Workforce adaptation to the cessation of motor vehicle manufacturing in Australia

Submission to ACE 2016

Over 2016 and 2017, the last of Australia's motor vehicle manufacturing plants will close their doors, retrenching several thousand workers. Agility, the solution to our economic woes, will be the key to recovery. Just how agile will workers need to be? This paper describes a scenario in which there is no "damage" in terms of increased unemployment, facilitated by flexibility in both occupation-specific real wages and willingness of workers to transition to new occupations and new regions. The scenario illustrates the extent of workers' changes in occupation and region, indicating the level of disruption caused by the closure of the motor vehicle manufacturing plants.

JEL codes: C68 J2 O14

1 Introduction

As the last of Australia's motor vehicle manufacturing plants closes its doors in 2017, the agility of the workforce will be put to the test. For the workforce to adjust to the end of motor vehicle manufacturing in Australia without an increase in unemployment, workers will be required to move to new industries, new occupations and new regions. The extent of this disruption is examined with the aid of the Victoria University Employment Forecasts (VUEF) which are produced using an extended version of the VU dynamic CGE model of the Australian economy.

Macroeconomic effects are found to dominate the impact of the closure of motor vehicle manufacturing. A substantial increase in imports of motor vehicles to replace domestic supply leads to real depreciation of the domestic currency. This provides opportunities for expansion in other trade-exposed industries, in particular agriculture and service exports. Given that displaced motor vehicle industry workers will not necessarily transition directly into these industries, this suggests that disruptions to employment will extend significantly beyond the immediate effect on displaced motor vehicle workers.

Many workers retrenched from the motor vehicle industry will not find new employment in their existing occupations, particularly those with occupations that are very specialised to motor vehicle manufacturing. Workers with no formal post-school qualifications or Certificate level qualifications in engineering fields will experience a fall in wages relative to the national average.

Motor vehicle manufacturing is concentrated in three regions: Melbourne, Geelong and Adelaide. In these regions, we find that a regional multiplier effect does exist, such that job losses extend beyond the direct job losses in motor vehicle manufacturing. In other regions however, the currency devaluation stimulates a small increase in employment.

2 Theory of the VU dynamic CGE model and VUEF extension

The VU dynamic CGE model draws heavily on the theory of the Monash model (Dixon and Rimmer 2002) and its predecessor ORANI (Dixon *et al* 1982). A recent forecast scenario developed with the VU model is described in J.Dixon *et al* (2014a, b). The version of the VU model used in this simulation comprises updated information in the form of (i) new input-output data (ABS 2013, Adams *et al* 2015) and macroeconomic data in respect of the year 2014-15 (ABS 2015), (ii) recent budget forecasts from the Australian Treasury (Commonwealth of Australia 2015), and (iii) recent forecasts for the terms of trade and key mining exports and prices (BREE 2015). The VUEF extension to the VU model is described in Section 2.1 below.

The VU model treats the national economy as a single region. Regional results for this study are generated using a tops-down disaggregation in the ORES tradition (Dixon *et al* 1982). This is described in Section 2.2 below.

The simulation reflects a stylised version of the closure of the motor vehicle industry. Activity in the industry is wound back over 2016 and 2017 by exogenously imposing (i) a decline in industry capital stocks, (ii) a leftward shift in the demand schedule for exports, and (iii) a decline in output. The model accommodates (i) by breaking the link between investment and capital. The export shock (ii) is simple to accommodate as the position of the export demand schedule is exogenous. The shock to output (iii) is accommodated by endogenising economy-wide preferences for the

import/domestic composition of motor vehicles. This is applied in such a way that aggregate demand for motor vehicles in unaffected, and the impact is simply to replace domestically produced motor vehicles with imported varieties.[1]

A crucial assumption in the simulation results presented here is that aggregate employment is unchanged as a result of the closure of the motor vehicle industry. This simulation should not be interpreted as showing that unemployment is unchanged as a result of the motor vehicle industry: in fact, a temporary increase is quite likely, particularly in the directly affected regions. Indeed, Beer (2008) finds that six months after the closure of a major motor vehicle manufacturing plant in Adelaide in 2004, unemployment among retrenched workers was almost 15 per cent, although this dropped to 5 per cent by 18 months. However, only half of retrenched workers found full time employment, with the remainder in part time or casual positions, and more than 70 per cent were earning a lower wage. In a general equilibrium setting, Wittwer (2013) finds that under sticky real wages, national employment would fall by almost 1 per cent following the cessation of motor vehicle manufacturing activity in Australia.

The simulation reported here has been designed to illustrate a scenario in which the workforce is sufficiently agile to adapt to a major disruption. The simulation provides a framework in which to observe the changes made by a fully agile workforce in employment by occupation, industry or region, as well as changes in occupation wage relativities.

The model computes only net results for employment. While aggregate employment is assumed to be unchanged, the changes in its composition are likely, and as such unemployment may increase in some cohorts and fall in others.

2.1 VUEF model extension

Following Meagher and Pang (2011) and Giesecke *et al* (2015), the VUEF model extends the labour market theory in the VU model. In the VU model, industries determine the occupation composition of employment by minimising the total cost of labour subject to aggregate labour requirements. In theory, changes in relative wages between occupations will drive changes in the occupation composition of employment. However, supply of labour to occupations is perfectly elastic within the constraint of exogenously determined national labour. In a typical model implementation, there is no impetus in the model to drive endogenous changes to occupation wages relative to each other.

