AUS-M Model Update:
The Price Puzzle, Fiscal Policy and the Zero Bound

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AUS-M Model Update – The Price Puzzle, Fiscal Policy and the Zero Bound

As the second decade of the 21st century draws towards a close, Australia finds itself close to the zero bound on interest rates, a situation which has arisen largely due to global circumstances, but perhaps augmented by recognition lags and policy inertia and miscalculations. (Always easy to spot with the benefit of 20 20 hindsight – modelling hopefully helps to reduce them – the stakes at the moment seem more than usually high.)

Challenges abound:

- The national accounts reveal that labour productivity fell in absolute terms in 2018-19, after several years of slow growth, and that multi-factor productivity is lower than it was in 2003-04.[1]
- Fiscal policy faces the twin problems of rising demand for services and expenditure with a rising old age dependency rate, and slowing growth in working age population and in the economy. It does so with a revenue base dependant on stamp duties at the State level and skewed towards taxes on labour and corporate income at the Federal. At the same time increasing congestion has revealed a stress inducing and productivity sapping deficit in infrastructure investment and planning in Australia's major cities.
- Global politics seems to be increasingly moving towards action on climate change. Meanwhile, Australia has one of the highest rates of greenhouse gas emissions in the OECD at around 22 tonnes of CO2 equivalent per capita per annum (compared to below 10 tonnes per capita in Europe, and 7 in the UK). The mitigation challenge is consequently larger.[2] Moreover, courtesy of the mining boom, Australia has allocated a significant proportion of its capital stock to the production of fossil fuels, which now account for almost half of mining exports and around 6 per cent of GDP (all of which will face increasing regulatory and price headwinds in overseas markets, and on the most recent proposals will probably need to fall to close to zero over the next thirty years.)

Electoral politics seems increasingly fractured in facing these challenges. Politicians chose to spend most of the recent election campaign arguing about poorly thought through proposals on interest deductions and franking credits. Meanwhile, teenage and young adult unemployment and underemployment, a key concern of many families in outer suburban electorates, was on the rise, with attendant rising youth poverty rates and homelessness. It went almost completely unmentioned. The rise in relative youth unemployment rates helps to explain persistent high rates of structural unemployment, contributing to a situation where only 92 per cent of the available labour supply is currently

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1 For the market sector, adjusted for labour and capital quality – ABS ANA 2018-19.

2 The adaptation challenge is also one of the largest amongst OECD countries given Australia's already hot and dry climate, with large areas of marginal agriculture exposed to changing rainfall patterns and river flows.

utilised.[3] The persistent amount of slack in the labour market has meant low wage growth and inflation, moving Australia closer to the aforementioned zero bound. The proximity to the zero bound increases Australia's vulnerability to economic shocks, and is also a game changer when it comes to macroeconomic policy.

How will our hero respond? Will productivity growth bounce back? To what extent does the zero bound increase Australia's vulnerability to external shocks? What are the implications for fiscal policy? Will interest rates and inflation ever return to normal? Are there direct feedbacks between low interest rates and low inflation, or low interest rates and higher hurdle rates that tend to lock economies into a low interest rate / low inflation world?

The following both updates an expanded model baseline (now extending to 2060 and including state detail) and provides some thoughts on these issues. The section below provides a brief overview of the medium-term projections (which in turn form the basis for policy and scenario analysis). That is followed by a section overviewing the main changes in the short-run projections since earlier in the year, focussing first on international developments in respect to international, trade, interest rates and inflation, then drawing out some of the implications for Australia. That is followed by a section comparing the model to the official forecasts, focussing on productivity, wages and the NAWRU. That leads into a discussion of the main factors shaping the current short-term projections and tests for the possibility that the model is missing a direct link between low interest rates and low inflation (and discusses briefly the price puzzle from VAR models). Finally, in the model simulations section, the chosen topic for this update is the impact of a global shock on the Australian economy at the zero bound. A variety of simulations are run highlighting and explaining the differences in transmission mechanisms compared to shocks that have occurred over the last quarter century and drawing out some implications for fiscal policy Appendix A provides a little more analysis/explanation around the price puzzle, while Appendix B updates some previous thoughts and evidence on youth unemployment and its contribution to structural unemployment.

Medium-Term Projections

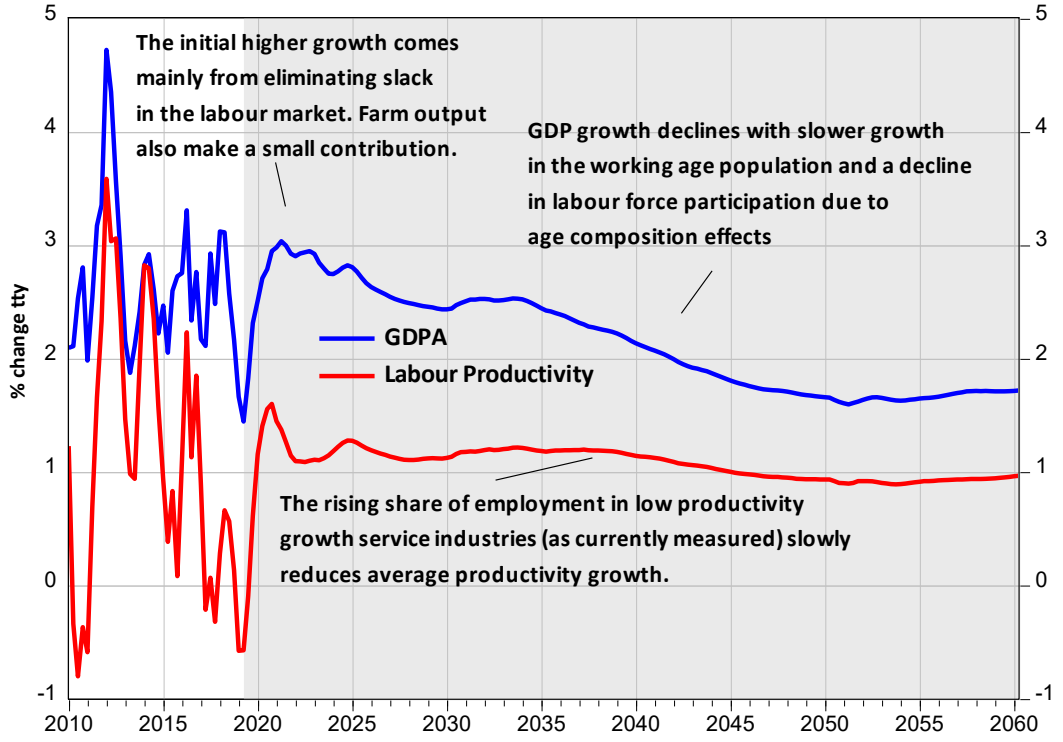
Slower population and GDP growth in the decades ahead, but initially slightly higher than the 2010s

The new projections out to 2060, are based on the ABS medium population projections with adjustments to net overseas migration following from the

[3] As a percentage of the hours currently on offer by households. The utilisation rate could be improved by both reducing structural unemployment and reducing the amount of slack in the labour market. (Young people would be major beneficiaries.) The additional employment and output generated from reducing the gap, if structural unemployment was lowered, would raises the revenue base, allowing fiscal expansion without threatening the underlying fiscal position. The additional requirement for business fixed capital and hence demand for funds would possibly be sufficient to lift the Australian economy out of the zero bound zone, (see Appendix B). As Chris Higgins used to say "Good microeconomic policy creates the room for good macroeconomic policy and vice versa".

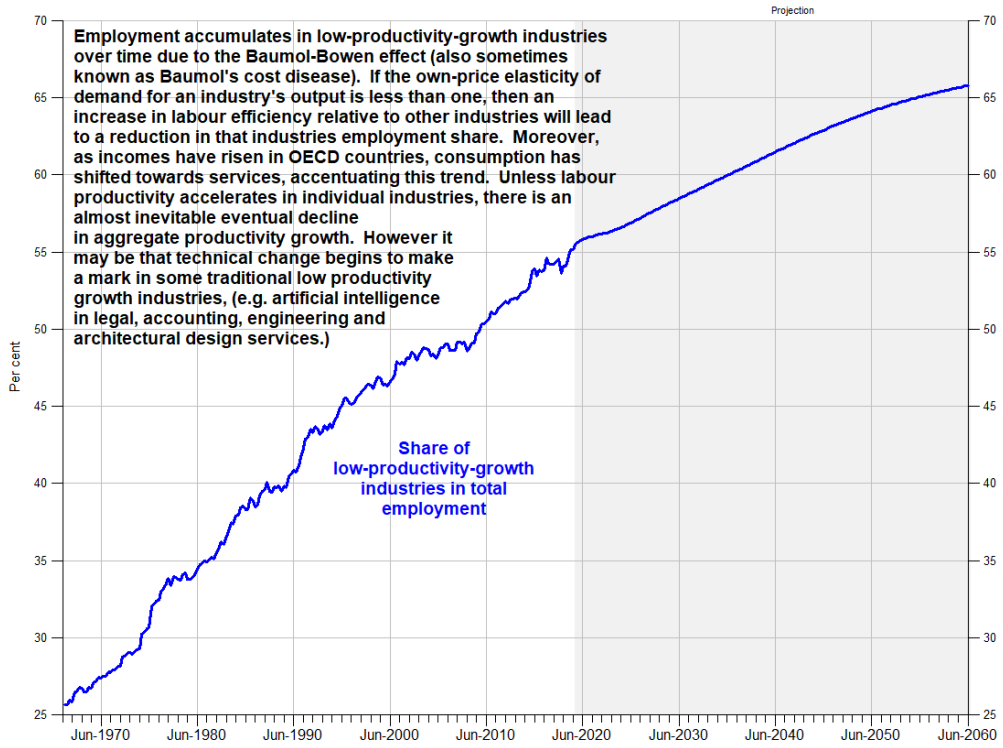
reduction in the official programme, and the likelihood that the pace of increase in overseas student enrolments (and education service exports) will slow. That is assumed to drop the net overseas migration to around 195,000 over the next few years, (from current levels of around 260,000) before returning to the ABS benchmark of 215,000. Trends in labour force participation and average hours worked are largely offsetting, so total hours supplied grows roughly at the same pace as the working age (15-74) population. The unemployment rate drops to around 4 per cent with the duration cohort model projecting a gradual reduction in long term unemployment lowering the model's NAWRU measure, and lower interest rates eventually translating into lower rental price inflation from the mid-20s creating a mildly deflationary force (see below). Labour and capital efficiency are projected forward at hopefully reasonable rates using historical trends as a guide. Surprisingly this led to relatively constant rates of measured productivity growth of around 1 per cent.

Chart 1: Medium-term Projections for GDP and Productivity Growth



Notes: Labour productivity is measured as GDP per total hours worked.
Data source: AUS-M Model Database and Simulation, Outlook Economics.

Chart 2: Share of Employment in Low Productivity Growth Industries



Notes: Employment in consumer services, property and business services, health and community services, education services and public administration as a percentage of total.
Data source: AUS-M Model Database and Simulation, Outlook Economics.

Aggregate labour productivity growth falls to a little below 1 per cent by the mid 2040s (Chart 1), but it's a little surprising that the further compositional shift in employment toward service sectors where measured labour productivity and labour productivity growth is low (e.g. accommodation cafes and restaurants, and health and community services – Chart 2) doesn't lead to larger reductions. Very high rates of labour efficiency growth in finance and insurance and communications are projected to eventually decline, but this has little impact on the aggregate measure of labour productivity, because of their low share of total employment (currently 5 per cent) which falls even further over the next decade (an example of the Baumol-Bowen effect at work). Meanwhile, offsetting that, growth in labour efficiency is projected to increase in property and business services (which includes professional services) on the assumption that it is a sector which will be more than proportionally impacted by AI.

Bringing this all together, per capita GDP is projected to increase at around 1.34 per cent per annum in the 2020s, up from 1.08 per cent in the 2010s, with contributions from the reduction in the unemployment rate, and capital deepening due to current low interest rates. It then falls back to 1 per cent in the 2030s and 2040s and a little below that in the 2050s.

All of which is highly contingent and even speculative. (Who knows what the future holds: Quantum computing? Fusion power? Rising populism? Thucydides trap?) The detailed projections aren't meant to be precise predictions but rather a

reasonable baseline to form the basis for sensitivity and scenario analysis, and to explore the implications of prospective developments. Even the process of compiling them throws up a series of issues.

- On the fiscal side there is the challenge of an aging population with increasing dependency ratios leading to a rise in government consumption expenditure relative to the tax base. In the baseline average tax rates on labour income need to rise by a further 4 percentage points by 2050 to keep the budget broadly in balance, and that is with relatively conservative assumptions about the growth in government consumption, continued taxes on capital income of around current levels, and roughly a ½ a percentage point reduction in general government investment as a percentage of GDP (bringing the growth in the government capital stock back in line with GDP). (The fiscal results are also quite sensitive to the modelling of the deflators for government expenditure, with for example declines in the relative price of government consumption making a significant contribution to fiscal consolidation in recent years.)
- On the climate change side, the projections assume, perhaps fancifully, that a carbon tax or equivalent is introduced from the mid-2020s, with rising carbon prices (i.e. the cost of emission permits / clean energy certificates) showing up as a rising tax on production in the electricity sector, (see RTGEGW)[4]. Moreover, as mentioned fossil fuel exports in the form of LNG, coal and oil now represent around 6 per cent of GDP and almost half of the value of mining exports. Consequently, an increasing shift towards global action is assumed to have a dampening impact on mining investment and output. On the other hand, work by the CSIRO[5] and Ross Garnaut point to the possibility that advances in renewable technology, along with a global carbon price will lead to a comparative advantage in energy intensive mineral processing, which combined with the electrification of transport would require a massive expansion in electricity output. The baseline doesn't incorporate anything along these lines, but nor does it include the prospective closure of parts of the current metals and processing industries due to higher gas and electricity prices. These would be obvious things to explore in more detail in future iterations.

Perhaps more importantly from a macro point of view, the model points to an extended period of low interest rates (in part based on expectations for global interest rates in current bond markets). As mentioned this is a good thing in that it reduces the interest servicing cost on Australia's foreign debt, leads to capital deepening and helps to maintain productivity and income growth for the next decade (which would otherwise be even lower). However, the relatively benign outlook in the baseline is contingent on an assumption of no major external shocks and a steady decline in the unemployment rate. The downside of low

4 The ABS treats receipts from the sale of emission permits as tax revenue.

5 CSIRO Annual National Outlook 2019 https://publications.csiro.au/publications/#publication/PIcsiro:EP183813

interest rates both here and overseas is that they make the economy more vulnerable to international shocks (discussed in more detail below). That is the baseline projections assume a continuation of the record period of 28 years of relatively uninterrupted growth. With interest rates near the zero bound that seems an increasingly contentious assumption. If there were a shock the constrained nature of the financial market response would mean that there would be no rapid adjustment and recovery as there has been in the past.

Comparison with Previous Projections – How the Forecasts are Changing

International Developments

The most significant developments relative to previous baselines have been on the external side with a larger slowing in global growth and industrial production than was previously factored in, and a concomitant and surprising further fall in global bond yields (driven by a reversal in direction by the Fed). There is a similar picture to earlier IMF and OECD global growth downgrades, with the main downward revisions being for countries remote from Australia, with the largest contribution this time around coming from Latin America (with Venezuela and Argentina in crisis and a number of others experiencing political turmoil). Meanwhile Asia and Australia's main trading partners are holding up fairly well, with the stimulus measures in China, and continuing supply problems in Brazil helping to maintain high iron ore and steel related commodity prices.

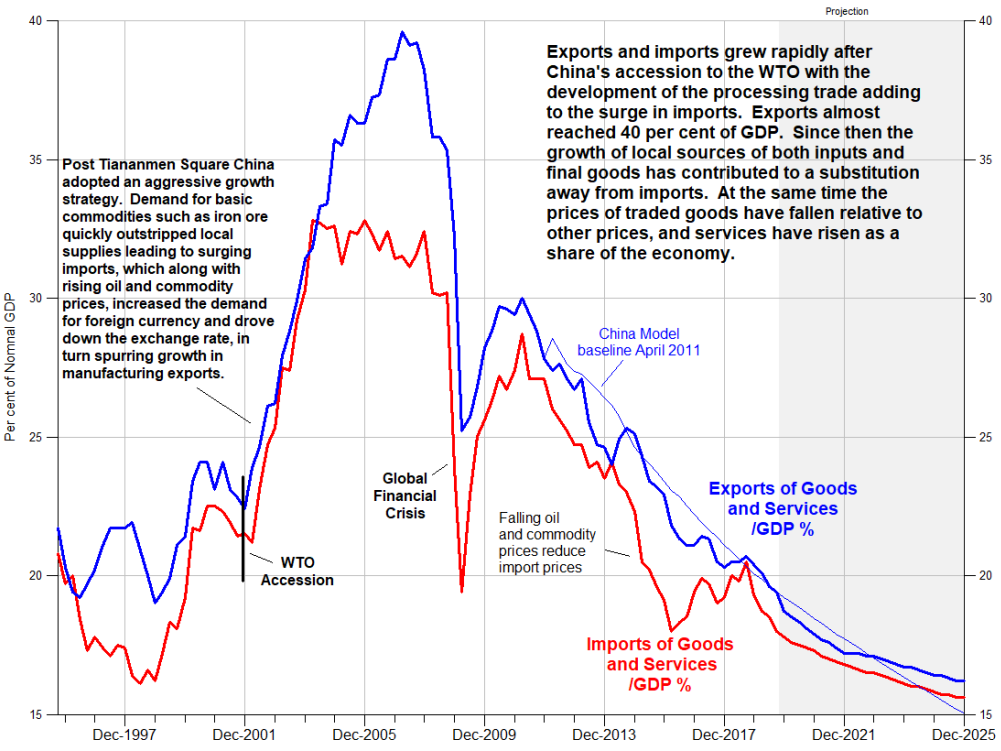
There is a large media focus on the trade dispute between the US and China, but so far the impacts seem reasonably small. On evidence for this, see Amiti et al https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.33.4.187 particularly on the lack of discounting from Chinese exporters into the US market. The lack of a price or terms of trade effect is suggestive of high elasticities of supply, i.e. ready substitution towards other markets, perhaps due to (a) the commodification of manufacturing products, and (b) the diversification of global trade, leading to more markets to divert into.[6] That in turn would seem consistent with the results from the China model, which indicates Chinese export volumes holding up in aggregate despite the decline in trade with the US. That argues for the larger effects of the trade dispute to be on risk perceptions and project specific investment uncertainty than on aggregate trade. There did appear to be significant impacts on confidence in China in 2018 lowering investment and domestic demand. But that led to the stimulus package which in turn helped to boost the demand for steel, a good thing for Australia.

Arguably much more important for World trade has been the natural slowing in growth in the cyclical components of demand as the advanced economies slow,

6 The greater the dispersion of trade and the higher the elasticities of supply, the greater the proportion of the costs of the distorting effects of trade barriers that are incurred by the country that imposes them. For a small open economy and commodity producer like Australia the vast bulk of the benefits from signing a free (read preferential) trade agreement comes from the action we takes ourselves.

and a kick down in the inventory cycle in the euro area and the US in the June quarter. (Alan Blinder once said for the US that "the inventory cycle is the business cycle", based on historical contributions to growth – these days the contributions are smaller and a lot spills over into imports.) Trade has also been effected by structural change in the trade intensive motor vehicle industry, including new emission and efficiency standards in Europe, limits on car registrations in Chinas major cities to control both congestion and pollution, and increasing domestic production in China along with increased internal sourcing displacing German exports. (As China's economy grows internal sourcing will naturally increase, and the trade share decline to be more like those of the United States and Europe with their massive internal markets. Chinas export share of GDP has halved since 2006 and the projections from the China model indicate shares will fall to around 16 per cent by the mid-2020s – Chart 3) In summary the slow-down in trade and industrial production seems explicable given other developments, doesn't seem to have a lot to do with the trade dispute, and following the same logic neither will any recovery if that occurs.

Chart 3: Chinese Imports and Exports as a % of GDP

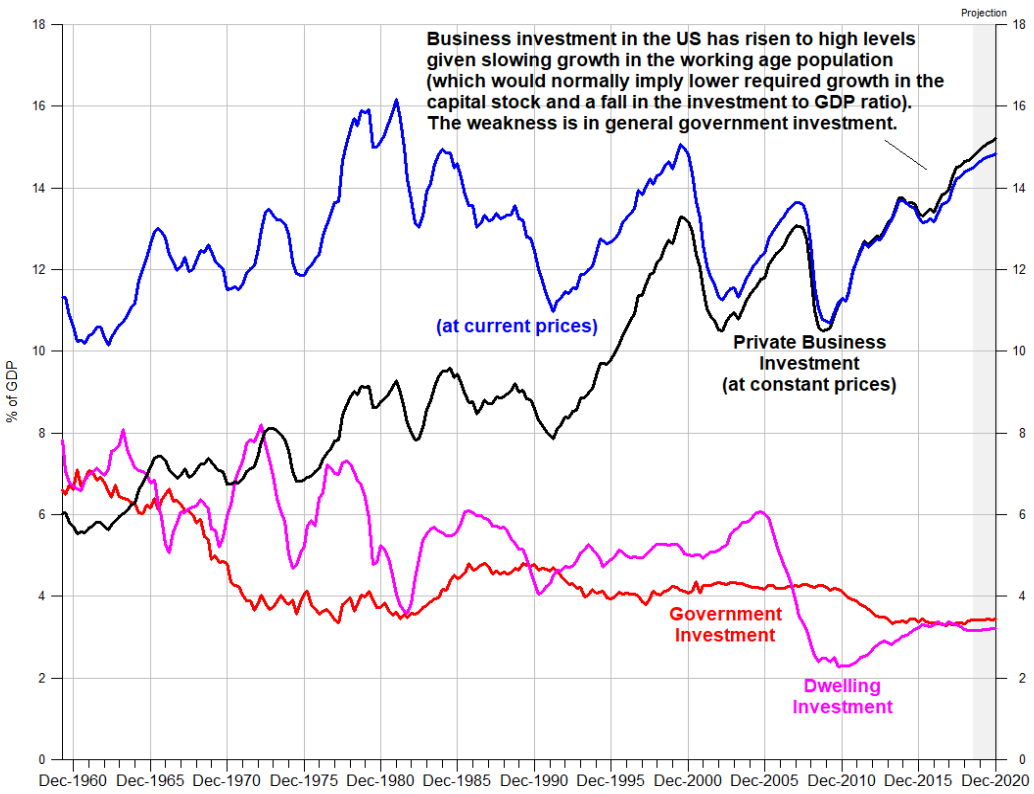


Notes: Exports and imports on a balance of payments basis as a percentage of nominal GDP. Note that part of the fall in the recent period may be due to over-estimation of nominal GDP growth as a result of reduced discounting by the NBS of local area data.
Data source: China Model Database and Simulation, Outlook Economics.

