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Appendix 1

Conceptual Background of the Food Value Chain

The concept of the food value chain (FVC) seems to be based on the arguments for the value chain (VC), especially the global value chain (GVC), value chain development (VCD), and other concepts focusing on the procurement system of the agri-food sector, rather than on discussions around the idea of the FVC itself.

The VC is described as 'the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use' (Kaplinsky, 2000: 121).[1] Although the VC includes a wide range of activities, the concept itself does not provide a specific analytical perspective.[2]

By contrast, the concepts of the GVC and VCD can offer guidance regarding the assessment of the comprehensive issues surrounding the VC. This chapter provides an overview of the literature on the GVC, VCD, and other concepts relating to the procurement system of the agri-food sector in the member states of the Association of Southeast Asian Nations (ASEAN), to clarify the basic ideas needed to evaluate the FVC.

1.1. Key Concepts in the Literature on the GVC

The notion of the GVC was constructed in line with studies on the global commodity chain that had been conducted by the Institute of Development Studies, based at the University of Sussex, since the 1990s. The idea of an interrelationship between upgrading and governance took root mostly around 2000, when the concept of the GVC first emerged; it is a distinctive perspective that has served as a theoretical basis for many studies on the VC. This section summarizes the concepts of upgrading and governance to provide a better understanding of this unique perspective on the VC.

Upgrading

A representative study on the notion of upgrading defines it as the maintaining or increasing of producers' incomes accompanied by an increase in 'the skill content of their activities and/or move

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[1]The difference between the VC concept and other chain concepts, such as supply chains, international production networks, and the French *filière*, is discussed in Bair (2005); Faße, Grote, and Winter (2009); and Coulibaly et al. (2010). However, according to many studies and publications, the VC concept seems to be used without any strict differentiation from the other concepts. This situation does not greatly differ from that of the dawn of the GVC concept. 'The "value chain" concept was adopted over several widely used alternatives because it was perceived as being the most inclusive of the full range of possible chain activities and end products' (Gereffi et al., 2001: 3).

[2] VC analysis sometimes aims at accomplishing VCD. However, the definition of 'VCD' is also ambiguous (Donovan et al., 2013: 16–17) because any goals can be assumed to qualify as development. Kaplinsky and Morris (2001) notes that the point of entry into VC analysis depends on the particular research interest.

into market niches' under the competitive pressure of globalisation (Humphrey and Schmitz, 2002b: 3).[3] It is notable that 'skill content' and technology are stressed, as well as income.

Table A1.1 shows four types of upgrading often classified by earlier studies.[4] The literature of in the 1990s on the global commodity chain focused on the concept of upgrading mainly in the context of how industries and firms could incorporate new functions into the VC to increase their profits (Gereffi, 1994, 1995). Functional upgrading, as defined in this table, corresponds to this kind of upgrading.[5] One example of functional upgrading is the acquisition of functions that generate higher VA than the original activity, such as a shift from mere assembly to full-package production, or the creation of original brands for their products (Gereffi, 1999). Inter-sectoral upgrading can be a countermeasure by suppliers to release lock-ins or overcome difficulties in functional upgrading in the context of strong and explicit coordination by buyers (Humphrey and Schmitz, 2002a).

Table A1.1. Typology of Upgrading

Process upgrading	Transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology
Product upgrading	Moving into more sophisticated product lines, which can be defined in terms of increased unit values
Functional upgrading	Acquiring new functions, such as design or marketing, or abandoning existing functions to increase the overall skill content of activities
Inter-sectoral upgrading	Entering a different sector to produce a new product by using specific knowledge, capabilities, or competence acquired in the original sector

Sources: Humphrey and Schmitz (2000b, 2002a, 2002b).

The concept of upgrading has evolved mainly in the literature on industrial clusters, industrial capability (IC), and technical capability (TC). The industrial cluster literature mainly emphasizes the importance of local industrial organisation, namely vertical and horizontal cooperation amongst firms for the purpose of upgrading (Bell and Albu, 1999; Schmitz and Nadvi, 1999). By contrast, IC/TC literature has focused on investment to acquire technology from inside and outside firms for the purpose of upgrading.

The term 'cluster' refers to 'the geographical and sectoral concentration of enterprises' (Schmitz, 1999a: 466). The formation of industrial clusters can be led by the private sector or by the government through such methods as the construction of special economic zones, the implementation of regional programs, the organisation of cooperatives, and other interventions to promote collective actions.

The literature on industrial clusters and upgrading tends to support measures that will improve the competitiveness of local producers when it comes to meeting the stricter requirements for

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[3] The definition used by Gereffi (2005) and Gereffi and Fernandez-Stark (2016) places more emphasis on the shift in the functions or positioning of actors in the GVC. For instance, Gereffi said, 'Industrial upgrading refers to the process by which economic actors—nations, firms, and workers—move from low-value to relatively high value activities in global production networks' (2005: 171).