The VUEF extension to the VU model is used to provide insight into the prospects for displaced motor vehicle industry workers. By understanding the occupation and skill profile of the workers in the motor vehicle industry, we can evaluate the impact on them in terms of movements in the relative wage of the relevant occupations, and in terms of likely options for alternative employment in other industries, occupations or regions.

In VUEF, the labour market is separated into many segments based on skills, where the term “skill” identifies post-school qualification by field and level. Each skill has a unique occupation profile. For example, within the skill “Bachelor degree: Health”, 37 per cent of employment is in the occupation “Midwifery and Nursing Professionals”, 13 per cent of employment is in “Medical Practitioners” and 11 per cent is in “Health Therapy Professionals”. Constraints on the supply of each skill group

[1] See Giesecke and Madden (2013) for an example of regional sourcing “twist” terms.

impose restrictions on supply of labour by occupation, which provide the mechanism by which occupation wages change relative to each other.

More formally, industries choose occupations to minimise their cost of labour subject to a CES aggregation function, i.e.:

$$x1lab\_s(i,o) = x1lab\_os(i) - \sigma\big(p1lab\_s(i,o) - p1lab\_os(i)\big) \quad (1)^2$$

and

$$p1lab\_os(i) = \sum_{o \in OCC} SHW\_S(o,i).p1lab\_s(i,o) \quad (2)$$

Furthermore, industries choose the skill mix within each occupation to minimise the cost of each occupation, again subject to a CES aggregation function, i.e.:

$$x1lab(i,o,s) = x1lab\_s(i,o) - \theta\big(p1lab(i,o,s) - p1lab\_s(i,o)\big) \quad (3)$$

and

$$p1lab\_s(i,o) = \sum_{s \in SKILL} SHW(i,o,s)\,.\,p1lab(i,o,s) \quad (4)$$

From the supply side, workers allocate labour to maximise revenue, according to a CET aggregation constraint, i.e.:

$$x1lab\_i(o,s) = x1lab\_io(s) + \tau\big(p1lab\_i(o,s) - p1lab\_io(s)\big) \quad (5)$$

and

$$p1lab\_io(s) = \sum_{s \in SKILL} SHW\_I(o,s)\,.\,p1lab\_i(o,s) \quad (6)$$

Equations (1)-(6) form a framework for allocating labour units in a CGE model. The term "labour units" refers to a unit of labour worth a set amount (say $1) in the initial solution of the model. Due to differences in average hourly wages across skill groups, even those working in the same occupation, labour units do not translate to the same amount of time in each occupation and skill.

Two simplifying assumptions make the model smaller and enable labour units to be translated into "real" units such as persons or hours.

Firstly, the need for three identifiers (industry, occupation and skill) in equation (3) is eliminated through the assumptions that (a) the skill share in each occupation is uniform across industries, and (b) that the percentage change in the price of a unit of occupation and skill specific labour is uniform across industries. That is:

(a) $SHW(i,o,s) = SHW\_I(o,s) \quad \forall i$ (7)

(b) $p1lab(i,o,s) = p1lab\_i(o,s) \quad \forall i$. (8)

[2] Definitions of terms are given in Appendix I. As a rule of thumb, "x1lab" refers to quantity units of labour and "p1lab" refers to price (wage). The qualifiers i, o and s refer to industries, occupations and skills respectively. An underscore indicates a term that has been aggregated over this dimension.

Secondly, given the uniformity across industries of movements in occupation and skill specific wages, we can assume that the percentage increase in persons identified by occupation and skill is equivalent to the corresponding percentage increase in labour units, i.e.:

$$pers\_i(o,s) = x1lab\_i(o,s) \quad (9)$$

Aggregate persons classified by skill is given by:

$$pers\_io(s) = \sum_{o \in OCC} SHP\_I(o,s) \,.\, pers\_i(o,s) \quad (10)$$

Growth in aggregate persons classified by skill is set exogenously, within the obvious constraint that it should be consistent with national growth in employment, and that the model should not be over-identified by setting the both the total and all of its components exogenously.

In formulating the VUEF scenario, the exogenously imposed growth trajectories in skill groups are not affected by the closure of the motor vehicle industry. Adjustments are made through wage-induced changes in employment classified by occupation and industry.

Finally, the VUEF model extension makes use of census data to disaggregate employment results from the 115 industries (IOIG classification) and 97 occupations (ANZSCO minor group) of the underlying VU model into 214 industries (ANZSIC group classification) and 358 occupations (ANZSCO unit group).

2.2 Regional disaggregation

A tops-down method in the tradition of the ORANI model (Dixon *et al* 1982, Chapter 6) is used to disaggregate national results to the regional level. In this framework, "national" industries – those which operate largely independently of local conditions – are assumed to grow at the national average in all regions in which they operate. The remaining "local" industries are assumed to grow at the growth rate of their local region, which will be determined by the performance of the national industries operating in that region. This framework is adjusted slightly in VUEF for factors such as structural differences in regional population growth.

