Missing Links in Australian Global Value Chains?

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Abstract

In recent decades, as technologies have developed and economies integrated, production processes have fragmented in many economies, connected by services trade, with only a small share of the value-added being produced in the final exporter. The better technologies have lowered costs, especially in transport and telecommunications, whilst open trade policies have provided better access to inputs and for outputs along the chain.

Australia's participation in the Global Value Chains (GVCs) appears to be relatively low, the chains short in terms of the number of links, and at the beginning of the chains, apart from final link imports. The low participation assessment is based on various measures such as relativities of the level of GVCs trade to overall trade, OECD GVCs participation rates, comparisons with relevant countries, and other measures like trade in terms of a country's net value-added, in contrast to gross trade.

Why does Australia's participation in GVCs appear low and does this matter? Is Australia's apparent low participation due to its isolation, relatively costly important trade enhancing services like transport and telecommunications, lack of comparative advantage, Non-Tariff Barriers (NTBs) on inputs and outputs in the chain (e.g. overly strict Sanitary and Phyto-Sanitary (SPS) measures, non-economic anti-dumping actions, and inconsistent FDI thresholds), Preferential Free Trade Agreements (PTAs) (e.g. Rules-of-Origin constraints), or what? As liberalisation in enabling services like telecoms generally helps imports as well as exports (e.g. on-line retail sales), liberalisation of Australian import protection on specific in-country links in the chain would appear to have a more significant potential impact on Australian participation in GVCs. Australia's apparent low participation rate, short links and at the beginning of GVCs may not matter. What does matter is if the participation rate etc does not reflect its potential in terms of maximising value added as a result of trade policies distorting inputs and outputs along the chain.

The paper analyses these questions, including drawing on some underlying research undertaken on Australian liberalisation of telecommunications and its impact on GVCs activity. Modelling of this scenario showed telecommunications liberalisation that reduced the cost of just imported telecommunications services are generally slight at US$128m because telecommunications account for only a small share of costs across most industries. But telecommunications liberalisation may lift productivity across the whole economy, being a transformative tool, resulting in more significant estimated economy-wide gains of US$3.2b and greater efficient GVC participation. A 10 per cent increase in input-augmenting technical change in industrial imports coming to Australia effectively reduces the costs of such imports and leads to a substitution away from domestic production and a greater use of imported inputs, from 37 to 40 per cent. This lower cost-driven increase participation in GVCs leads to a 3.4 per cent increase in exports, another component of participation rates, and a national income gain of 0.5 per cent. The conclusion from analysis of US industrial imports is that the imposition of trade barriers on industrial goods of 35 per cent multilaterally has a relatively significant impact on GVCs. The policy succeeds in creating manufacturing sector jobs in the US but real wages fall (marginally by 1-2 per cent) because consumers must pay more for their goods. GVCs are diminished, both in the United States and in other countries using industrial US goods as inputs.

Introduction

This paper analyses why Australia's involvement in Global Value Chains (GVCs), both inwardly and outwardly, appears low and whether this matters. The analysis includes some assessment of how trade barriers impeded integration into future liberalised GVCs.

In recent decades, as technologies have developed and economies integrated, production processes have fragmented in many economies, with only a small share of the final value-added being produced in the economy that exports the final product. This has resulted in the provision in several different economies of various raw materials, processed parts and components, as well as services that go into producing a given product, such as a processed food, plane or tradable service. Supply chains, connected by services trade, are increasingly global across many economies and have become referred to as GVCs. The international fragmentation of production is driven by better technologies that enable the fragmentation and lower costs, especially in telecommunications and transport services, in conjunction with open trade policies[1] that provide better access to inputs and for outputs along the chain.

Coordinating, financing, designing, ordering, managing inventory and so on, of the production process in GVCs requires facilitating communications. Improved telecommunication services have contributed to better coordination and so on, and had a significant influence on the spread of GVCs[2]. It is now much easier to monitor and, if necessary, intervene in production processes that are taking place in remote locations in various economies. However, some general trading arrangements and instruments can significantly influence the spread of GVCs. GVCs can be encouraged by trading arrangements and instruments that are open globally, and can be discouraged if they are not (OECD, WTO and World Bank 2014).

Fast developing GVCs have shown to be strong drivers of knowledge, innovation, productivity, growth and job creation, and Foreign Direct Investment (FDI) to be an important element in their development. Significant GVCs are developing not only in goods but in agriculture and mining, and services as well. Australia's comparative advantage in GVCs might be expected to be more in its competitive resources sector than manufacturing, with services delivered in these GVCs including more integrated and precise commodity marketing, better meeting compliance requirements and transformed (more productive) agricultural systems. Prospective sectors included processed foods and other raw material based sectors in minerals and energy (e.g. diamonds mined for polishing, cutting, setting in jewellery and so on). There would also appear to be some comparative advantage in certain final stages of service GVCs with services delivered including transferring of funds, information, presentations and reports. Prospective sectors include publishing, banking, data systems, advertising, (on-line) retail sales, distribution, tourism, aviation, education and the professions. The Western Australia Department of State Development stated in its submission to PC (2015b) that there are over 800 international and local companies in Perth servicing the resources sector and that mining services exports increased fourfold from 2006-07 to $250 million in 2012-13.

Services, and particularly the vitally important GVC-enabling services such as telecommunications and transport, are the links that join GVCs (OECD, WTO and World Bank 2014). In PC (1999) it is shown

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[1] In formulating future agendas for services liberalisation, it is best if the three liberalisation approaches of unilateralism, multilateralism (including the developing "services only" plurilateral TiSA agreement) and regionalism reinforce each other. Experience shows clearly that both multilateral and regional agreements have achieved little actual services liberalisation. Significant doses of unilateralism are required, especially for effective services trade liberalisation with its benefits in terms of competitiveness, productivity, economic growth and development (Bosworth and Trewin 2014).

[2] There are thresholds of telecommunication services standards like greater than 2nd generation (2G – speeds of 2-10 Mbps) that could be binding, over-riding any sectoral liberalisation, and would need to be met for economies to be considered in some GVCs, requiring more open trade and investment.

that 70 per cent of communications output was intermediate inputs and 59 per cent went into other services. In fact, technological change in services such as telecommunications, in conjunction with complementary liberalisation policies introduced into many APEC economies, like opening market access to mobile services (PSU 2011), improved the services in terms of its range, quality and prices, and played a critical role in the development of GVCs. Open telecommunications deliver 1.5 per cent faster growth, greater penetration, lower prices and more innovation (Mattoo, Rathindran and Subramanian 2000).

Such improvements in costs or productivity must make individual GVCs using telecommunications, or other trade enhancing services, more competitive. If such improvements do not occur some GVCs may not even develop as AFI (2016) point out for Australia in respect of the absence of transformative digital agricultural technologies requiring expensive high speed internet, estimated to increase cropping productivity in North America by 10-15 percent, and the OECD (2016) with high roaming charges. Examples have been given in interviews with Australian stakeholders like businesses and government agencies, and in submissions to recent relevant inquiries (e.g. PC 2015b), of some growth following opening of telecommunication services. However, in terms of proportions of total expenditures, those on communications were around 5 per cent for services, around 2 per cent for both agriculture and mining, and only around 1 per cent for manufacturing.

