berl economics

Report to:

Industry Capability Network

UPDATED MANUFACTURING MULTIPLIERS

FROM 2010/11 DATA

Prepared by

Hugh Dixon

Fiona Stokes

Dr Ganesh Nana

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Manufacturing Multipliers

Tables

1   Summary

This report describes a selection of multipliers related to the New Zealand domestic manufacturing industry. These multipliers are calculated from data for the 2010/11 year.

Multipliers are a tool used by economists to estimate the impact of expansion in an industry. This impact also takes into account indirect (upstream) impacts on other industries. In some cases, multipliers are also used to estimate the effects induced by such expansion.

The multipliers used in this report represent the impact of additional annual production in the manufacturing industry and sectors within that industry. Annual production in the industry and each sector is specified in terms of the value of its *gross output* (turnover or total sales).

The question is then asked:

What is the impact of this sector's annual production (gross output) rising by another $1m?

Subject to the assumptions listed in sub-section 3.1 below, a $1m increase in gross output in the New Zealand domestic manufacturing industry yields a further $0.88m in upstream expansion in industry gross output, and another $0.37m of induced activity.

- The initial and indirect effects of this industry are another $0.75m in value added across this and all upstream industries, as well as a further $0.19m in induced activity.

- In terms of employment, the initial, direct and indirect effects of this industry translate to another 7.98 full-time equivalents (FTEs) in this and all upstream industries, as well as a further 1.82 induced FTEs.

In total, an average $1m increase in the gross output of the domestic manufacturing industry results in an additional $0.94m in value added and 9.79 FTEs.

Alternatively, explicitly utilising the multiplier values:

- $1m of additional value added in the New Zealand domestic manufacturing industry results in $2.03m of initial and downstream value added. Including induced elements, this rises to $2.54m of value added.

- For each additional FTE employed in the New Zealand domestic manufacturing industry, an additional 1.84 FTEs are employed in initial and downstream industries. Including induced elements, this figure rises to 2.29 FTEs.

2   Introduction

This report describes a selection of multipliers related to the New Zealand domestic manufacturing industry.

The multipliers listed in this report have been calculated using a 59-industry input-output table for the March 2010/11 year. This table has been derived from the latest official 126-industry input-output data for the 1995/96 year, updated by BERL using the latest available data (2011).

Details of the 59 industries, and the 13 sub-sectors of manufacturing explicitly identified at this level, are listed in Table 2.1.4 below.

2.1   Definitions

2.1.1   Gross output

Gross output is the total sales of all outputs produced by a firm or industry. It is similar to the gross income or turnover figure on an enterprise's Operating Statement (or Profit and Loss Statement).

2.1.2   Value added

Value added measures the total value of the activities of all businesses and organisations in an industry.

In theory, it is equal to the value of the output of the business (sales or turnover) less its purchases of goods, services, and raw materials (including imported items) from other businesses. These purchases are used in the production of goods and are sometimes termed *intermediate* inputs. In practise, value added is equal to the sum of wages, salaries, profits and operating surplus accrued by all firms and enterprises within an industry and/or sector.

The total value added for an industry or sector is equivalent to it's contribution to New Zealand's Gross Domestic Product (GDP).

2.1.3   Employment (FTEs)

Employment is measured in terms of units of full-time equivalents (FTEs). Full-time equivalents are the number of people employed (including working proprietors).

By convention, FTEs are calculated on the basis that two people employed part-time equals one person employed full-time. The official Statistics New Zealand definition of full-time employment is a person working for 30 or more hours per week. Consequently, those recorded as working less than 30 hours per week are classified as part-time workers.

