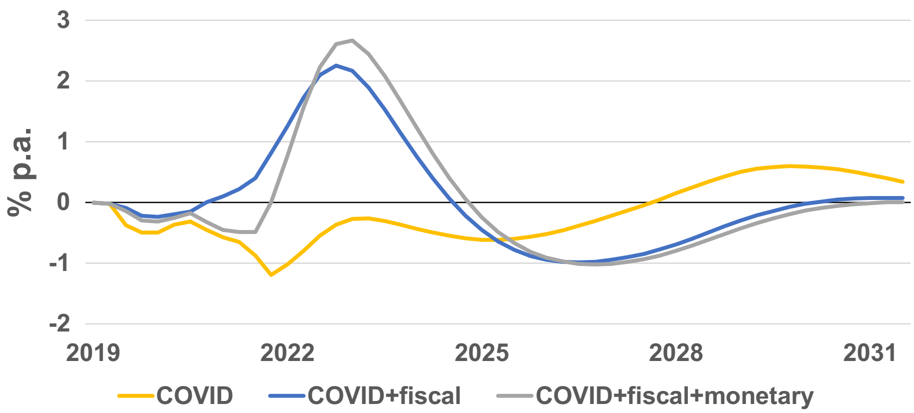

Figure 19. *90-Day Bill Interest Rate (Deviations from No COVID Scenario)*

eventually leads to unsustainably strong economic activity. This brings macroeconomic instability in the 3.5 years of the post-COVID era. This is finally followed by the resumption of macroeconomic stability in the normalcy era.

Economic Activity
Returning to the COVID-era, the COVID economic cycle was largely driven by the imposition and relaxation of social distancing with its effects on household consumption. Hence, in the *COVID plus fiscal* scenario, we see that the fluctuations in household consumption (Figure 12) relative to the *no COVID* scenario are associated with similar fluctuations in real GDP (Figure 15). The fluctuations in consumption and GDP shown in the two figures can be directly compared because they are expressed in real billions of dollars and both figures use the same scale.

These fluctuations are seen to be large when re-expressed as percentage changes over time, rather than as simple deviations from the *no COVID* scenario. On the entry to the economic downturn, in 2020q2, real household consumption fell by 13 per cent, while on the exit from the downturn, in the four quarters to the 2022q3, it rose by 12 per cent. This translates into qualitatively similar, but more muted, percentage changes in real GDP, broadly reflecting the share of GDP accounted for by household consumption. Real GDP fell by 7 per cent in 2020q2 and rose by 6 per cent in the four quarters to 2022q3.

At the industry level, a large part of the cycle in real GDP (Figure 15) was concentrated in the other private services (Figure 14), the industry most affected by social distancing under COVID. Cycles in the five other industries listed in Table 1 were more muted.

As noted above, in the post-COVID era, real GDP grew very strongly in the four quarters to 2022q3 in response to the end of social distancing and the aftereffects of the massive fiscal expansion. This results in a tight goods market.

Once the normalcy era is reached, real GDP is permanently lower in all three scenarios that include COVID than under the *no COVID* scenario. This can be seen in the negative deviations from the *no COVID* scenario shown in Figure 15. This is because in the COVID scenarios there is an ongoing population loss from NOM being very low during the COVID era (Figures 7 and 8), resulting in a smaller economy. In the long run (the year 2060), the population, employment, real GDP and total[8] real consumption are, respectively, 2.2, 2.3, 2.3 and 2.2 per cent lower in the *actual/forecast* scenario than in the *no COVID* scenario. This implies that, while the population loss leads to a loss in real GDP and real

[8]Total consumption includes household and government consumption.

consumption, these losses disappear when real GDP and consumption are re-calculated on a *per capita* basis, a better gauge of living standards.

In the *COVID* scenario, the large fall in GDP when COVID strikes (Figure 15) leads to a jump in unemployment (Figure 16). Early in the COVID era, 2020q3, unemployment is 4 percentage points higher in the *COVID* scenario than in the *no COVID* scenario (Figure 16). While this effect gradually fades, at the end of the COVID era in 2021q4 the unemployment rate is still almost 2 percentage points above its level in the *no COVID* scenario.