Australia's participation in the GVCs appears to be relatively low, the chains short in terms of the number of links, and at the beginning of the chains, apart from final link imports. The low participation assessment is based on various measures such as relativities of the level of GVCs trade to overall trade, OECD GVC participation rates, comparisons with relevant countries, and other measures like trade in terms of net value-added within a country in contrast to gross trade from the country. From the definition of the participation rate[3], participation could be low if imported intermediate inputs were low (e.g. due to import constraints) and/or exports of intermediate goods were low (e.g. due to constraints faced by exporters, or even bans imposed by the exporters (like Indonesia in respect of unprocessed minerals), or because the exporters have access to most of the intermediate goods required to export final goods).

Why does Australia's participation in GVCs appear low and does it matter? Is Australia's apparent low participation due to its isolation, relatively costly important trade enhancing services like transport and telecommunications, a lack of comparative advantage, Non-Tariff Barriers (NTBs) (e.g. overly strict Sanitary and Phyto-Sanitary (SPS) measures, non-economic anti-dumping actions, or inconsistent FDI thresholds), Preferential Trade Agreements (PTAs) (e.g. Rules-of-Origin (RoOs)), or what? As liberalisation in enabling services like telecommunications generally helps imports as well as exports (e.g. on-line retail sales), liberalisation of domestic import protection on specific in-country links in the chain would appear to have a more significant potential impact on Australian participation in GVCs. Australia's apparent low participation rate, short links and at the beginning of GVCs may not matter. What does matter is if the participation rate etc does not reflect its potential in terms of maximising value added as a result of trade policies distorting inputs and outputs along the chain.

This paper is made up of the following sections. The next section provides some background on GVCs, including those involving Australia. This is followed by an analysis of the impact of reforms on various trade constraints on GVCs (which incorporates some GTAP modelling). Lessons learnt and next steps in Australian reforms and related GVC aspects are then discussed with some conclusions drawn.

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[3] Participation rate = Backward (Upstream) participation rate + Forward (Downstream) participation rate
= (Foreign inputs value added + Domestic inputs value added in exports of other countries)/Gross exports

Background of GVCs, including those involving Australia

GVCs are not new, with evidence of trade in parts and components between branches of multinational enterprises from early in the 20th century (Athukorala and Talgaswatta 2016). But they have developed over time through various phases to recently become a significant component of global trade for an increasing number of products, now including services, beyond just a two-way exchange, and involving developing as well as developed economies. GVCs first appeared as a significant issue in PC reports in PC (2015a) reviewing trade and assistance over 2013-14 whereas trade and assistance issues have been reported from the inception of the PC and its forerunners over four decades ago.

There are number of key reinforcing drivers of the impressive development of the GVCs. Firstly, there have been advances in production technologies that enable the production process to be broken up into chains of finer processes. Secondly, technological innovations in services linking the chains, transport and telecommunications in particular, have shrunk the "distance" between links by improving and lowering the costs of these essential GVC services. Thirdly, the global opening of trade (e.g. the WTO Information Technology Agreement) and investment provided better access to inputs and for outputs along the chain.

GVCs favour economies with open borders and non-discrimination to trade and investment as well as secure property rights and an efficient business environment. On the other hand, some general trade and investment constraints can significantly limit the spread of GVCs. Gonzales of the World Bank in Barua et al (2015) cautions that "there is a risk of divergent regulatory regimes (as under PTAs) segmenting markets and raising trade costs as well as limiting the diffusion of GVCs beyond (to) non-members". As stated in OECD, WTO and World Bank (2014), "A (discriminatory) trade agreement by itself cannot put a given country on the right path, regardless of its ambition or content; this can be achieved only by the country itself, acting (unilaterally) on an understanding of what must be done and the political will to do it". It is added that "Tariffs and non-tariff barriers in the presence of GVCs are effectively a tax on exports that discourage GVCs". The absence of GVCs can expose the damage such policies can do to productivity, economic growth, employment and living standards. Such constraints need to be addressed not just in one economy but all economies throughout the chain.

Services like telecommunications and transport perform a vital role in linking the component processes in GVCs, especially telecommunications with its rapid technological development that has allowed other services like financing to be undertaken electronically and easier from remote locations in various economies. Modern financial services generally require telecommunication services. Similarly, coordinating the activities of modern logistics/transport services would be extremely challenging without telecommunication services. Telecommunications are pervasive. Often the contribution of telecommunications in many GVCs goes beyond a direct one.

Production is now much more services intensive as a result of the development of GVCs (Park et al 2014). "Servicification" (shifting to service sector firms of traditional manufacturing-related services embodied or embedded in the value of a given product) has increased: Australia now has 23 per cent of manufacturing firms engaged in services which compares to other OECD economies ranging from Japan at just 12 per cent to the US up to 59 per cent, with an average of 30 per cent over all of the OECD (Athukorala and Talgaswatta 2016).

Improved telecommunication services have contributed to better chain linkages, and had a significant influence on the spread of GVCs. There has been a 2-way link between services and GVCs growth that accelerates both their growths, which is a key reason for GVCs having expanded more rapidly than traditional commodity-based trade (Jones 2000). However, the impact that telecommunications have on GVCs could be non-linear; first facilitating GVCs by reducing transaction and coordination costs of international production, and then reducing the costs of producing close to consumers through automating and mass customisation (e.g. through 3-D printing). The pervasive enabling nature of

services like telecommunications makes them key determinants of competitiveness plus productivity of capital and labour.

The above background is mainly global and much of this applies to Australia but there are some specific Australian aspects that need to be stated before measuring the impacts of Australian reforms of constraints on GVCs involving Australia. Australia's involvement in manufacturing GVCs has not been significant. ABS data shows only 1.8 per cent of manufacturing firms were on average engaged in GVCs over 2005-14 and GVCs were not seen as strategically important by Australian business or public service (Withers et al 2015). Australian overall participation rate of resources, manufacturing, and services GVCs was 44 per cent in 2011 (below the Developed economies average of 48 per cent and around the lowest quarter of all economies listed in WTO (2016)).

The links or steps in GVCs that Australia is involved in tend to be short (around 2 on average overall and for resource GVCs, 2.6 for manufacturing GVCs, and 1.9 for services GVCs (Kelly and La Cava 2014)). They are also more at the beginning of the chain in terms of natural resource inputs (Barua et al 2015) and at the other end in terms of some services (apart from enabling services like telecommunications and transport) and final product outputs rather than final assembly.

