

REGIONAL EMPLOYMENT PROJECTIONS (2010-11 TO 2040-41)

The Modelling Framework

The regional employment projections were constructed using a whole-of-economy model – the Queensland General Equilibrium Model for Forecasting (QGEMF). QGEMF is a dynamic computable general equilibrium (CGE) model developed by Queensland Treasury, based on the MMRF/VURM model developed by the Centre of Policy Studies at Victoria University.¹

QGEMF explicitly models:

- two regions: Queensland and the Rest of Australia (ROA); and
- 122 commodities/industries.

Each region is modelled as a separate economy, with region specific governments, households and industries. The behavioural rules in the model generally follow neoclassical economic assumptions. That is, markets are assumed to be competitive, markets are assumed to clear and price relativities play a key role.

At a broad level, QGEMF determines economic growth using the 3P's. Under this approach gross state product (GSP) is considered a function of:

- population – in particular the number of people of working age;
- productivity – the average output per hour worked; and
- participation – the proportion of working age people engaged in the labour market and the average hours they work.

The modelling then allows for the overlaying of sectoral pressures arising from changes to industry specific productivity, household composition, global demand for exports and supply of imports and factor constraints.

The core economic data underpinning QGEMF is derived from the ABS 2006-07 National input-output (I-O) tables, disaggregated into a Queensland and ROA CGE database.² The disaggregation method utilises a wide range of secondary data, including labour force, trade, manufacturing, agricultural and mining surveys, and ABS state accounts to produce State-specific economic stocks and flows.

The core accounts have been updated to 2010-11 within the QGEMF model. Numerous historical data series are used to generate the revised 2010-11 QGEMF database, including data from the income and expenditure sides of GSP, employment, exchange rates, consumer prices and a range of industry specific data.

In addition to the core accounts, a range of supplementary data is utilised, including:

- household income accounts;
- demographic and labour force data;
- government financial statistics;
- debt, investment and capital data; and
- sectoral carbon and energy accounting data (derived from the National Greenhouse Inventory, ABS and BREE energy data, and various sector specific information).

The disaggregation of State level projections to regional planning areas uses a methodology adapted from Adams et al (2010).³ This methodology uses a regional disaggregation facility based on a combination of top-down economic theory and detailed regional demographic and economic data. The top-down facility allows for the treatment of demand from

¹ The MMRF model has been extensively documented. For more information on MMRF see Adams, P.D., Dixon, J., Giesecke, J. & Horridge, M.J. 2011, MMRF: Monash Multi-Regional Forecasting Model: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Working Paper, G-223. Available from the Centre of Policy Studies, Victoria University. Full documentation of the model is available on request.

² For details on the disaggregation method see Horridge, M 2002, Preparation of a CGE data base from the 1996-97 Australian Input-Output Tables, Centre of Policy Studies, Victoria University. More information on the Queensland dataset can be found in Queensland Treasury and Trade, 2012, Queensland industry structure: 2006-07. Available at www.qgso.qld.gov.au.

³ Adams, P. Dixon, J. Giesecke, J. and Horridge M. 2010. MMRF: Monash Multi-regional Forecasting model: A dynamic multi-regional model of the Australian economy. General paper no. G-223. Centre of Policy Studies, Victoria University.



local (within region) and non-local (state, national and foreign) sources. Specific additional treatments have been included for:

- labour demand for selected industries including construction, agricultural services, aged care, government services and those industries that rely heavily on tourism demand;
- employment on both a place of residence and a place of work basis (journey to work); and
- metropolitan areas within South East Queensland.

State Level Assumptions

Effort has been made to capture the structural changes that may occur over coming decades. These structural changes are informed by a range of factors including:

- historical analysis of changes to household preferences and technological change;
- consideration of likely changes to the composition of demand as the population ages;
- changes to world demand for Australian commodities;
- import prices;
- changes to relative prices from sector-specific productivity changes and factor constraints;
- identification of major projects in key sectors; and
- macro-economic observations between 2010-11 and 2014-15 and forecasts, as outlined in the 2015-16 State Budget over the forward estimates period.

Labour supply

The labour supply in each regional planning area is determined by:

- the working age population in each planning area; and
- the participation rate.

The working age population for each region is determined by a demographic module which is underpinned by assumptions consistent with the 2015 edition Queensland Government Population Projections (medium series).⁴

Future participation rates are imposed by age, gender and state. As a result, changes in the population of each age cohort determine the overall labour force participation rate in each region. These participation rates are projected to follow historical trends.

Unemployment rates

Assumptions around the long term unemployment rate are based on the concept of a rate that can be sustained without generating upward pressure on inflation. This is commonly referred to as the non-accelerating-inflation rate of unemployment (NAIRU).

