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Agro-food trade, GVCs and agricultural development in ASEAN

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AGRO-FOOD TRADE, GVCS AND AGRICULTURAL DEVELOPMENT IN ASEAN

Jared Greenville and Kentaro Kawasaki, OECD

The countries that comprise the Association of Southeast Asian Nations (ASEAN) have expanded their involvement in global agro-food trade through strong regional production growth and increasing consumer demands from population growth and higher incomes. Regional and international agro-food markets have thus become an important source of income and food for the regions producers and consumers. However, growth in trade has lessened in recent years with projections suggesting a further slowing over the medium term. This study explores the role that agro-food trade and participation in agro-food global value chains (GVC) has had on regional agro-food sectors and current barriers that are holding the region back from unlocking the full benefits of further integration into regional and global agro-food markets. It finds that although GVC engagement has increased regional agro-food growth between 2004 and 2014, gaps remain in the level of regional integration. Results from the analysis suggest that reducing the remaining tariff and non-tariff barriers, and creating an enabling environment to allow agricultural producers to better access service inputs, will help spur sector growth and agricultural incomes.

Key words: Agriculture, agricultural trade, regional integration, ASEAN

JEL codes: F14, F15, F60, Q17, Q18

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Executive Summary

Since 2000, the Association of Southeast Asian Nations (ASEAN) region has increased involvement in international agro-food markets, which play a larger role today in producers' incomes and in food supplies for consumers. Involvement in these markets also has consequences for the development of agro-food sectors across the region. This study aims to outline the relative competitiveness of ASEAN agro-food sectors (both regionally and globally) and to explore the changes that participation in international agro-food markets, and in global agro-food value chains (GVCs) more specifically, have had on domestic value added growth. In doing so, it seeks to explore the policy factors that have helped and hindered agricultural development.

ASEAN's involvement in international agro-food markets has been facilitated by its participation in agro-food GVCs. The region, while engaging in regional trade, has been mostly outward focused in its GVCs linkages. The strongest growth in GVC linkages are seen with the People's Republic of China (hereafter "China"), Europe, South America and South Asia.

For ASEAN's major export products – such as rice, palm oil and processed food products (much of which is related to fisheries) – the sectors' backward (buying foreign inputs from GVCs) and forward (selling inputs into GVCs that cross multiple borders) participation in agro-food GVCs mirrors those in other countries. Agricultural sectors, as an upstream supplier of primary products, have higher forward participation, and food sectors have a higher backward participation as more of their output goes straight to the final consumer. The region's major export products generally have higher forward participation, but lower backward participation compared with world averages.

The growth in agro-food exports from the region – from USD 31 billion in 2000 to over USD 129 billion in 2015 – has been underpinned by strong regional competitiveness in agricultural and food products. For agricultural products, the estimated relative comparative advantage at the country level has a geographic dimension – countries in the Mekong Delta show higher levels of comparative advantage than others. The picture is more mixed at the sector level, with other countries such as Indonesia and Malaysia displaying a strong comparative advantage in oilseeds related to palm oil production.

For food sectors, comparative advantage is less about geography and climate than is the case for agriculture. The key food sectors for the region are processed rice and vegetable oils and fats based on the high levels of primary production in the region. For other more transformed sectors, the comparative advantage is lower.

Agro-food GVC participation has also played a positive role in the development of the agro-food sector in the region. The use of foreign inputs to produce the region's agro-food exports (and by extension for all production more generally) has had a positive impact on total growth in domestic value added in the sector and in exports. The results suggest that ASEAN members with higher backward GVC participation in 2004 (that is, those with greater use of foreign inputs) experienced greater domestic value added growth over the following ten years as compared to those with lower participation.

GVC participation also supports a large share of the workforce in ASEAN (expressed as a share of total payments to labour). ASEAN's share of the total workforce across members that is reliant on ongoing agro-food GVCs is relatively high at an average of 4.9% (2014 figures, in

value terms), likely driven by the high shares of labour involved in agriculture and the sector's position as a net exporter. The dynamic impacts of GVC participation also mean that the returns to labour and other factors of production have also increased, in particular those of land and unskilled labour. This suggests that the use of foreign inputs in the production of agro-food products is beneficial for growth in labour returns (which may be number of jobs or higher wages or potentially both) and the returns to agricultural land owners.

While a number of positive developments are identified, some trends point to areas of concern. For a number of the key export products (rice and fishing), estimates at the regional and country level show high but falling levels of comparative advantage. At the same time, there have been stagnant or falling levels for other agro-food sectors, with the exception of strong growth in vegetable oils and forestry. While part of this is linked to growth in non-agriculture and food sectors, which is helping drive adjustment in agriculture, the presence of other factors such as the falling service share of agro-food exports and the policy mix directed at the agro-food sectors point to the potential to enhance agro-food competitiveness.

These trends suggest that ASEAN policy makers should intensify policy reforms that could help further the comparative advantage and returns from GVCs in the agro-food sectors. The agriculture sector in ASEAN remains relatively protected. Unilaterally reforming tariffs applied on agro-food imports has the potential to grow domestic value added creation from GVC participation in several ASEAN members and has the potential to grow backward participation, which may have longer term impacts on sector growth. However, given ASEAN's integration into world markets, tariffs faced in other markets also matter. The impacts of these barriers are significant and limit the potential gains for ASEAN members in participating in agro-food GVCs.

Beyond tariff barriers, ASEAN members' non-tariff measures create significant trade costs. A 15% reduction in these, solely between ASEAN member states through measures to improve regulatory harmonisation – such as in the processes within ASEAN's working groups – can have significant impacts on GVC participation and domestic value added creation. This study finds that improvements are seen for all ASEAN members and across almost all agro-food sectors, suggesting that such reforms would play a key role in enhancing GVCs in the region and harnessing the benefits they can bring.

Beyond trade policies, falling services use in the production of agro-food exports, particularly in business services that provide many “quality related” inputs to the sector, could limit the benefits from agro-food GVC participation. The results of the present analysis suggest that rising services use in exports is related to domestic value added growth, a trend seen in Viet Nam. These services often provide the links and the ability of agro-food sectors to participate in GVCs. Where this is a falling service share, and in general low levels of comparative advantage in service sectors, reforms to services trade restrictions could be a means to help promote agro-food GVC participation and domestic value added growth. Indeed, the performance of some sectors, such as government services and education, along with road and rail transport and construction, are important in shaping the enabling environment for the agro-food sector. Low performance in these services, or the lack of access to foreign suppliers of these services, can limit sector development as well as further increases in productivity. This would ultimately limit producer income growth.

1. Introduction

The Association of Southeast Asian (ASEAN) countries have become increasingly involved in international agro-food markets as their economies continue to develop (OECD/FAO, 2017). The strong increase in production and income growth has led to an equally strong increase in agro-food exports and imports, with the result that ASEAN has become increasingly influential in international agro-food markets for several products, either as supplier or consumer. In addition, ASEAN's involvement in international markets has influenced the development of those sectors in ASEAN that are involved and exposed to trade.

Trade is an increasingly important source of income for producers and food for consumers, with direct links to both sector development and to food security for a wide range of households. As in other countries, getting the most from international markets is important for ASEAN to leverage the benefits of trade for producers and consumers, as well as improve food security.

The nature of international trade in agro-food markets is also changing as it, much like trade in other goods, is increasingly taking place within global value chains (GVCs) (Greenville, Kawasaki and Beaujeu 2017a). ASEAN is not only a consumer of food and a producer of food for foreign consumers, it is also part of a larger international production system with interlinked supply chains and production systems. GVCs mean that the way trade influences both producers and consumers is more complex, in particular as the influence of policy is not straightforward, with protectionist policies such as tariffs, having negative effects on domestic outcomes for producers (Greenville, Kawasaki and Beaujeu, 2017a).

These changes suggest it is worth taking a closer look at how the development of the ASEAN agro-food sector has been influenced by the changing international trade landscape. These changes have implications for a wide range of policies, from those related to food security to those for the agricultural sector development.

This study will explore the changes that participation in international agro-food markets (and GVCs more specifically) have had on sector development in ASEAN, and the policy factors that have helped and hindered this. In examining changes in international market participation, the study will assess the relative comparative advantage of different agro-food sectors to explore the differences and opportunities across ASEAN member states. In particular, the revealed comparative advantage of key supporting non-tradable sectors will be explored to assess possible opportunities for domestic reforms to lift competitiveness and enhance the domestic returns from participating in international markets.

The findings and policy insights should shed light on areas that ASEAN member states should focus on to continue the development of their agricultural and food sectors. This process, along with moves towards trade openness, will continue to have, a positive impact on the region's food security – for both producers and consumers. The main focus of this study will be on the sectors that are important to the region. In this way, it will not pay equal attention to all 22 agro-food sectors for which data are available based on the Inter-Country Input-Output table developed from the GTAP database in Greenville, Kawasaki and Beaujeu (2017b).

This study will present changes in food production and trade across ASEAN (Section 2), provide a brief overview of the policy landscape that has influenced agriculture and trade within the region (Section 3), explore ASEAN's participation in global agriculture and food value chains (agro-food GVCs) (Section 4), and analyse the relative competitiveness of ASEAN's agro-food sectors and their key support sectors (Section 5). The final three sections will present the findings on the role that participation in international agro-food markets, and specifically the role of agro-food GVCs, have had on agro-food sector development (Section 6), present the policy influences on domestic value added growth and GVC participation (Section 7), and, finally, assess the implications for the region (Section 8).

2. The evolution of food production and trade in ASEAN

Growing agro-food production and development

ASEAN's main agricultural production activity is rice, which accounts for around 28% of the region's total agricultural output (in 2014). This share, however, has declined over time from 38% in 1964 as several countries shifted production towards other crops or towards livestock activities (Figure 1). This shift in production is also true for major rice-producing countries such as Viet Nam and Thailand, where despite strong growth in aggregate rice production, the share of rice in total agricultural production has fallen over time.

Figure 1. Production mix across ASEAN

Commodity shares of net production in constant 2004-06 international dollars, 1964 and 2014

Note: International prices are used to overcome issues in the aggregation of commodities that cannot be added up according to their physical weights. The FAO uses international prices in determining gross and net production values so that production trends can be seen without the influence of changes in exchange rates – see www.fao.org/faostat/en/#data/QV for further details.

Source: FAO (2017), FAOSTAT, <http://faostat.fao.org/>.

Both structural adjustment and diversification have played a role in the development of the region's agricultural sector (Figure 1), which has become a major producer of several cash crops that have supplied international demand in a wide variety of food sectors, e.g. palm oil, coffee and cocoa. These shifts have been accompanied by relatively strong productivity growth and area expansion. As noted in OECD/FAO (2017), total factor productivity (TFP) estimates (USDA, 2016) show high initial levels of input growth followed recently by stronger TFP growth. From the early 1970s onwards, however, new agricultural land use has been a key driver of output growth.

The shifts in the production systems of ASEAN countries has led one of the strongest growth periods in agricultural production in the world (Figure 2), surpassed only by other countries in Asia (driven largely by China). The region has seen continued strong growth since the 1970s, with a rapid acceleration occurring since the early 2000s.

This strong growth rate has increased the region's share of total world agricultural production; however, as may be expected from a region with relatively limited land resources, its overall share remains relatively small (Figure 3). In aggregate terms, ASEAN members¹ contributed in 2014 around 8.1% of the world's total agricultural output, up from 5% in 1964.

Figure 2. Growth in agricultural production in Southeast Asia

Growth in net production in constant 2004-06 international dollars from 1961 to 2014, index values (1961=1)

Note: International prices are used to overcome issues in the aggregation of commodities that cannot be added up according to their physical weights. The FAO uses international prices in determining gross and net production values so that production trends can be seen without the influence of changes in exchange rates – see www.fao.org/faostat/en/#data/QV for further details.

Source: FAO (2017), FAOSTAT, <http://faostat.fao.org/>.

¹ Depicted as Southeast Asia as the regional FAO aggregate also includes Timor-Leste.