Australia has little comparative advantage in manufacturing, and some services like shipping, so it might be expected that its involvement in manufacturing GVCs might be small. But Australia's comparative advantage in some resources and services might be able to overcome the disadvantage of its isolation and allow significant GVCs in these areas to form. The fact that Australia's involvement tends to be at the beginning or the end of GVCs is probably reflective of comparative advantage in resources and no real value added from undertaking further domestic links[4], plus high transport costs that only have to be met once in these links if there is no demand for imported intermediate inputs (e.g. with Live cattle exports (Trewin 2011)). Its GVCs involvement being short is again reflective of its comparative advantage in resources along with the fact that they go through relatively little transformation (say to a manufactured good) before joining GVCs, as do other products at the final sale retail end of the GVC.

Australia's participation in GVCs may be low for reasons like its isolation and have nothing to do with poor trade-related policies (e.g. excessively high transport costs due to cabotage), which could also make participation too high (e.g. "upgrading" through subsidies like with the assembly of submarines in Australia when efficient volume in less sophisticated activities matters more). Size does not necessarily matter in terms of participation rates. What matters is if the participation rate is not at its optimal level in terms of value added because of poor trade-related policies like trade constraints and subsidies. Qualitative analysis can help determine why participation rates might be what they are but modelling of "what if" scenarios are required to determine if they are optimal or could be improved through policy changes. Athukorala and Talgaswatta (2016) undertook econometric (gravity model) analysis of past Australian manufacturing GVC parts and components exports that supports the importance that service link costs and institutions had in these GVCs, and the insignificant impact of FTAs on parts and component exports from Australia. They concluded that small efficient GVCs in niche areas of manufacturing, like light/high value goods, with efficient service links provide gains to the Australian economy from comparative advantage just the same as have been provided from resources trade.

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[4] On occasions, political intervention results in no real domestic value being added to GVCs being extended in-country (e.g. the recent decision to assemble submarines in Australia rather than import them as cheaper finished units), illustrating that the length of the chain is not necessarily a good measure of its efficiency. In fact, a short length may be beneficial in terms of farmers' margins and product traceability. A similar situation may apply to extensions out of country as with Australian produced flaps and ailerons for the Boeing 787 mentioned in Athukorala and Talgaswatta (2016); possibly less efficient links being introduced to make the airliner "made in the world" and more saleable internationally.

Analysis of the performance of Australian GVCs

Before providing an explanation of the methodology to be used to assess the impact of reforms, it is useful to firstly overview the choice of methodologies based on the above background on the development of GVCs, in Australia and elsewhere. The issues that arise from the background are comprehensive and diverse so it is to be expected potential methodologies will be likewise. However, limitations, such as on data, and the need for as simple as appropriate methodologies that are easier to disseminate to all stakeholders, will narrow the potential methodologies down to the most appropriate and realistic given the circumstances.

The general methodology underlying more specific methodologies within the analytic framework is evidence-based policy analysis (Banks 2009 and Trewin 2016). This can vary in its complexity from simple comparative studies, often drawing on reviews of the literature, to the use of complex models capturing the behaviour of societies, using comprehensive data collections and sophisticated analytic strategies to obtain data series and parameters needed to apply these models.

Given data constraints, an integrated mix of qualitative (e.g. bibliographic surveys, stakeholder interviews and submissions to recent relevant inquiries like PC 2015b) and quantitative (e.g. "what if" scenarios in Computable General Equilibrium (CGE) modelling) methodologies along the lines of studies by MUTRAP (2011 and 2015), PC (2015b) and Trewin (2016) will be undertaken. As stated in PC (2015b), "Insufficiently robust data are major impediments to conducting modelling of reducing barriers to service exports for this study. … The Commission's approach to assessing the benefits to the Australian community from reducing barriers to service exports is (mainly) qualitative in nature, drawing on consultations with stakeholders and other information sources such as case studies and qualitative evidence where available, including from other countries.". Examples of the data challenges in this area are given in Park et al (2014), for example that contract manufacturing in GVCs can be classified as services. They state that such data challenges influence what is feasible analytically other than at a highly specific level through case studies where data is directly generated. Methodological challenges will occur in any attempt to move from the specific to more generalised conclusions.

There are limitations in all methodologies and practitioners need to be aware of these and how they may be addressed. Literature reviews, comparative studies and data collections need to be comprehensive, and social-economic models, being abstractions of reality focusing just on the key relationships, are only as good as their assumptions and reliability of data inputs. These assumptions need to be tested or the uncertainty captured with sensitivity analysis.

Significant GVCs are a relatively recent phenomena in Australia and there is very little relevant data on them until recently. In addition, the latest data is around 2014 so there is very little times series data of any length. Policy changes take time to have impacts and it is difficult to estimate when these kick-in and reach their full impact. Also, some reforms are ongoing. Thus to add to some comparative analysis and results from a small survey plus search of recent inquiry submissions, some "what if" CGE modelling of reform scenarios is undertaken to estimate their impacts.

The impacts of reforms on GVCs will be the focus of the remainder of this section, applying the integrated qualitative and quantitative approaches mentioned above. OECD (2013) and WTO (2016) data sheets on country GVCs are a key component of the qualitative analysis and CGE modelling of the quantitative analysis. The important telecommunication sector will be used as a representative service in much of the analysis.