2.1.4   Industry definition

Industry code	Description	ANZSIC96[1] code	ANZSIC06[2] code
Manufacturing sectors			
TCFL	Textiles and apparel manufacturing	C22	C13
WOOD	Wood product manufacturing	C231; C232	C14
PAPR	Paper and paper product manufacturing	C233	C15
PPRM	Printing, publishing and recorded media	C24	C16; J54; J55
PETR	Petroleum refining, product manufacturing	C251; C252	C17
CHEM	Fertiliser and other industrial chemical manufacturing	C253	C181; C182; C1831
RBPL	Rubber, plastic and other chemical product manufacturing	C254; C255; C256	C1832; C184; C185; C189; C19
NMMP	Non-metallic mineral product manufacturing	C26	C20
BASM	Base metals manufacturing	C271; C272; C273	C21
FABM	Structural, sheet and fabricated metal product manufacturing	C274; C275; C276	C22
TREQ	Transport equipment manufacturing	C281; C282	C23
MAEQ	Machinery and other equipment manufacturing	C283; C284; C285; C286	C24
OMFG	Furniture and other manufacturing	C29	C25
Other industries			
HFRG	Horticulture and fruit growing	A011	A011; A012; A013
SBLC	Livestock and cropping farming	A012; A01591	A014; A015
DAIF	Dairy and cattle farming	A013	A016
OTHF	Other farming	A014; A0151; A0152; A0153; A01593; A01599; A016	A017; A018; A019
SAHF	Services to agriculture, hunting and trapping	A02	A042; A05
FOLO	Forestry and logging	A03	A03
FISH	Fishing	A04	A02; A041
COAL	Coal mining	B11	B06
OIGA	Oil and gas extraction, production & distribution	B12	B07
OMIN	Other Mining and quarrying	B1511; B1512; C251; C252; D362	B08; B09; B10; D27

[1] ANZSIC96 : 1996 Australian and New Zealand Standard Industrial Classification.

[2] ANZSIC06 : 2006 Australian and New Zealand Standard Industrial Classification.

MEAT	Meat manufacturing	C211	C111; C112
DAIR	Dairy manufacturing	C212	C113
OFOD	Other food manufacturing	C213; C214; C215; C216; C217	C114; C115; C116; C117; C118; C119
BEVT	Beverage, malt and tobacco manufacturing	C218; C219	C12
EGEN	Electricity generation	C361 (part)	D261
EDIS	Electricity transmission and distribution	C361 (part)	D262
WATS	Water supply	D3701	D2811
WAST	Sewerage, drainage and waste disposal services	D3702; Q9634	D2812; D29
RCON	Residential construction	E4111; E4112	E301
OCON	Other construction	E4113; E4212; E42	E302; E31; E32
WHIN	Industrial goods wholesaling	F45; F46	F33; F34
WHOT	Other wholesale trade	F47	F35; F36; F37; F38
RETT	Retail trade	G	G
ACCR	Accommodation, restaurants and bars	H	H
RDFR	Road freight transport	I611	I461
RDPS	Road passenger transport	I612	I462
RAIL	Rail transport	I62	I47
WATR	Water transport	I63	I48
AIRS	Air transport and transport services	I64; I65; I66; I67	I49; I50; I51; I52; I53
COMM	Communication services	J	J56; J57; J58; J60
FINE	Finance	K73	K62
INSU	Insurance	K74	K63
SFIN	Services to finance and insurance	K75	K64
REES	Real estate	L7711; L7719 (part); L772	L6712; L672
EHOP	Equipment hire and investors in other property	L773; L774	L66
OWND	Ownership of owner-occupied dwellings	L7719 (part)	L6711
SRCS	Scientific research and computer services	L781; L782; L783	J59; M691; M692; M70
OBUS	Other business services	L784; L785; L786	M693; M694; M695; M696; M697; M699; N
GOVC	Central government administration and defence	M8111; M812; M813; M82; Q963	O751; O752; O754; O755; O76; O77
GOVL	Pre-school, primary and secondary education	N841; N842	P80
SCHL	Other education	N843; N844	P81; P82
OEDU	Local government administration	M8223	O753
HOSP	Hospitals and nursing homes	O861	Q84; Q86
OHCS	Other health and community services	O862; O863; O864; O87	Q85; Q87
CULT	Cultural and recreational services	P	R
PERS	Personal and other community services	Q95; Q961; Q962; Q97	S

Statistics New Zealand has updated its industry classification from ANZSIC96 to ANZSIC06 for their 2011 data releases. This report uses the new ANZSIC06 classification to define the 59-industries that make up the Input-Output table. Previous BERL reports used the ANZSIC96 classification to define the 59-industries.[3]

It is important to note that this change in classification may cause some changes in the 2011 multipliers, when compared to previous multipliers.

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[3] BERL. (2008) Updated Manufacturing Multipliers from 2007/08 Data .BERL: Wellington.

3   Interpretation

Multipliers are a tool used by economists to estimate the impact of expansion in an industry. This impact also takes into account indirect (upstream) impacts on other industries. In some cases, multipliers are used to estimate the induced effects of this expansion.

