

GLOBAL SUPPLY CHAINS: A PRELIMINARY ANALYSIS OF THE AUSTRALIAN CONSTRUCTION INDUSTRY

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Globalisation of the construction supply chain in Australia has led to an increasing amount of products and services being procured by construction companies or their sub-contractors from manufacturers or suppliers overseas. Led by the rapidly falling communication and coordination costs, the various stages of building construction need not be performed near to each other anymore; leading to increasing offshoring of manufacturing production to lower production cost countries in Asia. This study aims to characterise the extent to which the Australian construction sector has embraced global supply chains, and to determine the drivers for the increase in imports. Direct and indirect imports into the Australian construction industry are estimated at 7% and 14%, respectively. The main driver for this increase in imports is the manufacturing industry's loss of competitiveness in the domestic sector to lower production cost countries in Asia. In addition to the lower cost of imported products, other drivers for increased imports are increased competition, globalisation of Australian manufacturers, excess production capacity in Asia, and the shift to services. In response to these structural changes and increased global competition, labour needs to be retrained and reallocated from less competitive sectors to higher value added or higher skilled jobs.

Keywords: globalisation, outsourcing, supply chains, Australia

INTRODUCTION

An increasing amount of products and services are procured by construction companies and sub-contractors from manufacturers or suppliers overseas. The aim of this exploratory research is therefore to characterise the extent of the globalisation of the supply chain in the Australian construction industry. The construction industry supplies all new buildings and structures, provides for the maintenance of existing structures, and accounts for approximately half of all total investment in Australia. In order to construct these buildings and structures, the industry relies heavily on other sectors of the domestic economy to supply the necessary materials, skilled labour, technology, transportation and finance. Goods and services that cannot be procured domestically are imported.

In Australia, and undoubtedly, in many other developed economies, there are increasing concerns about the offshoring of manufacturing production and the procurement of extensive amounts of goods and services from Asia, in general, and China, in particular. Led by the rapidly falling communication and coordination costs, the various stages of building construction (or any other manufacturing activity) need not be performed near to each other anymore. Increased possibilities for fragmentation mean in essence that more parts of the building process become open to international competition. Globalisation has

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entered a phase in which international competition is now played out at the level of activities within industries, rather than at the level of whole industries (see the 'second unbundling' by Baldwin 2006).

The lower cost of building products available from overseas cannot be disregarded when Australian construction firms now bid for projects in an increasingly competitive market. Utilising a growing volume of imported products leads to reduced final costs for buildings, creating greater value for construction clients. Extending the supply chain globally can bring great benefits but also new risks. The supply of an unacceptable degree of non-compliant, unsuitable and occasionally faulty building products and components is being seen increasingly in major development projects, pointing to a weakness of Australian compliance regimes. Despite a long history of imports of construction products into the building industry, recent cases of non-compliant products have focused the attention of construction companies, industry stakeholders and the government to the sudden surge in the use of imports from abroad. Recent cases of sub-standard imported building products such as combustible aluminium composite panels, non-compliant electrical cables and structural ply, and asbestos tainted building products have been reported to a Senate Committee inquiry (Senate Economics References Committee 2016).

The primary objective of this research is to characterise changes in the direct and indirect import of intermediate goods into the Australian construction industry over the last decade. The second objective is to identify the drivers of this increase in imports and to discuss its implications on the future of the industry. The focus of this study is therefore on the increasing international fragmentation of the value chain reflecting the higher import shares in the value of final construction products. This research is the initial part of a wider research project to quantify the scope of value chain fragmentation at all stages of the construction process, and to measure its implications on construction output, domestic employment, income and value added.

LITERATURE REVIEW

Early trade models were based on the premise that national wealth and economic prosperity can only be attained by encouraging exports and the accumulation of gold or bullion. This mercantilist approach is based on the idea that exports should be encouraged, imports discouraged through the use of tariffs. A common viewpoint during the 18th century was that international trade is viewed as a zero-sum game where a gain by one trading nation results in a loss in another. In *The Wealth of Nations*, Adam Smith (1776, republished by Everyman's Library in 1991) defined the concept of absolute advantage, and suggested that two nations could gain from trade when each had an absolute advantage in one product. When Ricardo (1821) described the advantage of trade in his wine for cloth example, the difference in comparative costs reflecting a difference in techniques of production and division of labour resulted in a comparative advantage in each of these products in Portugal and Britain, respectively. Despite its extreme simplicity, the Ricardian model continues to perform surprisingly well empirically (Golub and Hsieh 2000). Later models to determine patterns and interactions of trade are founded on the Heckscher-Ohlin theory (Helpman 1981) that essentially states that countries will export products that use their abundant and cheap factors of production and import products that use the countries' scarce factors. In simple terms, it basically states that 'a capital-abundant country will export the capital-intensive good, while the labour-abundant country will export the labour-intensive good'.

