



Australian Government
Department of Employment

Australian Employment Projections

Carmel O'Regan

Director

Occupational and Industry Analysis

Labour Market Research and Analysis Branch

Labour Market Strategy Group

Who we are

Australian Government Department of Employment

- Responsible for national policies and programs in relation to employment, workplace relations and workplace safety

Labour Market Research and Analysis Branch

- Main source of labour market information within the department

Occupational and Industry Analysis team

- Analysis of employment by occupation and industry, including the production of annual employment projections

Why produce projections?

Indication of future employment growth used by:

The department: Policy advice to Government, e.g. whether special measures are required to assist workers made redundant from a particular industry

Government employment services: Identifying opportunities for job seekers

Other government agencies: Education and training policies, e.g. whether employers should be given incentives to hire apprentices in certain occupations/industries

Career advisors in schools and universities: Likely availability of jobs in the future for a particular region, industry or occupation

Our projections are not an employment target or goal

Task

- Annual projections for the coming five years
- Disaggregated by Industry, Occupation, Skill Level and Region - nearly 2000 series in all
- Need to be explainable, defensible and credible
- Limited staff resources
- Limited time to produce them

Data

Australian Bureau of Statistics (ABS) Labour Force Survey

- Around 30,000 Australian households surveyed each month
- Produces a wide range of labour market data
- Generally high level of quality
- Industry/occupation data published quarterly
- Long time series available in most cases (from mid 1980s)

Robust basis for our projections

Data

Projections based on trended or smoothed data, as it provides greater stability

“Greater forecasting accuracy is obtained by shrinking the seasonal component towards zero”
(Gooijer and Hyndman, 2006)

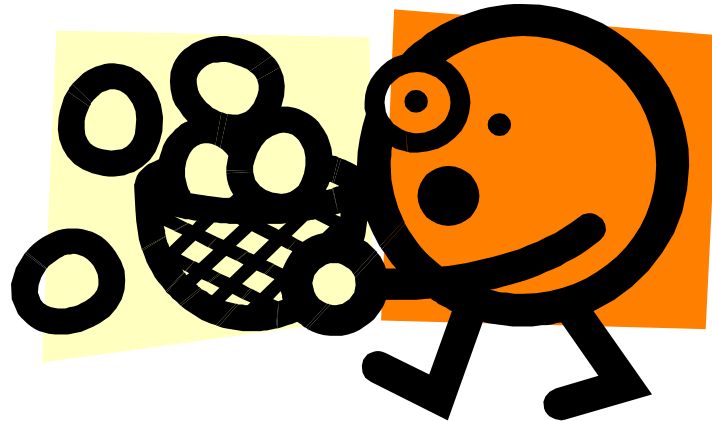
- Where the ABS does not publish trended data, we seasonally adjust and trend for ourselves (Henderson-13 in EViews)

Approach

- Previous approach was to individually assess each employment series, based on past employment growth and other labour market information
 - Relied heavily on judgement
 - Time consuming
 - Difficult to explain and defend
- In 2012, decided to look for a method which would be more defensible, credible, accurate and efficient
 - Required extensive research, and extensive testing on historical data

Literature review – lesson one

- Using a ‘combination’ of forecasts produces better results in the long run (on average)
 - Don’t put all your eggs in one basket, nor invest all your wealth in one stock!



Literature review – lesson one

- There is a wide range of academic literature supporting this notion
 - *Forecast **combinations** have frequently been found in empirical studies to produce better forecasts than methods based on the 'best' individual forecasting model. (Timmermann, 2004)*
 - ***Combining** multiple forecasts leads to increased forecast accuracy. This has been the result whether the forecasts are judgmental or statistical, econometric or extrapolation. (Clemen, 1989)*
 - *Compared with errors of the typical individual forecast, **combining** reduces errors. Under ideal conditions, combined forecasts were sometimes more accurate than their most accurate components. (Armstrong, 2001)*

Literature review – lesson two

- Our literature review indicated that univariate models perform as well as complex macroeconomic models in empirical studies



Literature review – lesson two

- Considering the constraints we face when producing the projections (time, funding and staff), the finding that ‘simple’ models can perform as well as ‘complex’ models was significant
 - *Simple mechanical forecasting schemes are often found to perform well empirically... It is difficult to outperform simple approaches such as a parsimonious autoregressive model.* (Elliot and Timmermann, 2008)
 - *The US Bureau of Labour Statistics projections [derived from a model based approach] do not differ significantly from those obtained from a naïve extrapolative model.* (Stekler and Thomas, 2005)

Literature review – lesson two

- We identified two time series models that were extensively tested and widely used across a range of time series forecasting settings
 - Autoregressive Integrated Moving Average (ARIMA)
 - Exponential Smoothing With Damped Trend (ESWDT)

