Method for generating forecasts of macroeconomic indicators

Macroeconomic Strategy, Economic Policy Group, Department of Treasury and Finance

December 2019

The Department of Treasury and Finance (DTF) monitors economic conditions in the Victorian economy and prepares forecasts of the main economic indicators of those conditions for the budget year and three ensuing years.[[1]](#footnote-2) The economic forecasts underpin the Government's fiscal outlook presented in the *Budget* and *Budget Update*.

The key economic indicators are forecast growth in real gross state product (GSP) and the level of nominal GSP, growth in employment, the unemployment rate, growth in wages (as measured by the Wage Price Index, or WPI), growth in consumer prices (as measured by the Melbourne Consumer Price Index, or CPI) and population growth.

The aim of this paper is to help the reader understand the methods used by DTF to undertake macroeconomic forecasts.[[2]](#footnote-3)

## Approach

A number of methods and sources of information are employed to generate macroeconomic forecasts. These include consideration of recent and current recorded values, econometric modelling, trends suggested by leading indicators, economic theory, industry and business liaison, insights provided by other forecasts, and the experience and intuition of DTF analysts.

The forecasting process is iterative. Many of the variables in equations are common, and dependent variables in one model may be explanatory variables in others, requiring several rounds to ensure convergence. In the process other sources of external information and the judgement and experience of the forecasters are used.

There is a point in recent history where actuals for each of the variables to be forecast are known (notwithstanding that the Australian Bureau of Statistics (ABS) often revises published data). This information provides the launch point for the forecasts.

Values for the final year(s) of the forecast period are treated as long‑run steady-state or trend values. These trend values may be derived from economic theory and based on fundamental drivers.[[3]](#footnote-4) (Sometimes, though, there may be good reason to depart from the trend values suggested by theory.) With the first forecast period grounded by the last measured values and trend values used to describe the last years of the forecast period, the forecasters’ task becomes filling in the path of a given economic variable over the intervening period.

The methodology is reviewed before each forecasting round with new parameters calculated from updated data, or new model specifications. From time to time more extensive reviews of the forecasting process are undertaken.

The following sections describe the methods used to forecast each of the main components of GSP, the labour market, the CPI, the WPI and population. Sources of data used to construct the models and adjust for contemporaneous and other influences are also provided.

## Gross state product

Real GSP is the sum of its expenditure components: household consumption, dwelling investment and ownership transfer costs, business investment, government expenditure, net international trade and the balancing item. Each of the components is forecast separately and aggregated to form a forecast of real GSP.

The trend value of real GSP is projected using estimates of the key long-run drivers of economic growth: population, workforce participation[[4]](#footnote-5) and productivity.

The framework also employs a measure of growth in the price deflator for GSP. This, with the most recent actual value published by the ABS, enables the generation of forecasts of nominal GSP. The GSP deflator forecasts are informed by forecast movements in the CPI.

Household consumption

Definition

Household final consumption expenditure (consumption) consists of the expenditure by households, including imputed expenditure, incurred by consuming goods and services.

Method

Consumption forecasts are based primarily on econometric relationships with key drivers, augmented by consideration of recent performance of indicators.

The long‑run equilibrium level of real consumption is determined by assumptions about population growth, labour income (total real compensation of employees), real net worth and the mortgage rate. In the short-run, a regression model is used to forecast consumption, and includes retail sales and consumer sentiment.

Household spending is positively related to labour income: all else equal, households will spend a share of their income, so growth in income leads to greater expenditure. Increases in household net worth are also linked with increased consumption for a given level of income.

Household spending is inversely related to the mortgage rate. Lower mortgage rates imply lower interest repayments on loans, increasing disposable income and boosting expenditure.

The consumption forecasts are generated, then adjusted based on additional information including data on retail trade, consumer sentiment, household savings behaviour and the composition of recent consumption spending (e.g. on discretionary and non‑discretionary goods and services). Trend consumption expenditure growth informs forecasts beyond the near‑term.

**Data sources**

Historical estimated resident population data is sourced from the ABS, *Australian Demographic Statistics* (catalogue 3101.0). Forecast ERP is sourced from population forecasts produced by the Macroeconomic Strategy team.