3.1   Assumptions

However, multipliers are a much misunderstood and, in some cases, misused tool. Their correct interpretation requires the acknowledgement of the severely limiting assumptions that form the basis of their derivation.

The most critical limiting assumptions are:

- availability of resources

* multipliers can only estimate *additional* economic activity (whether indirect or induced) where there is sufficient unused productive resources (labour and capital) to facilitate such an expansion in activity.

* where resources are already fully employed, then any indirect and/or induced activity calculated by multipliers should be interpreted as a *diversion* of economic activity, not an increase in activity.

- no change in relative prices

* the impacts estimated by multipliers are only valid under the assumption that relative prices (of goods, services and resources) remain unchanged. Where relative price change is expected to occur, then behavioural changes will be induced and the impact of this is not captured by standard multiplier analysis. To correctly investigate issues where relative prices are expected to alter, a general equilibrium approach is required. A general equilibrium modelling framework explicitly incorporates behavioural responses to relative price changes.[4]

- constant returns to scale production technology

* the calculated multipliers are only valid in a situation where additional production is undertaken given existing production function (technology) coefficients. In other words,

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[4] General equilibrium models capture such behavioural responses using the standard neo-classical theory of utility-maximising consumers, cost-minimising producers or profit maximising firms. This framework also allows a more comprehensive analysis of the economy-wide effects.

units of output are produced using the same inputs of raw materials, labour and capital in the same proportions as has been used in the production of previous units of output.

Therefore, multipliers are appropriate to assess the impact of small, marginal shocks rather than large-scale shocks.

3.2 Examples

3.2.1 General

The underlying logic of multiplier analysis is relatively simple. For example, the construction of a new facility such as a new furniture factory is initiated by a preliminary flow of expenditure; as designs are drawn, land is acquired and landscaped, labour is hired, and materials are purchased. This initial expenditure is labelled *initial* effects, and creates further expenditure flows.

In particular, this initial expenditure is magnified or *multiplied* as it flows on to the wider economy. This multiplication of the initial effect occurs in two ways:

- A construction firm purchases materials and services from supplier firms (labelled *direct* effects), who in turn purchase from their suppliers (labelled *indirect* effects). For example, raw materials will be required. These will be transported to processing plants and developed through various stages into appropriate building materials. These impacts are sometimes referred to as *upstream* effects.

- People employed in the construction and supplier firms earn an income (mostly from wages and salaries, but also from profits). After tax is deducted, they spend this income on consumption.[5] These impacts are referred to as *induced* effects.

This analysis of the construction phase determines the one-off impact of the development. Thereafter, the annual impact arising from the operation of the furniture factory is similarly divided into two flows of expenditure:

- The furniture factory purchases raw materials, as well as other goods and services from supplier firms, who in turn make further purchases from their suppliers (e.g. legal, accounting, insurance, marketing, transport, communications and distribution services). These impacts, the *direct* and *indirect* effects, are sometimes referred to as *upstream* effects.

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[5] Noting that a portion will also be saved.

- People employed in the furniture factory and in firms supplying materials and services earn an income (mostly from wages and salaries, but also from profits). After tax is deducted, this income is spent on consumption.[6] These impacts are referred to as *induced* effects.

3.2.2   Specific

In terms of the multipliers presented below, they represent the impact of additional annual production in the stated industry. Annual production in each industry is specified in terms of the value of its *gross output* (akin to turnover or total sales of the industry). The question is then asked:

What is the impact of this industry's annual production (gross output) rising by another $1m?

The multipliers, subject to the above assumptions, answer this question.

For example, the (direct plus indirect) gross output multiplier for Printing, Publishing and Recorded Media (PPRM) is stated in Table 4.1 as 1.70. This implies that for each additional $1m of gross output produced in PPRM, gross output across all industries (including PPRM) is required to increase by $1.70m.

These effects can also be translated into impacts on *value added* and *employment*. Table 4.2 lists the initial $1m of PPRM gross output as equivalent to producing $0.44m of value added in PPRM. This thereafter multiplies to an overall upstream effect on all industries (including PPRM) value added of $0.76m. The ratio of these numbers results in the stated value added multiplier of 1.72.

Similarly, Table 4.3 lists the initial $1m of PPRM gross output as requiring 6.72 units of FTE labour employment in PPRM. In turn, this multiplies to an overall upstream effect on all industries (including PPRM) employment of 9.49 FTEs. Again, the ratio of these two numbers results in the stated value for the FTE employment multiplier of 1.41.

