Australian Government
Productivity Commission

Australia's Automotive Manufacturing Industry

Supplement to Inquiry Report

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Economywide Modelling of Automotive Industry Change

The Productivity Commission

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Contents

Boxes

Figures

Tables

Abbreviations

Abbreviations

ABS	Australian Bureau of Statistics
AMWU	Australian Manufacturing Workers Union
ANZSIC	Australian and New Zealand Standard Industrial Classification
ASGC	Australian Standard Geographic Classification
ATS	Automotive Transformation Scheme
COAG	Council of Australian Government
CoPS	Centre of Policy Studies
FAPM	Federation of Automotive Products Manufacturers
FCAI	Federal Chamber of Automotive Industries
Ford	Ford Motor Company of Australia
GDP	Gross Domestic Product
GNE	Gross National Expenditure
GSP	Gross State Product
GST	Goods and Services Tax
HILDA	Household, Income and Labour Dynamics in Australia
Holden	General Motors Holden
IOPC	Input-output product code
MMRF	Monash Multi-Regional Forecasting (model)
MRES	Monash Regional Equation System
MYEFO	Mid-Year Economic and Fiscal Outlook
PC	Productivity Commission
PMV	Passenger Motor Vehicle
SUV	Sports Utility Vehicle
Toyota	Toyota Motor Corporation Australia
WISeR	Australian Workplace Innovation and Social Research Centre

Explanations

..	No change, zero or rounds to zero
(+)	Positive, between 0 and 0.05
(-)	Negative, between -0.05 and 0
na	Not applicable

1   Modelling approach

The terms of reference for this inquiry asked the Productivity Commission to report on, amongst other things, any significant transition issues or adjustment costs that may arise from alternative assistance mechanisms or policy changes and how they might be best managed. The Commission was also asked to quantify the economywide and regional costs and benefits of existing and alternative assistance mechanisms.

At the outset of the inquiry, quantitative analysis may have appropriately focused on alternative industry-specific assistance mechanisms and the economywide, industry and regional impacts of further assistance, notwithstanding that Ford Motor Company of Australia (Ford) had announced it would cease local vehicle manufacturing by October 2016. However, during the course of the inquiry, General Motors Holden (Holden) and Toyota Motor Corporation Australia (Toyota) also announced that they would cease motor vehicle and engine manufacturing in Australia by the end of 2017.

In view of these developments, the Commission has focused its quantitative analysis on the potential implications of the impending motor vehicle manufacturing plant closures in Australia. Quantitative analysis can shed light on the broad order of magnitude of the adjustment task.

In the Commission's modelling, the passenger motor vehicle manufacturing industry[1] workforce is assumed to decline by 80 per cent from current levels as a consequence of plant closures. This assumes that a number of jobs in design and engineering (consistent with the announcements of both Ford and Holden), head office, sales and marketing functions are retained. These latter services and the associated employment of labour and capital are reclassified (for the purpose of this analysis) to become part of the 'business services' sector in the Victorian economy — the current location of the head offices of Ford, Holden and Toyota.

Employment is also assumed to decline by 40 per cent from prevailing levels in the automotive components manufacturing industry as a result of the cessation of large-

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[1] Passenger motor vehicle manufacturing is defined in this supplement as the manufacture of passenger motor vehicles, light commercial vehicles (including sports utility vehicles) and associate engine production. It excludes manufacture of heavy commercial vehicles, including buses and trucks, caravans and trailers.

scale passenger motor vehicle manufacturing. Virtually all of this reduction is assumed to occur in component manufacturing in Victoria and South Australia.

The Commission's approach also allows for the operation of a small-scale motor vehicle manufacturing industry for specialist and bespoke vehicles — an allowance for this of around 2 per cent of current industry production has been included in this illustrative analysis. Accordingly, the exit of the major vehicle manufacturers is assumed to result in a 98 per cent decline in the Australian output of passenger motor vehicles.

With the closure of the major passenger motor vehicle manufacturing plants occurring by the end of 2017, industry-specific budgetary assistance to the automotive manufacturing industry is modelled as ending at that time.

It is important to note that the statistics quoted in this supplementary report follow the ABS classifications of the different segments of the automotive industry. These ABS classifications do not line up exactly with the boundaries commonly thought of within the automotive manufacturing industry or relevant to the administration of government assistance programs to the industry and its suppliers. In particular, '*automotive components manufacturing*' that forms part of the ABS motor vehicle and motor vehicle part manufacturing industry is defined more narrowly than what is regarded as automotive component manufacturing by the industry (which also covers a range of chemical, plastic, metal and glass products).[2] The Commission's analysis takes account of the industry's broader definition of automotive components manufacturing by capturing the broader range of manufacturing activities that support passenger motor vehicle manufacturing, and a system of input-output linkages between the passenger motor vehicle manufacturing industry and other industries.

The exit scenario modelled is outlined in table 1.1. To illustrate a range of possible adjustment implications following the closure of the major passenger motor vehicle manufacturing plants, the Commission has undertaken tests to highlight the sensitivity of possible changes and adjustment paths associated with these closures (chapter 4).

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[2] Automotive component manufacturing in this supplement refers to automotive electrical component manufacturing and other vehicle parts manufacturing (as classified to ABS Australian and New Zealand Standard Industry Classification (ANZSIC) 1993 classes 2813 and 2819 and the equivalent classes, 2313 and 2319, in ANZSIC 2006). These activities are separately enumerated in the Commission's modelling database (see below).

Table 1.1   **Illustrative scenarios modelled**

Scenario	Passenger motor vehicle and automotive components production	Budgetary assistance — motor vehicle manufacturing and automotive components
Exit scenario modelled		
Closure of motor vehicle manufacturing plants in Australia	All large-scale passenger motor vehicle manufacturing in Australia ceases by the end of 2017,[a] but some ongoing head office, design and engineering and marketing functions in Australia are maintained. Automotive component manufacture equivalent to 40 per cent of employment in the Australian components industry assumed to cease concurrently with the cessation of passenger motor vehicle manufacturing.	The profile for ATS funding incorporates reductions announced in the 2013-14 Mid-Year Economic and Fiscal Outlook.[b] No assistance allocated once large-scale passenger motor vehicle manufacturing ceases.

In estimating the timescale over which the economy adjusts to plant closures, aggregate unemployment is modelled as increasing in the short term as displaced automotive employees take time to find re-employment, but unemployment returns to base levels in the long term. Two job loss scenarios are considered based on the number of people currently employed in passenger motor vehicle manufacturing and the automotive supply chain and duration analysis of the unemployment experience of manufacturing industry workers.

Alternative modelling assumptions examined and sensitivity testing

- Alternative assumptions about the rate of adjustment in labour markets, with respect to the interstate mobility of the workforce.
- Alternative assumptions about the rate of adjustment of investment in new capital.
- Alternative assumptions about the effect of increased import substitution possibilities (Armington elasticities) across products by industry.

a Ford has announced it will cease vehicle and engine manufacturing in Australia by October 2016 and Holden and Toyota have announced they will cease vehicle and engine manufacturing in Australia by the end of 2017. **b** Based on estimates provided by the Department of Industry.

In view of the Commission's conclusion that the case for providing industry-specific assistance to the automotive manufacturing industry is weak, the analysis does _not_ seek to answer the questions: 'What are the cost disadvantages of manufacturing motor vehicles in Australia and what would be the likely level of government subsidies required to retain production in Australia?' Nor does it seek to answer the question: 'How might such a subsidy vary over time with changing consumer tastes and demand for local offerings, industry costs and changes in the terms of trade and other general economic conditions?' It follows that the modelling does not estimate the potential efficiency costs of continuing to provide assistance to the industry.

1.1 The modelling framework

To assess the economywide and regional impacts of changes in the automotive manufacturing industry, it is necessary to examine changes in the industry itself and flow-on effects to different sectors and groups within the economy. These impacts will depend on, among other factors, changes in resource use by different sectors of the economy, changes in Australia's terms of trade with the rest of the world and other relative prices effects.

The Commission and its predecessors have made extensive use of economywide computable general equilibrium models to assess the impacts of changes in industry assistance on economic activity and the impacts of economic policy reforms. In 2008, the Commission used a computable general equilibrium framework to model the effects of future automotive assistance arrangements (PC 2008) and in 2012, it used a similar (but updated and extended) framework to assess the impacts of Council of Australian Government's (COAG) policy reforms (PC 2012a). The particular model adopted in each of these studies, and a number of earlier studies, is the Monash Multi-Regional Forecasting (MMRF) model.

The version of the model being used in this study — termed the MMRF-Auto14 model — follows that used in the Commission's 2012 study on the impacts of COAG reforms. This model treats each state and territory as a separate economy linked by inter-regional trade. Production in each jurisdiction is disaggregated into 66 industries. The model also includes a regional equation system that applies a 'top-down' approach to project state and territory results to 58 statistical divisions on the basis of relative employment by industry in each division.

In the model, the automotive manufacturing industry is disaggregated into three segments:

- passenger motor vehicle manufacturing

- automotive component manufacturing, including among other things, the production of panels, fuel pumps, transmission systems, instrumentation, seatbelts, lights, windscreen wipers and air conditioners

- other automotive manufacturing, including other vehicle production (production of trucks, buses, motor bikes and motor scooters) and motor vehicle body and trailer production (which does not include the large-scale manufacture of passenger motor vehicles, but relates to the manufacture of bus and truck bodies, caravans and trailers, and modification of finished vehicles).

Separate identification of the passenger motor vehicle manufacturing segment in the model allows the model database to capture input-output linkages between the

passenger motor vehicle manufacturing industry and all other industries included in the model, including other manufacturing industries that are part of the automotive supply chain.

Based on ABS statistical information, inquiry information received through submissions and consultations, and the model database, it is estimated that:

- the passenger motor vehicle manufacturing industry accounts for about 0.1 per cent of both value added and employment in Australia, while the automotive components manufacturing industry (as defined by the ABS) accounts for just under a further 0.2 per cent

- over half of Australian-manufactured passenger motor vehicles by value is purchased by individuals and households for personal use, around 20 per cent is exported and 25 per cent is used as inputs into the creation of physical capital (investment)

- Australian-produced components and other manufactures make up around 30 and 25 per cent, respectively, of the costs of domestic inputs used in manufacturing passenger motor vehicles in Australia, with the remainder comprised of services

- Australian-sourced inputs account for almost 70 per cent of the cost of Australian-produced passenger motor vehicles, with the remainder being comprised of value adding inputs of labour and capital and imported components

- while the links between automotive components suppliers and passenger motor vehicle manufacturers differ substantially between firms, overall, just over 20 per cent of the Australian-manufactured output of automotive components (as defined by the ABS) are used directly in the manufacture of passenger motor vehicles

- around 70 per cent of automotive components produced in Australia are then used by other industries and consumers as aftermarket sales[3] with the balance being exported or for own use

- less than 1 per cent of other Australian-produced manufactures, such as metal and chemical products, are used in the manufacture of passenger motor vehicles

- the manufacture of passenger motor vehicles, including engines, is centred in the statistical divisions of Melbourne and Barwon (covering Geelong, where Ford's engine plant is located) in Victoria and Adelaide in South Australia (covering Elizabeth), with employment split between these divisions in the proportions around 70, 10 and 20 per cent, respectively

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3 Supply of accessories and parts for motor vehicles fitted after a new vehicle has been sold, such as for mechanical repairs.

- production of automotive components is located mainly in the capital city areas of Victoria and South Australia, with smaller contributions from New South Wales, Queensland and Western Australia (with the capital cities accounting in total for around 82 per cent of employment in components production).

The MMRF model is applied in *comparative-static* mode to project the longer-run effects of change and in *dynamic* mode to explore the timescale over which changes may occur and possible adjustment implications. Under the dynamic approach, the modelling scenario focuses on the path of the economy with the modelled closure of passenger motor vehicle manufacturing plants by the end of 2017.

The broad growth path of the economy adopted for this study follows that adopted for the Commission's 2012 report on the impacts of COAG reforms and is based on assumptions about changes in population, terms of trade and labour productivity (PC 2012). Modelled changes in labour productivity and other variables are based on historical data at the sectoral level. Changes in population are estimated using a cohort-based demographic model. It includes sector-specific changes for the motor vehicle manufacturing industries (appendix B).

The MMRF-Auto14 model as applied in this study is outlined in appendix A and the model database and its construction is outlined in appendix B. A detailed description of the theoretical structure of the model is provided in *A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy* (CoPS forthcoming). A draft of this manuscript is available on request to the Commission.

1.2 The modelling in context

No model can fully replicate the economy and all of its complex interactions. The economywide approach adopted in this inquiry seeks to capture many of the relationships relevant to modelling the closure of passenger motor vehicle manufacturing plants in Australia. The motor vehicle manufacturing closure scenario seeks to reflect the direct effects on industry of corporate decisions concerning the location of production facilities around the globe — decision-making processes which are determined outside of the model. In model simulations, the direct effects of decisions to establish or close plants are imposed on the model as exogenous 'shocks' or a model 'scenario' and the flow-on economic effects are estimated.

As the scenario modelled reflects production decisions imposed on the model, it should *not* be interpreted as a quantification of the effects of government policy

decisions. As discussed in the inquiry report, the cost of maintaining a motor vehicle manufacturing industry in Australia would likely be significant and would need to increase over time through import tariffs or budgetary assistance if current trends continue (inquiry report, box 3.8, p. 103). However, the precise level of assistance that would be required is uncertain and accordingly the efficiency and welfare effects of continued assistance have not been modelled.

While the economywide approach of the MMRF model supports the analysis of a range of changes affecting industry, regions and the national economy, there are some real-world processes that are not included. For example, the model does not capture the emergence of new activities and products or productivity improving changes in the use of resources. The model also does not capture factors such as economies of scale or scope that change the commercial viability of production units or lead firms to concentrate new production at a particular plant or in a particular location.

The dynamic modelling of the possible timescale of effects is based on a framework of 'adaptive' expectations where industry adjusts gradually to economic change. Under this approach, capital progressively depreciates and accumulates to equilibrate actual return on capital with the expected rate, based on the historical average. The possible implications of alternative rates of capital accumulation are investigated in this modelling exercise through sensitivity testing. More broadly, the economic adjustments that are realised may differ from those modelled to the extent that firms anticipate changes and, in so doing, adjust investment, output and employment decisions according to their expectations of the industry and economywide effects of the closure of passenger motor vehicle manufacturing plants in Australia.

The behavioural parameters included in the MMRF-Auto14 model determine the responsiveness of producers and consumers to changes in relative prices and are based on benchmark model values. To the extent that behavioural responses by producers and consumers differ (such as in purchasing local and imported supplies, the substitution between labour and capital in production or the relocation of labour between regions) from these benchmark values, results could under- or overstate outcomes.

Similarly, the compilation of the model database is based on many simplifying assumptions needed to translate and calibrate available statistical information into a balanced database representing the complex interactions in the economy. Deviations in the model data from actual economic flows could lead to under- or overstatement of aggregate results, or variation in the distributional effects of change from likely outcomes. As described in appendix B, the Commission has sought to reflect the

main features of the automotive manufacturing industry in the model database, including the observed declines in the level of output and employment in passenger vehicle manufacturing and the associated decline in this activity relative to other activities in the economy over the past decade.

1.3   Refereeing and consultation

In accordance with the requirements of the Productivity Commission Act, the Commission appointed two referees — Professor Peter Robertson, Head of Discipline/Winthrop Professor of Economics, University of Western Australia and Dr Ashley Winston, Chief Economist, KPMG Australia to assess its modelling approach and preliminary results. The Commission also held a modelling roundtable on 4 March 2014 to consider its preliminary results. Both referees attended the roundtable, as did representatives of Australian and state government agencies, the automotive industry and the Australian Manufacturing Workers Union (AMWU), as well as academics (inquiry report, appendix A). The consultations assisted the Commission to subsequently refine and improve the database construction, the modelling and presentation of results.

The modelling roundtable also allowed for discussion of modelling work provided by participants to the inquiry, in particular modelling provided by the Federal Chamber of Automotive Industries (FCAI) (sub. 30). As detailed in chapter 6 of the inquiry report, the modelling provided by the FCAI did not disaggregate the automotive manufacturing industry as in this report, but modelled a more than 90 per cent reduction in output of the entire industry. Their estimate of around 50 000 job losses is larger than the Commission's estimates.

In the Commission's assessment, a more appropriate upper bound estimate is 40 000 job losses, with plausible estimates of likely job losses (based on current industry employment) falling within this bound (chapter 3). This estimate takes account of the closure of passenger motor vehicle manufacturers and the flow on effects to component and other suppliers. It makes allowance for the significant extent to which manufacturers of aftermarket components, producers of buses and trucks and their component suppliers, and motor vehicle body and trailer manufacturers[4] will continue production following the closure of passenger motor vehicle manufacturing plants.

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[4] The ABS category 'motor vehicle body and trailer manufacturing' does not include the large-scale manufacture of motor vehicles, but relates to the manufacture of motor vehicle bodies (including bus and truck bodies), caravans and trailers, and modification of finished vehicles.

1.4 Structure of reporting on the modelling

Chapter 2 of this supplement presents the longer-run modelled impacts of the closure of the major passenger motor vehicle manufacturing plants in Australia at the national, state and regional levels. Chapter 3 reports on the possible timescale of impacts. Chapter 4 examines the sensitivity of results to alternative assumptions about labour and capital market adjustment and the extent to which imports can substitute for domestic production.

As noted, appendix A provides a description of the MMRF-Auto14 model, modelling assumptions and key model parameter values. Appendix B describes the database adopted, the disaggregation of the motor vehicle and parts industry and key cost and sales shares for the industry. Appendix C provides details of the specification of the modelling scenarios.

2 Estimated longer-run effects of the closure of passenger motor vehicle manufacturing plants

This chapter explores the longer-run economic effects of the exit of the three major passenger motor vehicle manufacturers and consequential reductions in supply chains in Australia using a comparative-static modelling approach. This modelling abstracts from transition and adjustment issues to focus on the longer-term impacts after full adjustment is simulated to have occurred. The timescale over which these impacts are projected to occur is explored in chapter 3 using a dynamic modelling approach, while sensitivity of the results to some alternative modelling assumptions is reported in chapter 4.

As noted in chapter 1, the analysis does not seek to assess the potential costs of assistance that would be required to retain the industry nor to estimate the flow-on effects of these costs to the community.

Details of the model and database used are outlined in appendixes A and B, respectively. Details of the modelling of the exit scenario are outlined in appendix C.

2.1 Wider industry effects

Modelled changes in the industry composition of the economy arise primarily from the exit of the passenger vehicle manufacturers, the associated supply chain adjustment and the flow on effects of these changes on activity levels across industries. The mechanisms bringing about these adjustments are outlined in box 2.1. Industry composition is also influenced, albeit to a lesser degree, by the assumed reallocation of industry-specific budgetary assistance from eligible passenger motor vehicle manufacturers and their suppliers to households.

Box 2.1   **How the closure of passenger motor vehicle manufacturing plants affects the broader economy**

The closure of the three major Australian passenger motor vehicle plants will affect the broader economy through a variety of mechanisms. The main mechanisms are captured in a stylised way in the MMRF model, although no model can capture all of the linkages and processes of the real world.

After the closure, Australian demand for passenger motor vehicles will be met through imports, rather than a mix of domestic production and imports as is currently the case. The initial effects of passenger motor vehicle manufacturing ceasing in Australia are a loss in employment in that industry and a decrease in net exports, as exports of passenger motor vehicles decrease and imports increase to meet consumer demand. This affects industries that rely on sales to vehicle manufacturing, with output and employment also falling in these supply chain industries.

These initial effects trigger changes in prices of products, labour and capital which lead to output changes throughout the economy. First, the decrease in net exports moves the trade balance into deficit, reducing demand for the Australian dollar and increasing demand for foreign currencies. The resulting depreciation of the Australian dollar will increase the cost of foreign goods relative to the cost of domestic production and increase the international competitiveness of Australian exports and domestic firms that compete with imports. Australian export volumes will increase and the volume of imports of goods and services (other than passenger motor vehicles) will decrease, resulting in an expansion of output and employment in domestic traded goods industries. Even without any further adjustments in factor prices or industry capital, this absorbs some of the workers displaced from auto assembly and the supply chain industries.

Second, and in the longer run, there is pressure on factor prices to adjust to factor surpluses or shortages. In particular, if the expanding industries do not fully absorb the labour from contracting industries at the prevailing wage, then downward pressure on real wages increases the profitability of expanding employment and output across a range of industries. These demand responses and effects will depend on demand for industry output, the labour intensity of different industries, and the impact of changes in the cost of labour on the price of inputs. The demand for other inputs, including capital, will increase as returns from productive activity rise and firms increase output.

The primary effect of the exit of the major passenger motor vehicle manufacturers will be to reduce the output of, and employment in the automotive manufacturing industry (table 2.1, column 1).[1] The estimated reduction in industry output and employment is less than 100 per cent to account for the retention of small-scale

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[1] To fill the local supply gap, local consumers and investors are modelled as replacing previously produced domestic supplies with imported passenger motor vehicles and automotive components. Exports of passenger motor vehicles are assumed to decline in line with industry output (appendix C).

specialist and bespoke vehicle manufacturers (assumed to be 2 per cent of the current industry). However, moderating the effects of passenger motor vehicle plant closures to an extent, some current activities relating to marketing, design and head office functions (and associated jobs) are assumed to continue, which are reclassified as business services in Victoria.

Table 2.1   **Estimated longer-run industry effects of the closure of passenger motor vehicle manufacturing plants in Australia**[a]

Percentage change

Variable	Exit of passenger motor vehicle manufacturers and consequential reductions in supply chains	Reallocation of budgetary assistance outlays	Total effects
Value added (at factor cost)			
Agriculture	0.9	(-)	0.8
Mining	2.6	-0.2	2.4
Manufacturing	-1.6	(-)	-1.6
of which:			
PMV manufacturing	-98	(-)	-98
Automotive components	-46	(-)	-46
Other manufacturing	0.5	(-)	0.5
Services	-0.1	(+)	(-)
Employment (persons)[b]			
Agriculture	1.3	-0.1	1.3
Mining	2.7	-0.2	2.5
Manufacturing	-1.1	(-)	-1.2
of which:			
PMV manufacturing	-98	(-)	-98
Automotive components	-40	(-)	-40
Other manufacturing	0.6	(-)	0.5
Services	(+)	(+)	(+)

(+) Positive, between 0 and 0.05. **(-)** Negative, between -0.05 and 0. **a** Longer-run impact after full adjustment relative to current passenger motor vehicle manufacturing operations. **b** Aggregate employment assumed unchanged from levels that would otherwise prevail.