Historical real household consumption is the chain volume measure of Victorian household final consumption expenditure obtainable from ABS, *Australian National Accounts* (catalogue 5206.0).

Total compensation of employees is the only source of household income available on a quarterly basis at the state level. Data are sourced from ABS, *Australian National Accounts* (catalogue 5206.0). Total compensation of employees is projected using the wage price index and employment forecasts (see below).

Real Victorian compensation of employees is calculated as Victorian compensation of employees divided by the Victorian implicit price deflator (IPD) for household consumption. The Victorian IPD for household consumption is derived by dividing Victorian nominal household consumption by Victorian real household consumption.

Australian real household net worth is calculated as the difference between Australian household assets less liabilities divided by the Victorian implicit price deflator for household consumption. Data on the Australian household assets and liabilities are sourced from the Reserve Bank of Australia (RBA), *Household and Business Balance Sheets*, Table E1. Forecasts are based on ARIMA models which use up‑to‑date data on share prices.

The mortgage rate is the standard variable loan rate that Australian banks set. Data on the standard variable loan rate is obtainable from the RBA, *Indicator Lending Rates*, Table F5.

The Victorian implicit price deflator for household consumption is projected based on consumer price index forecasts (see below).

Private investment

Definitions

The term ‘private investment’ is used here as short-hand for the National Accounts’ category of private gross fixed capital formation. Private investment comprises dwelling investment, ownership transfer costs and business investment.

Dwelling investment and ownership transfer costs

Definitions

Dwelling investment is the value of acquisitions of new dwellings, home improvements (alterations and additions), and conversions from non-dwellings to dwellings (as defined by the ABS, *Australian System of National Accounts: Concepts, Sources and Methods*, 2015, catalogue 5216.0).

OTC consist of fees paid to lawyers; fees and commissions paid to real estate agents and auctioneers; stamp duty; title office charges; and local government charges (as defined by ABS, *Australian System of National Accounts: Concepts, Sources and Methods, 2015*, catalogue 5216.0).

Method

Dwelling forecasts are derived using an iterative process involving review of recent and historical data, consideration of forward indicators and other information, econometric analysis and judgement. Informal information considered when determining forecasts includes movements in the number of building approvals, the number and value of housing finance commitments, the future path of interest rates, consumer sentiment, economic growth and recent new home sales. Where relevant, this additional information may be included as adjustment factors in forecasts generated by the econometric model.

The econometric model follows an error correction specification. This accommodates both long‑run equilibrium relationships between the variable being forecast and the explanatory variables and short-run movements from the long-run value. The dependent variable is the year‑ended percentage change in dwelling investment. Using year‑ended growth rates smooths out the quarter‑on‑quarter volatility in the series to enable the model to extract a better signal from the data.

Dwelling investment is modelled exclusively using demand‑side factors, where supply is assumed to adjust perfectly to changes in demand. In the short run, Melbourne established house prices are the most intuitive, readily measured and economically significant of the demand drivers tested.

An increase in the growth rate of the residential property price index in the current period is expected to lead to a positive growth rate of dwelling investment, assuming all other factors remain constant. The intuition for this is that when potential house builders see the price of established houses rising, they will be encouraged to make an investment in housing. There will be immediate effects, but depending on the characteristics of the households, there will also be lagged effects to account for the time taken for households to obtain finance, get building permits approved, select builders and other requirements before the full impact of house prices start to flow through to investment.

In the long‑run, dwelling investment is largely driven by demographic factors. An increase in the population leads to an increase in dwelling investment, due to the related increase in demand for housing. A fall in average household size implies an increase in the number of households and, consequently, in the number of houses.

The ownership transfer cost (OTC) forecasts are based on consideration of recent data, judgement and some econometric modelling. The econometric model is a simple linear relationship between the volume of OTC and the volume of land transfer duty transactions. An increase in land transfer duty volumes will lead to both concurrent and lagged increases in ownership transfer costs. The lagged response possibly reflects real estate agents charging and receiving fees some time after a property transaction is finalised.