Enabled by falling trade costs and new communications technologies, many products are now produced by networks of firms spread all over the world. These networks of production are located across multiple countries to gain access to capital, technology, natural resources, labour and other inputs to achieve cost and other competitive advantages. The emergence of such a network or global supply chain presents firms with opportunities to capture specific stages or niches within globalised production processes, and to expand their operations to higher value added activities in the value chain. Baldwin and Evenett (2012) asserts that developed economies should be chasing high-skills high-value added jobs such as design, marketing, and research and development to remain competitive. Asia's comparative advantage lies in the low-skill and capital value-added manufacturing segments of the value chain. Gasiorek and Lopez-Gonzalez (2013) reported that it is this complementarity which allows countries to engage in mutually beneficial specialisation.

Previous empirical studies of the international fragmentation of production were focused on estimating either the domestic value added content of a unit bundle of exports, or the shares of imports in all intermediate inputs. Using world input-output tables, Los *et al.*, (2015) proposed to measure for each product all value adding activities and to trace the location of these activities; in effect fully decomposing the value of the product into domestic value added and value added abroad. They concluded that the opening up of China and other countries with extremely low labour costs, combined with rapidly declining coordination costs have enable value chains to become global. Recognising the advantages of production in lower cost countries, manufacturing companies have developed global sourcing strategies to win competitive advantage (Murray 2001). Motivations for global sourcing include lowering production costs (Trent and Monczka 2003, Schiele *et al.*, 2011) or gaining access to superior technology, quality products, raw materials and specialised knowledge (Brockwell 2008).

RESEARCH METHODS

This study drew upon the National Account Input-Output tables (ABS Cat.No.5209) for 2001-02 and 2012-13 produced by the Australian Bureau of Statistics (www.abs.gov.au) to characterise the changes of direct competing imports into the construction industry. These tables provide highly disaggregated supply and use data of goods and services throughout the economy. Changes to the primary and intermediate inputs for the construction industry over the period were analysed by comparing the actual import values and direct requirements coefficients. Additional data on the sources of these imports were obtained from the World Input-Output database - a project funded by the European Commission as part of the Seventh Framework Programme (www.wiod.org).

Indirect imports into the construction industry (e.g. via the manufacturing industry) can be obtained by mathematical manipulation of input-output tables with direct allocation of imports (ABS Cat.No.5246). However, the homogeneity assumption inherent in input-output analysis obscures the traceability of, say, steel plates imported by a steel fabricator for incorporation into the construction of a framed building compared to steel plates utilised in the manufacture of trucks. In order to overcome this limitation, data on imports for the manufacturing sectors that supply the construction industry were obtained from the IBIS World database (www.ibisworld.com.au) together with their respective shares of output supplied to the construction industry. The drivers for the greater utilisation of imports or company strategies to address competition from low cost producers were obtained from a search on secondary data sources: company annual reports, administrators' reports, government reports and industry publications.

FINDINGS

A comparison of the top ten imports into the construction industry in 2001-02 and 2012-13 is shown in Table 1. Intermediate products such as fabricated metal products, electrical equipment, iron and steel, have consistently remained at the top of this list. Direct competing imports into the construction industry increased from about 4% of total output in 2012-02 to 7% in 2012-13.

Table 1: Top ten imports into the construction industry

Rank	Imports 2001-02	Value \$(m)	Imports 2012-13	Value \$(m)
1	Fabricated metal products	654	Petroleum Product Manuf.	3866
2	Other electrical equipment	436	Electrical Equipment Manuf.	3056
3	Electronic equipment	404	Iron and Steel Manuf.	2560
4	Ceramic products	369	Polymer Product Manuf.	2189
5	Iron and steel	361	Basic Chemical Manuf.	2119
6	Plastic products	356	Structural Metal Product Manuf.	1788
7	Motor vehicles and parts equip.	318	Electronic Equipment Manuf.	1343
8	Basic chemicals	297	Professional Services	1313
9	Other machinery and equip.	246	Other Fab. Metal Product manuf.	1287
10	Insurance	239	Other Wood Product Manuf.	892

Data from the world input-output tables produced by Dietzenbacher *et al.*, (2013) indicate that direct imports that were initially from USA, Germany and Great Britain were gradually being replaced by imports from China, Indonesia and Korea (see Table 2). Since 2011, China has become the main source of imports to the construction industry supplying electrical equipment, basic metals, fabricated metal, rubber, chemical and plastic products, and computers.