The NAIRU depends on a complex range of economic, demographic and institutional factors, including the way inflation expectations are formed, the wage-setting environment, the tax-transfer system, and the education and skills of people in the labour force. The NAIRU varies over time and cannot be measured directly. It is typically estimated using economic models, which provide a range of estimates with a considerable margin of imprecision around these estimates.

A constant NAIRU of 5.5% at the state level is assumed in the modelling after the forward estimates period.

Productivity

Over the forward estimates period, aggregate labour productivity is consistent with that assumed in the 2015-16 Queensland State Budget. Over the long-run, average sector-specific labour productivity growth rates are used, with the compositional mix of industrial production determining aggregate productivity growth.

Sector-specific labour productivity is assumed to reflect recent changes and longer term historical trends. Capital deepening is modelled on the basis of relative returns to capital across industries. For market sector industries, that

⁴ Available at <http://www.qgso.qld.gov.au/subjects/demography/population-projections/>



component of projected labour productivity that is not captured by capital deepening is assumed to be multifactor productivity (MFP) arising from 'primary factor augmenting' technical change.

Developments in the resources sector have been key drivers of structural change for both the national and State economies. The modelling accounts for resource sector developments by:

- ensuring QGEMF's core accounts reflect current levels of investment and capital stocks; and
- taking into account projects completed, currently under construction and committed, based on Deloitte Access Economics Investment Monitor (December 2015 edition and earlier editions)⁵ and the Department of State Development's major projects directory.⁶

Commodity exports are consistent with historical observations, the State Budget 2015-16 and expectations of longer term commodity export trends.

Global assumptions

Over the long run, global growth is determined by:

- the growth rates of countries at the frontier of production (a function of productivity, population and participation); and
- the rate at which other countries per capita incomes converge with these countries.

Specific modelling and analysis of the global outlook for commodities was undertaken to derive internally consistent long run global assumptions about the effect of global growth on both demand for Australian commodities and the price of foreign goods consumed in Australia.

Household expenditure patterns

Household expenditure patterns are determined by:

- the relative prices of different goods;
- household income; and
- consumer preferences.

The relative prices of goods and household incomes are determined within QGEMF and reflect a wide range of economic influences such as resource constraints, the terms of trade and exchange rates, returns to land, labour and capital and redistributive policies.

Expenditure on specific goods is determined in QGEMF such that households purchase bundles of goods which maximise a utility function subject to a budget constraint, with consideration for subsistence and supernumerary expenditures.

Household taste shifts account for any additional change in consumption patterns after accounting for changes in incomes and relative prices. Assumed changes to household tastes are based on historical decomposition analysis by the Centre of Policy Studies⁷ and the Australian Treasury.⁸ The taste shift terms are assumed to decline to zero in a linear fashion between 2020 and 2050, reflecting uncertainty about how persistent these trends will be in the future.

Projected shifts in household consumption patterns suggest a continuation of the long-run trends, showing a declining proportion of expenditures on basic commodities (such as food and energy) and an increasing proportion of expenditures on elaborately prepared goods and services including personal services, restaurants, holidays and communication services.

⁵ Deloitte Access Economics, 2016, *Investment Monitor*, December 2015 Edition

⁶ Department of State Development, 2014, *Major Projects Map*

⁷ Adams, P. D., Dixon, P.B., McDonald, D., Meagher, G. A. & Parmenter, B. R. 1994, Forecasts for Australian economy using the MONASH model, *International Journal of Forecasting*, 10(4), 557-571.; Dixon, P.B. & Rimmer, M. T. 2002, *Dynamic general equilibrium modelling for forecasting and policy: a practical guide and documentation of MONASH*. Contributions to Economic Analysis 256, North-Holland, Amsterdam; and Giesecke, J. 2004, *The extent and consequences of recent structural changes in the Australian economy, 1997-2002: Results from historical decomposition simulations with MONASH*. Centre of Policy Studies, general Working paper No. G-151, December 2004.

⁸ Commonwealth Treasury 2008, *Economic Modelling Technical Paper 4*, Garnaut Climate Change Review, October 2008.



The government sectors

In general, the level of government service provision is assumed to move with real household consumption. This assumption reflects the idea that, as its citizens become wealthier, there are increasing expectations regarding the quantity and quality of services provided by their governments.

Government expenditure on health-related care is also assumed to be heavily influenced by changes in the age structure of the population. Under this assumption, real expenditure on age-related health and other care increases with the proportion of the population aged over 65.

Government budgets are held fixed as a share of GDP.