As a very trade-exposed industry, the motor vehicle industry is treated as a national industry. In the context of the input-output data used in the VUEF model, the motor vehicle manufacturing industry is part of the larger industry ***Motor Vehicles and Parts; Other Transport Equipment Manufacturing***. As such, this industry has activity in regions other than Melbourne, Geelong and Adelaide, the only regions in which motor vehicle *manufacturing* takes place. The tops-down algorithm is modified for this simulation to ensure that the impacts of the closure of motor vehicle manufacturing are concentrated on Melbourne, Geelong and Adelaide.

2.3 The motor vehicle sector in the VUEF model

According to Census data, there were almost 60,000 people employed in Motor Vehicle and Parts Manufacturing (ANZSIC group 231) in 2011, over a range of activities and occupations.

Approximately 40% of employment was in Motor Vehicle Manufacturing (ANZSIC class 2311) with most of the remainder in Motor Vehicle Body and Trailer Manufacturing and Other Motor Vehicle Parts Manufacturing. Activity was concentrated in the regions of Melbourne, Adelaide and Geelong. Since 2011, employment in the sector has declined, particularly in Adelaide. In 2015, aggregate employment in Motor Vehicle and Parts Manufacturing had fallen to 50,000 people.

Table 1 shows the top 10 occupations in Motor Vehicle and Parts Manufacturing, which account for 54 per cent of employment in motor vehicle manufacturing. An additional five occupations in Table 1 are those for which the motor vehicle manufacturing industry accounts for more than 5 per cent of national employment.

The ability of workers in these occupations to adapt to the cessation of motor vehicle manufacturing will depend on their employment prospects in alternative industries. Of particular concern are the prospects for ANZSCO group 3242 (Vehicle Body Builders and Trimmers) for whom the motor vehicle manufacturing industry provides 39 per cent of employment.

The final column in Table 1 shows the main skill group supplying each occupation. The skill classifications of the displaced motor vehicle workers will be important in determining alternative occupations for these workers.

Table 1: Key occupations associated with the motor vehicle industry, 2015

ANZSCO unit group	Occupation description	Occupation as percentage of MV industry employment	MV industry as share of Occupation employment	Main skill (%)
Top 10 occupations in MV industry				
8322	Product Assemblers	13.2	24.6	no p.s. (64)[3]
3223	Structural Steel and Welding Trades Workers	10.0	7.0	Mech. Ind. (65)[4]
2335	Industrial, Mechanical and Production Engineers	6.0	10.1	Mech. Ind. (53)
3232	Metal Fitters and Machinists	5.3	2.5	Mech. Ind. (62)
3242	Vehicle Body Builders and Trimmers	4.0	39.0	Auto. Eng. (42)[5]
7411	Storepersons	3.9	1.6	no p.s. (65)
3212	Motor Mechanics	3.6	1.9	Auto. Eng. (69)
1335	Production Managers	3.3	3.2	no p.s. (27)
7123	Engineering Production Workers	2.4	6.1	no p.s. (53)
7213	Forklift Drivers	2.2	2.2	no p.s. (72)
Remaining occupations for which MV industry accounts for more than 5% of national employment				
3234	Toolmakers and Engineering Patternmakers	1.4	11.9	Mech. Ind. (68)
8393	Product Quality Controllers	1.8	7.9	no p.s. (45)
8391	Metal Engineering Process Workers	1.4	6.6	no p.s. (67)
7112	Industrial Spraypainters	0.9	6.3	no p.s. (56)
3125	Mechanical Engineering Draftspersons and Technicians	0.7	5.7	Mech. Ind. (63)

Source: VUEF model estimates

3 Results

3.1 Macroeconomic mechanisms

The simulation has been run to show the impact of adjustment to the closure of the motor vehicle manufacturing plants with a fully flexible workforce. This is a scenario in which displaced workers accept jobs at potentially lower wages, in other occupations, and in other regions. Capital is assumed to adjust slowly, with existing capital depreciating at normal rates, and relative rates of return signalling the industrial composition of new capital created through investment. The one exception is the motor vehicle industry, for which it is assumed that operators simply "switch off the lights" and the value of capital is written off over a very short period.

Results are presented in comparison to a hypothetical "business-as-usual" baseline, in which the motor vehicle manufacturing industry does not cease operations. In the context of the motor

[3] No formal post-school qualification
[4] ASCED Narrow Field 0307 Mechanical and Industrial Engineering and Technology
[5] ASCED Narrow Field 0305 Automotive Engineering and Technology

vehicle industry closure, which has been announced, we know the "business-as-usual" baseline to be fictitious, while the "scenario" in which the motor vehicle industry closes is in fact similar to the baseline orderly adjustment scenario of J.Dixon *et al* (2014a, b).

As a consequence of assuming no impact on aggregate employment, the fall in GDP as a result of the motor vehicle plant closures is modest (Figure 1). The fall in the capital stock has a negative impact on GDP growth in 2016, which is somewhat counteracted by an increase in the effectiveness of labour. This increase is explained by a change in the composition of employment in the economy. Compensation per employee in the motor vehicle industry is less than the national average, even after accounting for the relatively large share of low-paid occupations in the industry.[6] By releasing workers from the lower paid motor vehicle industry into relatively more productive industries,[7] there is a slight increase in economy-wide effective employment. This effect is very small and could easily be negated by an increase in the unemployment rate in the order of magnitude of 0.05 percentage points.