Table 2: Top five source countries for imports into the construction industry

Rank	Country (1995)	%	Country (2011)	%	Country (2014)	%
1	USA	13	China	25	China	20
2	Japan	12	USA	11	USA	7
3	Germany	10	Japan	6	Japan	5
4	Great Britain	7	Germany	5	Korea	5
5	China	6	Indonesia	5	Germany	4
	Rest of the World	52	Rest of the World	49	Rest of the World	59

In parallel with this increase in direct imports, additional imports may also flow into the construction industry through the supply of intermediate products from the domestic manufacturing industry. A list of manufacturing sectors that commonly supply the construction industry is listed in Table 3 together with the proportion of output that was supplied to the construction industry in the right-most column. The total value of import

penetration into these manufacturing sectors increased from 19% in 2006-07 to 25% in 2015-16 leading to estimates of total imported content of approximately 20%.

Four manufacturing sectors that exhibited the highest import contents (> 50%) in 2015-16 were C2029 Ceramic Products, C2142 Aluminium, C2432 Electrical Equipment, and C2462 Construction Machinery. The high import proportion reflects the decision of local manufacturers to import from lower production cost developing countries. In 2015, GWA Group Limited (a ceramic products manufacturer) announced a strategy for a phased exit of manufacturing of bathroom and kitchen products and transition to sourcing from established overseas suppliers (GWA 2015). This strategic repositioning was to enhance competitiveness by shifting manufacturing of their products to lower cost countries while maintaining domestic product development, research and design, and marketing activities. In the same vein, Alcoa Australia's Point Henry facilities closed at the end of 2014 as part of its global strategy to lower its aluminium production cost by divesting or closing high production cost plants and investing in the lowest-cost aluminium production facilities (Alcoa 2015). Nearly two thirds of Australian domestic demand is now being met by cheaper foreign imports, the majority of which come from China. Growing import penetration of cheaper foreign products has led to the decline of the local manufacturing industry. In C2462 Construction Machinery Manufacturing, many of the earthmoving equipment are imported from multinational manufacturers that build equipment overseas. Latimer (2016) reported that foreign-owned construction equipment manufacturer, Sandvik, will gradually relocate majority of manufacturing operations offshore while maintaining client servicing and equipment support operations locally.

The sectors with medium import contents (between 25% and 50%) were C1413 Timber, C2090 Glass wool and Stone, C2221 Structural Steel, C2431 Electric Cable, C2452 HVAC, and finally, C2511 Furniture. Products from C1413 Timber are widely used in housing construction such as timber for the house framing, and in the manufacture of components such as door and window frames. Imported timber from New Zealand, Indonesia and Chile now account for 26% of domestic demand, up from 13% in 2006-07. Tasmanian timber company, Gunns, once a major player in this sector, entered into voluntary administration in September 2012 as a result of increasing competition from other countries, an oversupply of plantation woodchip and a high Australian dollar (Gunns Limited 2012). Imports for glass wool insulation and stone (C2090) increased to 26.4% of domestic demand mainly due to imports from high quality dimension stone from the United States and Italy, and low cost products from China. CSR, one of the largest insulation manufacturers in Australia, supplying close to 35% of the fibreglass insulation market, closed its rock-wool insulation factory in Victoria and mothballed a kiln in New South Wales in 2011 because of deteriorating international competitiveness and market oversupply due to the withdrawal of the government home insulation subsidies (CSR 2012).

The most significant change was observed for C2221 Structural Steel Fabrication that increased its imported content from only 5.4% in 2006-07 to 27.8% in 2015-16. This sector is one of the most important sectors supplying materials for the construction industry, which constitutes 95% of this manufacturing sector's market. Structural steel products include reinforcing steel rods and welded mesh, rolled structural sections, steel plates and fabricated steel girders, roof trusses and scaffolding. The bulk of fabricated steel product imports to Australia are sourced from low-cost producers located in China, Thailand and Indonesia. Excess production of steel in China has led to numerous allegation of dumping of surplus product into Australia, many of which have received

affirmative determination of dumping by the Anti-Dumping Commission (Anti-Dumping Commission 2015). Despite the imposition of duties of up to 53% for some steel products, domestic steel maker Arrium Limited remains uncompetitive and was eventually put under voluntary administration in April 2016 (KMR 2016).