Data sources

Dwelling investment for Victoria is sourced from ABS, *Australian National Accounts* (catalogue 5206.0).

The residential property price index for Melbourne is from the CoreLogic Hedonic Home Value Index. The use of a hedonic series is useful in overcoming the issue of compositional bias associated with median price and repeat sales measures. The base period for the index is 31/12/2009.

The historical series for Victoria's total estimated resident population is sourced from the ABS, *Australian Demographic Statistics* (catalogue 3101.0) while forecasts are provided by the Victorian Department of Environment, Land, Water and Planning (DELWP) and the Department of Treasury and Finance.

Persons per household for Victoria is calculated as the estimated resident population divided by the number of households in Victoria. The forecasts of the number of households are provided by DELWP and DTF.

Ownership transfer costs for Victoria are sourced from ABS, *Australian National Accounts* (catalogue 5206.0). Land transfer duty volumes are sourced from the in‑house land transfer duty model used for tax forecasting.

Business investment

Definition

Business investment comprises four components: non‑dwelling construction, machinery and equipment, intellectual property products, and biological cultivated resources.

Non‑dwelling construction contributes significantly to the volatility of business investment and reflects the lumpy nature of major long‑term projects, while machinery and equipment investment is relatively short‑term in nature. Intellectual property products exhibit relatively stable growth over time.

Method

Victorian business investment is forecast using a combination of methods, including the output of an econometric model modified with adjustments informed by partial indicators and qualitative analysis.

Econometric analysis is undertaken with a single equation ordinary least squares model. Business investment forecasts are explained by changes to the lending margin for investment in Australian business and movements in the risk‑free cost of capital (the cash rate). Victorian business conditions and historical levels of Victorian business investment are the other explanatory variables.

The lending margin is the difference between the cost of borrowing for a small business and the risk‑free rate of return. The small business weighted‑average rate on credit outstanding is sourced from the RBA and the official cash rate is used as a proxy for the risk‑free cost of capital. A decrease in the lending margin indicates that lenders require a lower rate of return to invest in Australian business. Lower required rates of return will have a positive effect on business investment. A decrease in the official cash rate leads to lower borrowing costs, and positively affects business investment.

When the economy is performing well and business conditions are good, business investment tends to grow. Survey data from the National Australia Bank (NAB) is used as the measure of business conditions in Victoria.

A large component of business investment is long‑term, so business investment in the previous quarter is correlated with current levels of business investment. Investment inertia is included in the form of last quarter's growth in Victorian business investment.

Because business investment is highly volatile and there are limited explanatory variables of statistical significance, DTF uses a number of other indicators to inform the forecasts. These include projected capacity utilisation (from NAB business survey), investment intentions information (from the Deloitte Access Economics *Investment Monitor*), survey data about profitability (from NAB business survey), building activity (from ABS) and the capex investment survey (from the ABS).

The trend growth rate of business investment is informed by the historical average and the projected strength of the economy.

Data sources

Business investment data are sourced from ABS, *Australian National Accounts* (catalogue 5206.0); official interest rates are obtained from the RBA; and data on the cost of borrowing for small businesses are obtained from the RBA, *Indicator Lending Rates*, Table F5. Business conditions are obtained from the NAB Monthly Business Survey (available on subscription).

Government expenditure

Definition

Government expenditure (public final demand) represents activity generated by various levels of government (Commonwealth, state and local) within the economy through its consumption of goods and services and gross fixed capital formation (i.e. investment).

Method

Public final demand forecasts are based on announced policy and spending intentions of the Commonwealth and Victorian governments. The forecasts are informed by information from, but not limited to, policy announcements, election commitments, industry intelligence, information from within DTF and financial information in budget documents. This information is used to formulate an outlook for likely future government expenditure.

In the near term, proxies for ABS components of government expenditure are constructed from the latest ABS data and published financial statements in the latest available budget or budget update for the Commonwealth and Victorian governments. The proxies are used, along with forecasts of population growth and other information about government spending intentions, to inform the growth rate forecasts.