Figure 3. Regional shares of global production

Share of net production in constant 2004-06 international dollars (%), 1961 to 2014

Note: International prices are used to overcome issues in the aggregation of commodities that cannot be added up according to their physical weights. The FAO uses international prices in determining gross and net production values so that production trends can be seen without the influence of changes in exchange rates – see www.fao.org/faostat/en/#data/QV for further details.

Source: FAO (2017), FAOSTAT, <http://faostat.fao.org/>.

Increasing the level of food security

Both agricultural development and strong overall economic development have led to significant declines in food insecurity in the ASEAN region. GDP growth has been relatively strong – a trend that is expected to continue into the medium term with four countries in the region expected to see higher per capita growth over the next 15 years than they saw over the past 15 years (OECD/FAO, 2017).

Figure 4. Undernourishment rates in Southeast Asia

3-year moving averages of undernourishment rates (%), 1999-2001 to 2013-15

Source: FAO (2017), FAOSTAT, <http://faostat.fao.org/>.

Overall, this region has experienced one of the world's strongest declines in food insecurity, as measured by the FAO's prevalence of undernourishment rates (Figure 4). However, although undernourishment has fallen significantly, there do remain areas of concerns related to stunting and wasting (OECD, 2017a). Analysis of household level data also suggests that despite the progress made a large proportion of the population in several ASEAN countries risk food insecurity (OECD, 2017a); that is, individuals sufficiently close to undernourishment thresholds would be vulnerable to changes in food prices or supplies.

Increasing involvement in trade

With growing per capita production, ASEAN's role in world agro-food trade has been expanding (Figure 5). While the region has been a net agro-food exporter since the early 1990s, this position increased considerably since the early 2000s; in 2015, exports were around USD 130 billion, compared with USD 88 billion in agro-food imports (WITS, 2017).

Figure 5. Total agro-food imports and exports from ASEAN

Value in nominal USD billions, 1990 to 2015

Source: WITS (2017), World Integrated Trade Solution,
<https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.

Vegetable and animal fats and oils – in this case, palm oil – are the most important agro-food export for the region (Figure 6). Palm oil accounts for the largest share of the value of agro-food exports, at around 30% of the total. However, this share has fallen in recent years. Fisheries products are the second largest export item (in value terms), with ASEAN accounting for 15% of world fish exports in recent years (OECD/FAO, 2017). Overall, the region's export mix is relatively concentrated, with the top ten products accounting for over 75% of total export value. There is greater diversity on the import side where the top ten products account for just over 55% of total imports. Flours, brans and other food industry preparations and residues, dairy products, fish and seafood, and wheat are all major imports.

Rice is also a significantly traded crop in the region. Overall, ASEAN is a net exporter of rice, with export values in 2014 five times greater than import values. The net export position is driven by Thailand and Viet Nam, with Cambodia also becoming a net exporter in recent years (Figure 7).

Overall, these shifts in ASEAN's participation in international markets mean that regional food supplies and regional producer incomes are increasingly reliant on international markets. Given the concentration of exports mix, it also suggests that specific value chains associated with these exports, and remaining competitive within them, is important for ASEAN producers.

Figure 6. Main agro-food export and import products in ASEAN

Share of total agro-food exports and imports in nominal USD billions, selected years

Source: WITS (2017), World Integrated Trade Solution, <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.

Projections of future production and trade over the medium term do not suggest a significant change. The *OECD/FAO Agricultural Outlook* (2017) projects a deepening of existing trading positions, that is that ASEAN will export more of its current export products and import more of its current imports. However, slowing productivity growth and limits on land expansion and other input use (such as water) are projected to begin slowing production growth rates over the next 15 years. A further complicating factor will be the impact of climate change on the region's production systems, which is likely to be significant for some (OECD, 2017a; OECD, 2017b).

Figure 7. Main agro-food importers and exporters in ASEAN

Values of total agro-food imports and exports in nominal USD billions, selected years

Source: WITS (2017), World Integrated Trade Solution, <https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.

3. The current policy backdrop

Agricultural policies

Given the variety of production systems and differences in the relative strength of the agricultural sectors across ASEAN, the policy focus varies across countries. In general, however, much of the region's agricultural policy mix can be described as rice-centric; that is, policies in most ASEAN countries have a heavy focus on rice.

Recent OECD analysis provided a stocktaking of agricultural policies in ASEAN, both related to production-based policies and to innovation systems (OECD, 2017a). A brief summary of this analysis is provided below.

Production-based policies

ASEAN production policies are interlinked with self-sufficiency policies (Box 1) that seek to enhance domestic production. For most countries, these policies concentrate on rice. This focus has meant that for many countries, agricultural infrastructure investments and producer support have been heavily biased towards this sector. This is seen in both importing countries such as Indonesia and the Philippines (OECD, 2012; OECD, 2017b), and in exporting countries such as Thailand and Viet Nam (OECD, 2017a). Exporting countries have relied on interventions, such as restrictions on land use (a policy also applied in Malaysia), and production schemes, such as the paddy pledging scheme in Thailand.

In some ASEAN countries, production policies are interlinked with consumer policies through the use of public stockholding and public distribution. Indonesia, Malaysia and the Philippines all employ such policies. In each case, governments purchase supplies of staple products (mainly rice) at minimum prices to support producers and then distribute this rice at reduced prices to poor consumers. These policies create a dependency between consumer food security and producer policies, and can alter the incentives for production heavily towards staple crops.

Innovation systems

Agricultural innovation systems are considered to play a vital role in developing the sector. Research priorities are generally guided by national priorities and development objectives. The public sector has a dominant role in the innovation system, both as a funder and provider of agricultural R&D. But across ASEAN, most governments significantly underinvest in agricultural R&D, to the extent that innovation systems in some countries lack the research capacities to address the challenges facing their agriculture sectors. And in most countries, innovation systems have been established with limited engagement with farmers.

Governments also have a key role in managing and providing agricultural extension services. Extension systems are similarly underfunded and poor co-ordination of extension providers has resulted in gaps in coverage. However, several countries are reforming their systems to make them more participatory and responsive to farmers' needs.

Research agencies across ASEAN have developed strong linkages with a large number of international research institutes and development agencies, including as members of international research networks. There is also substantial co-operation between higher education institutes across the region.

Regional frameworks

ASEAN has relatively sound regional frameworks that seek to oversee domestic and trade-related agricultural policies. Key elements of these are related to food security. The ASEAN Integrated Food Security Framework (AIFS Framework) and the Strategic Plan for

ASEAN Cooperation in Food, Agriculture and Forestry (ACFAF) provide the basis of for regional efforts to tackle long-term food security. These regional frameworks include core policy areas and a number of “Strategic Thrusts”, which set out actions for ASEAN member states to address food security. They are supported by the ASEAN Plus Three Emergency Rice Reserve (APTERR), which seeks to provide food coverage across the region in times of severe, short-term need.

These regional policies fall under the wider ASEAN Economic Community (AEC) Blueprint. This overarching policy seeks to create one production base across ASEAN, agriculture included, with the ultimate aim of the free movement of production between ASEAN member states.

Box 1. Self-sufficiency: Regional or national?

A number of ASEAN members have in place self-sufficiency policies targeted at a range of different commodities (Table 1). In most, rice is a key part of the product mix, with a range of targets between full self-sufficiency or some set proportion of total annual consumption. The general aim of such policies is to reduce the reliance on imports on the assumption that domestically-sourced production is more stable and secure than that sourced from international markets. In this way, self-sufficiency and food security policies have been linked (OECD, 2017a).

Table 1. Self-sufficiency targets across ASEAN related to agricultural production

Country	Self-sufficiency target
Brunei Darussalam	Rice self-sufficiency of 20% by 2015 and 60% over the longer term (2035)
Cambodia	No specific self-sufficiency targets
Indonesia	Complete self-sufficiency (100% of domestic production) targets for rice, maize and soybeans by 2017 and beef and sugar by 2019
Lao PDR	Production targets for rice ~ 4.2 million tonnes by 2015 and rate of increase targets for other products. Absolute quantity targets of food production for some commodities
Malaysia	Self-sufficiency targets for rice of 90% of domestic consumption plus other production targets
Myanmar	No specific self-sufficiency targets
Philippines	Self-sufficiency in rice by 2013 but later abandoned set year target. Self-sufficiency in maize production by 2013
Singapore	Increase self-sufficiency levels to 30% for eggs, 15% of fish and 10% of leafy vegetable
Thailand	No specific self-sufficiency targets
Viet Nam	Maintain a 2.5% rice yield increase per year until 2020 and the set aside of 3.8 million hectares of land specifically for rice production.

Source: OECD (2017a).

However, where self-sufficiency targets are supported by market interventions the impacts on food security have been most often negative in aggregate, due to higher domestic prices (despite the benefits to producers with marketable surpluses – Swinnen and Squicciarini, 2012) and greater risks to supplies from greater exposure to more frequent domestically-based risks (OECD, 2017a).

A further consideration is that one goal of ASEAN is to create a common production base which includes agricultural production. When viewed from a regional perspective, ASEAN is self-sufficient in rice and is a very significant exporter of rice. With different climatic zones across its members, regional production is less variable than that in any one ASEAN member state.

In this light, further embracing the goals of ASEAN and the ASEAN Economic Community Blueprint mean that national targets for self-sufficiency are not required. However, for this to be fully achieved, both exporters and importers in the region need to have confidence in each other, suggesting that additional disciplines may need to be included in the regional architecture.

Agro-food trade policies

ASEAN member states continue to make use of a range of border barriers. Across the region, agro-food tariffs generally remain high; simple applied tariffs averaged 10% between 1995 and 2015, with the highest rates in Thailand and Viet Nam (Figure 8). Beyond tariffs, a range of other measures related to import licensing are also used – particularly in Indonesia, Malaysia, and the Philippines with respect to rice (the Philippines has also made use of quotas).

Figure 8. Average agro-food tariffs in ASEAN, 1995-2015

Source: WITS (2017), World Integrated Trade Solution,
<https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx>.

Non-tariff measures (NTMs) applied by ASEAN member states also influence trade and, along with and private voluntary standards, are playing an increasingly important role in influencing agro-food trade within GVCs. NTMs represent the range of laws, regulations and requirements that influence the flow of goods across borders. They include measures such as sanitary and phyto-sanitary requirements (SPS) and technical barriers to trade (TBT), along with customs procedures as trade requirements such as pre-shipment inspections. Most NTMs are in place to achieve legitimate regulatory goals, with effects found to be both trade enhancing and trade distorting (for example, see Disdier et al. 2008; Winchester, 2009; and Li and Beghin, 2012), but they can impose potentially significant costs (see Greenville et al., forthcoming). Similarly, private standards can increase costs and act as barriers, while at the same time potentially enhance the returns for those who can meet them (Smith, 2009; OECD, 2013b; Colen et al. 2012; Volpe-Martincus et al., 2010; Otsuki, 2011). In both instances, the cost-raising effects of such measures often disproportionately impact smaller producers (FAO, 2014).

SPS and TBT requirements are the most prevalent forms of NTMs used by ASEAN members on agro-food products (Figure 9). This pattern is common to all members where statistics are available, with close to all trade covered by some form of SPS or TBT. The exception is Lao PDR which has fewer TBT measures. Pre-shipment inspection (PSI) and quantitative restrictions (QR) are less common, but are used extensively in some countries in the region.

Figure 9. The use of non-tariff measures on agro-food trade in ASEAN

Note: Frequency is the share of agro-food product lines covered by at least one NTM of the types depicted. Coverage ratio is the share of imports covered by at least one NTM of the types depicted.
Source: Author estimates.

While all countries use NTMs, differences in the measures applied across the group means that intra-regional trade is also inhibited. Across ASEAN member states, most differences exist between SPS arrangements (Figure 10), with the Philippines having the largest proportion of lines with different requirements – close to 20%. Looking at similarities on a bilateral basis (Figure 11), while each ASEAN member is more likely to have a similar measure with one or more of its ASEAN trading partners, rates are still on average below 30%. Similarities with non-ASEAN trading partners are lower still, showing a range of regulatory differences among several of ASEAN's main trading partners.

Figure 10. Heterogeneity scores for agro-food NTMs across ASEAN

% of different types of NTMs per product line by type of measure (HS2 level)

Note: QRs are quantitative restrictions; PSI is pre-shipment inspection; TBT technical barriers to trade and SPS sanitary and phyto-sanitary.