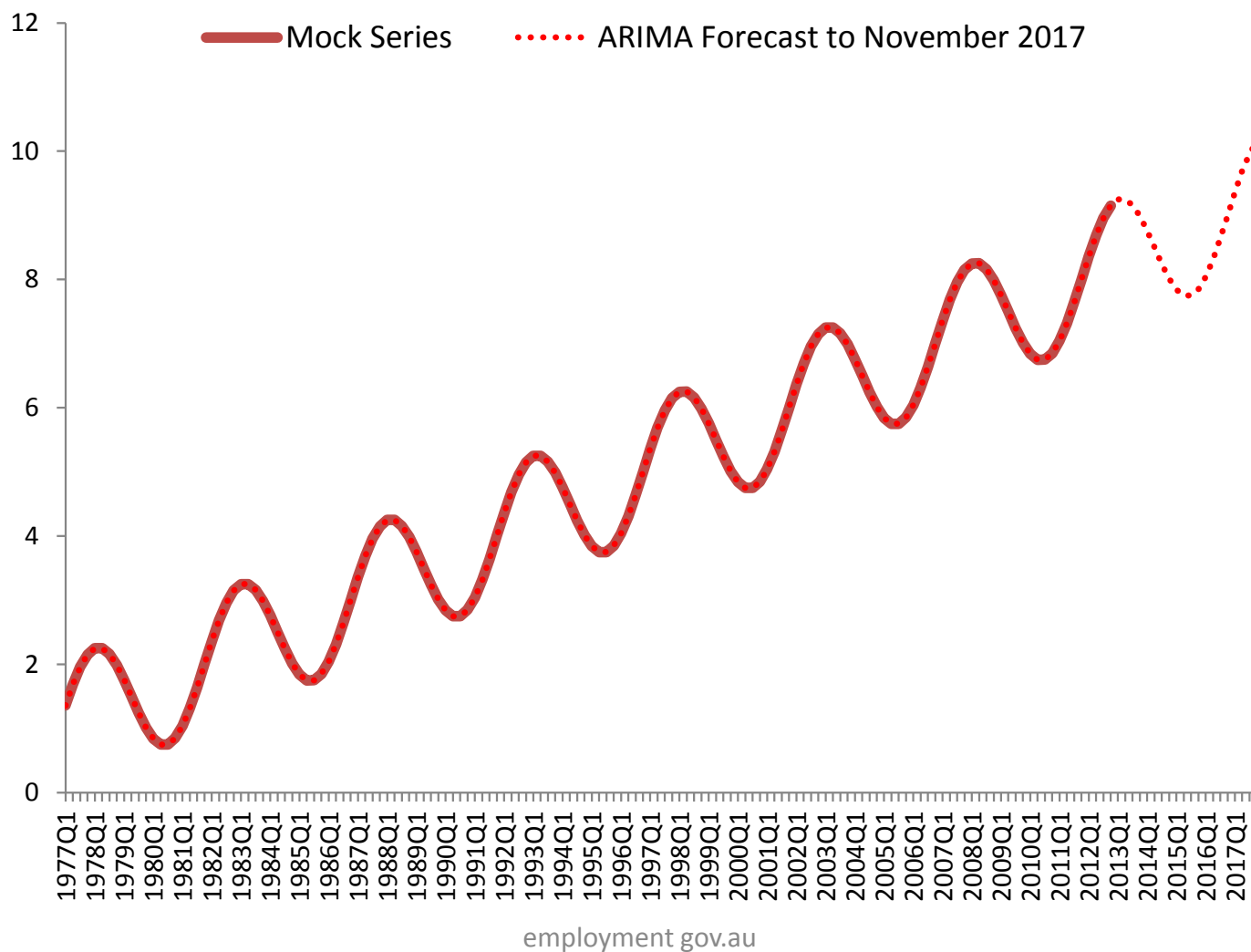
ARIMA

Autoregressive Integrated Moving Average

- An ARIMA model analyses the historical data in a series to estimate how the most recent declines or increases in a series have typically reverberated and persisted
- An ARIMA forecast is easily generated through the EViews statistical program