Turning to the induced effects, *assuming* on average 90 percent of post-tax wage income is re-spent on domestic household consumption (i.e. is net of personal income tax and household savings), *induced* impacts comprise (continuing the PPRM example):

- a further $0.44m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.14.

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[6] Again, noting also that a portion will be saved.

- a further $0.22m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.22.

- a further 1.87 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 1.69.

4 Multiplier tables

The following three tables list the derived effects and impacts, along with the consequential multipliers, for the 13 manufacturing sectors identified.

For each table:

- the first column lists the *initial* effect of a $1m expansion in gross output of the stated industry.

- the second column lists the *direct* effect on all other industries (including non-manufacturing sectors) of the $1m expansion in gross output of the stated industry.

- the third column is the sum of columns 1 and 2.

- the fourth column lists the *indirect* effect on all industries (including the stated industry as well as other manufacturing *and* non-manufacturing sectors) of the $1m expansion in gross output of the stated industry.

- the fifth column is the sum of columns 3 and 4.

- the sixth column is the *induced* effect on all industries (including the stated industry as well as other manufacturing *and* non-manufacturing sectors) of the $1m expansion in gross output of the stated industry.

- the seventh column is the sum of columns 5 and 6.

- the eighth column is the initial plus upstream multiplier applicable to expansion in activity in the stated industry - being column 5 divided by column 1 (this is sometimes referred to as the *type 1B* multiplier).

- the ninth column is the initial plus upstream and induced multiplier applicable to expansion in activity in the stated industry - being column 7 divided by column 1 (this is sometimes referred to as the *type 2* multiplier).

4.1 Summary

The last line of each of these three tables lists the weighted-average (13-industry) manufacturing multiplier.

In particular, a $1m increase in gross output *(subject to the assumptions listed in sub-section 3.1 above)*, yields a further $0.88 upstream expansion in industry gross output and also another $0.37m of induced activity.

The initial and indirect effects here translate to another $0.75m of value added across the original and all upstream industries as well as a further $0.19m of induced activity. In employment terms, the initial, direct and indirect effects translate to another 7.98 FTEs across the original and all upstream industries as well as a further 1.82 induced FTEs.

In total, an average $1m increase in the gross output of the domestic manufacturing industry results in an additional $0.94m in value added and 9.79 FTEs.

Alternatively, explicitly utilising the multiplier values:

- $1m of additional value added in manufacturing results in an initial impact of $2.03m plus downstream value added. Including induced elements, this rises to $2.54m of value added.

- Each additional FTE in manufacturing results in an initial impact of 1.84 FTEs. Including induced elements, this figure rises to 2.29 FTEs.

4.1.1 Impact on tax revenue and benefit payments

In terms of the impact on government finances (for the 2010/11 year), **assuming all of the 9.79 FTEs employment increase comes totally from those previously receiving unemployment benefits**:

- government expenditure on unemployment benefits declines by $115,435.[7]

- government income tax revenue increases by $89,146.[8]

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[7] From data in the Pre-election Economic and Fiscal Update 2011, unemployment benefit payments in 2010/11 totalled $943m with an average 78,000 beneficiaries, implying an average payment of $12,090.

[8] This figure was obtained from the Treasury *Budget and Economic Fiscal Update* income tax data, and updated input-output data on compensation of employees (akin to wage income) as well as number of FTEs. It implies an average annual income of $47,516 per FTE and an average income tax rate of 19.2%.

Also, an indication of the increased consumer purchasing power can be calculated as follows:

Average annual income per FTE	$ 47,516
Less income tax	$ 9,103
Disposable income per FTE	$ 38,413
Less previous unemployment benefit income	$ 11,788
	$ 26,626
Number of FTEs	9.79
Increase in purchasing power	**$ 260,748**

It should be noted that an adjustment should be made in the above calculations for the income tax that would have been payable on the unemployment benefit. This adjustment has, however, not been made to maintain some comparability to previously reported figures. In addition, the additional consumer spending would, no doubt, impact on the Government's GST receipts.

These observations reinforce the partial nature of the above analysis. To capture the impact of manufacturing expansion on the overall economy in a more comprehensive manner requires a general equilibrium framework, as noted earlier.