In the *COVID plus fiscal* scenario, the massive fiscal expansion means the elevation in unemployment is more moderate and short-lived than in the *COVID* scenario. The maximum addition to the unemployment rate is less than 2 percentage points instead of 4 percentage points. By the end of the COVID era, the unemployment rate is nearly 1 percentage point lower than its level in the *no COVID* scenario instead of nearly 2 percentage points above that *no COVID* level. Overall, the fiscal expansion meant that unemployment was around 2 percentage points lower for 3 years than otherwise would have been the case.

Similarly, over the same period, employment is simulated to be around 500,000 higher. This simulated estimate may seem low compared to the Bishop and Day (2020) estimate that JobKeeper alone added 700,000 to employment. However, as discussed in Section 2.2, Borland and Hunt (2023) point out that Bishop and Day (2020) count the large number of workers who were stood down and receiving JobKeeper as employed. In contrast, our estimate does not because the simulated employment effects depend on labour demand. Borland and Hunt (2023) also point out that the Bishop and Day (2020) estimate extrapolates percentage employment effects for casual workers to permanent workers whereas historically employment of permanent workers is less variable.[9] After taking into account these major influences on the Bishop and Day (2020) estimate, our results do not seem inconsistent with their study.

In any case, it is clear that the fiscal response to COVID, included in the *COVID plus fiscal* scenario, contributes to stability in unemployment during the COVID era, from 2020 to 2021, by reducing variability in unemployment compared to the *COVID* scenario. However, this situation reverses in the post-COVID era, 2022q1 to 2025q2.

In the post-COVID era, unemployment stabilises in the *COVID* scenario, gradually converging to its path under the *no COVID* scenario. However, in the *COVID plus fiscal* scenario, such is the strength of the fiscal expansion, that unemployment continues to fall to trough in 2022q3 at 1.5 percentage points below its level in the *no COVID* scenario. After also allowing for the monetary expansion in the *actual/forecast* scenario, this trough in unemployment is deeper at nearly 2 percentage points below the *no COVID* scenario. This tightness in the labour market corrects only gradually during the remainder of the post-COVID era.

In summary, while the fiscal expansion was initially successful in moderating variability in unemployment in the COVID-era, it was applied too strongly and for too long, leading to greater variability in unemployment in the post-COVID era.

By the time the normalcy era is reached, from 2025q3 onwards, the unemployment rate is close to converging to the estimated NAIRU of 4.2 per cent in all scenarios. Hence, from 2025q3 onwards, the unemployment rate differs little from its path under the *no COVID* scenario under all three scenarios represented in Figure 16.

Inflation

Similar to the discussion about the unemployment results, we consider the inflation results by sequentially moving through the three eras.

In the *COVID* scenario, the weakness in the economy from the COVID recession leads to generally lower wage and price inflation in the COVID era (Figures 17 and 18). For example, at the end of the

[9]The same is true if we compare variability in employment between part-time and full-time workers. In the period considered by Bishop and Day (2020), February 2020 to May 2020, part-time employment fell by 13 per cent while full-time employment fell by only 4 per cent.

COVID era in 2021q4, annual consumer price inflation is 2 percentage points below its level in the *no COVID* scenario. The simulation result that COVID reduced inflation suggests that social distancing reduced household consumption more by suppressing demand than by suppressing supply. These consumer demand and supply effects were discussed in Sections 2.1 and 3.3.

The exception to this pattern of lower price and wage inflation is an early, short-lived upward spike in measured wage inflation (Figure 17). However, as explained in Section 3.3, this spike was due to a compositional effect on the average wage from a disproportionate loss of low wage jobs rather than to a rise in wage rates per hour.

The fiscal and monetary expansions in response to the COVID recession help offset this negative impact on wage and price inflation from COVID. At the end of the COVID era in 2021q4, the outcomes for wage and price inflation in the *actual/forecast* scenario are little different from those under the *no COVID* scenario. On the one hand, COVID by itself reduces consumer inflation by 2 percentage points, as noted above. However, this is largely neutralised by inflation contributions of 1.2 percentage points from the fiscal expansion and 0.6 percentage points from monetary expansion.