Source: Commission estimates based on the MMRF-Auto14 model.

In the Commission's assessment, national employment in automotive components production could decline by up to 40 per cent (chapter 1). The decline in employment would be concentrated in the passenger motor vehicle producing states of Victoria and South Australia (58 per cent of jobs in component manufacturing are assumed to be lost in these two states) and would imply a decline in national value added of automotive components of nearly 50 per cent. This divergence between output and employment reflects higher value added per person employed

by component manufacturers supplying the three major motor vehicle producers, mainly in Victoria and South Australia, compared to component manufacturers in other states. This reflects an input-output structure of the Victorian and South Australian suppliers that is characterised by production systems focused on higher-volume standardised lines more dependent on capital inputs compared to producers in other states that are, in some cases, producing small run length, customised parts for the aftermarket.

Nevertheless, the estimated decline in output and employment in automotive component manufacturing is smaller than that in passenger motor vehicle manufacturing, on account of sales of automotive components to other activities — in particular, to the aftermarket, to truck and bus manufacturing, and exports. Component manufacturing that is not directly linked to passenger motor vehicle production in Australia would not experience the direct reduction in demand for its output and would potentially benefit indirectly from the decline in real wages, the projected real depreciation of the Australian dollar associated with the exit of motor vehicle producers and expansion of activity levels more broadly.

With the decline in demand for intermediate inputs used in the production of passenger motor vehicles, the activities in the wider manufacturing industry (which includes automotive inputs such as metal, glass, plastic and rubber product manufacturing) are projected to decline.

The primary effect of the exit of the major passenger motor vehicle manufacturers and associated supply chain adjustment is to reduce the output of, and employment in, the automotive manufacturing industry (table 2.1, column 1). The changes are estimated to generate total job losses in the order of 33 000 from the industry and affected components and other suppliers. The Commission's report conservatively rounds this up, and refers to 'up to 40 000' jobs lost.

In the longer-run environment modelled, national employment is assumed to be maintained through adjustment in real wages and the real depreciation of the exchange rate, which — after a period of adjustment to the direct and indirect effects of the modelled plant closures — lead to higher employment in a range of other activities. The activities projected to expand in the longer run from levels that would otherwise have prevailed include, in particular, the more capital–intensive, trade-exposed mining, agricultural and service industries, as well as other manufacturing activities not linked to passenger motor vehicle manufacturing.

Output from these activities is typically more responsive in the longer run to changes in the real exchange rate relative to other more labour-intensive domestically-oriented non-traded (mainly service) activities. On balance, the

services sector is modelled to decline slightly, notwithstanding that some service industries expand to support trade-exposed activities (and the impact of reclassifying, as services, some design and engineering, head office, sales and marketing functions currently integrated into the manufacturing operations of Ford, Holden and Toyota).

The effect of industry-specific budgetary assistance on production and employment in the automotive manufacturing industry has not been modelled. However, the modelling assumes the freeing up of government funds following exit of the industry is reallocated as a lump-sum payment to Australian households. This is estimated to have a small effect on industry outputs (in automotive manufacturing and other industries) due to the increase in consumption expenditure. Increased consumption expenditure causes an expansion of the non-traded sector (services in particular) and some crowding out of activity in the traded sector — particularly in agriculture and mining — as resources are reallocated to the non-traded sector. These effects moderate somewhat the impacts of the real depreciation on broad industry composition triggered by passenger vehicle manufacturing closure.

2.2 Aggregate effects

The estimated aggregate effects of the closure of passenger motor vehicle manufacturing plants on the economy are presented in table 2.2. Overall, the results suggest that the aggregate effects will be small. For example, as modelled, the estimated longer-run Australia-wide effects of the plant closures and cessation of subsidies could raise national output, after the economy has fully adjusted, by around 0.1 per cent relative to the level it otherwise would have been if manufacturing operations had remained at current levels (table 2.2, column 3). Real gross national expenditure and each component — domestic consumption, investment and government spending — could also increase fractionally.

However, notwithstanding that the effects on GDP and other aggregate variables will be small, the magnitude and even direction of change depends on factors such as the relative capital intensity of the rest of the economy and its ability to draw in additional capital and other influences. For example, sensitivity testing presented in chapter 4 confirms that, although modest, aggregate impacts are influenced by impediments to job mobility across states, and may be negative. It also should be borne in mind that an increase in GDP will not necessarily translate to an increase in net national income to the extent of terms of trade declines and changes in *net* investment income associated with additional capital accruing outside Australia (PC 2005).

Table 2.2 Estimated longer-run economywide effects of the closure of passenger motor vehicle manufacturing plants in Australia[a]

Percentage change

Variable	Exit of passenger motor vehicle manufacturers and consequential reductions in supply chains	Reallocation of budgetary assistance outlays	Total effects
Real gross domestic product	0.1	(+)	0.1
Real gross national expenditure	(-)	(+)	(+)
of which:			
Real household consumption	-0.1	0.1	(+)
Real investment	0.1	(+)	0.1
Real government spending	(-)	0.1	(+)
Export volumes	2.5	-0.2	2.3
Import volumes	2.0	(+)	2.0
Real exchange rate[b]	0.4	(-)	0.4
Terms of trade	-0.3	(+)	-0.3
Real unit labour cost[c]	-0.2	(+)	-0.2
Consumer real wages[d]	-0.2	(+)	-0.1

(+) Positive, between 0 and 0.05. **(-)** Negative, between -0.05 and 0. **[a]** Longer-run impact after full adjustment relative to current passenger motor vehicle manufacturing operations. **[b]** Real depreciation of the Australian dollar (defined as the Australian dollar price of imports less the GDP(E) deflator). **[c]** Real unit labour cost paid by producers inclusive of taxes on labour income used in production (such as payroll tax). **[d]** Real wage rate received by workers after the payment of any taxes on labour income used in production (such as payroll tax), but before income tax.

Source: Commission estimates based on the MMRF-Auto14 model.

The estimated changes in trade flows are larger in magnitude than those for broader aggregates. This is because, as outlined in box 2.1, import volumes would increase to fill the gap in supply left by the reduction in the domestic production of cars, while the real depreciation of the Australian dollar promotes expansion of export industries. Imported passenger motor vehicles are projected to constitute the main part of the increase in imports.

While downward pressure on real wages associated with the cessation of passenger motor vehicle assembly would lower household incomes (table 2.2, column 1), lower subsidy payments to passenger motor vehicle and component manufacturers would enable those funds to be redistributed — modelled as increasing household disposable incomes. This assumed reallocation increases household real consumption spending to levels above those that would otherwise have prevailed and would raise gross national expenditure (table 2.2, column 2).

2.3   State and territory effects

The state and territory results reflect the location of the passenger motor vehicle manufacturing plants that are scheduled to close and their input suppliers — mainly in Victoria and South Australia — versus the location of activities that are projected to expand — which are generally located in other jurisdictions. While there would be some flow-on expansion in non-automotive industries in Victoria and South Australia, the outcomes for these jurisdictions are estimated to be dominated by the changes in the passenger motor vehicle manufacturing activities and their supply chains, all other things remaining equal.

With national employment assumed fixed in the longer run, activity and employment are projected to be lower than otherwise in Victoria and South Australia, and higher in all other jurisdictions, most notably in export-orientated industries in Western Australia, Queensland as well as New South Wales and other jurisdictions (table 2.3).

Other reductions in output and shifts in employment are also projected in Victoria and South Australia, as the effects of the closure of passenger motor vehicle manufacturing operations ripple through state economies. Affected activities include those that supply inputs indirectly to passenger motor vehicle producers and their suppliers, as well as those that supply consumer goods, such as trade and transport services. These flow-on effects are estimated to account for about one half of the total projected impacts for Victoria and South Australia.

Table 2.3   **Estimated longer-run state and territory effects of the closure of passenger motor vehicle manufacturing plants in Australia**[a]

Percentage change

	NSW	Vic	QLD	SA	WA	Tas	NT	ACT	Aust
Real gross product	0.5	-1.9	1.1	-2.3	1.9	1.0	1.0	0.2	0.1
Employment	0.6	-1.8	1.1	-2.2	1.6	0.8	0.9	0.2	..[b]
Real gross expenditure per person	-0.2	0.4	-0.3	0.5	-0.2	-0.3	-0.3	-0.1	(+)
Value added (at factor cost)									
Agriculture	0.9	0.6	1.0	0.7	0.9	0.8	0.9	0.4	0.8
Mining	2.1	0.1	2.6	0.8	2.7	2.2	2.2	..	2.4
Manufacturing	0.7	-5.9	1.6	-6.4	2.0	1.3	1.8	0.5	-1.6
of which:									
PMV manufacturing	Na	-98	na	-98	na	na	na	na	-98
Automotive components	-2.5	-58	1.0	-58	1.7	1.0	0.9	0.1	-46
Other manufacturing	0.8	-0.6	1.6	-1.0	2.0	1.3	1.8	0.5	0.5
Services	0.4	-1.5	0.9	-2.2	1.4	0.7	0.7	0.1	(-)
Employment (persons)									
Agriculture	1.3	1.0	1.5	1.0	1.4	1.0	1.4	0.5	1.3
Mining	2.3	0.8	2.7	1.7	2.7	2.3	2.3	..	2.5
Manufacturing	0.8	-4.8	1.5	-4.6	1.9	1.3	1.7	0.6	-1.2
of which:									
PMV manufacturing	na	-98	na	-98	na	na	na	na	-98
Automotive components	-2.4	-58	1.1	-58	1.8	1.0	1.0	0.2	-40
Other manufacturing	0.9	-0.5	1.5	-0.8	2.0	1.3	1.7	0.6	0.5
Services	0.5	-1.5	1.0	-2.1	1.5	0.7	0.8	0.2	(+)

na Not applicable. **..** No change. **a** Longer-run impact after full adjustment relative to current passenger motor vehicle manufacturing operations. **b** Held fixed by assumption.

Source: Commission estimates based on the MMRF-Auto14 model.

These modelled estimates of employment and output changes illustrate the effect of manufacturing plant closures, abstracting from other possible changes in the economy. For example, actual outcomes for Victoria and South Australia will also depend on their productivity growth paths, other structural changes in their economies and other factors affecting their competitiveness relative to other Australian state and territories and internationally.

The output and employment impacts for jurisdictions other than Victoria and South Australia (most notably New South Wales, Queensland and Western Australia) reflect the net effect of three generally positive factors.

- First, the automotive component manufacturing industries in these jurisdictions are less reliant on sales to passenger motor vehicle manufacturing than are component producers in Victoria and South Australia.

- Second, these jurisdictions tend to be more reliant in the MMRF database on export-orientated industries that are projected to benefit from the reallocation of resources shed as a result of the exit of passenger motor vehicle manufacturers.

- Third, increased employment opportunities in these jurisdictions are projected to increase state and territory populations above levels that would otherwise have prevailed, raising demand for consumer goods and services.

Possible transition paths for the state economies are illustrated in chapter 3.

2.4   Sub-state regional effects

Reflecting that the Australian passenger motor vehicle manufacturing industry is located in Melbourne, Adelaide and Geelong, estimates of the longer-run impacts on regional economies and employment indicate that the effects are concentrated in the Barwon (covering Geelong), Adelaide and Melbourne statistical divisions. Employment in these regions is estimated to decline by 3.4, 3.3 and 2.6 per cent respectively (table 2.4). In the long run, employment is estimated to increase in the 55 remaining statistical divisions throughout Australia (including all other statistical divisions in Victoria and South Australia).

The estimated employment reductions in the Adelaide and Melbourne statistical divisions make the largest contributions to their respective state employment results (-2.5 and -1.9 percentage point contributions, respectively) (table 2.4). As Barwon accounts for only about 5 per cent of employment in Victoria, the estimated contribution made by the Barwon statistical division to the Victorian result is -0.2 percentage points, much less than for the Melbourne statistical division. The projected reductions in employment in Victoria and South Australia (table 2.3) are entirely attributable to reductions in the Barwon, Adelaide and Melbourne statistical divisions (table 2.4).

Table 2.4 **Estimated longer-run regional contributions to the changes in state employment from closing passenger motor vehicle manufacturing plants in Australia**[a]

State and key statistical divisions	Regional impact	Regional contributions to the state total
	Percentage change	Percentage points
Victoria	**-1.8**	**-1.8**
Melbourne	-2.6	-1.9
Barwon (Geelong)	-3.4	-0.2
All other regions	1.2	0.3
South Australia	**-2.2**	**-2.2**
Adelaide	-3.3	-2.5
All other regions	0.8	0.2
New South Wales	**0.6**	**0.6**
Sydney	0.5	0.3
All other regions	0.7	0.2
Queensland	**1.1**	**1.1**
Brisbane	0.9	0.4
All other regions	1.2	0.7
Western Australia	**1.6**	**1.6**
Perth	1.5	1.1
All other regions	1.7	0.5

(+) Positive, between 0 and 0.05. **(-)** Negative, between -0.05 and 0. Contributions may not add to state totals due to rounding. **a** Longer-run impact after full adjustment relative to current passenger motor vehicle manufacturing operations.

Source: Commission estimates based on the MMRF-Auto14 model.

3 Timescale over which the impacts of plant closures could occur

This chapter uses a dynamic-modelling framework to illustrate adjustments that may ensue after the closure of passenger motor vehicle manufacturing plants in Australia.

The closure of the manufacturing plants will result in a decline in employment in automotive manufacturing and related activities and, as the economy adjusts, an increase in employment in other industries. While jobs are continually being lost and created in the economy, the scale of job losses could lower the level of national employment and raise the rate of unemployment in the immediate post-closure period. Such effects would be concentrated in specific-regions of Victoria and South Australia and the effects may be sensitive to the rate at which these economies adjust following the manufacturing plant closures.

To illustrate the adjustment process and flow-on implications for state and national economies, two job loss scenarios are modelled — a higher and a lower job loss scenario. In each of these, it is assumed that people previously employed in passenger motor vehicle manufacturing and upstream industries add to national unemployment in the short run (box 3.1). The higher job loss scenario estimates that in the order of 33 000 jobs could be lost with the closure of passenger motor vehicle manufacturing, and the consequential rationalisation of firms in the automotive supply chain.

The higher job loss scenario includes job losses among component manufacturers, other manufacturers and suppliers of services used by motor vehicle producers. There could be a smaller number of job losses if some component manufacturers or other suppliers were able to adjust to plant closures without shedding jobs, for example by seeking new opportunities in the years before the closures.

On the other hand, there may be other job losses arising from the initial contraction in production across the economy. For example, the closure of passenger motor vehicle manufacturing plants could affect demand at local restaurants or other businesses, leading to further job losses. The extent of any such job losses will depend on the time period over which plant closures occur, on production and consumer behaviour and on adjustment in the supply chain.

Box 3.1 **Transitional unemployment and job loss scenarios**

The Commission's analysis of people previously employed in the Australian manufacturing sector (appendix C, Inquiry Report) shows that about two thirds of former manufacturing employees were re-employed on a full time, part time or casual basis within 12 months of becoming unemployed. This is broadly consistent with the experience of retrenched Mitsubishi employees following the closure of the Lonsdale engine manufacturing plant in 2004. The analysis also indicates that the number of people that remain unemployed tapers off over time.

It is estimated that around 29 000 people are currently employed in passenger motor vehicle manufacturing and what the ABS classifies as automotive component manufacturing. In addition, an estimated 16 300 people are employed in other manufacturing and service activities supplying passenger motor vehicle manufacturers.

In the modelling, it is assumed that passenger motor vehicle manufacturers and input-supplier job losses occur in 2016-17, although, as noted in the inquiry report, the job losses will more likely be staggered over several years. It is also assumed that the movement of people between employment and unemployment and into and out of the workforce is such that the unemployment arising from the closures would be eliminated by 2020-21 (appendix C).

The Commission considered two scenarios for job losses among industries that supply the passenger motor vehicle manufacturing industry.

- A 'higher' job loss scenario where: 80 per cent of jobs in the passenger motor vehicle manufacturing industry would be lost (20 per cent retained for ongoing design and engineering, head office, sales and marketing functions and specialist and bespoke passenger motor vehicle manufacturing); 40 per cent of employees in automotive component firms lose their job; and flow-on job losses in the supply chain in proportion to each industry's sales to passenger motor vehicle producers.
- A 'lower' job loss scenario where: job losses in passenger vehicle manufacturing match those announced by Ford, Holden and Toyota (6600); 40 per cent of employees in automotive component firms lose their job; proportional declines in employment in other manufacturing industries; and non-manufacturing industries responding via real wage adjustments (rather than job losses).

		2016-17	*2017-18*	*2018-19*	*2019-20*
	Victoria	24 150	8 190	3 890	1 330
Higher job loss scenario	South Australia	8 390	2 850	1 350	460
	Other states	70	20	10	0
	Total	**32 610**	**11 060**	**5 250**	**1 790**
	Victoria	11 980	4 060	1 930	660
Lower job loss scenario	South Australia	3 930	1 330	630	220
	Other states	70	20	10	0
	Total	**15 980**	**5 410**	**2 570**	**880**

Source: Commission estimates.

Reflecting this uncertainty, the Commission has conservatively reported that up to 40 000 people may lose their jobs as a result of the closure of the motor vehicle manufacturing plants and the rationalisation of firms in the supply chain.

While the modelling does assume that plant closures do not affect the longer-term rate of unemployment, it does not imply that each person losing their job is ultimately re-employed or re-employed on a full-time basis or at a similar wage. Rather, it postulates that the broader labour market structure and general economic conditions determine the aggregate level of employment and rate of unemployment, and the distribution of jobs across activities and regions.

The sensitivity of results to alternative assumptions is detailed in chapter 4.

3.1   Regional perspective

As indicated by the longer-run comparative-static simulations (chapter 2), the economic impact of the closure of passenger motor vehicle manufacturing plants in Australia is projected to lead to a shift in employment between activities and regions and investment in new activities. With the closure of passenger motor vehicle manufacturing plants, output and employment in Victoria and South Australia are projected to decline at the time of shutdown relative to levels that would otherwise have prevailed without the shutdown. The declines would reflect both the direct effects of plant closure and the induced (or flow-on) effects of lower levels of activity and employment on aggregate state expenditure and activities providing goods and services to consumers and investors (including retail and service industries, as well as manufacturing).

The changes in output and employment induced by the plant closures will be significant in the short term in several regions of metropolitan Melbourne and Adelaide, and in Geelong.

Against the backdrop of ongoing growth, it is projected that the output reductions in 2016-17 associated with plant closures could offset around half of the annual increase in GSP that may otherwise occur in Victoria and South Australia. The estimated changes in employment also broadly align with the annual increase in employment that could otherwise occur (figure 3.1) — although as noted in the main report, the employment reductions associated with the closure of passenger motor vehicle manufacturing are likely to be staggered over several years.[1]

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[1]   As noted in the inquiry report, Ford, Holden and Toyota have given advance notice of their intention to close their manufacturing plants and some employees might leave before the

Figure 3.1   State employment: illustrative timescale of the effects of closing passenger motor vehicle manufacturing plants, assuming a fully mobile labour force[a]

Higher job loss scenario ('000 persons)

Victoria

Closure of motor vehicle manufacturing plants, 2016-17

South Australia

Other jurisdictions
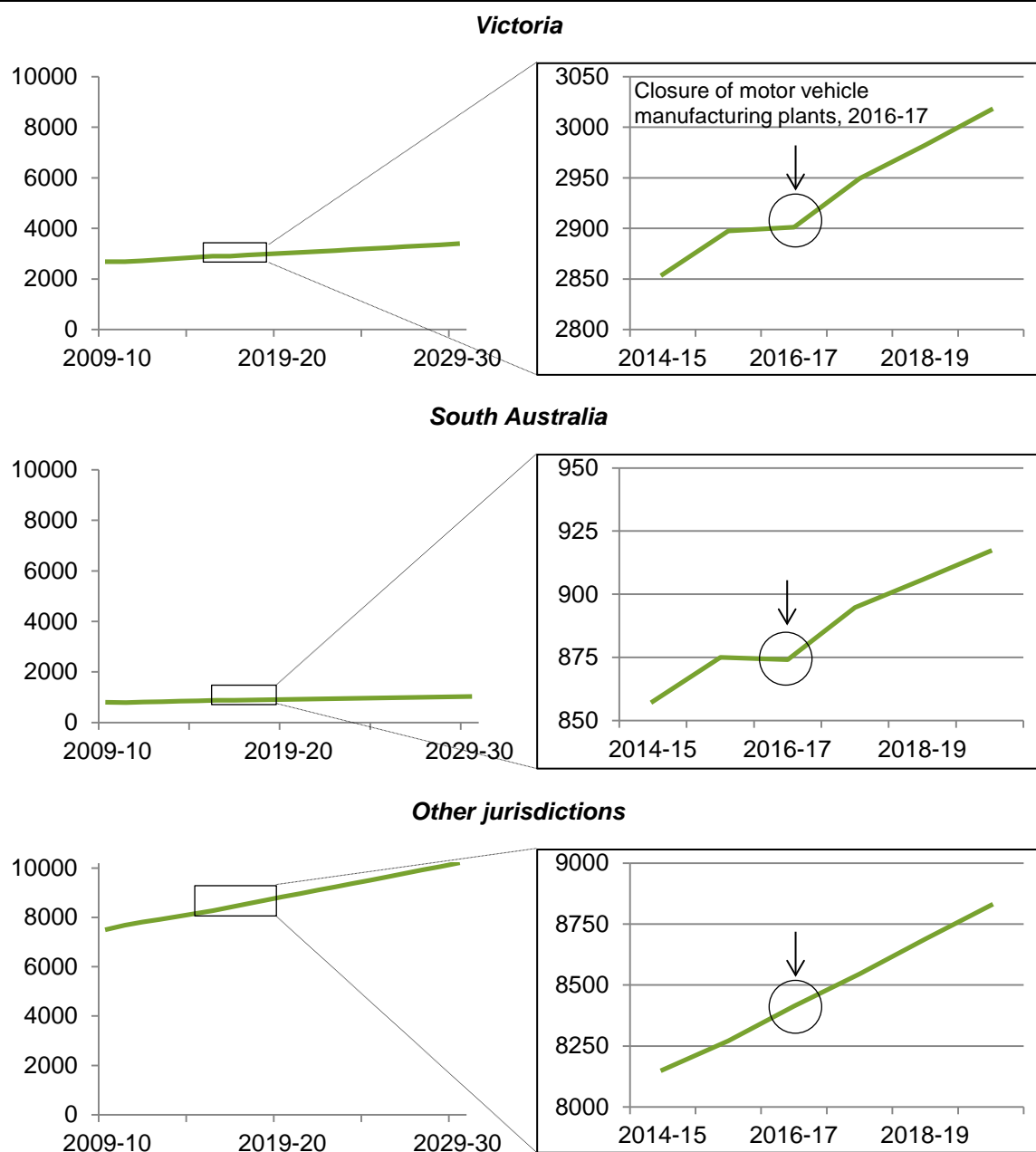
a Note that the right hand figures are drawn for the sub-period 2014-15 to 2019-20 to different scales to illustrate the impacts in the context of scales relevant to the respective jurisdictions over the sub period.