Source: Author estimates.

Figure 11. NTM similarity scores for ASEAN member states

Share of similar NTMs between trading partners

Note: Calculated at the product level (HS2), indicates the share of similar type of NTMs between two partners for a product.

Source: Author estimates.

The use of NTMs, and in particular the differences in those applied among trading partners, can increase trade costs for both ASEAN and non-ASEAN exporters. One way to view these is to examine the extent to which NTMs raise the unit cost of products traded and to use this information to calculate an *ad valorem* tariff equivalent. These are shown in Figure 12. The estimates suggest that the combined effects of NTMs, on average across ASEAN, are akin to an equivalent tariff of 22%, almost twice the applied tariffs on agro-food trade. The largest effects of these measures are seen in the Philippines and Myanmar, with PSI and SPS/TBT respectively accounting for the largest increases in trade costs.

Figure 12. *Ad valorem* equivalent of NTMs in ASEAN

Note: Represents the tariff equivalent effect of NTMs.

Source: Author estimates.

It is important to note, however, that not all of the value of the *ad valorem* equivalent can be seen as an inefficient trade cost, as part of this cost may be due to legitimate regulatory constraints on trade. This is the case for TBT and SPS measures which represent the largest cost effects of NTMs for ASEAN member states, reflecting their greater use.

Participation in regional trade agreements

ASEAN has become increasingly involved in preferential and regional trade agreements (RTAs), with a marked increase since 2000 (three agreements compared to 41 in 2017, Figure 13). This increase reflects both collective ASEAN-wide agreements with other countries (such as the ASEAN-Australia-New Zealand agreement) and those between individual ASEAN members and other countries (where both Singapore and Malaysia have been active).

With the increase in RTAs, trade among ASEAN member states and between member states and the rest of the world is increasingly governed by various rules of origin (RoO). RoO ensure that only products produced within the member group can access the concessions of the agreement and can take various forms. RoO applied on agricultural products can require substantial transformation – the product must have changed HS chapter, heading or sub-heading – or require a specific technical process, minimum value added content, or production wholly within a member country. RoO are often combinations, with products required to meet both a change in tariff classification and some other measure.

For agro-food products in total, the composition of RoO in ASEAN RTAs is shown in Figure 14. Taken at a broad level (change in tariff classification type and “other”), the most common RoO requirement in collective ASEAN RTAs are “other” requirements including minimum value added content, technical process requirements (or a combination of both), or requirements to be wholly produced in the originating country. In the ASEAN-Japan, ASEAN-Australia-New Zealand, ATIGA, and those agreements between individual ASEAN member states and other countries, change in HS chapter requirements are most common. The lowest product coverage of RoO exists in the ASEAN Trade in Goods Agreement (ATIGA) and the ASEAN-Australia-New Zealand agreement.

Figure 13. ASEAN's involvement in preferential and regional trade agreements

Incidence of new agreements and stock of existing agreements, 1976 to 2017

Note: Agreements include those between ASEAN members, between ASEAN as a group and other countries and those of individual ASEAN members and other countries.

Source: WTO (2017), World Trade Organization RTA Database, https://www.wto.org/english/tratop_e/region_e/region_e.htm.

Figure 14. Types of RoO in ASEAN RTAs

% of tariff lines across all agro-food products

Note: CTC is change in tariff classification. For non-ASEAN group RTAs, average across range of agreement is presented. ASEAN represents the ASEAN Free Trade Agreement and ATIGA is the more recent ASEAN Trade in Goods Agreement.

Source: Author estimates.

4. ASEAN's participation in agro-food GVCs

With increasing participation in international markets, ASEAN's place and engagement in GVCs has also been changing. In this section, two aspects of GVC participation are explored. The first relates to ASEAN's place in world flows of value added used in other countries' exports. The second relates to GVC participation based on the concept of vertical specialisation, the backward and forward indicators of GVC participation.

Different approaches have been used to characterise the forward and backward participation of a country in GVCs. The most commonly applied approach is based on indicators of "vertical specialisation" (Hummels et al., 2001; Koopman et al., 2011). These indicators are based on value chain participation in terms of the origin of the value added embodied in exports both looking backward and forward from a reference country; backward for foreign value added embodied in exports and forward for domestic value added used as inputs to produce exports in the destination country. The indicators are calculated from inter-country input-output tables (ICIOs) (as in Timmer et al. 2012; OECD 2013a; OECD 2013d; and UNCTAD 2013). Greenville, Kawasaki and Beaujeu (2017a;b) used such indicators to depict forward and backward participation for 20 agro-food sectors in 2011. These indicators, however, have limitations. They represent average results for industries with often very heterogeneous firm structures (or farm types), with some firms solely serving domestic markets and others specialising in exports.

Briefly, the backward participation index is measured as the share of foreign value added that is included in the total export value of a country. The forward GVC participation index is measured as the share of a country's value added arising from its own exports included in exports of other countries.² The indexes measure very different forms of engagement. For example, a country that is predominantly assembling products into final goods and subsequently exporting these will have a strong backward participation index but a small forward participation measure. Conversely, a country which predominantly supplies intermediates to an assembler will have a strong forward participation indicator but a small backward participation measure. These participation measures therefore provide a metric of engagement in the form of buying from (backward participation) and selling to (forward participation) GVCs – in other words, the demand and supply sides of the value chain activity. Differences across countries in forward and backward participation can then be analysed to explore the structural and policy determinants that underpin engagement in GVCs.

Flows of agro-food domestic value added

The export of agro-food domestic value added for use in other countries' exports provides one means to visualise the landscape of agro-food GVCs and how this has changed over time. For a given country or region, the use and consumption of foreign value added and the use of its value added in other countries partially indicates its connectedness within global agro-food value chains. For the agro-food sector as a whole, these linkages are drawn out in Figure 15. The relative intensity of the shading indicates the change in value terms of value added flows between countries between 2004 and 2014 (levels data are present in Annex 2).

² The calculation of value added exported for a sector includes both that embodied in direct exports and that which is captured in the export of other using domestic industries. For example, if the paddy rice industries exports directly into a production process in another country that exports to a third country, but also the processed rice industry exports rice that it sources domestically to that same foreign processing industry, the value added attributed to the domestically sourced paddy rice within processed rice exports is included in determining the forwards participation of the paddy rice industry.

Reading Figure 15, going across the rows to the right shows the increase in a country's exports of agro food value added used in other countries' exports; that is, changes in selling into GVCs. Going down the columns shows the change in the source of foreign value added used in a country's own exports; that is, changes in buying from GVCs.

The results show that ASEAN's integration into agro-food GVCs has been particularly strong with China, South America and South Asia (India predominately). Between 2004 and 2014, ASEAN exports of agro-food value added used in other countries' exports accounted for 9% of the increase in total trade in value added within agro-food GVCs globally (its forward linkages). ASEAN's purchases of value added from other countries for use in its own exports accounted for 14% of this total increased trade in value added within GVCs (ASEAN's backward linkages).

Figure 15. Changes in regional flows of agro-food value added, 2004-14

Note: The table shows the growth rate between 2004 and 2014 of value-added created in agro-food sectors in Origin country that is included in Destination country's (total) export.

Source: Author estimates.

ASEAN's intra-regional growth in trade in value added as a source for the production of exports has been relatively low (that is, forward linkages within the ASEAN group of countries). Of the region's increase in agro-food exports of value added between 2004 and 2014 for use in the production of other agro-food exports, only 18% went into the production of regional exports with the rest sent to other regions across the world for use in their exports. However, as a share of the value added that was purchased by ASEAN member states for the production of their exports (that is, backward linkages within the ASEAN group of countries), the amount is larger. Out of the increase in purchase of value added for the production of ASEAN agro-food exports, 42% was sourced from the region. Overall, this suggests that ASEAN sources regionally for its exports, but is a global supplier of inputs for the production of agro-food exports around the world.

Figure 16. Bilateral flows of gross exports and value added to and from ASEAN

Direct exports and direct and indirect flows of value added in agro-food products, USD million

Source: Author estimates.

In terms of bilateral flows of agro-food value added between ASEAN and key trading partners, in general, gross flows overstate the amount of value added that is traded (Figure 16). This occurs because of both re-purchases of own value added (from its global linkages) and purchases of value added indirectly from other countries. Only in the case of China are the direct and indirect flows of value added greater than the gross export flows. This is due to the large amount of value added supplied by China for use in the world's exports.

Participation in agro-food GVCs

By sectors

Food sector exports in ASEAN make use of higher shares of foreign inputs than agricultural sectors (Figure 17). Between 2004 and 2014 most food sectors (9 out of the 16 which exported in all years) increased their backward participation in agro-food GVCs. However, the processed rice and vegetable oils and fats sectors – two of the largest export sectors – were among the sectors which experienced falls, potentially due to further domestic development of the related agricultural sectors.

For forward participation, the major export crops – paddy rice and palm oil – dominate with high participation in ongoing GVCs. The higher results for these primary production crops also mirrors results in other parts of the world with agriculture, as a downstream industry, having higher rates of forward participation. That said, between 2004 and 2014, forward participation generally fell for most agro-food sectors in ASEAN. Only five of the 16 sectors that exported in all periods saw increases in their forward participation. This may be due to losses in competitiveness (discussed in the next section) or, due to the nature of the indicator, could be due to a shift to final products in the exports of these sectors.

Figure 17. Backward and forward participation by sector in ASEAN

Compared with world averages, in 2014 ASEAN's main export sectors generally had lower backward participation but higher forward participation compared with other countries (Figure 18). In total, six of the ten major export sectors had lower backward participation than the world average, with four of the ten having lower forward participation than the world average. For the main agro-food export item, vegetable oils and fats, ASEAN had lower backward but higher forward participation. This is likely due to its global dominance in the sector as a supplier of palm oil and the scale of the related domestic agricultural sectors. The result for processed rice is reversed, potentially reflecting the nature of the product (more consumed directly in final demand) and potentially the greater sourcing of inputs from within the region and abroad – such as paddy rice and other machinery and packaging inputs into the processing activity

Figure 18. World versus ASEAN GVC participation, 2014

Note: Estimates for sectors with more than USD 10 million in exports with outliers (estimates greater than 50) excluded.

Source: Author estimates.

By country

Across ASEAN, backward GVC participation was highest in Singapore, Viet Nam, Malaysia and Thailand (Figure 19). For Singapore, the results are to be expected; given the limited domestic agricultural production, most processing relies on imported intermediates. Where exports of agricultural products are recorded, they are often re-exports of previously imported products. Over time, however, backward participation has fallen potentially suggesting greater domestic processing, increasing Singapore's domestic value added content within these exports. Viet Nam, however, has become more open to foreign inputs over time, with a rising share of backward participation (on both simple and weighted average terms). Viet Nam has done this while maintaining strong export growth.

Forward participation is more variable and is biased by large export crops in some countries. On a trade weighted basis, Lao PDR has the highest rates of forward participation largely driven by its forestry sector. However, on a simple average basis, Indonesia and Malaysia have higher forward participation suggesting that a greater number of their smaller export sectors are involved in GVCs as input suppliers to chains that continue over multiple countries. A similar result is seen for the Philippines.

Looking at the changes in overall agro-food GVC participation over time for each ASEAN member state shows that around half of all countries involved in agro-food exporting increased participation and the other half decreased (Figure 20). The results varied depending on simple versus trade weighted averages (with trade weighted more representative of the agro-food sector overall, but simple averages allowing changes across all sectors to be better represented). For all countries, changes in forward participation were largely responsible for the overall changes seen. The largest change was seen for Lao PDR, again largely driven by changes in the use of its forestry sector exports.

Figure 19. Agro-food GVC participation across countries

Simple and trade weighted agro-food sector averages

Note: Rest of Southeast Asia includes Myanmar. Estimates for sectors with more than USD 10 million in exports with outliers (estimates greater than 50) excluded.

Source: Author estimates.

Of the large agro-food trading members of ASEAN, Viet Nam was the only country to see an increase in GVC participation on a trade weighted basis (although it fell on a simple average basis). On simple averages, both Malaysia and Indonesia saw total agro-food GVC participation increase, suggesting increases in agro-food GVC participation in sectors outside their main export products.