ARIMA

Autoregressive Integrated Moving Average



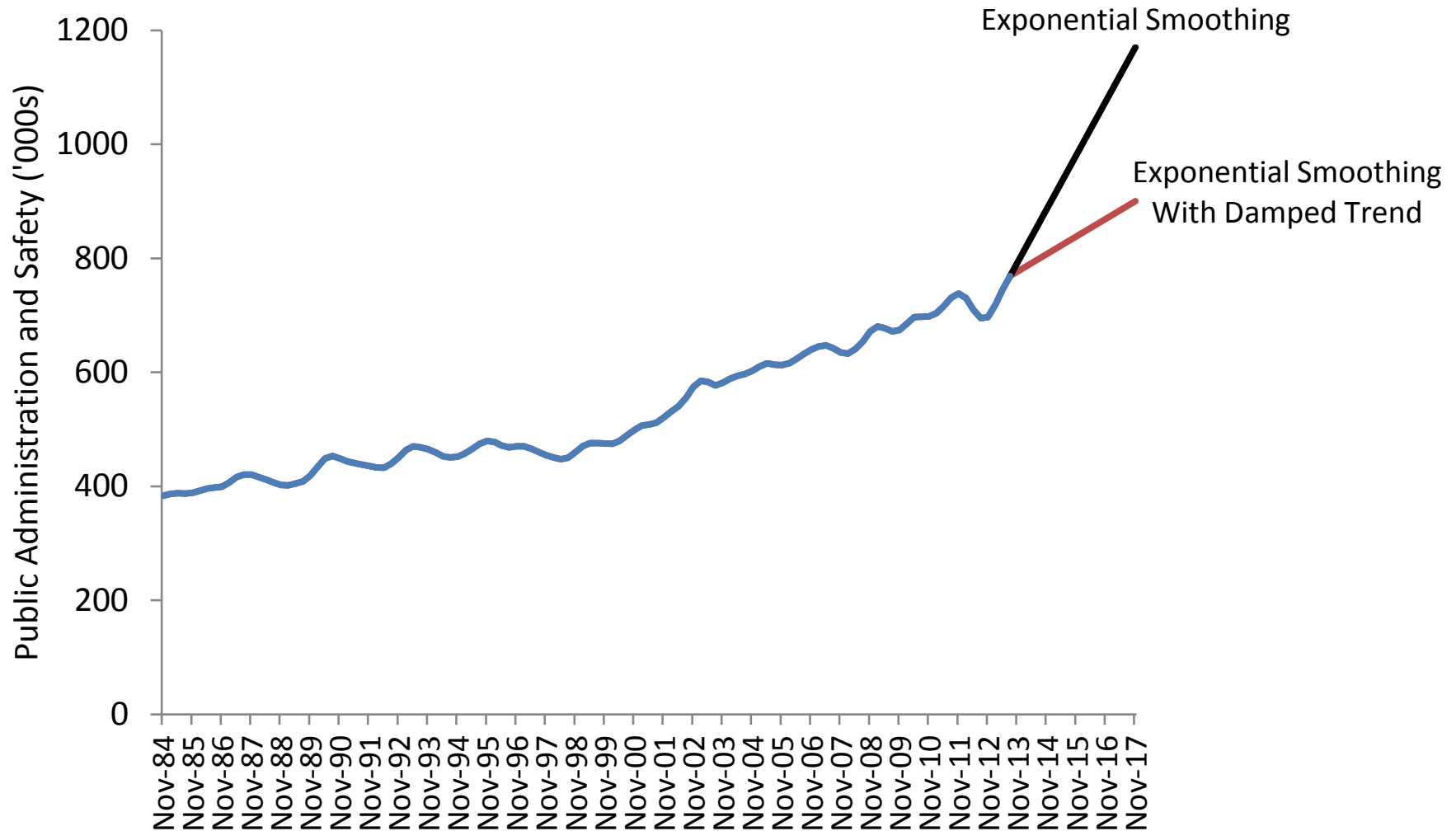
ESWDT

Exponential Smoothing With Damped Trend

- An ESWDT model describes a time series by its evolving 'level' and 'trend' (or slope)
- The standard ESWDT algorithm is implemented through an Microsoft Excel VBA program developed within the Department of Employment

ESWDT

Exponential Smoothing With Damped Trend



Scaling and consistency

- The Australian Treasury publishes forecasts for total Australian employment, based on an economic model
 - We need to be consistent with these, so we scale our forecasts to this total
 - This also improves the accuracy of our projections
- We also scale our forecasts at the detailed industry/occupation level (e.g. Dairy Cattle Farming) to try to ensure that they sum to something close to the higher levels (e.g. Agriculture, Forestry and Fishing)

Adjusting projections

- Our projections are also manually adjusted for known future industry and regional developments where we feel that the relevant projection does not accurately reflect these imminent realities
- In essence, these adjustments act as another 'independent' forecast to be 'combined' with the forecasts obtained from time series analysis
- Two components:
 - Desktop research
 - Consultation

Desktop research

- Reading articles and research papers, e.g. by Reserve Bank of Australia
- Analysing other official datasets, e.g. business investment, major resource projects, construction activity, retail turnover
- Comparison with projections/forecasts from industry bodies or other research organisations, e.g. Deloitte Access Economics

Consultation

Within the Department

- Areas which perform ongoing monitoring of the labour market, e.g.:
 - Notification of redundancies
 - Liaison with employers
 - Skill shortage research
 - Surveys of employers' recruitment experiences
- Plus our own experience/expertise in occupational/industry labour markets

Consultation

Other agencies

- Agencies with industry knowledge, e.g.:
 - Department of Industry (manufacturing, resources, energy, vocational education and training)
 - Department of Education (early childhood, schools, higher education)
 - Australian Workforce and Productivity Agency

Adjusting projections – an example

National Disability Insurance Scheme (NDIS)

- Significant Government program that will induce the investment of billions of dollars each year into Australia's Health Care industry from 2013 onwards



Adjusting projections – an example

National Disability Insurance Scheme (NDIS)

- Analysis and modelling indicates that the program will require an additional 100,000 workers in the Health Care and Social Assistance industry
- This will have an unprecedented impact on employment in the industry that has not been accounted for in our projection
- We therefore increased our projection for Health Care and Social Assistance by a similar figure, and reflected the growth in the relevant sectors and occupations (e.g. Aged and Disabled Carers)