Qualitative analysis of participation rates

    a.   Participation rates
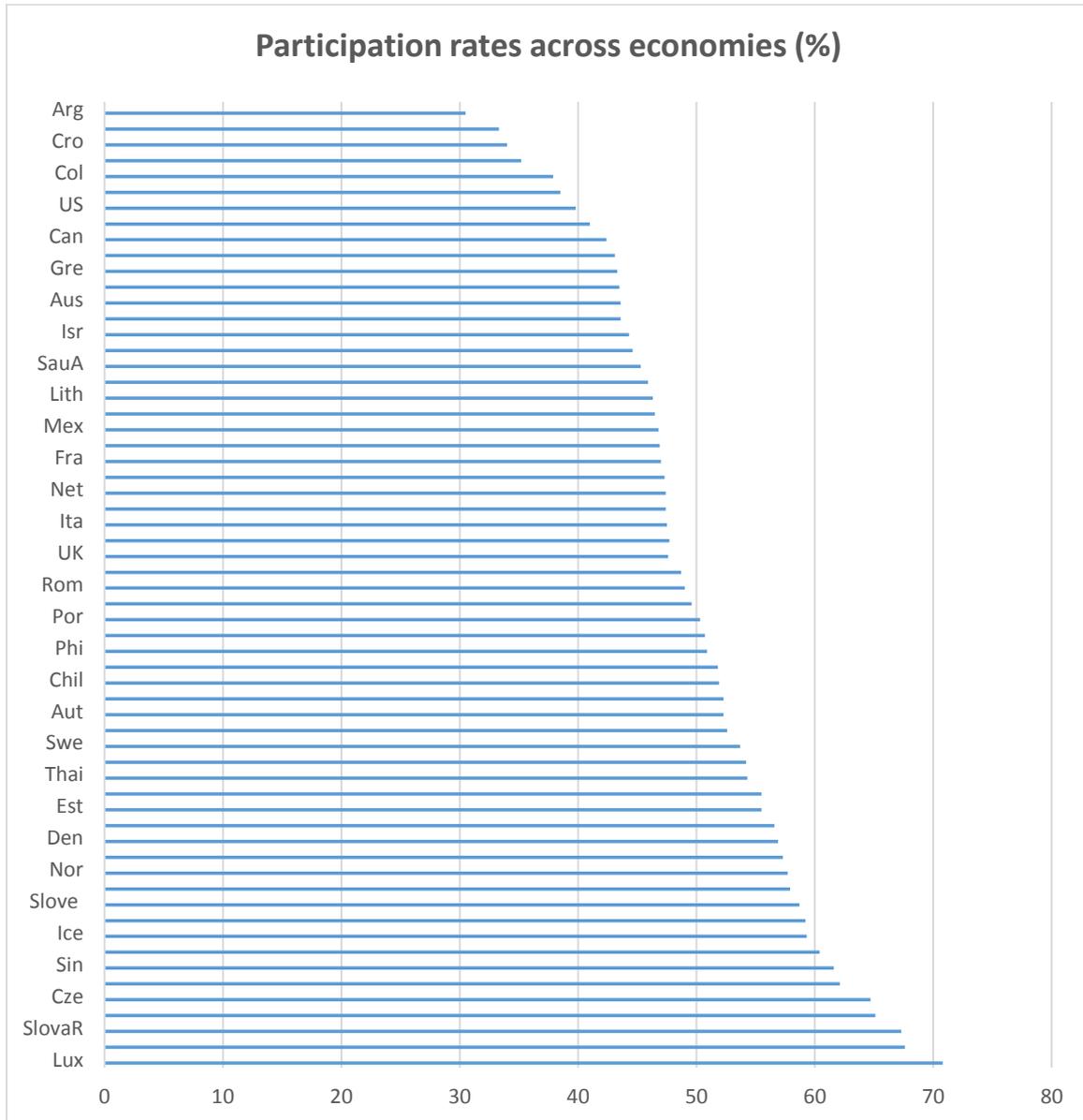
Australian participation rate moved up to 44 per cent in 2011 (Figure 1) (approximately 30 per cent attributed to Exports of intermediate goods and 14 per cent to Import content) (WTO 2016) with a growth rate of 12 per cent since 1995 (WTO 2016). Despite the significant growth rate, this participation rate ranks along with a number of other developed economies in the quarter of lowest participation rates of the 61 economies in the WTO list. Notwithstanding Australia's (and New Zealand's (NZ)) distance from world markets, its participation rate is higher than that of some big (in absolute terms) GVCs in developed economies like Canada (42 percent) and the US (40 percent), plus near neighbour NZ (33 percent), though not of Japan (47 percent), nor developing economies in China (48 percent), Korea (one of the highest at 62 percent) and Mexico (47 percent). What is noticeable from the participation rates is that large economies tend to have low values, along with resource rich economies like Australia and those with large services; and small economies tend to have large values. Geography can also be a key determinant of participation rates. Large economies generally have low participation rates as they only need to source a small proportion of overseas intermediate inputs and export many final goods. On the other hand, small economies need to source a large share of intermediate goods from abroad and thus

have larger participation rates. Resource rich economies tend to be involved in GVCs at the beginning of the chain before the need for many intermediate inputs, and hence will have low participation rates and mainly downstream/forward linkages, including in associated services like transport and telecommunications.

As mentioned earlier, Australia's comparative advantage might be expected to be more in resource and some service-based GVCs. Its participation is driven mainly through resources exports (mining dominating these) followed by service exports, both with downstream links, with (basic metals) manufacturing only marginally involved through upstream links or imports (as is mining to a similar extent). Mining in large miner Canada makes up a much lower contribution (6 percentage points) to Canada's slightly lower overall participation rate than it does to Australia's mining participation rate (16 percentage points) (OECD 2013). Australia's participation rates in agricultural and food GVCs are both around 1 percentage point contributions with agriculture being mainly forward/downstream (domestic inputs in foreign exports e.g. Australian vegetables in processed NZ exports) and food mainly backward/upstream (foreign inputs into Australian exports e.g. transport services). In NZ, amongst its highest GVCs participation rates were Agricultural at 3 percentage points (mainly backward e.g. foreign energy inputs in NZ exports) and 5 percentage points in Food (mainly backward e.g. Australian vegetables, tropical fruits etc processed in NZ). Australia's Transport and telecommunications participation is relatively high at around 4 percentage points, about the same as equally isolated New Zealand. However, Australia's costs to trade at the border (export or import) range between $1200-1220 per container whilst for NZ the range is a much smaller $825-870 per container. With time to trade, Australia's range is 8-9 days whilst NZ's is a larger 9-10, and with documents to trade Australia's is 5-7 and NZ a smaller 4-6 days (WTO 2016), the average total days roughly balancing out.

b. Value-added along manufacturing/services GVC

The resources comparative advantage, along with the "tyranny of distance", is reflected in Australia having a relative high domestic value-added in exports (Barua et al 2015) which is one component of the participation rate.

The majority of final demand for manufactured goods and market services in Australia represents domestic value added with foreign value added only around 25 per cent (OECD 2013). Market services has the largest domestic value added but foreign value added is more important in the final demand for manufactured goods. Value added in Australian food products final demand is mainly created domestically (70 percent) (as is NZ's). In the US, domestic value added in food products is 80 percent, as is Mexico's, and in its smaller northern neighbour, Canada, a low 50 percent. Australia's domestic value added is lowest in GVC related sectors like Electrical equipment (15 per cent) and Transport equipment (40 per cent). Australian Services levels of domestic value added are high, like Transport and Telecoms (80 per cent – higher than Canada, NZ and the US) and Finance and Insurance (85 per cent – lower than Canada, NZ and the US). It is not clear from the numbers whether these different values are due to aspects like different quantities and/or prices of the service and/or constraints on foreign participation.

c. Export shares in GVCs

Gross export shares are less meaningful than export shares in value-added terms in a GVC world. Australia's total exports represent around 1.6 per cent of total world exports in value-added terms, slightly above its share in gross terms (1.4 per cent). Mining is the most important at just under 6 per cent in both terms but with gross exports slightly larger. Other important industries being Agriculture, Food products, Base metals and Transport and Telecommunication services, are all around 3 per cent with value-added slightly larger. In comparison, Canada in Mining export shares is a higher 7 per cent in both terms, in contrast to its lower than the Australian participation rate contribution of mining, which takes into account foreign inputs. Wood & Paper is 5.5 per cent with value added larger along with

Food and Chemicals & Minerals, both at 2.5 per cent. Agriculture at 5.5 per cent and Transport & Telecoms at 4 per cent have Gross trade larger. NZ Agriculture is 1.4 per cent in both terms. Food at 1.5 per cent and Wood & Paper at 0.7 per cent are larger in value added terms. US has large values in most industries, especially Services (e.g. Business 25 per cent), and with value added larger, except for Agriculture at 15 per cent, Food at 10 per cent and Mining 2 per cent.

d. Competitiveness in manufacturing GVCs: role of services

Almost a third of the value of Australian manufacturing exports in 2009 represents growing services value-added, especially Business services and to a lesser extent Distribution, Transport and Telecommunications, and Financial services. The service value added of manufacturing exports has declined in some industries like Basic metals and Electrical equipment.