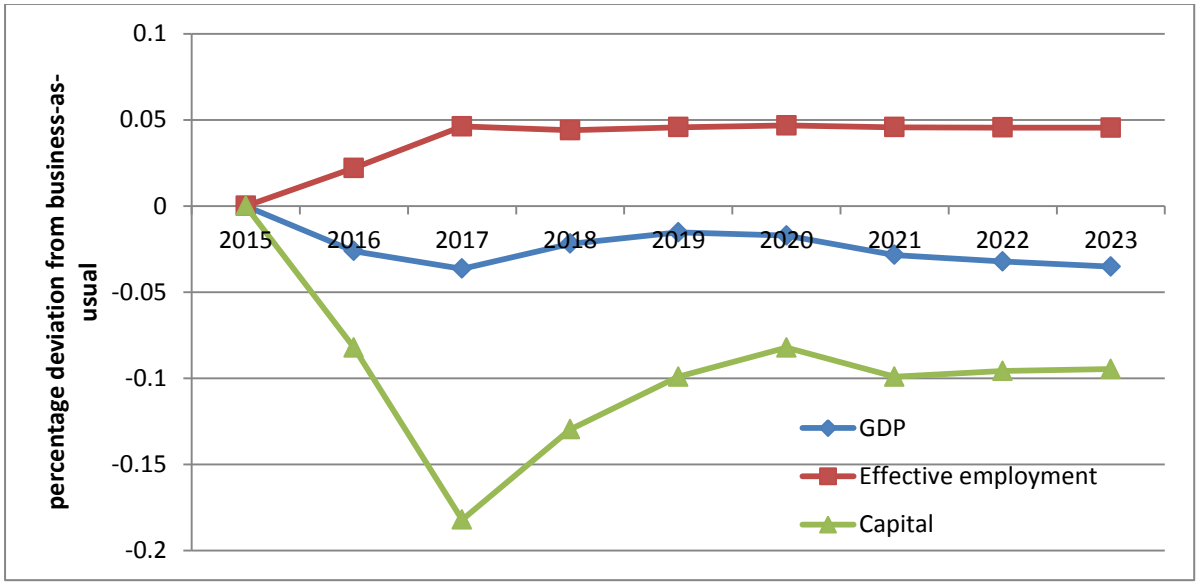

Figure 1: Impact on GDP

Effects on the composition of expenditure on GDP are more significant, and these effects are an important determinant of the level of disruption caused by the closure of motor vehicle manufacturing (Figure 2). Purchases of motor vehicles are not expected to fall; therefore a significant increase in imports of motor vehicles will be necessary to make up the shortfall in domestic production. The increase in imports is matched by an increase in exports of a similar magnitude, facilitated by real devaluation of almost 1.5 per cent. Although in volume terms, exports grow by slightly than imports, the balance of trade moves slightly towards deficit because of the exchange rate effect.

[6] We calculate that the motor vehicle industry's wage bill would be approximately 25% higher if it paid the national average wage for each occupation.

[7] Industries may be more "productive" in terms of return to labour if they are more capital intensive or if they have greater total factor productivity.

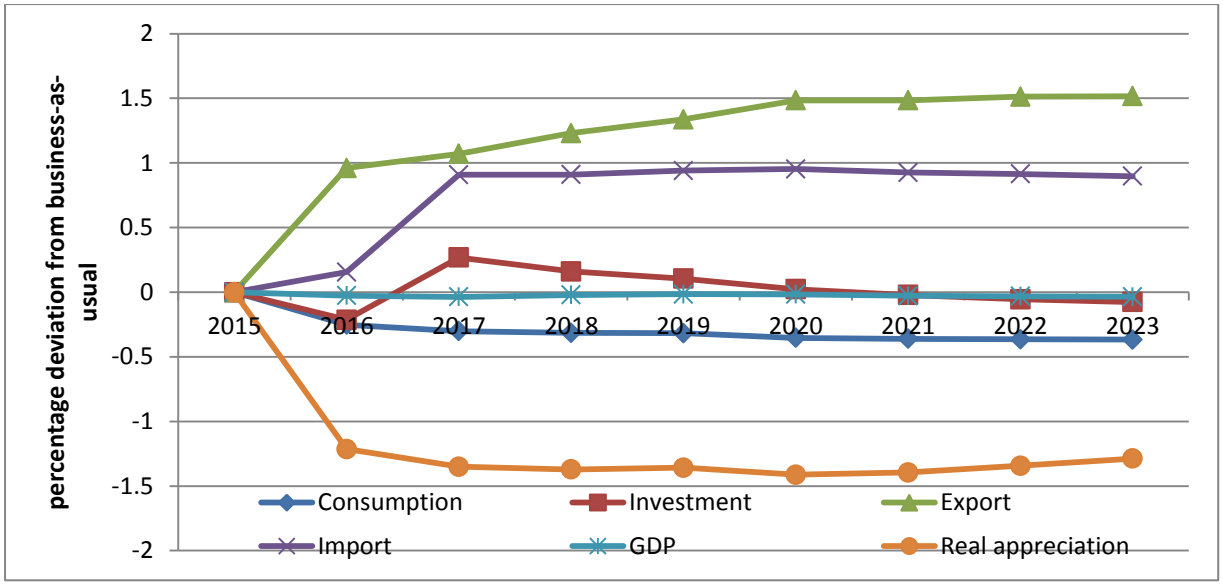

Figure 2: Expenditure on GDP

There is also a slight short term increase in aggregate investment. The release of workers from the motor vehicle sector leads to increases in employment in almost every other industry. For these industries, the increase in employment relative to capital attracts investment. The aggregate increase in investment in these industries is slightly larger than the decrease in investment in the motor vehicle sector. This is because the motor vehicle sector is slightly less capital intensive than the economy as a whole.