Source: Commission estimates based on the MMRF-Auto14 model.

closures. The timing of retrenchments at firms supplying the motor vehicle manufacturers will also vary, depending on the circumstances facing individual firms.

As indicated by the longer run comparative-static simulations (chapter 2), some of the resources from Victoria and South Australia will shift to other jurisdictions, as expanding activities progressively absorb labour from contracting industries. This will lead to a small increase in gross product and employment in these other parts of Australia. The full national effects are likely to be realised over an extended period as regional industries take time to adapt and the workforce to adjust fully, including between occupations and location of work.

The timing and magnitude of the adjustment is sensitive to assumptions about the flexibility of real wages (discussed below) and the interstate mobility of labour (examined in chapter 4).

3.2 National perspective

Given the limits on the capacity of expanding industries to absorb labour leaving vehicle manufacturing and suppliers in the short run, the effects of plant closures in Victoria and South Australia are initially projected to outweigh the expansionary effects across the economy as a whole. In net terms, national economic growth is projected to slow in 2016-17 with the exit of passenger motor vehicle manufacturing. The slowdown in the rate of growth of GDP is estimated to range from 0.2 to 0.3 per cent for the low and high job loss scenarios respectively, all else equal.

The low job loss scenario assumes greater real wage flexibility in the workforce in the short term. The real wage adjustments would make an increase in employment in non-auto related activities more attractive for employers, reducing the transitional lag between plant closure and redeployment of retrenched employees. The greater the flexibility of real wages and the movement of people between regional activities, the lower would be the short-run declines in employment and decline in output.

Plant closures also release funds previously paid as automotive subsidies. The modelling assumes for illustrative purposes that Australian households receive these budgetary assistance outlays in the form of lump-sum payments. This leads to an increase in consumer demand.

Over time, the national labour market continues to adjust. In line with the empirical results from the Commission's analysis using the Household, Income and Labour Dynamics in Australia (HILDA) survey, and survey information about the experience of retrenched Mitsubishi employees, it is assumed that additional unemployment arising from plant closures would taper off over a four to five year

period. Over this period, real wages would adjust, so that the labour is progressively absorbed by existing and new activities across the economy. Firms would adjust their capital depending on the profitability of doing so. As noted in chapter 2, the real exchange rate depreciation associated with this adjustment process would favour trade-exposed exporting and import competing activities.

4 Alternative modelling assumptions and sensitivity testing

The scale (and potentially direction) of the results reported in the preceding chapters depend on the choice of model parameters and other assumptions. Selective testing has therefore been undertaken to gauge the sensitivity of modelled estimates to parameters and other assumptions. This chapter tests the sensitivity of estimates to:

- the assumption of 'sticky' interstate mobility of labour

- capital market adjustment assumptions

- alternative (higher) longer-run import substitution elasticities.

Overall, the sensitivity tests indicate that greater flexibility in product and factor markets increases production possibilities over the longer run for the economy as a whole, after a period of adjustment, from levels that may otherwise be attained.

4.1 'Sticky' interstate labour markets

The MMRF model includes a representation of the supply of labour and the demand for labour by eight occupational groups. The model also includes a representation of the movement of labour across jurisdictions. In standard parameter settings, labour is assumed to move unimpeded between jurisdictions according to changes in the relative competitiveness of industries in each state and territory, but subject to changes in the supply of and demand for labour by occupation. Under this treatment, projected *changes* in occupation-specific wages would be the same across the country, although underlying absolute wage levels could differ.

For the purposes of testing the sensitivity of results to alternative assumptions about interstate labour mobility, an alternative parameter value representing 'sticky' interstate labour markets has been adopted.[1] This alternative assumption means that changes in occupational wages as well as the deployment of labour can vary between states.

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[1] The flexible movement of labour between states and territories is represented by a transformation parameter value of 20, while sticky interstate mobility is represented by a parameter value of 1.

The mobility of labour between regions will influence the degree to which real wages would need to adjust to absorb labour released by the contracting industries and activities. The more constrained (or 'sticky') the mobility of labour across regional industries, the greater the adjustment in real wages that would be required to bring about the relocation of labour between existing activities (in the short run) and the encouragement of new activities and investment to absorb labour released from those industries that are contracting (in the longer run).

In the short run, there would be less movement of labour from Victoria and South Australia and fewer resources to expand activity in other jurisdictions. Thus, although there would be less reduction in output and employment in Victoria and South Australia, increases in output and employment in other jurisdictions would be lower relative to the case of greater interstate mobility of labour (figure 4.1).

In the longer term, the reduced movement of labour between jurisdictions limits the extent to which labour migrates to higher-valued uses and industry expansion possibilities. This will increase economywide adjustment costs relative to the case where labour can move unimpeded between jurisdictions. The constrained mobility scenario leads to a smaller projected increase in national output with the cessation of passenger motor vehicle manufacturing — less than a 0.05 per cent increase in GDP — compared to 0.1 per cent assuming the flexible movement of labour (table 4.1).

Table 4.1 **Illustrative longer-run effects of closing passenger motor vehicle manufacturing plants in Australia, alternative interstate labour mobility assumptions**

Percentage change

	NSW	Vic	QLD	SA	WA	Tas	NT	ACT	Aust
Flexible interstate mobility of labour									
Real gross product	0.5	-1.9	1.1	-2.3	1.9	1.0	1.0	0.2	0.1
Employment	0.6	-1.8	1.1	-2.2	1.6	0.8	0.9	0.2	..
Real gross expenditure per person	-0.2	0.4	-0.3	0.5	-0.2	-0.3	-0.3	-0.1	(+)
Sticky interstate mobility of labour									
Real gross product	0.2	-0.9	0.5	-1.1	0.9	0.6	0.5	0.1	(+)
Employment	0.2	-0.7	0.4	-0.8	0.5	0.4	0.4	0.1	..
Real gross expenditure per person	-0.1	-0.1	(-)	-0.1	0.1	(-)	-0.1	-0.1	(-)

.. No change. **(+)** Positive, between 0 and 0.05. **(-)** Negative, between -0.05 and 0.

Source: Commission estimates based on the MMRF-Auto14 model.

Figure 4.1   **State employment: illustrative timescale of the state effects of closing passenger motor vehicle manufacturing plants, alternative interstate labour mobility assumptions**
'000 persons

Victoria

Closure of motor vehicle manufacturing plants, 2016-17

South Australia

Other jurisdictions

—— Higher job loss and flexible interstate mobility of labour

• • • • • Higher job loss and 'sticky' interstate mobility of labour
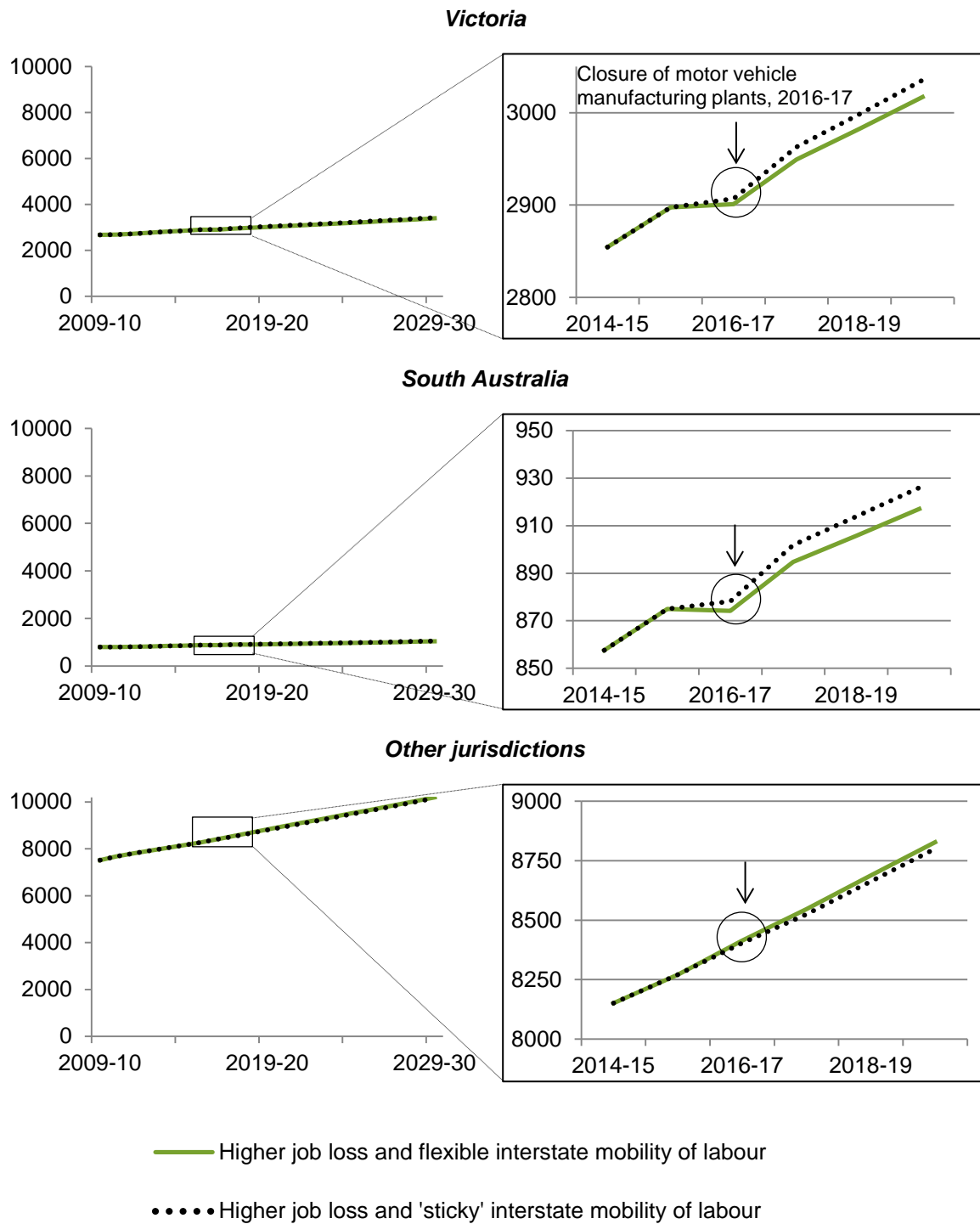
Source: Commission estimates based on the MMRF-Auto14 model.

At the national level, the upward output effect of sticky regional labour mobility for Victoria and South Australia is more than offset by the downward output effect for other jurisdictions in the short run. Over time, after a period of adjustment, the level of output with flexible interstate mobility of labour would increase relative to the level with sticky regional labour mobility (figure 4.2, right hand panel). The differences at the national level are small relative to the overall level of change occurring (figure 4.2, left hand panel).

Figure 4.2   **National output: illustrative timescale of the national effects of closing passenger motor vehicle manufacturing plants, alternative interstate labour mobility assumptions**
$ billions 2012-13

Source: Commission estimates based on the MMRF-Auto14 model.

4.2   Alternative capital market adjustment assumptions

The modelling of the response of investment to changes in industry competitiveness — reflecting the effects of real depreciation and real wage changes — was undertaken according to three different parameter values that capture different rates of capital accumulation. In the central simulations reported in this chapter, the standard model parameter values were adopted. These standard parameter values assume that capital accumulation in an industry will occur so that the industry rate of return on capital reverts (after an economic shock) to its 'normal' level after seven years, all other things being equal. In the sensitivity testing, it was assumed

that the adjustment period would extend over a shorter, four to five-year period and a longer, ten to eleven year period.

The capital market adjustment sensitivity tests indicate that the projected time path of change is not sensitive to the parameter value used. This suggests that factors affecting the supply of investment goods (including labour market constraints), rather than demand for those goods, are more important in determining the magnitude of impacts and pace of adjustment to the scenario modelled.

4.3   Import substitution elasticities

Traditionally, in computable general equilibrium modelling, the scope for producers and consumers to substitute between domestic and imported supplies has been considered greater in the longer run than from year-to-year. These differences might be due to such factors as the need to assess the relative value of products from alternative sources of supply, re-commit to new supply contracts and develop supply chains. The exact magnitude of these effects on the model parameter values is uncertain, although early studies into import substitution (Armington) elasticity values in Australia indicated that longer-run import substitution elasticities could be twice, or more than twice, the short-run elasticity values (Dixon et al. 1982). To illustrate the impact of higher elasticity values on the estimated longer-run impacts of the shutdown of passenger motor vehicle manufacturing in Australia, the prevailing year-to-year elasticities that have been adopted for the base case have been increased by a uniform factor of two (appendix A).

If such higher elasticity values are to represent substitution possibilities, the projected longer-run impacts of the shutdown of passenger motor vehicle manufacturing plants are broadly similar (albeit slightly higher when measured in terms of gross national expenditure) at the national level than implied by the modelling results based on the benchmark year-to-year elasticity values. If higher elasticity values were to apply, the lower real wage costs would flow through the economy to enable import competing activities in Victoria and South Australia and other jurisdictions to expand more than otherwise. This would offset some of the negative effects of the closure of passenger motor vehicle manufacturing plants — but the impact is negligible. On the other hand, the increase in output and employment in import competing activities would moderate the projected increase in the output of export-orientated activities, such as those located in Queensland and Western Australia. The net effect is set out in table 4.2.

Table 4.2 **Sensitivity of longer-run effects of closing passenger motor vehicle manufacturing plants in Australia to higher import substitution elasticities**

Percentage change

	NSW	Vic	QLD	SA	WA	Tas	NT	ACT	Aust
Standard elasticities									
Real gross product	0.5	-1.9	1.1	-2.3	1.9	1.0	1.0	0.2	0.1
Employment	0.6	-1.8	1.1	-2.2	1.6	0.8	0.9	0.2	..
Real gross state expenditure per person	-0.2	0.4	-0.3	0.5	-0.2	-0.3	-0.3	-0.1	(+)
Difference between Higher elasticities case and Standard elasticities cases									
Real gross product	(+)	(+)	(-)	(+)	(-)	(-)	(-)	(-)	(-)
Employment	(+)	(+)	(-)	(-)	(-)	(-)	(-)	(-)	..
Real gross state expenditure per person	(-)	(-)	(+)	(+)	(+)	(+)	(+)	(+)	(+)

.. No change. **(+)** Positive, between 0 and 0.05. **(-)** Negative, between -0.05 and 0.

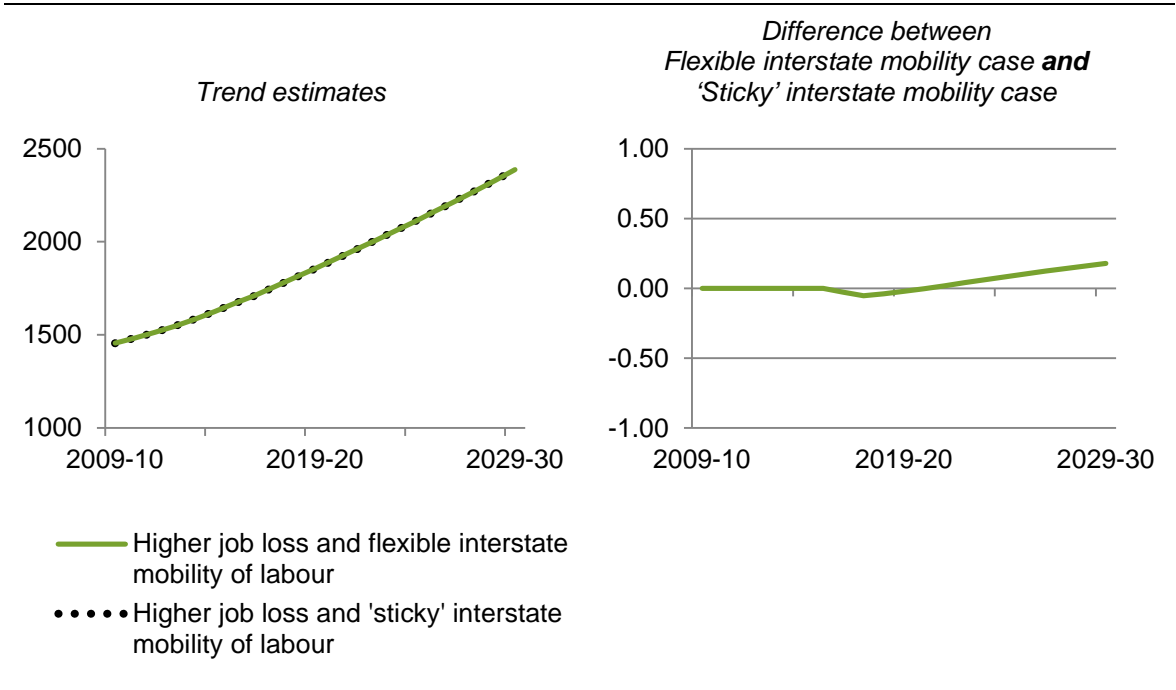*Source*: Commission estimates based on the MMRF-Auto14 model.

A   The MMRF model

This appendix provides an overview of the MMRF-Auto14 model used in this inquiry to assess the economywide and regional effects of impending and possible changes in the automotive industry. MMRF-Auto14 is based on the Monash Multi-Regional Forecasting (MMRF) model that has been used widely by the Commission and others to analyse the effects of public policy in Australia, and is well suited to examining policies with a regional focus and the effects of industry adjustment.

A.1   An overview of the MMRF model

The MMRF model is a 'bottom-up' model that treats each state and territory as a separate economy. The benchmark model from which MMRF-Auto14 was adapted includes:

- 64 industries and commodities in each state, and the inter-linkages between these contained in the input-output tables

- state labour markets, comprised of eight occupations, with the supply of labour moving between states to equate changes across states in occupational-specific real wages

- eight state-specific household sectors, which supply domestic factors of production (labour and capital), consume goods and services, and pay income and commodity taxes

- eight state and territory governments

- the Australian Government.

Important elements of the theoretical structure of the version of MMRF used in this project include the following:

- households change their consumption bundles in response to changes in aggregate expenditure and relative prices

- producers adapt their output and their relative use of labour, capital and agricultural land in response to changes in relative prices

- foreign demand for Australian exports responds to the export price of Australian products, and exporters can accrue short-term returns in response to price changes.

The model is documented in more detail in CoPS (forthcoming).

Database

The MMRF database is composed of:

- a production core, comprised of eight input-output tables (one for each state and territory) that are linked through interstate trade

- fiscal accounts for the nine governments

- cohort-based population and demographic accounting.

The production core of the database shows how each industry in each state and territory economy is linked to other industries within that state and in other states. It is based on input-output tables prepared by the ABS, complemented by various ABS national and state publications. It provides a detailed description of the structure of production according to a constant returns to scale production technology and demand for industry outputs and imports, in each state and territory. Within this framework, it shows:

- the flow of industry outputs to other industries (termed 'intermediate inputs'), final demands by households (consumption), government, investment (for capital formation purposes) and exports

- the transport and distribution costs associated with transferring products from the producer (or the port of entry in the case of imports) to final consumers and other users, as well as product taxes and subsidies pertaining to product flows (including the GST, import duties and excise taxes)

- the cost structure of industries in terms of intermediate inputs of commodities (goods and services supplied by domestic industries and by imports), primary factors of production (labour, capital and agricultural land), other costs to production and indirect taxes and subsidies not elsewhere classified (such as payroll taxes).

The initial database includes 64 industries, of which there are: 6 agricultural and related industries; 6 mining industries; 21 manufacturing industries; 8 utility industries; 2 construction industries; 4 trade, repair and food and accommodation industries; 8 transport industries; and 9 finance, government and other service industries.

For the purpose of the current study, the 'motor vehicles and parts' industry in the standard classification has been disaggregated into three components:

- passenger motor vehicle manufacturing

- automotive components manufacturing

- a residual other automotive manufacturing.

The disaggregation of the motor vehicles and parts industry was based on detailed product information that underpins the ABS *Input-Output Tables* (described in Appendix B).

The fiscal accounts detail revenue and expenditure for the nine state, territory and Australian governments and align with the ABS *Government Financial Statistics*. The accounts include a range of:

- government revenue sources, such as income tax, payroll tax, the GST, excise duties and other commodity taxes and tariffs

- government expenditure, including operating expenses, welfare payments and government grants.

The fiscal accounts for each state and territory government also include, where relevant, those for local government.

The cohort-based population and demographic module supports the modelling of the population over time in the dynamic version of the model. The demographic module models population change for age and gender-specific subsets, or cohorts using a 'stock-flow' approach, and determines labour supply by applying age, gender and state-specific participation rates to the number of people in each cohort. The module also allows for people to move between states in response to changes in labour demand by state industries.