As discussed previously the advanced countries were inevitably going to slow as unemployment rates reached their limits, and in many ways the transition to lower growth rates is going remarkably well. Inflation has again ticked down in a number of countries, but in part the low inflation outcomes reflect positive supply side developments (which absent the zero bound are a good thing).

These include: increased labour force participation by older workers in most advanced countries, lower equilibrium unemployment rates with structural changes in labour and product markets, surging production of oil in the US (up 4 million barrels since 2017) and a surprisingly strong pick-up in productivity growth in the US, (see Chart 11 below), which along with a high exchange rate and lower oil prices seems to be responsible for the recent lower headline CPI outcomes. Business investment has picked up in the US (Chart 4) no doubt in part due to the corporate tax changes, leading to capital deepening and supporting the pick-up in productivity. Similarly business investment has picked up in a number of other OECD countries, a pattern which seems to be consistent with positive supply side shocks (e.g. the fall in equilibrium unemployment rates) interacting with the zero bound on interest rates (extending the adjustment process). A positive supply shock leads to lower inflation and lower interest rates in the short term and a positive adjustment to the capital stock requiring a temporary increase in business investment. The lift in business investment seems to belie much of the discussion of secular stagnation which tends to have an emphasis on things like reduced competition across markets, or falling investment prices (although relative plant and equipment prices stopped falling around 2011) or new forms of Knightian uncertainty (due to elevated levels of disruption or potential disruption across markets, but then again indicators of structural change across industries are not at particularly high levels).

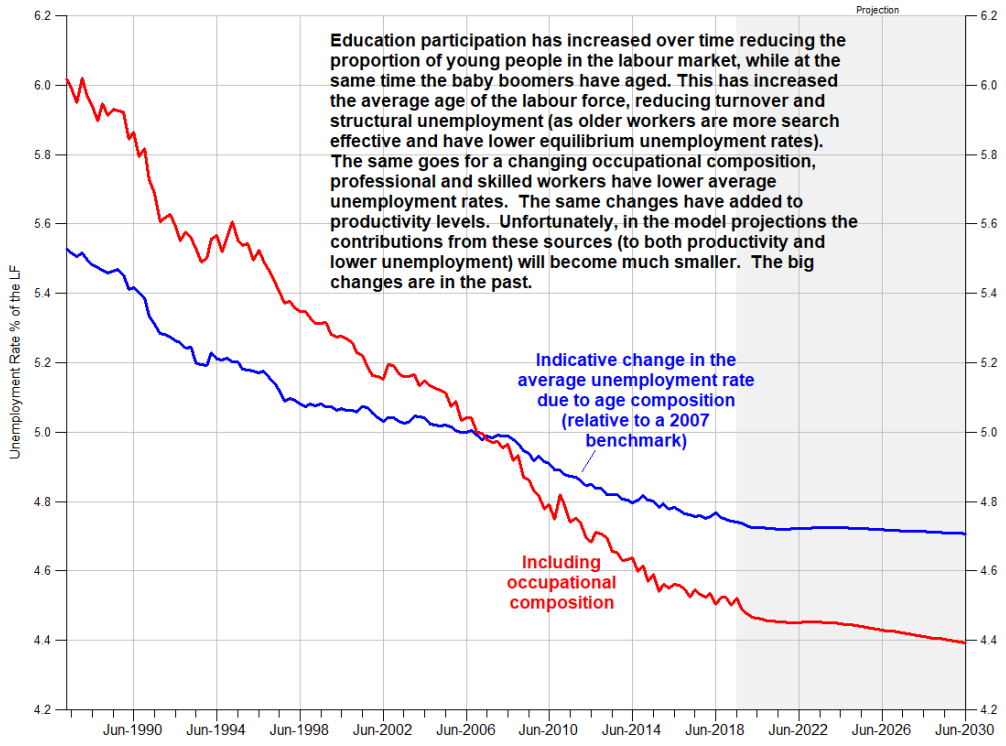
Chart 4: US Investment Components as a % of GDP



Notes: Quarterly data seasonally adjusted
Data source: OECD Economic Outlook Database, Outlook Economics.

There are many possible reasons for the apparent downshift in structural unemployment across OECD countries, including the changing composition of the workforce with increasing shares of both professional workers and an aging of the workforce, with both groups having lower turnover rates and lower equilibrium unemployment rates (as Steve Kennedy pointed out in a speech some years ago). If we do some simple calculations using the Australian data (Chart 5) the compositional changes in demand (for skills) and supply (by age group) could rationalise up to a 1 ½ percentage point reduction in the equilibrium unemployment rate since the early 1990s. [But without a detailed model endogenizing the turnover behaviour of the different groups, (e.g. Pissarides-Mortensen) it's hard to draw any firm conclusions about the implications for aggregate wage behaviour (or to reconcile it with the lack of an inward shift in the Beveridge curve). That is while the downshift in Chart 5 is suggestive, there is not necessarily a direct translation into lower structural unemployment.]

Chart 5: Indicative Impact of Compositional Shifts on Unemployment



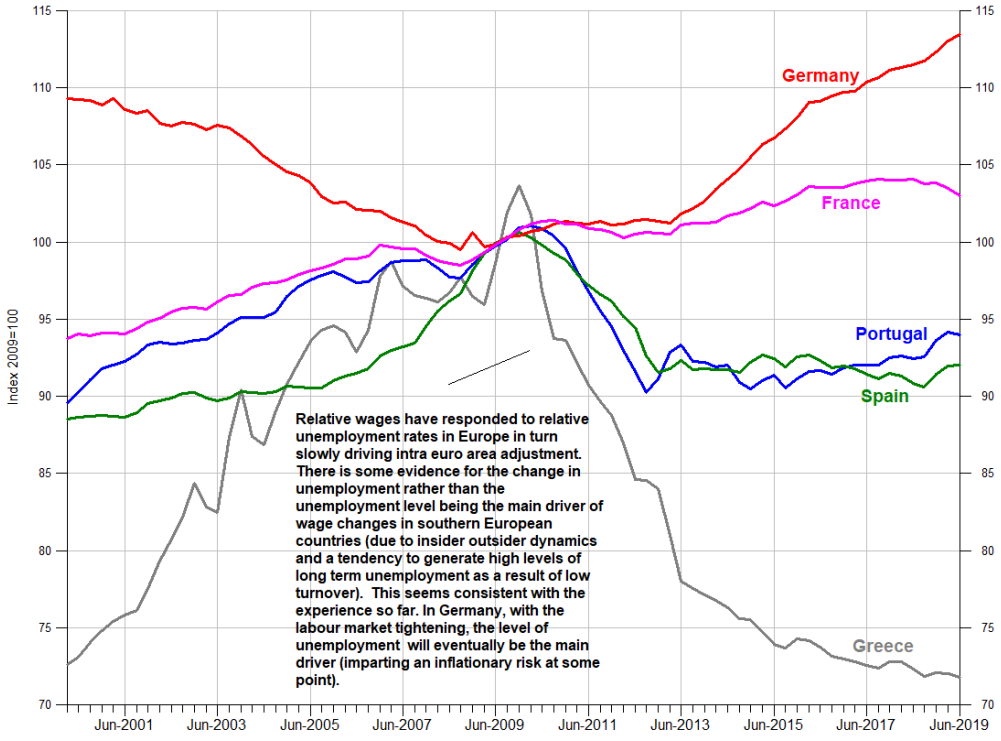
Notes: Series on age and occupational composition imputed by taking relative unemployment rates of the age groups and occupation groups in 2007 and applying the shifting shares of the groups in total employment over time.
Data source: AUS-M Modell Database and Simulation, Outlook Economics.

Another likely contributor, along with declining union density and changing labour and product markets, is the uncounted benefits of IT developments adding to consumer surplus / welfare but not counted as part of GDP. Recent estimates by the Federal Reserves David Byrnes and Carol Corrado https://www.federalreserve.gov/econres/feds/files/2019049pap.pdf, indicate that if counted they would increase GDP growth by around ½ a per cent a year, or put another way they imply that consumer price inflation over the last decade

has been overstated by around ½ a percentage point a year relative to changes in consumer welfare. Similarly uncounted impacts on consumer surplus from advances in medical technology have been estimated to be worth up to 1 per cent per annum, again implying an understatement of productivity growth and an overstatement of inflation. That in turn would help to explain both the fall in the equilibrium unemployment rate measured from wage equations, and, along with increased anchoring, the apparent flattening of the Phillip's curve (with respect to the response to inflation).

But while the Phillip's curve might be muted, it hasn't disappeared. (The laws of supply and demand haven't been repealed.) Relative wage levels across Europe for example seem to be responding in a normal way to relative unemployment rates, (Chart 6) as have wages across States in Australia. (As an aside, the slowly changing relative positions shown in Chart 6 help to explain the pattern of recent developments within Europe, e.g. the slow fall in the German current account surplus (from extraordinarily high levels of around 8-9 per cent), the slowing of German industrial production and the relative rise of business investment in France. It has been an unnecessarily protracted process but adjustment within the euro area is occurring.)

Chart 6: Relative Wages Across the Euro Area



Notes: Compensation per employee divided by the euro area core HCPI. Note that this understates the dispersion in hourly wages as average hours have fallen by 4 per cent in Germany since 2008 but have been largely unchanged in France, Portugal and Spain
Data source: OECD MEI Database, Outlook Economics.

In summary, if we combine the fall in the equilibrium unemployment rates and the advances in IT services and medical technology, higher participation rates,

the surge in US oil supply and other developments, it's possible to argue that the OECD economies are responding to what are large positive supply side shocks, the short term impact of which is to lower inflation and interest rates. If we further combine that with the large structural global shift in activity to emerging markets (more than half of global saving now occurs in emerging markets which often have poorly regulated capital markets, and insecure property rights) it seems possible to explain or at least partially understand the conjunction of remarkably low level of advanced country bond yields with low unemployment rates and high and rising levels of business investment. (It is also possible that low interest rates themselves contribute directly to lower prices in sectors featuring oligopolistic or monopolistic competition, further extending the adjustment process, delaying the inflation response and possibly flattening the price Phillip's curve – see Appendix A.)

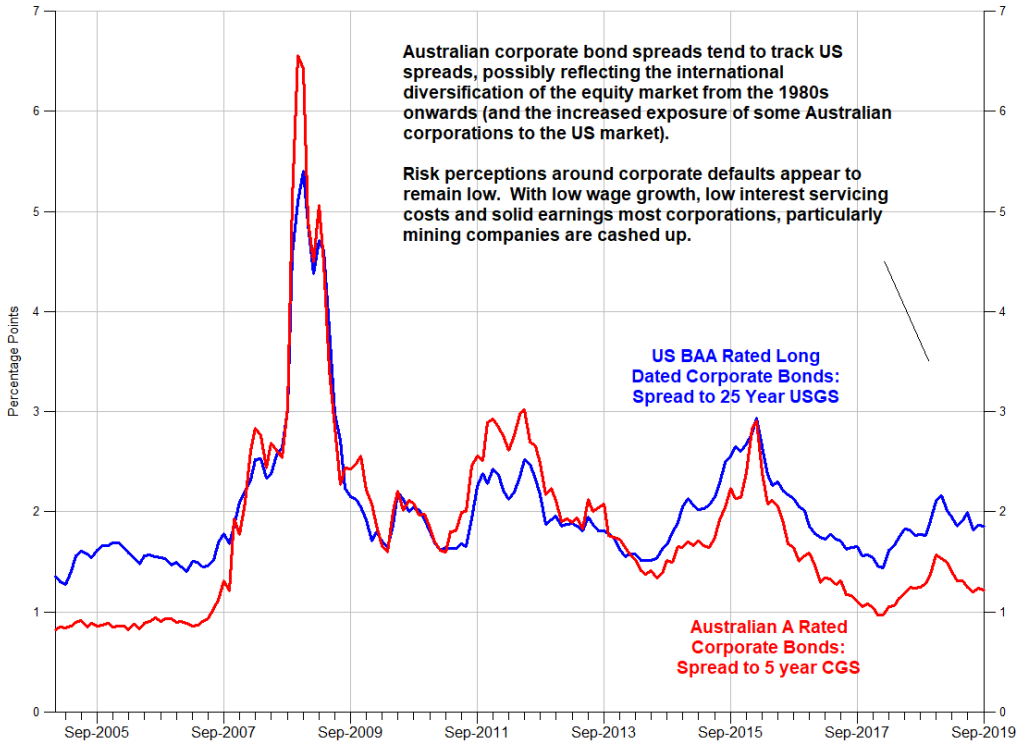
Implications for Australia

International developments are generally quite positive but at the same time leave the economy more vulnerable

From Australia's perspective the mix of international developments: continued growth in our trading partners; high commodity prices; and, the fall in global bond yields is quite positive. But it comes with an increased level of downside risk. So long as advanced country interest rates remain near the zero bound they will be vulnerable to any adverse shock (for example coming from financial markets or the political sphere). That in turn doubles the vulnerability of a small open economy with free capital flows and a floating exchange rate like Australia. Without either a global interest rate response, or a domestic interest rate response Australia, is much more exposed to a global downturn than it has been to crises in the recent past (the Asian Financial Crisis in 1997-98, the Tech Wreck of 2001, and the Global Financial Crisis of 2008-09). Work with both TRYM and AUS-M predicted that Australia would weather those crises relatively well, that losses to national income from falling commodity prices would not translate to large or sustained falls in activity and employment. But the financial market response, (falling global interest rates, a falling exchange rate and the domestic monetary policy reaction) was critical to that. That is no longer the case. The model indicates that the consequences of a global shock at the current conjuncture, without a fiscal response, would be much more adverse, with potentially large falls in activity and large and protracted increases in the unemployment rate, (see simulations section below).

However notwithstanding the increased vulnerability, risk perceptions in the financial market as measured by Australian corporate risk spreads remain low. But it seems likely that would change rapidly in the event of an crisis as the vulnerability of the economy was exposed, and given the close historical link between US and Australian risk spreads (Chart 7).

Chart 7: US and Australian Corporate Bond Spreads



Notes: Series are percentage point spreads of corporate bonds to equivalent dated benchmark government bonds.
Data source: FRB Historical Database and RBA Bulletin, Outlook Economics.

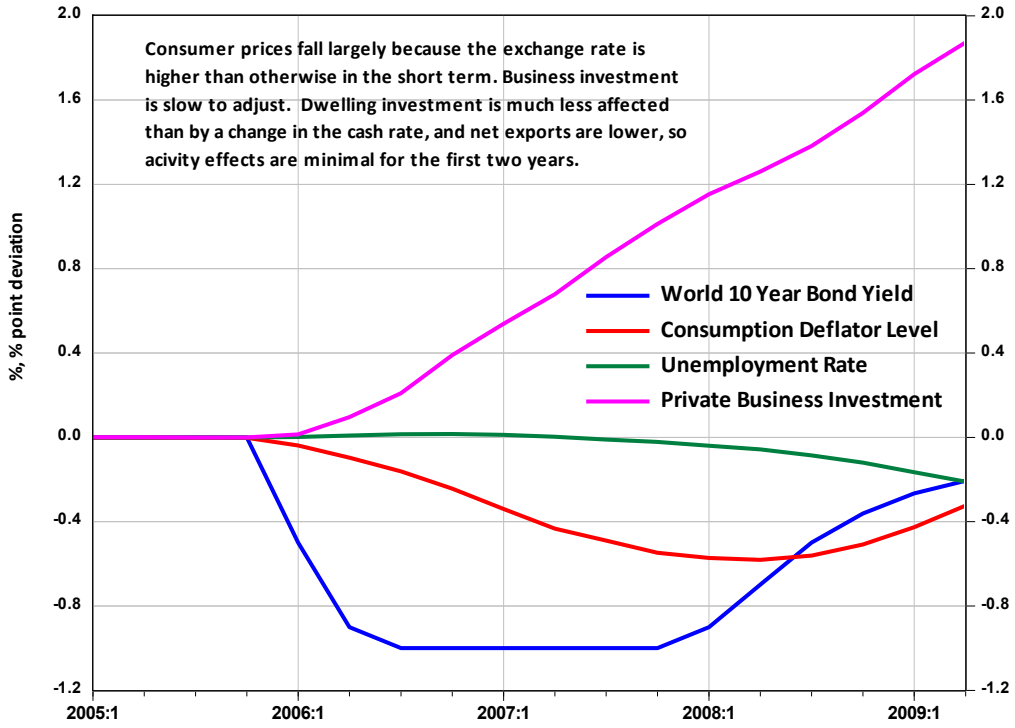
Changes in the Domestic Outlook

For the national model the broad picture hasn't changed greatly since earlier in the year (see second comparison table attached). The key factors behind the numbers are still largely the same (with the exception of the large drop in global real bond yields since April noted above). The main changes in the domestic projections are ones of degree rather than kind:

- the fall in dwelling investment is now projected to be somewhat larger in 2019-20 (the slump in unit construction now looks likely to be a bit more protracted);
- labour force participation has been somewhat higher than previously projected, continuing the gains of the last two years (probably for similar reasons);
- there have been some delays with some of the large infrastructure projects leading to some temporary softness in underlying general government (IGGU) and hence public final demand (feeding through to construction activity); and,
- the CPI is projected to be a bit lower, partly due to a change in the equation for the dwelling investment deflator PIDW, leading to a lower forecast for that component as housing investment slumps.

There has also been a change in the domestic interest rate outlook mainly driven by the fall in global bond yields. That fall has fed through to lower domestic yields and is one factor behind the stronger projections for business investment in the outyears. If maintained, the higher investment then eventually accumulates into a much larger capital stock, boosting labour productivity and adding as much as 2 per cent to per capita GDP. The falls in global yields have also had a mild deflationary impact by maintaining a higher exchange rate than it otherwise would have been (as capital flows in to take advantage of higher domestic interest rates driving them down in turn). The model indicates that a 1 percentage point fall in the global bond yields has little immediate effect on activity, (it has the reverse effect on net exports and less effect on dwelling investment that a domestic cut in rates), and leads to lower consumer prices – about ½ a per cent lower after 18 months (Chart 8), which induces a similar fall in the overnight cash rate. (So perhaps we should be thanking Jay Powell for the cuts to the cash rate – without him the exchange rate would have been lower and interest rates higher.)

Chart 8: Impact of a 100 Basis Point Fall in Global Bond Yields



Notes: Counterfactual simulation of a 100 basis points fall in WRIGL persisting for two years and then decayed away with the monetary policy reaction (RI90F equation) turned off to isolate the impact of the change in bond yields. Results are percentage and percentage point deviations from baseline levels. (The simulation is run as a historical counterfactual as running it on the current forecast baseline leads to domestic bonds hitting the zero bound.)
Data source: AUS-M Model Simulation, Outlook Economics.

So there have been offsetting developments, with overall growth in activity largely unchanged. However, the similarity in the forecasts possibly obscures a larger point from a policy perspective That is that there has been a significant increase in downside vulnerability. The falls in global bond yields and the local cash rate have helped to shore up the model's projections for business investment, dwelling investment, asset prices and household consumption in the

out years, but with not much left in the tank, either here or overseas, if some of the risks around the global outlook materialise.

Comparison with Official Forecasts – Productivity, Wage Growth and Low Inflation

With regards to the comparison with the official forecasts, the most recent RBA numbers are much closer to the model than the Treasury Budget forecasts, which among other things had higher near term GDP growth, much higher wage growth (which has been a feature for a while), and a much higher current account deficit (comparing the data in the Budget Comparison Table with the April model projections in the Model Comparison Table attached). In contrast, the more recent RBA forecasts are fairly indistinguishable from the model forecasts (in part reflecting a downward revision in the RBA's NAIRU to 4.5 per cent, bringing it into line with the model estimate). The model has a slightly larger fall in dwelling investment and slightly slower public final demand, but slightly stronger growth in business investment and exports. Overall it has greater falls in demand through the year in 2019 but a stronger recovery in 2020 (conditional on a slow recovery in global growth). That said the August RBA forecasts were based on the March quarter accounts and the difference in profile is partly due to the slower through the year growth in demand revealed in the June quarter accounts. (Private final demand fell by 0.4 per cent through the year.)

Inflation consistent with the target band requires balance in all of the markets

One remaining tension is in the inflation forecasts. The August RBA forecasts had CPI converging back into the target band in 2021, while the model has inflation falling back below it. In the model this is because unemployment remains above the model's NAWRU estimate, so that wage growth continues to be subdued. As Luci Ellis recently noted, for wage growth to rise to a level consistent with the inflation target requires further falls in the unemployment rate. In the model, the impact of the imbalance in the labour market is reinforced by the short-term imbalance in the housing market showing up in both falling new dwelling price inflation and falling rental inflation. (New dwelling and maintenance costs make up 10 per cent of the CPI, while rents make up another 7 per cent, and account for 19 per cent of the national accounts consumption deflator). For inflation to be consistent with the inflation target requires balance in all the markets, not just the labour market (or at least for imbalances to be offsetting). For the product market most industries are roughly in balance in terms of capital utilisation with some disinflation coming from distributional services (retail and wholesale trade) and also from finance and insurance, with an assumption that oligopoly rents are gradually eroded by competition, (and also that low interest rates put a squeeze on margins).[7]

[7] Although the impact here is mainly on declining mortgage margins RMWDG, i.e. on dwelling investment rather than consumer prices.