Figure 20. Change in ASEAN agro-food GVC participation, 2004 to 2014

Note: Rest of Southeast Asia includes Myanmar. Estimates for sectors with more than USD 10 million in exports with outliers (estimates greater than 50) excluded.

Source: Author estimates.

Composition of value added in exports

Domestic value added shares in ASEAN agro-food exports show that food sectors have lower domestic shares compared with agricultural sectors (Figure 21). The greatest overall share in value added is generally from agriculture, either directly or as an input into the food sector's exports. Services sector inputs are also important, more so than industrials, but remain below the levels seen globally.

Figure 21. Domestic value added shares of gross exports by sector, 2004 and 2014

Note: Trade weighted averages.

Source: Author estimates.

Between 2004 and 2014, the domestic share of export value remained relatively constant at 78% (Table 2). There was, however, a fall in the services share by around 2 percentage points in total across domestic and foreign. With a fairly stable industrials share in export value, this means that the share in export value from agriculture and food sectors increased.

Table 2. Composition and changes in industry shares of gross agro-food export value

Shares (%) across product groupings, 2004 and 2014

	Domestic share	Domestic services share	Foreign service share	Domestic industrials share	Foreign industrials share
2004					
Agro-food	0.78	0.11	0.06	0.05	0.09
Agriculture	0.89	0.06	0.03	0.04	0.07
Food	0.75	0.14	0.07	0.05	0.10
2014					
Agro-food	0.78	0.11	0.06	0.05	0.09
Agriculture	0.88	0.05	0.03	0.04	0.07
Food	0.75	0.13	0.06	0.05	0.09

Note: Trade weighted averages.

Source: Author estimates.

Service use in ASEAN agro-food production and exports

The falling levels of service use in ASEAN agro-food exports warrants further investigation to explore which service sectors are important and where those changes have taken place. Exploring the relative intensity of service use in exports (expressed as a share of total sector value added) highlights the fall that has been seen (Figure 22).

Figure 22. Relative service addition by sector to agro-food exports in ASEAN, 2004-14

Service value added in exports relative to total sector value added (%)

Note: Total sector value added weighted averages.

Source: Author estimates.

The main service inputs are from the business services trade, financial, insurance and transport sectors. The business services sector is a broad category and includes farm consultants and agents, research, development and extension along with plant and equipment hire and contractors. Trade represents retail and wholesale trade services, along with hotels and restaurants, repairs of motor vehicles, and the retail sale of automotive fuel. The fall in service use in ASEAN is largely due to a fall in trade and business services use which fell during the financial crisis and did not recover.

However, the aggregate masks differences across countries (Figure 23). There are both absolute differences in service use and differences within service sectors, both of which represent differences in the production structure of the agro-food sectors across ASEAN. Singapore's agro-food sector (predominately a food sector) is very different and much smaller than those in other ASEAN countries, and its relative use of business services is much greater than in other ASEAN countries. A similar pattern is seen in Viet Nam, which has a much higher relative use of business services compared with other ASEAN countries.

Figure 23. Relative service addition by service sector to agro-food exports by country, 2004-14

Service value added in exports relative to total sector value added (%)

Note: Total sector value added weighted averages for each country.

Source: Author estimates.

The overall changes seen at the ASEAN level have largely been driven by changes in Indonesia, Malaysia, and the Philippines (as some of the larger economies in the region). For these three countries, service use has fallen as the use of business services (Indonesia and Malaysia) and trade services (in the Philippines) has decreased. In contrast, Viet Nam, which has experienced strong agro-food sector growth and gains in competitiveness and returns from participating in world markets, has increased its use of trade and financial services.

Figure 24. Changes in service sector value added in exports by country

Change in service value added in exports relative to total sector value added (% point)

Note: Total sector value added weighted averages for each country and region as a whole.

Source: Author estimates.

Domestic sourcing for exports

Beyond service use, other domestic sectors underpin agro-food sector participation in GVCs. In ASEAN, as in other countries globally, the production of agro-food exports makes use of a number of inputs from other domestic sectors. Mapping these links at the sector level provides additional insights into the sectors that help underpin the competitiveness of agro-food exports. The domestic input use for agro-food trade in ASEAN is shown in Figure 25. This “heatmap” shows, with relative shading, the intensity of input sourcing of non-own sector inputs into sector exports. The column sectors are the exporting sectors with the row sectors the input supplying sectors. At the aggregate level, around 52% of inputs used in agro-food exports come from other agro-food sectors, largely because of the links between the food and agriculture sectors (which vary in importance for different sectors). The second largest domestic inputs for exports are the services sectors (discussed above), at close to 28% of total inputs used across the region.

Several common patterns emerge across the sectors in ASEAN. These include:

- The importance of oil (fossil fuels) and chemicals and plastics (fertilisers and pesticides) in all agricultural production is evident.
- Trade services are uniformly important for all agro-food sectors, with the exception of the region’s processed rice trade, along with financial and business services.
- The significant inter-dependence of agriculture and food sectors.
- There is feedback from the food sector (particularly the large and highly differentiated food products n.e.c. sector) to the agriculture sector. These links suggest that steps to improve the competitiveness of the both sectors will benefit the other, and that policies that place barriers on imports of inputs to the food sector may adversely affect the agriculture sector in the region.

Figure 25. Domestic sector-sector links for agro-food export production

Exporting Source	Paddy rice	Wheat	Cereal grains nec	Vege., fruit, nuts	Oil seeds	Sugar cane & beet	Plant- based fibers	Crops nec	Livest ock	Animal nec	Raw milk	Wool	Forestr y	Fishin g	Bovin e meat	Meat produ cts nec	Vege. oils and fats	Dairy	Proce ssed rice	Sugar	Food produ cts nec	Bev. and tobacco
Paddy rice								14%	29%	5%	28%	3%			4%	7%			70%		3%	5%
Wheat												4%									3%	
Cereal grains nec										4%	4%	3%									6%	
Vege., fruit, nuts							3%		4%	9%	7%	3%				4%		3%			9%	1%
Oil seeds										1%	4%	3%					50%		4%		5%	
Sugar cane & beet												7%						3%		47%		1%
Plant- based fibers																						
Crops nec			2%	8%	20%	17%	6%		3%	1%	11%	3%	6%	17%			4%	3%			3%	14%
Livestock						2%									42%			3%				
Animal nec						12%	7%									33%		4%				
Raw milk																		8%				
Wool																						
Forestry	19%		5%			10%						3%		4%								
Fishing								5%	4%												10%	
Bovine meat																						
Meat products nec																						
Vege. oils and fats																						
Dairy																						
Processed rice																						
Sugar																		3%				1%
Food products nec						7%	2%	3%	7%	24%	10%	6%		7%	3%	8%		7%				2%
Bev. and tobacco																						
Other mining		3%	3%	3%	3%	3%	3%	3%				3%	4%	3%		3%	3%	3%	3%	3%	3%	3%
Oil	20%	18%	14%	8%	3%	7%	11%	10%	3%	3%	8%	24%	19%	3%	3%	3%	3%	3%	3%	3%	3%	7%
Textiles																						
Apparel																						
Leather																						
Wood																						
Paper																						5%
Chem, rubber, plastic	11%	12%	17%	18%	19%	13%	13%	26%	5%	5%	4%	7%	7%	4%	3%	3%	5%	5%	5%	5%	5%	6%
Other industry	3%	4%	4%	3%		3%		3%					4%	4%								
Construct																						
Trade	30%	29%	24%	22%	14%	15%	16%	12%	12%	16%	13%	14%	18%	15%	19%	16%	12%	18%	7%	14%	19%	19%
Transport nec	3%	5%	4%	3%	3%	2%	3%	3%	3%	1%	2%	5%	5%	3%	1%	2%	3%	3%		3%	4%	3%
Water transport																						
Air transport																						
Communic ation				2%									3%									
Financial	11%	13%	10%	8%	7%	4%	7%	3%	8%	1%	2%	7%	4%	6%	4%	4%	3%	5%	1%	7%	4%	5%
Insurance																						
Business services	9%	5%	5%	5%	5%	5%	9%	4%	1%	1%		9%	7%	4%	4%	2%	3%	9%	1%	3%	4%	7%
Rec & other					7%			6%					6%									
Public Admin																						

Note: Shading shows relative intensity of input sourcing from row sector for column exporting sector. Own sector value added excluded.

Source: Author estimates.

5. Relative comparative advantage of ASEAN agro-food sectors

Some of the changes in agro-food GVC participation are due to changes in the relative comparative advantages of ASEAN's agro-food sectors compared with elsewhere in the world. Trade in value added data enables a closer look at the comparative advantage of agro-food sectors across ASEAN (OECD, 2013c; Ferto, 2017; Brakman and van Marrewijk, 2016). With the development of GVCs, using gross exports can be misleading in understanding the relative comparative advantage of a sector as gross flows include domestic and foreign value added content. In this context, using trade in value added, both direct and indirect, provides a better picture of the sectors' and countries' relative comparative advantages.

Revealed comparative advantage (RCA) indicators are calculated by comparing a country's shares in world exports of value added with its shares of total domestic value added in final demand.³ These are computed at the sector or industry level. If a country's share in exports of value added exceeds its share of value added in total final demand, then it is said to have a relative comparative advantage in that product. Thus, indicator values greater than 1 suggest relative comparative advantages, while those less than 1 suggest relative comparative disadvantages. In this section, RCA indicators for ASEAN agro-food and support sectors are explored, along with their changes over time.

Comparative advantages across countries

Using data on total domestic value added traded suggests that the ASEAN region has a strong comparative advantage in most agricultural and food products (Figure 26). For agriculture, the least developed members and Viet Nam have the greatest advantage – mostly the countries in the Mekong delta region. These results suggest a strong link to natural comparative advantages from geography and natural resources.

For food products, geography is less important but still plays a role. The strong comparative advantage of Indonesia is largely due to the production of palm oil which has a natural resource and climatic underpinning. For Thailand, processed food products, many from fisheries, are a key driver of the comparative advantages.

Despite the high levels of revealed comparative advantage, for many countries across both food and agriculture there have been declines in comparative advantage between 2004 and 2014. The exceptions to this have been Lao PDR for agriculture, but mainly through its forestry sector (grouped within agriculture) and on the food side, Indonesia, Malaysia and the Philippines. Thailand has maintained its position over the period for both agriculture and food.

³ Note that in the presence of distortions, RCA may not reflect true comparative advantages, because trade patterns are affected not only by comparative advantages but also by trade policies such as import tariff and export subsidies. There are various types of RCA indicators, but French (2017) suggested that it is reasonable to employ the Balassa's index as a summary device for descriptive analysis, keeping in mind that one should always compare relative values of the index. Our RCA indicator is the extension of Balassa's index using value-added, instead of gross value. In this study, "comparative advantage" and "RCA" are used interchangeably.

Figure 26. Revealed comparative advantage in agriculture and food

Weighted average by sector and country

Note: Values greater than 1 (shown by the line) suggest comparative advantage. Averages weighted by total direct and indirect value added traded. Rest of Southeast Asia includes Myanmar.

Source: Author estimates.

Changes in comparative advantage across sectors

At the sector level, the region's comparative advantages lie in several of its key export products (Figure 27). Rice (paddy and processed), palm oil (vegetable oils and fats and oilseeds) and fishery products (fishing) all score highly on the RCA indicators. Other cash crops (crops n.e.c.) also have high comparative advantages. Notwithstanding a number of strong performers, the analysis by sector suggests the region has comparative advantages in being an agro-food supplier. This is likely to have helped underpin the agricultural transformation over the past two decades described above.

However, despite the strong RCA results, the changes over time raise questions (Figure 28). It should be cautioned that changes in RCAs can be underpinned by growth and changes in competitiveness in other sectors, rather than any fundamental change in the sector that is being examined. Of the 22 sectors examined, only nine have experienced growth in the comparative advantages between 2004 and 2014. In both rice and fishing – key export products – the relative comparative advantage of ASEAN as a producer has fallen the most.