Further out, the trend growth rate dominates the forecast. The trend growth rate of government expenditure is estimated to correspond closely to the trend growth rate of GSP.

Data sources

Forecasts by governments of their own expenditure – as contained in budget and budget update documents – are an important source of information for estimating public demand. Thus Victorian *Budget* forecasts of public demand draw upon estimates from the previous Victorian *Budget Update* and Commonwealth mid-year publications, and Victorian *Budget Update* forecasts draw upon estimates from the previous Victorian and Commonwealth budgets.

Annual government expenditure is obtained from ABS, *Australian National Accounts: State Accounts* (catalogue 5220.0). Quarterly data are obtained from ABS, *Australian National Accounts* (catalogue 5206.0).

Historical population data are sourced from ABS, *Australian Demographic Statistics* (catalogue 3101.0). Victorian estimated residential population on 30 June is taken to represent population for the preceding financial year. The population forecast methodology is described later in this document.

Net international trade

Net international trade is total goods and services exports less total goods and services imports.

International goods trade

Definition

Goods exports and imports comprise the volume of movable goods that change ownership between residents and non‑residents, and are generally valued at the boundary of the exporting country. They do not include shipping costs between countries (which are counted as trade in transportation services).

Method

As with other macroeconomic variables, DTF uses a mixture of formal (econometric) and informal methods to forecast volumes of traded goods. Econometric models capture the historical relationship between trade volumes and indicators of demand, supply and price and provide guidance about future activity.

Informal information includes contemporaneous data such as knowledge of current and prospective weather conditions affecting Victoria’s crop production, which can then be expected to flow through to exports. Similarly, information about the strength of household demand and business investment will inform forecasts of imports.

Merchandise exports

The merchandise exports model proxies the decisions by Australian producers to either sell their products on the domestic or the international market. This decision is driven by the difference in relative prices. An increase in the relative price of exports to domestic sales leads to an increase in the relative volume of exports to domestic sales. The model also accounts for the cost associated with firms selling to export markets through a profit maximisation function.

Export prices are driven by the rural commodity prices (in foreign currency) and the exchange rate. This is because the majority of Victoria’s merchandise exports are agricultural. Rural commodity prices are sourced from the RBA.

Merchandise imports

Forecasts of Victorian import volumes are made using an error correction model. Long‑run imports are determined by the price of imports relative to domestic production and the level of economic activity in Victoria. The same variables also appear in the short‑run relationship allowing them to have different effects in the short‑ and long‑run.

Import prices are driven by world inflation and the exchange rate. This is because Victoria is relatively small compared with the global economy. The price of domestic production is proxied by the producer price index for the manufacturing industry. This is because the bulk of Victoria’s imports are manufactured goods. The price of domestic production is driven by the cost of its inputs to production, namely capital and labour. The cash rate is used as a proxy for the cost of capital, while average compensation of workers is used as a proxy for the cost of labour.

The calculation of the trend growth rates of merchandise exports and imports is informed by the long‑term average growth rates of merchandise exports and imports derived from available ABS data.

Data sources

The ABS is the main source of merchandise trade data. Due to changes in the availability of state-level international trade data, the econometric models use a mixture of historical ABS merchandise trade series and goods trade data from the quarterly ABS *Balance of Payments and International Investment Position* (catalogue 5302.0) release. Data from the International Monetary Fund *World Economic Outlook Database* are used in computing changes in relative prices and relative demand between Victoria and the rest of the world. The RBA provides time series data for commodity prices and exchange rates which are also used in the models.

Other sources of information are drawn on as required. Examples include estimates of Victorian crop yields and business liaison. It is especially important that trade forecasts can be justified against the backdrop of world events, and this means that information from a wide range of sources is used to influence the outputs of the econometric models.

International service exports

Definition

Services are intangible goods. Export services encompass those rendered by Victorian residents to non‑residents. The main service exports for Victoria are education and tourism. Education is the largest service export category, while tourism is the second largest category of service exports in Victoria.

Method

International service exports involve a combination of elements including a review of historical data, econometric analysis and judgement.