Lower global bond yields may themselves be deflationary by adding to the disruption in product market

The fall in global bond yields may also be having an effect here. There is an argument that for industries and markets where monopolistic or oligopolistic competition are a feature, interest rates might have a direct effect on prices. If there is such a direct effect then that might help to explain the recent weak inflation outcomes that have accompanied low interest rates both here and overseas. It would also help to explain the "price puzzle" first noted by Christopher Sims in 1992 (i.e. that variations in the Fed funds rate lead to short-run changes in prices in the same direction in simple 3 variable VARS). (The exclusion of interest rates from the price equations of structural models is an example of what he described as "incredible identifying restrictions".) This seems important both given recent developments, and also recent evidence from the RBA which demonstrated that the price puzzle existed for Australian data, see Bishop and Tulip (2007)
https://www.rba.gov.au/publications/rdp/2017/pdf/rdp2017-02.pdf.

One way of testing this argument is to look at the evidence directly in the industry price equations in AUS-M. (Interest rates don't appear directly in the price equations in AUS-M. Nor do they appear in the price equation in the Pagan-Dungey structural VAR,[8] which in the past has been used as a benchmark for the comparison of simulation properties, i.e. of a complex structural system like AUS-M to one with minimal restrictions. So it's also an important issue in evaluating policy responses and running sensitivity analysis using these models.)

The good news from the model's point of view, (and also the Pagan-Dungey VAR) is that testing the change in the cash rate in the relevant industry output price equations in AUS-M, provides no evidence of any systematic direct short-term impact.[9] While not conclusive, that probably rules out a significant direct interest rate effect via the "cost channel" (interest costs on short-term borrowing for working capital) as a rationale for low consumer price inflation outcomes.[10]

But it is possible that there are slower acting and harder to detect effects from lower bond yields and lower long-term borrowing costs that have a disinflationary effect, for example by increasing the contestability of oligopolistic

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8 See http://www.dungey.bigpondhosting.com/pdfs/DP2008_ecmterms.pdf

9 The exception was for the construction sector, where changes in the cash rate did have significant explanatory power, a result which was robust across different sample periods. It's a result which makes sense given the high level of borrowing and working capital required by developers and infrastructure providers. However construction prices predominantly feed into the investment deflators, PIOB and PIDW, and hence have a very slow feed through to consumer prices. Having recently revised the PIDW equation and lowered the forecasts, changing the PGCST equation is unlikely to have much effect on the current model results. It's one of many caveats and is flagged for future work.

10 That doesn't rule out other forms of the cost channel, such as increased costs due to labour hoarding or higher inventory to sales ratios. But they provide a reason, among others, for slow adjustment of prices to demand conditions, which is already captured in the equations.

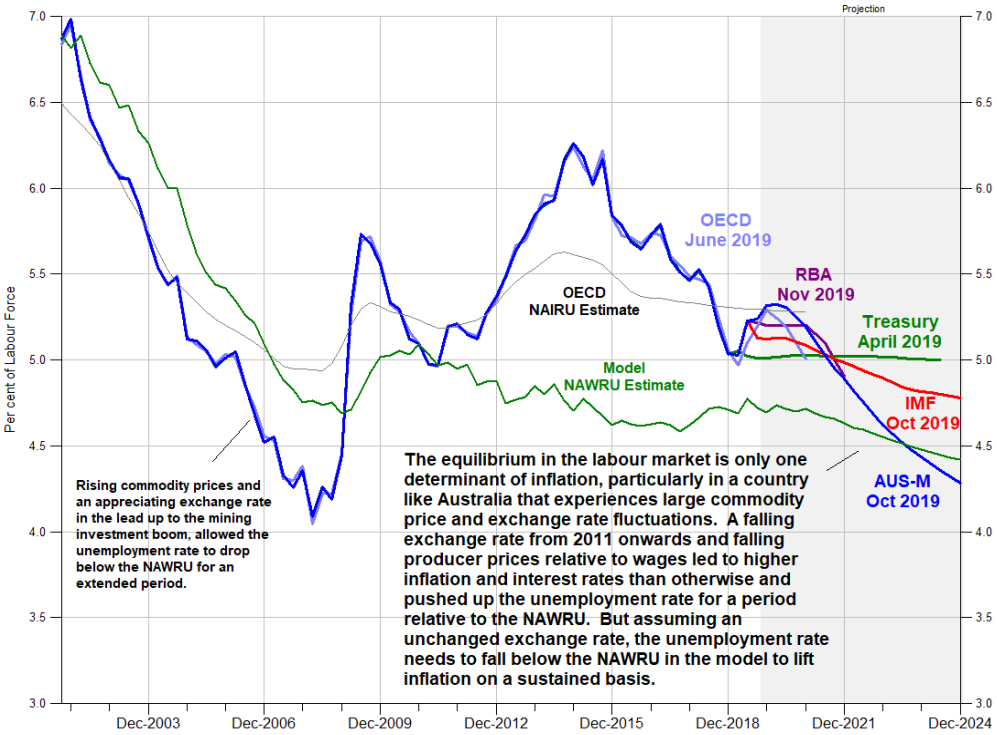
markets. And its doesn't seem possible to rule that argument out, although if true it would only add to the other forms of disruption to product markets occurring at the moment (Amazon, Uber, Airbnb etc.). So it is a possible downside risk to the model inflation projections (given the evidence for a direct effect from the RBA VAR model), which would also mean a lower short-run NAIRU. The issue, and the VAR result is discussed in more detail in Appendix A.

Disinflation from the housing and product markets can be represented as a temporary fall in the NAIRU relative to the NAWRU

Both the developments in the housing market (with falling rental price inflation, and slower growth in the dwelling investment deflator) and the impact of lower long bond yields, or other disruptive influences in the product market, insofar as they are occurring, could be represented as a temporary fall in the economy-wide NAIRU (defined in terms of price inflation) relative to the model's NAWRU (defined in terms of wage inflation). (Offsetting that has been other influences that have been raising prices such as the fall in the exchange rate and higher electricity and gas prices.) The model's wage equation indicates a NAWRU at around 4.6 per cent and gradually falling over the projection period (mainly driven by a projected fall in long-term unemployment from the cohort model which feeds through to an improvement in the average search effectiveness of the unemployed lowering RNUSEA relative to RNU.)[11] Developments in the dwelling and product markets mean that, in the model at least, the economy wide NAIRU (defined in terms of price inflation) is probably at the moment a little below the NAWRU estimate (shown in Chart 9 below).

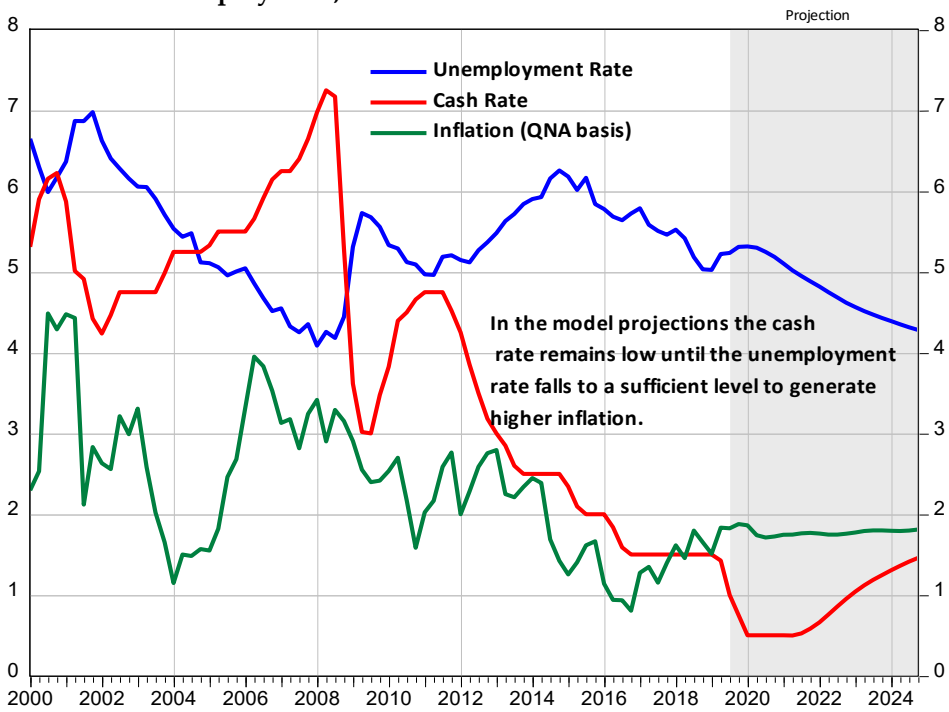
[11] Note a NAWRU of 4.6 per cent on a heads basis is roughly equivalent to 7 per cent on an hours worked basis accounting for hours on offer by under-employed part-time workers.

Chart 9: Unemployment Projections and the Model NAWRU



Notes: OECD NAIRU interpolated from annual data. IMF, RBA & Treasury series interpolated from published data.
Data source: RBA MPS, Treasury BP1, IMF WEO, OECD EO105, AUS-M Database, Outlook Economics.

Chart 10: Unemployment, Inflation and the Cash Rate



Notes: Consumer price inflation (RINF) is the through the year change in the national accounts household consumption deflator.
Data source: AUS-M Model Simulations and Database, Outlook Economics.

There must be about a 1 in 3 chance of the cash rate hitting the zero bound

That said there is a wide range of uncertainty around any inflation forecast 18 months out with a standard error of around 1 per cent, mainly stemming from the volatility in key inputs such as oil prices and the exchange rate, which are in turn difficult if not impossible to predict. The standard deviation on the through the year change in the $US/$A exchange rate since 2000 has been 12.6 per cent while that on through the year changes in oil prices has been 33 per cent. A standard deviation error on either assumption feeding into the model would lead to a 1 percentage point error on the inflation forecast 18 months out. That in turn applies fairly directly to the projections for the cash rate – sooner or later they have to move with inflation. That is, the fan chart of possible outcomes around the cash rate is similar to, and directly related to the fan chart around the projected inflation rate. As the cash rate is projected to be at low levels through to mid-2020, the fan chart for the cash rate has to be heavily truncated at the zero bound – implying around a one in three chance of hitting it. In fact on some arguments around the impact of low interest rates on the credit channel in a fractional reserve banking system, or a range of speculative arguments Lawrence Summers puts for a backward bending IS curve
https://twitter.com/lhsummers/status/1164490361881931777?lang=en
you could say that the economy is already there.

The implications depend on whether the economy hits it hard or it's a glancing blow.

Past simulations using the model, e.g. in APRA stress testing exercises, seem to indicate that the implications of that depends on the nature of the shock driving interest rates lower – in particular whether the economy hits the zero bound hard or if it is a glancing blow. For example an appreciation of the exchange rate to the high 70s (US cents/$A), or a fall in the oil price into the $US 40 a barrel range would lead to a temporary fall in inflation of the size required to cause the cash rate to temporarily hit the zero bound, but would have few ongoing effects. A temporary encounter like that doesn't appear to matter much. Responses are a little delayed but the economy doesn't seem to have much problem in exiting the zone. That is very different from a fall in the cash rate due to an adverse international shock that has large impacts on activity and unemployment.

There is probably an even chance of a hard hit while interest rates are still low

As mentioned the chance of the former glancing blow type fall in inflation is probably something like 1 in 3. The chance of a significant adverse international shock happening over the next 12 to 18 months is much lower, probably somewhere between 1 in 5 and 1 in 10. (The probability will be elevated so long as the advanced economies remain near the zero bound.) That in turn implies a probability of an adverse international shock at some point over the next six to eight years, the amount of time bond markets are projecting interest rates will remain low, of something like 1 in 2, if not higher. Moreover, if we define risk as probability times consequences, then the risk might be much higher than the chance, in that the consequences of the chance materialising will possibly be quite severe (see simulations section).

The costs are non-linear

Moreover the costs appear to rise in a non-linear fashion with the size of the shock. That is, there appear to be further threshold effects, or rather non-linearities, beyond the interest rate zero bound depending on the size of the shock (and consequently depending on the size of the policy response). This seems mainly to be due to the fact that as wage growth falls there are more and more employees affected by absolute cuts to nominal wages, leading to increased wage resistance (Akerlof's goal line effect – for early Australian evidence see the detailed work by Leong and Dwyer, 2000, https://www.rba.gov.au/publications/rdp/2000/pdf/rdp2000-08.pdf.) Avoiding very low rates of wage inflation seems to be the key to avoiding very large impacts on unemployment.

Productivity growth has been an important area of difference

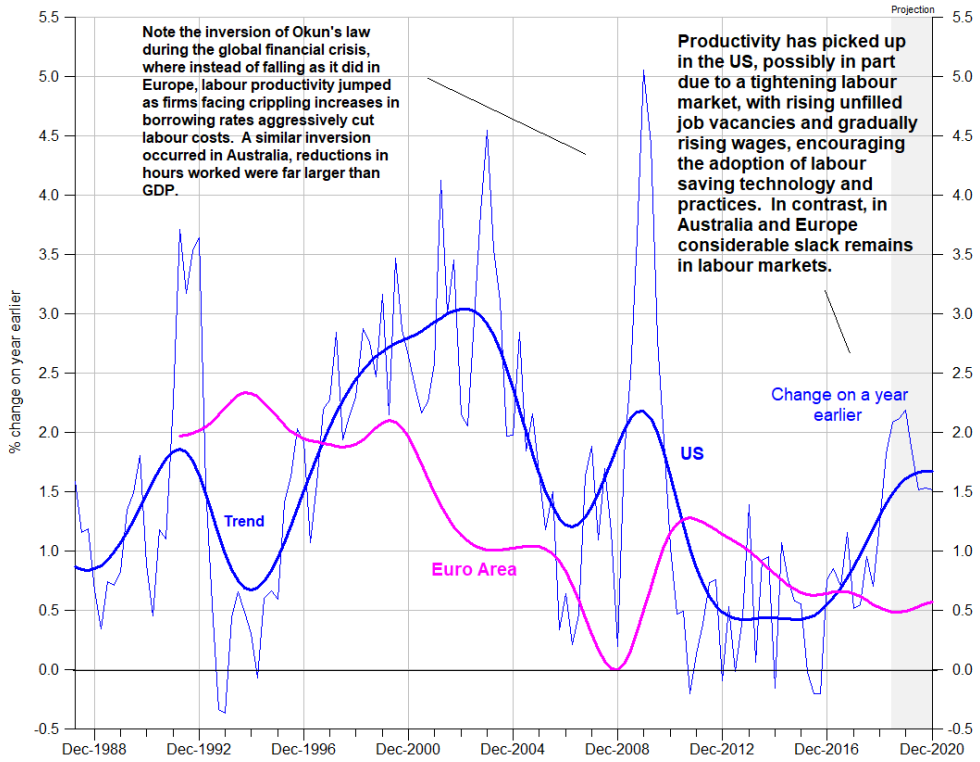
On productivity growth, it has also been a persistent source of difference with the official forecasts, with the model projecting much lower growth over the last few years. Even the lower model projections have been on the high side, with measured labour productivity on an hours worked basis falling in absolute terms in 2018-19 (the flip side of high employment growth). The model attributes this to three main factors:

- Substitution towards labour with low wage growth across most industries relative to output prices (and profits); and
- Compositional effects within manufacturing and construction (e.g. the shift from capital intensive engineering construction towards labour intensive housing in the construction sector and in manufacturing the decline of capital intensive sectors such as basic metal products and oil refining relative to more labour intensive such as food processing).
- Slower growth in underlying labour quality with fewer contributions from increasing experience (as the baby boomers retire), and smaller shifts in occupational composition. (In fact the contribution of labour quality was negative through 2018-19 on the model's measure (QLQLU), which was partly cyclical with more of the unskilled who have high turnover being drawn into employment, and partly structural for example the expansion of health and community services employment under the NDIS.)

The model has measured labour productivity bouncing back to around 1 per cent per annum, reflecting less contribution from both substitution towards labour and the compositional changes within manufacturing and construction, and with continuing strong underlying gains in labour efficiency in industries such as finance and communications, and some assumed gains in professional services due to AI. But it may well be that this is again too optimistic and if so GDP growth will be lower than projected in the medium-term and inflation and interest rates will be higher. On the positive side, is the evidence of a pick-up in productivity growth in the US over the last two years (Chart 11). But that said, the US is at a very different stage in the economic cycle with the job vacancy rate at 4½ per cent (BLS JOLTS Survey) now a full percentage point higher than the unemployment rate at 3½ per cent (as opposed to 1¾ per cent and 5¼ per cent

respectively in Australia). The tightening US labour market would be encouraging adoption of labour saving technology and practices, and its more competitive markets and higher weight in technology industries such as Amazon, Google etc., probably means we should be cautious in assuming a similar pick up will occur here.

Chart 11: US Labour Productivity Growth (Hours basis)



Notes: Through the year growth in labour productivity measured as GDP divided by total hours worked (national accounts basis). Average hours worked sourced separately from BLS and OECD. Trends use a combination of Henderson and Whittaker-Henderson filters.
Data source: US BLS, OECD Economic Outlook 105, OECD Labour Statistics, Outlook Economics.

Differences with the Treasury medium term projections due to lower productivity in the baseline are offset by a lower NAIRU assumption

Although the model has persistently had lower productivity projections than the official forecasts, it has also had persistently lower projections for the NAIRU (and consequently lower projections for wage and price inflation). The two differences, lower productivity and lower equilibrium unemployment, are broadly offsetting in the impact on GDP projections, at least over the first few years. The higher employment growth that closes the unemployment gap gives back the GDP that is taken away by the lower productivity projection.

It's also probably important to note here that the Treasury medium term projections are not forecasts, but rather assumptions to form the basis for the Budget's expenditure and revenue calculations, (see Bullen et al 2014, https://treasury.gov.au/sites/default/files/2019-03/tsy-medium-term-economic-projection-methodology.pdf). For example the assumption is that any unemployment gap left at the end of the forecast period, typically the first two

years, is closed in a linear fashion over the next several years at which point the unemployment rate sits at the NAIRU. (Similarly CPI inflation is assumed to quickly converge on the mid- point of the target and stay there.) And given a persistent probability of shocks, and the fact that the non-linear response to them tends to raise the average rate of unemployment relative to the NAIRU, it probably pays to be conservative with the chosen level. (Also the costs of forecast errors is asymmetric.) With multiple objectives, it's a difficult problem to handle.

The model projections by comparison are much simpler. They are the best guess for the path of the economy contingent on the exogenous factors we are feeding in (projections for world growth, global interest rates etc.), which in turn are the best estimates we can come up with. Risks can be higher or lower on either side but we handle this by noting them and sometimes running simulations to illustrate their effect. Uncertainty increases the further out the horizon, but for the unemployment rate the path is necessarily one which is consistent with the inflation rate. Given that being above equilibrium tends to depress wage growth, monetary policy has to accommodate a fall to below equilibrium for inflation to be pushed back up into the target band. That dynamic fall, and difference from the Budget methodology, consequently compounds the difference arising from the difference in the estimates of the NAIRU. In turn that creates a framing issue tending to make the model numbers shown in Chart 9 seem optimistic, (and possibly also an anchoring issue tending to bias perceptions of where the NAIRU is to the higher number – see Appendix B). (It also arguably generates a degree of policy complacency around the number.)

Main Influences on the Model Projections

In interpreting the results, it helps to think through the main shocks operating on the model, and the adjustment processes they are likely to engender. Over the last two years there have been four large shocks:

1. Higher commodity prices accompanied by a lower exchange rate (as opposed to the usual higher exchange rate) – contributing to both current account and budget surpluses (a rising exchange rate usually neutralises much of the effect on the latter). The main short term impact of this is on incomes particularly for mining companies and trade exposed industries, and employment (as real producer wages fall in the affected industries). Activity effects are slower to come through mainly driven by a gradual pick up in investment, mining output and exports, but with some short term influence, via higher wealth than otherwise, on household consumption. (It also shows up in higher corporate GOS and higher business saving, the mining sector in particular is cashed up.)
2. A balanced budget multiplier shock (with public final demand up strongly, partly funded by higher average income taxes and tighter welfare criteria on households, e.g. tighter asset tests for pensioners) – this was mainly lifting demand through 2017-18 and 2018-19, and is likely to make less of a contribution in 2019-20. Growth in public final demand will slow, albeit with infrastructure investment remaining at a high level, but offsetting that there

will be some relief for households in the form of tax cuts, although this contributes to higher saving in the model. So roughly speaking for 2019-20 there is a partial reversal of the balanced budget multiplier.

3. A positive labour supply shock in the form of three components: (a) high net migration; (b) higher labour force participation (females due to higher demand via NDIS and lower fertility rates, and older workers possibly due to low interest returns and falling prices of investor housing); and (c) a falling NAWRU (which is effectively an increase in supply). The combination of the three, (a) plus (b) plus (c) amounts to a fairly large shock. This lowers wage growth, inflation and interest rates in the short term, but is a significant positive in the medium term (improving the budget balance and lifting living standards).
4. Lower global interest rates (which have lowered Australia's borrowing costs and, as debt is rolled over, will contribute around about a 1 % point improvement in the net income balance and also help the budget balance in 2019-20 by lowering debt servicing costs). The impacts are mainly on asset prices (helping to support house and equity prices) and hence wealth in the short term, and will contribute to an increase in business investment and the capital stock, and hence productivity, real consumer wages and per capita household incomes in the medium term (if they persist).