On the positive side, some key export products – vegetable oils and fats and sugar – have seen increases in their RCA. Similarly, for other crops n.e.c., which include cash crops such as coffee, cocoa, tea, and rubber, relative comparative advantage has also increased. However, the mix of increases and decreases in comparative advantage are at odds with the policy focus which has sought to increase rice production, often at the expense of other crops and potentially of agricultural incomes.

There has also been a large increase in the forestry sector. However, this is largely driven by changes within Lao PDR. With weak institutions and poor environmental regulations in many of ASEAN countries (see OECD, 2017a), this raises questions about the sustainability of the sectors that have underpinned this strong export performance.

Figure 27. RCA across agro-food sectors in ASEAN, 2004-14

Weighted average by sector

Note: Values greater than 1 suggest comparative advantage. Averages weighted by total direct and indirect value added traded.

Source: Author estimates.

Figure 28. Changes in agro-food comparative advantage in ASEAN, 2004 to 2014

Absolute difference (2004-14) in weighted average by sector

Note: Averages weighted by total direct and indirect value added traded.

Source: Author estimates.

Services supporting agro-food sectors

Exploring trade in value added that is both directly and indirectly sourced provides a means to examine a wider range of sectors in a similar manner, particularly those that do not trade directly. While for a number of service sectors there is little direct trade, as they provide inputs into the non-tradable sectors, their value added gets traded within the goods (and services) that move across international borders. The RCAs for a wider range of sectors, and in particular

services sectors, can therefore provide some insight into the competitiveness of the sectors that support the agro-food sectors.

Across ASEAN countries, most service industries do not exhibit any revealed comparative advantage (Figure 29). Only Singapore (the most developed member of the group) and Philippines have RCA scores above 1. For the Philippines, the result is driven by its communication sector. Furthermore, there has been little change between 2004 and 2014 in these indicators for most ASEAN members.

Figure 29. Service sector revealed comparative advantage

Weighted average by country and sector

Note: Values greater than 1 (shown by the line) suggest comparative advantage. Averages weighted by total direct and indirect value added traded. Rest of Southeast Asia includes Myanmar.

Source: Author estimates.

Across the service sectors, those which represent inputs into agro-food GVCs and form part of the enabling environment – related to business services, road and rail transport (transport n.e.c.) along with financial and insurance services – have low comparative advantage scores (when Singapore is excluded). Trade services, however, exhibit strong RCAs.

The lack of comparative advantage in these sectors should not be an issue for ASEAN. No single country can have a comparative advantage across the full range of sectors. What is important in this context is for producers in these countries to have access to these services from abroad. As such, the external trade environment for services becomes more important for these countries.

6. The role that GVC participation has played in ASEAN's agro-food sector growth

GVC participation can have flow-on impacts on the industries involved. A number of studies have explored these changes through the lens of “upgrading” (OECD, 2015a). Upgrading can be narrowly thought of as moving “up” the value chain, but this misses a number of important aspects of the potential benefits that GVCs can bring to industries and countries. These include the effects on growth in total domestic value added along with impacts on sector employment, productivity, income per worker, and the labour skill mix (Lopez Gonzalez, 2016; OECD, 2015a). OECD (2015a) highlights that in terms of assessing the benefits of GVC participation, the focus should be on the growth in absolute domestic value added created as opposed to just growth in the share of domestic value added in unit value.

Numerous studies have demonstrated that trade is positively related to economic growth (see for example Badinger, 2008; Alesina et al., 2005). That is, countries with greater trade openness exhibit higher rates of economic growth and/or higher rates of technological progress. The channels through which trade can affect economic growth include: the availability of cheaper inputs; greater competition pressure inducing more efficient business practices; greater availability of foreign technology and spillovers from foreign direct investment; a wider set of stakeholders creating greater pressure for better domestic policies and improved functioning of institutions; and scale economies and traditional comparative advantage-induced static gains from trade (Melitz, 2003; Meissner, 2014). Alcalá and Ciccone (2004) provide evidence of the effect of openness on labour productivity, finding that trade helps improve labour efficiency directly rather than through capital accumulation (capital deepening).

The effects of trade at the firm or sector level are more complex. Shepherd and Stone (2012) provide evidence that firms involved in trade tend to hire more workers and pay higher wages. In ASEAN, workers specialised in producing intermediates used by other countries to produce exports (that is forward GVC jobs) were found to have, on average, higher productivity than workers producing gross exports (Lopez Gonzalez, 2016). By contrast, recent papers by Autor et al. (2013; 2014; 2016) and Acemoglu et al. (2016) highlight how competitive pressures from China and the role of automation have depressed aggregate manufacturing employment in the United States. For agriculture, Yoo et al. (2012) found that trade openness significantly increased productivity growth in Korean agriculture.

Other aspects of GVC participation, such as the greater use of services in the production process, have been linked to improvements in sector performance, particularly for manufacturing (Hoekman and Shepherd, 2015). Similarly, service sector performance, and in particular transport and storage and within that maritime transport, have been found to influence transformation in sectors important for developing countries, such as automotive, and mining and quarrying (Jouanjean, Gourdon and Korinek, 2017). For agro-food sectors, a negative impact from service trade restrictions on domestic value added creation was found (Greenville, Kawasaki and Beaujeu, 2017a).

Past work has shown that sector trade policy is an important influence on GVC participation. Of particular relevance was the role of import barriers which were found to have a negative impact on GVC participation (Greenville, Kawasaki and Beaujeu, 2017a).

In this section, the role that GVCs have played in agro-food sector growth in ASEAN is explored. Following the approach developed in the OECD paper *Dynamic changes and effects of agro-food GVCs* (Greenville, Kawasaki and Jouanjean, forthcoming) (Box 2), several aspects of agro-food sector growth were examined with specific reference to ASEAN countries. The main influences explored relate to different areas identified in past studies as drivers of sector development from GVC participation, both previous GVC participation and policy factors. Particular aspects identified through the trends observed in agro-food GVCs globally (see Greenville, Kawasaki and Jouanjean, forthcoming) were also explored. These include:

- *Learning through importing – using foreign value added to promote domestic value added:* Past analyses have suggested that use of foreign factors has been an important input into the growth of exports of domestic value added – that is, backward participation leads to future growth. This growth is driven through changes in the competitiveness of sectors from being able to access foreign factors and the spillovers often created, an extension of the embodied technical change theories of foreign direct investment.
- *GVC participation, employment and the factor market in general:* The labour content of agro-food exports has changed over time. This may be a result of shifts in production location but some of the changes may also be related to GVC participation itself and the impacts from use of competitively priced intermediate inputs and their embodied technical change – that is, the influence of backward and forward participation on returns.
- *The role of services and domestic value added creation:*⁴ Services form a significant share of agro-food final and export value. The inclusion of services in the value chain may be indicative of growth opportunities for the sector itself and thus may be a driver of domestic value added growth.

The full details of the regression analysis are given in Annex 1. To assess the above aspects, several aspects of GVC participation are explored. These relate to:

- Backward participation in the initial period (2004) to capture the use of foreign factors and the original level of integration in GVCs of a country-sector.
- Forward participation in the initial period (2004) to capture the participation in a specific type GVC which continues beyond the trading partners borders.
- Share of domestic value added that ends in foreign final demand (change between periods) to capture participation in continuing value chains or varying types (so selling into GVCs in general).
- Change in the concentration in imported intermediate inputs by a sector measured at the source-type level, this is used to explore the concentration of backward connections of an industry (it is, however, also likely to be linked to policy settings and overall openness of the sector to international markets).

For policy variables, given the limited availability of a consistent set of policy indicators, only measures relating to tariffs applied and faced, and specific trade concerns raised at the WTO over SPS and TBT were explored. These NTM measures have significant limitations as they do not provide much information about the stock of NTMs. For policy measures under the control of domestic policy makers, change variables were examined so that policy changes could be assessed. Those relating to the external trading environment were held at initial values. Given these limitations, policy measures were specifically analysed using the OECD METRO model (Section 7).

⁴ For the purpose of this study, services explored include non-transport services. Transport services were excluded from the analysis as the growth in their use should be proportional to rising trade and production levels.

Box 2. Estimating the impact of GVC participation on agro-food sector transformation

A fixed effects panel regression model was used to explore the impact of GVC participation. This model attempts to correct for both the price movements and specific country characteristics that may influence sector development and trade with GVCs (see Annex 3 for full details of the model).

The panel regression model makes use of data on 22 agro-food sectors across 141 countries and regions. It includes time-based fixed effects to account for the changes in real prices that occurred over the period and country-year level fixed effects to control for country-specific geographic characteristics and other time-based events (such as weather) that may influence trade and sector growth.

The model was used to explore the impact of GVC participation and policy on total sector domestic value added growth, growth in domestic value added exported, along with shares of domestic value added from intermediates (other sectors), land, labour (skilled and unskilled) and capital. For the regression, exports observations with very small trade amounts were dropped.

Learning through importing – using foreign value added to promote domestic value added

For ASEAN, as for countries globally, the use of foreign factors in the production of agro-food exports has had a positive effect on sector development and growth (Figure 30). That is, using imported intermediate inputs in agro-food production processes is positively related to sector growth. Sectors with higher rates of backward participation in agro-food GVCs in 2004 had higher growth in total domestic value added over the period 2004 to 2014. For ASEAN, the effect is lower than that estimated for the rest of the world. However, in terms of domestic value added growth from agro-food exports the result was not different from that seen globally.

Figure 30. GVC participation impacts on domestic value added growth, total and exports

Note: The result for concentration on imported intermediate inputs depicted has been multiplied by -1 so that it illustrates falls in concentration

Source: Author estimates.

Forward participation in GVCs was found to have a positive influence on growth in aggregate and through exports. For ASEAN, and other countries globally, participating in GVCs with third country links (through the re-export of exported value added) as captured by the forward participation indicator was not found to be significant.

For ASEAN countries, decreasing concentration in the imported intermediate input bundle was found to have a positive impact on the growth of total domestic value added in the sectors. This result suggests that having access to a wider range of imported inputs is important for the region, be it through access to inputs from a wider range of countries or a wider variety of input types.

This has direct implications for trade policy suggesting that more open and less discriminatory policies are likely to be the most beneficial for agro-food sector growth.

GVC participation and employment impacts

GVCs have the potential to create employment through their influence on promoting domestic value added creation. This employment can be generated by sectors directly participating in agro-food GVCs through their own exports, or via indirect participation by linking with other domestic sectors as the pathway to GVC participation. As can be seen with the use of domestic factors for agro-food exports (Figure 25), agro-food sectors provide inputs for other sectors to participate in GVCs; for example, a fruit grower providing fruit to the juice maker who sells into a GVC.

ASEAN has a significant proportion of its agro-food workforce that is reliant upon GVC participation either directly or indirectly. Viewed through the lens of the share of total labour returns that come from trade in GVCs reveals that ASEAN's agro-food workers are one of the most reliant regions on GVCs (Figure 31). In 2014, around 28% of the agro-food workforce (in value terms) was reliant on trade in GVCs, second behind Europe (primarily the EU countries).

Figure 31. Employment from agro-food GVCs participation, share of agro-food workforce

Note: Simple average across countries in the regions identified.

Source: Author estimates.

When viewed as a share of the total workforce – that is, the returns to labour across the economy as a whole – the importance of agro-food GVCs in ASEAN stands out compared with other large regions (Figure 32). This result is largely due to a high share of the population within ASEAN countries employed in agriculture and the relatively trade-exposed nature of a number of the major sectors.

Figure 32. Employment from agro-food GVCs participation, share of total workforce

Note: Simple and weighted (by total value added) average across countries in the regions identified.

Source: Author estimates.

Between 2004 and 2014, however, the importance of GVC participation in contributing to the total workforce income was stable to falling. On a simple average basis across the ten ASEAN member states, the employment value created by GVCs remained stable, but on a weighted average (by sector size), it fell. The declining share of labour returns on a weighted average basis is indicative of the broader process of adjustment that has been occurring within the agro-food sectors in ASEAN (OECD/FAO, 2017). As capital use and productivity increases, total labour use in the sector is falling with some substitution to other factors of production. At the same time, these changes also promote labour returns for those who remain employed in the sector, as possibly captured by the simple average which has remained stable.