The explanatory variables used in the services exports econometric model are the expenditure of inbound tourists and the stock of international students in Australia. Education exports exhibit path dependency since the majority of higher‑education courses take at least three years to complete. Changes in the number of commencing international students in the system in any year will have a flow‑on effect on the value of education exports in subsequent years.

The Commonwealth Department of Home Affairs forecasts international student departures and arrivals. This is combined with data from Australian Education International (AEI) on the stock of student enrolments to compute forecasts for student numbers.

The expenditure of inbound tourists is driven by national inbound arrivals and the price of service exports. Tourism Research Australia (TRA) produces forecasts of tourist visitor numbers, while the price of service exports is estimated based on world inflation and the exchange rate.

Data sources

Data on Victorian service exports is obtained from the annual ABS, *Australian National Accounts: State Accounts* (catalogue 5220.0) and the quarterly ABS, *Balance of Payments and International Investment Position* (catalogue 5302.0) release. Subsequent ABS releases such as ABS, International *Trade in Services by Country, by State and by Detailed Services Category* (catalogue 5368.0.55.003) also provide further detail on the breakdown of service exports by type and by country.

Home Affairs forecasts of student visa applications are sourced from its website and student enrolment data is sourced from the AEI website. TRA forecasts of tourist visitor numbers are sourced from its website.

Other sources of information are also drawn on as required, and these are used to influence the outputs of the modelling approach so as to develop forecasts which accord with all known relevant factors.

International service imports

Definition

Service imports encompass those services (that is, intangible goods) rendered by non‑residents to Victorian residents. The main service import for Victoria is tourism: that is, overseas holidays taken by Victorian residents.

Method

Forecasts of service imports and exports are drawn from a variety of sources, including a review of recent and historical data, consideration of forward indicators and other information, judgement and econometric analysis. The additional information sourced from outside of the econometric analysis are included as adjustment factors to forecasts generated by the model, so that the pattern of forecasts accords with the overall assessment of the service import sector.

Victorian service imports are forecast with a simple ordinary least squares econometric model. Growth in services imports are determined by the exchange rate and expenditure on overseas trips in real terms. The expenditure of outbound tourists is driven by national departures and relative prices. Relative prices are included since Australian residents face a choice between domestic and overseas holidays. Forecasts for outbound travellers are produced by TRA.

The calculation of the trend growth rates of service exports and imports is informed by the long‑term average growth rates of service exports and imports derived from available ABS data.

Data sources

Data on Victorian service imports are obtained from the annual ABS, *Australian National Accounts: State Accounts* (catalogue 5220.0) and the quarterly ABS, *Balance of Payments and International Investment Position* (catalogue 5302.0) release. Subsequent ABS releases such as ABS, *International Trade in Services by Country, by State and by Detailed Services Category* (catalogue 5368.0.55.003) also provide further detail on the breakdown of service imports by type and by country.

Forecast data from TRA on annual estimates of outbound departures are sourced from its website.

Balancing item

Definition

The balancing item contains components of expenditure that are difficult to measure. Notionally it captures net interstate trade in goods and services, changes in inventories and other miscellaneous components. The ABS estimates GSP on the income side and the balancing item is, in effect, the difference between the income measure and all other components of the expenditure measure of GSP.

Method

Forecasts for the balancing item are informed by forecasts of GSP growth for the other states and Victorian state final demand growth. However, as Victoria’s balancing item comprises a large and volatile part of its GSP, balancing item forecasts are ultimately reconciled with views of the overall growth rate for Victorian GSP in the context of economic developments.

## Employment and unemployment rate

DTF forecasts three components of the labour market: employment, the unemployment rate and the participation rate.

Definition

The labour market refers to the interaction between the supply and demand for labour. The ABS classifies the status of an individual as employed, unemployed or not in the labour force.

Employed persons are those who undertook paid work for one or more hours in the reference week, typically the week before they were surveyed by the ABS. Unemployed persons are those who did not work in the survey week but were actively looking for work and were available to start work. The unemployment rate is the ratio of unemployed persons to the labour force (the labour force is the sum of employed and unemployed persons). The participation rate is the ratio of the labour force to the civilian population aged 15 years and over.