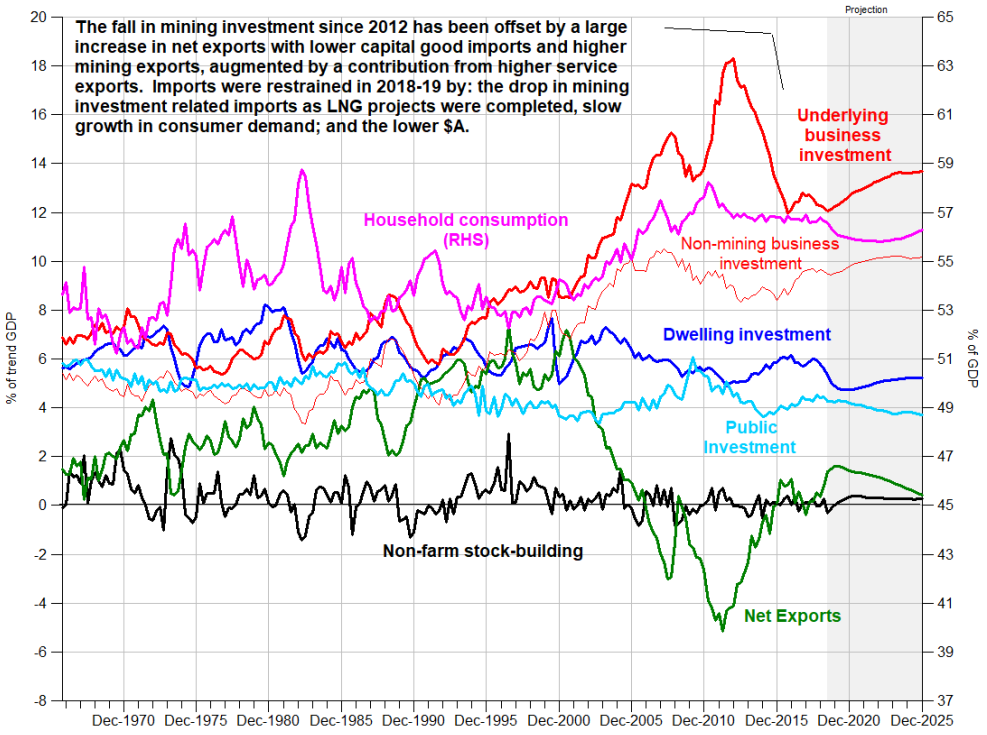
Note that these are all positive shocks, (2) plus (3) help to explain slow growth in wages, household income and consumption. The normal transmission of (3) depends crucially on the interest rate response, but this was initially constrained due to concerns around household debt and house prices, and arguably by recognition lags around the changes occurring in the labour market (over-prediction of wage growth), and is now being constrained by the lower bound on interest rates, so the adjustment process has become unusually drawn out.

With the large positive shocks taking time to come through, in the short term outcomes are dominated by temporary negatives:

a) Downturn in the dwelling cycle (particularly units).
b) Falling agricultural production and incomes in NSW and Queensland (with flow on effects to household income and consumption).
c) Delays in rolling out some public infrastructure projects due to planning delays but also possibly related to increased pressure on State government budgets with the fall in stamp duty collections.
d) Kick down in the inventory cycle, with inventories being run down in the June quarter. (The contribution is the change in the change so this will turn into a positive contribution when the run down comes to an end.)

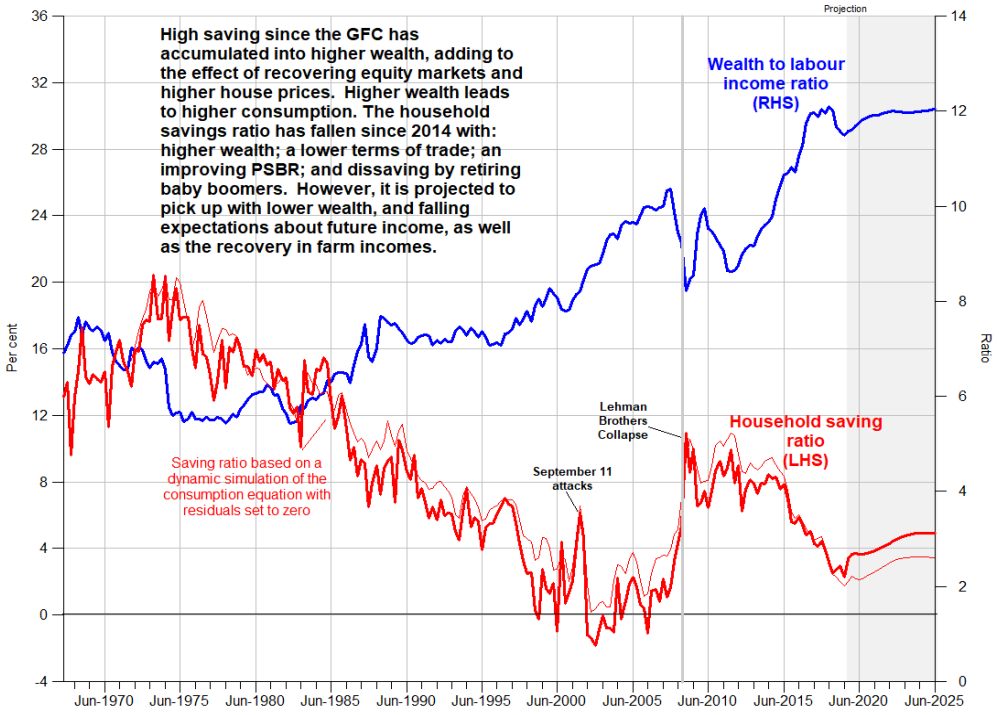
It takes a while for the economy to respond to a lower exchange rate and lower global interest rates and the benefits of these positive shocks will become more apparent when the dwelling cycle turns and farm conditions and output return to normal, (or at least when they stop falling). The movements in the major components of demand are shown in Chart 12 below.

Chart 12: Demand Components as a Percentage of Potential GDP



Notes: Consumption is shown as a percentage of GDP and is plotted on the right hand scale. All others LHS.
Public investment includes government enterprise investment (e.g.NBN) and is adjusted for second hand asset sales.

Chart 13: Household Saving Ratio and Wealth to Labour Income



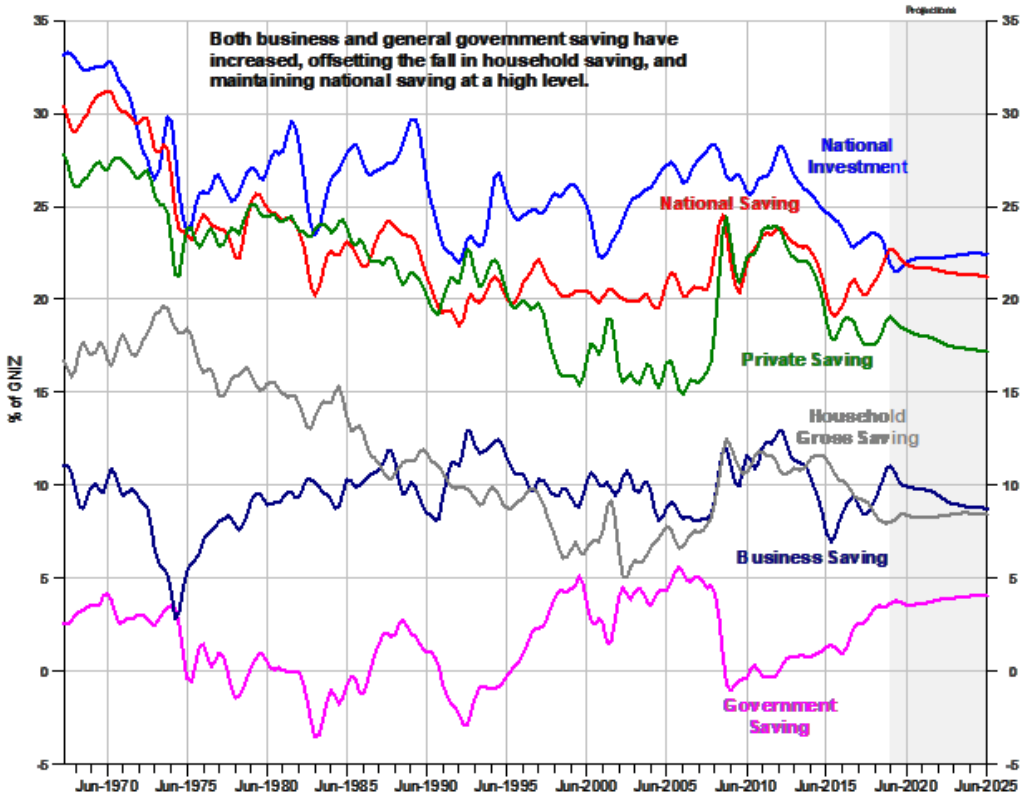
Notes: Household net saving as a % of net household disposable income. Labour income is after tax and includes benefit payments.
Data source: AUS-M Model Database and simulation, Outlook Economics estimates.

Growth in household consumption remains low, with an extended period of low wage and labour productivity growth (real hourly after-tax consumer wages have fallen in absolute terms over the last 5 years) contributing to lowered perceptions of future incomes and a rise in the household savings ratio – Chart 13. (Most of the tax cut is saved and there is also a contribution in 2020-21 from an assumed recovery in farm incomes.)

In the mean-time so long as the unemployment rate remains above the NAWRU the model is pointing towards continued low inflation outcomes, and low interest rates.

There are obviously a lot of caveats around that, and with interest rates already near the effective zero bound, a lot for policy makers (and everyone else for that matter) to worry about with regard to downside risks. Risk spreads on corporate bonds however remain remarkably low (Chart 7). Perhaps that is understandable – the flip side of low wage growth is high profits, and with interest rates low and gearing relatively conservative, debt servicing costs are very low. That in turn equates to a lot of retained earnings, showing up as high business and national saving (Chart 14), one reason that the current account balance has spun into surplus, and that the demand for funds has been low.

Chart 14: National, Savings and Investment (% of Gross National Income)



Notes: Gross saving and investment as a percentage of gross national income smoothed with a 5 quarter Henderson filter.
Data source: AUS-M Model Simulation and Database. Outlook Economics

The housing market becomes out of sync with the labour market in the out years

One feature of the model outlook particularly impacting on the outyears is the unusually large amount of adjustment and dynamic disequilibrium in the housing market. The dwelling bust through 2019-20 and 2020-21 eventually leads to a significant shortfall in supply (if the rest of the economy continues to grow as projected). This leads to a significant tightening of the rental market through 2021, with rental vacancies (KVACD) falling to low levels, leading to an acceleration in rental prices (PCRE) adding to the recovery in established house prices already underway. With negative global real bond yields and the cash rate at record lows, this leads to something of a boom in house building from 2021-22 onwards. That in turn leads to overbuilding and an oversupplied market, high vacancy rates and falling rents. But with persistently low interest rates, rents have to fall a long way to reduce the rental returns and to bring demand into line with supply (see Appendix A). Rental prices make up 19 per cent of the household consumption deflator in the national accounts. So the falls required continue to depress inflation in the second half of the decade even after the unemployment rate has fallen to below the estimated NAWRU. The low inflation keeps interest rates a little lower than otherwise compounding the size of the adjustment required in rents.

This problem where disequilibrium in one market (housing market) impacts on equilibrium in other markets (financial market, labour market, goods market) is sometimes referred to as a Dreze constrained equilibrium see: https://www.jstor.org/stable/2525813?seq=1#page_scan_tab_contents). It is always present to some extent in simulations in AUS-M, which features partial adjustment processes across a number of markets. But the present medium-term path of the economy seems somewhat unusual in the degree to which the housing market and the labour market become out of sync., with the housing market being persistently oversupplied by the mid-2020s, at the same time as the labour market tightens. In part, it is a working through of the effects of lower global bond yields with the lower required rate of return ultimately leading to a larger dwelling capital stock and lower rental prices, all of which are a good thing, but a significant reversal from the situation that occurs through 2021-22 when the rental market tightens and rental prices rise.

In itself it is probably not of great moment given the uncertainties around the projections. But it is a reminder of the very large and unusual changes that are flowing from global markets and the large adjustments the present conjuncture, which has resulted in extraordinarily low interest rates, implies across markets. That in turn leads to more than the usual number of caveats around the model projections, including importantly with the regard to the response of the model to interest rates as they approach the zero bound. (It's notable for example that the wedge between benchmark floating rate mortgages and 90 day bank bills has increased by 50 basis points over the last six months.)

Model Simulations – Increased Vulnerability to External Shocks

To demonstrate that greater vulnerability, and hence uncertainty, and to briefly examine the policy implications, two shocks have been run, the first as a historical counterfactual starting in 2003q1 (with no discretionary fiscal response) and the second, exactly the same shock run off the forecast baseline starting in 2020q1 (firstly with no discretionary fiscal response and then a number of variations on an active fiscal responses).

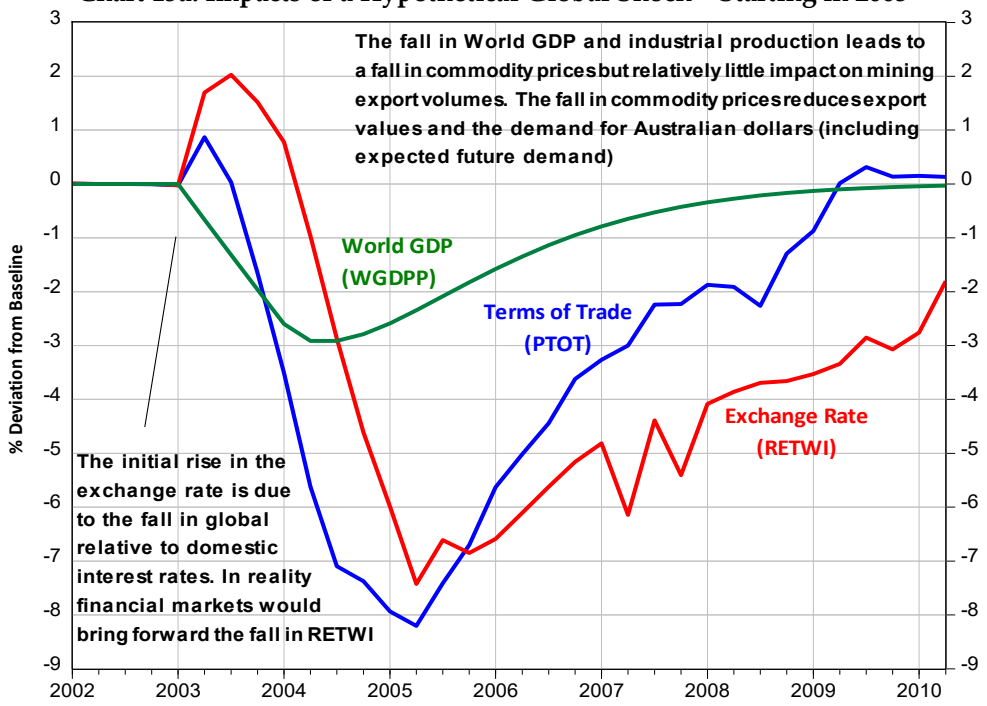
The shock is calibrated drawing on experience in modelling the Asia Financial Crisis, the Tech Wreck of 2000-01 and the Global Financial Shock, to construct a broadly representative global shock, with large falls in equity markets, contagion in corporate risk, a marked slowing in the growth of global trade and industrial production, and (a likely feature of any prospective downturn) lower oil prices, which also lower manufacturing good import supply prices.

The impacts of running the shock as a historical counterfactual starting in 2003 on some key variables and unemployment are shown in Charts 15a, 15b and 15c below. As can be seen the shock leads to a fall in commodity prices and a fall in the exchange rate, which combined with the cuts in the cash rate and a fall in bond yields helps to insulate the economy from the shock, with the unemployment rate peaking at 1 percentage point higher and then recovering. Key features in this are that:

- the Australian economy is small open economy with free capital flows and a floating exchange rate (which among other things means that the normal Mundell-Fleming results apply in the medium term – i.e. fiscal policy is crowded out by the financial market reaction over a couple of years); and
- Australia is predominantly a commodity exporter and an importer of investment goods, inventories and consumer durables. That means export volumes are not greatly exposed to short-term falls in world trade. The effects are felt mainly in terms of lower prices.

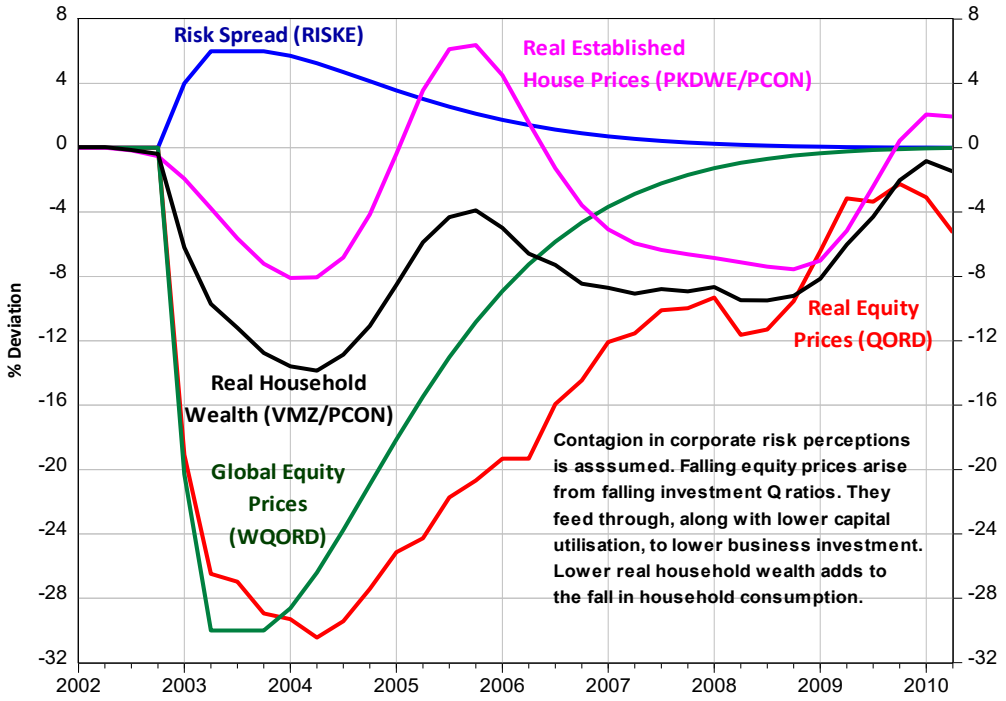
On the domestic demand side, the impacts on private investment, inventory building and durables consumption have a large leakage into imports. As a result the impact on net exports is fairly neutral in the first year or two then becomes positive as the effect of the lower exchange rate kicks in.

Chart 15a: Impacts of a Hypothetical Global Shock – Starting in 2003



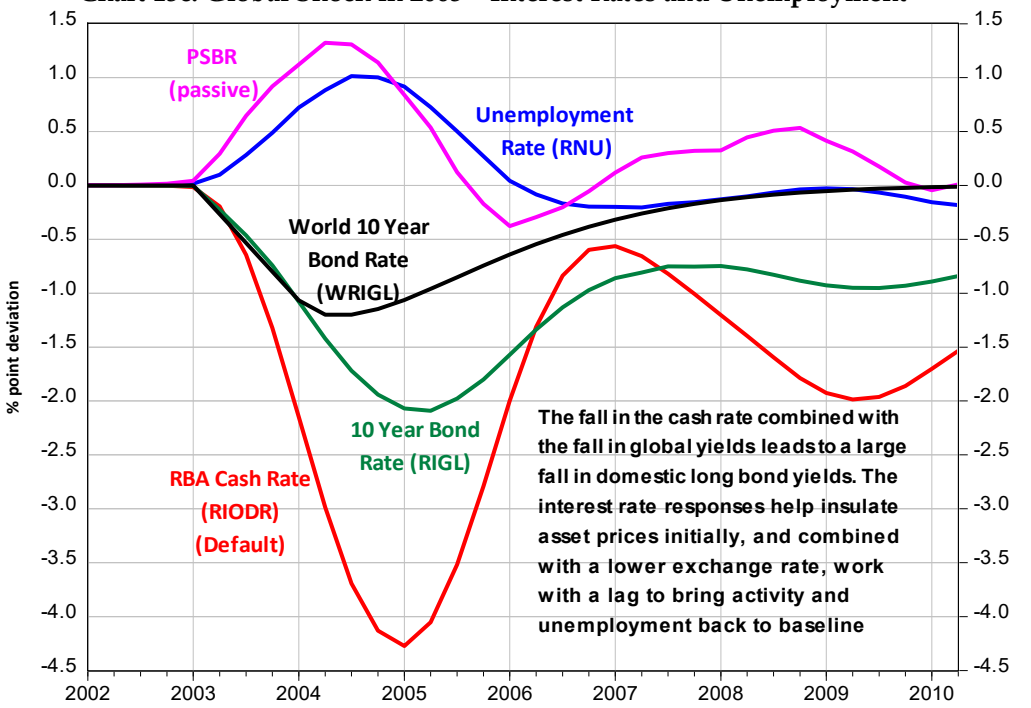
Notes: All series are expressed as per cent deviations from baseline levels

Chart 15b: Global Shock in 2003 – Asset Prices and Wealth



Notes: All series are expressed as per cent deviations from baseline levels apart from RISKE which is percentage point deviation.

Chart 15c: Global Shock in 2003 – Interest Rates and Unemployment



Notes: All series are expressed as percentage point deviations from baseline levels. The PSBRIs % point deviation as a percentage of GDP.
Data source: AUS-M Model Simulation and Database. Outlook Economics

Key features in terms of the financial transmission are:

- an assumed contagion in corporate risk spreads (based on the historical co-movement see Chart 7), leading to a spike up in domestic equity risk (RISKE) which also spreads to perceptions of risk in the housing market (RISKDW); and
- the fall in global bond yields which along with the cuts to the cash rate flow through to a large reduction in domestic bond yields

The flow through of global to domestic risk is important to the short term fall in asset prices, demand and output. (Without the risk contagion there is less than half the impact on activity and employment.) Offsetting that, the flow through of lower global bond yields adds to the effect of the monetary policy reaction and the fall in the exchange rate, partially insulating the economy from the risk effects and contributes to recovery.

There are many qualifications to the results and assumptions that could be altered. For example the exchange rate would probably respond earlier to the likely impact on commodity prices rather than falling as they occur (Chart 15a). An earlier fall in the exchange rate would reduce the peak impacts on activity and unemployment 18 months later (and also reduce the impacts on the PSBR). Similarly a more forward looking response from monetary policy, with a little assistance from fiscal policy, could probably eliminate most of the short-run cyclical effects if implemented quickly. (So the uncertainty around the outlook for policy makers is an important aspect determining the result.)