Australia has a relative high quantity or per unit costs/service value added in food exports compared to other relevant countries such as neighbouring NZ, large agricultural producers in Canada and the US, and large developing country, China (Fig. 7, OECD (2013) Complementary GVCs: Australia descriptive note). For example, on Wholesale, retail, etc services Australia's value is 11 per cent compared to NZ/US's 8 per cent and China's 7 per cent though Canada's are 14 percent; and on Transport, storage, telecoms etc Australia's value is a high 9 per cent, compared to another isolated country in NZ at 6, the US/Canada at 5 per cent and China 4 percent.

Services Trade Restrictiveness Indices (STRI)

Great strides have been made in the quantitative analysis of services, and their impacts, with the development of databases on STRI (e.g. World Bank 2016 with quite old data and OECD 2016a with a broader set of restrictions which has been updated annually over the last few years) and their use in econometric models to measure the impact of these restrictions (see for example MUTRAP 2010 and PC 2015b). The STRI has values between 0 (sector is fully open) and 1 (sector is fully closed). The index is made up of a weighted combination of key restrictions like foreign entry and barriers to competition.

Nordas and Rouzet (2015) Table 4 shows the relationships between Exports of goods under Broad Economic Categories, including some GVCs-related ones like Parts and accessories and Non-Durable consumer goods, and restrictions in services (mean STRIs) within broad categories. Table 1 here extracts from the Nordas and Rouzet (2015) table the more significant higher-valued elasticities for the GVCs-related goods. The elasticities are all negative as expected – GVC exports are constrained by higher services trade restrictions. Computer, Telecoms, Air and Maritime services are strongly associated with the more significant higher-valued elasticities but caution is given about inferring causalities from the elasticities.

Table 1: Relationships between exports of GVCs-related goods and services restrictions

	Parts and accessories	Non-durable consumer goods
Computer	-0.833**	-0.777***
Telecoms	-0.716**	-0.818***
Air		-1.954***
Maritime	-1.057***	-1.324***

Source: Drawn from Nordas and Rouzet (2015), Table 4

With services, the World Bank estimated the 2008 STRI in telecommunications for Australia as 25 per cent closed which was the 4th highest of Australia's services sectors and on the average of comparable economies. The highest component restrictions were on foreign entry and barriers to competition, both of which restrict openness. More recent 2015 STRI estimates by the OECD (2016a) using experts

weighting (OECD_STRI_telecommunications.pdf)[5] of restrictions and taking into account a broader range of domestic discrimination restrictions, came up with a slightly lower percentage closed, 22.9, and the same highest component restrictions. However, now Japan, which was in both the World Bank 2008 with a similar STRI to Australia as well as the OECD 2015 STRI datasets, was significantly more open than Australia at 17.0, suggesting Australia has gone backwards in relative terms.

Some examples of Australian GVCs trade constraints

Some reasons why GVCs involving Australia might be small, short and at the ends of the chains, such as a lack of comparative advantage, isolation and involvement in discriminatory trading arrangements, were discussed earlier. Now some further policy constraints will be briefly discussed before some CGE modelling is undertaken to estimate the benefit of addressing some of trade constraints.

An article in The Australian newspaper (2017a) about costly NTBs associated with the absence of harmonisation around accepted international standards not being addressed in Australia's PTA with China discusses Australian exports in agriculture and food to China but the same applies for Chinese exports to Australia. It is pointed out in respect of these standards that most restrict trade unnecessarily with no consumer protection or biosecurity benefits, acting as unjustified non-tariff barriers. Such trade restrictiveness barriers are broader in their costs than noted in the article: for example, raising prices and decreasing availability for (internationally) safe food; increasing disease risk through higher (protected) prices that encourage smuggling; and increasing the threat of retaliatory actions. Harmonisation of international standards on Maximum Residue Limits for pork (Australia's are currently twice as strict) have been estimated to increase Australian welfare by $25m and world welfare by $400m (Trewin 2016). Australia should unilaterally address its own costly non-tariff barriers.

Economic concerns like on competition from imported products are rightfully not an aspect of Sanitary and Phyto-Sanitary/Technical Barriers to Trade (SPS/TBT) arrangements, though many seem to be operated as though they are (Trewin 2016) and this constrains the development of GVCs. Take the case of Fijian fresh ginger imports to Australia. Fijian authorities requested the right to export fresh ginger to Australia in 2003 (Morgan, 2013). It took a decade before an import risk analysis was completed which approved the importation to Australia of Fijian fresh ginger imports under certain conditions like fumigation. However, this approval was further delayed by the lobbying of an Australian Senate inquiry on the effect of these imports, including on the future of the local industry. The local industry had been unable to continuously supply domestic processors like Buderim Ginger a few years back due to a disease outbreak and the company, which is involved in GVCs, began to import early-stage processed Fijian ginger in brine. Australian processors have continued with these imports to protect their supply chain and diversify their supply risk. Prices of fresh ginger have come down as a result of the recent Fijian fresh ginger imports, further assisting the development of related GVCs. A similar situation applied recently with respect to honey (The Australian 2017b). Australian processors and food manufacturers like Capilano have been diversifying their sources by increasing honey imports (in their case from overseas plants they own) in light of local supplies diminishing due to climate variation. The cheaper, more reliable imports have also provided consumers with a greater (price) choice and reliability of honey.

Another NTB constraining the development of GVCs mentioned earlier were non-economic anti-dumping actions. It would appear not to be in Australia's interests, regardless of the negative impacts on the development of GVCs, to put anti-dumping duties on more cheaply produced Chinese iron and steel products which assist the development of GVCs based on these intermediate inputs and which

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[5] Nordas et al 2014 had both equal and experts weighting values, and Australia's value did not change whilst Japan's changed by only 10 percent.

consist substantially of exported Australian iron ore. It has been accepted under the Australia-New Zealand Closer Economic Relations Trade Agreement (ANZCERTA) that a good being cheaper is an insufficient basis for applying punitive duties and that any anti-dumping action should be looked at under competition law (e.g. predatory pricing) of which none have in the many years that ANZCERTA has been in place. Cheaper iron and steel would have a significant impact on downstream domestic industries like construction and the overall economy. Apart from directly raising the price of some goods, spill-overs from anti-dumping action, like less competition over a broader range, leads to more extensive higher prices and less innovation.