The drop in real household income which occurs as a result of both declining GDP and the declining real exchange rate underlies the fall in household consumption.

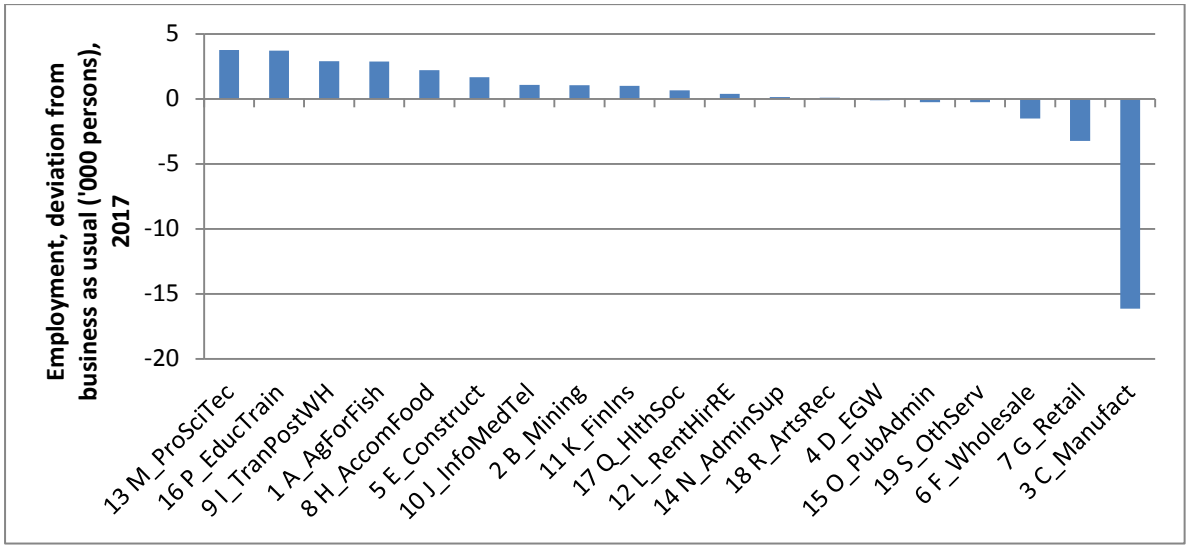

Figure 3: Impact on employment by ANZSIC division, 2017

The impact of these compositional changes is to stimulate activity in export-oriented activities including agriculture and higher education. Figure 3 shows employment in 2017, after the motor

vehicle manufacturing industry has ceased operations, compared to the hypothetical business as usual. Apart from the manufacturing sector itself, the largest declines in employment are in Retail and Wholesale. This is a reflection on the decline in household consumption.

There are increases in employment in the trade-exposed divisions Professional, Scientific and Technical Services, Education and Training, and Agriculture, Forestry and Fishing. Employment also expands in the Transport, Postal and Warehousing division, an important margin commodity for many exports.

At a more detailed level, significant increases in employment occur in the agricultural and higher education sectors, in the occupations of Livestock Farmer and University Lecturer. These effects are more pronounced than increases in employment in industries that could actually absorb workers in the occupations released from the motor vehicle industry, such as other manufacturing industries.

This result should not be interpreted as a suggestion that retrenched motor industry workers will become farmers or academics. Rather, the depreciation of the currency will create opportunities for employment in agriculture and education that otherwise would not have existed. The closure of the motor vehicle industry has clear losers – the displaced motor vehicle industry workers – while the winners are less obvious and more dispersed.

The disruption to the Australian workforce therefore extends beyond the impact on the directly affected workers. The industries in which the modelling shows a net gain in employment should not be presumed to absorb directly the former motor vehicle industry workers. The directly affected worker A, displaced from the motor vehicle industry, may move to another industry, taking the place of worker B, who moves to a third industry. Although worker B had no direct link to the motor vehicle industry, she too is affected by its closure. The modelling only shows the net effect. However, the detailed results for employment cross classified by industry and occupation, and by occupation and skill enable us to conjecture on the likely opportunities for former motor vehicle industry workers and others.