A.2 The economic environment (model closure[1])

The primary focus of this study is on the likely impacts on the Australian economy and regional economies from the closure of the major passenger motor vehicle manufacturing plants in Australia. More specifically, the study asks the question 'how might the Australian economy differ with the closure of the major passenger motor vehicle manufacturing plants?'.

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[1] The term 'model closure' is used to refer to the assignment of the model's variables between those determined outside the model (exogenous variables) and those determined by the model (endogenous variables).

To examine the longer-term impacts, a longer-term modelling environment is used for the comparative-static modelling. In this environment, the estimated effects reflect those that are likely to occur once there has been a complete adjustment in capital and labour use across jurisdictions and industries.

The study also examines the timescale over which adjustments may occur, or the transition path, using a dynamic, or year-to-year, modelling environment.

Comparative-static modelling environment

The comparative-static modelling undertaken in this study follows the long-run environment used in the Commission's previous modelling of the economywide effects of future automotive assistance arrangements (PC 2008) and in its modelling of the impacts of COAG reforms (PC 2012b). The key elements of the long-run economic environment used in this study are as follows.

- The model index of consumer prices is the numeraire. That is, changes in domestic prices in the model can be interpreted as changes relative to the general level of prices in the economy. In all simulations, the nominal exchange rate is flexible.

- National employment by occupational group responds to differences in real pre-tax wages for that occupational group compared to the average across all occupational groups, as does state employment in each occupational group. The population and number of households in each state are assumed to change in line with state employment, with the unemployment rate in each state held fixed. The national population is held fixed.

- Each industry adjusts its capital stocks in order to equate its expected and actual rates of return on capital. The base-line expected rates of return are determined by values in the MMRF database. Industries' demands for investment goods are linked to changes in industry-specific capital stocks by an exogenous investment/capital ratio.

- Nominal household consumption is determined by post-tax household disposable income, while the balance of trade as a ratio of gross domestic product (GDP) in local currency prices is allowed to vary.

Government tax rates are assumed fixed, so that revenue moves in line with the various tax bases. In the model core, the level of real public consumption expenditure is assumed to move in proportion with the level of real aggregate household consumption expenditure. In the fiscal module, nominal government expenditure (including government consumption and other outlays) changes in line

with the underlying drivers of economic activity in the MMRF model (such as population, unemployment, aggregate economic activity and prices). The budget position is held fixed as a share of GDP or GSP through the use of lump-sum transfers to, or from, households.

It is assumed that the closure of the major passenger motor vehicle manufacturing plants will not influence the national supply of labour — that is, after the economy has adjusted to the closure of the passenger motor vehicle manufacturing industry, national labour supply will be the same as it would otherwise have been. Higher national and regional output therefore depends on higher productivity of labour and the relocation of labour between regional industries. In the MMRF model, the base levels of national labour supply and employment by eight occupational groups are represented by their levels in 2005-06.

These closure settings align with those used in PC (2008). They differ from those adopted in PC (2012b) with respect to the treatment of government expenditure. In that study, changes in real government expenditure were assumed to be discretionary to enable the Commission to report on the 'fiscal implications' of COAG reforms assessed.

Recursive-dynamic modelling environment

As it involves running the model through time in one-year steps, the modelling environment used in the 'recursive-dynamic' modelling is different from that used in the long-run comparative-static modelling discussed previously. Each step in the recursive-dynamic modelling is similar to a short-run comparative-static simulation, but with gradual adjustment in capital and labour markets. The model database is updated at each annual step (collectively referred to as the 'reference case').

The dynamic modelling environment

The modelling environment used for the reference case assumes that:

- Population growth and the aggregate supply of labour are determined by the demographic module outlined in the Productivity Commission paper *Economy-wide Modelling of the Impacts of COAG Reforms* (PC 2012b).

- Investment, and with it the capital stock, in each industry gradually responds to differences between the expected and actual rates of return on capital. The base-line expected rates of return are determined by values in the MMRF database. The adjustment process is outlined in CoPS (forthcoming).

- Nominal government expenditure (including government consumption and other outlays) moves in line with the underlying drivers of economic activity in MMRF (such as population, unemployment, aggregate economic activity and prices).[2]

- The budget position is held fixed as a share of GDP or gross state product (GSP) through the use of lump-sum transfers to, or from, households.

In common with the comparative-static modelling:

- Nominal household consumption is determined by post-tax household disposable income, while the balance of trade as a ratio of GDP in local currency prices is allowed to vary. Regional household consumption is determined by regional post-tax household disposable income.

- Government tax rates are assumed to remain fixed so that revenue moves in line with the various tax bases.

The exit scenario modelling environment

The modelling environment used for the policy scenario is aligned to that used for the reference case, except for closure switches required to model the closure of the major passenger motor vehicle manufacturing plants in Australia (appendix C).

A.3   Model parameters

In such models such as MMRF, the key parameters are mediate the responsiveness of trade volumes to changes in the competitiveness of local industry and the use of labour and capital between activities and across regions. These include:

- export demand elasticities

- import substitution elasticities

- primary factor substitution elasticities, and occupational transformation (supply-side) and substitution (demand-side) elasticities.

The elasticities used in the comparative-static modelling are more representative of a longer-run modelling environment in which greater flexibility exists for the economy to adjust to changes in relative prices, rates of return and other factors than in the year-to-year dynamic modelling. Reflecting the more limited scope for

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[2] In the current implementation of the MMRF model, real regional government investment is modelled as moving in line with total real regional investment.

adjustment year-on-year relative to the longer term, the year-to-year elasticities generally take a smaller value than the longer-run elasticities. The standard benchmark MMRF parameter values have been used in the year-to-year modelling.

Export demand elasticities

Export demand elasticities govern the extent to which greater export volumes come at the expense of price declines — the greater the elasticities, the smaller the price declines required. The central results in this supplement assume a value of -10 for all export demand elasticities in comparative-static long-run simulations, a value which is considered more appropriate for the long-run nature of the projections presented in this study. This setting assumes that in the longer run Australian producers have little influence over world prices of the products they sell. The export demand elasticity of -10 was adopted by the Commission in its previous modelling of the effects of future automotive assistance (PC 2008).[3]

In year-to-year simulations, the reference value of -5 adopted by the Centre of Policy Studies is applied. This value assumes that Australia has a somewhat greater influence over prices in the short term than in long term. For example, Australian producers might be able to increase prices in the short term by withholding supply of commodity exports, but would be expected to have less effect on global prices in the long term. This is because other commodity exporters may respond to higher prices by increasing their own supply, or major importers may turn to domestic production. The year-to-year export demand elasticity value of -5 was adopted by the Commission in its assessment of the impacts of COAG reforms (PC 2012b).

Domestic-import substitution elasticities

Domestic-import substitution elasticities determine the degree of substitutability between domestically produced and imported products (Armington elasticities). More specifically, the elasticities determine the sensitivity of:

- domestic demand for imports to changes in the price of imports relative to domestic production
- domestic demand for domestic production to changes in the price of domestic demand relative to imports.

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[3] This involved changing the MMRF parameters SIGMAEXP (traditional exports) and SIGMAEXPNTR (non-traditional exports) for all commodities.

The values adopted in this study are the standard values incorporated by the Centre of Policy Studies in the MMRF model. These values are being applied in both the longer-run comparative-static and year-to-year simulations. The values range between 0 (for products with little or no imports) and 10 (for products with a high degree of flexibility). Elasticity values of 5.2 are set for passenger motor vehicles and other automotive manufacturing (PC 2008) and, reflecting its status as an input into production, 2 for automotive components.

To examine the implications of greater responsiveness of imports in the longer term to relative price changes, a sensitivity test that doubles the year-to-year value of the elasticities is undertaken (chapter 4).[4]

The standard values of the import substitution elasticities and the values used in the sensitivity test are listed in table A.1.

Primary factor substitution and occupational mobility parameters

On the demand side, substitution elasticities determine the degree to which labour and capital inputs can be substituted for each other in production. The benchmark values for year-to-year simulations in the MMRF model are 0.5 for all industries and regions. Reference values in the longer-term comparative-static simulations are 1.25.[5]

MMRF also includes elasticities governing the degree of substitutability in use of the eight different occupations in production. The benchmark values for year-to-year simulations are 0.35. The selection of these values reflects an assumption that employers have limited flexibility to alter the occupational mix used in production on a year-to-year basis. The values being applied in the longer-term comparative-static simulations are 1 to reflect higher substitution prospects over the longer run.[6]

On the supply side, transformation elasticities determine the extent to which the supply of labour can move between the eight occupational groups. The benchmark value for year-to-year simulations is set at 0.1. The selection of this value reflects an assumption that, on a year-to-year basis, employees have limited potential to change

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[4] This involved changing the MMRF parameters SIGMA1O (industry demand), SIGMA2O (investment demand) and SIGMA3O (household demand) for all commodities.

[5] This involved changing the MMRF parameter SIGMA1FAC for all industries and regions.

[6] This involved changing the MMRF parameter SIGMA1LAB for all industries and regions.

their occupation. The value in the longer-term comparative-static simulations is 1 to reflect higher transformation prospects over the longer run.[7]

Table A.1   **Domestic-import substitution elasticities in the MMRF model**

No.	MMRF industry	Standard elasticity	Higher elasticity used in sensitivity test	Import share in domestic use
				Per cent
1	Livestock	1.45	2.90	..
2	Crops	0.50	1.00	1
3	Dairy cattle	2.00	4.00	..
4	Other agriculture	1.97	3.94	6
5	Forestry and logging	2.00	4.00	3
6	Fishing	0.50	1.00	5
7	Coal mining	0.50	1.00	..
8	Oil mining	10.00	20.00	77
9	Gas mining	10.00	20.00	..
10	Iron ore mining	0.50	1.00	18
11	Other metal ore mining	0.50	1.00	21
12	Other mining	2.00	4.00	3
13	Meat products	0.50	1.00	4
14	Dairy products	1.60	3.20	10
15	Other food beverages and tobacco	1.49	2.98	21
16	Textiles, clothing and footwear	2.91	5.82	66
17	Wood and wood products	1.99	3.98	17
18	Paper and paper products	1.10	2.20	37
19	Printing, publishing and recorded media	2.00	4.00	12
20	Petrol	0.40	0.80	25
21	Other petroleum and coal products	0.40	0.80	35
22	Chemical products	1.94	3.88	51
23	Rubber and plastic products	1.50	3.00	38
24	Other non-metallic minerals products	1.18	2.36	23
25	Cement and lime	0.26	0.52	2
26	Iron and steel	0.82	1.64	28
27	Alumina	1.00	2.00	4
28	Aluminium	1.00	2.00	25
29	Other non-ferrous metals	1.00	2.00	23
30	Metal products	1.89	3.78	22
31	**Passenger motor vehicle manufacturing**	**5.20**	**10.40**	**59**
32	**Automotive components manufacturing**[a]	**2.50**	**5.00**	**44**
33	**Other automotive manufacturing**	**5.20**	**10.40**	**51**
34	Other equipment	1.31	2.62	63

(Continued next page)

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7   This involved changing the MMRF parameter SIGMALABO.

Table A.1 (continued)

No.	MMRF industry	Standard elasticity	Higher elasticity	Import share in domestic use
				Per cent
35	Other manufacturing	0.92	1.84	56
36	Electricity generation – coal	0	0	..
37	Electricity generation – gas	0	0	..
38	Electricity generation – oil	0	0	..
39	Electricity generation – hydro	0	0	..
40	Electricity generation – other	0	0	..
41	Electricity supply	0	0	..
42	Gas supply	0	0	..
43	Water and sewage services	0	0	..
44	Residential construction	0	0	..
45	Non-residential construction	0	0	..
46	Wholesale trade	0	0	..
47	Retail trade	0	0	1
48	Mechanical repairs	0	0	..
49	Hotels, cafes and restaurants	0	0	9
50	Road freight transport	0	0	1
51	Road passenger transport	0	0	18
52	Rail freight transport	0	0	1
53	Rail passenger transport	0	0	23
54	Pipeline and other transport	0	0	..
55	Water transport	2.00	4.00	39
56	Air transport	2.00	4.00	51
57	Services to transport	0	0	1
58	Communication services	0	0	3
59	Financial services	0	0	2
60	Ownership of dwellings	0	0	1
61	Business services	0	0	3
62	Government administration and defence	0	0	..
63	Education	0	0	3
64	Health services	0	0	1
65	Community services	0	0	4
66	Other services	0	0	1

.. Zero or less than 0.5 per cent. **a** A lower elasticity is adopted for the use of automotive components in production than for manufactured motor vehicles to better align with the elasticities used for other manufactured intermediate products. Reflecting the aftermarket nature of their sales, the import substitution elasticities for household and investment demand are set to the same as for manufactured passenger motor vehicles.

Sources: MMRF-Auto14 database; Commission estimates.

The model also includes an elasticity governing the extent of mobility in the labour supply between states. Previous versions of the MMRF model did not explicitly include this transformation behaviour, but implicitly assumed infinite transformation possibilities or imposed interstate migration exogenously. Consistent with earlier practice, a high transformation parameter value of 20 has been adopted. Under this approach, the mobility of labour between regional industries is influenced by other factors (such as the primary factor substitution and occupational mobility parameters). For the purposes of illustrating the sensitivity of results to alternative assumptions about interstate labour mobility, an alternative parameter value representing 'sticky' interstate labour markets of 1 is adopted (chapter 4).[8]

Capital market adjustment parameters

Capital market adjustment (or investment) parameters in MMRF determine the rate at which industries accumulate new capital on the basis of changes in relative competitiveness and what this implies for returns to capital. Broadly, the benchmark investment parameter values in MMRF are set at 0.5 to ensure that, from an economic shock, capital accumulation will occur so that the industry rate of return on capital returns to 'normal' after a period of around seven years, all other things remaining equal.

Because the rate of economic adjustment to the closure of the major passenger motor vehicle manufacturing plants in Australia is likely to be sensitive to the responses of other industries to the announced changes, a 'more rapid' adjustment scenario is modelled using parameter values of 0.4 (a lower value implying more rapid adjustment) in a range of greater than zero to less than 1.[9] Under this scenario, returns on capital would return to normal levels after around four to five years, other things being equal (chapter 4). The impact of possible slower adjustment is also modelled using a parameter value of 0.6. Under this scenario, returns on capital would return to normal levels after around ten years, other things being equal. Although the choice of parameters in general equilibrium modelling is uncertain and often subject to judgment, Dixon and Rimmer noted in the documentation for the MONASH model that parameters are typically chosen so that 'employment effects of a shock to the economy are largely eliminated after 5 years' (Dixon and Rimmer 2002, p. 205).

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[8] This involved changing the MMRF parameter SIGMALABS.

[9] This involved changing the MMRF parameter ADJ_COEFF.

B   Model database

This appendix outlines how the MMRF-Auto14 database used for this inquiry was produced and provides key information about the input–output structure of the automotive manufacturing industry. It covers:

- the generation of the initial MMRF database that formed the starting point for the database used in this inquiry (section B.1)

- the disaggregation of the motor vehicles and parts manufacturing industry into constituent industries covering the manufacture of passenger motor vehicles, the manufacture of trucks, buses, trailers, caravans and other specialist vehicles, and the manufacture of automotive components (section B.2)

- the uprating of the disaggregated database from a reference year of 2005-06 to 2012-13 (section B.3)

- the structure of the automotive manufacturing industries in the inquiry database (section B.4)

- the inclusion of data needed to assess the sub-state regional impacts of the closure of passenger motor vehicle manufacturing plants (section B.5).

It should be noted that comprehensive input–output tables are not available for the current period. Work for this inquiry has sought to fill this gap from a range of sources including input–output tables for 2005-06 and 2009-10, population census information for 2006 and 2011, other data from the Australian Bureau of Statistics (ABS), and information provided by the Department of Industry and other participants to the inquiry.

B.1   Creating the initial model database

The database used for this inquiry was created from the standard MMRF model database, which aligns with the 2005-06 ABS *Input-Output Tables*. The standard database is compiled in three broad steps to suit model data and classification requirements (figure B.1).

Figure B.1 **Stages in creating the initial MMRF database used for this inquiry**

Stage	Regions	Industries
ABS 2005-06 Input-Output Tables	1	109
	Australia	Agriculture, mining, manufacturing and service industries disaggregated
ORANI-G	1	183
	Sub-state local government areas	Agriculture, mining, manufacturing and service industries aggregated
TERM	205	183
	State and Territories	Sectors aggregated
	8	64
		Database 'hammered' to align as best as possible to control targets
MMRF	8	64

Source: CoPS (forthcoming).

In the first step, the 2005-06 ABS national input–output tables for 109 industries were converted to a 183-sector database to be consistent with another general equilibrium (GE) model of the Australian economy (ORANI-G). This produced a national database with a structure that is broadly consistent with that of the regional database used in the MMRF model.

Second, the national database was disaggregated to 205 sub-state regions, to form what is known as the TERM database. This was done using:

- 2006 ABS *Census of Population and Housing* data on employment by industry, to define regional production of the 183 industries at the local government area level

- ABS 2003-04 *Household Expenditure Survey* data to estimate household consumption per statistical division

- trade data from 49 ports to estimate international trade flows in and out of each statistical division.[1]

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[1] Further details of steps one to three are provided in CoPS (forthcoming) and Horridge, Madden and Wittwer (2005).

Interregional trade flows were then estimated within the constraints provided by the basic data using a gravity modelling approach.

Third, the number of regions and industries in the TERM database was then aggregated to the state/territory level to generate the eight-region MMRF database, with 64 industries (table B.1).

Table B.1   **Concordance between industries in the initial MMRF database and the 2005-06 ABS input-output industry groups**

No.	MMRF industry	IOIG	Input–output industry group
1	Livestock	0101	Sheep
		0103	Beef cattle
2	Crops	0102	Grains
3	Dairy cattle	0104	Dairy cattle
4	Other agriculture	0105	Pigs
		0106	Poultry
		0107	Other agriculture
		0200	Services to agriculture, hunting and trapping
5	Forestry and logging	0300	Forestry and logging
6	Fishing	0400	Commercial fishing
7	Coal mining	1101	Coal
8	Oil mining	1201	Oil and gas (part)
9	Gas mining	1201	Oil and gas (part)
10	Iron ore mining	1301	Iron ores
11	Other metal ore mining	1302	Non-ferrous metal ores
12	Other mining	1400	Other mining
		1500	Services to mining
13	Meat products	2101	Meat and meat products
14	Dairy products	2102	Dairy products
15	Other food beverages and tobacco	2103	Fruit and vegetable products
		2104	Oils and fats
		2105	Flour mill products and cereal foods
		2106	Bakery products
		2107	Confectionery
		2108	Other food products
		2109	Soft drinks, cordials and syrups
		2110	Beer and malt
		2113	Wine, spirits and tobacco products
16	Textiles, clothing and footwear	2201	Textile fibres, yarns and woven fabrics
		2202	Textile products
		2203	Knitting mill products
		2204	Clothing
		2205	Footwear
		2206	Leather and leather products

Table B.1   (continued)

No.	MMRF industry	IOIG	Input–output industry group
17	Wood and wood products	2301	Sawmill products
		2302	Other wood products
18	Paper and paper products	2303	Pulp, paper and paperboard
		2304	Paper containers and products
19	Printing, publishing and recorded media	2401	Printing and services to printing
		2402	Publishing, recorded media and publishing
20	Petrol	2501	Petroleum and coal products (part)
21	Other petroleum and coal products	2501	Petroleum and coal products (part)
22	Chemical products	2502	Basic chemicals
		2503	Paints
		2504	Medicinal and pharmaceutical products; pesticides
		2505	Soap and other detergents
		2506	Cosmetics and toiletry preparations
		2507	Other chemical products
23	Rubber and plastic products	2508	Rubber products
		2509	Plastic products
24	Other non-metallic minerals products	2601	Glass and glass products
		2602	Ceramic products
		2604	Plaster and other concrete products
		2605	Other non-metallic mineral products
25	Cement and lime	2603	Cement, lime and concrete slurry
26	Iron and steel	2701	Iron and steel
27	Alumina	2702	Basic non-ferrous metal and products (part)
28	Aluminium	2702	Basic non-ferrous metal and products (part)
29	Other non-ferrous metals	2702	Basic non-ferrous metal and products (part)
30	Metal products	2703	Structural metal products
		2704	Sheet metal products
		2705	Fabricated metal products
31	**Motor vehicles and parts**	**2801**	**Motor vehicles and parts; other transport equipment**
32	Other equipment	2802	Ships and boats
		2803	Railway equipment
		2804	Aircraft
		2805	Photographic and scientific equipment
		2806	Electronic equipment
		2807	Household appliances
		2808	Other electrical equipment
33	Other manufacturing	2809	Agricultural, mining and construction machinery
		2810	Other machinery and equipment
		2901	Prefabricated buildings
		2902	Furniture
		2903	Other manufacturing

No.	MMRF industry	IOIG	Input–output industry group
34	Electricity generation – coal	3601	Electricity supply (part)
35	Electricity generation – gas	3601	Electricity supply (part)
36	Electricity generation – oil	3601	Electricity supply (part)
37	Electricity generation – hydro	3601	Electricity supply (part)
38	Electricity generation – other	3601	Electricity supply (part)
39	Electricity supply	3601	Electricity supply (part)
40	Gas supply	3602	Gas supply
41	Water and sewage services	3701	Water supply; sewerage and drainage services
42	Residential construction	4101	Residential building
43	Non-residential construction	4102	Other construction
		4201	Construction trade services
44	Wholesale trade	4501	Wholesale trade
		4502	Wholesale mechanical repairs
		4503	Other wholesale repairs
45	Retail trade	5101	Retail trade
46	Mechanical repairs	5102	Retail mechanical repairs
		5103	Other retail repairs
47	Hotels, cafes and restaurants	5701	Accommodation, cafes and restaurants
48	Road freight transport	6101	Road transport (part)
49	Road passenger transport	6101	Road transport (part)
50	Rail freight transport	6201	Rail, pipeline and other transport (part)
51	Rail passenger transport	6201	Rail, pipeline and other transport (part)
52	Pipeline and other transport	6201	Rail, pipeline and other transport (part)
53	Water transport	6301	Water transport
54	Air transport	6401	Air and space transport
55	Services to transport	6601	Services to transport, storage
56	Communication services	7101	Communication services
57	Financial services	7301	Banking
		7302	Non-bank finance
		7401	Insurance
		7501	Services to finance, investment and insurance
58	Ownership of dwellings	7701	Ownership of dwellings
59	Business services	7702	Other property services
		7801	Scientific research, technical and computer services
		7802	Legal, accounting, marketing and business management services
		7803	Other business services

No.	MMRF industry	IOIG	Input–output industry group
60	Government administration	8101	Government administration
	and defence	8201	Defence
61	Education	8401	Education
62	Health services	8601	Health services
63	Community services	8701	Community services
		9101	Motion picture, radio and television services
		9201	Libraries, museums and the arts
		9301	Sport, gambling and recreational services
64	Other services	9501	Personal services
		9601	Other services

Source: CoPS (forthcoming).