[4] However, upgrading cannot really be divided so neatly into four patterns. For example, product upgrading can be realized through process upgrading (Gibbon, 2004). Several more patterns have been proposed by other studies, such as those by Frederick (2010) and Fernandez-Stark et al. (2012).

[5] 'Buyer' and 'supplier' indicate two firms or sectors vertically linked by a business transaction in the chain, such as a retailer (buyer)–wholesaler (supplier), retailer (buyer)–processor (supplier), and processor (buyer)–farmer (supplier).

production, design, and marketing that have accompanied globalisation. Such competitiveness is thought to be possible through joint action or cooperation amongst industrial clusters, as well as through their external economies (Schmitz, 1999a; Schmitz and Nadvi, 1999).[6] Cooperation leads to collective efficiency, including benefits from the disintegration and specialisation of individual firms; it also enables industrialisation driven by local small enterprises.[7]

Both vertical and horizontal cooperation can affect a wide range of activities, such as investment, production, distribution, marketing, and design (Table A1.2). With regard to the effect on investment, clustering, especially in the incipient stage of industrialisation, facilitates 'the mobilisation of financial and human resources, that it breaks down investment into steps with small risk, that the enterprise of one creates a foothold for the other, that ladders are constructed which enable small enterprise to climb up and grow' (Schmitz and Nadvi, 1999: 1507).

Table A1.2. Types of Cooperation and its Effects

Cooperation	
Vertical cooperation	● Producer and user improvements of components ● Alliances across the VC
Horisontal cooperation	● Sharing of equipment ● Sectoral associations
Effects of cooperation	
Investment	● Breaking down investment into small steps with lower risk
Production	● Improving quality, speed, and flexibility ● Certifying products
Distribution	● Building infrastructure for speedier and more cost-efficient transportation
Marketing	● Organising a trade fair
Design	● Creating local design capacity ● Developing brand names

VC = value chain.
Sources: Schmitz (1998, 1999a).

The IC/TC literature has focused on the process of acquiring technology, which is not fully discussed in the industrial cluster literature. The literature on ICs/TCs defines 'upgrading' based on the absolute speed of technological change or innovation.[8] Dahlman, Ross-Larson, and Westphal (1985) define upgrading as an increase in efficiency and productivity through a minor change in existing producing units, such as a rearrangement of the organisation, in contrast to a radical change in technology. Similarly, Bell (2007) classifies innovation as 'upgrading innovations', characterised by incremental

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[6] Consciously pursued 'cooperation' is contrasted with passively enjoyed 'external economies'. Marshall (1890) divides economies arising from an increase in the scale of production of any kind of goods into two classes. External economies are 'those dependent on the general development of the industry', and internal economies are 'those dependent on the resources of the individual houses of business engaged in it, on their organisation and the efficiency of their management'. When 'social benefits are higher than private benefits we speak of external economies' (Schmitz, 1999a: 474). External economies include the benefit of labour market pooling, support for more specialized local suppliers of inputs and services, technology spillovers, and market access (Schmitz, 1999a, 1999b; McCormick, 1999).

[7] Collective efficiency is defined as 'the competitive advantage derived from local external economies and joint action' (Schmitz, 1999a: 466).

[8] Kaplinsky and Morris (2001: 37) suggest a decrease in the VA and market share when the rate of innovation becomes lower than the rates of competitors. The relative speed of technological change also seems to be something that is important to consider upgrading, as defined by Humphrey and Schmitz (2002b).

advances in technology, and 'new facility innovations', characterised by radical technological advances.

Innovation, including upgrading, is thought to be achieved through a change in the ongoing production system as a result of the accumulation of ICs, which is defined as highly complex TCs that are 'required to specify and design new products, develop novel machines and install new processes, establish new channels of supply and distribution', rather than to undertake ongoing operations (Bell and Albu, 1999: 1723).[9]

ICs are accumulated through an investment called 'learning', with the aim of acquiring and creating human resources and knowledge bases for innovative strategies (Bell and Figueiredo, 2012). Table A1.3 shows mechanisms of learning from inside and outside firms for improving the firms' ICs. This table indicates that learning is a complex mechanism of knowledge creation and acquisition, including pre- and post-learning processes such as preparation, assimilation, and codification.

Table A1.3. Typology of Learning Mechanisms for Latecomer Firms

	Internal learning	External learning
Preparation	● Organisational arrangements for knowledge creation, assimilation, and codification, or external knowledge acquisition	
Creation or acquisition	● Training in innovation-related skills and experience acquisition	
	● Knowledge creation by R&D	● Establishment via FDI of R&D facilities in knowledge-rich locations in other countries
	—	● Acquisition of codified knowledge as a basis for developing new products or processes ● Acquisition of ready-made specifications for new products ● The hiring of 'ready-made' innovative human capital
Assimilation	● Intra-firm communication of knowledge ● Knowledge articulation and assimilation	—
Codification	● Knowledge codification	

— = not applicable, FDI = foreign direct investment, R&D = research and development.
Sources: Bell and Figueiredo (2012), tables 1 and 2.