Hence, the macroeconomic policy response to COVID, included in the *COVID plus fiscal plus monetary* scenario, contributes to stability in inflation during the COVID era, from 2020 to 2021, by reducing variability in inflation compared to the *COVID* scenario. However, this situation reverses in the post-COVID era, 2022q1 to 2025q2, just as it did for variability in unemployment.

In the post-COVID era, wage and price inflation initially rise in the *COVID* scenario, as the brake on consumer spending from social distancing is released. By 2022q4, annual consumer price inflation in the COVID scenario is 1.2 percentage points above the level in the *no COVID* scenario. However, this effect soon peaks and then disappears fairly quickly.

In the *COVID plus fiscal plus monetary* scenario, the consumption boom and tight labour market resulting from expansionary macro policy send inflation much higher in 2022. Such is the strength of the fiscal expansion, that it adds 2.4 percentage points to annual consumer price inflation by 2022q4, and the monetary expansion adds a further 0.6 percentage points, giving a total contribution from expansionary macro policy of 3 percentage points. Thus, by 2022q4, consumer price inflation in this scenario is 4.2 percentage points above its level in the *no COVID* scenario, made up of contributions of 1.2 per cent from the exit from COVID and 3.0 percentage points from expansionary macro policy. This large inflation shock does not completely dissipate until around the end of the post-COVID era in 2025q2.

This leads to a similar conclusion on macro policy and inflation to that drawn about macro policy and unemployment. While the fiscal and monetary expansions was initially successful in moderating variability in inflation in the COVID-era, they were applied too strongly and for too long, leading to greater variability in inflation in the post-COVID era.

Monetary Policy

In the *COVID* scenario, the higher unemployment and lower inflation resulting from the COVID recession lead to a lower short-term interest rate under the model's Taylor rule for monetary policy (Figure 19). Indeed, over the period from 2020q2 to 2022q2, the short-term interest rate is at the ZLB under the *COVID* scenario, and hence is constrained from going any lower. Thus, over this ZLB period, the fluctuations in the deviation of the short-term interest between its path in the *COVID* scenario and its path in the no *COVID* scenario that are shown in Figure 19 reflect fluctuations in the *no COVID* path, not in the *COVID* path.

In the *COVID plus fiscal* scenario, we have already seen that the fiscal response leads to tight labour and goods markets, which in turn lead to excessive wage and price inflation in the post-COVID era. In this environment, the model's Taylor rule would ordinarily predict that the short-term interest rate would begin rising above the ZLB from 2021q3. Thus, the *COVID plus fiscal* outcome for the short-term interest is significantly above the *COVID* outcome from 2021q3, and remains above until the end of the post-COVID era in 2025q2. This monetary policy response is needed to bring unemployment and inflation back to their target values.

The *COVID plus fiscal plus monetary* scenario takes into account that the Reserve Bank delayed increasing the short-term interest rate above the ZLB compared to the timing ordinarily predicted by the Taylor rule. Instead of beginning to raise rates in 2021q3, it began raising rates later, in 2022q2. As explained in Section 3.4, this delay is captured in the model's Taylor rule by including a dummy variable, *COVID_2122*, for this discretionary monetary expansion in the 2021–22 financial year. That dummy variable is switched on in this scenario.

Keeping the short-term interest at the ZLB for an additional three quarters means that, for those quarters, the short-term interest rate is similar to the *COVID* scenario, but below the *COVID plus fiscal* scenario (Figure 19). This easier monetary policy in 2021–22 in the *COVID plus fiscal plus monetary* scenario, compared to the *COVID plus fiscal* scenario, pushes unemployment even lower (Figure 16), and wage and price inflation higher (Figures 17 and 18). Ultimately, this means that the short-term interest rate has to be raised more in the post-COVID era to bring unemployment and inflation back to their target values (Figure 19).