B.2   Disaggregating the motor vehicles and parts manufacturing industry

The initial MMRF database used for this inquiry contains a single industry covering all motor vehicle, parts and other automotive production in Australia. This reflects the industry and commodity structure used by the ABS in its *Input-Output Tables* (ABS 2009a, 2009b), which provides the detailed structure of the Australian economy on which the initial (standard) model database is based.[2]

The single motor vehicles and parts industry was disaggregated for the purposes of this inquiry into three industries using more detailed ABS product information (ABS 2009b) and information provided in the course of the inquiry:

- *passenger motor vehicle manufacturing*, which consists of finished motor vehicles with less than 10 persons capacity and second hand motor vehicles[3]

- *automotive components manufacturing*, which consists of automotive electrical component manufacturing and other vehicle parts manufacturing (ANZSIC 1993 classes 2813 and 2819), and covers the manufacture of components such as panels, gaskets, cranks, cam shafts, gears, flywheels, fuel pumps, transmission systems, instrumentation, seatbelts, lights, windscreen wipers and air conditioners (supplied to passenger motor vehicle producers, the automotive aftermarket or exported)

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[2] Reflecting the ABS *Input-Output Tables* on which it is based, the reference year in the latest MMRF database is 2005-06.

[3] There is no production of second hand passenger motor vehicles as part of the product 'second hand motor vehicles', so the treatment of this product has no effect on results. The second hand motor vehicles product accommodates sales of motor vehicles by final buyers (households and businesses).

- a residual *other automotive manufacturing*, which includes, among other things, the manufacture of trucks, buses, trailers, caravans and other specialist vehicles.[4]

The full mapping used between the relevant ABS input-output product codes (IOPCs) (that underpin the input-output product groups (IOPGs) in the ABS *Input-Output Tables*) and the automotive industries in the disaggregation are listed in table B.2.[5]

The definition of 'automotive components manufacturing' used above (which also reflects the ABS ANZSIC 1993 and 2006 definitions, table B.3) is narrower than the supply chain boundaries commonly thought of within the industry, as it does not include many manufactured inputs used in producing vehicles that do not form part of the product group 'Motor vehicles and parts; other transport equipment' (IOPG 2801) in the 2005-06 *Input-Output Tables*. Other inputs in the automotive supply chain include: chemicals, paints, plastics and plastic products, tyres, rubber and glass products, textile products and the production of metals and metal products that form parts of different ABS manufacturing industries. For example, windscreens and other vehicle windows form part of the ABS product group 'glass and glass products' (IOPG 2601). Throughout this appendix, the full range of manufactured products used in the manufacture of passenger motor vehicles are referred to as '*manufactured inputs*', of which 'automotive components manufacturing' that forms part of the ABS 'motor vehicle and motor vehicle part manufacturing' industry (ANZSIC 2006 group 231) is a component.

The value of total use of manufactured inputs by the automotive industry is just over double the value of use of automotive components manufacturing as classified by the ABS.[6]

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[4] This disaggregation broadly follows the approach adopted in the Commission's 2008 study *Modelling Economy-wide Effects of Future Automotive Assistance* (PC 2008), except that in that earlier study items were grouped according to whether the general tariff rate was 10 per cent or otherwise.

[5] There is some inconsistency between the ABS IOPC labels and the corresponding flows recorded in the ABS product details for 2005-06. For example, IOIG 2801 'Motor vehicles and parts; other transport equipment' uses $1 597 million of IOPC 28190025 'Motor vehicle parts and equipment nec (*excl associated with motor vehicle manufacturing*)' [emphasis added]. The Commission has interpreted the IOPC labels more broadly to include items *used* in passenger motor vehicle manufacturing, as implied by the use of the products recorded in the ABS product detail data.

[6] The ABS *Input-Output Tables* and accompanying product details do not differentiate the sale of automotive components to the production of passenger motor vehicles from sales to the production of trucks, buses, trailers, caravans and other automotive manufacturing. Information from the 2008 study and additional information provided in the course of this inquiry have been used to disaggregate the use of supplies to these two industries.

Table B.2　Concordance between the disaggregated automotive industries and the detailed 2005-06 ABS input-output products

Industry[a]	IOPC[b]	IOPC description
Passenger motor vehicles manufacturing	28110010	Finished motor vehicles with less than 10 persons capacity
	28119010	Second hand motor vehicles
Automotive components manufacturing	28130011	Vehicle electric motors of an output not exceeding 37.5W; other DC motors and DC generators
	28130012	Motor vehicle and truck air conditioners
	28130013	Motor vehicle apparatus for making, breaking, protecting & making connections to/in electrical circuits (excl wiring)
	28130014	Motor vehicle or motor cycle wiring harnesses
	28130015	Motor vehicle, tractor or motor cycle starting, heaters, demisters, windscreen wipers; lighting/signalling equipment
	28130016	Motor vehicle, tractor and motor cycle filament lamps and sealed beam lamps
	28130017	Motor vehicle & tractor gauges, revolution & production counters, speed indicators, thermostats & similar instruments
	28190010	Motor vehicle transmission assemblies (excl associated with the manufacture of complete vehicles/engines)
	28190021	Cylinder blocks, pistons, connecting rods, valves (excl associated with the manufacture of complete vehicles/engines)
	28190022	Fuel, lubricating or cooling medium pumps (excl associated with the manufacture of complete vehicles or engines)
	28190023	Cranks, cam shafts, gears and flywheels (excl associated with the manufacture of complete vehicles/engines)
	28190024	Motor vehicle, tractor and truck gaskets (excl associated with the manufacture of complete vehicles or engines)
	28190025	Motor vehicle parts and equipment nec (excl associated with motor vehicle manufacturing)
	28190026	Motor vehicle body panels
Other automotive manufacturing	28110020	Finished motor vehicles with 10 or more person capacity
	28110030	Finished trucks, truck type vehicles, utilities and panel vans
	28110040	Unassembled motor vehicles nec
	28110050	Chassis with engines for motor vehicles
	28110060	Engines nec, for motor vehicles or tractors
	28110071	Cranks, crank & cam shafts, gears and flywheels (associated with the manufacture of complete vehicles or engines)
	28110072	Motor vehicle, tractor and truck gaskets (associated with the manufacture of complete vehicles or engines)
	28110073	Motor vehicle, tractor & cycle parts nec (associated with the manufacture of complete vehicles & engines)
	28120011	Motor vehicle and truck bodies (coachwork)
	28120020	Caravans, camper trailers and similar vehicles
	28120031	Agricultural self-loading and unloading semi-trailers (incl tippers)

Table B.2   (continued)

Industry[a]	IOPC[b]	IOPC description
	28120032	Other semi-trailers for the transport of goods & materials (incl tankers, vans, transporters, stock crates & jinkers)
	28120041	Trailers for the transport of goods and materials (incl box trailers, boat trailers and horse floats)
	28120042	Other trailers & semi-trailers nec (excl for the transport of goods & materials, & domestic type camper trailers)
	28120050	Body panels for trucks and buses
	28120060	Parts nec, for motor vehicle trailers and semi-trailers
	28290010	Transport equipment, parts and accessories nec
	28291810	Royalties income and licence fees (2811-2819, 2829)
	28291900	Repairing and servicing (2811-2819, 2829)
	28291920	Other income (2811-2819, 2829)
	28291950	Increase in stocks - work-in-progress (2811-2819, 2829)
	28298000	Motor scooters and motor cycles

na Not applicable. **nec** not elsewhere classified. **a** Industries and products as defined by the Commission for the purposes of disaggregating the MMRF database. **b** IOPC refers to Input–Output Product Classification code.

The disaggregation of the motor vehicles and parts industry used detailed input-output information from the Commission's 2008 modelling of the *Economy-Wide Effects of Future Automotive Assistance* (PC 2008) as the starting point for the current disaggregation. This earlier information was updated, where possible, using a combination of available input-output data (ABS 2009a, 2009b), industry data (DoI 2013), ABS *Census of Population and Housing* data and other information provided by participants to this inquiry about aspects of the structure of the industry. The procedure used to disaggregate the 'motor vehicles and parts' industry in the initial MMRF database is outlined in box B.1.

Box B.1 **Disaggregating the motor vehicles and parts industry**

The database generated by the Centre of Policy Studies (CoPS) for the Commission's 2008 modelling of the *Effects of Future Automotive Assistance* provided the starting point for disaggregating the 'motor vehicles and parts' industry in MMRF (PC 2008). First, for each variable requiring disaggregation, shares were derived from the 2008 database. The shares were calculated as the value for each disaggregated automotive industry divided by the sum of the values of the three new automotive industries.

Next, these shares were applied to the initial MMRF database used for the current inquiry. That is, the shares were multiplied by the corresponding aggregate motor vehicles and parts value to generate values for each new automotive industry.

Adjustments were then made to the database to reflect more recent data and to satisfy the technical requirements of the model, as set out below.

- Sales totals for the disaggregated motor vehicles and parts industries were adjusted to align with control targets based on the ABS input-output product details in annex table B1.1. Aggregate sales by domestic producers were based on sales of the products manufactured by the three disaggregated industries distributed in the proportions 0.51, 0.26 and 0.23. Import sales of the products produced by the three industries were distributed across industries in the proportions 0.59, 0.19 and 0.22.

- Sales for the new automotive industries were allocated across intermediate use, exports and household final consumption to broadly align with sales shares reported in the source input-output tables listed in annex table B1.2.

- State sales of components and other manufactured goods to the passenger motor vehicle manufacturing industry were calibrated to data on purchases of manufactured inputs by passenger motor vehicle producers based on data from submissions (FCAI, sub. 30; GM Holden, sub. 58; Government of South Australia, sub. 68; WiSER, sub. 8). The derived sales shares are discussed below.

- The 'value added in production' shares for the Australian automotive industries were aligned as closely as possible with values implied by the 2005-06 ABS *Input-Output Tables* (table B1.3). The distribution of value added and sales across jurisdictions was based on the 2008 study (table B1.4). Employment was distributed across states by reference to employment shares by industry from the ABS 2006 *Census of Population and Housing* (table B1.5).

- To satisfy the technical modelling requirement of zero profits for each industry, costs were adjusted to match sales. This was done by scaling costs from all sources (primary factors and intermediate inputs) for passenger motor vehicle, component and other automotive manufacturing industries, leaving their cost shares (the share of each input in total costs) constant.

The resulting disaggregated database was then checked for structural soundness.

Table B.3   **Mapping of ABS motor vehicle and motor vehicle part manufacturing industry data to MMRF industry**[a]

ANZSIC 1993 industry	Broadly equivalent ANZSIC 2006 industry	Disaggregated MMRF industry
2811 Motor vehicle manufacturing	2311 Motor vehicle manufacturing	Passenger motor vehicle manufacture (part)[b]
		Other automotive manufacturing (part)[b]
2812 Motor vehicle body and trailer manufacturing	2312 Motor vehicle body and trailer manufacturing	Other automotive manufacturing
2813 Automotive electrical component manufacturing	2313 Automotive electrical component manufacturing	Automotive components manufacturing
2819 Other motor vehicle parts manufacturing	2319 Other motor vehicle parts manufacturing	Automotive components manufacturing

a Used to map ABS data for ANZSIC 2006 group 'Motor vehicle and motor vehicle part manufacturing' (ANZSIC 2006 group 231) to MMRF industry. **b** The products that make up 'passenger motor vehicle manufacturing' accounted for 82 per cent of domestic 'Motor vehicle manufacturing' (ANZSIC 2006 class 2311) in 2005-06, with other automotive manufacturing accounting for the remaining 18 per cent.

B.3   Uprating the database from 2005-06 to 2012-13

The disaggregated 2005-06 MMRF database was uprated to 2012-13 to reflect the relative and absolute decline in Australian passenger motor vehicle manufacturing that has occurred since 2005-06 (box B.2). The industry trends used to uprate the 2005-06 database are set out in table B.4. Given the paucity of data available on aspects of the automotive components manufacturing and other automotive manufacturing industries, the modelling scenario gives greater weight to tracking changes in the passenger motor vehicle manufacturing industry over this period than to the remaining automotive industries.

Box B.2   Recent trends in Australian automotive manufacturing

The Australian motor vehicle manufacturing industry has been getting smaller in recent years relative to other activities as well as in absolute terms, as measured by output and employment.

The number of sales of passenger motor vehicles and sports utility vehicles (SUVs) in Australia (imported and domestically manufactured) grew at just over 2 per cent per year in the six years from 2006. Behind this trend, the number of SUV sales have increased by 10 per cent, while sales of sedans have declined by 1 per cent per year. The largest decline in sale numbers has been in the large vehicle segment of the market (including imports as well as Holden Commodores assembled in Elizabeth, Ford Falcons assembled in Broadmeadows and Toyota Aurions assembled in Altona), which declined by 12 per cent per year.

Overall, the volume of Australian production of passenger motor vehicles and SUVs declined at 6 per cent per year over the same six year period (2006 to 2012) — falling from 330 000 units to 220 000 units. A relatively large decline in Australian production volumes occurred in 2009, coinciding with a 20 per cent appreciation of the Australian dollar relative to the US dollar. The volume of Australian vehicle exports also declined at a similar rate to Australian production.

Flow-on implications for the use of Australian-produced manufactured inputs

The decline in passenger motor vehicle production has translated into a decline in the demand for manufactured inputs to passenger motor vehicle manufacturing. Department of Industry data indicate that the value of Australian-sourced manufactured inputs used by passenger motor vehicle producers in Australia decreased by more than 10 per cent per year from 2006 to 2012 (falling from $4.65 billion to $2.34 billion in nominal terms).[7]

Department of Industry data also indicate that the nominal value of exports of manufactured automotive inputs (that is, 'components' broadly defined) declined by 2 per cent per year.

With respect to the automotive components manufacturing industry as defined by the ABS, data from the ABS *Australian Industry* publication indicate that the nominal value of total sales and employment for the industry fell by around 5 per cent per year between 2005-06 and 2011-12.

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[7] Data from the Department of Industry refer to the 'value of components sourced from Australian suppliers', but this includes a broader range of manufactured inputs than included in the ABS motor vehicle and motor vehicle part manufacturing industry.

The more rapid rate of decline in the use of Australian manufactured inputs in passenger motor vehicle production (from the Department of Industry data) compared with total automotive component production (from the ABS data) indicates that the importance of passenger motor vehicle producers as users of components manufactured in Australia has been decreasing. In 2005-06, using these two data sources and a range of plausible assumptions to address the discrepancy between automotive components manufacturing and manufactured inputs more broadly, it is estimated that between 25 per cent and 38 per cent of automotive components produced in Australia would have been used in passenger motor vehicle manufacturing in Australia (discussed in the annex B2). Comparable estimates for 2012-13 are in the range 17 to 25 per cent — representing a decline of about 5 per cent per year.

Such a trend would be consistent with information provided to this inquiry by the Australian Automotive Aftermarket Association (sub. 54), which noted that the aftermarket segment has shown strong year-on-year growth.

Sources: Commission estimates based on DoI (2012, 2013); ABS (2013, *Australian Industry*, 2011-12, Cat. no. 8155.0, Data cube 81550DO003_2011_12).

Table B.4   **Automotive industry-specific changes applied in the uprating of industry flows, annual average, 2005-06 to 2012-13**

Per cent per year

Industry	Measure targeted	Estimate based on	Value
Passenger motor vehicle manufacturing	Australian production of cars (real)	*Key Automotive Statistics 2012* (DoI 2013)	-7.7
	Passenger motor vehicle exports (real)	*Key Automotive Statistics 2012* (DoI 2013)	-8.3
	Employment (persons)[a]	Estimates based on *Key Automotive Statistics* (DoI 2013)	-7.5[b]
Automotive components manufacturing	Gross output (real)	Estimates based on *Australian Industry* (ABS 2013a)	-5.0[c]
	Employment (persons)[a]	Estimates based on *Australian Industry* (ABS 2013a)	-4.5[c]
Other automotive manufacturing	Employment (persons)[a]	Estimates based on *Australian Industry* (ABS 2013a)	-2.4[b]

[a] Employment in 2005-06 and 2012-13 shown in tables B1.5 and B.9, respectively. [b] State-specific shocks applied as part of the uprating based on the average annual percentage change between tables B.9 and B1.5. [c] Modelled as a 0.5 per cent decline in labour productivity.

Sources: Commission estimates based on DoI (2013); ABS (2013a).

Other activities were uprated according to changes in population, terms of trade and labour productivity (PC 2012b). Australia's terms of trade increased during much of the period 2005-06 to 2012-13, reaching a peak in 2011-12 (ABS 2013d).

The resulting national output and employment shares by sector broadly align with the sectoral distribution of activity reported in the Australian National Accounts (figure B.2). The passenger motor vehicle industry in Australia is estimated to account for about 0.1 per cent of aggregate economic activity in 2012-13, while the automotive component manufacturing industry (as defined by the ABS) is estimated to account for just under 0.2 per cent.

The uprated 2012-13 database was also checked against the latest year for which ABS *Input-Output Tables* are available (2009-10) (ABS 2013b, 2013c). The resulting database was found to be broadly comparable with the available information for that year.

The dynamic modelling assumes production and employment in the passenger motor vehicle industry remains fixed from 2012-13 to 2016-17.

B.4 Structure of the automotive manufacturing industry in the inquiry database

Sourcing of intermediate inputs

Inputs sourced from Australian manufactured goods and Australian service suppliers are estimated to account for about 80 per cent of inputs to passenger motor vehicle manufacturing in the 2012-13 database (table B.5). The share is slightly higher for inputs to the manufacture of automotive components at just over 80 per cent.

Table B.5 **Source of intermediate inputs used by the motor vehicles and parts industry in the MMRF database, estimated 2012-13 basis**[a]
Per cent

	Passenger motor vehicle manufacturing	*Automotive components*[b]
Domestically produced	79.0	82.2
Imported	21.0	17.8
Total	**100.0**	**100.0**

a Estimated at basic prices. Under this convention, domestic supplies are valued on an ex-factory or service establishment basis, while imports are valued at the border inclusive of international insurance costs and freight costs (that is, on a cif basis). **b** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819).

Source: Commission estimates.

Figure B.2   **Comparison of actual and projected distribution of production and employment by broad industry sector, Australia, 2012-13**
Per cent

Production (gross value added)

ABS National Accounts

Model projection

Agriculture 2.4   Mining 8.6   Manufacturing 7.1   Services 81.9

Agriculture 2.6   Mining 9.1   Manufacturing 8.9   Services 79.4

Employment (persons)

ABS Labour Force Survey

Model projection

Agriculture 2.6   Mining 2.3   Manufacturing 8.2   Services 86.8

Agriculture 3.0   Mining 2.0   Manufacturing 9.5   Services 85.5

Sources: ABS (2013, *Australian System of National Accounts*, 2012-13, Cat. no. 5204.0); ABS (*Labour Force, Australia, Detailed, Quarterly*, Feb 2014, Cat. no. 6291.0.55.003); Commission estimates.

Composition of domestically sourced intermediate inputs

Domestically sourced manufactures are estimated to account for over half of all domestically sourced intermediate inputs (goods and services combined) to the Victorian and South Australian passenger motor vehicle industry in the 2012-13 database. Products classified as automotive components manufacturing account for over half of manufactured inputs, while the remainder relate to a range of other manufactures including glass, rubber, plastic, chemical and metal products (table B.6).

A large proportion of components and other manufactured inputs to passenger motor vehicle manufacturing in Victoria and South Australia are estimated to be sourced from within those states. Based on inquiry information about the use of Australian-produced manufactured inputs by passenger motor vehicle producers and industry activity levels, it is estimated in the 2012-13 database that manufactured inputs sourced from Victorian-based suppliers make up about 49 per cent of intermediate inputs to Victorian passenger motor vehicle manufacturing (that is, 29.9 per cent plus 19.1 per cent in table B.6), while manufactured inputs sourced from South Australian-based suppliers are estimated to make up about 31 per cent (that is, 21.0 per cent plus 10.5 per cent) of intermediate inputs to South Australian passenger motor vehicle manufacturing. Manufactured inputs from:

- Victorian-based suppliers make up just over 12 per cent (8.2 per cent plus 4.1 per cent) of intermediate inputs to passenger motor vehicle manufacturing in South Australia.

- South Australian-based suppliers make up just over 6 per cent (0.9 per cent plus 5.2 per cent) of intermediate inputs to passenger motor vehicle manufacturing in Victoria.

Table B.6   **Source of domestically produced intermediate inputs to the domestic passenger motor vehicle manufacturing industries in the MMRF database, estimated 2012-13 basis**[a]

Per cent

	Victoria	*South Australia*
Manufactured inputs	**58.2**	**50.6**
of which:		
Automotive components manufacturing [b]	31.2	30.1
Sourced from:		
Victoria	29.9	8.2
South Australia	0.9	21.0
Other manufactured inputs	27.0	20.5
Sourced from:		
Victoria	19.1	4.1
South Australia	5.2	10.5
Transport, services and other inputs	**41.8**	**49.4**
Total	**100.0**	**100.0**

a Estimated at basic prices. Under this convention, manufactured goods are valued on an ex-factory basis, while services are inclusive of transport and distribution costs. **b** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819).