Table 3: Changes in Manufacturing imports from 2006-07 to 2015-16

Code	Description	2006-07 Imports (%)	2015-16 Imports (%)	Change	Construction Share
C1411	Log Sawmilling	16.9%	17.5%	0.6%	49.9%
C1413	Timber Re-sawing and Dressing	12.9%	26.0%	13.0%	76.2%
C1490	Fabricated Wood Manufacturing	16.6%	25.0%	8.4%	84.9%
C1492	Wooden Structural Component Manuf.	1.2%	1.4%	0.3%	76.7%
C1916	Paint and Coatings Manuf.	12.5%	16.4%	3.9%	27.5%
C2010	Glass and Glass Product Manuf.	12.9%	18.8%	5.8%	60.0%
C2021	Clay Brick Manuf.	0.3%	0.0%	-0.3%	87.0%
C2029	Ceramic Product Manuf.	57.3%	69.3%	12.0%	57.0%
C2031	Lime and Cement	3.5%	7.3%	3.8%	78.0%
C2034	Concrete Products	5.5%	12.1%	6.5%	100.0%
C2090	Glass wool, stone and other mineral	18.4%	26.4%	8.1%	72.5%
C2110	Iron Smelting and Steel Manuf.	17.1%	16.2%	-0.9%	34.8%
C2132	Aluminium Smelting	0.4%	4.4%	4.0%	21.5%
C2142	Aluminium Extruding	43.5%	68.5%	25.0%	20.3%
C2221	Structural Steel Fabrication	5.4%	27.8%	22.4%	95.0%
C2222	Prefabricated Metal Buildings	3.4%	7.1%	3.7%	84.1%
C2223	Aluminium Door and Window Manuf.	2.0%	8.5%	6.5%	86.8%
C2229	Structural Metal Product Manuf.	0.6%	1.1%	0.4%	91.0%
C2240	Sheet Metal Product Manuf.	14.6%	15.6%	1.0%	36.3%
C2431	Electric Cable and Wire Manuf.	36.1%	48.8%	12.7%	31.1%
C2432	Electric Lighting Equipment Manuf.	39.6%	67.2%	27.5%	76.2%
C2452	Heating, Cool. & Vent. Eqmt. Manuf.	39.8%	45.4%	5.6%	100.0%
C2462	Mining & Construction Mach Manuf.	67.5%	61.0%	-6.5%	49.1%

Companies in the C2431 Electric Cable and Wire Manufacturing sector have similarly faced stiff competition from imported low-priced products manufactured in lower labour cost locations. Imports in this sector were nearly 50% in 2015-16 as purchasing decisions in the construction industry are made solely on price. The two largest wire and cable manufacturers in Australia are foreign-owned, and were reported to gradually shift production of more generic products overseas to lower operating costs. In reality, Australian manufacturer are also importers of significant quantities of electric cable. The

Australian Cablemakers Association has alleged that importers are dumping electrical cables from China, and asserted that some of these products do not comply with Australian standards (Moulis Legal 2015).

Increasing competition from imports over the past five years has resulted in 45% of domestic demand being met with imports in 2015-16 for C2452 HVAC Equipment Manufacturing. Local manufacturers have outsourced production to Asian countries to cut costs and improve margins.

Two other manufacturing industries that were examined were; C2010 Glass and Glass Product Manufacturing mainly because there is only one remaining local manufacturer of float glass; and C2031 Cement and Lime Manufacturing because the production of clinker is facing heightened competition from lower cost producers in Asia. Viridian, a division of CSR Limited, is the only local manufacturer of float glass. Low-cost imports from China have steadily captured a greater share of the domestic demand for flat-glass products leading to a number of applications by Viridian to the Anti-Dumping Commission to investigate cases of dumping by Chinese float glass producers. As a result, float glass from a majority of producers in China now attracts an Interim Dumping Duty. This led a turnaround for Viridian with earnings of \$3.1 m in 2015 and \$8.1m in 2016 after 3 consecutive years of losses in 2012, 2013 and 2014 (CSR 2016). Despite these duties, the importation of architectural and automotive glass products from China has consistently remained about 48% of total imports over the last three years.

C2031 Cement and Lime Manufacturing consist of firms that manufacture clinker, hydraulic cement and lime. For maximum environmental and economic efficiency, cement kilns must run at capacity. If a portion of the kiln's capacity is displaced by imports, a kiln is no longer economically or environmentally efficient to run. In 2015-16, imports constitute 7.3% of domestic demand, double the 3.5% in 2006-07. Australian producers of clinker have opted to scale back production, and decided to import clinker from lower cost manufacturers overseas and grind the cement in Australia. The cost of complying with the strict environmental regulations regarding plant emissions and effluent in Australia together with the introduction of the carbon tax in 2012 heightened competitive pressure on the domestic cement sector. In 2012-13, clinker was imported from Japan, China and Indonesia while imports of cement came predominantly from China, Taiwan and Thailand. None of these countries have put a price on carbon emissions. The carbon tax was eventually repealed in July 2014.