The overall effects of these macro policy developments on interest rates can be illustrated using the peak effect predicted for 2023q3. In that quarter, *COVID* alone would have lowered the short-term interest rate by 0.4 percentage points compared to its level in the *no COVID* scenario (Figure 19). The *COVID* fiscal expansion meant that the short-term interest is instead 2.2 percentage points above the *no COVID* scenario level (Figure 19), or 2.6 percentage points above the *COVID* scenario level. The monetary expansion of 2021–22 adds a further 0.4 percentage points to the short-term interest rate in 2023q3 (Figure 19). Thus, the fiscal and monetary expansions taken together add 3.0 percentage points to the short-term interest rate needed in 2023q3 to bring unemployment and inflation back towards their target values.

Overall, the results show that there would have been greater macroeconomic stability if the Reserve Bank had followed a standard Taylor rule, and started increasing interest rates in 2021q3, as in the hypothetical *COVID plus fiscal* scenario. Instead, the Reserve Bank waited until 2022Q2, as in the *actual/forecast* scenario or *COVID plus fiscal plus monetary* scenario. These differences in macroeconomic stability between the two scenarios are evident in the results for unemployment (Figure 16), wage and price inflation (Figures 17 and 18) and the short-term interest rate (Figure 19). Why did the Reserve Bank Board wait so long to begin increasing interest rates? In November 2020, when the cash rate was set to 0.1% p.a., Lowe (2020, p.3) explained the approach being pursued by the Board as follows.

> The Board will not increase the cash rate until actual inflation is sustainably within the target range. It is not enough for inflation to be forecast to be in the target range. For inflation to be sustainably within the target range, wage growth will have to be materially higher than it is currently. This will require a lower rate of unemployment and a return to a tight labour market. On the current outlook, it will take some years to get there. Given this, the Board is not expecting to increase the cash rate for at least three years.

This suggests three factors that may have contributed to this unusual wait by the Board.

First, under the Taylor rule, the cash rate would be set to a neutral rate, currently around 3% p.a., when inflation and unemployment are at their targets. Yet Lowe (2020) seems to suggest that the Board had decided not to even begin increasing the cash rate from a highly stimulatory level of 0.1% p.a. until inflation and unemployment had reached their targets. Under this odd change to the Taylor rule by the Board, monetary policy is still stimulating the economy when its targets have been met, making it late in moving to a neutral stance.

Second, the Board had decided that it would use wages growth as an important signal about when to begin increasing interest rates. In practice, price inflation and unemployment, which feature in the Taylor rule, signalled a need for a higher cash rate before wages growth did.

Third, the Board signalled that it did not expect to begin increasing the cash rate until 2023Q4 at the earliest. Having signalled that expectation, it may have been reluctant to depart any further from it.

So, the Board would have done better in managing monetary policy in 2021–22 if it had followed the standard Taylor rule, as it mostly had in the past, except in the special circumstances of the Global Financial Crisis (GFC). Indeed, it would have been possible to outperform the Taylor rule if the Board had been successful in forecasting the outbreak of inflation, ahead of it occurring, which it did not, as documented in the introduction.

This paper demonstrates that the inflation outbreak could have been foreseen to a substantial extent using detailed modelling of the inflationary consequences of both the massive fiscal expansion in response to COVID and the exit from social distancing. This would have enabled monetary policy to act pre-emptively to lessen the inflation outbreak.

7. Conclusion

The COVID recession in 2020 and 2021 was mainly generated by lower household consumption of certain services under COVID social distancing. This lead to lower activity in those industries and forced household saving. (Unlike in previous recessions, investment did not play a major role.) The loss of employment and profits in the directly affected industries had the potential to reduce incomes in those industries, leading to lower consumer spending that would have spread the economic weakness to other industries.

Those potential effects on those other industries were averted by a massive discretionary fiscal expansion. This fiscal expansion was successful in reducing the depth and length of the COVID recession. Unemployment was temporarily around 2 percentage points lower for 3 years than otherwise would have been the case.