Many variations could be run, but the broad features are reasonably representative of the three major international shocks that have impacted the economy since the early 1990s.[12] Impacts of consumer and investment confidence were greater during the GFC. The Tech Wreck itself had less effect on the local equity market as Australia is underweight in technology stocks. The Asian Financial Crisis had less effect on commodity prices, (which at that point were largely determined by demand from the advanced countries).[13] It similarly had less effect on global interest rates (again set by conditions in the advanced countries). However it did feature large movements in the cross rates for the $A in the foreign exchange market which turned out to be probably more positive for Australia than a fall in global bond yields.[14]

Confidence effects don't usually perpetuate themselves (except at the zero bound)

One question that perennially arises is around confidence/risk perceptions/expectations, and whether the model results are an artefact of an assumption of mean reversion. In particular many people ask whether/or think that a fall in confidence can be self-reinforcing and lead to a protracted downturn (a subject of contention both during the Asian Financial Crisis and the Global Financial Crisis.)[15] The surprising answer is: no, not so long as interest rates have room to respond. A shift in the IS curve that arises from confidence is no different from one arising from fiscal policy and is largely crowded out by the financial market response after about 18 to 24 months. That is, the Mundell-Fleming results for fiscal policy[16] also apply to confidence.[17] Confidence effects

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12 But note that these were global demand shocks arising out of financial markets, very different to the oil price supply-side shocks of 1973-74 and 1980-81.

13 China was still too small to be a significant player, had yet to join the WTO, (2001),and supplied almost all of its own commodity demand. It was only post 2001 as infrastructure investment took off that China's demand for basic commodities like iron ore outstripped its own supplies leading to surging imports. Combined with rising oil and commodity prices, demand for foreign currency increased, driving down the exchange rate and contributing to the extraordinary surge in manufacturing exports, (Chart 3) (which if we follow the results of Autor et al, eventually led to Donald Trump).

14 The $A fell against the $US and other advanced country currencies that set the price for our commodity exports but rose against Asian countries which were a source for our imports. The overall effect was worth around 1 ½ per cent of GDP cet. par., and was one factor that contributed to the prediction from TRYM that GDP growth would actually increase in 1998-99, despite the downturn in Asia (which it subsequently did).

15 Perhaps the starkest example of this was a series of headline grabbing articles by the Financial Reviews long time editor Max Walsh during the Asian Financial Crisis, arguing that due to Australia's increasing links with Asia, and snow-balling confidence effects, it too was headed for a Great Depression type downturn. Max was not alone in thinking along these lines, which presented a huge challenge in explaining the model results.(see previous footnote).

16 That for a small open economy with a floating exchange rate and free capital flows fiscal policy is crowded out by the financial market reaction and net exports.

17 On mean reversion, if the cash rate is pushed to 17 per cent at a point where inflation is running at 5 to 6 per cent and that is combined with an international shock as in 1990-91,

can dominate short term outcomes, as they did during the early stage of the global financial crisis, but so long as financial stability is maintained, they are gradually offset by the interest rate and exchange rate response. The financial crowding out follows from the structure of the economy, not the specification choices for individual equations. The simple Mundell-Fleming results also drive fiscal and monetary policy assignment.

In the past passive fiscal policy has been close to optimal

The assumption for fiscal policy in the simulation is for no discretionary response, i.e. to let the automatic stabilisers work, but not to do any more. Work using the TRYM model in the 1990s indicated that this was close to the optimal response for Australia over a surprising wide range of shocks.[18] Those applied results and others like them, in turn helped to shape the consensus behind the assignment of monetary policy to short term macro stabilisation, and fiscal policy to a relatively passive role with a focus on balance over the cycle, with the assignment formalised in the monetary policy framework memorandum of understanding 1996 and the Charter of Budget Honesty 1998 respectively.

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increased risk, and a downturn in the office construction cycle, and if further monetary policy is slow to recognise and respond to the unfolding downturn, then the model will certainly produce a very large 1990-93 style recession – one that will feed through to large increases in structural unemployment via an increase in long-term unemployment, which in turn will take more than a decade to unwind. That is, the model is estimated on the basis of historical data, and the appropriate combination of shocks to the model will replicate past recessions.

18 Partly due to the difficulty of achieving significant effects relative to a simple cut in interest rates. For example, temporary income tax cuts can be implemented quickly but have a large leakage into household saving and into imports (particularly in Australia where consumer discretionary items such as durables and MVs are almost entirely imported). They have to be big, i.e. cost a lot, to reduce the burden on interest rates by even a small amount. Increases in infrastructure investment have greater short-run multipliers but take time to ramp up. Increases in government consumption also have larger short-term multipliers but can be hard to unwind.

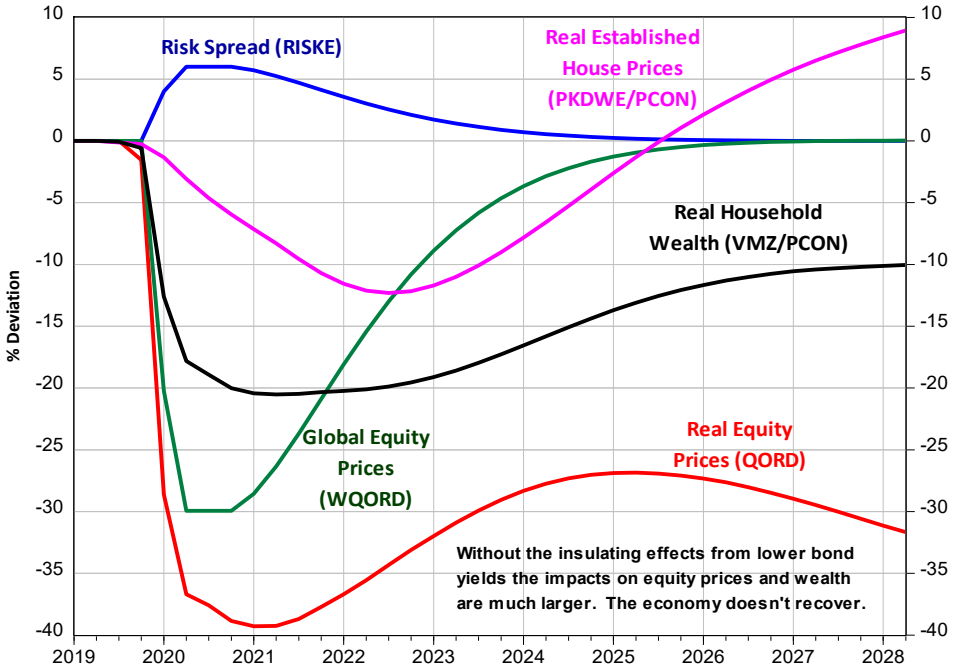
However, this work didn't consider what might be called inter-temporal fiscal policy, i.e. of the timely, temporary and targeted variety, designed to bring forward activity, things like a temporary doubling of the first home owners grant or temporary business investment allowances. Rather the focus was on discretionary changes to aggregate government expenditure and tax rates. Fiscal policy of the former variety can certainly play an important role in the short-term, reducing the pressure on interest rates. The experience of the GST transition in 2000 was something of an eye opener in that regard, (i.e. in respect to how large the inter-temporal effects could be). Fiscal policy also has a larger role to play in global supply shocks (where global interest rates and inflation are moving in a different direction to activity). These are harder to handle with monetary policy and have more persistent effects on activity. Moreover, discretionary fiscal policy can play a role in targeting individual regions, above and beyond fiscal equalisation via the Grants Commission.

Simulations Results at the Zero Bound – The World Turned Upside Down

The modelling work underlying the policy assignment, (which has served the country well since the mid 1990's), was invariably done analysing shocks on baselines featuring reasonably high cash rates as a starting point. But policy outcomes are very different when interest rates are close to the zero bound. [The starting point for the 2003 counterfactual above is a cash rate of 4.75 per cent. The average cash rate in the two decades to 2013 was 5.2 per cent. The average cash rate for the last five years has been 1.6 per cent, (and that has been for a period with falling commodity prices and a falling exchange rate).] Financial markets are predicting interest rates to stay low for an extended period (albeit possibly incorporating a self reinforcing expectation insofar as the low interest rates themselves lead to the possibility of the interaction of shocks with the zero bound)[19].

As mentioned to test the effect on the economy, and to draw out the implications for policy in contrast with the conventional results, the same shock has been run on the model forecast baseline starting in 2020q2. The results are shown in the charts below.

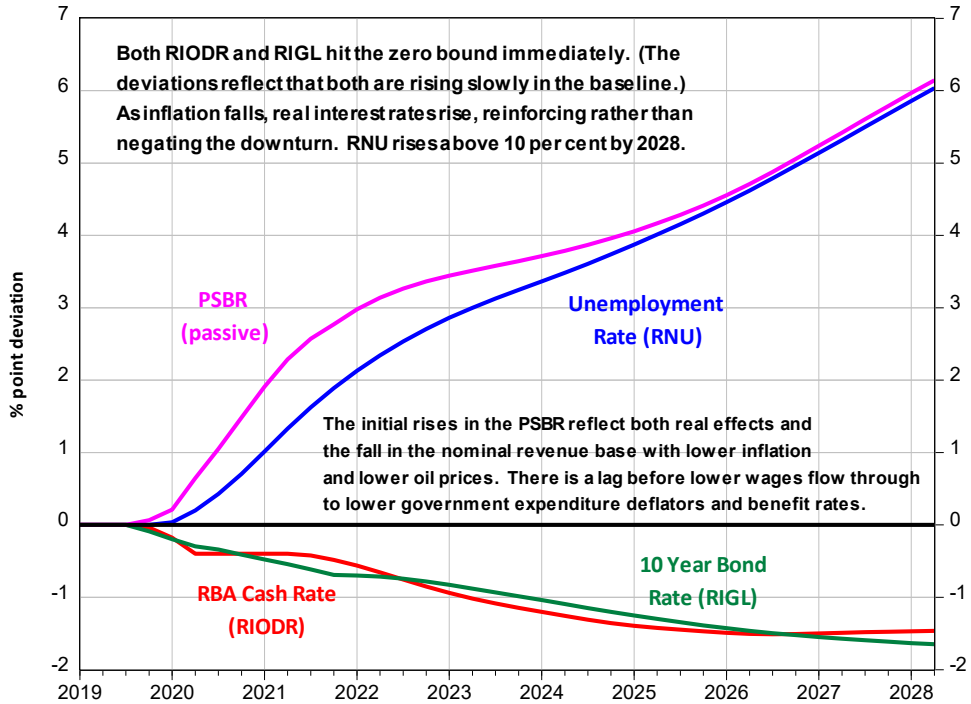
Chart 16a: Impacts of a Global Shock in 2020 – Asset Prices and Wealth



Notes: All series are expressed as per cent deviations from baseline levels
Data source: AUS-M Model Simulation and Database. Outlook Economics

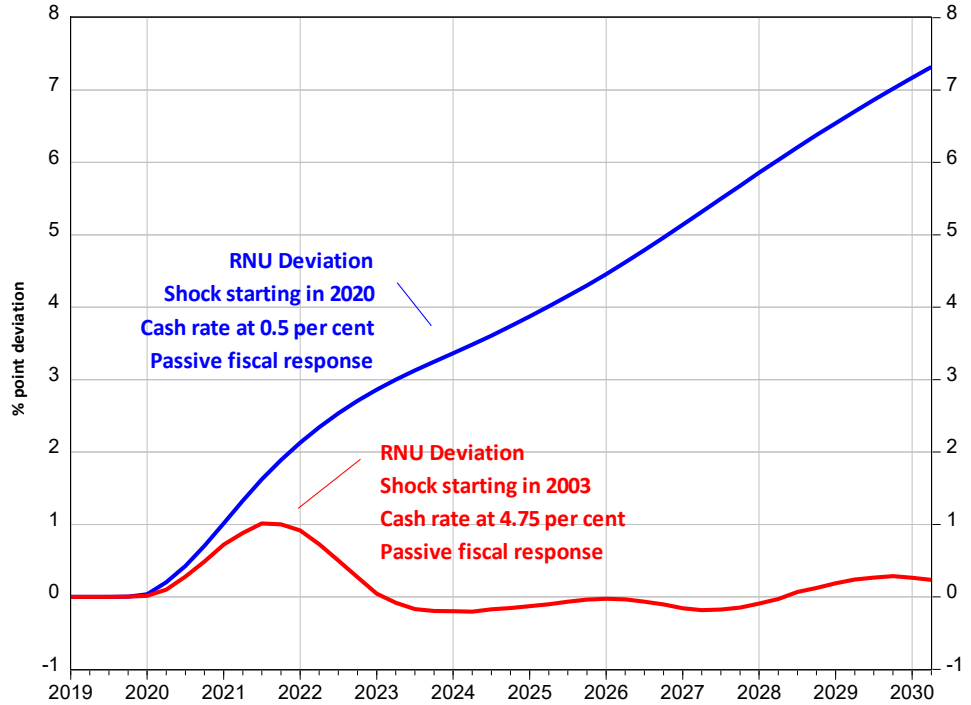
[19] In the Dixit Pindyck treatment of physical investment as a call option, the increased downside risk for a given level of volatility would lead to a requirement for a larger gap between the spot price and the strike price (rise in the hurdle rate) for the option to be exercised (investment project given the go ahead), which would perpetuate the lower interest rate. In which case there is the possibility of multiple equilibria: a bad low interest rate equilibrium where uncertainty and low interest rates interact to perpetuate themselves; and, a good higher inflation, higher employment equilibrium where interest rates are safely above the zero bound and risk perceptions are low.

Chart 16b: Global Shock in 2020 – Interest Rates and Unemployment



Notes: All series are expressed as percentage point deviations from baseline levels, in the case of the PSBR as a percentage of nominal GDP
Data source: AUS-M Model Simulation and Database. Outlook Economics

Chart 16c: Comparison of Unemployment Outcomes - 2020 versus 2003



Notes: Series are % point deviations in the unemployment rate RNU from baseline levels. 2003 deviations lagged by 17 years to the equivalent starting point for the comparison.
Data source: AUS-M Model Simulation and Database. Outlook Economics

As mentioned earlier the results at the zero bound are highly non-liner and depend on whether the interaction with the zero bound is a hard hit or a glancing blow. In this case it's a hard hit. Both the cash rate and bond yields hit the zero

bound in the first quarter. Real interest rates thereafter start to rise as inflation falls. The higher real interest rates and lower inflation expectations mute the fall in the exchange rate in response to lower commodity prices. Without the fall in bond yields the impact of the risk contagion on risk spreads on equity and asset prices and hence household wealth is much larger. (Equity prices fall by 40 per cent by the end of the fist year rather than 30 per cent and real household wealth by 20 per cent rather than 13 per cent).

Without a policy response the shock starts to feed on itself. Lower demand leads to lower inflation which leads to higher real interest rates, a higher real exchange rate than otherwise, reinforcing the lower demand. By the end of the second year the impact on unemployment is twice as large (Chart 16c) and that on the PSBR is three times as large (Chart 16b). The deterioration in the fiscal position is equivalent to 3 per cent of GDP or $60 billion and rising. GDP is 5 ¼ per cent lower (a little over $100 billion) at the same point.

And it could be worse. In running the simulation a nominal wage resistance term has been imposed on the wage equation which serves to limit (halve) the amount of deflation (when nominal wage growth falls below zero). Moreover, risk spreads are assumed to gradually fall to zero by about the end of the fourth year. But the opposite would probably happen. Risk perceptions and uncertainty would rise as firms and households struggled to understand what was happening to the economy. Unlike the 2003 shock, there is nothing to stop a fall in confidence perpetuating itself.[20]

The Return of Fiscal Policy

Nothing that is except a discretionary fiscal policy response.[21] To provide some guide to the effect of fiscal policy in these circumstances the shock has been run with a range of different fiscal responses, with the results summarised in the charts below. The first point to note is that a gradual discretionary tightening to stem the blow out in the deficit and reduce the build-up in public debt is self-defeating. (There is none of the normal benefit in the form of lower interest rates,

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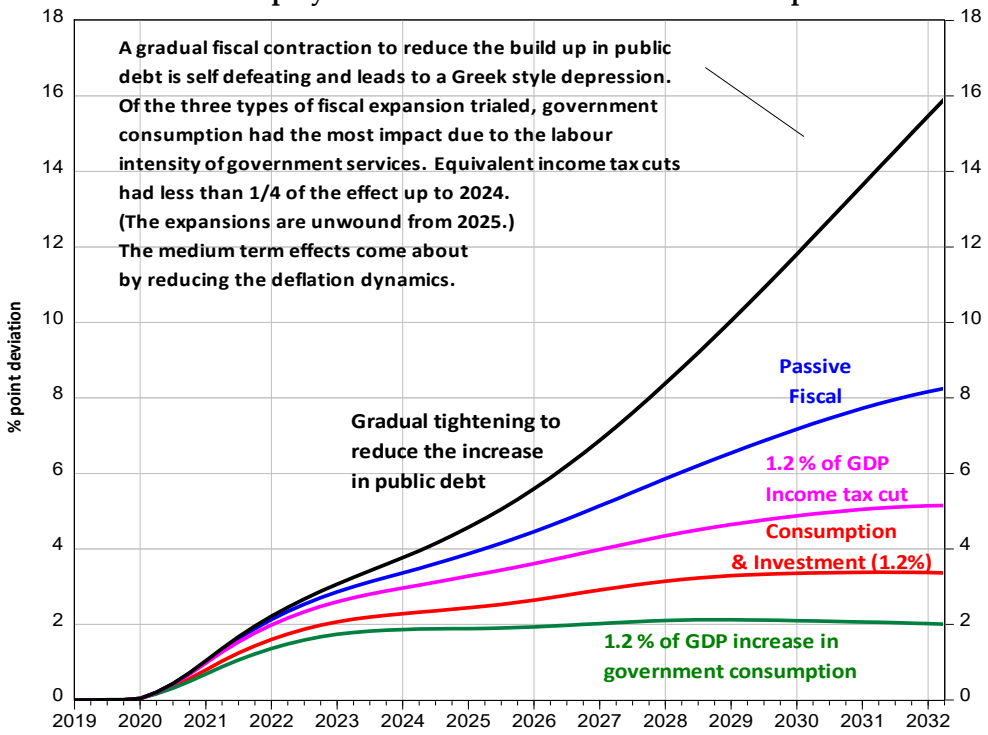
20 But there are many uncertainties around the simulations. For example one consequence of negative inflation is to increase the value of real money balances, i.e. currency and money held in bank accounts will become more valuable leading to offsetting effects on wealth for some household an effect first noted by Arthur Pigou. Counteracting this, the household sector is liable for a great deal of debt, the cost of servicing of which rises as incomes fall. AUS-M contains some but not all of the detail to capture effects like this. The process of running APRA stress testing simulations involving the zero bound has led to many modifications, for example to the valuation effects on components of foreign assets and liabilities, and to those on government debt and private bond holdings, as well as modifications to other equations such as the asymmetry on wages. Judgement still has to be applied. One thing to note on the valuation effects is that they will lead to considerable redistribution across households and potentially large increases in financial stress, compounding the aggregate effect of falling asset prices and incomes.

21 Bond yields in the simulation are already at the zero bound ruling out QE, although perhaps not some quasi-fiscal action by the RBA, although that seems likely to be limited by the RBA Act and if not would require agreement by the Executive given the over-ride power provided to the Treasurer in the Act. No new MOU has been forthcoming even though this is a contingency that could arise during the life of the current Parliament.

and real interest rates rise with lower inflation.)[22] In contrast fiscal expansion which requires the deficit to be even higher in the first two years, has the unusual quality of fully paying for itself after the fourth year. (The fiscal expansion involved a discretionary change equivalent to 1.2 per cent of GDP introduced through the first two years then gradually wound back after the fifth year.)

While the simulations are only meant to be illustrative and exploratory, a few things stand out. Firstly, when faced with a deflationary shock that is feeding on itself, the most effective policies are those that do the most to reduce the deflation. In this case the increased expenditure on government consumption is more effective because it leads to increases in output from sectors (health and community services, education services) which are more labour intensive. By doing more to directly reduce unemployment the intervention has a greater effect on reducing wage deflation, which then feeds through to lower real interest rates, which lower the real exchange rate, bolster demand feeding back to further reductions and so on.

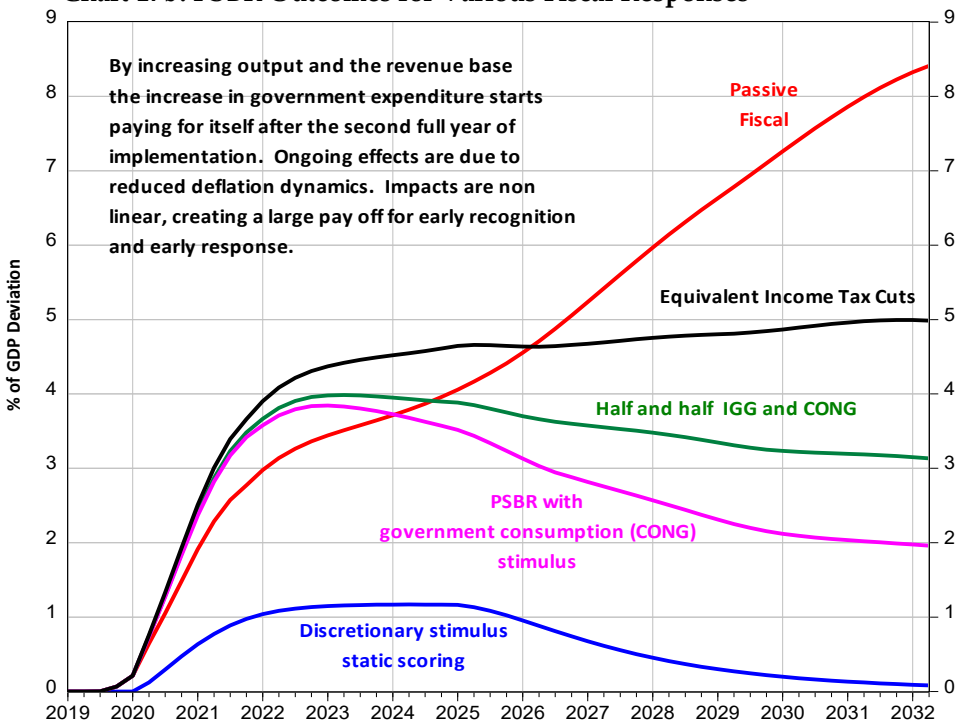
Chart 17a: Unemployment Outcomes for Various Fiscal Responses



Notes: All series are expressed as percentage point deviations from baseline levels, in the case of the PSBR as a percentage of nominal GDP

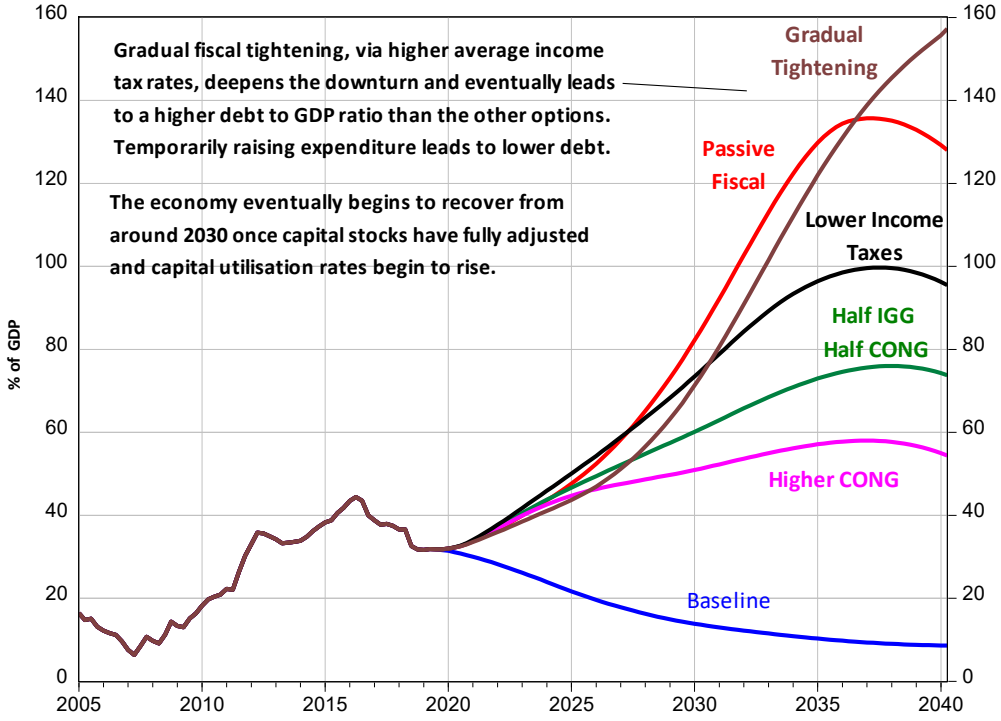
22 While it's possible to think of cases where a fiscal contraction can be expansionary, this doesn't seem to be one of them. For example, in modelling Vietnam some years ago it became clear that fiscal tightening could have an expansionary effect via its impacts on investor risk perceptions. The result followed from the fact that the country had a regulated exchange rate (which could be subject to speculative runs), high levels of foreign currency debt, and was heavily dependant on inflows of direct foreign investment. For Australia, at the zero bound, the impact on risk perceptions would probably be to worsen them as the economy deteriorated and the revenue base shrank leading to even higher required tax increases or expenditure cuts. In Australia's case a fall in the exchange rate leads to a direct improvement in the net foreign asset position.