Table 4.1 2011 Gross Output Multipliers for Manufacturing Sectors

	EFFECTS OR IMPACTS ($M PER $M OF GROSS OUTPUT							MULTIPLIERS	
	Initial	Direct	Initial + Direct	Indirect	Initial + Direct + Indirect	Induced	Initial + Direct + Indirect + Induced	Initial + Upstream	Initial + Upstream + Induced
Gross Output Coefficient									
TCFL	1.00	0.48	1.48	0.51	1.99	0.50	2.49	1.99	2.49
WOOD	1.00	0.66	1.66	0.79	2.45	0.48	2.93	2.45	2.93
PAPR	1.00	0.56	1.56	0.63	2.19	0.36	2.55	2.19	2.55
PPRM	1.00	0.38	1.38	0.32	1.70	0.44	2.14	1.70	2.14
PETR	1.00	0.34	1.34	0.23	1.58	0.10	1.67	1.58	1.67
CHEM	1.00	0.42	1.42	0.35	1.77	0.23	2.00	1.77	2.00
RBPL	1.00	0.39	1.39	0.34	1.73	0.36	2.09	1.73	2.09
NMMP	1.00	0.52	1.52	0.52	2.03	0.41	2.44	2.03	2.44
BASM	1.00	0.45	1.45	0.44	1.89	0.31	2.20	1.89	2.20
FABM	1.00	0.47	1.47	0.41	1.87	0.43	2.30	1.87	2.30
TREQ	1.00	0.36	1.36	0.33	1.69	0.47	2.16	1.69	2.16
MAEQ	1.00	0.42	1.42	0.36	1.77	0.43	2.20	1.77	2.20
OMFG	1.00	0.46	1.46	0.46	1.92	0.44	2.36	1.92	2.36
AVGE MFG	1.00	0.45	1.45	0.43	1.88	0.37	2.25	1.88	2.25

Source: BERL

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Table 4.2 2011 Value Added Multipliers for Manufacturing Sectors

	EFFECTS OR IMPACTS ($M PER $M OF GROSS OUTPUT)							MULTIPLIERS	
	Initial	Direct	Initial + Direct	Indirect	Initial + Direct + Indirect	Induced	Initial + Direct + Indirect + Induced	Initial + Upstream	Initial + Upstream + Induced
Value added coefficient									
TCFL	0.36	0.18	0.54	0.22	0.76	0.25	1.01	2.12	2.82
WOOD	0.29	0.23	0.52	0.34	0.86	0.24	1.10	2.96	3.78
PAPR	0.34	0.21	0.56	0.26	0.82	0.18	1.00	2.38	2.91
PPRM	0.44	0.17	0.61	0.15	0.76	0.22	0.97	1.72	2.22
PETR	0.32	0.20	0.52	0.12	0.64	0.05	0.69	1.98	2.13
CHEM	0.30	0.18	0.48	0.16	0.64	0.12	0.76	2.11	2.49
RBPL	0.33	0.16	0.49	0.15	0.64	0.18	0.82	1.93	2.47
NMMP	0.40	0.22	0.62	0.22	0.84	0.21	1.05	2.11	2.63
BASM	0.47	0.19	0.66	0.20	0.86	0.15	1.02	1.84	2.16
FABM	0.37	0.20	0.57	0.18	0.75	0.21	0.97	2.03	2.61
TREQ	0.42	0.15	0.58	0.14	0.72	0.24	0.96	1.70	2.26
MAEQ	0.39	0.18	0.57	0.16	0.73	0.21	0.94	1.89	2.44
OMFG	0.40	0.18	0.58	0.20	0.78	0.22	1.00	1.95	2.51
AVGE MFG	0.38	0.19	0.56	0.19	0.75	0.19	0.94	2.03	2.54

Source: BERL

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Table 4.3 2011 Employment Multipliers for Manufacturing Sectors