WTO (2016) states that FDI "contributes to the structural and geographical diversification of multilateral enterprises. Its principal aims are to "slice up" the production process and seize the comparative advantages particular to each participant in the supply chain …". FDI has been found to be a key driver of the development of GVCs, for example joint interests in the chain working to break down trade barriers in all economies involved. FDI openness has been found to increase participation by over 20 percentage points (OECD 2015b). Thus differential FDI thresholds under which countries need not gain the approval of the Foreign Investment Review Board as applies in Australia can constrain the development of some GVCs, for instance in the sensitive agricultural and food area (e.g. Kidman cattle holdings in respects of Chinese FDI) where FDI, like Japanese investment in cattle and meat enterprises, helped develop GVCs.

These examples provide some explanation, along with isolation, excessive transport (e.g. shipping) costs, and non-open borders and discrimination on trade and investment, of why there have been no big Australia success stories like with electronics elsewhere as is apparent from the analysis, interviews and literature reviews, including of submission to recent relevant inquiries undertaken in the case study. The following qualitative CGE modelling puts some level of economic benefit on liberalisation of such constraints.

How can the (joint potential) impact of a liberalising enabling-service in a GVC say be measured if the associated good (or subsequent in-country service, say government customs services) have not been liberalised and negate any actual impact? Actual data would not show this potential but broad "what if" CGE modelling may be useful in this, as well as in other aspects such as addressing data limitations (e.g. yet to be collected data could be addressed through such applications). Moreover, the impacts of liberalising one economy's GVC-enabling services could have spill-overs (with shares dependent on market powers) to subsequent links that may or may not have been liberalised, requiring Australian and whole of chain impacts to be measured. In recent years Australian telecommunication services reforms have taken a backward step with the return to a government-owned "quasi"- monopoly fixed-line fibre-optic broadband network. Thus there is little recent reform to analyse with real data the impact of telecommunication services reform on GVCs. Modelling of the impacts of proposed reforms under the newly introduced multi-technology version of the NBN, some of which were introduced only within the last year or so and are ongoing, is required. This modelling needs to measure economy-wide, GVC-related aspects like intermediate inputs, as well as national and whole-of-chain impacts.

Quantitative analysis of trade barriers on GVCs

The question that is addressed here is what impact trade barriers have on domestic production and trade, and whether liberalisation would contribute to Australian industries (manufacturing, agriculture and minerals, and services) integrating into efficient future GVCs.

Liberalisation of telecommunication services is worthy of analysis because communications play an important role in integrating different stages of production and distribution. The first step in the analysis is to assess the current trade in intermediate goods and services. A second step is to show the upstream and downstream linkages between sectors. A further step is to make a judgement as to how trade may be affected if these impediments were eliminated or imposed. To apply, we use a well-known global

equilibrium model, GTAP, to assess the potential impacts of imposing trade barriers on upstream and downstream sectors, export industries and GVCs. GTAP (Hertel 1997) is a well-documented, static, multi-regional, multi-sector model that assumes perfect competition, constant returns to scale and imperfect substitution between foreign and domestic goods and services, and between imports from different sources. We use the Version 9, with a base year of 2011.

We simulate three hypothetical scenarios:

    (i)   a ten per cent reduction in the cost of importing communication services into Australia;

    (ii)   a ten per cent reduction in the costs of importing industrial inputs into Australia; and

    (iii)   a 35 per cent tariff on industrial goods imported into the United States.

The first scenario relates to communication services and the remaining two to trade in industrial goods. The second captures the observation that improved communications for example lowers the costs of managing a remotely located production process and therefore encourage fragmentation. While such costs will differ from one industry to the next, a ten per cent across the board cut illustrates the potential impacts. The third scenario, as President Trump proposed prior to his election, illustrates the negative impact of restricting imports when much of the value in the end product is added outside the final exporting country. Although much of the pre-election talk was about restricting imports from China and Mexico, it is obvious that to be effective the barriers would need to be imposed on a large number of exporters, otherwise exports from other countries would merely be substituted for those from China or Mexico. The first two scenarios reveal an increase in the use of imported intermediates, that is, integration into GVCs, while the third shows a decrease in integration. This implies, conversely, that trade liberalisation encourages GVCs.

    (i)   Australian liberalisation of trade in communication services

Liberalisation of telecommunication services is worthy of analysis because communications play a role in every sector. Table A.1 in the Appendix shows the use of domestic and imported intermediate inputs of communications by Australian firms. The three main users of communications as intermediate inputs are public administration, defence, health and education, and recreation in addition to business services nec (large values can be a sign of GVCs (Athukorala and Talgaswatta 2016)), retail trade and construction. Similar to recreation (film and television), education relies heavily on communication. Australia has a large export industry in secondary and tertiary education. This is a sector where improved communications could have a large impact.

However, the data show that communication services do not make up a large share of input costs even for the heaviest users, such as the retail trade, transport and recreational services. Some five per cent of the costs of recreational services are attributed to communications. Other sectors use less. The manufacturing sector outlays 1.6 per cent of its input costs on communications. This is close the national average of 1.7 per cent. The agricultural sector uses less than one per cent. This suggests that improving communication services is unlikely to have a large impact on productivity in agriculture and manufacturing, because communication services make up such a small component of total costs. However, this understates the potential gains because telecommunications, despite its relatively small economic size, is a tool that can increase productivity in seemingly unrelated areas. In this respect, it can be transformative. Telecommunications liberalisation was estimated to lift productivity across the whole economy (assumed at 0.1 per cent (Dee 2011)), resulting in more significant estimated economy-wide gains of US$3.2b per annum (Trewin and Vanzetti 2016).

Results (Table 2) show that reducing the cost of importing telecommunication services has a positive effect on each way trade and welfare ($128 million), but little impact on the use of intermediate imports. The estimated impacts on GVCs growth are generally slight because communications account for only a small share of costs across most industries. The sectors which most increase their use of imported intermediate imports are "Recreation and other services", which includes tourism, "Public

Admin/Defence/Health/Education", Sea transport, and "Gas manufacture and distribution", but in each case the change is less than one per cent, with the possible exception of recreation, health and education.

Table 2. Impact of ten per cent reduction in cost of imported communication services

	%
Australian imports	0.02
Australian exports	0.04
Australian imports of intermediates	0.12
Australia real wages	0.02
	$m
Australian welfare	128

Source: GTAP simulations.

GVCs involving Australia, apart from final stages, are small. As liberalisation in enabling services like telecommunications works both ways in the sense that it encourages imports and exports along the GVCs, liberalisation of domestic protection on specific in-country links in the chain, may have a more significant impact on GVCs. Accounting for the scope of telecommunication services liberalisation to lift productivity across the whole economy through aspects such as its embedded nature in GVCs, plus it being an instrument for new transformative technologies and a lever for investment, results in more significant economy-wide gains.

(ii)   Australian imported intermediates in the industrial sector

Inputs into Australian industrial production are shown in Table A.2 in the Appendix. The total in 2011 amounted to $407 trillion, of which $151 trillion or 37 per cent are imported. Of course the sectoral aggregation is arbitrary, but the share is inflated by motor vehicles and parts, transport equipment and electronics. The biggest users of imported inputs are construction and retail trade (distribution). The latter is a big user of motor vehicles.