Chart 17b: PSBR Outcomes for Various Fiscal Responses



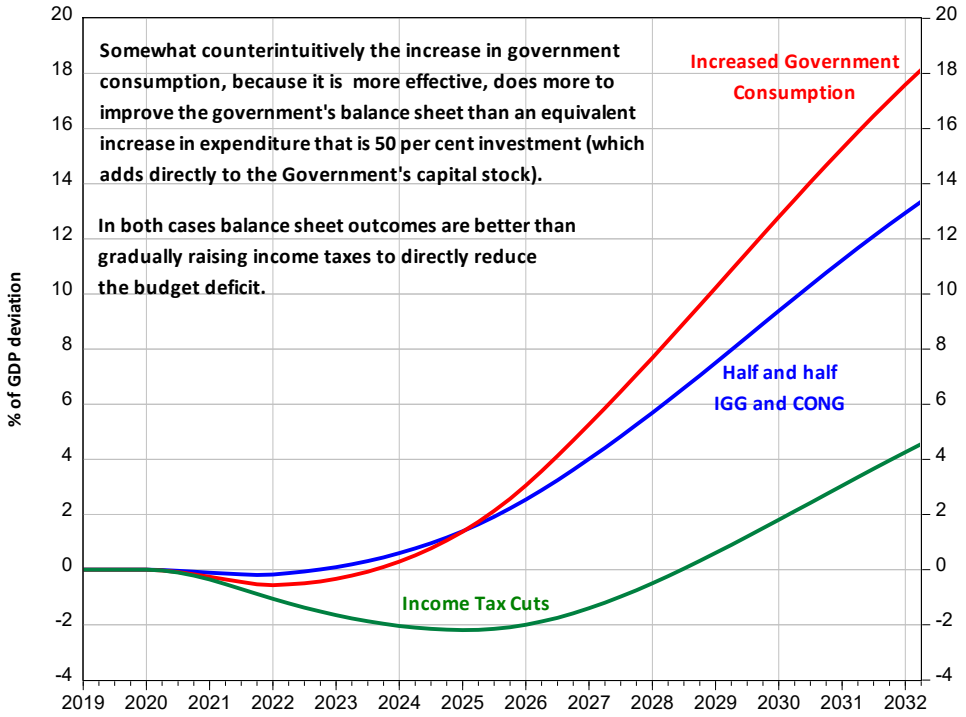
Notes: All series are expressed as percentage point deviations from baseline levels as a percentage of GDP

Chart 17c: Outcomes for Government Net Financial Liabilities



Notes: All series are general government net financial liabilities as a percentage of nominal GDP

Chart 17d: Impact of Fiscal Options on the Government Balance Sheet



Notes: Series are the deviation of government net wealth as a percentage of baseline GDP less the deviation in government net wealth in the no discretionary adjustment (passive fiscal policy case). IGG stands for General Government Investment, CONG General Government Consumption
Data source: AUS-M Model Simulation, Outlook Economics.

Surprisingly the additional government consumption spending ends up being better for the government wealth position on its balance sheet than an increase in government investment which builds the capital stock (Chart 17d). (And this doesn't account for valuation effects on other government assets, e.g. the Future Fund, which would be worth more in a more highly employed economy.) In both cases the fiscal position as measured by the impact on the government's balance sheet is improved by the temporary increase in spending (relative to no discretionary response).

The lasting impacts of the increase in government consumption expenditure in turn suggests that speed of recognition and response are critical to outcomes and can have lasting effects (as opposed to the conventional situation where policy delays aren't necessarily particularly costly because you can catch up by doing a little more in the subsequent period).

The brief exploration, represented by the simulations above, raises many more questions. How effective would inter-temporal fiscal policy be (temporary measures that induce a bring-forward in private expenditure)? To what extent do the results depend on the composition and severity of the shock? What role could structural reforms in labour or product markets or tax reforms play?[23]

[23] Tax reforms which improve the efficiency of the tax system can also have positive short-run dynamic effects. For example replacing State payroll tax with an increase in the GST would both improve long-run welfare and increase the short-run demand for labour as the economy adjusted to the change. Similarly reforming corporate taxation, replacing the

What impact could particular targeted measures have? How plausible is it to quickly raise government expenditure without inducing inefficiencies? How sensitive are the results to key model parameters?[24] What are the impacts across States?

Unlike monetary policy which involves one instrument, with fiscal policy the devil is in the detail. That is not only from an economic point of view, but also an administrative and political one, with for example most proposals requiring co-ordination with the States.

Caveats and Conclusions

There are more than the usual caveats both to the model baseline and the sensitivity results above. The baseline is contingent on IMF and OECD forecasts for a slow recovery in growth in global activity, but the simulation results testing the consequences of a global shock indicate that the economy is more vulnerable to negative global developments than it has been in the past and that there is potentially a long tail to the downside risks. Moreover, we have no post-war historical experience with a period of near zero interest rates and on this component the model is outside its historical range. The same applies to the simulation results which are sensitive to for example the realism of the adjustments to the wage equation. The results depend on how households and businesses form their expectations, perceive risk and many other things.

Australia is a small open economy, a commodity exporter and an importer of investment equipment and consumer durables. It is quite distinct from the US and Europe, with their huge internal markets and low trade shares. Just as they have in the past, shocks here will play out differently. Policy prescriptions that work for the US and Europe do not necessarily translate.

Barack Obama's chief of staff Rahm Emanuel once said that "you should never waste a good crisis". Fiscal policy responses are complex and the welfare effects

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revenue with more efficient taxes (inheritance taxes? taxes on excess rents?) could boost investment in the short term as the capital stock adjusts.

24 For example most tax models would project increases in labour supply as a result of cutting income tax rates. If we incorporated a similar effect, then the efficiency effects would offset the leakage into savings and imports and potentially improve outcomes relative to those shown in Chart 17 above. In AUS-M the income and substitution effects on labour supply of a change in the after-tax real consumer wages are offsetting – the estimated Marshallian uncompensated supply elasticity is zero, consistent with the Australian time series data (hours-supplied basis). The calibrations in most tax models would predict that recent slow wage growth and rising average income tax rates would be associated with a contraction in labour supply. But average after-tax, quality-adjusted, consumer real wages have fallen by 3 ½ per cent in Australia over the last five years, yet labour supply has surged. The estimated labour supply elasticity means that the welfare impacts of a build up in government debt in AUS-M are much smaller than those in a calibrated DSGE model like Woodford, 2011. See also De Long and Summers (2012), and more recently Blanchard (2019) for US discussion of the costs and benefits of fiscal policy at the zero bound.

of different policy choices can be large. That means there is a large payoff from being prepared rather than making it up as you go.

The dogmas of the quiet past?

Abraham Lincoln once said "the dogmas of the quiet past are inadequate to the stormy present". Historian's looking back might identify the relatively high interest rates of the last thirty years as an anomaly,[25] a quiet past, for Australia at least. The transition to a period of low interest rates represents a sea change for monetary and fiscal policy, exposing the economy to a stormy present. That in turn means the policy frameworks and prescriptions that have held for the last quarter century may no longer be fit for purpose.[26] The stakes for policy makers and financial markets in understanding how economic and policy responses might change seem high. Hopefully the model results and the brief analysis and thoughts above are of some help in that endeavour.

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25 See Haldane, (2015), https://www.bankofengland.co.uk/speech/2015/stuck, Chart 5, P19, the only period of sustained high interest rates since Babylonian times.

26 For example if the simulation results in this note are a guide, in some circumstances it may not be possible, or desirable, to achieve a balanced budget on average over a run of years, particularly on a cash balance basis. Recent developments have exposed the limitations of the underlying cash balance as a headline target (including the problem of counting capital grants to the States as recurrent expenditure). Auerbach and Kotlikoff would argue that such a measure is "devoid of meaning" from an inter-generational perspective. The upcoming Intergenerational Report provides an opportunity to assess these issues, and possibly to redefine measures and reframe medium term goals in terms of the wealth position on the balance sheet, e.g. see IMF, 2018, https://www.imf.org/en/Publications/FM/Issues/2018/10/04/fiscal-monitor-october-2018 . The results also put a focus on Federal/ State fiscal and financial arrangements and coordination. With regard to the monetary policy framework, stochastic simulations on structural models point to, if anything, a higher inflation target band in a low interest rate environment, not a lower one as some commentators have suggested (see Kiley and Roberts, 2017).

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Appendixes

Appendix A: AUS-M, Low Interest Rates, Low Inflation and the Price Puzzle

We normally think of a reduction in short-term interest rates by the central bank as boosting demand, lowering unemployment, increasing capital utilisation, lowering the exchange rate, and thereby lifting wage and price inflation. Indeed that is the standard response in AUS-M with a 1 percentage point temporary reduction in the cash rate lifting the consumer price level by about 1 per cent after around 18 months. The channels of influence are the conventional ones with lower interest rates: leading to higher dwelling investment; lowering the exchange rate; boosting asset prices and wealth and hence household consumption; lowering required rates of return and boosting business investment (albeit with most of the short term response coming from changes to capacity utilisation); all of which boosts demand, lowers unemployment and crucially increases wage inflation; with both wages and increased capital utilisation lifting output prices; which combined with higher import prices flow through to higher consumer prices. (Higher consumer prices flow back to wages which flow back to further increases in prices and so on, which lower real interest rates, and at some point the stimulus has to be unwound or reversed.)

We have good empirical evidence for these linkages, and good theories like Bernanke-Gertler that explain the pattern of effects, (i.e. the credit channel and the outsized influence on dwelling investment relative to business investment). It seems like a triumph of logic and empiricism. But despite that there is a surprising lack of evidence from VAR models for a causal link between interest rates and the price level, something known as the "price puzzle" , e.g. see https://www.rba.gov.au/publications/rdp/2017/pdf/rdp2017-02.pdf. In the face of the other evidence, we tend to dismiss the VAR results and explain them away in one way or another. But what if there is something to the result? The experience of other countries at the zero bound tends to suggest that interest rates may not be as powerful as we once thought at lifting the price level, with countries tending to become stuck and having a surprising amount of difficulty generating inflation. Could a similar thing happen here? What would be the mechanism? (The answers to these questions have large implications both for economic policy and financial markets.)

For the model most of the behavioural modelling of inflation is on the industry output price side. The model's industry output price equations reflect the conventional result, which is that lowering the required rate of return in a competitive industry has no immediate impact on prices. For a competitive industry prices are determined by demand and supply, and on the industry side, by the position of the marginal cost curve, determined in turn by the level of the capital stock, labour costs and capital efficiency. (The cost of borrowing doesn't come into it except indirectly.) The lower required rate of return, in the event of a fall in global bond yields, lowers the marginal product condition for capital, but this only has an effect on prices as the capital stock expands. In the meantime there are excess returns on current physical capital which show up in higher equity prices and higher earnings after interest payments. The rise in the

investment Q ratio leads to an increase in investment which in the short-term adds to aggregate demand helping to lift the aggregate price level. If incumbents don't respond to the excess returns by increasing investment, then that would encourage the expansion of the capital stock via new entrants and lead to loss of market share. Either way the capital stock expands until the marginal product of an additional unit equals the lowered user cost (real interest rate plus depreciation plus a risk premium). The larger less expensive capital stock increases labour productivity and real wages and lowers prices. Competition eventually delivers the full benefit of lower interest rates to households. (Given the elasticity of substitution across most industries is substantially less than one, the GOS share should fall, other things being equal.)

Lower global interest rates eventually lower real rental prices

The dwelling sector might provide an example of a competitive sector with low barriers to entry – if we lower the required rate of return for the sector there is no immediate effect on rental prices, which are determined in the short term by the relative supply and demand of rental properties represented by the vacancy rate. Landlords don't directly discount rents if their borrowing costs drop. Rather the effect on rental prices only comes through as the supply of rental properties expands and the rental vacancy rate rises. In the meantime the lift in dwelling investment contributes to aggregate demand tending to lift aggregate prices (and the short run returns in excess of the required rate lead to a rise in the market price of established house above their development cost). But in the long run the increased supply of rental properties leads to a large drop in their relative price. (For example a 1 percentage point reduction in the required rate of return, that occurred for the housing sector alone, would eventually lead to roughly a 20 per cent fall in the relative rental price – although the result would take a long time to flow through. Note that the impacts are much smaller in other sectors – for dwellings the estimated risk premium is low and GOS represents 100 per cent of output at factor cost.) Given that the estimated long-run elasticity of demand for rental services with respect to prices is around 0.6, the end result is a significant reduction in the dwelling GOS share in GDP.

Firms with market power – avoiding ruinous competition

If we consider markets which due to various barriers to entry, (e.g. cost of establishing networks, regulatory requirements, economies of scope and scale), tend towards monopoly or oligopoly, the flow through of a structural shift in bond yields might be quite different. For example, take the stylised case of a monopolist in a market where there are given barriers to entry, the cost of surmounting of which can be expressed as a constant rate of return to the incumbent capital stock. The monopolist, to discourage new entrants and to avoid what Warren Buffet describes as "ruinous competition", sets a price level which achieves an excess rate of return just below this threshold. What happens in the event of a reduction in the bond yield in this case? There would be pressure on the firm to directly lower its price level. (Otherwise there would be an excess of excess returns enticing new entrants to leap the barriers to entry.) It would reluctantly have to lower prices and move up it's marginal cost curve in the short-run. The lower price level would then increase demand for its product. That would increase employment (despite the increase in the producer wage

implied by the lower price). So there would be direct price and employment responses, and the investment response would be slow (which seems to fit the pattern of current developments). (This is the reverse of the response in the competitive market, where the individual price and employment responses lag the adjustment in the capital stock, abstracting from the changes in aggregate demand.) A similar thing could occur in the case of oligopolistic competition. Individual players might gradually lower their prices directly to preserve their market share and pre-empt new entrants (encouraged by lower borrowing costs and the temporary excess returns on offer). Another way of putting this is that the fall in the bond yield , would temporarily force them to share their excess returns with their customers as the aggregate economy expanded and as they adjusted their capital stock. (In equilibrium the extra excess returns are eliminated and they are back to square one with normal excess returns at the lower required rate of return.)

The model's current industry output equation have a degree of flexibility in terms of accounting for different speed of responses to changing wages and capital utilisation across industries. (Each industry will respond to a shock by simultaneously altering employment, investment and output prices, with the speed of response in each direction determined by the data.) They are designed to capture the responses of output prices to fluctuations in wages, exchange rate changes, and fluctuations in demand evident in the time series data, But the generic specification doesn't necessarily handle the interaction of large changes in the required rates of return in markets with oligopolistic competition as described above.

The model might overstate prices in the presence of a fall in global bond yields

It is hard to know how much effect the specification choice, which allows for constant but not systematically varying monopoly rents, might have in practice (without more detailed investigation). On the face of it the broad picture of the monopolistic or oligopolistic response described seems to have some similarities with recent Australian outcomes, i.e. weak inflation, and slowly responding investment. And as mentioned a direct flow through from a fall in bond yields to the threat of competition and hence to prices and margins would help to explain the price puzzle and why countries seem to become stuck at low interest rates. As the GOS share accounts for 36 per cent of GDP at factor cost, or 43 per cent if we allocate out gross mixed income, it seems a significant source of uncertainty.[27]

Low interest rates to high hurdle rates?

But there are many other sources of uncertainty, and the GOS share point, also highlights the potential effect of increased competition from other sources and disruption to market incumbents due to the emergence of Amazon etc.. A more compelling argument for countries finding it difficult to exit the zero bound zone, might be a link working not from lower interest rates to lower inflation but from low interest rates, to higher risk perceptions, and hence to a slower

[27] About half of that is determined in global commodity markets or clearly competitive domestic markets.

response in investment and demand. Given the simulation results described in the text, it would be rational for firms to increase their hurdle rates once the economy had entered the zero bound zone (see footnote 19).

The missing missing-link

As mentioned in the text, testing for the change in cash rate in the models industry output equations over different sample periods did not provide any evidence for a direct effect (with coefficients small, insignificant and unstable over different sample periods), with the exception of construction which tends to oligopoly in parts of the market and has significant borrowing and holding costs. (In the case of construction the effect feeds through to the investment deflators, not directly to consumer prices.)[28]

That seems to rule out the cost channel via short term borrowing for working capital as a significant source of direct influence on consumer prices. Looking at the evidence for such a channel in the US presented in Bath and Ramey (2002) the results seem unconvincing. The regressions are run for the manufacturing sector, which is energy intensive, using gross output prices, which include input prices, rather than value added prices or margins, which is what the argument relates to. With the sample period including the two big oil shocks of 1973-74 and 1979-80 it is perhaps not surprising they find direct effects in some of the data. Testing the manufacturing output price equation in AUS-M, which is essentially a margins equation, there seems to be no direct effect in the Australian data.

How to reconcile the VAR and model results?

Which leaves the question of the reconciliation of the model with the RBA price puzzle VAR results. Such a reconciliation seems possible (just). A couple of observations, based on first impressions without the benefit of testing or more detailed analysis:

- The VAR includes both the underlying CPI and the RBA measure of the real exchange rate. The latter uses the underlying CPI in its construction, (the nominal trade weighted exchange rate times the underlying CPI divided by traded weighted trading partner core CPIs). That means any survey error or distortions due to administrative changes such as to child care payment arrangements in 2018q3 would be directly present in both the price measure and the exchange rate, i.e. the short term noise in both series would be highly correlated. If the coefficient on the contemporaneous cash rate term in the exchange rate equation is positive, then that would give a mechanism for the

[28] The GFC possibly provides an example of the cost channel at work in the US, with corporations facing crippling borrowing costs when rolling over debt (see Chart 7) aggressively cutting labour costs leading to an inversion of Okun's law (see Chart 11). It follows that any firm with market power would have been forced to raise prices or temporarily hold them higher than otherwise in the face of falling demand. Note that this doesn't explain the price puzzle, corporate risk spreads were rising as the fed funds rate was falling – it would lead to temporarily higher prices for a lower fed funds rate, and also an apparent short-run flattening of the price Phillip's curve. If so, corporate risk spreads would be a missing variable in both industry employment and output price (margin) equations.

cash rate to directly effect the contemporaneous price level (albeit in a totally spurious way).

- In the AUS-M exchange rate equation, an uncovered interest parity condition is assumed as a starting point, (following on from the fact that covered interest parity holds by arbitrage). (The parity condition is imposed at the long end so also depends on the bond yield equation and the equation for 10 year ahead inflation expectations.) Typically this leads to a 2-3 per cent response in the exchange rate to a 1 percentage change in the cash rate.[29] The change in the exchange rate in turn makes a significant contribution to the price and activity results. However in the historical data the systematic signal coming from changes in interest rates is small relative to the amount of noise in the exchange rate numbers. With quarterly data it would probably take very long time series to efficiently pick it up, particularly if point one is a problem. Consequently the estimated linkage is possibly much weaker in the VAR, and if so would lead to a smaller flow through of interest rates to prices.

And then there is the problem noted in the paper of controlling for inertia in policy settings and the fact that policy is responding to price surprises which would lead to a direct correlation. It seems possible that a combination of the above explains the difference in results.

All of which is a long way of saying: (a) there is not much evidence of a direct link between short-term interest rates and consumer prices through the working-capital cost channel; (b) in the case of a large shift down in global interest rates the model might tend to overstate inflation; and (c) the impact of lower long-term borrowing costs is one of a number of factors likely to impact on margins, and seems unlikely to be large enough by itself to lock in a low inflation /low interest rate world.

As always more work is needed.