Adjustment, however, does not explain all the shifts. Across countries, in terms of both agricultural workforce and agro-food workforce there are varying changes across ASEAN member states (Figure 33). Much of the aggregate fall has been in the employment share related to GVCs in Malaysia, a country where agriculture RCA has fallen along with declines in the use of services in its production of agricultural exports. Similarly, Indonesia and the Philippines have seen agricultural employment shares fall in conjunction, with similar declines in service use and RCA in the case of Indonesia (the food sector in Indonesia has not experienced a decline). For both of these countries, agricultural distortions have also increased (OECD, 2017c), and have likely increased in Malaysia as well for some products such as rice, although less is known (OECD, 2017a). In Viet Nam, falls have been seen despite increases between 2004 and 2007, potentially suggesting that the pace of agricultural-related reforms has begun to slow.

Beyond the agro-food sectors, GVC participation can create employment in other sectors through the use of other domestic inputs into agro-food export production (Figure 34). Looking at the bundle of agro-food exports and including the other sector labour value contributions provides a means to examine the overall economy-wide impact on employment from agro-food GVC participation in ASEAN.⁵ Close to 6% of the total workforce in ASEAN in 2014 (in value

⁵ It has been assumed that all labour included in exports from agro-food sectors represent the labour returns along with the labour included in the inputs to non-agro-food exports; for example, the labour associated with plant-based fibre inputs into textiles. However, the non-agro-food

terms) was reliant on agro-food GVCs with considerable variation across countries – Lao PDR at one end with 17% and Brunei Darussalam at the other with less than 1%. The majority of this is related to agriculture sector employment (with the exception of Singapore), followed by food sector employment then services sector employment.

Figure 33. Changes in GVC-related employment across ASEAN member states, 2004-14

Figure 34. Employment from agro-food GVC participation across all sectors, 2014

Note: ASEAN result represents total value added weighted average across ASEAN member states.

Source: Author estimates.

labour in exports of non-agro-food sectors is not considered. Following on from the example, the labour used by the textiles sector and its purchases from other manufacturing or service sectors are not included.

Beyond the direct generation of employment, GVC participation has impacts on the relative returns to labour compared with other factors of production. Backward GVC participation creates a shift away from the share of the final value captured by intermediate inputs and increases the share of the final value that is captured by value added factors; that is, it increases the returns to the producers in the sectors by promoting higher returns to land, labour and capital (Figure 35).

Figure 35. Changes in the shares of value added from GVC participation

Note: The result for concentration on imported intermediate inputs depicted has been multiplied by -1 so that it illustrates falls in concentration.

Source: Author estimates.

Although the result obtained for ASEAN countries is less than that seen on average globally, it remains significant. The effect of GVC participation is to decrease the costs to producers of their intermediate inputs through increasing their access to more competitive inputs and through access to better information about how to use these inputs in the production process. This fall in the relative cost of these factors (or growth in value at a given cost) increases the returns to the other factors of production – land, labour, and capital.

For ASEAN, the strongest effect of backward participation is on increasing the returns to land and unskilled labour – showing a clear positive impact on those producing in the agriculture and food sectors. Unlike the result seen globally, backward participation in ASEAN has a much smaller effect on the returns to capital invested in the sector. This may be due to the production techniques applied and farmer characteristics, but may also be due to less well-functioning capital markets that have limited private sector investment in agriculture (OECD, 2017a).

A falling concentration in the imported intermediate input bundle had a similar effect on ASEAN producers – a much larger effect than that seen elsewhere in the world. For ASEAN producers, it appears that the diversity of imported inputs (sources and types) is an important element of the competitive effects from GVC participation. Thus for ASEAN, non-preferential trade reforms that promote access to imported inputs from a range of countries are likely to be particularly important.

The role of services and domestic value added creation

Service use across the value chain in ASEAN was found to be important for domestic value added growth (Figure 36). Although lower than elsewhere in the world, increases in the share of services in export value helped to increase domestic value added growth in the sector. That

is, increasing the export value shares captured by services is linked to increasing the total returns to agricultural and food producers in ASEAN.

This result suggests, however, that increasing the returns to farmers and food producers will not necessarily mean they capture a higher *share* of the export dollar. In fact, a falling share brought about from an increasing contribution from the service sector would likely increase total returns to the farmers and producers, while the opposite – that of a rising agro-food share in export value – may actually be indicative of decreasing overall returns to producers. This highlights the need for caution in attempts to target shares in export or final value as a policy metric of success or otherwise when participating in value chains – global or domestic.

The results for services are also indicative of the changing nature of agro-food trade. Within GVCs, accompanied by the “de-commodification” of agricultural products, there is increasing complexity in the products that are delivered for export and to the final consumer. This complexity, and in many cases services employed to increase the quality of the product, increases total farmer and producer returns.

Figure 36. Changes from increasing service shares of exports in ASEAN

Effects on value added growth and shares of value added across factors

Note: Impacts from changes in service sector share of export value.

Source: Author estimates.

7. Policy influences on domestic value added growth from GVCs

The econometric analysis did not provide insights into the effects of policy on GVC participation for ASEAN. Given this, an alternative evaluation of policy impacts on GVCs has been explored adopting the approach set out in [Greenville et al. \(forthcoming\)](#). The approach which makes use of the OECD METRO model (Box 3) to explore the impacts of tariff and non-tariff measures on GVC participation and domestic value added growth in ASEAN countries, isolating the effect of these policies. Full details of the model aggregation, at the sector and country level, are provided in Annex 3.

Specifically, three scenarios are explored.

- A reduction in tariffs (and quotas) by ASEAN countries – that is, ASEAN countries unilaterally remove their own tariffs on agro-food products (tariffs charged).

- A reduction in tariffs (and quotas) by all countries – that is, worldwide elimination of agro-food tariffs.
- A reduction in the effect of non-tariff measures by ASEAN countries on ASEAN trade – that is, moves to harmonise NTM systems among ASEAN countries, including reductions in the licensing and state trading related barriers that quantitatively restrict trade. These trade costs have been modelled as “iceberg” costs suggesting their presence increases the cost of trading within ASEAN and decreases the quantities of trade observed.

Box 3. The OECD METRO model

In 2015, the OECD launched a new global computable general equilibrium (CGE) trade model known as METRO (Modelling TRade at the OECD) (OECD, 2015b). CGE models are computer simulation models that use data to explore the economic impact of changes in policy, technology, and other factors. They show how different sectors inside one economy are linked and how multiple economies are connected to each other, and how resources such as labour, capital and natural resources are best allocated across all economic activities. The METRO model builds on the GLOBE model developed by Scott McDonald and Karen Thierfelder (2013).

The METRO database currently covers 61 economies across 57 economic sectors. It is based on the Global Trade Analysis Project (GTAP) database, and uniquely incorporates recent OECD statistical developments. METRO allows users to analyse global value chains (GVCs) by drawing on the OECD-WTO Trade in Value Added (TiVA) database, providing a platform to more fully integrate structural policy issues in the analysis of trade policy. METRO also features an extensive library of trade-related policies, including current border tariff rates and export restrictions, as well as domestic taxes and support. Using METRO, it is now possible to track trade flows by their use (i.e. intermediate, household, government and investment) in addition to bilateral links between source and destination markets. This will greatly enhance the ability to model movements of goods and services, especially along global value chains.

Changes in agro-food GVC participation

The impact of various policy measures on ASEAN agro-food GVC participation is shown in Figure 37. For most ASEAN member states examined, and for the region overall, reforms to reduce tariff and non-tariff barriers promote backward participation. The combination of NTM and tariff cost reductions, or that of widespread reform, has the greatest impacts on backward participation. The effects are not uniform across countries partly due to the shifts in the product mix created by the reforms modelled. For example, for Cambodia which sees falls in all situations, the effect is dominated by a shift towards vegetables, fruits and nuts which have a lower backward participation than the average in the pre-reform period. This means the overall backward participation of the agro-food sector falls. For the vegetables, fruits and nuts sector there is little change in backward participation. The same effect is seen for Viet Nam under the global tariff reduction simulation which is prompted by a large increase in rice trade, a product with a lower than average backward participation for Viet Nam.

The overall results for backward participation, in conjunction with the findings in the previous section show that higher levels of past backward participation are positive for growth. This suggests that removing tariffs on agro-food products and reducing the trade costs associated with non-tariff barriers can provide beneficial changes to GVC participation. These changes should foster future sector growth.

For forward participation, the results are more mixed and mostly negative. The result is complicated by shifts in the products exported – those which often target final demand. The relatively higher trade barriers associated with more processed products means that reform promotes this type of trade more than trade in primary products, with the compositional shift causing the averages to fall. Given these effects, changes in domestic value added offer a better measure of the impact of the reform on the benefits from GVC participation.

Figure 37. Changes in GVC participation from tariff and NTM reductions

% point changes compared to 2011 base

Source: Author estimates.

Changes in exports of direct and indirect domestic value added***Tariffs, quotas and domestic value added creation***

Past work identified that tariffs on agro-food product can act as a tax on exports (Greenville, Kawasaki and Beaujeu, 2017a). Tariffs applied by ASEAN members on imports into their countries of agro-food products were found to mostly replicate this effect when ASEAN members unilaterally reduced tariffs on their agro-food products (Trade scenario on Figures 38 and 39). Countries that had the highest tariffs on agro-food products saw the greatest gains – Cambodia, Thailand and Viet Nam. However, the increase in exports for domestic value added was not seen for all countries due to the displacement of preferential access within ASEAN for Indonesia and Malaysia. For both, market access improvements by ASEAN displaced some agro-food exports, leading to falls in export quantities. However, when market access reductions are global, there is a promotion of domestic value added in all ASEAN members, and indeed globally.

The other impact seen from market access barriers relates to changes to the pathway of GVC-related domestic value added creation for some countries. For Thailand and Viet Nam, reduction in own tariffs on agro-food imports promotes domestic value added creation in exports through downstream domestic sectors – essentially the reduction in tariffs improves the competitiveness of downstream sectors which increase the domestic value added created through GVC participation by upstream sectors. This is seen by the strong increase in indirect domestic value added creation from GC participation. In Cambodia, the relationship is reversed, with tariff reductions helping promote direct exports to either final demand or as intermediates from the agro-food sectors.

Figure 38. Changes in exports of agro-food direct and indirect domestic value added from tariff and NTM reduction by country

% change compared to 2011 base

Source: Author estimates.

At the sector level across ASEAN (Figure 39), changes in the export mix drive changes in domestic value added creation. The reduction in own agro-food tariffs promotes sectors for which ASEAN countries have a comparative advantage, allowing them to further grow domestic value added generated from agro-food GVC participation. Tariff reductions at the global level have a greater impact and one that is more positive overall for all sectors across ASEAN. Improving the trading environment globally provides a larger potential for ASEAN members to gain from agro-food GVC participation, highlighting their interconnections in terms of both the use of imports and the use of their exports across the globe.

Non-tariff measures and domestic value added creation

ASEAN members apply a wide range of NTMs on agro-food products as discussed above. However, NTMs are not like tariffs in the sense that they are created by regulatory instruments

in place for a non-trade related reasons – such as health, safety or product requirements.⁶ What generally creates costs when trading are the differences in requirements between countries – the exporter needs to comply with standards different from those in their home market. As such, it is unlikely that a number of the NTMs could be reduced on a multilateral basis as they require some harmonisation in standards across sets of countries, thus having little (or potentially adverse) effects on countries not part of the harmonisation efforts.

Figure 39. Changes in exports of agro-food direct and indirect domestic value added from tariff and NTM reduction by product

Source: Author estimates.

For this study, the effects of harmonisation within ASEAN were explored, that is for trade among ASEAN members. This is in line with a number of efforts currently underway among ASEAN member states and with the ASEAN Free Trade Agreement (Greenville, 2018). The effects of NTM harmonisation are explored in conjunction with non-preferential tariff reduction by ASEAN member states and as a standalone measure.

⁶ Quantitative restrictions are different to these and changes to them do not require regulatory reforms or harmonisation across different countries.