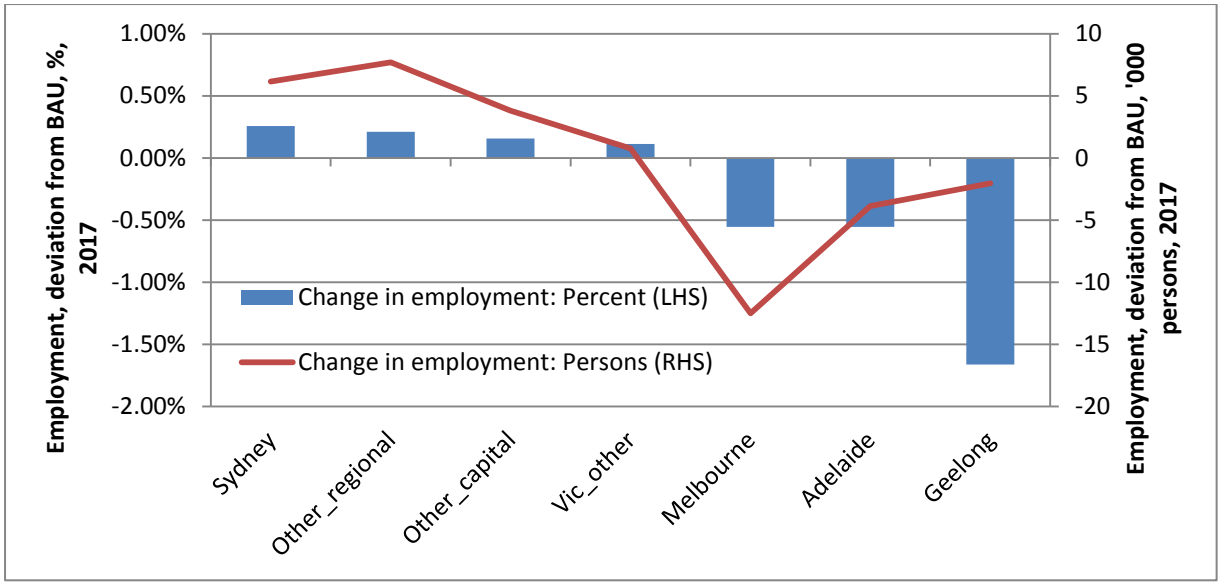

Figure 4: Regional impact on employment, deviation from business as usual, 2017

Regional changes in employment reflect the composition of economic activity in the regions (Figure 4). The motor vehicle manufacturing regions Geelong, Melbourne and Adelaide all suffer a fall in employment. In absolute terms, the fall in Melbourne is largest, although in percentage terms, the fall in Geelong is most significant. Small percentage increases in employment in the remaining regions are sufficient to absorb the fall in employment in Geelong, Melbourne and Adelaide.

In Melbourne, Geelong and Adelaide, the aggregate fall in regional employment is greater than the fall in employment in motor vehicle manufacturing alone, suggesting that regional multiplier effects exist. This is despite employment being fixed by assumption at the national level.

3.2 Prospects for displaced motor vehicle workers

Two alternatives are considered for workers in motor vehicle manufacturing. There are (1) to continue in the same occupation in a different industry, and (2) to find employment in an alternative occupation. Both of these outcomes might also entail moving to a different region and potentially receiving lower wages.

Our modelling shows only the net changes in employment by region, industry and occupation. Given the dominance of the general equilibrium effects, which provide stimulus to export activities such as agriculture and higher education, the first round impacts on the displaced motor vehicle workers are obscured.

While the national average wage will grow more slowly as a result of the closure of the motor vehicle industry, wages for several occupations will decline significantly more than the national average. The capacity or willingness for these workers in these occupations to absorb a declining wage will be an important indicator of the agility of the workforce. Institutional factors such as legislated minimum wages or unionisation may act as impediments. A more effective route to improving the earning capacity and prospects for displaced workers would be to provide support and training to enable them to transition easily into new employment.

It is important to note that the modelling shows that wages will increase even if the motor vehicle industry closes. It is only the rate of increase that is affected. The largest relative declines in occupation wages are for Packers and Product Assemblers (ANZSCO minor group 832) and all sub-categories of Automotive and Engineering Trades workers (ANZSCO sub-major group 32). The variation in the impact on wages is also evident in the model results for average wage growth classified by skill group. Wages for all levels of qualification in the field of Engineering decline by more than the national average. Wages for workers with no post school qualification are also negatively impacted by slightly more than the national average.

Figure 5 shows the percentage of workers in each of fifteen selected occupations (Table 1) that will be employed in their existing occupation in an alternative industry in 2017. For some occupations, such as Metal Fitters and Machinists (ANZSCO 3232) and Production Managers (ANZSCO 1335), around 50 per cent of workers displaced from the motor vehicle industry will find work in the same occupation in another industry. For others, less than 10 per cent of workers will be able to remain in their existing occupation.

The prospects for a selection of the most affected occupations are discussed below.