	EFFECTS OR IMPACTS (FTES PER $m OF GROSS OUTPUT)							MULTIPLIERS	
	Initial	Direct	Initial + Direct	Indirect	Initial + Direct + Indirect	Induced	Initial + Direct + Indirect + Induced	Initial + Upstream	Initial + Upstream + Induced
Employment cofficient: FTEs/GOUT (number per $m)									
TCFL	6.65	2.06	8.72	1.97	10.69	2.13	12.82	1.61	1.93
WOOD	3.87	1.66	5.53	2.82	8.34	2.04	10.38	2.16	2.68
PAPR	1.61	1.43	3.04	1.99	5.03	1.55	6.59	3.13	4.10
PPRM	6.72	1.58	8.30	1.18	9.49	1.87	11.35	1.41	1.69
PETR	0.34	0.49	0.82	0.65	1.47	0.41	1.88	4.37	5.58
CHEM	0.86	1.03	1.89	1.12	3.01	0.99	4.00	3.49	4.64
RBPL	2.97	1.40	4.37	1.22	5.59	1.53	7.11	1.88	2.39
NMMP	3.06	2.00	5.06	1.83	6.88	1.75	8.64	2.25	2.82
BASM	1.44	1.22	2.66	1.54	4.20	1.32	5.51	2.91	3.82
FABM	5.19	1.84	7.03	1.50	8.53	1.82	10.36	1.64	2.00
TREQ	5.51	1.63	7.14	1.25	8.39	2.02	10.40	1.52	1.89
MAEQ	4.68	1.78	6.46	1.39	7.84	1.83	9.67	1.68	2.07
OMFG	5.58	1.83	7.41	1.64	9.05	1.89	10.94	1.62	1.96
AVGE MFG	4.71	1.68	6.39	1.59	7.98	1.81	9.79	1.84	2.29

Source: BERL

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4.2 Summary of manufacturing sectors

The following section discusses the impact of each manufacturing sectors annual production (gross output) increasing by another $1m.

4.2.1 Textile, clothing, footwear and leather manufacturing

Looking firstly at textile, clothing, footwear and leather manufacturing (TCFL), the gross output multiplier is 1.99. This implies that for each additional $1m of gross output produced in TCFL, gross output across all industries (including TCFL) is required to increase by $1.99m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of TCFL gross output as equivalent to producing $0.36m of value added in TCFL. This multiplies to an overall upstream effect on all industries (including TCFL) of $0.76m of value added. The ratio of these numbers results in the value added multiplier of 2.12.

Turning to employment, the initial impact of the TCFL sector increasing its annual production by another $1m will result in 6.65 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including TCFL) of 10.69 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.61.

The induced impacts of the TCFL sector increasing annual production by another $1m are:

- a further $0.50m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.49.

- a further $0.25m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.82.

- a further 2.13 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 1.93.

In total, an average $1m increase in the annual production of the textile, clothing, footwear and leather manufacturing industry results in an additional $1.01m in value added and 12.82 FTEs.

4.2.2 Wood product manufacturing

For the wood product manufacturing sector (WOOD), the gross output multiplier is 2.45. This implies that for each additional $1m of gross output produced in WOOD, gross output across all industries (including WOOD) is required to increase by $2.45m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of WOOD gross output as

equivalent to producing $0.29m of value added in WOOD. This multiplies to an overall upstream effect on all industries (including WOOD) of $0.86m of value added. The ratio of these numbers results in the value added multiplier of 2.96.

Turning to employment, the initial impact of the WOOD sector increasing its annual production by another $1m will result in 3.87 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including WOOD) of 8.34 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 2.16.

The induced impacts of the WOOD sector increasing annual production by another $1m are:

- a further $0.48m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.93.

- a further $0.24m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 3.78.

- a further 2.04 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 2.68.

In total, an average $1m increase in the annual production of the wood product manufacturing industry results in an additional $1.1m in value added and 10.38 FTEs.

4.2.3   Paper product manufacturing

For the paper product manufacturing sector (PAPR), the gross output multiplier is 2.19. This implies that for each additional $1m of gross output produced in PAPR, gross output across all industries (including PAPR) is required to increase by $2.19m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of PAPR gross output as equivalent to producing $0.34m of value added in PAPR. This multiplies to an overall upstream effect on all industries (including PAPR) of $0.82m of value added. The ratio of these numbers results in the value added multiplier of 2.38.

Turning to employment, the initial impact of the PAPR sector increasing its annual production by another $1m will result in 1.61 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including PAPR) of 5.03 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 3.13.

The induced impacts of the PAPR sector increasing annual production by another $1m are:

- a further $0.36m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.55.

- a further $0.18m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.91.

- a further 1.55 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 4.10.

In total, an average $1m increase in the annual production of the paper product manufacturing industry results in an additional $1m in value added and 6.59 FTEs.

4.2.4   *Petroleum refining and product manufacturing*

For the petroleum refining and product manufacturing sector (PETR), the gross output multiplier is 1.58. This implies that for each additional $1m of gross output produced in PETR, gross output across all industries (including PETR) is required to increase by $1.58m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of PETR gross output as equivalent to producing $0.32m of value added in PETR. This multiplies to an overall upstream effect on all industries (including PETR) of $0.64m of value added. The ratio of these numbers results in the value added multiplier of 1.98.