Among industrial goods, as opposed to services, the biggest user of imported intermediates is "chemicals, rubber and plastic", motor vehicles and parts, fabricated metal products, and "Other machinery and equipment". About 17 per cent of industrial production is exported, although our data does not make it clear whether these exports are used in the production process or for final consumption.

A ten per cent increase in input-augmenting technical change in industrial imports coming to Australia effectively reduces the costs of such imports and leads to a substitution away from domestic production and a greater use of imported inputs, from 37 to 40 per cent. There is a 3.4 per cent increase in exports. The most significant increase in industrial exports are in the products which tend to use a large share of imported inputs (Table 3).

Table 3. Change in Australian imports and exports of industrial products

	Imports	Exports
	%	%
Textiles	12.4	6.7

Wearing apparel	7.6	1.7
Leather products	6.6	9.3
Wood products	4.3	10.2
Paper products, publishing	16	-1.5
Petroleum, coal products	9.6	5
Chemical, rubber, & plastic prods	3.8	11.7
Mineral products nec	4.8	8.2
Ferrous metals	7	1.3
Metals nec	9.3	14.1
Metal products	7.9	2.3
Motor vehicles and parts	26.4	1.5
Transport equipment nec	11.9	2
Electronic equipment	14.9	2.8
Machinery and equipment nec	13.6	13.5
Manufactures nec	1.7	-0.9

Source: GTAP simulation.

In Australian there is a national income gain of 0.5 per cent. Real wages are enhanced by 1 to 1.6 per cent depending on the type of labour.

However, in this scenario the technological change has come from nowhere, and is assumed costless in the modelling. In reality, infrastructure has to be put in place to allow such developments to occur. These costs are not taken into account here.

(iii)   US industrial imports

US imports of industrial goods amounted to $1,702 billion in 2011, of which a quarter came from China. The major categories were electronic goods such as mobile phones and television sets, and manufactured goods more generally. These attract fairly low tariffs, although footwear and apparel are notable exceptions, as are some agricultural products, such as nuts. Prior to the election, President Trump suggested a range of policies limiting Chinese imports, including a tariff on industrial goods of between 32 and 45 per cent (Campbell 2016). This was designed to attempt to assist American manufacturing workers, particularly in rust-belt areas. This policy has a number of shortcomings. One is that American consumers are likely to purchase imported goods from alternative exporters, such as Korea or Mexico. Another, of interest here, is that many of the inputs used in production in China come from the United States, because China is well-integrated into GVCs.

In China, over one third of exports include foreign content, and this figure is closer to 55 percent in the ICT and electronics sector, which dominates Chinese exports to the US (OECD 2015a). An example is Apple's iPhone. Despite being assembled in China, the country adds very little value to the final product: with a total cost of US$187, Chinese workers contribute only US$6.50 to the value of an iPhone, whilst Korea contributes US$80.05, Chinese Taipei US$20.75, and Germany US$16.08 (Thompson 2013).

To prevent importers merely switching their source to other countries, the US would have to impose tariffs on a range of countries. Table 4 shows the impact of a hypothetical 35 per cent tariff on all industrial goods from all countries, but not including primary products such as oil and gas, or agriculture. National imports would decline 24 per cent, whereas national output would increase 8 per cent as domestic production would substitute for imports. Industrial exports would also fall, as the exchange rate adjusts to keep trade in balance. A large share of these exports is used in global value

chains, but it is not possible to determine how much of this is for direct consumption and how much is used as intermediate inputs.

Table 4. Change in US imports and exports of industrial products

	Imports	Exports
	%	%
Textiles	-29	-43
Wearing apparel	-23	-47
Leather products	-13	-49
Wood products	-44	-37
Paper products, publishing	-44	-28
Petroleum, coal products	-38	-6
Chemical, rubber, & plastic prods	-40	-35
Mineral products nec	-38	-28
Ferrous metals	-38	-33
Metals nec	-38	-55
Metal products	-47	-42
Motor vehicles and parts	-34	-33
Transport equipment nec	-50	-46
Electronic equipment	-38	-60
Machinery and equipment nec	-46	-43
Manufactures nec	-36	-46

Source: GTAP simulation.

In the import side, the GTAP data allows us to trace the use of intermediate inputs. Table 5 shows the change in the share of imported intermediate imports in each sector. In the initial database most industrial products have a share of around 50-60 per cent. After a 35 tariff is imposed, the share drops to 10-20 per cent, although leather goods are an exception.

Table 5. Change in share of imported intermediate inputs in US industry

	Initial	Final
	%	%
Textiles	0.57	0.23
Wearing apparel	0.55	0.10
Leather products	0.58	0.46
Wood products	0.53	0.10
Paper products, publishing	0.53	0.04
Petroleum, coal products	0.52	0.12
Chemical, rubber, & plastic prods	0.55	0.17
Mineral products nec	0.53	0.10
Ferrous metals	0.55	0.16
Metals nec	0.58	0.26
Metal products	0.54	0.08
Motor vehicles and parts	0.55	0.26

Transport equipment nec	0.55	0.15
Electronic equipment	0.59	0.26
Machinery and equipment nec	0.56	0.21
Manufactures nec	0.56	0.20
Average	0.55	0.18

Source: GTAP simulation.

The policy succeeds in creating manufacturing sector jobs in the United States but real wages fall marginally because consumers must pay more for their goods. The effect is 1-2 per cent, depending on the type of labour. GVCs are diminished, both in the United States and in other countries using industrial US goods as inputs.

Conclusions

This paper analyses why Australia's participation in GVCs, both inwardly and outwardly, appears low. The analysis includes some assessment of how trade barriers impede integration into future liberalised GVCs.

Global fragmentation of supply chains is driven by better technologies that enable fragmentation and lower costs, especially in telecom and transport services, in conjunction with open trade policies that provide better access to inputs and for outputs along the chain. Services have a significant role in GVCs, both as a link between production processes and indirectly through their embodiment in these, plus more generally as a transformative technology that stimulates innovation.

Despite the various phases of reforms such as in Australia's telecommunications sector many years ago, participation in GVCs remains small. As liberalisation in enabling services like telecommunications helps both imports as well as exports (e.g. on-line retail sales), liberalisation of domestic import protection on specific in-country links in the chain will have a more significant impact on GVCs. Complementary reforms in other areas along the chain such as with RoOs, anti-dumping actions, CoOL, SPS plus cross-border as well as other constraints on services trade and investment will be necessary before reforms in telecommunications sectors themselves can impact on GVCs. Qualitative analysis of Australia's apparent low participation rate, short links and of the initial end suggest these may not matter. What would matter is if the participation rate etc does not reflect its potential in terms of maximising value added as a result of trade policies distorting inputs and outputs along the chain.

Quantitative analysis of a hypothetical communication services trade reform, a productivity increase in the use of industrial intermediates and a US tariff on industrial imports indicate that the impact on GVCs is mixed but an underlying message is that trade liberalisation encourages GVCs.