Method

Employment and the unemployment rate are explicitly forecast using a combination of econometric models and judgement. The participation rate is calculated as a residual.

The long-term forecasts for employment are based on historical trends and projected demographic and structural shifts in the labour force (e.g. population ageing). The short-term forecasts for employment are based on a linear model that considers surveyed hiring intentions and household consumption expenditure. Judgement is used to account for factors that are not fully captured by the model such as job vacancies, job advertisements and surveyed unemployment expectations.

The unemployment rate is estimated using a linear model that considers the unemployment gap. The unemployment gap is the difference between the unemployment rate and the estimated trend rate of unemployment. The trend rate of unemployment is estimated using a model that considers structural factors in the labour market.

Judgement is used to reconcile the labour market forecasts with the overall economic outlook as labour is an important factor of production.

Data sources

The working age population and its components (employed, unemployed and those not in the labour force) are included in the ABS Labour Force Survey (catalogue 6202.0). The data are released monthly. Forecasts of population growth are underpinned by population projections described below.

Job vacancies data are based on the quarterly, original series reported in the ABS’ Job Vacancies series (catalogue 6354.0), and the Commonwealth Department of Jobs and Small Business’ monthly Internet Vacancy Index (seasonally adjusted data). Average weekly earnings data are sourced from the ABS publication of the same name (catalogue 6302.0). Measures of firm hiring intentions (quarterly, original data) are sourced from the NAB Business Survey and consumer unemployment expectations (monthly, original data) are sourced from the Westpac-Melbourne Institute Consumer Sentiment survey.

## Wages growth

Definition

The Wage Price Index (WPI) is the ‘total hourly rate of pay excluding bonuses index’. It is based on a weighted combination of ordinary time hourly wage and salary rates and overtime hourly rates. As a result, it reflects changes in both the ordinary time and overtime hourly rates. Bonuses are excluded since they, and commission payments, can reflect changes in the quality of work performed.

Method

Adjustments to the wage growth forecasts are made with reference to a number of labour market estimates from the ABS as well as forward indicators. Given lags involved in wage setting, employment growth and the unemployment rate provide a guide to future wage growth. In addition, leading indicators used include the Commonwealth Department of Jobs and Small Business’ *Trends in Federal Enterprise Bargaining* report and ABS *Job Vacancies* (catalogue 6354.0).

DTF forecasts quarterly movements of the WPI with an augmented Phillips‑curve model which has the wage price index as a function of inflation, inflation expectations and the unemployment rate.

Higher inflation means higher living costs, which leads to higher wage claims. It also enables businesses to afford to pay their workers higher wages. A lower unemployment rate reflects strong demand for labour and more firms bargaining to attract suitable employees with higher wages. The model has a dummy variable for the September quarter (the period when annual minimum wage decisions come into effect).

The trend value of wage growth is given by the trend growth for inflation plus average growth in labour productivity.

Data sources

Inflation data are sourced from the ABS, *Consumer Price Index* (catalogue 6401.0) and are released on a quarterly basis. The unemployment rate is sourced from ABS, *Labour Force* (catalogue 6202.0) and converted from a monthly to a quarterly basis. The methods for making inflation and unemployment rate forecasts are described elsewhere in this paper. Inflation expectations are derived using Commonwealth 10‑year bond and indexed bond yields. The projection method is described below.

The value of the minimum wage dummy is determined by the timing of the annual minimum wage decision made by Fair Work Australia. Their National Minimum Wage Orders generally come into operation on 1 July. For the first quarter in which the decision will affect wages (September quarter), the value is one; for all other quarters the value is zero.

## Consumer prices growth

Definition

Inflation is the general increase in the prices of goods and services over time. It is measured by changes in the Melbourne Consumer Price Index (CPI), which captures the price movements of a fixed basket of goods and services consumed by metropolitan households. For DTF's forecasting purposes, the CPI categories for Melbourne have been differentiated into market goods and services (excluding volatile items) and all other items.