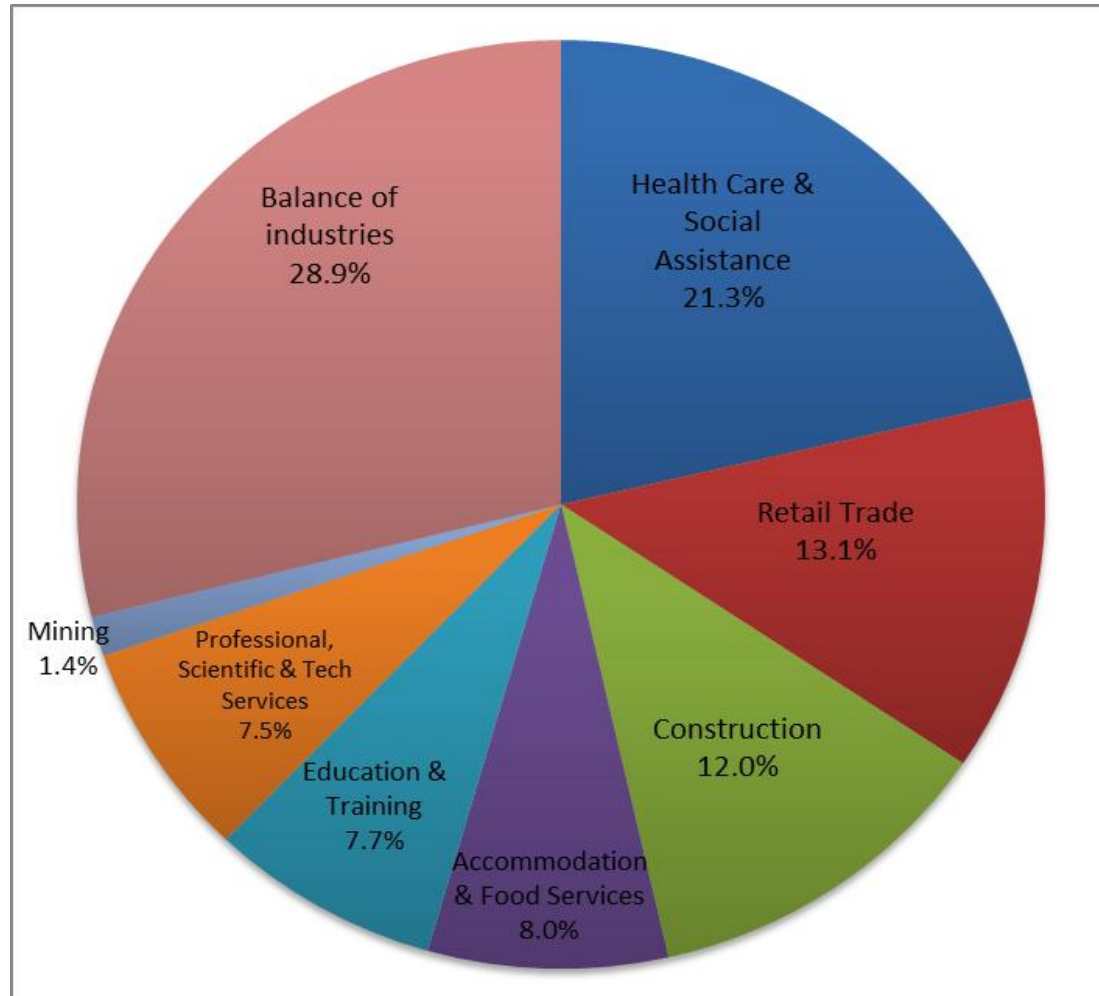
Department of Employment projections

Industry projections - five years to November 2017

Industry	Employment level - Nov 2012 ('000s)	Projected Employment growth - Nov 2012 to Nov 2017 ('000s)	Projected Employment growth - Nov 2012 to Nov 2017 (%)
Agriculture, Forestry and Fishing	322.5	-13.5	-4.2
Mining	269.7	11.5	4.3
Manufacturing	967.1	14.2	1.5
Electricity, Gas, Water and Waste Services	149.1	3.3	2.2
Construction	995.3	100.2	10.1
Wholesale Trade	423.6	15.5	3.7
Retail Trade	1220.5	109.1	8.9
Accommodation and Food Services	786.2	66.8	8.5
Transport, Postal and Warehousing	583.5	41.6	7.1
Information Media and Telecommunications	229.1	9.6	4.2
Financial and Insurance Services	421.4	16.1	3.8
Rental, Hiring and Real Estate Services	197.7	11.1	5.6
Professional, Scientific and Technical Services	913.8	62.8	6.9
Administrative and Support Services	397.1	26.1	6.6
Public Administration and Safety	687.3	43.2	6.3
Education and Training	897.5	64.5	7.2
Health Care and Social Assistance	1369.9	177.8	13.0
Arts and Recreation Services	217.9	21.8	10.0
Other Services	451.3	38.5	8.5
ALL INDUSTRIES	11535.2	820.1	7.1