Source: Commission estimates.

Disposition of output

About 60 per cent of domestically produced passenger motor vehicles are estimated to have been sold to Australian households in the 2012-13 database, with the balance used in investment (by businesses and governments) or exported (table B.7). In line with available input-output data, only minimal use of domestically produced passenger motor vehicles is estimated as an intermediate input to production in the 2012-13 database.

With regard to automotive components manufacturing, over one-fifth of its output is used in passenger motor vehicle manufacturing in the 2012-13 database (box B.3).

Table B.7 Use of domestically produced motor vehicles and parts in the MMRF database, estimated 2012-13 basis[a]

Per cent

	Passenger motor vehicle manufacturing	Automotive components manufacturing[b]
Use by industries	0.1	78.8
of which:		
Passenger motor vehicle manufacturing	..	20.7[c]
Automotive component manufacturing	..	2.5
Other automotive manufacturing	..	4.0
Other industries	0.1	51.6
Sales to investment and other[d]	24.2	4.7
Sales to households final consumption	57.4	12.0
Export sales	18.3	4.6
Total sales	**100.0**	**100.0**

.. No Change. **a** Estimated at basic prices. Under this convention, manufactured goods are valued on an ex-factory basis, while services are inclusive of transport and distribution costs. **b** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819). **c** See box B.3. **d** Including sales to government final consumption and change in inventories.

Source: Commission estimates.

The share of production of automotive components covered by the ABS ANZSIC classes 2813 and 2819 that is used by the passenger motor vehicle manufacturing industry in 2012-13 is sensitive to the scale of operation of vehicle manufacturing and the level of component production in Australia.

Although dated, the natural year to benchmark these estimates to is 2005-06, the benchmark year for the model database. For that year, it is estimated that about 35 per cent of domestically produced components were used in the manufacture of passenger motor vehicles. This estimate is based on the database disaggregation process described in box B.1. In particular, state sales of components to the passenger motor vehicle manufacturing industry were calibrated to data on purchases of manufactured inputs by passenger motor vehicle producers, based on data from submissions. These data were more recent, so the 2005-06 database was calibrated to a higher level of sales proportional to the larger size of the domestic passenger motor vehicle industry in 2005-06.

Applying a 5 per cent annual decline in the share of automotive components produced in Australia that is used by the passenger motor vehicle manufacturing industry (box B.2) to the estimated share in the 2005-06 database (35 per cent) suggests that just under 24 per cent of Australian produced components would have been used in the manufacture of passenger motor vehicles in 2012-13 (compared with 21 per cent in the database).

Another point of comparison is the use of all manufactured inputs. In the 2012-13 database (at basic or ex-factory prices, re-expressed in 2012-13 dollars), $1829 million of goods manufactured in Victoria are estimated to be used in passenger motor vehicle manufacturing ($1640 million in Victoria and $189 million in South Australia). Passenger motor vehicle producers are also estimated to use $542 million of goods manufactured in South Australia ($196 million in Victoria and $345 million in South Australia). Allowing for the difference between prices paid by the motor vehicle producers and basic prices, these data are within 10 per cent of targets based on data on purchases of manufactured inputs by passenger motor vehicle producers (FCAI, sub. 30; GM Holden, sub. 58; Government of South Australia, sub. 68; WiSER, sub. 8).

Two other sources of information — the ABS 2009-10 *Input–Output Tables* and the Department of Industry's Key Automotive Statistics publication — also provide indicative information on the current share of automotive components manufacturing used in passenger motor vehicle manufacturing. These sources suggest that between 17 per cent and 32 per cent of automotive components were used in passenger motor vehicle manufacturing in 2012-13. The methods used to estimate these ranges are described in the annex B2.

The estimates derived in the annex B2 may differ from those provided by other sources because those provided in the annex are based on the use of automotive components as defined in ABS classifications.

- Suppliers of the aftermarket are included in the estimates (in contrast, they can be excluded in some estimates that relate only to tier 1 or supply-chain firms).

- Suppliers of other manufactured goods such as windscreens, steel and paint are not included.

Supply and use of automotive components by jurisdiction

Component producers in Victoria and South Australia are relatively more reliant on sales to industry in general, and domestic passenger motor vehicle manufacturing in particular, than producers in other states (table B.8). Component producers in other jurisdictions generally sell proportionately more of their output to households (for example, sale of aftermarket parts directly to households) and to exports than do Victorian and South Australian producers.

Automotive component producers are also estimated to have substantial sales to other industries, with the single most important using industry across jurisdictions being mechanical repairs. The high usage shares in non-passenger motor vehicle manufacturing industries are broadly consistent with the 2005-06 and 2009-10 ABS *Input-Output Tables*.

Table B.8   **Use of domestically produced automotive components in the MMRF database, estimated 2012-13 basis**[a]

Per cent

	Components produced in:			
	Victoria	South Australia	Other regions	All regions
Sales to production	86.2	89.0	61.9	78.8
of which:				
Passenger motor vehicle manufacturing	32.4	24.3	1.0	20.7
of which:				
In Victoria	29.4	2.7	0.5	15.3
In South Australia	2.9	21.6	0.4	5.4
Other automotive manufacturing	4.5	2.1	4.3	4.0
Mechanical repairs	21.6	26.6	25.4	23.7
Other industries	27.7	36.0	31.2	30.3
Sales to investment and other[b]	0.6	6.3	10.1	4.7
Sales to household final consumption	8.9	0.9	22.5	12.0
Export sales	4.3	3.8	5.5	4.6
Total sales	**100.0**	**100.0**	**100.0**	**100.0**

a Estimated at basic prices. Under this convention, manufactured goods are valued on an ex-factory basis, while services are inclusive of transport and distribution costs. **b** Including sales to government final consumption and change in inventories.

Source: Commission estimates.

Employment

Actual employment in the Australian automotive manufacturing industry is estimated to have declined from 2005-06 to 2012-13 at almost 5 per cent per year, with the largest decline being for passenger motor vehicle manufacturing (8 per cent per year) and smallest for other automotive manufacturing (2 per cent per year) (based on tables B.9 and B1.5). The decline in passenger motor vehicle manufacturing employment has been larger in South Australia (12 per cent per year) than in Victoria (5 per cent per year) and is reflected in the uprated database.

Employment in the uprated database for 2012-13 (table B.9) is generally consistent with the latest available data from a range of sources (table B.10). Employment in automotive component manufacturing is smaller than that in the Federation of Automotive Products Manufacturers (FAPM) submission (sub. 69) owing to the narrower focus of the automotive components manufacturing industry in the uprated database (confined to automotive components manufacturing as classified by the ABS, which excludes other manufactured inputs such as windscreens, steel and paint).

Table B.9   **Motor vehicles and parts industry employment in the MMRF database, estimated 2012-13 basis**[a]

Persons

	Passenger motor vehicle manufacturing	*Automotive components*[a]	*Other automotive*
Victoria	9 127	9 351	6 421
South Australia	2 223	2 962	1 002
New South Wales	..	2 492	4 242
Queensland	..	2 185	5 128
Western Australia	..	797	1 943
Tasmania	..	93	274
Northern Territory	..	29	94
Australian Capital Territory	..	14	39
Australia	**11 350**	**17 923**	**19 145**

.. No change. **a** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819).

Sources: Commission estimates based on: Ford (sub. 65); Holden (sub. 58); Toyota (sub. 31); ABS (*Australian Industry, 2011-12*, Cat. no. 8155.0); ABS (*Census of Population and Housing*, 2006).

Table B.10 Employment estimates for the Australian motor vehicles and parts manufacturing industry

Latest available data

Source	Year	Passenger motor vehicles	Automotive components	Other automotive	Motor vehicles and parts
ABS, *Labour Force Survey*	2013				44 000[a]
ABS, *Australian Industry*	2011-12	17 274[b]	18 774	14 680	50 728
ABS, *Census of Population and Housing*	2011	14 481[c]	16 169	18 353	49 003
Ford, Holden and Toyota submissions	2013	11 350			
Department of Industry, *Key Automotive Statistics*	2012	11 053			
FAPM submission	2013		34 000[d]		

a Based on quarterly employment, averaged to the November quarter of 2013, for ANZSIC 2006 Group 231 (Motor vehicle and motor vehicle part manufacturing). **b** Includes non-passenger motor vehicle manufacturing, in particular truck and bus manufacturing. **c** Excludes employment reported in regions other than Melbourne, Barwon and Adelaide in order to minimise the inclusion of non-passenger motor vehicle manufacturing. **d** Includes employment outside the automotive manufacturing industry as defined by the ABS. For example, motor vehicle windscreen suppliers are classified by the ABS as glass and glass product manufacturing, and steel and paint inputs are classified into other parts of manufacturing.

Sources: ABS (*Labour Force, Australia, Detailed, Quarterly*, November 2013, Cat. no. 6291.0.55.003); ABS (*Australian Industry*, 2011-12, Cat. no. 8155.0); ABS (*Census of Population and Housing*, 2011); DoI (2013); Ford (sub. 65); Holden (sub. 58); Toyota (sub. 31); FAPM (sub. 69).

B.5   Sub-state regions

State and regional economies have greater (or lesser) dependence on particular industries than the economy as a whole. For the purposes of projecting the regional impacts associated with the closure of the major Australian passenger motor vehicle manufacturing plants and the consequent contraction of their Australian-based suppliers, the Monash Regional Equation System (MRES) was added to the MMRF model to disaggregate state employment changes to sub-state regions. It does so using a 'tops-down' approach which pro-rates state employment changes to sub-state regions based on their initial *share* of state employment in each industry in the current simulation year. The 58 sub-state regions in MRES are based on the ABS *Australian Standard Geographic Classification* and are analogous to the 'statistical divisions' used by the ABS (table B.11).[8]

Passenger motor vehicle manufacturing is concentrated in the Melbourne, Adelaide and Barwon (covering Geelong) statistical divisions in the 2012-13 database

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[8]   The sub-state regions in Western Australia are based on those used by the Western Australian Government and differ somewhat from the ABS statistical divisions.

(table B.12). These regions, respectively, account for roughly 70, 20 and 10 per cent of national employment in this industry (based on the 2011 ABS *Census of Population and Housing*).

Automotive component manufacturing (as defined) in the 2012-13 database is more widely dispersed than passenger motor vehicle manufacturing, but, nonetheless, is concentrated in capital city statistical divisions in most mainland States (Melbourne, Adelaide, Sydney, Brisbane and Perth). There is also some component manufacturing employment in other regions, such as the Central Highlands (covering Ballarat) and Barwon in Victoria, the Darling Downs (covering Toowoomba) in Queensland and Hunter (covering Newcastle) in New South Wales (table B.12).

The shares in the model were calibrated to the regional employment shares in table B.12. Total employment in each industry was calibrated to the levels in table B.9.

Table B.11   **Sub-state regions in the MMRF regional equation system**

	MRES Region	*ABS SD*	*Main centre*	*Other selected urban centres*
1	Sydney	105	Sydney	Campbelltown, Gosford, Katoomba, Parramatta, Sutherland
2	Hunter	110	Newcastle	Cessnock, Maitland, Muswellbrook, Nelson Bay, Singleton
3	Illawarra	115	Wollongong	Kiama, Mittagong, Moss Vale, Shellharbour, Shoalhaven
4	Richmond-Tweed	120	Lismore	Ballina, Byron Bay, Casino, Tweed Heads
5	Mid-North Coast	125	Coffs Harbour	Grafton, Kempsey, Port Macquarie, Taree
6	Northern	130	Tamworth	Armidale, Glen Innes, Gunnedah, Inverell, Moree, Tenterfield
7	North Western	135	Dubbo	Bourke, Cobar, Coonabarabran, Gilgandra, Mudgee, Walgett
8	Central West	140	Orange	Bathurst, Blayney, Cowra, Forbes, Lithgow, Oberon, Parkes
9	South Eastern	145	Queanbeyan	Bega, Bombala, Cooma, Crookwell, Goulburn, Yass, Young
10	Murrumbidgee	150	Wagga Wagga	Cootamundra, Griffith, Gundagai, Hay, Narrandera, Tumut
11	Murray	155	Albury	Balranald, Deniliquin, Holbrook, Tumbarumba, Wentworth
12	Far West	160	Broken Hill	Tibooburra, Wilcannia
13	Melbourne	205	Melbourne	Altona, Dandenong, Lilydale, Mornington Peninsula, Sunbury
14	Barwon	210	Geelong	Anglesea, Apollo Bay, Colac, Lorne, Queenscliff, Torquay, Winchelsea
15	Western District	215	Warrnambool	Camperdown, Hamilton, Port Fairy, Portland
16	Central Highlands	220	Ballarat	Ararat, Avoca, Bacchus Marsh, Creswick, Daylesford
17	Wimmera	225	Horsham	Dimboola, Halls, Gap, Nhill, St Arnaud, Stawell
18	Mallee	230	Mildura	Donald, Kerang, Ouyen, Swan Hill
19	Loddon	235	Bendigo	Castlemaine, Heathcote, Kyneton, Maryborough, Wedderburn
20	Goulburn	240	Shepparton	Benalla, Cobram, Echuca, Kyabram, Rochester, Yarrawonga
21	Ovens-Murray	245	Wodonga	Beechworth, Bright, Mount Beauty, Rutherglen, Wangaratta
22	East Gippsland	250	Sale	Bairnsdale, Lakes Entrance, Mallacoota, Omeo, Orbost
23	Gippsland	255	Traralgon	Moe, Morwell, Yallourn, Wonthaggi

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Table B.11   (continued)

	MRES Region	ABS SD	Main centre	Other selected urban centres
24	Brisbane	305	Brisbane	Beenleigh, Caboolture, Ipswich, Logan, Mount Gravatt, Redcliffe
25	Gold Coast	307	Gold Coast	Burleigh Heads, Coolangatta, Robina, Southport, Surfers Paradise
26	Sunshine Coast	309	Noosa	Buderim, Caloundra, Coolum, Maroochydore, Maleny
27	West Moreton	312	Beaudesert	Boonah, Gatton, Nambour
28	Wide Bay-Burnett	315	Hervey Bay	Bundaberg, Gympie, Maryborough, Mundubbera
29	Darling Downs	320	Toowoomba	Dalby, Goondiwindi, Stanthorpe, Warwick
30	South West	325	Charleville	Quilpie, Roma, St George
31	Fitzroy	330	Rockhampton	Emerald, Gladstone, Yeppoon
32	Central West	335	Longreach	Barcaldine, Blackall, Winton
33	Mackay	340	Mackay	Clermont, Proserpine
34	Northern	345	Townsville	Ayr, Bowen, Charters Towers, Ingham
35	Far North	350	Cairns	Atherton, Cooktown, Innisfail, Mareeba, Mosman, Weipa
36	North West	355	Mount Isa	Cloncurry, Hughenden, Normanton
37	Adelaide	405	Adelaide	Elizabeth, Gawler, Glenelg, Henley, Marion, Salisbury
38	Outer Adelaide	410	Mount Barker	Barossa Valley, Kangaroo Island, Onkaparinga, Victor Harbor
39	Yorke & Lower North	415	Yorketown	Bute, Riverton, Wallaroo
40	Murray Lands	420	Renmark	Murray Bridge, Pinnaroo
41	South East	425	Mount Gambier	Bordertown, Kingston, Naracoorte
42	Eyre	430	Port Lincoln	Ceduna
43	Northern	435	Whyalla	Coober Pedy, Port Augusta, Port Pirie, Woomera
44	Perth	505	Perth	Armadale, Fremantle, Joondalup, Kwinana, Rockingham, Wanneroo
45	South West	510	Bunbury	Busselton, Collie, Mandurah, Manjimup, Margaret River, Pemberton
46	Great Southern	515	Albany	Denmark, Katanning
47	Wheatbelt	520, 525	Northam	Merredin, Moora, Narrogin
48	Goldfields-Esperance	530	Kalgoorlie	Boulder, Coolgardie, Esperance
49	Mid West	535(p)	Geraldton	Meekatharra, Mount Magnet
50	Gascoyne	535(p)	Carnarvon	Exmouth
51	Pilbara	540	Port Hedland	Karratha, Newman, Tom Price
52	Kimberley	545	Broome	Derby, Kununurra, Wyndham
53	Greater Hobart	605	Hobart	Clarence, Glenorchy, Sorell
54	Southern	610	Geeveston	Bicheno, Huonville, Triabunna
55	Northern	615	Launceston	Deloraine, Georgetown, St Helens
56	Mersey-Lyell	620	Devonport	Burnie, Queenstown, Smithton, Ulverstone, Zeehan
57	Northern Territory	7	Darwin	Alice Springs, Katherine, Nhulunbuy, Tennant Creek
58	Australian Capital Territory	8	Canberra	

a The regions in Western Australia are based on those used by the Western Australian Government with the remainder based on ABS statistical divisions.

Source: Based on ABS (*Australian Standard Geographic Classification (ASGC)*, Cat. no. 1216.0).

Table B.12 **Passenger motor vehicle manufacturing and automotive components manufacturing employment, by state and selected MMRF region, based on 2011 Census data**
Per cent

State and sub-state region	Passenger motor vehicle manufacturing			Automotive components manufacturing		
	Share of total for industry	Share of state for industry	Share of sub-state region[a]	Share of total for industry	Share of state for industry	Share of sub-state region[a]
New South Wales	**0**	**0**	**0.00**	**14**	**100**	**0.08**
Sydney	0	0	0.00	9	68	0.08
Hunter	0	0	0.00	1	7	0.06
Murray	0	0	0.00	1	6	0.29
All other regions	0	0	0.00	3	19	0.06
Victoria	**80**	**100**	**0.50**	**52**	**100**	**0.36**
Melbourne	72	89	0.59	45	87	0.42
Barwon	9	11	1.09	2	4	0.30
Central Highlands	0	0	0.00	2	5	0.61
Loddon	0	0	0.00	1	1	0.15
All other regions	0	0	0.00	2	3	0.08
Queensland	**0**	**0**	**0.00**	**12**	**100**	**0.11**
Brisbane	0	0	0.00	7	57	0.12
Darling Downs	0	0	0.00	1	11	0.23
Gold Coast	0	0	0.00	1	10	0.09
Mackay	0	0	0.00	1	5	0.14
All other regions	0	0	0.00	2	17	0.06
South Australia	**20**	**100**	**0.42**	**17**	**100**	**0.39**
Adelaide	20	100	0.56	16	96	0.51
All other regions	0	0	0.00	1	4	0.06
Western Australia	**0**	**0**	**0.00**	**4**	**100**	**0.07**
Perth	0	0	0.00	4	88	0.08
All other regions	0	0	0.00	1	12	0.03
Tasmania	**0**	**0**	**0.00**	**1**	**100**	**0.04**
Northern Territory	**0**	**0**	**0.00**	**0**	**100**	**0.03**
Australian Capital Territory	**0**	**0**	**0.00**	**0**	**100**	**0.01**
Capital cities	*91*	*na*	*na*	*82*	*na*	*na*

a Indicative sub-state employment shares based on the level of regional employment as reported in the 2011 Census. The sub-state impacts reported in chapter 2 are based on the employment shares in the MMRF-Auto14 database.

Source: Commission estimates based on ABS (*Census of Population and Housing*, 2011, source file generated using TableBuilder Pro on 31 January 2014).

Annex B1 Reference year database tables

Table B1.1 Motor vehicles and parts industry sales in the MMRF database, estimated 2005-06 basis[a,b]

$ million (2005-06 dollars)

	Passenger motor vehicle manufacturing	Automotive components manufacturing[c]	Other automotive manufacturing
Sales of domestic supplies	12 429	6 375	5 711
Sales of imported supplies	14 385	4 593	5 311
Total sales	**26 814**	**10 968**	**11 021**

a Components may not add to totals due to rounding. **b** Excluding re-exports. **c** Based on the ABS ANZSIC 2006 classes: automotive electrical component manufacturing (class 2313); and other motor vehicle parts manufacturing (class 2319).

Sources: Commission estimates based on: ABS (*Australian National Accounts: Input-Output Tables — Electronic Publication*, 2005-06, Cat. no. 5209.0.55.001); ABS (*Australian National Accounts: Input-Output Tables (Product Details)*, 2005-06, Cat. no. 5215.0.55.001).

Table B1.2 Use of domestically produced motor vehicles and parts in the MMRF database, estimated 2005-06 basis[a]

Per cent

	Passenger motor vehicle manufacturing	Automotive components manufacturing[b]	Other automotive manufacturing
Sales to production	..	82.6	33.9
of which:			
Passenger motor vehicle manufacturing	..	35.4	0
Automotive components manufacturing	..	2.1	1.0
Other industries	..	45.0	32.8
Sales to investment and other[c]	23.8	3.6	40.4
Sales to household final consumption	56.7	3.7	14.8
Export sales	19.4	10.1	11.0
Total sales	**100.0**	**100.0**	**100.0**

a Components may not add to totals due to rounding. **b** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (ANZSIC 2006 class 2813); and other motor vehicle parts manufacturing (ANZSIC 2006 class 2819). **c** Including sales to government final consumption and change in inventories.

Sources: Commission estimates based on: ABS (*Australian National Accounts: Input-Output Tables — Electronic Publication*, 2005-06, Cat. no. 5209.0.55.001); ABS (*Australian National Accounts: Input-Output Tables (Product Details)*, 2005-06, Cat. no. 5215.0.55.001).

Table B1.3 Motor vehicles and parts industry costs in the MMRF database, estimated 2005-06 basis

$ million (2005-06 dollars)

	Passenger motor vehicle manufacturing	Automotive components[a]	Other automotive
Total intermediate use	10 262	4 162	3 989
Compensation of employees	1 384	1 418	1 148
Gross operating surplus & mixed income	958	858	477
Taxes less subsidies on products	116	29	27
Other taxes less subsidies on production	-291	-91	70
Australian production	12 429	6 375	5 711
Competing imports	13 557	4 356	5 204
Total uses	25 985	10 731	10 914
Gross value added[b]	**2 051**	**2 184**	**1 694**

a Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819). **b** Sum of compensation of employees, gross operating surplus & mixed income and other taxes less subsidies on production.