Market goods and services captures the types of goods and services typically driven by market factors (excluding volatile items) and consists of all CPI groups except for the following: automotive fuel, fruit and vegetables, utilities, property rates and charges, child care, health, other services in respect of motor vehicles, urban transport fares, postal services, and education. The excluded items represent those which are more heavily influenced by non-market factors (such as administered price changes) or exhibit volatility as a result of supply‑side factors.

The trend value of consumer price growth is estimated to correspond to the mid-point of the RBA’s inflation target band.

Method

Headline inflation forecasts are developed using these CPI basket subsets. A combination of econometric modelling, extension of historical trends and judgement based on partial information underpin the forecasts.

Inflation in market goods and services is forecast using an ordinary least squares econometric model. In the model, year‑ended inflation in market goods and services is positively related to the inverse of the unemployment rate, an autoregressive term, inflation expectations, and a dummy variable to account for the introduction of the GST. Inflation is negatively related to the annual change in the unemployment rate.

The remaining segment of the CPI basket, comprised of administered and other seasonal/volatile items, is forecast using a bottom‑up approach based on historical trends and partial information, and informed by judgement of future trends and leading indicators.

The headline inflation forecast for Victoria is based on the sum of the contributions to growth from inflation in market goods and services and the other seasonal/volatile items. Adjustments are made based on additional information such as recent movements in the value of the Australian dollar, developments in oil markets and relevant government policies.

Data sources

Historical values of the CPI are sourced from ABS, *Consumer Price Index (*catalogue 6401.0). The econometric model for inflation in market goods and services relies on unemployment rate forecasts and projected inflation expectations (both described elsewhere).

## Population

Method

Forecasts of aggregate population growth are based on expected changes in the components of population growth, which are natural increase, net overseas migration and net interstate migration. High‑level forecasts are developed jointly by the Department of Environment, Land, Water & Planning (DELWP) and DTF and are underpinned by a cohort‑component model for population projections constructed by DELWP. This model projects population by age, sex and region of Victoria for up to 40 years.

Natural increase (that is, births less deaths) is a relatively stable component of population growth. Assumptions underpinning the natural increase forecasts concern fertility rates and mortality rates, and are based on projections by the ABS, adjusted for recent actuals.

Net overseas migration has been the most volatile component of population growth over the past decade. This component measures the difference between overseas arrivals and departures for permanent and long‑term moves.

Net interstate migration has been a relatively small component of population growth for Victoria over the past decade, but has increased in recent years. DTF and DELWP use recent population movements data and expected relative state economic performance to inform a plausible level of net interstate migration over the forecasting horizon.

Data sources

Official estimates of Victoria’s estimated resident population are obtained from ABS, *Australian Demographic Statistics* (catalogue 3101.0). The ABS population projections, which are used as a base for assumptions underpinning Victoria’s population projections, can be found in ABS, *Population Projections, Australia, 2017 (base) to 2066* (catalogue 3222.0). DELWP prepares its own population projections, going out 40 years for Victoria, metropolitan Melbourne and regional Victoria and 20 years for small areas, for the purposes of state government planning. The latest population projections are contained in *Victoria in Future 2019*.

## Input series

This section lists data series used as inputs to several of DTF’s forecasting models

Method

Oil prices (West Texas Intermediate) are assumed to follow futures pricing.

Exchange rates (in US dollar and trade-weighted terms) are assumed to remain at their latest daily values.

Petrol prices are assumed to follow the sum of the oil price (adjusted for AUD‑USD exchange rate), petrol excise (indexed biannually) and GST (10 per cent of oil price component and petrol excise).

The cash rate is assumed to follow the implied zero coupon yields on market instruments, as estimated by the Reserve Bank of Australia.

The standard variable mortgage rate is assumed to follow the cash rate plus a fixed lending margin based on its latest quarterly value.

Commonwealth bond yields (10-year maturity) are projected using Treasury Corporation of Victoria forecasts in the short-term and are assumed to follow movements in the cash rate thereafter.

Inflation expectations are calculated as the difference between standard and indexed bond yields at a maturity of 10 years.

In the short run, household financial assets are projected using an econometric model based on the All Ordinaries Index, reverting to long-run average growth thereafter.