Turning to employment, the initial impact of the PETR sector increasing its annual production by another $1m will result in 0.34 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including PETR) of 1.47 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 4.37.

The induced impacts of the PETR sector increasing annual production by another $1m are:

- a further $0.1m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 1.67.

- a further $0.05m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.13.

- a further 0.41 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 5.58.

In total, an average $1m increase in the annual production of the petroleum refining and product manufacturing sector results in an additional $0.69m in value added and 1.88 FTEs.

4.2.5 Fertiliser and other industrial chemical manufacturing

For the fertiliser and other industrial chemical manufacturing sector (CHEM), the gross output multiplier is 1.77. This implies that for each additional $1m of gross output produced in CHEM, gross output across all industries (including CHEM) is required to increase by $1.77m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of CHEM gross output as equivalent to producing $0.30m of value added in CHEM. This multiplies to an overall upstream effect on all industries (including CHEM) of $0.64m of value added. The ratio of these numbers results in the value added multiplier of 2.11.

Turning to employment, the initial impact of the CHEM sector increasing its annual production by another $1m will result in 0.86 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including CHEM) of 3.01 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 3.49.

The induced impacts of the CHEM sector increasing annual production by another $1m are:

- a further $0.23m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.00.

- a further $0.12m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.49.

- a further 0.99 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 4.64.

In total, an average $1m increase in the annual production of the fertiliser and other industrial chemical manufacturing industry results in an additional $0.76m in value added and 4 FTEs.

4.2.6 Rubber, plastic and other chemical product manufacturing

For the rubber, plastic and other chemical product manufacturing sector (RBPL), the gross output multiplier is 1.73. This implies that for each additional $1m of gross output produced in RBPL, gross output across all industries (including RBPL) is required to increase by $1.73m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of RBPL gross output as equivalent to producing $0.33m of value added in RBPL. This multiplies to an overall upstream effect on all industries (including RBPL) of $0.64m of value added. The ratio of these numbers results in the value added multiplier of 1.93.

Turning to employment, the initial impact of the RBPL sector increasing its annual production by another $1m will result in 2.97 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including RBPL) of 5.59 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.88.

The induced impacts of the RBPL sector increasing annual production by another $1m are:

- a further $0.36m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.09.

- a further $0.18m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.47.

- a further 1.53 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 2.39.

In total, an average $1m increase in the annual production of the rubber, plastic and other chemical product manufacturing industry results in an additional $0.82m in value added and 7.11 FTEs.

4.2.7 Non-metallic mineral product manufacturing

For the non-metallic mineral product manufacturing sector (NMMP), the gross output multiplier is 2.03. This implies that for each additional $1m of gross output produced in NMMP, gross output across all industries (including NMMP) is required to increase by $2.03m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of NMMP gross output as equivalent to producing $0.40m of value added in NMMP. This multiplies to an overall upstream effect on all industries (including NMMP) of $0.84m of value added. The ratio of these numbers results in the value added multiplier of 2.11.

Turning to employment, the initial impact of the NMMP sector increasing its annual production by another $1m will result in 3.06 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including NMMP) of 6.88 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 2.25.

The induced impacts of the NMMP sector increasing annual production by another $1m are:

- a further $0.41m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.44.

- a further $0.21m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.63.

- a further 1.75 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 2.82.

In total, an average $1m increase in the annual production of the Non-metallic mineral product manufacturing industry results in an additional $1.05m in value added and 8.64 FTEs.

4.2.8   Base metals manufacturing

For the base metals manufacturing sector (BASM), the gross output multiplier is 1.89. This implies that for each additional $1m of gross output produced in BASM, gross output across all industries (including BASM) is required to increase by $1.89m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of BASM gross output as equivalent to producing $0.47m of value added in BASM. This multiplies to an overall upstream effect on all industries (including BASM) of $0.86m of value added. The ratio of these numbers results in the value added multiplier of 1.84.

Turning to employment, the initial impact of the BASM sector increasing its annual production by another $1m will result in 1.44 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including BASM) of 4.20 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 2.91.

The induced impacts of the NMMP sector increasing annual production by another $1m are:

- a further $0.31m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.20.

- a further $0.15m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.16.

- a further 1.32 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 3.82.