At the same time, this fiscal expansion was so large that it over-compensated for the potential income losses due to COVID. In aggregate, there was $2 of compensation for each $1 of private income loss due to COVID. The combination of the end of social distancing and the aftereffects of the over-compensation in fiscal policy led to unsustainably strong economic activity in 2022.

By 2022q4, consumer price inflation is 4.2 percentage points above its level in a hypothetical *no COVID* scenario. This is made up of contributions of 1.2 per cent from the release of a brake on consumer spending with the end of social distancing under COVID and 3.0 percentage points from expansionary macro policy.

Overall, while the macroeconomic policy response made unemployment and inflation less variable during the COVID era of 2020 and 2021, the excessive nature of that response makes unemployment and inflation considerably more variable during the post-COVID era from 2022 to mid-2025.

The JobKeeper program, in its original form, included three different forms of over-compensation for COVID income losses. This led to disincentive effects, windfall gains and contributed to the excessive fiscal expansion. Hence, if there is a JobKeeper program in a future pandemic, its design should be changed. It should only be available to businesses that are not able to operate normally because of social distancing. Payments should not extend beyond the duration of social distancing. The payments should be redesigned to reduce the great unevenness in compensation for lost profits.

To capture the COVID recession, macro models can be adjusted to model the effects of (mandatory and voluntary) social distancing on economic activities. This paper demonstrates that approach using geographic mobility measures based on domestic and international passenger movements at airports. The most important effect of low geographical mobility under COVID was suppressed demand and supply of certain consumer services. Other highly significant effects include lower labour force participation and much lower international trade in services. NOM was also suppressed.

The main policy lesson for a future pandemic is that fiscal policy should compensate, but not overcompensate, for income losses from social distancing. Compensation helps to limit the weakness in economic activity and employment and to avoid inequities. However, overcompensation at the macro level leads to an outbreak of inflation once social distancing ends. Overcompensation at the program level can have harmful disincentive effects and create inequities. Finally, monetary policy should take more account of the stimulus already provided by fiscal policy, so that monetary policy does not remain very loose for too long, as was the case.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix I

Table A1. *Fiscal Levers in the Macro Model*

Fiscal area	Fiscal detail/base
General government final demand	Consumption, investment
General government transfers	Age-related, child-related, disability-related, unemployment-related, other transfers to households, transfers to business, transfers to overseas
Company income tax	Tax rate, rate of immediate expensing for investment in (a) machinery and equipment and (b) structures
Goods and services tax	Tax rate, coverage rate by industry
Stamp duty on conveyances	On ownership transfer costs
Other product taxes	On final demand, on intermediate inputs (allows for differences in effective tax rates between components)
Payroll tax	Tax rate (allows for differences in effective tax rates at the industry level)
Land-related taxes (municipal rates, state land tax)	On land rents (allows for differences in effective tax rates at the industry level)
Other production taxes net of subsidies	On gross value added by industry
Mining royalties	On mining industry gross value added

Note: Tax and transfer rates are generally effective rates rather than statutory rates.

Table A2. *Modelling COVID: T-Statistics for Immobility Effects*

	COVID variable Code	Domestic immobility 1-COVID_DOM	National lockdown COVID_202	Consumption immobility effect CCOVID	International immobility 1-COVID_INT	Int. students immobility 1-COVID_EDU
Model equation(s)						
Households						
Household consumption	HCONZ	−11.64	−6.30			
Household demand (non-housing)	HCONZi (i = A,B,C,G)			−13.85, −5.74, −12.85, −6.01		
Household demand (housing services)	PHCONT			−3.89		
Labour force participation	lNSU	−3.24	−6.89			
Average wage (compositional effect)	W		4.31, 3.02 (−1)			
Investment in ownership transfer costs	CFOTC	−3.43				
Producers						
Employment in services (adjustment speed)	Ni (i = G,S)	4.36, 5.79				
Prices for domestic sales of services	PDOM (i = G,SM,SN)	2.87, 2.20, 1.57				
Travel-related International Trade						
Exports of services	BEXi (i = G,SN)				−3.02, −13.98	−7.53, −5.25
Imports of services	IMi (i = G,SN)				−13.00, −21.08	