Sources: Commission estimates based on: ABS (*Australian National Accounts: Input-Output Tables — Electronic Publication*, 2005-06, Cat. no. 5209.0.55.001); ABS (*Australian National Accounts: Input-Output Tables (Product Details)*, 2005-06, Cat. no. 5215.0.55.001); ABS (*Australian Industry, 2011-12*, Cat. no. 8155.0).

Table B1.4 Regional share of gross value added by the automotive industry in the MMRF database, estimated 2005-06 basis[a]

Per cent

	Passenger motor vehicle manufacturing	Automotive components[a]	Other automotive
Victoria	69.8	64.6	46.5
South Australia	30.2	21.1	8.1
New South Wales	..	8.0	26.2
Queensland	..	5.0	12.0
Western Australia	..	1.0	6.5
Tasmania	..	0.3	0.6
Northern Territory	..	..	0.1
Australian Capital Territory	..	..	..
Australia	**100.0**	**100.0**	**100.0**

a Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819).

Source: Commission estimates based on PC (2008).

Table B1.5 Motor vehicles and parts industry employment in the MMRF database, estimated 2005-06 basis[a]

Persons

	Passenger motor vehicle manufacturing	Automotive components[b]	Other automotive	Total automotive manufacturing
Victoria	14 265	14 004	7 461	35 730
South Australia	5 384	4 592	1 545	11 521
New South Wales	..	3 144	4 894	8 038
Queensland	..	2 222	6 065	8 287
Western Australia	..	650	2 204	2 854
Tasmania	..	126	312	438
Northern Territory	..	28	121	149
Australian Capital Territory	..	34	48	82
Australia	**19 649**	**24 800**	**22 650**	**67 099**

a Estimates of national employment by activity allocated across states using the corresponding employment shares in ABS 2006 *Census of Population and Housing*. **b** Based on the ABS ANZSIC 1993 classes: automotive electrical component manufacturing (class 2813); and other motor vehicle parts manufacturing (class 2819).

Sources: Commission estimates based on: ABS (*Australian Industry,* 2011-12, Cat. no. 8155.0); ABS (*Census of Population and Housing*, 2006); DoI (2013).

Annex B2   Use of Australian produced automotive components by passenger motor vehicle producers

There is no information that allows direct estimation of the share of total production of automotive components manufactured in Australia that is sold to domestic passenger motor vehicle producers. There are some estimates of the reliance of tier 1 and other supply chain firms on sales to passenger motor vehicle producers (Government of South Australia, sub. 68; Victorian Government, sub. PP284), but these do not align well with the automotive components industry as classified by the ABS, in particular because estimates that relate to tier 1 and other supply chain firms exclude firms that only supply the aftermarket.

The Commission has estimated the reliance of Australian automotive component manufacturers on passenger motor vehicle producers using two different approaches.

The first approach draws on the detail of inter-industry flows of goods and services in ABS *Input-Output Tables*. Some limitations with this approach are that input-output data:

- only provide information on the use of components by motor vehicle manufacturing industry (which includes the manufacture of passenger motor vehicles as well as trucks, buses, trailers, caravans and other specialist vehicles)

- do not provide a split of the use of automotive components manufacturing by the automotive manufacturing industry according to whether automotive components are manufactured in Australia or imported (although, for each IOPC product, there is a split between domestic and imported *total* sales to *all* Australian users, which is used by the ABS to obtain a pro-rata estimation of domestic supplied components)

- are most recently available for 2009-10.

An upper bound estimate is derived by assuming that truck and bus producers use domestic components one quarter as intensively as passenger motor vehicle producers[9] and that 64 per cent of components used in the automotive manufacturing industry in 2009-10 were domestically sourced (Dowling 2014 and DoI 2013). A lower bound estimate is derived by assuming that truck and bus

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[9] There is little publicly-available data on the use of domestically sourced components in bus and truck manufacturing in Australia. The assumption that domestically sourced components are used less intensively in bus and truck manufacturing than in passenger motor vehicle manufacturing is made in order to give an upper bound estimate of use of components in passenger motor vehicle manufacturing, rather than being based on any data.

manufacturers use domestic components equally as intensively as passenger motor vehicle producers and that 40 per cent of components used in the automotive manufacturing industry were domestically sourced in 2009-10 (a lower-bound because it is based on 2013 data from FAPM, sub. 69, and domestic content has declined between 2009-10 and 2013). For both estimates, the share of domestically produced components going to passenger motor vehicle producers was assumed to decline by 5 per cent per year between 2009-10 and 2012-13 (box B.2).

The *second approach* uses an estimate of the value of manufactured inputs that passenger motor vehicle producers sourced from Australian suppliers from Department of Industry data (DoI 2013) in conjunction with an estimate of the total sales and service income for automotive components producers from the ABS Australian Industry publication (ABS 2013a).[10]

The limitations with this approach are:

- the estimate of the value of manufactured inputs supplied to passenger motor vehicles and parts manufacturing industries includes, not just automotive components manufacturing as classified by the ABS, but also other manufactured inputs such as windscreens, steel and paint

- latest industry survey data available are for 2011-12.

An upper bound estimate is derived by assuming that 60 per cent of all manufactured inputs supplied to passenger motor vehicle producers are automotive components (as noted in section B.2, the value of automotive components as classified by the ABS is about half the value of the total use of manufactured inputs by the automotive industry). A lower bound estimate is derived by assuming that 40 per cent of all manufactured inputs supplied to passenger motor vehicle producers are from automotive components manufacturing. As above, the share of domestically produced components going to passenger motor vehicle producers was assumed to decline by 5 per cent per year for both estimates. (Applying the same approach to comparable data for 2005-06 yields an estimated range of 25 to 38 per cent, demonstrating the decline in the importance of automotive components use by passenger vehicle manufacturers over recent years.)

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[10] An alternative approach is to use the Department of Industry data in conjunction with the Australian Automotive Aftermarket Association's (AAAA) (sub. 54) estimate of turnover of firms that supply components to the aftermarket. This estimate is based on the AAAA's database of members, plus an additional allowance for non-member suppliers to the aftermarket based on visitor registration at the Aftermarket Trade Show. Depending on the assumptions used, the estimate of the reliance of component manufacturers using this approach is about 30 per cent.

The analysis presented here suggests that the share of total production of automotive components manufactured in Australia that was sold to domestic passenger motor vehicle producers in 2012-13 is likely to lie between 17 and 32 per cent (table B2.1).

Table B2.1   **Estimates of the fraction of domestically produced automotive components used in passenger motor vehicle manufacturing**
Per cent

Approach	Upper bound	Lower bound
2012-13		
Based on ABS *Input-Output Tables*	32	17
Department of Industry data with ABS industry survey data	25	17
2005-06		
Department of Industry data with ABS industry survey data	38	25

C Model implementation of the exit scenario

This appendix sets out the variable shocks and model closure changes used for modelling the exit scenario.

C.1 Exit scenario modelled

The MMRF modelling reported in chapters 2 to 4 involved running the same exit scenario under two different modelling environments:

- a longer-run *comparative-static* modelling environment to estimate the longer-run effects of the cessation of passenger motor vehicle manufacturing in Australia and the consequential impacts on supply chain activities and the broader economy

- a *recursive-dynamic* environment to project the timescale over which the impacts are likely to occur (year-to-year impacts).

These modelling environments and parameter settings are detailed in appendix A.

The common variables shocked and associated closure changes used in the comparative-static and dynamic modelling are listed in table C.1. The scenario specific closure changes and model shocks to account for differences in the longer-term and year-to-year modelling environments are discussed later in this appendix.

Exit of passenger motor vehicle manufacturers

The closure of Australian passenger motor vehicle manufacturing plants is modelled as a 98 per cent reduction in the *use* of locally produced passenger motor vehicles. It is assumed that, at the regional level, imported passenger motor vehicles fill the gap left by domestic production (implemented via a demand 'twist' towards imports). As a result, domestic demand for passenger motor vehicles remains unchanged.

Table C.1   **Modelling of the exit scenario**

Closure change and rationale	Exogenous variable	Endogenous variable	Victoria	South Australia	All other states
Passenger motor vehicle manufacturing					
Sales to households are targeted to simulate the reduction in sales of domestically produced cars in each state. A twist term adjusts so that sales of domestically produced cars are replaced by imports.	Sales of domestically produced cars to households (x3c)	Twist term for household demand towards imported cars (twistsrc3)	-98%	-98%	-98%
Sales to investors are targeted to simulate the reduction in sales of domestically produced cars in each state. A twist term adjusts so that sales of domestically produced cars are replaced by imports.	Sales of domestically produced cars to investors (x2_car)	Twist term for investment demand towards imported cars (twistsrc2)	-98%	-98%	-98%
State exports of cars are targeted to reflect the cessation of major domestic production of cars. An export demand shift term adjusts to accommodate the change.	Export sales of domestically produced cars (x4r)	Volume shift in export demand (f4q)	-98%	-98%	na
Final use of Victoria's business services are targeted to reflect the continued provision of head office, design and marketing functions to the offshore parent company and designated as export demand in the modelling.	Exports sales of business services (x4r)	Volume shift in export demand (f4q)	+30%	na	na
Automotive component manufacturing					
Employment in the automotive component industry targeted to simulate the reduction in sales by component producers that sell to local PMV production. A twist term adjusts so that remaining demand is met by imports.	Employment in the automotive components industry (x1emp_o)	Twist term for industry demand towards imported automotive components (twistsrc1)	-58%	-58%	NSW: -2.4
Intermediate demand in other states for automotive components supplied by Victoria and South Australia is targeted to simulate the reduction in sales by component producers that sell to local PMV production. A twist term adjusts so that remaining demand is met by alternative sources.	Intermediate demand for automotive components supplied by producers in Victoria and South Australia (x1_carparts)	Twist term for industry demand towards automotive components supplied by other states (twistdom)	na	na	-58%

(Continued next page)

Table C.1   (continued)

Closure change and rationale	Exogenous	Endogenous	Victoria	South Australia	All other states
Budgetary outlays					
Federal government subsidies to the automotive industry cease with the exit of the domestic car production.	Federal government grants to private industry (d_wgfse_50 0("Federal"))	Shift term on federal government grants to private industry (f_wgfse_500 ("Federal"))	See table C.2		
Other closure changes					
The budget position is held fixed as a share of GDP or gross state product through the use of lump-sum transfers to, or from, households.	Change in net lending/ borrowing balance fixed as a share of GDP (d_wgfsbudG DP(Govt)	Lump-sum transfers to, or from, households (d_wgfse_80 0 (Govt))	na	na	na

na Not applicable.

The exit scenario allows some small-scale motor vehicle manufacturing activity to remain after the closure of large-scale vehicle manufacturing activity (assumed to be 2 per cent of current output). This is based on the possibility that the existing manufacture of some specialised and bespoke vehicles might continue (for example, TomCar Australia, sub. 32).

The exit scenario also allows for the retention of some of the design and engineering, head office, sales and marketing functions, by the three passenger motor vehicle manufacturers, modelled as an increase in export demand for 'business services'. The retention of these service functions is assumed to correspond to the business service output equivalent of 20 per cent of current employment in the passenger motor vehicle industry, with the activity centred in Victoria, the head office state of the current producers. The retention of these activities implies that the overall reduction in employment as a consequence of passenger motor vehicle manufacturing plant closures is around 80 per cent from current levels.[1]

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[1] Ford, Holden and Toyota have announced that plant closures will directly affect about 6600 of their employees. This represents about 60 per cent of their current workforce. For Ford and Toyota, announced job losses only relate to manufacturing employees, so a greater number of retrenchments could occur if there are also reductions in design and engineering, head office, sales and marketing positions at these two firms.

As stated in chapter 6 of the Commission's report, it is assumed that 40 per cent of all automotive components manufacturing employees (as classified by the Australian Bureau of Statistics) nationally lose their jobs. This implies much larger reductions in Victoria and South Australia reflecting their greater reliance on sales to passenger motor vehicle manufacturing. With industry employment (and by implication output) determined exogenously, there is a 'twist' in favour of imported automotive components to fill the gap between demand and supply.[2] In the modelling, it is assumed that output by manufacturers of automotive components (for example for the aftermarket and bus and truck assembly) in states other than Victoria, South Australia and New South Wales (the main states that supply automotive components to passenger motor vehicle production) moves in line with gross state product.[3]

Budgetary assistance

With the closure of large scale passenger motor vehicle manufacturing, industry-specific budgetary assistance, which has been focused on the operations of Ford, Holden and Toyota and their upstream component suppliers, is also assumed to end. The comparative static modelling estimates the impact of the total (that is, cumulative value) of industry-specific budgetary support that would not be paid due to the closure of large-scale passenger motor vehicle manufacturing.

Changes in industry-specific budgetary assistance are estimated based on funding caps for the Automotive Transformation Scheme (ATS) that incorporate savings set out in the Government's 2013-14 Mid-Year Economic and Fiscal Outlook (MYEFO) estimates, as well as projected assistance under other industry-specific schemes (annex). The consequential reduction in industry-specific budgetary assistance modelled amounts to $656 million in total (table C.2). The dynamic modelling estimates the impact of the reduction in assistance in the respective years in which they were budgeted to be paid.

As noted in chapter 1, this illustrative approach to modelling changes in budgetary assistance should *not* be interpreted as a quantification of the effect of government policy decisions. Maintaining a motor vehicle manufacturing industry in Australia would have required significant and (if historic trends were to continue) ever

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[2] This approach is used as the model database does not differentiate between automotive components manufactured for aftermarket use from those used in passenger motor vehicle manufacturing. The modifications made to the model code to achieve this are detailed in box C.1.

[3] Implemented by shocking the exogenous variable x1emp_o for each relevant state, making the twist term twistsrc1 endogenous.

increasing levels of assistance through tariffs or budgetary assistance. Given the decisions of the three motor vehicle manufacturers to cease their local manufacturing, the level of assistance that would have been necessary to sustain local manufacturing is hypothetical, uncertain and has not been modelled.

Table C.2   **Changes in Australian Government industry-specific budgetary assistance consequential on the closure of passenger motor vehicle manufacturing plants in Australia**
$ million (current prices)

Description of direct impact	2016-17	2017-18	2018-19	2019-20	2020-21
Scheduled Australian Government assistance to the domestic car industry**a**	-178	-187	-175	-92	-25
Cumulative Australian Government assistance to the domestic car industry	-178	-365	-540	-632	-656

a Australian Government payments to the domestic car industry to fall with the exit of claimants. Assistance estimates account for savings to the ATS included in the Australian Government's 2013-14 MYEFO. In longer-run simulations, the reduction is estimated as the value of funding scheduled under current arrangements had the businesses remained, that is, the accumulated scheduled assistance over the years 2016-17 to 2020-21, inclusive. This assistance was adjusted for the effect of price changes to align with the reference year in the MMRF database (based on the average rate of growth in the CPI between the June quarters 2006 and 2012 of 2.6 per cent per annum).

Source: Commission estimates based on information provided by the Department of Industry.

The automotive industry also receives non-budgetary assistance in the form of a 5 per cent import tariff (since 1 January 2010). The modelling assumes that this rate remains unchanged after the ending of passenger motor vehicle manufacturing.

Modelling the timescale over which the impacts may occur

Closure changes to model the decommissioning of capital stocks

In addition to the variable swaps and model shocks set out in table C.1, estimating the timescale of effects in the recursive-dynamic modelling framework required closure changes to ensure that the remaining capital stocks of exiting vehicle and components producers change in proportion to the exogenous changes in their output (table C.3).[4,5]

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4   The capital use closure changes avoid maintaining capital stocks at pre-closure levels in the exit scenario.

5   Ideally, these closure changes would also be applied to the buildings and equipment that are effectively being transferred from the passenger motor vehicle manufacturing industry to the Victorian business services industry. However, this was not done due to the difficulty in

Table C.3 Additional model closure changes to assess the timescale over which the impacts of closing of passenger motor vehicle manufacturing plants in Australia in 2016-17 may occur

Closure change and rationale	Exogenous variable	Endogenous variable	Victoria	South Australia	All other states
Turn-off the MMRF theory linking the change in investment the change in the capital stock for the Victorian and South Australian passenger motor vehicle and automotive components manufacturing industries	Industry and state-specific change in the ratio of investment to capital stock (r_inv_cap)	Industry and state-specific shift term in investment equation (d_feeqror)	0	0	na
Turn-off the MMRF capital accumulation theory for Victorian and South Australian passenger motor vehicles and automotive components manufacturing industries	Change in capital growth rate (d_k_gr)	Shift term in capital growth rate equation (d_fk_gr)	0	0	na
Reduce the use of capital in production by the Victorian and South Australian passenger motor vehicle and automotive component manufacturing industries in proportion to output[a]	Capital productivity by industry and state (x1capprod)	Mid-year capital stock used in production (f_x1cap2)	0	0	na

na Not applicable. **a** Fixing capital productivity at zero ensures that the use of capital in production in the Victorian and South Australian industries changes proportionately with their output.

Change in unemployment

Recognising that the closure of large-scale passenger motor vehicle manufacturing in Victoria and South Australia and the consequent contraction in the supply chain will have implications for state labour markets, the dynamic modelling allows state unemployment rates to vary. This is modelled as commencing in 2016-17.

The modelling assumes 'partial adjustment' in the labour market. Initially, adjustment takes the form of changes in the quantity of labour employed (resulting in additional unemployment) in those states with passenger motor vehicle manufacturing, automotive components and other input-supplying industries. Gradually, the labour market adjustment shifts towards changes in the price, rather than quantity, of labour (implying changes in real wages).

quarantining the capital stock being transferred from the wider use of capital stock by the Victorian business services industry.

The rate at which this adjustment is assumed to occur is based on analysis of the duration of unemployment by people previously employed in the Australian manufacturing sector (appendix C of the Commission's inquiry report). These estimates are based on the first eleven waves of the Housing, Income and Labour Dynamics in Australia (HILDA) survey. This analysis indicates that, on average, 17 per cent of manufacturing employees surveyed found a job within one month and two-thirds had found some form of employment within one year. After 12 months or more, the transition probabilities are similar to the experience following the closure of Mitsubishi's Lonsdale engine manufacturing plant in 2004.

The MMRF modelling focuses on the rate at which state labour markets adjust over time and it is assumed that these labour markets continue to adjust at the same rate as the former manufacturing employees did over the first year, as outlined above. This is achieved by fitting a curve to the transition probabilities for re-employment.[6] The resulting transition path implies that 84 per cent of the aggregate labour market adjustment has occurred after twenty-four months, 95 per cent after thirty-six months and 100 per cent after forty-eight months (figure C.1). While the modelling does not assume each person retrenched will be reemployed (and reemployed at the same wage), it does assume that aggregate unemployment will return to base levels after a period of adjustment, as reflected in the estimated transition path.

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[6] The fitted curve takes the form $y = 0.2615\ln(t) + 0.0008$, where t is the time in months since displacement.

Figure C.1   Labour market transition probabilities used in formulating the changes in state unemployment modelled

Probability of finding employment

$$y = 0.2615\ln(t) + 0.0008$$
$$R^2 = 0.9982$$

Months since job loss (t)

——— Estimated transition probability   ••••• Extrapolation
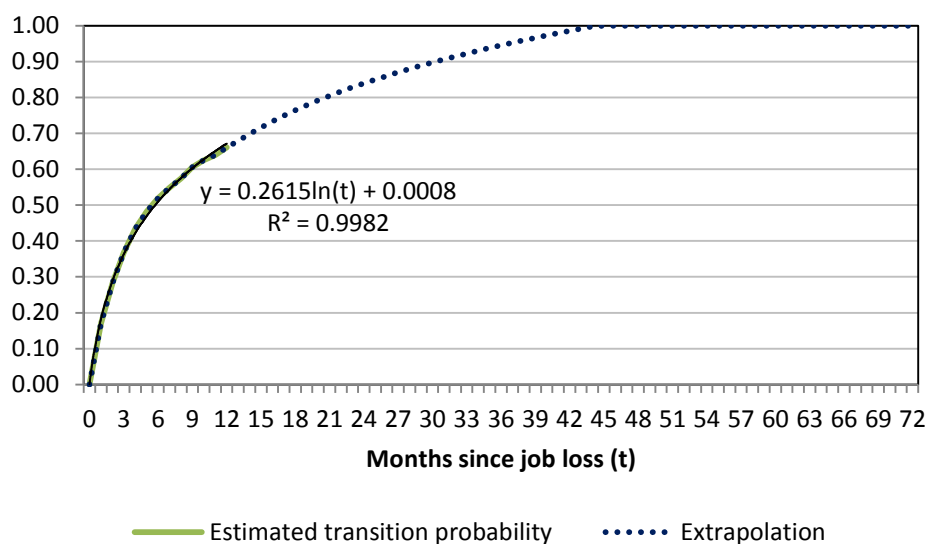
Source: Productivity Commission estimates based on appendix C of volume 1 of this report.

Further, the Commission's modelling is based on the assumption that the closure of passenger motor vehicle plants will not have any effect on economywide labour participation rates. The Commission's analysis of HILDA data indicates that some retrenched employees are likely to leave the workforce altogether — about 20 per cent of unemployed manufacturing employees left the workforce within two years of becoming unemployed. However, the effect on aggregate participation rates is uncertain, as it is unclear how many of these people would have left the workforce anyway (for example, they might have retired).

The number of employees that will lose their jobs as a result of the closure of the three passenger motor vehicle manufacturers ceasing manufacturing operations in Victoria and South Australia will depend on a range of factors, including the inter-linkages between industries and the extent to which input suppliers can find alternative markets utilising their manufacturing capabilities after the closure of large-scale passenger motor vehicle manufacturing (which together determine the extent of flow-on effects to employees in input-supplying and related activities). The extent to which retrenched employees subsequently become 'unemployed' will depend on the opportunities open to these people (which will, in turn, depend on the underlying strength of the economy and local job markets), their skills and their willingness to accept alternative employment opportunities. Such factors are difficult to gauge in advance.