Compared with unilateral tariff reform, the 15% reduction in NTM related trade costs within ASEAN had a larger impact on domestic value added creation. The effects were also positive overall for all ASEAN members and for almost all agro-food product exports in ASEAN. Thus, both NTM costs imposed and those faced by ASEAN members in trading within the region have a significant impact on the returns from agro-food GVC participation. When combined with unilateral tariff reductions, the gains are larger for several ASEAN member states.

These results indicate the role of trade policies, whether border-related tariffs or quotas, or measures that increase trade costs due to NTMs, in determining the gains from GVC participation. Overall, the results suggest that reforming these policies could provide a boost to the returns on offer from GVC participation.

8. Implications for the region

ASEAN is playing an increasingly significant role in world agro-food markets. This means that international markets are playing a larger role in ASEAN producers' incomes and the development of agro-food sectors in the region. This growth has been based on the fairly strong agricultural performance and the growing number of bilateral and regional trade agreements.

ASEAN's involvement in agro-food international markets has been facilitated by its participation in agro-food GVCs. The region, while engaging in regional trade, has been mostly outward focused in its GVCs linkages. The strongest growth in GVC linkages were in China, Europe, South America, and South Asia (India – largely through palm oil).

For ASEAN's major export products, results from backward and forward participation repeat some of the trends seen across the world. Agricultural sectors have higher forward participation, with food sectors having higher backward participation. For the region's major production and export products, they generally have higher forward participation but lower backward participation than world averages.

The growth in agro-food trade originating from the ASEAN countries has been underpinned by strong regional competitiveness in agricultural and food products. For agricultural products, relative comparative advantages at the country level have a geographic underpinning; countries in the Mekong delta show higher levels of comparative advantage than others. The picture is more mixed across the full range of agricultural products, with countries such as Indonesia and Malaysia having high comparative advantage in oilseeds.

For food, comparative advantages across countries run less along geographic lines but still play a role. The key sectors for the region relate to processed rice and vegetable oils and fats due to the high levels of primary production in ASEAN. Vegetable oils and fats have a strong geographical underpinning. For other more transformed food sectors, comparative advantages are lower.

GVC participation has played a positive role in the development of the agro-food sector in ASEAN. The use of foreign factors in the production of the region's agro-food exports (and production more generally), has had a positive impact on total sector domestic value added growth and growth from exports. The results suggest that while the effects for ASEAN are lower than on average across the world, members with higher backward GVC participation experienced greater domestic value added growth between 2004 and 2014.

GVC participation supports a large share of the workforce in ASEAN (expressed in value terms). ASEAN's share of the total workforce reliant on ongoing GVCs is relatively high, likely driven by the high shares of labour involved in agriculture in some countries and the net export position of the region. The dynamic impacts of GVC participation mean that the returns to labour and other factors of production have also increased – in particular, the use of foreign

factors in the production of agro-food products is beneficial for growth in labour returns (which may be number of jobs or higher wages, or potentially both).

On the less positive side, changes over time in revealed comparative advantage suggest that ASEAN may be losing its competitive edge in international markets. For a number of key export products, estimates at the regional and country level show falling levels of comparative advantage. This relates in particular to rice, which is the key focus of government intervention in the region, which has increased over the period since the food price crisis in 2007/08.

Part of this relates to the fact that the agriculture sector in ASEAN remains relatively highly protected. Unilaterally reforming tariffs applied on agro-food imports has the potential to grow domestic value added creation from GVC participation in a number of ASEAN members and to grow backward participation through imports, which may have longer term impacts on sector growth. This also holds for some of the region's major agro-food exporters – Thailand and Viet Nam. However, given ASEAN's integration into world markets, tariffs faced in other markets also matter. The impacts of these barriers are significant and limit the potential gains for ASEAN members in participating in agro-food GVCs.

Beyond tariff barriers, the NTM of ASEAN members create significant trade costs. NTM use and the trade cost effects between ASEAN members and those for non-ASEAN countries are high. Coupled with the increasing mix of RoO, this highlights the effect that NTMs can potentially have on hindering GVC participation and domestic value added creation in the region. A 15% reduction in NTMs solely between ASEAN member states through measures to improve regulatory harmonisation – such as through the processes within ASEAN's working groups – can have significant impact on GVC participation and domestic value added creation. The improvements seen for all ASEAN members and across almost all agro-food sectors suggest that such a reform could play a key role in enhancing GVCs in the region and in harnessing the benefits they can bring. Thus, continued efforts to harmonise NTM provisions within ASEAN could generate significant benefits for the agro-food sectors of ASEAN members.

Shifts away from protectionist trade policies provide an opportunity to better support the agro-food sector. For ASEAN countries, around 52% of the inputs used in agro-food exports are sourced from other domestically-based agro-food sectors. Thus, enhancing the competitiveness and productivity of these sectors is key to GVC participation and the returns created. Reducing trade barriers will help, but other steps are needed. For many ASEAN countries, agricultural infrastructure and R&D spending is low. Increasing investments in these areas to complement reductions in trade costs (tariffs and NTM-related) can help producers gain the most from GVC participation by providing them with increased ability to use foreign inputs and better access to foreign markets.

Beyond agro-food sector policies, the falling use of services in the production of agro-food exports, particularly those related to the business services that provide many “quality related” inputs, is potentially limiting the benefits from agro-food GVC participation. The results of the present analysis suggest that increasing service use in exports is related to domestic value added growth, a trend seen in Viet Nam. These services often provide the links and ability for agro-food sectors to participate in GVCs. Falling service share, and on average the low levels of comparative advantage in service sectors, point to the possibility of reforms to services trade restrictions as a means to help promote agro-food GVC participation and domestic value added growth. Currently, around 28% of the inputs into agro-food exports come from domestic service sectors. Furthermore, for some sectors such as government services, education, road and rail transport, and construction, low levels of performance could be indicative of issues in the enabling environment which can slow sector development and limit further increases in productivity. These will ultimately limit the growth in producer incomes.

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ANNEX 1.

MODEL SPECIFICATION AND DETAILED RESULTS

The model

For the regression analysis, following equation was estimated:

$$\Delta y_{cst} = \alpha \mathbf{X}_{cs,t-1} + \beta \Delta \mathbf{Z}_{cst} + \theta_{cs} + \eta_{ct} + u_{cst} \quad (\text{A1})$$

where the indices c , s , and t represent country, sector, and time and α and β are parameters to be estimated. The symbol Δ denotes the difference (per year) from the previous period (for example, $\Delta y_{cst} \equiv y_{cst} - y_{cs,t-1}$). The dependent variable y is either sector's total value-added (DVA), value-added embedded in sector's export (DVA in exports), or the input/factor shares (intermediate, land, skilled labour, unskilled labour, and capital). $\mathbf{X}$ and $\mathbf{Z}$ are vectors of regressors. Some regressors ($\mathbf{X}$) are measured as initial value at period $t-1$ to avoid endogeneity concern caused by reverse causality, while others ($\mathbf{Z}$) are measured as difference when reverse causality is not likely the case. The model includes two fixed effects: θ controls for country-sector specific unobservable factors (e.g. product characteristics) and η for country-year specific unobservables (e.g. weather, macroeconomic shocks, and food prices).

Parameters are estimated by the fixed effect estimator using panel dataset for 2004, 2007, 2011, and 2014. The dataset covers 22 agro-food sectors (GTAP sector 1 through 14 and 19 through 26) for 141 countries and regions. To avoid unrealistic changes in dependent variables, observations with small value added (less than USD 10 million) are dropped from the regressions (when dependent variable is DVA in exports, observations with DVA in exports less than USD 10 million are dropped).

To pick up the separate impact on ASEAN, an ASEAN dummy was created with was interacted with all the variables in the model.

The following tables show summary statistics (measured as level, not in differences) and full regression results. As DVA and DVA in exports are transformed in logarithm, the difference from the previous period approximates growth rate.

Table 3. Summary statistics

Variable name	Mean	Std. Dev.	Min	Max	Description
Dependent variables					
DVA	5.630	1.776	2.303	12.173	Value-added (log of USD million)
DVA in exports	3.116	2.283	0	9.428	Value-added embedded in export (log of USD million)
Intermediate share	0.554	0.233	0.002	0.994	The share of intermediate in total gross input
Land share	0.073	0.106	0.000	0.951	The share of value added by land in total gross input
Unskilled labour share	0.159	0.144	0.000	0.693	The share of value added by unskilled labour in total gross input
Skilled labour share	0.037	0.048	0.000	0.608	The share of value added by skilled labour in total gross input
Capital share	0.161	0.117	0.001	0.838	The share of value added by capital in total gross input
Regressors					
Backward	0.188	0.126	0.001	0.813	Backward indicator
Forward	0.740	2.375	0.000	29.778	Forward indicator
Tariffs faced	6.685	13.491	0.000	250.0	Average tariff faced (weighted by export value. %)
SPS faced	1.856	7.302	0.000	128.0	# of SPS faced
TBT faced	0.847	6.135	0.000	192.0	# of TBT faced
Tariffs charged	9.838	23.723	0.000	485.9	Average tariff charged (weighted by import value. %)
SPS charged	1.327	8.310	0.000	225.0	# of SPS charged
TBT charged	0.605	7.315	0.000	360.0	# of TBT charged
DVA in foreign demand	0.297	0.259	0.001	1.000	This represents the destination of the value added generated in the sector - that is the domestic or foreign markets. It shows the share which is ultimately consumed by foreign consumers.
Service share	0.102	0.068	0.000	0.414	This represents the source of value added in the output of the sector that ultimately originated from service sectors (GTAP sector 51-57)
Imported inputs concentration	0.016	0.015	0.003	0.236	Herfindahl index, measured as the sum of squared share of imported value added used for the output (calculated at source country * source sector level), where a higher value indicates higher concentration.

Source: Author estimates.