Communications are a small cost in most industries, and imported intermediates are a small fraction of that. Here we have assumed a ten per cent improvement, implemented over the medium term of 3-5 years. This is large, but not inconceivable, given underlying productivity growth of 1-2 per cent per year. However, like the railways or electricity, communications have the scope to be transformative, leading to greater gains in productivity than the analysis suggests. If better communications leads to greater use of imported intermediates in the production process across the board, the potential gains are much greater. The estimated welfare impacts on GVCs growth from liberalisations that reduce the costs of just imported telecommunication services are generally slight, estimated at US$128m, because communications account for only a small share of costs across most industries, with the possible exception of Recreation, Communications and Transport. However, telecommunication services liberalisation may lift productivity across the whole economy as, despite telecommunications relatively small economic size, it is a transformative tool that can increase productivity in seemingly unrelated

areas, resulting in more significant estimated economy-wide gains of US$3.2 billion from just a 0.1 per cent productivity increase (Trewin and Vanzetti 2016).

A ten per cent increase in input-augmenting technical change in industrial imports coming to Australia effectively reduces the costs of such imports and leads to a substitution away from domestic production and a greater use of imported inputs, from 37 to 40 per cent, resulting in greater participation in GVCs. There is a 3.4 per cent increase in exports and a national income gain of 0.5 per cent.

A tariff policy that affects national trade will have a significant impact on GVCs. However, a bilateral tax that affects imports from one country, such as China, will have only limited impact because national trade is not greatly affected. This result is driven by the Armington elasticities in the model, which determine the ability of countries to switch sources of supply or to find alternative destinations for their products. For this reason the United States would need to impose similar tariffs on Chinese competitors.

The conclusion from our quantitative analysis is that the imposition or removal of trade barriers multilaterally has a relatively significant impact on GVCs, depending on the size of the barrier. Our results would be enhanced if we allowed the scope for retaliation by trading partners which would surely lead to a more dramatic result.

Our modelling is limited by the absence of data on the share of exports that are used as intermediates. We know this share on the import side, but not for exports. Therefore, we cannot be sure that exports from a specific country are used as intermediate inputs or as final consumer goods. Moreover, our analysis cannot trace the links in the chain, that is, the different stages of production that occur in different countries. As trade barriers are reduced, the number of links is likely to increase.

Key lessons for GVCs reforms from the above analysis include that they require an open-trade and investment environment. GVCs in light of analysis of value-added trade measures reinforce previous trade policy analysis recommendations on openness, namely that non-discriminatory multi-lateral trade reform is the most effective way to improve national and global welfare (closely followed by the more effective unilateral trade reform which is not dependent on agreements with a large number of other economies); policies that seek to lower import and other business costs have the best chance of promoting firm and economic growth; and policies that seek to pick so-called "winners" (e.g. trying to grow inefficient industries, sometimes providing assistance through restricting competition or through subsidies) invariably disadvantage more competitive activities, such as through diverting efficient resource-allocation and it is better to introduce pro-competitive policy reform and appropriate investments in physical and human capital (PC 2015a).

The analysis also suggests (e.g. Low 2016) that there should be an increased priority to services, given the evidence of their greater importance with value-added data, addressing impediments of service delivery to manufacturing and resources trade as well as direct services trade by factoring services into economic and policy analysis. Specific policy reform lessons are set out in the following Box.

Policy Reform Lessons

- **In general, open up GVCs to trade and investment, promoting activities with comparative advantage, though the opening may need to be undertaken incremental such as through credible industry plans**
- **Encourage foreign entry (e.g. no inconsistent FIRB FDI thresholds)**
- **Reform trade though the most effective non-discriminatory multi-lateral trade agreements or the more assured effective uni-laterally trade (e.g. preferential-light Rules-of-Origin (RoOs), economics-based anti-dumping, no Country-of-Origin Labelling (CoOL), SPS based on international standards, etc)**
- **Remove trade restrictions on data flows across borders to the extent that they are the least restrictive to address privacy, security and other legitimate public policy objectives**
- **Lower import and business costs to promote GVC firms and economic growth**
- **Facilitate trade such as by reducing supply-chain barriers (e.g. single windows, self-certification & appropriate capital investment)**
- **Commit to continuous structural reform given the dynamic nature of services**
- **Don't "pick winners" as invariably this disadvantages competition (small but efficient resource use is good, unlike large and inefficient resource use)**
- **Know the costs and benefits of current and prospective regulations**
- **Increase priority to services, given its recently estimated high revealed value added**

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GTAP Data Appendix

Table A.1 Use of domestic and imported communications of Australian firms, 2011

	Domestic	Imported
	US$m	US$m
Crop products	369	9.3
Livestock products	386.4	12.3
Forestry	8	0.2
Fishing	10.7	0.4
Coal	113.6	1.8
Oil	35.2	0.8
Gas	23.5	0.4
Other minerals	197.7	3.3
Textiles	27.6	0.8
Wearing apparel	25.1	0.6
Leather products	2	0
Wood products	83.5	2.8
Paper products, publishing	369.9	12.5
Petroleum, coal products	50.6	1.5
Chemical, rubber, plastic prods	285.5	8.5
Mineral products nec	187.6	6.2
Ferrous metals	63.7	1.9
Metals nec	53.1	1.5
Metal products	163.2	5.4
Motor vehicles and parts	114.6	3.6
Transport equipment nec	54.2	1.5
Electronic equipment	177.5	1.5
Machinery and equipment nec	377.1	6.1
Manufactures nec	96.1	1.7
Electricity	148.5	4
Gas manufacture, distribution	38	1.2
Water	129.8	4.3
Construction	1753.5	53.8
Trade	6061.3	165.8
Transport nec	2786.8	65.4
Sea transport	31	1
Air transport	96.1	3.2
Communication	4838	193.4
Financial services nec	720.6	17.9
Insurance	166.7	4.2
Business services nec	6415.6	169.1
Recreation and other services	2227.2	68.9
Pub. Admin/Defence/Health/Education	5770.7	167.6
Dwellings	34.9	1

	Domestic	Imported
Capital goods	115.6	0
Total	34609.4	1005.4

Source: GTAP v9 database.

Table 4. Intermediate industrial inputs, Australia, 2011

	Domestic	Imported	Import share
	$m	$m	
Textiles	3970	2941	0.43
Wearing apparel	1147	847	0.42
Leather products	446	833	0.65
Wood products	14247	4782	0.25
Paper products, publishing	31644	3424	0.10
Petroleum, coal products	17372	6606	0.28
Chemical, rubber, & plastic prods	36711	21988	0.37
Mineral products nec	20644	2338	0.10
Ferrous metals	22193	3574	0.14
Metals nec	9717	9769	0.50
Metal products	30127	6143	0.17
Motor vehicles and parts	17497	21194	0.55
Transport equipment nec	8697	8034	0.48
Electronic equipment	7375	16019	0.68
Machinery and equipment nec	26966	40560	0.60
Manufactures nec	8250	1750	0.18

Source: GTAP v9 database. Industrial products excludes agriculture and food, minerals and energy and services.