Industry contributions to projected growth

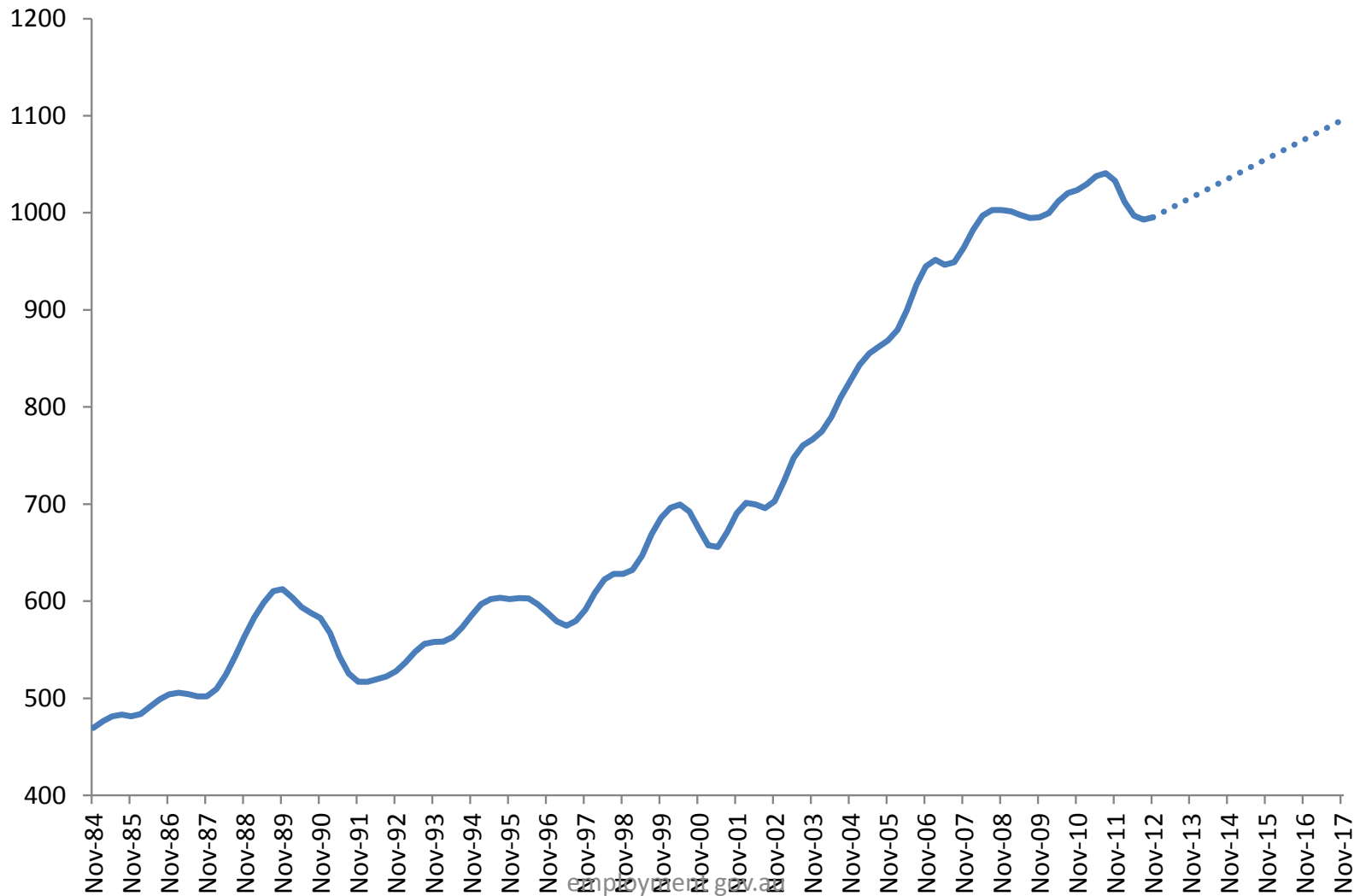
Five years to November 2017



Past and projected growth

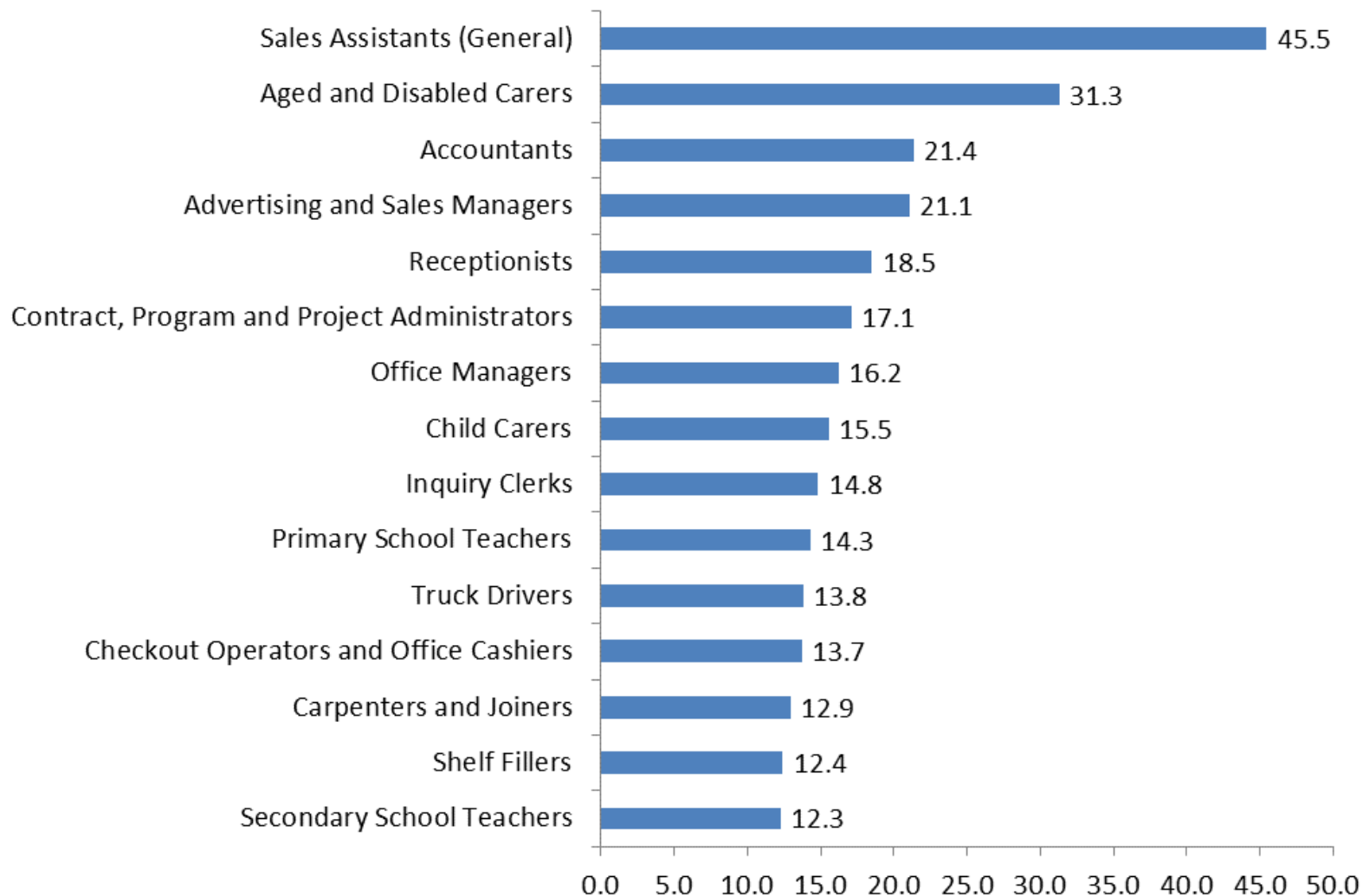
Australian Construction employment

Historical and five years to November 2017



Growth occupations

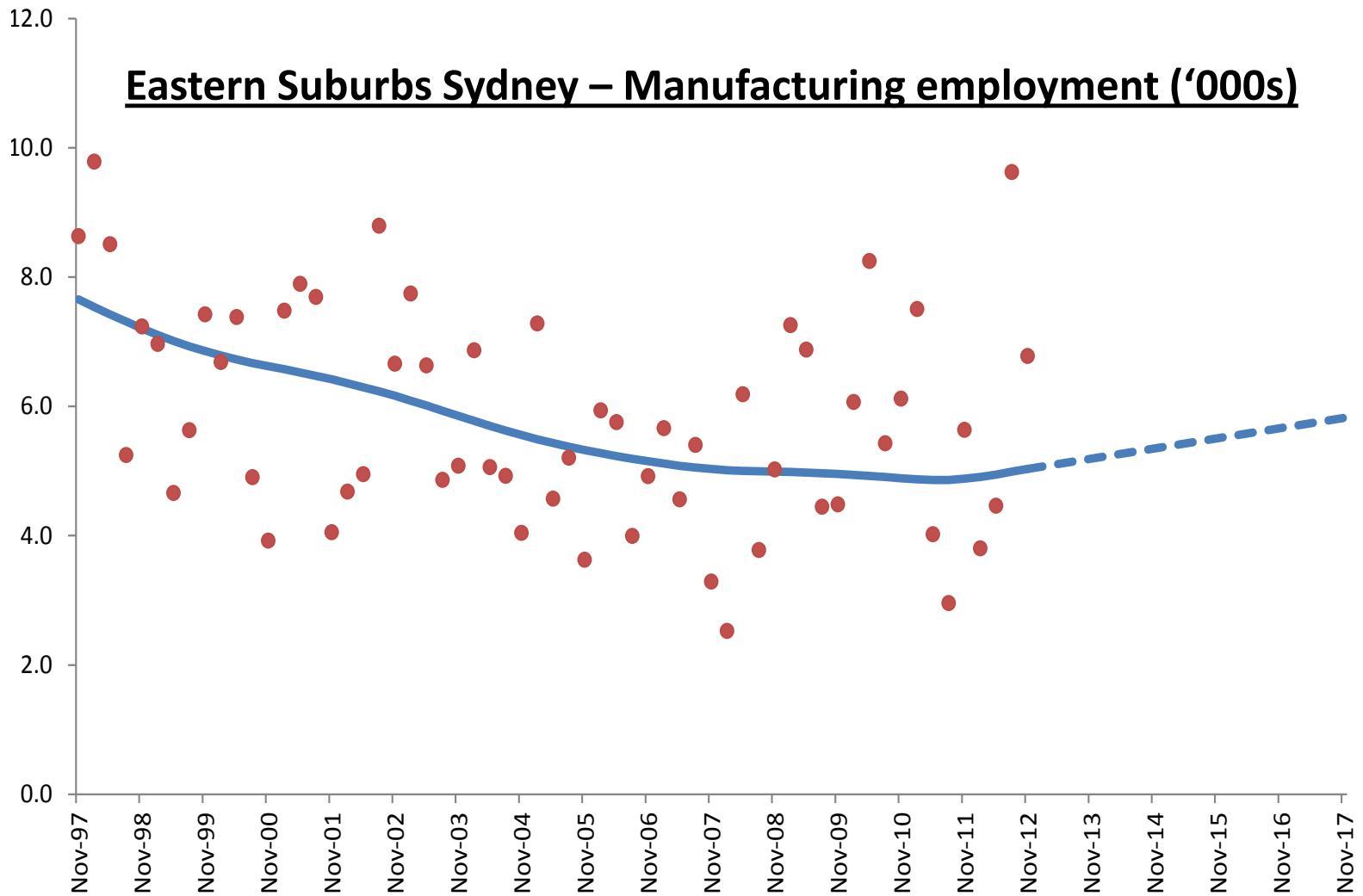
Five years to November 2017 ('000)



Regional projections

- To produce regional projections we use the same method as just described
- However, Australian regional employment data can show considerable volatility, due to the sparse and widely distributed population
 - Particularly when disaggregated by industry, as relevant populations can get very small
- To create more robust and stable projections, we first apply the Hodrick Prescott Filter to the historical data to abstract from the volatility and identify the longer term trend