In total, an average $1m increase in the annual production of the base metals manufacturing industry results in an additional $1.02m in value added and 5.51 FTEs.

4.2.9 Structural, sheet and fabricated metal product manufacturing

For the structural, sheet and fabricated metal product manufacturing sector (FABM), the gross output multiplier is 1.87. This implies that for each additional $1m of gross output produced in FABM, gross output across all industries (including FABM) is required to increase by $1.87m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of FABM gross output as equivalent to producing $0.37m of value added in FABM. This multiplies to an overall upstream effect on all industries (including FABM) of $0.75m of value added. The ratio of these numbers results in the value added multiplier of 2.03.

Turning to employment, the initial impact of the FABM sector increasing its annual production by another $1m will result in 5.19 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including FABM) of 8.53 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.64.

The induced impacts of the FABM sector increasing annual production by another $1m are:

- a further $0.43m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.3.

- a further $0.21m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.61.

- a further 1.82 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 2.

In total, an average $1m increase in the annual production of the structural, sheet and fabricated metal product manufacturing industry results in an additional $0.97m in value added and 10.36 FTEs.

4.2.10 Transport equipment manufacturing

For the transport equipment manufacturing sector (TREQ), the gross output multiplier is 1.69. This implies that for each additional $1m of gross output produced in TREQ, gross output across all industries (including TREQ) is required to increase by $1.69m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of TREQ gross output as equivalent to producing $0.42m of value added in TREQ. This multiplies to an overall upstream effect on all industries (including TREQ) of $0.72m of value added. The ratio of these numbers results in the value added multiplier of 1.7.

Turning to employment, the initial impact of the TREQ sector increasing its annual production by another $1m will result in 5.51 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including TREQ) of 8.39 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.52.

The induced impacts of the TREQ sector increasing annual production by another $1m are:

- a further $0.47m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.16.

- a further $0.24m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.26.

- a further 2.02 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 1.89.

In total, an average $1m increase in the annual production of the transport equipment manufacturing industry results in an additional $0.96m in value added and 10.4 FTEs.

4.2.11   Machinery and other equipment manufacturing

For the machinery and other equipment manufacturing sector (MAEQ), the gross output multiplier is 1.77. This implies that for each additional $1m of gross output produced in MAEQ, gross output across all industries (including MAEQ) is required to increase by $1.77m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of MAEQ gross output as equivalent to producing $0.39m of value added in MAEQ. This multiplies to an overall upstream effect on all industries (including MAEQ) of $0.73m of value added. The ratio of these numbers results in the value added multiplier of 1.89.

Turning to employment, the initial impact of the MAEQ sector increasing its annual production by another $1m will result in 4.68 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including MAEQ) of 7.84 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.68.

The induced impacts of the MAEQ sector increasing annual production by another $1m are:

- a further $0.43m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.2.

- a further $0.21m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.44.

- a further 1.83 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 2.07.

In total, an average $1m increase in the annual production of the machinery and other equipment manufacturing industry results in an additional $0.94m in value added and 9.67 FTEs.

4.2.12   Other manufacturing

For the other manufacturing sector (OMFG), the gross output multiplier is 1.92. This implies that for each additional $1m of gross output produced in OMFG, gross output across all industries (including OMFG) is required to increase by $1.92m. Translating these effects into impacts on value added, Table 4.2 lists the initial $1m of OMFG gross output as equivalent to producing $0.4m of value added in OMFG. This multiplies to an overall upstream effect on all industries (including OMFG) of $0.78m of value added. The ratio of these numbers results in the value added multiplier of 1.95.

Turning to employment, the initial impact of the OMFG sector increasing its annual production by another $1m will result in 5.58 units of employment being required in this sector. In turn, this multiplies to an overall upstream effect on all industry employment (including OMFG) of 9.05 FTEs. The ratio of these two numbers results in the FTE employment multiplier of 1.62.

The induced impacts of the OMFG sector increasing annual production by another $1m are:

- a further $0.44m of industry gross output across all industries - resulting in a total initial, upstream and induced gross output multiplier of 2.36.

- a further $0.22m of industry value added across all industries - resulting in a total initial, upstream and induced value added multiplier of 2.51.

- a further 1.89 units of FTE employment across all industries - resulting in a total initial, upstream and induced employment multiplier of 1.96.

In total, an average $1m increase in the annual production of the other manufacturing industry results in an additional $1.0m in value added and 10.94 FTEs.