DISCUSSION

There is now clear evidence of an increased utilisation of imported products and services in the Australian construction industry both directly through imports from construction companies, and indirectly through imported products utilised by the manufacturing sectors to produce intermediate inputs for the construction sector. This reaffirms Baldwin's (2006) paradigm of global trade where labour intensive activities are offshored to lower production cost countries. With increasing pressure from clients and heightened competition in the building market leading to tight margins (Deloitte 2016), construction companies are constantly under pressure to obtain the cheapest input prices. The Australian construction industry has clearly shifted from a reliance on 'Factory North America' in 1995 to 'Factory Asia' by 2011 where China is now the single largest source country for construction-related imports.

It may be argued that globalisation has affected the manufacturing industry, on which the construction industry depends for a large proportion of its intermediate inputs, to a greater

extent. In recent years, domestic manufacturing companies were affected by both the high Australian dollar and high unit labour costs, constraining its overall competitiveness (DOI 2014). The wage price index for manufacturing increased from 74.5 in 2001 to 110.1 in 2012 (ABS 2016) reflecting a wage increase of more than 3% annually. In the light of higher inputs costs, manufacturers have chosen to import intermediate inputs because these are cheaper than locally sourced inputs. Australian and foreign-owned manufacturing companies that operate across numerous manufacturing sites regularly monitor and compare performance on a cost basis; and would often take a strategic decision to shift production to a lower manufacturing cost location. As the scale of production increases, manufacturers may find it optimal to divide the production line into different fragments where a stage that makes relatively high use of unskilled labour can be shifted to another location where labour unit costs are relatively low. Obviously, the savings from this shift to locations with relatively low unit labour costs must outweigh the higher transportation and communication costs associated with the outsourced production. This is similar to manufacturers in the Australian automotive sector where the demise of the sector was attributed to the failure of tariff protection, the ineffectiveness of the economic assistance packages, the high Australian dollar during the period of the mining boom and immediately after the global financial crisis, and the strategies adopted by multinational automotive companies to shift production to lower cost economies (Clibborn *et al.*, 2016).

In response to these competitive forces, manufacturers have shifted their focus from production to the provision of services such as maintenance of lifts over the entire life cycle, product design, marketing and other high value-added services that rely on expert knowledge of product features and capabilities. This is in line with the observation by Timmer *et al.*, (2013) that international fragmentation does not necessarily lead to destruction of manufacturing jobs in advanced economies, but counteracted by a steady increase in the number of high value added jobs in the services sector.

The impact of the proposed carbon tax in 2012 was to cause the shift of a number of cement manufacturing lines to countries in Asia where no price is put on carbon emissions. This is an example of the cement industry exploiting trade as a means of mitigating emissions (Peters and Hertwich 2007). On the other hand, the cement sector has maintained an import parity pricing on cement as a recent measure to fend off the penetration of imports from lower production cost countries that seems to have slowed the decline of the sector, limited cement imports and maintained the viability of existing cement kilns.

CONCLUSIONS

Direct imports into the Australian construction industry have doubled from about 4% of total output in 2005-06 to 7% in 2015-16. The increase of indirect imports through intermediate demand is now approximately 14% of total output. This level of imported products and services in the Australian construction industry lends further weight to recent observations that the sector has tapped into and now dependent on a global supply chain. The more important conclusion is that a great quantity of imported products and services flow into the construction industry through intermediate inputs from the manufacturing industry.

In response to the second research objective, the drivers for increased imports via the manufacturing sectors are: (i) cheaper goods produced overseas, (ii) increased pressure from clients to reduce construction costs and increased competition within the industry, (iii) globalisation of Australian manufacturers with production capacity in various

locations and their strategic decision to shift production to the lower cost location, (iv) excess production capacity in Asia that often exceeds Australian demand by several multiples, and (v) servitisation of Australian manufacturers (e.g., focusing on product design, marketing and maintenance).

In addition to these drivers for extending the supply chain globally, local factors such as the introduction of a climate policy or stricter environmental standards, which impedes the competitiveness of Australian manufacturing, can also cause a shift of production overseas especially when direct competitors do not face similar carbon costs or onerous emission regulations.

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