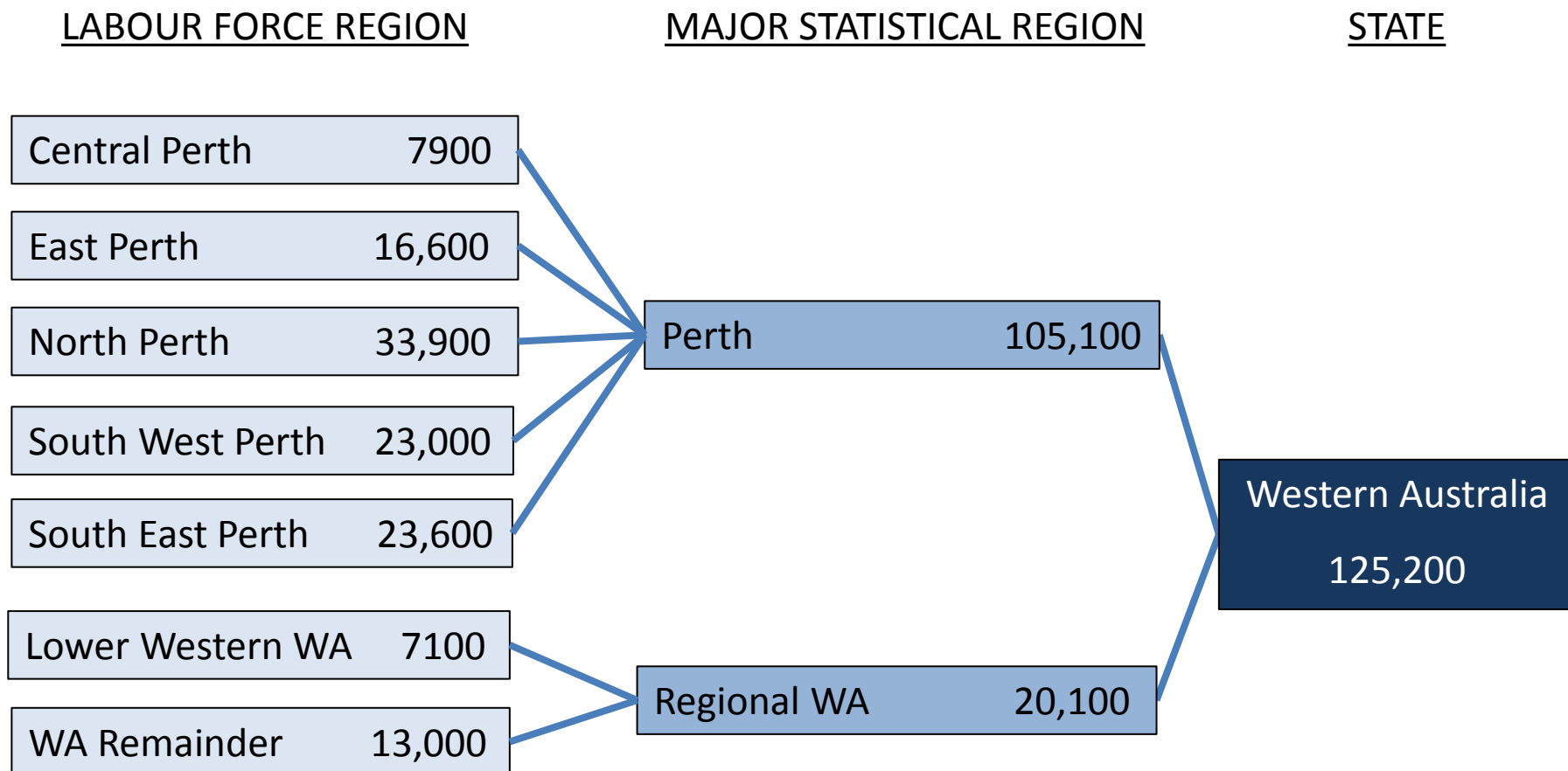
Regional projections



Scaling of regional projections

Western Australia regional projections –

Projected five year change to Nov 2017 ('000s)