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29 The exchange rate response is a source of uncertainty in model simulations (something that has been flagged for a while now see: https://www.sciencedirect.com/science/article/pii/S1474667017470881). It has limited influence in a short-term forecasting context where the spot exchange rate combined with CIP is assumed to be the best predictor of the future exchange rate, and where movements due to UIP are small relative to the uncertainty around the exchange rate outlook (around market perceptions of the equilibrium exchange rate). In a policy scenario context results will also depend on how the model is simulated, whether the default settings are used, or for example the 10 year bond rate RIGL is made fully forward looking using RIGLX. That is the sensitivity results are always contingent.

Appendix B: Uncertainty, the NAWRU, Rising Relative 15-24 Year Unemployment and the Zero Bound

Synopsis:

- In applying judgement and in deriving policy or other implications from the model results, its important to understand the sources of uncertainty around the numbers.
- There is probably a misconception that the NAWRU is a particular source of uncertainty. In one respect it's just another estimated constant/state variable among many across the model's equations.
- It hasn't been a particular source of error in the model wage forecasts over the last five years. Nor has the estimate changed much.
- Errors in the wage forecast have chiefly arisen from the variables feeding into the equation.
- The uncertainty arises from uncertainty around things like oil prices, the exchange rate, productivity growth and global developments.
- Overconfidence about the lack of confidence in the NAWRU estimate can be a source of error if it leads to unwarranted judgemental adjustment to the wage forecasts.
- That said, the level of the estimate is quite important to welfare outcomes and close study of what determines it's level yields many benefits.
- The measure on a heads basis has become increasingly unrepresentative of the degree of equilibrium underutilisation of the labour force.
- One factor arguably pushing it up is increasing relative 15-24 year old unemployment.
- Government has the power to implement policies that will address the problem.
- Policies that either reduce the structural rate of unemployment, increase productivity, or increases competition, will tend to be deflationary in the short term. That complicates but doesn't necessarily prevent their implementation at the zero bound. In fact the dynamic benefits, (higher growth, higher investment) would arguably assist in eventually exiting the zone. Reducing structural unemployment, which has a large feedback to fiscal policy, allowing fiscal expansion, may have some relative merit in this regard.

There is inevitably a lot of uncertainty around the model projections, and any projections for that matter, for inflation, activity and unemployment. But it is important to understand the source of that uncertainty. Its common for policy makers to be reported as saying that there is a great deal of uncertainty around estimates of the NAIRU, and for economists to express a degree of scepticism about the concept. But that is not true from an applied sense, at least looking at recent history and the model's past projections. The wage equation's NAWRU is actually reasonably closely determined in the model, largely reflecting a lot of work on the measurement of the wage and unemployment series that feed into it

– there is a lot of structure behind it. [30] There is also a lot of structure around the product market yielding stochastic trends for labour and capital efficiency, and also the housing market. The three markets combined, plus global developments which shape commodity prices and the exchange rate, determine where the full-model NAIRU ends up.

The NAWRU estimate from the wage equation has not been a significant source of wage forecasting error. Rather errors on wages have reflected the errors on the series that feed into the equation. The misconception that it is loosely defined and determined, has probably led to judgemental adjustments to wage forecasts in the past which have been too large. If so, then it has been a case of over-confidence about the lack of confidence leading to policy error. The key thing is that the uncertainty around the outlook isn't so much coming from the wage equation, but rather the uncertainty that surrounds exchange rates, oil prices, global bond and equity markets and developments in the real economy, including productivity.

But while not necessarily being a significant source of forecast error it is a key determinant of the degree of utilisation in the labour market and the economy as a whole, and changes to it have large welfare effects. As mentioned in the text the NAIRU measured on a heads basis is an increasingly distorted representation of the degree of utilisation. If we allow for the increased prevalence of part time work and the increased trend to underemployment of those workers, a figure of 4.6 per cent on a heads basis translates to roughly 7 per cent on an hours basis, (i.e. as percentage of the total hours being offered by households). A 7 per cent equilibrium unemployment rate in no way represents full employment. Australia should be able to do a lot better than that. As argued previously, the question for Australia should be, not: why is wage growth so puzzlingly low? but rather: why is wage growth so puzzlingly high? That is: why is the NAIRU estimate so high?

One identifiable factor pushing up the estimate is the increasing relative unemployment rates of the young people (Chart A.1). As argued in previous notes, this has multiple causes, but in some ways is the flip side of creating a

[30] There is probably also a misconception about the sensitivity of the estimate to equation specification. For example one issue of contention for the wage equation is the role of productivity, specifically, how much allowance is made for changes in trend productivity in shaping wage demands, which can raise or lower the NAWRU estimate. For example if an allowance is made for some or all of the 1990s surge in productivity to account for the pick up in wage growth during the period then that would lead to a lower estimated NAWRU for that period. (Note that in the full model a pick up in productivity growth flows through to nominal wage growth, just not directly.) But the model's price equations incorporate wages adjusted for stochastic trends of labour efficiency. That means in a *full model context* how much of the change in trend productivity is captured directly in the wage equation, has next to no impact on where the full model equilibrium unemployment rate ends up, i.e. if none flows through to wages, pushing up the estimated NAWRU, the full model NAIRU defined in price terms still ends up in the same place. (That turns it into something of a semantic issue, the sort of thing Laurence Kotlikoff points to as being common in economic language.) The specification choice changes the gap between the two but not the final result.

funding model for universities which relies on increasing exports of education services. (Changing occupational shares have reduced the proportion of entry level jobs, while the large increase in overseas students and young people on working holiday visas has increased the supply of labour for this component, despite lower participation rates.) The increase in relative unemployment in turn has interacted with the award system, with widespread reports of 'inadvertent' underpayment of young workers by restaurants and retail chains. The increase in relative youth unemployment has probably pushed up the model's NAWRU estimate as measured by something like 0.4 of a percentage point over the last decade (i.e. compared to relative levels in earlier decades – Chart A.1). This is due to a compositional effect, working in the reverse direction to that in Chart 5, and a discontinuity. Young workers, because of their high turnover represent almost 40 per cent of the unemployed, but account for a much smaller proportion of total hours worked and even less of the wage bill (around 8 per cent). That means even in normal times their unemployment has little impact on aggregate wage growth. And now, as they increasingly interact with award minimums, they cease to have any significant downward effect at all. It's a discontinuity. It follows that replacing young people in the unemployment queue, via increased training or changed relative labour costs, with older workers who exert some downward pressure on aggregate wages would lower the aggregate equilibrium unemployment rate.

There are many government wage subsidy and active labour market programs for unemployed young workers that aim to achieve this. They arguably could be usefully reviewed and expanded. Governments also have the power to change relative labour costs directly, via payroll tax concessions, and by raising the age of compulsion for superannuation. [31] On the basis of some admittedly rough estimates and assumptions, the changes to payroll tax and compulsory super on costs,[32] would be sufficient to reduce relative youth unemployment rates to around their earlier levels, via small changes in the relative probabilities of exiting the employment queue. If so then that would reduce the aggregate equilibrium unemployment rate by something like 0.3 to 0.5 of a percentage point. Given the evidence of increased rates of consumption poverty (not to mention homelessness) among young people in last year's PC research report on inequality, the welfare effects of this would likely be much larger than would be indicated by simulations in a model like AUS-M (which themselves are large).

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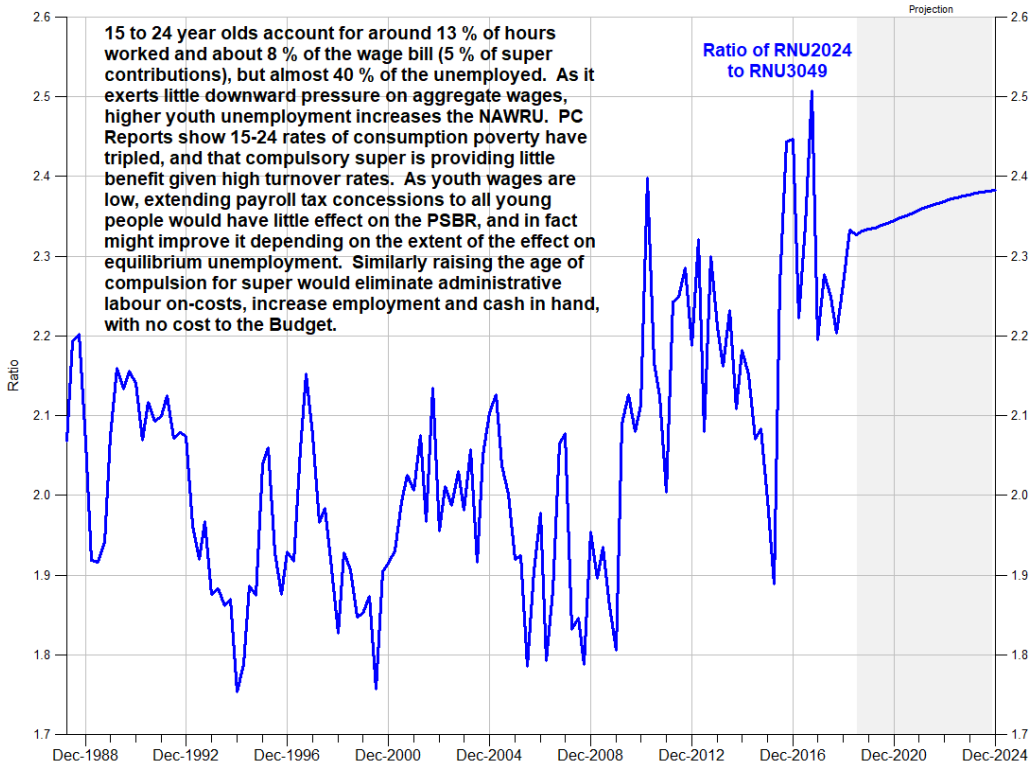
[31] On the basis of another rough calculation the impact on final superannuation balances of raising the age of compulsion to 25 would be close to totally offset by the next scheduled increase in the statutory rate. The impacts on final balances could also be offset by nudges to voluntary super for those with cash in hand, and an expansion of the first home owners super scheme. One advantage of this is that it gives young households access to the higher returns persistently earnt by the large industry super funds.

[32] Part of the reduction would be translated by the Fair Work Commission to higher award wages, i.e. increasing direct cash in hand, but importantly eliminating time consuming administrative on costs for high turnover young workers.

Chart A.1: Relative Unemployment Rates (20-24 age group to 30-49s)



Notes: Series is the 20-24 year old unemployment rate as a ratio of the 30-49 year old unemployment rate.
Data source: US BLS, OECD Economic Outlook 105, OECD Labour Statistics, Outlook Economics.

But implementing structural reforms that might reduce wage pressure is difficult at a time of already low wage growth. Chris Higgins used to say that "good microeconomic policy creates the room for good macroeconomic policy, and vice versa". That simple truth isn't altered by the fact that the economy is close to the zero bound. Reforms which reduce structural unemployment, of which the above example is only one, act to lower wage pressure but not necessarily wage growth. The effects on wage growth take some time to come through, and in theory can be entirely offset by forward looking policy settings which keep demand and the growth in the capital stock in line with the expansion of effective labour supply. For a small open economy with a floating exchange rate and where export demand elasticities are high, whichever path is taken, the real labour price index returns to very close to its baseline level. (In that respect it is no different to an exogenous increase in population or labour force participation.) Employment, the revenue base and after tax labour incomes are, in the end, all higher.[33]

The same logic is true for reforms that increase labour productivity. The increased supply is deflationary if not anticipated and accommodated. Good

[33] See Downes and Bernie (1999) for a detailed description, and Debelle and Vickery (1997) for the benefits of a forward looking monetary policy response to a fall in the NAIRU, albeit on a baseline with higher interest rates than now. With interest rates effectively at the zero bound the weight moves to fiscal policy to anticipate the structural change. (The same is true for structural reforms which increase productivity.)

microeconomic policy, requires good macroeconomic policy and feeds back to a stronger fiscal position. Higher growth engenders higher investment and hence demand for funds and would ultimately help to lift the economy out of the zero bound zone. Of all the reforms to increase growth, reducing the structural rate of unemployment has by far the greatest feedback to fiscal policy. In the case of a 1 percentage point reduction in structural unemployment, the PSBR is reduced by more than 2 percentage point of GDP, which provides room for the fiscal expansion to lift demand and lower the unemployment rate. It creates greater policy resilience. Given the challenges Australia faces, it certainly needs more of that.

Table A1: Comparison of AUS-M Model Forecasts with Treasury Budget Forecasts

	Budget (2 April 2019)				AUS-M Model (22 October 2019)				
	History	Forecasts			History		Forecasts		
	2017-18	2018-19	2019-20	2020-21	2017-18	2018-19	2019-20	2020-21	2021-22
Government Consumption					3.7	4.5	4.7	2.8	2.6
Household Consumption	2.8	2 1/4	2 3/4	3	2.8	1.9	1.4	2.5	2.8
Non-rental Consumption					2.9	1.8	1.3	2.7	3.0
Rental Consumption					2.4	2.4	2.0	1.7	2.0
Dwelling Investment	0.2	1/2	-7	-4	0.6	-0.4	-11.9	0.3	5.4
Private Business Investment					8.9	-1.0	4.3	6.7	5.5
Underlying Private Business Investment	6.0	1	5	4 1/2	6.3	-1.3	3.2	6.4	5.4
Mining Investment	-4.1	-10 1/2	4	4 1/2	-3.2	-11.0	6.6	8.3	7.3
Non-Mining Business Investment	9.7	4 1/2	5 1/2	4 1/2	9.8	1.8	2.2	5.9	4.8
Private Final Demand					3.5	0.9	0.6	3.0	3.5
Private Final Demand (Underlying)	3.0	1 1/2	2 1/4	2 3/4	3.1	0.8	0.5	3.0	3.4
Public Investment (Underlying)					9.3	4.2	-0.8	0.7	-0.4
Public Final Demand (Underlying)	4.5	5 1/2	3 1/4	3	4.7	4.4	3.6	2.4	2.1
Domestic Final Demand					3.5	1.7	1.2	2.8	3.1
Private Non-Farm Stock Building (% contrib)	0.0	0	0	0	0.0	-0.2	0.1	0.3	0.0
Gross National Expenditure	3.4	2 1/2	2 1/2	2 3/4	3.5	1.5	1.3	3.1	3.1
Exports of Goods and Services	4.1	3 1/2	4	1 1/2	4.1	3.5	5.0	4.4	3.9
Imports of Goods and Services	7.1	1 1/2	3	2 1/2	7.1	-0.1	1.1	5.4	4.5
Net Exports (% contrib)	-0.6	1/2	1/4	- 1/4	-0.6	0.8	0.8	-0.1	-0.1
Gross Domestic Product (Expenditure)					2.8	2.3	2.2	3.0	3.0
Gross Domestic Product (Income)					3.0	1.7	3.0	3.0	2.8
Gross Domestic Product (Production)					2.9	1.9	1.9	2.8	3.0
Gross Domestic Product (Average)	2.8	2 1/4	2 3/4	2 3/4	2.9	2.0	2.3	2.9	2.9
Gross Non-Farm Product					3.0	2.2	2.4	2.8	2.8
Non-Commodity GDP					3.0	1.9	2.1	2.8	2.9
Nominal GDP	4.7	5	3 1/4	3 3/4	4.8	5.3	3.5	3.4	4.3
Terms of Trade	1.7	4	-5 1/4	-4 3/4	1.7	6.0	-1.8	-4.3	-0.4
Current Account Balance as a % of GDP	-2.8	-1 3/4	-2 3/4	-3 3/4	-2.8	-0.6	0.5	-0.5	-0.6
Total Employment					3.0	2.4	2.1	1.6	1.8
Through the year	2.7	2	1 3/4	1 3/4	2.7	2.6	1.6	1.8	1.8
Employment Demand					3.3	2.5	1.9	1.7	1.9
Unemployment Rate (%)					5.5	5.1	5.3	5.1	4.9
End Year	5.4	5	5	5	5.4	5.2	5.3	5.0	4.8
Labour Force Participation Rate (15-64)					81.1	81.6	82.4	82.7	83.1
Labour Force Participation Rate (15 plus)					65.5	65.7	66.1	66.2	66.2
End Year	65.6	65 1/2	65 1/2	65 1/2	65.6	66.0	66.2	66.2	66.2
Household Consumption - deflator					1.4	1.7	1.8	1.7	1.8
Non-rental consumption - deflator					1.4	1.8	2.0	1.7	1.6
Rental consumption - deflator					1.5	1.3	1.3	1.7	2.4
CPI: All groups					2.0	1.6	1.8	1.9	1.9
Through the year	2.1	1 1/2	2 1/4	2 1/2	2.2	1.4	1.8	2.0	1.9
Gross Domestic Product Deflator	1.8	2 1/2	1/2	1	1.8	3.3	1.2	0.5	1.3
Average Weekly Earnings (QNA Basis)					1.4	1.8	2.7	2.6	2.9
Average Hourly Earnings (Av of ABS Measures)					1.6	2.0	2.9	2.8	3.0
Average Hourly Earnings Quality Adjusted					1.6	1.8	2.5	2.4	2.7
Wage Price Index					2.1	2.3	2.3	2.4	2.7
Through the year:	2.1	2 1/2	3	3 1/2	2.1	2.3	2.4	2.5	2.8
90 Day Bill Rate (end year) (a)	2.0	2.0	2.0	2.0	2.0	1.5	0.7	0.7	1.0
10 Year Bond Rate (end year) (a)	2.7	2.2	2.2	2.3	2.7	1.6	1.0	0.9	0.9
Exchange Rate ($US/$A end year)	0.76	0.71	0.71	0.71	0.76	0.70	0.68	0.68	0.68
Oil Price ($US/Barrel Tapis end year)	76	67	67	67	76	71	61	60	59
Commonwealth Budget Balance (b)	-0.5	-0.2	0.4	0.5	-0.8	0.0	0.2	0.1	0.3
National PSBR % of GDP (c)					0.7	0.3	0.0	0.1	-0.3
GST Revenue ($Bill) (d)	65.5	69.2	71.7	75.4	69.8	72.2	73.3	76.6	80.4

Notes: Figures are growth rates unless otherwise indicated – "end year" refers to average of last quarter for the year. (a) Treasury based on market expectations a week before Budget. (b) Commonwealth underlying cash balance as a percentage of GDP. (c) Public Sector Borrowing Requirement including state and local government – note that the ABS allocates part of the statistical discrepancy to the PSBR in balancing the national accounts. (d) Budget figures on a cash basis compared to national accounts figures on an accruals basis.
Data source: Treasury Budget 2 April 2019, AUS-M model simulations based on June Quarter 2019 QNA, Outlook Economics.

Table A2: AUS-M Model Forecasts: 22 October versus 26 April 2019

	AUS-M Model (26 April 2019)				AUS-M Model (22 October 2019)				
	History	Forecasts			History		Forecasts		
	2017-18	2018-19	2019-20	2020-21	2017-18	2018-19	2019-20	2020-21	2021-22
Government Consumption	3.7	5.1	3.2	2.8	3.7	4.5	4.7	2.8	2.6
Household Consumption	2.8	1.9	1.8	2.6	2.8	1.9	1.4	2.5	2.8
Non-rental Consumption	2.9	1.8	1.8	2.7	2.9	1.8	1.3	2.7	3.0
Rental Consumption	2.4	2.4	2.0	1.9	2.4	2.4	2.0	1.7	2.0
Dwelling Investment	0.2	0.1	-7.0	-0.1	0.6	-0.4	-11.9	0.3	5.4
Private Business Investment	8.6	0.0	3.5	6.4	8.9	-1.0	4.3	6.7	5.5
Underlying Private Business Investment	6.0	-0.7	2.9	6.2	6.3	-1.3	3.2	6.4	5.4
Mining Investment	-3.8	-10.9	3.3	14.6	-3.2	-11.0	6.6	8.3	7.3
Non-Mining Business Investment	9.6	2.5	2.9	3.8	9.8	1.8	2.2	5.9	4.8
Private Final Demand	3.4	1.1	1.2	3.0	3.5	0.9	0.6	3.0	3.5
Private Final Demand (Underlying)	3.0	1.0	1.1	3.0	3.1	0.8	0.5	3.0	3.4
Public Investment (Underlying)	8.0	8.1	2.5	0.4	9.3	4.2	-0.8	0.7	-0.4
Public Final Demand (Underlying)	4.5	5.6	3.1	2.3	4.7	4.4	3.6	2.4	2.1
Domestic Final Demand	3.4	2.0	1.6	2.8	3.5	1.7	1.2	2.8	3.1
Private Non-Farm Stock Building (% contrib)	0.0	-0.1	0.1	0.1	0.0	-0.2	0.1	0.3	0.0
Gross National Expenditure	3.4	2.0	1.7	2.9	3.5	1.5	1.3	3.1	3.1
Exports of Goods and Services	4.1	3.4	5.2	3.5	4.1	3.5	5.0	4.4	3.9
Imports of Goods and Services	7.1	0.9	3.0	4.8	7.1	-0.1	1.1	5.4	4.5
Net Exports (% contrib)	-0.6	0.5	0.5	-0.3	-0.6	0.8	0.8	-0.1	-0.1
Gross Domestic Product (Expenditure)	2.7	2.6	2.1	2.6	2.8	2.3	2.2	3.0	3.0
Gross Domestic Product (Income)	3.0	1.6	1.9	2.6	3.0	1.7	3.0	3.0	2.8
Gross Domestic Product (Production)	2.9	1.9	2.2	2.7	2.9	1.9	1.9	2.8	3.0
Gross Domestic Product (Average)	2.8	2.0	2.1	2.6	2.9	2.0	2.3	2.9	2.9
Gross Non-Farm Product	3.0	2.3	2.0	2.6	3.0	2.2	2.4	2.8	2.8
Farm Product	-3.4	-7.9	4.6	5.9	-1.8	-7.1	0.0	8.9	7.0
Non-Commodity GDP	3.0	2.0	1.9	2.7	3.0	1.9	2.1	2.8	2.9
Nominal GDP	4.7	5.1	4.2	3.7	4.8	5.3	3.5	3.4	4.3
Terms of Trade	1.7	5.0	0.2	-1.3	1.7	6.0	-1.8	-4.3	-0.4
Current Account Balance as a % of GDP	-2.8	-1.2	-0.4	-0.8	-2.8	-0.6	0.5	-0.5	-0.6
Total Employment	3.0	2.3	1.5	1.8	3.0	2.4	2.1	1.6	1.8
Through the year	2.7	2.0	1.4	2.0	2.7	2.6	1.6	1.8	1.8
Employment Demand	3.3	2.4	1.5	1.9	3.3	2.5	1.9	1.7	1.9
Unemployment Rate (%)	5.5	5.1	5.1	4.9	5.5	5.1	5.3	5.1	4.9
End Year	5.4	5.2	5.1	4.7	5.4	5.2	5.3	5.0	4.8
Labour Force Participation Rate (15-64)	81.1	81.5	81.8	82.1	81.1	81.6	82.4	82.7	83.1
Labour Force Participation Rate (15 plus)	65.5	65.6	65.6	65.6	65.5	65.7	66.1	66.2	66.2
End Year	65.6	65.6	65.6	65.7	65.6	66.0	66.2	66.2	66.2
Household Consumption - deflator	1.4	1.7	2.1	1.7	1.4	1.7	1.8	1.7	1.8
Non-rental consumption - deflator	1.4	1.7	2.1	1.5	1.4	1.8	2.0	1.7	1.6
Rental consumption - deflator	1.5	1.6	2.1	2.5	1.5	1.3	1.3	1.7	2.4
CPI: All groups	2.0	1.8	2.6	2.0	2.0	1.6	1.8	1.9	1.9
Through the year	2.2	1.9	2.5	1.8	2.2	1.4	1.8	2.0	1.9
Gross Domestic Product Deflator	1.8	3.0	2.1	2.5	1.8	3.3	1.2	1.8	1.9
Average Weekly Earnings (QNA Basis)	1.4	1.8	2.6	4.2	1.4	1.8	2.7	2.6	2.9
Average Hourly Earnings (Av of ABS Measur	1.7	2.1	2.9	4.3	1.6	2.0	2.9	2.8	3.0
Average Hourly Earnings Quality Adjusted	1.5	1.7	2.4	4.1	1.6	1.8	2.5	2.4	2.7
Wage Price Index	2.1	2.3	2.4	4.1	2.1	2.3	2.3	2.4	2.7
Through the year:	2.1	2.3	2.5	2.5	2.1	2.3	2.4	2.5	2.8
90 Day Bill Rate (end year) (a)	2.0	1.7	1.3	1.3	2.0	1.5	0.7	0.7	1.0
10 Year Bond Rate (end year) (a)	2.7	1.5	1.3	1.2	2.7	1.6	1.0	0.9	0.9
Exchange Rate ($US/$A end year)	0.76	0.70	0.70	0.70	0.76	0.70	0.68	0.68	0.68
Oil Price ($US/Barrel Tapis end year)	76	69	64	63	76	71	61	60	59
Commonwealth Budget Balance (b)	-0.6	0.1	-0.1	0.2	-0.8	0.0	0.2	0.1	0.3
National PSBR % of GDP (c)	0.6	0.7	0.7	0.2	0.7	0.3	0.0	0.1	-0.3
GST Revenue ($Bill) (d)	68.8	72.3	74.5	78.1	69.8	72.2	73.3	76.6	80.4