Regional Assumptions

The regional disaggregation of state results is undertaken using a methodology adapted from Adams et al (2010).⁹

Regional employment projections are created using a combination of top-down economic estimates and detailed regional demographic data. The top-down facility is used to overcome the significant data limitations that exist at the region level.

The regional disaggregation of state results accounts for:

- differences in the industrial composition of regions;
- local and external drivers of industry demand, including separate drivers for construction, government services, international and foreign tourism, and other service industries;
- differences in the regional rates of demographic change, including changes to the age structure of regional populations and the implications for workforce participation;
- international and domestic tourism demand;
- significant investment projects;
- differences in drivers of growth for regions within South East Queensland relative to the rest of Queensland; and
- the availability of industrial land to support changes in industry activity.¹⁰

Once regional activity by industry is determined, place of work employment is determined by the ratio of employment to activity (labour productivity). For many industries, particularly service industries, there is insufficient robust data to determine labour productivity at the regional level. Where insufficient data exists, regional labour productivity by industry is assumed to be the same as State-level labour productivity by industry. Region-specific labour productivity by industry is assumed to grow in proportion to the change in State level labour productivity by industry.

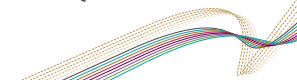
Regional employment is provided on both a place of residence and place of employment basis, to allow considerations of possible changes to journey to work over time. For regions outside of South East Queensland, Census data show that there are only a small proportion of workers who travel across regions for work. However, in South East Queensland there are large flows of workers who travel across LGA's for work purposes.

The allocation of workers by place of residence and place of work is informed by:

- 2011 Census journey to work data;
- the demand for workers in each region (place of work demand);
- the supply of workers in each region, where the supply of workers in each region is informed by the age structure of populations in each region, the age and gender specific participation rates of the population and sensible constraints in the level of unemployment; and
- an assessment of likely future levels of industry-specific employment self-containment, where this is informed by base year employment characteristics and rates of regional population growth.

⁹ Adams, P. Dixon, J. Giesecke, J. and Horridge M. 2010. MMRF: Monash Multi-regional Forecasting model: A dynamic multi-regional model of the Australian economy. General paper no. G-223. Centre of Policy Studies, Victoria University.

¹⁰ It was considered that, for the large regions being considered in the exercise, it is unlikely that land supply would constrain industry growth.



Industrial composition of regions

The industrial composition of regions has been informed by Queensland Treasury's estimates of gross regional product (GRP),¹¹ published in 2013. The publically available estimates of GRP have been adjusted to provide estimates for regional planning areas and input-output industry groups.

Changes to age structure of regional populations

Population changes are consistent with projections in the Queensland Government Population Projections (2015 edition, medium series).¹²

Population is used to derive regional labour supply and determine the level of resident employment available from a region. The resident labour supply in a given region is estimated using the age and gender population projections and age and gender specific regional participation rates.

Baseline regional age and gender specific participation rates are estimated from Census 2011 data and the ABS Labour Force Survey. Participation rates by age and gender in each region are assumed to move in proportion with age and gender specific participation rates at the State level.

Significant investment projects

The employment projections in this report are informed by significant investment projects that are completed, under construction or committed, based on the Deloitte Access Economics Investment Monitor (December 2015 edition and earlier editions)¹³ and the Department of State Development's major projects directory.¹⁴ The consideration of significant projects likely to proceed is consistent with the commodity assumptions used in the State-level modelling.¹⁵

Employment Data

The 2010-11 base year employment data uses the 2011 Census as the primary data source for employment by place of residence, place of work, occupation, employment type and industry.¹⁶

Adjustments have been made to Census employment to account for undercount, seasonality and to appropriately allocate any not stated (NS) or not defined values.

These adjustments were performed using GEMPACK (General Equilibrium Modelling Package), a software package produced by Victoria University. The use of GEMPACK enabled adjustments to be performed on a matrix with more than 2 dimensions, automated error checking and the ability to easily make adjustments to metadata.

Projections of employment are driven by the economic outcomes of the modelling, which themselves are a product of the State level and regional assumptions implemented in the model.

¹¹ Available at <http://www.qgso.qld.gov.au/products/reports/experimental-estimates-grp/experimental-estimates-grp-2010-11.pdf>

¹² Available at <http://www.qgso.qld.gov.au/subjects/demography/population-projections/>

¹³ Deloitte Access Economics, 2016, *Investment Monitor*, December 2015 Edition

¹⁴ Department of State Development, 2014, *Major Projects Map*

¹⁵ As discussed in section **Error! Reference source not found.**

¹⁶ While the base year database includes employment by occupation and type of employment, the published projections do not include data for these dimensions.