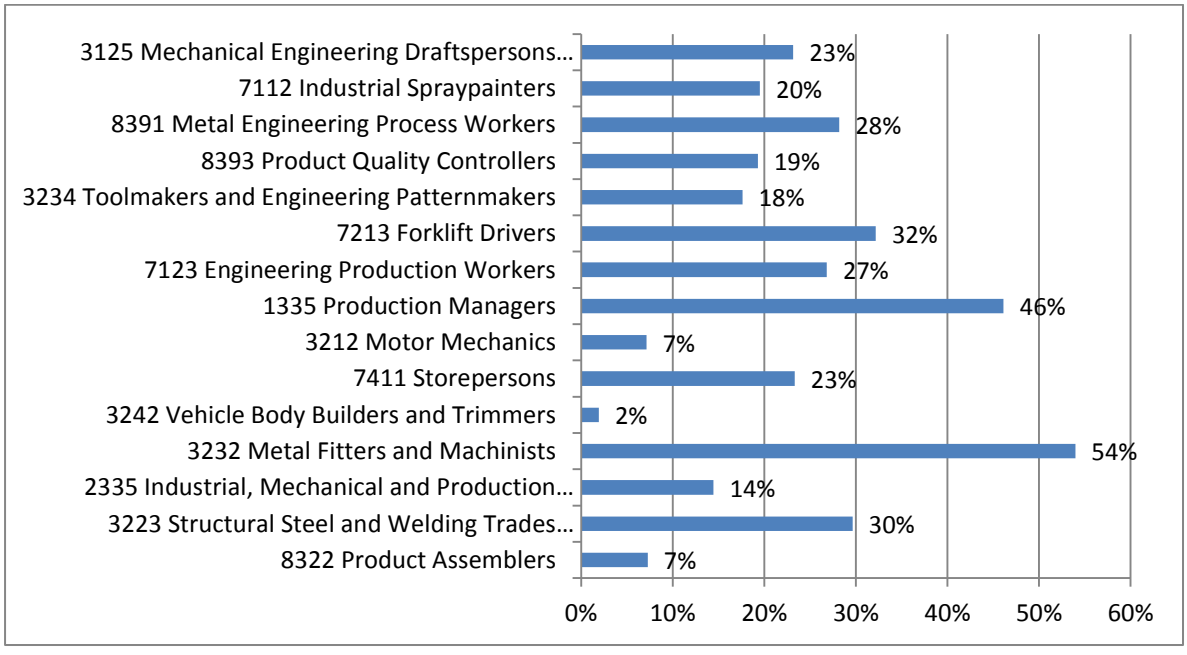

Figure 5: Percentage of displaced workers employed in the same occupation in alternative industries, 2017

Of all occupations, ***Vehicle Body Builders and Trimmers*** (ANZSCO 3242) are the most reliant on the motor vehicle manufacturing industry, which employs 40 per cent of persons in this occupation. Of Vehicle Body Builders and Trimmers not employed in the motor vehicle industry, in 2015 more than half are employed in the industry group Automotive Repair and Maintenance (ANZSIC 941). The prospects for this industry are quite unresponsive to the fall in the real exchange rate, and it is

expected to absorb very few displaced workers in the occupation of Vehicle Body Builders and Trimmers.

Displaced Vehicle Body Builders and Trimmers will need to find alternative occupations in order to remain employed. Almost 70 per cent of workers in this occupation have a post school qualification. The vast majority of these are in various fields of engineering, mainly at the Certificate level. Prospects for these skill groups are discussed below.

Although ***Toolmakers and Engineering Patternmakers*** (ANZSCO 3234) are part of the same broad occupation classification as Vehicle Body Builders and Trimmers (Sub-major Group 32: Automotive and Engineering Trades Workers), the alternative employment prospects for this occupation are quite different. Alternative employment for this occupation exists in several manufacturing activities, including Polymer Products (ANZSIC 191) and various groups of subdivisions 21 (Primary Metal and Metal Product Manufacturing), 23 (Transport Equipment Manufacturing) and 24 (Machinery and Equipment). These industries are somewhat trade-exposed, being import competing, and to a lesser extent, exporters. They expand somewhat as a result of the real currency devaluation, and provide some employment for Toolmakers and Engineering Patternmakers.

However, the majority of displaced workers in this occupation will need to find alternative occupations. More than 80 per cent of workers in this occupation have a post school qualification. Like Vehicle Body Builders and Trimmers, most of these are in various engineering fields, mainly at the Certificate level.

Product Assemblers (ANZSCO 8322) are very reliant on the motor vehicle industry for employment, with almost 25 per cent of this occupation employed in the motor vehicle industry.

Alternative industries for Product Assemblers include various classes of Machinery and Equipment Manufacturing and Furniture Manufacturing. However, while the motor vehicle manufacturing industry sheds more than 3000 product assemblers, these alternative industries only pick up around 300 product assemblers.

The industries providing alternative employment for Product Assemblers are concentrated in the major cities, particularly Melbourne, Sydney, Perth and Adelaide. This bodes well for displaced workers in Melbourne and Adelaide. However, these industries have very little presence in Geelong. The modelling shows that there are no regions in which there is a net increase in employment of Product Assemblers as a result of the closure of the motor vehicle industry.

For ***Industrial, Mechanical and Production Engineers*** (ANZSCO 2335), like Toolmakers and Engineering Patternmakers, the main field of qualification for this occupation is Mechanical and Industrial Engineering and Technology. However, although qualified in the same fields, Industrial, Mechanical and Production Engineers tend to be more highly qualified than the other occupations discussed, with more than 70 per cent of workers in this occupation holding a bachelor degree or higher.

The main industry to employ this occupation is Architectural, Engineering and Technical Services. This industry, along with various groups under the ANZSIC sub-division Machinery and Equipment Manufacturing, will absorb some workers displaced from the motor vehicle industry. Overall, the

increase in employment of Industrial, Mechanical and Production Engineers will absorb only around 15 per cent of the displaced workers in this occupation.