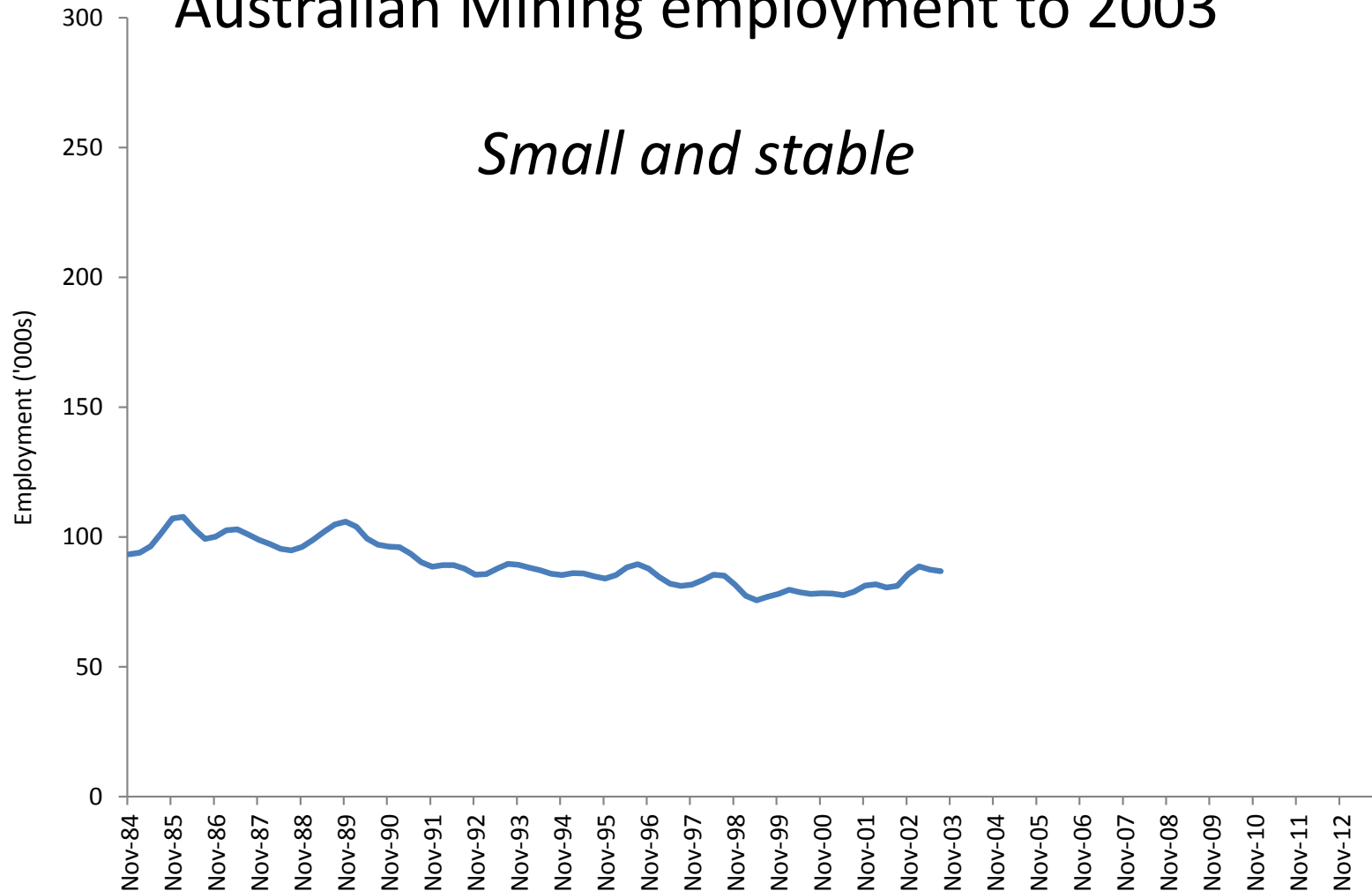
Limitations

- We recognise, and remain acutely aware, that all forecasting and projection methods have limitations
- There are some shocks to the economy that no method, including the one used by the Australian Government Department of Employment, can consistently and accurately forecast
 - Global Financial Crisis
 - Mining boom in Australia
 - Natural disasters

Limitations – an example

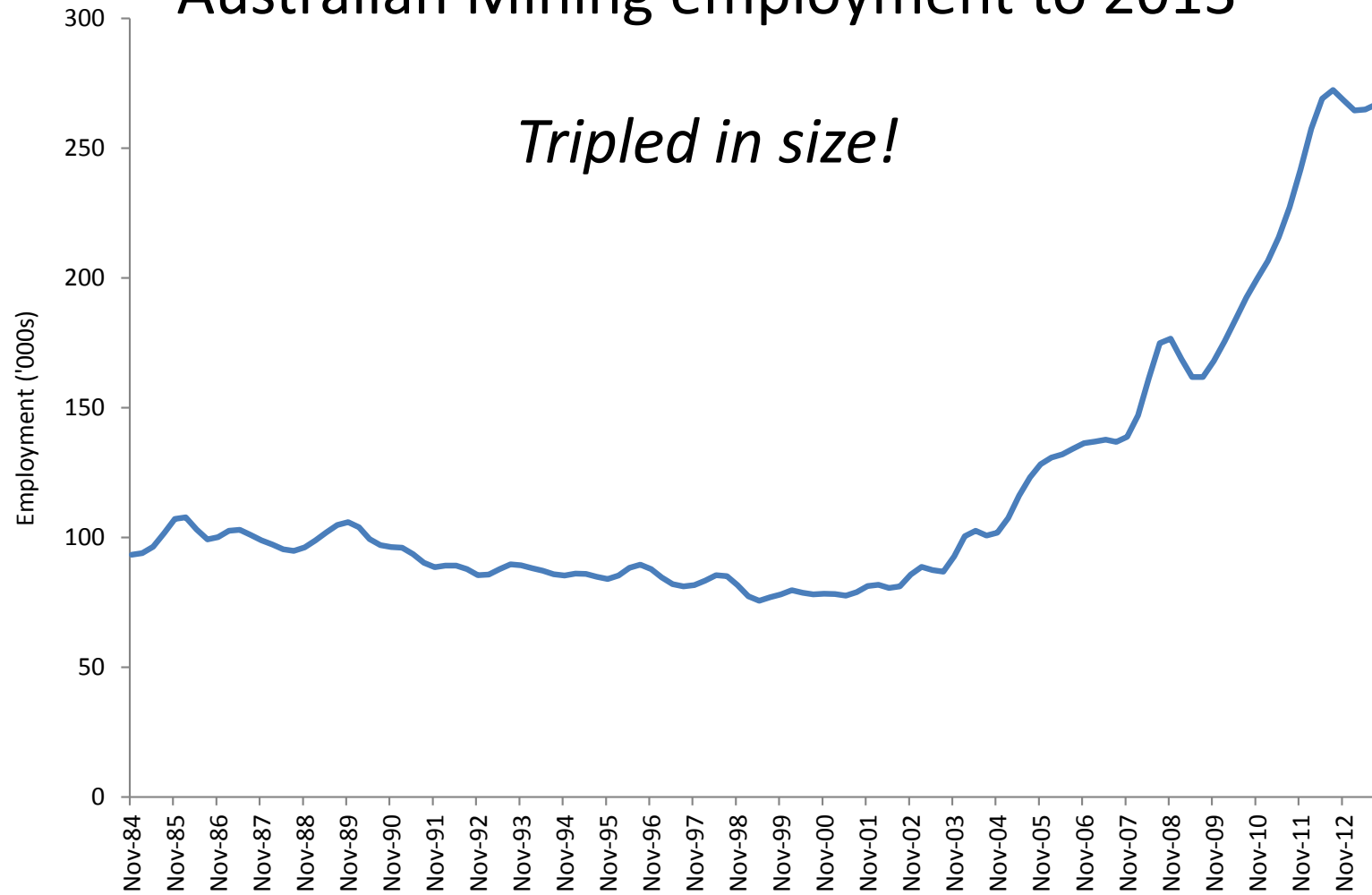
Australian Mining employment to 2003

Small and stable



Limitations – an example

Australian Mining employment to 2013



Summary

- Combining forecasts produces better results in the long run (on average)
- Simple univariate models (ARIMA and ESWDT) more closely align with our aims, resources, data and constraints, and perform as well as model based projections
- Known future industry and regional developments are also accounted for
- Scaling seeks to ensure consistency with Treasury's forecasts of total Australian employment, as well as across industries, sectors, and geographical levels

Further information

Labour Market Information Portal:

- lmip.gov.au

Job Outlook website:

- joboutlook.gov.au

Australian Jobs publication:

- employment.gov.au/australianjobs

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