Table 4. Full regression results

Variables	DVA	DVA in exports	Intermediate share	Land share	Unskilled labour share	Skilled labour share	Capital share
Backward	0.718 [7.49]***	0.540 [2.40]**	-0.127 [-7.80]***	0.030 [2.70]***	0.03 [3.66]***	0.01 [3.98]***	0.06 [6.37]***
Forward	0.00 [-1.18]	0.01 [0.53]	0.00 [-0.96]	0.00 [-1.16]	0.00 [1.15]	0.00 [2.03]**	0.00 [1.84]*
Tariffs faced	0.00 [0.70]	0.00 [-0.39]	0.00 [-1.88]*	0.00 [-0.53]	0.00 [0.99]	0.00 [1.87]*	0.00 [2.84]***
SPS faced	0.00 [-0.68]	0.00 [-0.25]	0.00 [0.95]	0.00 [-0.61]	0.00 [0.30]	0.00 [-1.41]	0.00 [-0.65]
TBT faced	0.00 [1.15]	0.00 [0.54]	0.00 [1.53]	0.00 [-0.26]	0.00 [-1.23]	0.00 [-2.19]**	0.00 [-0.32]
DVA in foreign demand (difference)	0.43 [9.83]***	1.59 [17.93]***	0.00 [-0.67]	0.00 [-0.66]	0.00 [1.82]*	0.00 [-0.20]	0.00 [1.57]
Service share	3.08 [3.68]***	-0.17 [-0.13]	-0.12 [-1.25]	0.12 [1.63]	-0.09 [-2.33]**	-0.01 [-0.69]	0.10 [2.47]**
Imported inputs concentration (difference)	-0.21 [-1.38]	-0.03 [-0.07]	0.08 [3.50]***	0.03 [1.75]*	-0.06 [-4.54]***	-0.01 [-2.19]**	-0.04 [-3.73]***
Tariffs charged(difference)	0.00 [-2.17]**	0.00 [-0.98]	0.00 [2.70]***	0.00 [-1.34]	0.00 [0.83]	0.00 [-1.15]	0.00 [-2.49]**
SPS charged (difference)	0.00 [0.04]	0.00 [0.99]	0.00 [1.11]	0.00 [-1.35]	0.00 [0.83]	0.00 [0.50]	0.00 [-0.40]
TBT charged (difference)	0.000 [-1.59]	0.000 [-0.23]	0.000 [0.40]	0.000 [1.31]	0.000 [-1.12]	0.000 [-2.55]**	0.000 [-0.48]
Backward*ASEAN	-0.487 [-2.79]***	-0.570 [-1.11]	0.072 [2.73]***	-0.009 [-0.58]	-0.003 [-0.34]	-0.010 [-1.97]**	-0.045 [-3.20]***
Forward*ASEAN	0.000 [0.37]	0.023 [0.70]	0.000 [0.25]	0.000 [1.24]	0.000 [-0.19]	0.000 [-1.52]	0.000 [-1.65]*
Tariffs faced*ASEAN	0.000 [-1.13]	0.002 [0.79]	0.000 [1.97]**	0.000 [-0.22]	0.000 [-1.39]	0.000 [-0.54]	0.000 [-2.66]***
SPS faced*ASEAN	-0.001 [-0.59]	-0.010 [-1.04]	0.000 [1.67]*	0.000 [-1.10]	0.000 [-1.74]*	0.000 [-0.57]	0.000 [-0.58]
TBT faced*ASEAN	0.002 [0.60]	0.090 [2.76]***	-0.001 [-1.39]	0.000 [2.61]***	0.000 [1.97]**	0.000 [-1.53]	0.000 [-0.08]
DVA in foreign demand (difference)*ASEAN	0.046 [0.40]	0.260 [0.96]	-0.003 [-0.26]	0.009 [1.07]	0.002 [0.43]	-0.001 [-1.11]	-0.006 [-2.02]**
Service share*ASEAN	-2.410 [-2.23]**	2.240 [0.95]	0.086 [0.71]	-0.249 [-2.95]***	0.029 [0.61]	0.113 [3.23]***	0.023 [0.43]
Imported inputs concentration (difference)*ASEAN	-1.030 [-1.93]*	-1.470 [-1.32]	0.381 [3.63]***	-0.167 [-2.19]**	-0.104 [-2.15]**	-0.031 [-2.20]**	-0.079 [-1.94]*
Tariffs charged(difference)*ASEAN	0.000 [2.13]**	0.003 [1.99]**	0.000 [-0.02]	0.000 [-0.17]	0.000 [-1.06]	0.000 [0.20]	0.000 [1.15]
SPS charged (difference)*ASEAN	0.000 [-1.54]	-0.002 [-2.19]**	0.000 [0.20]	0.000 [0.07]	0.000 [-0.54]	0.000 [-0.49]	0.000 [0.10]
TBT charged (difference)*ASEAN	0.000 [0.65]	0.000 [0.63]	0.000 [0.29]	0.000 [1.20]	0.000 [-0.01]	0.000 [-0.68]	0.000 [-1.12]
Constant	0 [0.43]	0 [0.42]	0 [8.06]***	0 [-3.89]***	0 [-2.20]**	0 [-3.29]***	0 [-6.45]***
Observations	5099	3204	5099	5099	5099	5099	5099
R-squared	0.54	0.58	0.33	0.21	0.50	0.39	0.16

Note: t-statistics in brackets. *** p<0.01, ** p<0.05, * p<0.1

Source: Author estimates.

ANNEX 2.

FLOWS OF AGRO-FOOD VALUE ADDED

Figure 40. Heatmap of value added linkages for ASEAN, 2004

Flows of domestic value added, USD million

Destination Origin	MENA	Sub-Saharan Africa	North America	Central America	South America	China	East Asia	ASEAN	South Asia	EU28	Other Europe
Middle East and North Africa	476	45	182	12	44	77	169	159	75	2080	221
Sub-Saharan Africa	180	412	181	10	25	310	304	395	180	2457	136
North America	457	93	2546	306	231	1242	1761	1092	136	2685	201
Central America	21	7	201	101	17	33	70	34	5	539	46
South America	499	141	618	130	958	794	606	727	101	4160	301
China	454	168	1343	98	134		3258	2188	291	4165	335
East Asia and Oceania	220	66	465	24	44	1075	1497	1437	92	1456	94
ASEAN	306	118	528	29	60	1316	1527	2668	174	2208	155
South Asia	369	79	242	17	30	206	309	532	227	1355	99
EU28	1026	229	830	70	181	465	1042	733	94	24361	1600
Other Europe	308	19	133	14	23	477	267	144	133	2661	500

Note: The table shows the flows of value-added created in agro-food sectors in Origin country that is included in Destination country's (total) export.

Source: Author estimates.

Figure 41. Heatmap of value added linkages for ASEAN, 2007

Flows of domestic value added, USD million

Destination Origin	MENA	Sub-Saharan Africa	North America	Central America	South America	China	East Asia	ASEAN	South Asia	EU28	Other Europe
Middle East and North Africa	694	92	355	22	63	141	242	189	106	3045	317
Sub-Saharan Africa	228	508	252	16	38	657	364	465	175	2915	167
North America	739	130	2905	361	372	1609	2084	1309	267	3225	256
Central America	28	7	271	144	21	58	104	51	6	724	43
South America	714	224	859	156	1376	1742	933	1045	117	5977	432
China	886	311	1939	110	287		4365	2784	471	7285	685
East Asia and Oceania	244	65	509	23	56	1473	1688	1463	76	1780	127
ASEAN	412	177	735	28	97	1887	2012	2942	265	2986	275
South Asia	549	132	324	25	50	574	399	726	424	1970	131
EU28	1376	350	1014	71	225	718	1203	773	131	34001	2289
Other Europe	670	61	188	16	36	1008	339	180	331	3845	613

Note: The table shows the flows of value-added created in agro-food sectors in Origin country that is included in Destination country's (total) export.

Source: Author estimates.

Figure 42. Heatmap of value added linkages for ASEAN, 2011

Flows of domestic value added, USD million

Destination Origin	MENA	Sub-Saharan Africa	North America	Central America	South America	China	East Asia	ASEAN	South Asia	EU28	Other Europe
Middle East and North Africa	857	128	347	23	65	202	277	270	152	3143	454
Sub-Saharan Africa	306	435	449	28	52	823	472	861	228	4101	416
North America	1172	169	4482	733	515	3784	3302	2391	476	4528	382
Central America	73	33	637	316	117	112	250	89	17	1249	129
South America	1471	310	1660	294	1745	3697	1641	2303	240	9016	859
China	1427	531	3306	276	594		6432	5592	1160	11427	1094
East Asia and Oceania	402	129	662	48	86	2175	2360	2439	216	2401	185
ASEAN	680	291	1321	59	200	2800	2967	5386	607	4350	394
South Asia	1008	220	612	47	98	1163	659	1687	874	3193	268
EU28	1955	470	1351	140	327	1120	1606	1034	206	43169	2901
Other Europe	1035	114	260	26	56	747	410	244	85	4820	568

Note: The table shows the flows of value-added created in agro-food sectors in Origin country that is included in Destination country's (total) export.

Source: Author estimates.

Figure 43. Heatmap of value added linkages for ASEAN, 2014

Flows of domestic value added, USD million

Destination Origin	MENA	Sub-Saharan Africa	North America	Central America	South America	China	East Asia	ASEAN	South Asia	EU28	Other Europe
Middle East and North Africa	857	128	347	23	65	202	277	270	152	3143	454
Sub-Saharan Africa	306	435	449	28	52	823	472	861	228	4101	416
North America	1172	169	4482	733	515	3784	3302	2391	476	4528	382
Central America	73	33	637	316	117	112	250	89	17	1249	129
South America	1471	310	1660	294	1745	3697	1641	2303	240	9016	859
China	1427	531	3306	276	594		6432	5592	1160	11427	1094
East Asia and Oceania	402	129	662	48	86	2175	2360	2439	216	2401	185
ASEAN	680	291	1321	59	200	2800	2967	5386	607	4350	394
South Asia	1008	220	612	47	98	1163	659	1687	874	3193	268
EU28	1955	470	1351	140	327	1120	1606	1034	206	43169	2901
Other Europe	1035	114	260	26	56	747	410	244	85	4820	568

Note: The table shows the flows of value-added created in agro-food sectors in Origin country that is included in Destination country's (total) export.

Source: Author estimates.

ANNEX 3.

METRO MODEL SPECIFICATION

Table 5. Sectors in the model

No.	Code	Description	Comprising
1	pdr	Paddy rice.	Paddy rice
2	wht	Wheat.	Wheat
3	gro	Cereal grains nec.	Cereal grains nec.
4	v_f	Vegetables, fruit, nuts.	Vegetables, fruit, nuts
5	osd	Oil seeds.	Oil seeds
6	c_b	Sugar cane, sugar beet.	Sugar cane, sugar beet
7	pfb	Plant-based fibres.	Plant-based fibres
8	ocr	Crops nec.	Crops nec
9	ctl	Cattle,sheep,goats,horses.	Cattle,sheep,goats,horses.
10	oap	Animal products nec.	Animal products nec.
11	rmk	Raw milk.	Raw milk
12	wol	Wool, silk-worm cocoons.	Wool, silk-worm cocoons
13	frs	Forestry.	Forestry
14	fsh	Fishing.	Fishing
15	cmt	Meat: cattle, sheep, goats, horse.	Meat: cattle, sheep, goats, horse
16	omt	Meat products nec.	Meat products nec
17	vol	Vegetable oils and fats.	Vegetable oils and fats
18	mil	Dairy products.	Dairy products
19	pcr	Processed rice.	Processed rice
20	sgr	Sugar.	Sugar
21	ofd	Food products nec.	Food products nec
22	b_t	Beverages and tobacco products.	Beverages and tobacco products
23	ext	Mining and Extraction	Coal, oil, gas, minerals nec
24	tex	Textiles and Clothing	Textiles; Wearing apparel
25	lmc	Light Manufacturing	Leather products, wood products, paper products, publishing, metal products, motor vehicles and parts, transport equipment nec, manufactures nec
26	hmc	Heavy Manufacturing	Petroleum, coal products, chemical, rubber, plastic prods, mineral products nec, ferrous metals, metals nec, electronic equipment, machinery and equipment nec
27	utc	Utilities and Construction	Electricity, gas manufacture, distribution, water, construction
28	trd		Trade.
29	trn	Transport	Transport nec, sea transport, air transport.
30	bus	Business Services	Communication, financial services nec, insurance, business services nec.
31	ots	Other	Recreation and other services, pubadmin, defence, health, education, dwellings

Table 6. Countries and regions in the model

No.	Code	Description	Comprising
1	AUS	Australia	Australia
2	NZL	New Zealand	New Zealand
3	CHN	China	The People's Republic of China
4	KOR	Korea	Korea
5	XEA	Rest of East Asia	Hong Kong, China; Mongolia, Chinese Taipei, Rest of East Asia, Brunei Darussalam.
6	JPN	Japan	Japan
7	IDN	Indonesia	Indonesia
8	MYS	Malaysia	Malaysia
9	THA	Thailand	Thailand
10	KHM	Cambodia	Cambodia
11	LAO	Lao PDR	Lao People's Democratic Republic
12	PHL	Philippines	Philippines
13	SGP	Singapore	Singapore
14	VNM	Viet Nam	Viet Nam
15	XSA	Rest of South Asia	Bangladesh, Nepal, Pakistan, Sri Lanka, Rest of South Asia
16	IND	India	India
17	MEX	Mexico	Mexico
18	CAN	Canada	Canada
19	USA	United States	United States
20	ARG	Argentina	Argentina
21	CHL	Chile	Chile
22	BRA	Brazil	Brazil
23	CRI	Costa Rica	Costa Rica
24	XLA	Rest of Latin America	Bolivia, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean
25	XEU	EU27	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Bulgaria, Croatia, Romania
26	GBR	UK	United Kingdom
27	CHE	Switzerland	Switzerland
28	NOR	Norway	Norway
29	UKR	Ukraine	Ukraine
30	RUS	Russia	Russian Federation
31	ZAF	South Africa	South Africa
32	XMN	Middle East and North Africa	Bahrain, Iran Islamic Republic of, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa
33	XSS	Sub-Saharan Africa	Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, Rest of South African Custom
34	XRW	ROW	Rest of Oceania, Rest of Southeast Asia, Rest of North America, Rest of EFTA, Albania, Belarus, Rest of Eastern Europe, Rest of Europe, Kazakhstan, Kyrgyzstan, Tajikistan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia, Rest of the World