Workers with ***no formal post school qualifications,*** such as most Product Assemblers and Vehicle Body Builders and Trimmers displaced by the motor vehicle industry closure will need to move into alternative occupations to remain employed. Almost two thirds of Product Assemblers and half of Vehicle Body Builders and Trimmers have no formal post school qualification.

The net decline in employment of Product Assemblers with no post school qualification is almost 2000 persons. Employment of persons with no post school qualifications in some other occupations declines also. To reflect a fully agile labour market, we assume that total employment of persons with no post school qualifications remains fixed. To achieve such agility, there are increases in employment of persons with no post school qualifications in various farming occupations (ANZSCO unit groups 1213, 1214, 1212, 8415), clerical occupations (Receptionists 5421, General clerks 5311), and labourers (Packers 8321, Commercial Cleaners 8112, Housekeepers 8114), Waiters (4315).

Most of the remaining displaced workers have qualifications in a field of ***Engineering*** (mainly Electrical and Mechanical and Industrial), mainly at the Certificate level. Although there is a decline in aggregate employment in the ***Technician and Trades Workers*** occupations, within this group there are increases in Electricians (3411) and Aircraft Maintenance Engineers (3231). Other significant alternative occupations for these workers are the ***Machinery Operators and Drivers*** occupations including Truck Drivers (7331) and Drillers, Miners and Shot Firers (7122).

Although employment for Engineers in ***Professional*** occupations declines in aggregate, there are increases in employment for Engineers in Civil Engineering Professionals (2332) and Software and Applications Programmers (2613).

4 Conclusions

As a result of the closure of the motor vehicle industry, imports of motor vehicles will increase and taking the real exchange rate to around 1.5 per cent lower than it otherwise would have been. This provides a small stimulus to trade-exposed activities, including the manufacturing industries that can provide alternative employment for some displaced workers from the motor vehicle industry.

A simulation in the VUEF model, in which the national unemployment rate is unaffected by the closure of the motor vehicle industry, illustrates a scenario in which the economy is sufficiently agile for there to be no net change in national employment. This is not to say that all displaced workers from the motor vehicle industry will be re-employed: rather, it is likely that some of these workers will become unemployed, retire earlier than they otherwise would have, or otherwise disengage with the labour force. Through exchange rate devaluation, opportunities arise for other individuals who may enter the workforce in a different occupation than they otherwise would have, or delay retirement, or have otherwise been unemployed or non-participants in the labour force.

The modelling shows that the prospects for workers displaced from the closure of the motor vehicle industry differ markedly depending on occupations and qualifications. For example, while product assemblers will have some opportunity to find employment in alternative industries, opportunities for vehicle body builders and trimmers are almost negligible. The difference in the prospects for

these two occupations can be explained by movements in the real exchange rate. Whereas product assemblers have some prospects in other manufacturing activities, vehicle body builders and trimmers will be very reliant on the Automotive Repair and Maintenance industry for employment. Devaluation of the real exchange rate will not provide any stimulus to this industry as it is not trade-exposed.

The difference in prospects for the occupations *Vehicle Body Builders and Trimmers* and *Toolmakers and Engineering Patternmakers* illustrates a strength of highly detailed CGE modelling. While these occupation unit groups are part of the same sub-major group (Automotive and Engineering Trades Workers), their employment patterns differ substantially in terms of important industries and qualifications. Modelling at a coarser level of aggregation would not have shown these differences.

The modelling shows some cause for concern, identifying several occupations for which less than 10 per cent of displaced motor vehicle workers are likely to be re-employed in the same occupation in different industries. While it is inevitable that displaced motor vehicle workers will need to find work in new industries, it creates an additional burden or disruption for individuals to need to change occupation as well.

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Appendix I: Terms used in equations (1) – (10)

model variable	dimension	description
		percentage change in…
x1lab	IND * OCC * SKILL	labour units
x1lab_s	IND * OCC	labour units aggregated over skill
x1lab_i	OCC * SKILL	labour units aggregated over industry
x1lab_io	SKILL	labour units aggregated over industry and occupation
x1lab_os	IND	labour units aggregated over skill and occupation
p1lab	IND * OCC * SKILL	price per labour unit
p1lab_s	IND * OCC	price per labour unit averaged over skill
p1lab_i	OCC * SKILL	price per labour unit averaged over industry
p1lab_io	SKILL	price per labour unit averaged over industry and occupation
p1lab_os	IND	price per labour unit averaged over skill and occupation
pers_i	OCC * SKILL	persons aggregated over industry
pers_io	SKILL	persons aggregated over occupation and industry

model coefficient	dimension	description
SHW_S	IND * OCC	wage-bill share of occupation in industry, i.e. WAGEBILL(i,o)/sum(o,OCC,WAGEBILL(i,o))
SHW	IND * OCC * SKILL	wage-bill share of skill in occupation in industry, i.e. WAGEBILL(i,o,s)/sum(s,SKILL, WAGEBILL (i,o,s))
SHW_I	OCC * SKILL	wage-bill share of occupation in skill, i.e. WAGEBILL(o,s)/sum(o,OCC, WAGEBILL(o,s))
SHP_I	OCC * SKILL	person share of occupation in skill, i.e. PERSONS(o,s)/sum(o,OCC,PERSONS(o,s))