Recognising these uncertainties, two unemployment scenarios are modelled.

- A 'higher' job loss scenario, which is based on:

    - an 80 per cent reduction with respect to current employment in the passenger motor vehicle manufacturing industry, reflecting:

        ⋯ 98 per cent reduction in passenger motor vehicle manufacturing employment as such, with

        ⋯ 20 per cent of existing employment remaining to undertake the head office, design and marketing functions and specialised and bespoke passenger motor vehicle manufacturing that will continue (equivalent to 2270 people)[7]

    - 40 per cent of employees nationally in the automotive components manufacturing industry (as defined by the ABS) lose their jobs (informed by the Commission's assessment that employment in the automotive components industry will decline by about 40 per cent with the ending of large-scale passenger motor vehicle manufacturing — chapter 1)

    - an estimate of the flow-on effects to all other direct-input suppliers of manufactured inputs *and* services to passenger motor vehicle manufacturing (assumed to be in proportion to the share of their sales to the Victorian and South Australian passenger motor vehicle manufacturing industries).[8]

- A 'lower' job loss scenario, which is based on:

    - announcements by the three major passenger motor vehicle manufacturers that 6600 employees would be retrenched (out of a workforce of 11 500)

    - 40 per cent of employees nationally in the automotive components manufacturing industry becoming retrenched (as in the higher job-loss scenario)

    - an estimate of the flow-on effects to direct-input suppliers of manufactured inputs (but *not* service inputs) to passenger motor vehicle manufacturing.[9,10]

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[7] This remaining employment is re-classified in the modelling to the business service industry in Victoria, the location of the head offices of the major manufacturers, on account of its input structure being closer to those of the remaining head office functions than passenger motor vehicle manufacturing.

[8] Sales shares to the passenger motor vehicle manufacturing industry are applied to the level of industry employment in the MMRF-Auto14 database to give an estimate of the initial number of job losses. The total number of jobs lost in each jurisdiction is the sum of jobs lost across all input-supplying industries.

[9] For example, 1.3 per cent of Victorian metal products employment is assumed to be lost as a result of the end of large-scale passenger motor vehicle manufacturing in Victoria (370 employees out of 28 700), as the Victorian passenger motor vehicle manufacturing industry uses 1.3 per cent of domestically produced metal products in the MMRF-Auto14 database.

The implied higher and lower bound estimates of unemployment are 33 000 and 16 000, respectively. The resulting estimates of the number of employees potentially affected are provided in tables C.4 and C.5 (upper panel). Monthly transition probabilities described above are then applied to derive the number of retrenched former employees in each scenario that have not found employment (tables C.4 and C.5, middle panel).

Finally, annual unemployment *rate* shocks are derived from the number of retrenched former employees seeking employment immediately and then after twelve, twenty-four, thirty-six and forty-eight months. This approach means that, in 2016-17, all retrenched former employees are assumed to become unemployed. The estimated *changes* in the state unemployment rates (tables C.4 and C.5, lower panel) were applied uniformly across occupations to the MMRF variable d_unro.

This approach assumes a worst-case scenario in which all job losses occur at once. As noted in the inquiry report, in reality job losses will be staggered over several years. Ford, Holden and Toyota have given advance notice of their intention to close their manufacturing plants and some employees might leave before the closures. The timing of retrenchments at firms supplying the motor vehicle manufacturers will also vary, depending on the circumstances facing individual firms.

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[10] It is assumed that this unemployment occurs in the region in which the passenger motor vehicle manufacturing or vehicle components manufacturing industries are located. To the extent that these inputs are sourced from other jurisdictions, the resulting estimates of employees retrenched in the state in which the vehicle manufacturing or component manufacturing occurs will be overstated, and correspondingly understated in the supplying region.

Table C.4   **Assumed changes in unemployment rates by state attributable to closing passenger motor vehicle manufacturing plants in Australia: higher estimate**[a,b]

	Victoria	South Australia	New South Wales	Australia
Employees initially assumed to be retrenched following the end of large-scale manufacturing (persons)				
Total	24 150	8 390	70	32 610
Of which:				
Passenger motor vehicle manufacturing	6 860	2 220	0	9 080
Input-supply industries[c]	17 290	6 170	70	23 530
Retrenched employees that are assumed to remain unemployed following the end of major passenger motor vehicle manufacturing (persons)[d]				
2016-17	24 150	8 390	70	32 610
2017-18	8 190	2 850	20	11 060
2018-19	3 890	1 350	10	5 250
2019-20	1 330	460	0	1 790
2020-21	..	..	..	..
Change in state unemployment rate by occupation (percentage points)				
2016-17	+0.8420	+1.0108	+0.0018	na
2017-18	-0.5564	-0.6674	-0.0013	na
2018-19	-0.1499	-0.1807	-0.0003	na
2019-20	-0.0893	-0.1072	-0.0003	na
2020-21	-0.0464	-0.0554	..	na

.. Zero or less than 10 people. The numbers of persons unemployed have been rounded to the nearest 10. **a** Assuming 98 per cent reduction in passenger motor vehicle manufacturing and allowing for the retrenchment of employees in all input-supplying industries in proportion to the share of their sales accounted for by the passenger motor vehicle manufacturing industry (assuming full pass through). **b** While some employment losses may occur owing to some interstate interlinkages, employment losses in Queensland and Western Australia are assumed to be zero for modelling purposes. **c** All industries supplying inputs to the domestic passenger motor vehicle manufacturing industry (including automotive components suppliers). **d** The number of employees initially retrenched that are assumed to remain unemployed based on the estimated transition probabilities.

Source: Commission estimates.

Table C.5   **Assumed changes in unemployment rates by state attributable to closing passenger motor vehicle manufacturing plants in Australia: lower estimate[a,b]**

	Victoria	South Australia	New South Wales	Australia
Employees initially assumed to be retrenched following the end of large-scale manufacturing (persons)				
Total	11 980	3 930	70	15 980
Of which:				
Passenger motor vehicle manufacturing	5 000	1 600	0	6 600
Input-supply industries[c]	6 980	2 330	70	9 380
Retrenched employees that are assumed to remain unemployed following the end of major passenger motor vehicle manufacturing (persons)[d]				
2016-17	11 980	3 930	70	15 980
2017-18	4 060	1 330	20	5 410
2018-19	1 930	630	10	2 570
2019-20	660	220	..	880
2020-21	..	..	..	..
Change in state unemployment rate by occupation (percentage points)				
2016-17	+0.4177	+0.4735	+0.0018	na
2017-18	-0.2761	-0.3132	-0.0013	na
2018-19	-0.0743	-0.0843	-0.0003	na
2019-20	-0.0443	-0.0494	-0.0003	na
2020-21	-0.0230	-0.0265	..	na

.. Zero or less than 10 people. The numbers of persons unemployed have been rounded to the nearest 10. **[a]** Assuming that passenger motor vehicle manufacturers reduce employment in-line with their stated intentions and allowing for the retrenchment of employees in manufacturing industries that supply inputs to the passenger motor vehicle manufacturing industry in proportion to the share of their sales accounted for by the passenger motor vehicle manufacturing industry. **[b]** While some employment losses may occur owing to some interstate interlinkages, employment losses in Queensland and Western Australia are assumed to be zero for modelling purposes. **[c]** Manufacturing industries supplying inputs to the domestic passenger motor vehicle manufacturing industry (including automotive components suppliers). **[d]** The number of employees initially retrenched that are assumed to remain unemployed based on the estimated transition probabilities.

Source: Commission estimates.

C.2   Model code and related changes

The MMRF model code (CoPS forthcoming) was modified to enable the scenarios presented in this paper to be modelled. These additions to the model code are listed in box C.1.

Box C.1   Code added to the MMRF model for this inquiry

Import-domestic twist term on investment demand for passenger motor vehicles

```
Variable (all,c,COM)(all,q,REGDST)
twistsrc2(c,q) # Investor twist in ratio of imports to
domestically-produced inputs #;

Equation E_x2a # Demand for c from s for investment in
state q, User 2 #
(all,c,COM)(all,s,ALLSRC)(all,i,IND)(all,q,REGDST)
x2a(c,s,i,q) =
IF{s ne "imp",
    x2c(c,i,q) - SIGMA2C(c)*[p2a(c,s,i,q) - p2c(c,i,q)]} +
IF{s eq "imp",
    x2o(c,i,q) - SIGMA2O(c)*[p2a(c,"imp",i,q)-p2o(c,i,q)]+
    (V2PURT(c,"domestic",i,q)/(TINY + V2PURO(c,i,q)))*
        (twistsrc2(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c)};

Equation E_x2c # Demand for domestic composite, User 2 #
(all,c,COM)(all,i,IND)(all,q,REGDST)
x2c(c,i,q) =
x2o(c,i,q) - SIGMA2O(c)*[p2c(c,i,q) - p2o(c,i,q)] -
    [V2PURT(c,"imp",i,q)/(TINY + V2PURO(c,i,q))]*
        (twistsrc2(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c);
```

Import-domestic twist term on household demand for passenger motor vehicles

```
Variable (all,c,COM)(all,q,REGDST)
twistsrc3(c,q) # Household twist in ratio of imports to
domestically-produced inputs #;

Equation E_x3a # Demand for goods by source, User 3 #
(all,c,COM)(all,s,ALLSRC)(all,q,REGDST)
x3a(c,s,q) =
IF{s ne "imp",
    x3c(c,q) - SIGMA3C(c)*[p3a(c,s,q) - p3c(c,q)]} +
IF{s eq "imp",
    x3o(c,q) - SIGMA3O(c)*[p3a(c,"imp",q) - p3o(c,q)] +
    (V3PURT(c,"domestic",q)/(TINY+V3PURO(c,q)))*
        (twistsrc3(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c)};
```

Box C.1   (continued)

Equation E_x3c *# Demand for domestic composite, User 3 #*
(**all**,c,COM)(**all**,q,REGDST)
x3c(c,q) = x3o(c,q) - SIGMA3O(c)*[p3c(c,q) - p3o(c,q)] -
    [V3PURT(c,*"imp"*,q)/(TINY   +   V3PURO(c,q))]*
        (twistsrc3(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c);

Domestic demand for passenger motor vehicles in investment

Set REG_Car *# Regions producing cars # (VIC, SA) ;*
    Subset REG_Car **is subset of** REGDST ;

Set COM_Car *# PMV commodity # (Cars) ;*
    Subset COM_Car **is subset of** COM ;
    Subset COM_Car **is subset of** IND ;

Set Not_Car = IND - COM_car ;

Variable (**all**,c,COM_Car)(**all**,q,REGDST)
x2_car(c,q) *# Demand for domestic cars in investment #;*

Equation E_x2_car
 # Demand for domestic cars in investment #
(**all**,c,COM_Car)(**all**,q,REGDST)
ID01[**sum**{s,REG_Car,**sum**{i,IND,
V2PURA(c,s,i,q)}}]*x2_car(c,q) =
  sum{s,REG_Car,**sum**{i,IND, V2PURA(c,s,i,q)*x2a(c,s,i,q)}};

Intermediate demand for automotive components supplied by Victoria and South Australia

Set CarParts (CarParts) ;
    Subset CarParts **is subset of** COM ;

Variable (**all**,c,CarParts)(**all**,q,REGDST)
x1_carparts(c,q)
 # Demand for domestic cars in production #;

Equation E_x1_carparts
 # Demand for Vic & SA car parts in production #
(**all**,c,CarParts)(**all**,q,REGDST)
ID01[**sum**{s,REG_Car,**sum**{i,Not_Car,
V1PURA(c,s,i,q)}}]*x1_carparts(c,q) =
    sum{s,REG_Car,**sum**{i,Not_Car,
V1PURA(c,s,i,q)*x1a(c,s,i,q)}};

(Continued next page)

Box C.1 (continued)

Domestic-domestic twist term on intermediate demand for automotive components

```
Set NotREG_Car = REGSRC - REG_Car ;

Set DOMSOURCE # Aggregated domestic sources #
(REG_Car,NotREG_Car);

Coefficient
(all,c,COM)(all,d,DOMSOURCE)(all,i,IND)(all,q,REGDST)
V1PURD(c,d,i,q) # Purchase value for current production:
Two domestic sources #;

Formula (all,c,COM)(all,i,IND)(all,q,REGDST)
V1PURD(c,"REG_Car",i,q) = sum{s,REG_Car, V1PURA(c,s,i,q)};

Formula (all,c,COM)(all,i,IND)(all,q,REGDST)
V1PURD(c,"NotREG_Car",i,q) = sum{s,NOTREG_Car,
V1PURA(c,s,i,q)};

Variable (all,c,COM)(all,q,REGDST)
twistdom(c,q) # Intermediate twist in ratio of SA & Vic to
other domestic inputs #;

Variable (all,c,COM)(all,i,IND)(all,q,REGDST)
p1a1(c,i,q) # Price of domestic composite from REG_Car,
User 1 # ;

Equation E_p1a1 # Price of domestic composite, User 1 #
(all,c,COM)(all,i,IND)(all,q,REGDST)
ID01[V1PURD(c,"REG_Car",i,q)]*p1a1(c,i,q)  =
    sum{s,REG_Car, V1PURA(c,s,i,q)*(p1a(c,s,i,q) +
a1a(c,s,i,q))};

Variable (all,c,COM)(all,i,IND)(all,q,REGDST)
p1a2(c,i,q)
# Price of domestic composite from NotREG_Car, User 1 # ;

Equation E_p1a2 # Price of domestic composite, User 1 #
(all,c,COM)(all,i,IND)(all,q,REGDST)
ID01[V1PURD(c,"NOTREG_Car",i,q)]*p1a2(c,i,q)  =
    sum{s,NOTREG_Car, V1PURA(c,s,i,q)*(p1a(c,s,i,q) +
a1a(c,s,i,q))};
```

Box C.1 (continued)

```
Equation E_x1a # Demand for c from s by industry i in q #
(all,c,COM)(all,s,ALLSRC)(all,i,IND)(all,q,REGDST)
x1a(c,s,i,q) - a1a(c,s,i,q) =
IF{c ne "CarParts",
  IF{s ne "imp",
    x1c(c,i,q) - SIGMA1C(c)*[p1a(c,s,i,q) + a1a(c,s,i,q) -
p1c(c,i,q)]} +
  IF{s eq "imp",
    x1o(c,i,q) - SIGMA1O(c)*[p1a(c,"imp",i,q) +
a1a(c,"imp",i,q) - p1o(c,i,q)] +
    (V1PURT(c,"domestic",i,q)/(TINY+V1PURO(c,i,q)))*
        (twistsrc1(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c)}} +
IF{c eq "CarParts",
  IF{s ne "imp",
   IF{s eq "VIC" or s eq "SA",
    x1c(c,i,q) - SIGMA1C(c)*[p1a1(c,i,q) - p1c(c,i,q)] +
(V1PURD(c,"NotREG_Car",i,q)/(TINY+V1PURT(c,"domestic",i,q)
))*
        (twistdom(c,q))}  +
   IF{s ne "VIC" and s ne "SA",
    x1c(c,i,q) - SIGMA1C(c)*[p1a2(c,i,q) - p1c(c,i,q)] -
(V1PURD(c,"REG_Car",i,q)/(TINY+V1PURT(c,"domestic",i,q)))*
        (twistdom(c,q))}}  +
  IF{s eq "imp",
    x1o(c,i,q) - SIGMA1O(c)*[p1a(c,"imp",i,q) +
a1a(c,"imp",i,q) - p1o(c,i,q)] +
    (V1PURT(c,"domestic",i,q)/(TINY+V1PURO(c,i,q)))*
        (twistsrc1(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c}} ;
```

Import-domestic twist term on intermediate demand for automotive components

```
Variable (all,c,COM)(all,q,REGDST)
twistsrc1(c,q) # Intermediate twist in ratio of imports to
domestically-produced inputs #;
```

```
Equation E_x1c # Demand for domestic composite, User 1 #
(all,c,COM)(all,i,IND)(all,q,REGDST)
x1c(c,i,q) =
    x1o(c,i,q) - SIGMA1O(c)*[p1c(c,i,q) - p1o(c,i,q)] -
    (V1PURT(c,"imp",i,q)/(TINY+V1PURO(c,i,q)))*
        (twistsrc1(c,q) + twistsrc(c,q) + twistsrc_c(q) +
nattwistsrc_c);
```

Annex C1   Budgetary assistance to the automotive industry

Actual and projected budgetary assistance to the automotive manufacturing industry indicates a future decline in budgetary outlays to the industry (table C1.1). This assistance includes the ATS, the Green Car Innovation Fund and the Automotive New Markets Initiative, as well as conditional grants to passenger motor vehicle manufacturers (detailed in chapter 5 of the Commission's inquiry report).

Capped ATS assistance amounts are based on available funding under that part of the scheme (rather than expected payments), and account for savings included in the Australian Government's 2013-14 Mid-Year Economic and Fiscal Outlook. In a given year, actual ATS payments can differ substantially from the annual cap due to unallocated funding.

Table C1.1 Actual and projected budgetary assistance to the automotive manufacturing industry[a]

$ million (current prices)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Passenger motor vehicle manufacturing											
ATS – capped assistance[a]	82	163	154	178	110	69	83	101	96	50	14
ATS – uncapped assistance	55	87	63	58	37	25	11	3	..	..	..
Green Car Innovation Fund	63	126	47	6	1	..	..	..	..	..	..
Automotive Supply Chain Development Program	2	2	3	..	..	..	..	..	..	..	..
Automotive Market Access Program	1	1	..	..	..	..	..	..	..	..	..
Investment incentive for Ford	..	34	..	..	..	..	..	..	..	..	..
Investment incentive for Holden	..	..	..	36	51	113	16		..	..	..
Investment incentive for Toyota	..	..	..	7	19	1	1	1	..	..	..
Total	**203**	**412**	**268**	**285**	**218**	**207**	**111**	**105**	**96**	**50**	**14**

Table C1.1 (continued)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Automotive components											
ATS – capped assistance[b]	65	130	123	142	88	55	66	81	77	40	11
Automotive Industry Structural Adjustment Program	14	9	..	..	..	..	..	..	..	..	..
Automotive Supply Chain Development Program	-	-	..	..	..	..	..	..	..	..	..
Automotive New Markets Initiative			3	11	9	7					
Total	**80**	**139**	**126**	**153**	**97**	**61**	**66**	**81**	**77**	**40**	**11**
Other industries[c]											
ATS – capped assistance	2	3	3	4	2	1	2	2	2	1	–
Automotive Supply Chain Development Program	3	3	1	..	..	..	..	..	..	..	..
Automotive New Markets Initiative			1	1	1	1					
Automotive Market Access Program	1	1	..	..	..	..	..	..	..	..	..
Total	**6**	**7**	**5**	**5**	**3**	**2**	**2**	**2**	**2**	**1**	**–**
Total (all industries)	**288**	**558**	**399**	**443**	**318**	**271**	**178**	**187**	**175**	**92**	**25**

.. Estimated to be zero. **–** Less than $0.5 million. **a** Totals may not be the sum of components due to rounding. **b** Figures for 2010-11, 2011-12 and 2012-13 estimated using actual payments for the 2010, 2011 and 2012 calendar years. Figure for 2013-14 estimated using updated cap that accounts for unallocated funding rolled forward. All other figures estimated using capped funding profile that accounts for savings outlined in 2013-14 Mid-Year Economic and Fiscal Outlook **c** Including other manufacturing activities, business and government services.

Sources: Information provided by the Department of Industry; Commission estimates.

References

ABS (Australian Bureau of Statistics) 2009a, *Australian National Accounts: Input-Output Tables — Electronic Publication,* 2005-06, Cat. no. 5209.0.55.001, Canberra.

—— 2009b, *Australian National Accounts: Input-Output Tables (Product Details),* 2005-06, Cat. no. 5215.0.55.001, Canberra.

—— 2013a, *Australian Industry,* 2011-12, Cat. no. 8155.01, Canberra.

—— 2013b, *Australian National Accounts: Input-Output Tables — Electronic Publication,* 2009-10, Cat. no. 5209.0.55.001, Canberra.

—— 2013c, *Australian National Accounts: Input-Output Tables (Product Details),* 2009-10, Cat. no. 5215.0.55.001, Canberra.

—— 2013d, *Australian System of National Accounts,* 2012-13, Cat. no. 5204.0, Canberra.

CoPS (Centre of Policy Studies) forthcoming, *MMRF5: Monash Multi-Regional Forecasting Model (Version 5) — A dynamic multi-regional applied general equilibrium model of the Australian economy.*

Dixon, P.B. and Rimmer, M.T. 2002, *Dynamic, General Equilibrium Modelling for Forecasting and Policy: A Practical Guide and Documentation of MONASH*, North-Holland Publishing Company, Amsterdam.

——, Parmenter, B.R., Sutton, J. and Vincent, D.P. 1982, *ORANI: A Multisectoral Model of the Australian Economy*, North-Holland publishing company.

DoI (Department of Industry) 2012, *Key Automotive Statistics 2012*, Canberra.

—— 2013, *Key Automotive Statistics 2013*, Canberra.

Dowling, J. 2014, 'Why Australia's car manufacturers — Toyota, Holden and Ford — all conked out', *The Courier Mail*, Brisbane, 14 February.

Horridge, M., Madden, J. and Wittwer, G. 2005, 'Using a highly disaggregated multi-regional single-country model to analyse the impacts of the 2002-03 drought in Australia', *Journal of Policy Modelling*, vol. 27, no. 3, pp. 285–308.

PC (Productivity Commission) 2005, *Modelling the Impacts of Infrastructure Industry Change over the 1990s*, Supplement to Review of National Competition Policy Reforms, Inquiry report no. 33, Canberra (appendix B).

—— 2008, *Modelling Economy-wide Effects of Future Automotive Assistance*, Research report, Melbourne.

—— 2012a, *Impacts of COAG Reforms: Business Regulation and VET*, Research report, Canberra.

—— 2012b, 'Economy-wide modelling of impacts of COAG reforms', *Impacts of COAG Reforms: Business Regulation and VET*, Canberra.