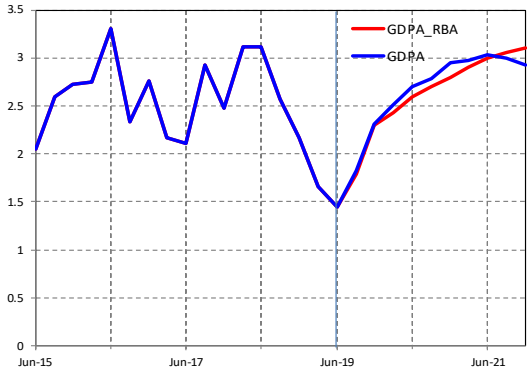
Notes: Figures are growth rates unless otherwise indicated – "end year" refers to average of last quarter for the year. (a) Model projections using optimal control (constrained to hold interest rates unchanged in the short term). (b) Commonwealth underlying cash balance as a percentage of GDP. (c) Public Sector Borrowing Requirement including state and local government – note that the ABS allocates part of the statistical discrepancy to the PSBR in balancing the national accounts. (d) ABS QNA accruals basis.
Data source: AUS-M model database and simulations, Outlook Economics.

Summary Table: Model Baseline 22 Oct 2019	Financial Year					Decade Averages						
	2018-19	2019-20	2020-21	2021-22	2022-23	2000s	2010s	2020s	2030s	2040s	2050s	
National Accounts by Expenditure												
Government Consumption	4.46	4.67	2.81	2.63	2.60	3.06	3.51	2.72	2.43	2.15	1.80	P
Household Consumption	1.92	1.44	2.49	2.80	2.85	3.72	2.80	2.89	2.53	1.87	1.65	P
Non-rental Consumption	1.80	1.30	2.68	3.00	2.99	3.90	2.87	3.00	2.55	1.89	1.74	P
Rental Consumption	2.42	2.02	1.71	1.96	2.28	3.04	2.52	2.43	2.44	1.77	1.23	P
Dwelling Investment	-0.45	-11.87	0.34	5.39	6.69	0.80	1.42	3.31	1.94	-0.01	0.66	P
Attached Dwelling Investment	-3.54	-16.76	-6.54	-2.33	2.48	0.32	7.34	3.18	2.00	-0.01	0.66	P
Underlying Private Business Investment	-1.30	3.19	6.45	5.35	5.09	7.53	0.98	3.60	1.61	1.36	1.43	P
Machinery and Equipment: - IPES	3.47	4.42	7.16	7.58	7.21	8.12	1.11	4.01	1.13	0.98	1.06	P
Other Building and Structures: - IOBS	-7.23	1.29	5.68	3.21	3.12	6.20	0.14	3.00	1.56	1.22	1.48	P
Private Final Demand	0.89	0.62	2.99	3.46	3.57	3.77	2.32	3.06	2.34	1.65	1.55	P
General Government Investment (Underlying)	7.65	0.17	2.79	-2.11	-0.34	8.21	4.61	1.42	2.22	1.95	1.79	P
Government Final Demand (Underlying)	4.41	3.64	2.42	2.10	1.96	3.71	3.26	2.39	2.50	2.11	1.78	P
Gross National Expenditure (A)	1.19	1.50	3.12	3.06	3.09	3.73	2.57	2.90	2.42	1.78	1.61	P
Imports of Goods and Services	-0.11	1.10	5.38	4.53	4.07	7.46	3.94	3.51	2.46	1.97	1.65	P
Exports of Goods and Services	3.47	4.96	4.40	3.90	3.25	3.13	5.31	2.57	2.30	2.19	1.89	P
Gross Domestic Product (Average)	1.96	2.34	2.94	2.94	2.91	3.04	2.84	2.69	2.39	1.82	1.67	P
GDP per Capita (GDPA/NPOP)	0.48	0.83	1.80	1.86	1.73	1.56	1.08	1.34	1.11	0.97	0.81	P
Real Gross Disposable Income	3.03	2.86	2.73	2.94	2.64	3.94	2.81	2.73	2.39	2.05	1.79	P
National Accounts by Production												
Gross Product at Basic Prices: Agriculture, Forestry & Fishing	-7.06	0.02	8.93	6.99	4.70	1.90	-0.28	4.42	2.36	1.49	1.18	P
Gross Product at Basic Prices: Mining	5.40	5.42	2.55	2.64	2.22	3.66	6.55	1.60	1.82	2.66	2.23	P
Gross Product at Basic Prices: Manufacture	-1.47	-3.46	-0.05	0.93	0.96	0.93	-1.01	1.10	1.49	1.15	1.47	P
Gross Product at Basic Prices: Construction	-3.63	-3.13	1.24	2.82	3.64	4.90	1.32	2.71	1.73	0.52	0.77	P
Gross Product at Basic Prices: Distributional Services (FGI)	0.77	1.33	3.92	3.56	3.18	3.62	2.36	2.78	2.09	1.65	1.75	P
Gross Product at Basic Prices: Finance and Insurance	2.44	2.26	3.20	3.86	3.85	4.27	3.45	3.58	3.69	2.41	2.06	P
Gross Product at Basic Prices: Property and Business Services (LMN	3.73	3.42	4.27	4.34	4.27	3.34	4.23	3.59	2.62	1.87	1.75	P
Gross Product at Basic Prices: Consumer Services (HRS)	2.78	3.17	2.81	2.48	2.36	2.20	2.30	2.34	2.01	1.56	1.56	P
Gross Product at Basic Prices: Communications	2.75	8.37	6.63	4.00	3.74	4.00	4.23	4.08	2.39	1.58	1.64	P
Gross Product at Basic Prices: Human Capital and Administration (OI	4.97	3.37	2.47	2.47	2.53	3.25	3.43	2.56	2.45	2.07	1.75	P
Output of Dwellings	2.43	2.02	1.72	1.97	2.29	2.34	1.86	2.43	2.44	1.77	1.23	P
Indirect Taxes Less Subsidies on Products	0.12	-0.97	1.25	2.29	2.57	1.80	1.64	2.40	2.33	1.82	1.69	P
Gross Domestic Product (Production)	1.91	1.87	2.84	3.02	2.99	3.04	2.78	2.73	2.38	1.83	1.68	P
National Accounts by Income												
GOS Agriculture	-21.21	3.90	16.99	12.47	7.36	7.58	6.76	7.64	4.42	3.55	3.22	P
GOS Mining	25.98	11.06	-6.66	0.85	3.28	13.50	6.11	2.00	2.61	3.96	3.74	P
GOS Manufacturing	2.96	2.18	-3.34	1.48	3.21	2.60	-0.31	2.51	3.83	3.37	3.76	P
GOS Construction	17.24	-11.97	-1.73	-2.59	-1.67	9.70	6.03	-1.38	4.76	3.32	3.91	P
GOS Non-Financial Private Corporations	11.66	8.54	-0.11	2.45	3.01	9.29	4.83	2.90	3.73	4.02	3.87	P
GOS Financial Services	7.21	5.91	1.87	2.08	3.08	8.39	6.79	2.92	3.98	3.82	3.20	P
GOS Property and Business Services	15.11	-4.96	-0.60	1.17	2.17	18.10	9.29	3.72	4.78	4.41	3.33	P
GOS Consumer Services	4.87	-1.14	13.20	8.17	5.03	8.93	1.58	5.76	5.16	4.48	4.59	P
GOS Communication Services	-12.96	6.92	17.96	4.71	-2.09	5.85	-0.73	2.32	3.06	3.86	3.72	P
GOS Electricity Gas and Water	12.12	1.36	9.69	4.27	0.81	5.20	7.35	2.85	4.66	4.20	4.70	P
GOS Human Capital Services	4.43	-4.98	11.15	7.81	5.42	6.08	3.11	6.80	6.91	4.50	4.58	P
WSS Total	4.33	5.54	4.31	4.71	4.91	6.67	5.01	4.93	5.24	4.65	4.04	P
Indirect Taxes Less Subsidies on Products (Current Prices)	0.25	1.29	4.56	5.03	4.86	5.56	4.42	4.72	4.71	4.10	3.81	P
GDP at Market Prices (Income measure of GDP)	5.02	4.20	3.48	4.14	4.37	7.00	4.86	4.38	4.81	4.39	3.97	P
Gross Disposable Income (allows for transfers of income by residents	5.00	4.91	3.78	4.27	4.17	6.88	4.97	4.45	4.85	4.40	3.98	P
Real Gross Disposable Income	3.03	2.86	2.73	2.94	2.64	3.94	2.81	2.73	2.39	2.05	1.79	P
Gross Domestic Product (Income)	1.67	2.99	3.02	2.80	2.79	3.05	2.89	2.65	2.45	1.84	1.65	P
Prices and Wages												0
Gross Domestic Product (A) - deflator	3.29	1.18	0.45	1.30	1.53	3.83	1.92	1.68	2.30	2.51	2.28	P
Consumer Price Index: 16th Series	1.63	1.80	1.94	1.92	1.81	3.16	2.29	1.98	2.40	2.55	2.34	P
Household Consumption - deflator	1.70	1.83	1.73	1.76	1.77	2.82	2.07	1.82	2.10	2.33	2.23	P
Non-rental consumption - deflator	1.78	1.96	1.74	1.62	1.42	2.40	1.91	1.67	2.20	2.37	2.10	P
Rental consumption - deflator	1.35	1.29	1.71	2.35	3.23	4.63	2.72	2.47	1.70	2.17	2.80	P
Wage Price Index	2.31	2.34	2.39	2.69	2.89	3.71	2.96	3.06	3.65	3.45	2.98	P
Labour Market												
Total Employment	2.41	2.06	1.63	1.82	1.77	2.17	1.88	1.55	1.20	0.81	0.73	P
Labour Force (persons)	2.01	2.24	1.46	1.51	1.50	2.05	1.92	1.41	1.16	0.86	0.73	P
Unemployment Rate:	5.12	5.29	5.14	4.85	4.60	5.47	5.51	4.42	3.73	3.88	4.22	L
Civilian Adult Population - Working Age aged 15 - 64 (persons)	1.34	1.22	1.10	1.12	1.14	1.56	1.42	1.10	1.08	1.02	0.74	P
Average Hours Worked	-0.32	-0.49	-0.20	-0.05	0.02	-0.53	-0.31	-0.06	-0.01	0.00	0.01	P
Financial Market												
90 Day Bill Rate	1.85	0.84	0.70	0.83	1.19	5.49	2.86	1.42	2.03	2.84	2.96	L
10 Year Bond Rate	2.24	0.99	0.93	0.90	1.01	5.65	3.44	1.39	2.29	3.10	3.28	L
Trade Weighted Exchange Rate	-4.79	-3.34	-0.18	0.02	0.00	2.24	-0.14	-0.02	0.00	0.00	0.00	P
Real Long Term Interest Rates of Australia's Major Trading:	-0.20	-0.44	-0.30	-0.18	-0.09	2.42	0.23	-0.05	0.40	1.03	1.31	L
Balance of Payments												0
Terms of Trade	6.01	-1.80	-4.27	-0.38	0.40	4.76	-0.08	-0.24	-0.14	0.17	0.07	P
Trade Balance: * 100 / GDPAZ	2.56	3.02	1.81	1.60	1.51	-1.52	-0.03	1.25	-0.19	0.13	0.94	L
Net Income Balance: * 100 / GDPAZ	-3.20	-2.56	-2.28	-2.15	-2.33	-3.46	-3.07	-2.29	-1.64	-1.54	-1.40	L
Current Account Balance: * 100 / GDPAZ	-0.64	0.47	-0.47	-0.56	-0.82	-4.98	-3.10	-1.04	-1.83	-1.41	-0.46	L
Net Foreign Liabilities: * 25 / GDPAZ	52.89	49.40	46.58	44.58	42.12	54.39	55.39	39.95	34.93	31.64	27.06	L
House Prices, Wealth and Consumption												
House price index: Australia-wide (ABS Capitals adjusted for regional	-5.47	-1.19	6.16	4.65	3.81	7.59	3.78	3.89	3.15	2.86	2.76	P
Real Equity Prices (S&P200)	1.61	8.30	0.48	0.44	-0.14	1.30	3.18	0.38	-0.34	-0.33	0.02	P
Investment Q Ratio: Mining	1.73	1.80	1.55	1.50	1.50	2.42	2.07	1.58	1.62	1.41	1.30	L
Private Sector Wealth (current market prices)	0.05	4.33	5.92	5.31	5.01	8.86	7.01	5.39	5.03	4.48	4.21	P
Household labour and benefit income (current prices)	2.64	4.62	3.99	4.54	4.77	7.00	3.81	4.70	4.97	4.44	3.93	P
Capital and other income (including capital gains)	7.95	6.58	2.00	2.82	2.98	9.17	5.32	3.05	3.95	4.17	4.02	P
Average income tax rate on labour income	0.25	0.25	0.25	0.25	0.25	0.23	0.22	0.26	0.27	0.28	0.29	L
Rental Vacancies	2.60	2.66	2.30	1.79	1.58	2.58	2.42	2.46	3.11	2.90	2.32	L
Household Consumption with Imputed Services	2.06	1.74	2.20	2.55	2.77	3.68	2.88	2.85	2.59	1.91	1.67	P
Durables and other goods	3.87	2.23	5.17	5.16	4.63	6.57	4.54	4.30	2.95	2.18	1.60	P
Motor vehicles	-3.68	-6.09	6.02	8.21	5.20	2.40	3.34	4.48	2.17	1.60	1.63	P
Other Services	1.20	1.84	2.03	2.23	2.51	2.39	2.22	2.67	2.57	1.82	1.95	P
General Government Sector												0
Income tax revenue (taxes on labour income)	8.02	5.33	5.29	5.09	5.38	4.19	6.76	5.20	3.95	2.97	2.59	P
Total General Government Revenue	5.80	4.78	3.57	4.27	4.41	5.24	5.76	4.43	4.98	4.61	4.19	P
Total Expenditure	4.58	3.75	3.74	3.03	3.46	7.16	4.70	4.34	5.22	4.90	4.34	P
Public Sector Borrowing Requirement: / GDPAZ	0.30	0.04	0.08	-0.31	-0.61	-0.32	2.36	-0.54	0.00	0.80	1.66	L

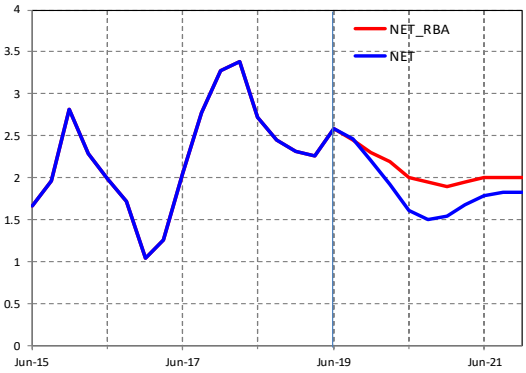
P = Annual Percentage Change
L = Average Level (average of quarterly levels)

Chart A.2: Comparison of AUS-M Baseline and RBA SMP Forecasts

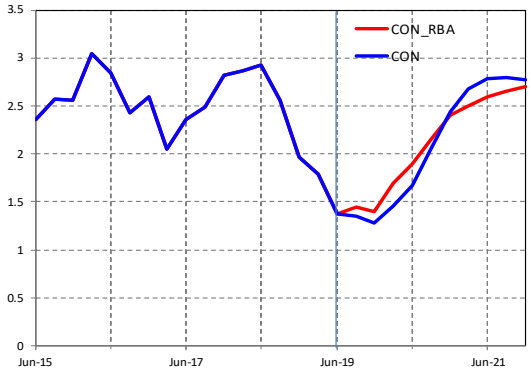
GDP Growth: RBA (8 Nov MPS) and Model



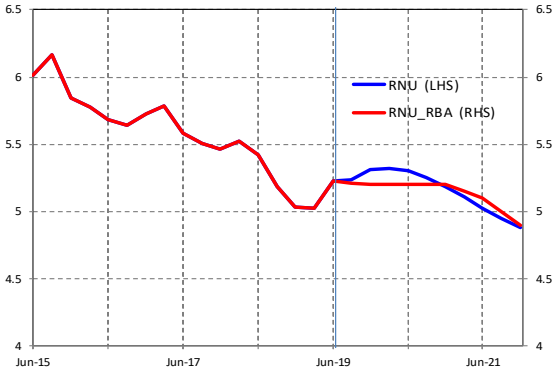
Employment Growth: RBA and Model



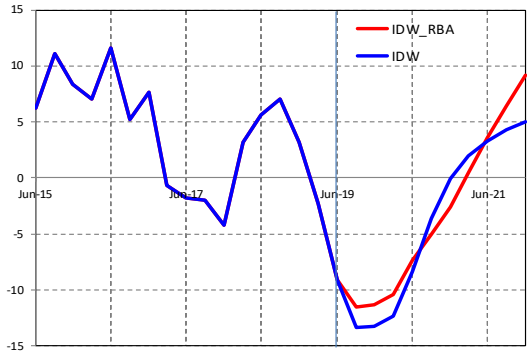
Household Consumption: RBA and Model



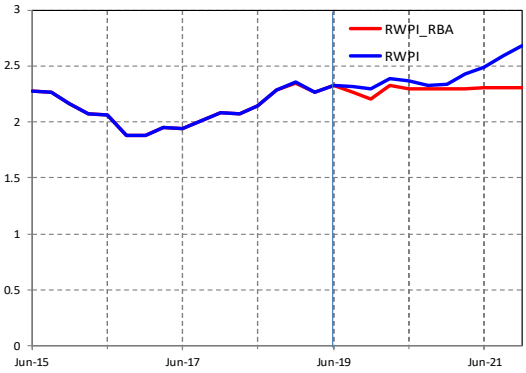
Unemployment Rate: RBA and Model



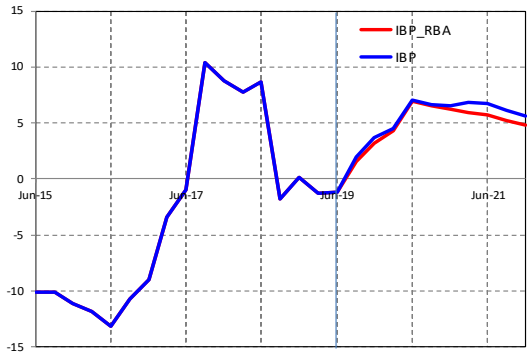
Dwelling Investment: RBA and Model



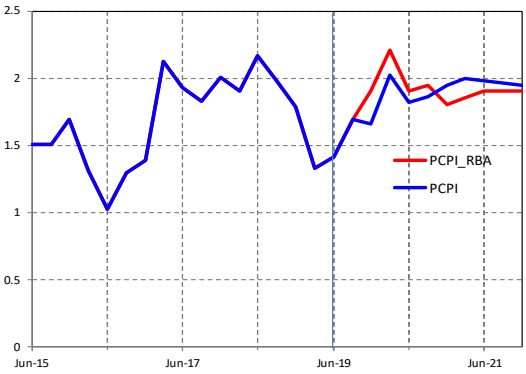
Labour Price Index: RBA and Model



Private Business Investment: RBA and Model



Headline CPI: RBA and Model



Notes: Series are through the year % changes rates except for the unemployment rate. RBA series interpolated from published table.
Data source: RBA Statement on Monetary Policy 8 November 2019, AUS-M Model 22 October 2019 Baseline, Outlook Economics.