## Data sources

ABS, *Australian Demography,* catalogue number 3101.0

ABS, *Population Projections, Australia, 2017 (base) to 2066,* catalogue number 3222.0

ABS, *Australian National Accounts: National Income, Expenditure and Product,* catalogue number 5206.0

ABS, *Australian System of National Accounts: Concepts, Sources and Metho*ds, catalogue number 5216.0

ABS, *Australian National Accounts: State Accounts,* catalogue number 5220.0

ABS, *Average Weekly Earnings,* catalogue number 6302.0

ABS, *Balance of Payments and International Investment Position,* catalogue number 5302.0

ABS, *International Trade in Services by Country, by State and by Detailed Services Category,* catalogue number 5368.0.55.003

ABS, *Labour Force,* catalogue number 6202.0

ABS, *Labour Force, Detailed,* catalogue number 6291.0.55.001

ABS, *Labour Force, Detailed, Quarterly,* catalogue number 6291.0.55.003

ABS, *Labour Force Experience*, catalogue number 6206.0

ABS, *Employment and Earnings, Public Sector, Australia*, catalogue number 6248.0.55.002

ABS, *Wage Price Index*, catalogue number 6345.0

ABS, *Job Vacancies*, catalogue number 6354.0

ABS, *Residential Property Price Indexes: Eight Capital Cities*, catalogue number 6416.0

ABS, *Consumer Price Index*, catalogue number 6401.0

ANZ, *Job Advertisement series*, http://www.media.anz.com/phoenix.zhtml?c=248677&p=irol-jobad&nyo=0

Commonwealth of Australia, *Review of Treasury Macroeconomic and Revenue Forecasting* (chair David Chessell), December 2012

Commonwealth Department of Jobs and Small Business, *Internet Vacancy Index,* http://lmip.gov.au/default.aspx?LMIP/VacancyReport

Commonwealth Department of Jobs and Small Business, *Trends in Federal Enterprise Bargaining* *report,* <http://www.jobs.gov.au/trends-federal-enterprise-bargaining>

CME Group, *Crude Oil Futures Settlements,* http://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude\_quotes\_settlements\_futures.html

Deloitte Access Economics, *Investment Monitor,* various quarters

Department of Environment, Land, Water & Planning, *Victoria in Future 2016,* http://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future-2016

Federal Reserve Bank of St. Louis, *Crude Oil Prices: West Texas Intermediate (WTI) – Cushing, Oklahoma,* http://research.stlouisfed.org/fred2/series/MCOILWTICO

International Monetary Fund, *World Economic Outlook Database,* http://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index.aspx

National Australia Bank, *Business Survey data*

Australian Institute of Petroleum, *Victorian State Average*, https://aip.com.au/pricing/ULP/VIC/Victorian-State-Average

Reserve Bank of Australia (RBA) Statistical Tables, *Household and Business Balance Sheets*, Table E1.

RBA, *Interest Rates* *and Yields – Money Market – Monthly,* Table F1.1*,*

RBA, *Capital Market Yields – Government Bonds – Monthly,* Table F2.1

RBA, *Indicator Lending Rates,* Table F5

RBA, *Exchange Rates – Daily – 2014 to Current – F11.1*

RBA, *Zero-coupon Interest Rates – Analytical Series – 2009 to Current – F17*

Thomson Reuters Eikon

Westpac-Melbourne Institute, *Consumer Sentiment Index*

1. In the December *Budget Update*, it is necessary to forecast values for population growth for 2018-19 as actuals are not yet available. [↑](#footnote-ref-2)
2. This paper is a further step in DTF’s policy of increasing transparency of its operations. The paper is designed to assist readers to understand how DTF’s forecasts are made, with the aim of increasing confidence in the forecasts. [↑](#footnote-ref-3)
3. Fundamental drivers of nominal growth include population, productivity and inflation. [↑](#footnote-ref-4)
4. This term is defined as the product of the labour force participation rate of the working-age population, the employment rate of the labour force, and average working hours per employed worker, and it is conceptually equivalent to overall labour utilisation in the economy. [↑](#footnote-ref-5)