Table A3. *Model Inputs in COVID and No COVID Settings*

Variables		Time period of COVID effect	Settings for time period of COVID effect	
Description	Code		Without COVID	With COVID
Geographic mobility				
Domestic mobility	*COVID_DOM*	2020q1–2023q1	Normal (1.00)	Actual and projected (see Figure 5)
International mobility	*COVID_INT*	2020q1–2024q2	Normal (1.00)	Actual and projected (see Figure 5)
International students	*COVID_EDU*	2020q1–2027q2	Normal (1.00)	Actual and projected (see Figure 5)
National lockdown	*COVID_202*	2020q2–2020q2	Normal (0)	1
Net overseas migration (via demographic model)	*NOM*	2020/21–2023/24	Normal (218k per year)	Actual and projected (see Figure 7)
International economy				
World prices for manufactured imports	*PIMFC*	2020q2–2022q2	Normal (annual world inflation rate of 2.5%)	Actual and projected (price lower to 2021q2, higher to 2022q2, then convergence to normal)
World prices for other service imports	*PIMFSN*	2020q2–2022q3	Normal (annual world inflation rate of 2.5%)	Actual and projected (price lower in 2020q2, higher to 2022q3, then normal)
Foreign short-term interest rate	*RSF*	2020q2–2022q4	Normal (adjusts to equilibrium rate of 3.5% p.a. by 8% per quarter)	Actual and projected (interest rate lower to 2022q3, then similar to normal path)
Other domestic				
Consumption residual	*HCONZ_A*	2020q1–2022q2	Normal (projected with AR(1))	Actual and projected (similar to normal path from 2022q3)
Labour supply residual	*lNSU_A*	2020q1–2022q3	Normal (projected with AR(1))	Actual and projected (similar to normal path from 2022q4)

Table A4. *Model Inputs without and with Macro Policy Expansion*

Variables		Time period of policy expansion	Settings for time period	
Description	Code		Without policy expansion	With policy expansion
Spending				
Business subsidies (i = A, B,C,G,SN)†	*RTPNOi*	2020q2–2021q4	2019 effective rates	Includes 20% of JobKeeper
Business transfers†	*POLBUS*	2020q2–2021q1	Zero	80% of JobKeeper & boosting cash flow
General government consumption	*GCON*	2020q2 onwards	Projected from 2019 base	Actual, then elevating by 5% in 22–23, 3.5% in 23–24 and 2.5% from 24–25 onwards
General government gross fixed capital formation	*CFGG*	2021q2 onwards	Projected from 2019 base	Actual, then elevating by 5% in 22–23, 3.5% in 23–24 and 2.5% from 24–25 onwards
Gap between benefit and survey unemployment	*RLMR*	2020q2 onwards	Normal (0.5% of labour force)	Declining from actual of 5.1% in 2020q3 to 2.3% in 2022q3 and 0.5% in long run
Unemployment benefit rate (relative to wage)	*POLUNEMP*	2020q1 onwards	2018/19 effective rates	Doubling of rates in 2020q2-2020q3 then declining to 10% above from 2021q2
Other household transfer rates (relative to wage)	*POL(CHILD, AGED, DISAB, OTHER)*	2020q2, 2020q3	2021/22 effective rates	Boosted by 10% in 2020q2 and 8% in 2020q3 by $750 COVID payments to households
Taxes				
Effective average personal income tax rate	*POLLAB*	2020q3–2022q2	Policy announced pre-COVID	Lowered by 0.014 due to bring forward of stage 2 personal income tax cuts
Immediate expensing of machinery and equipment	*POLIO*	2020q2–2023q2	Zero immediate expensing	Immediate expensing of up to 2/3 of investment in plant and equipment under accelerated depreciation
Average payroll tax rate	*POLPAY*	2020q2–2021q4	2019 effective rates	Actual COVID payroll tax concessions
Monetary policy				
Taylor rule dummy for loose money in 2021–22	*COVID_2122*	2021q3–2022q2	Dummy set to zero	Dummy set to one

†Which refers to the RTPNOi and POLBUS rows. See Table 6.