The industrial cluster can encourage external learning on the part of firms. Humphrey and Schmitz (2000b) explain the roles of technological gatekeepers in two types of industrial clusters. The first is a cluster that collaborates with technology-support organisations, including public sector institutes and business associations. The second is a cluster of small firms led by large local firms, called the 'hub-and-spoke cluster.' An example of the former, concerning Brazilian fruit exports, was provided by Damiani (1999), as well as by Humphrey and Schmitz (2000a: 10), who describe it as encompassing 'the acquisition of knowledge about market entrance requirements, the development, and maintenance of a reputation for quality which applied to producers in the region as a whole and introduction of pest control procedures to satisfy USDA [United States Department of Agriculture] requirements on fruit fly control'.

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[9] A simpler TC required for ongoing operations is called 'production capability' (Bell 2007, 2009).

Governance

The second key concept emphasised in the GVC literature is governance.[10] Governance is a concept focused on organisational structure and inter-firm transactions between buyers and suppliers. A model presented by Gereffi, Humphrey, and Sturgeon (2005) is often cited to explain governance.[11]

According to this model, the types of governance, or vertical relationships amongst firms, can be classified by the degree of explicit coordination,[12] and by the power asymmetry of firms in the chain. The type of governance is determined by the complexity of the transactions, the ability to codify transactions, and the suppliers' capabilities to meet buyers' requirements (Figure A1.1).[13] Buyers would engage in explicit coordination with sellers when seeking to define a product or requiring complex conditions when dealing with suppliers.[14] Meanwhile, a higher degree of codification or standardisation would ease the complexity of transactions and diminish explicit coordination (Humphrey and Schmitz, 2000b; Gereffi, Humphrey, and Sturgeon 2005).

This model of governance is useful for prospecting the organisational structure of firms from changes in the complexity of transactions and in suppliers' capabilities due to the trend of economic growth and globalisation. This model emphasises standards and certification schemes, which can reduce the complexity of transactions through an intervention into the VC.[15]

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[10] Gereffi et al. (2001: 2–3) write, 'By focusing on the chain or organisational network as the unit of analysis, rather than the firm, interesting question about power, governance and the dynamics of chins emerge'.

[11] The typology of governance laid out by Gereffi, Humphrey, and Sturgeon (2005) has still been utilized in recent literature, such as Gereffi and Fernandez-Stark (2016), and has served as a theoretical backbone of the discussion on the GVC in recent years. For example, Jespersen et al. (2014) analysed individual types of aquaculture VCs in Asian countries based on the framework provided by Gereffi, Humphrey, and Sturgeon (2005).

[12] Explicit coordination means 'non-market forms of coordination of economic activity' (Gereffi, Humphrey, and Sturgeon, 2005: 100).

[13] 'Capability' can be defined as the knowledge, experience, and skills that are needed to carry out activities of organisations in the context of governance (Richardson, 1972). Richardson notes, 'The capability of an organisation may depend upon command of some particular material technology…or may derive from skills in marketing or knowledge of and reputation in a particular market' (1972: 888). 'Capability' is sometimes defined as 'competence' in Gereffi, Humphrey, and Sturgeon (2005).

[14] According to Humphrey and Schmitz (2004: 97), product definition includes '1. What is to be produced: product design and specifications. 2. How it is to be produced. This involves the definition of production processes, which can include elements such as the technology to be used, quality systems, labour standards and environmental standards. 3. How much is to be produced, and when: production scheduling and logistics.'

[15] Gereffi, Humphrey, and Sturgeon (2005: 98) write that the 'effectiveness of industry actors and the social processes surrounding the development, dissemination, and adoption of standards and other codification schemes … opens the door for policy interventions and corporate strategy'.

Figure A1.1. Determinants of VC Governance Type

		Ability to codify transactions			
		Low		High	
		Capability of supplier			
		Low	High	Low	High
Complexity of transactions	Low	Unlikely to occur		Exclusion	Market
	High	Hierarchy (vertical integration)	Relational	Captive	Modular

VC = value chain.

Notes: 'Exclusion' is not shown in Table 1 of Gereffi, Humphrey, and Sturgeon (2005) because it would not appear in the GVC. However, the exclusion is 'quite common, and with requirements for suppliers increasing, perhaps increasingly likely to occur' in developing countries (Gereffi, Humphrey, and Sturgeon, 2005: 100–01).

Source: Gereffi, Humphrey, and Sturgeon (2005), Table 1.

This model of governance is largely influenced by the theory of transaction-cost economics, which explains the spectrum of governance structures, from market to hierarchy, by focusing on specific characteristics of inter-firm transactions between buyer and supplier. Williamson (1979) explains the complexity of transactions or contractual relations by specifying three factors: frequency, uncertainty, and asset specificity.[16] Asset specificity is especially emphasised as a key factor in distinguishing amongst governance structures (Williamson, 1979, 1991). When assets are nonspecific to buyers and suppliers, the transactions will be organised as a market exchange because of the advantages regarding production costs due to scale economies, aggregation of uncorrelated demands, and economies of scope. However, when there is a higher specification of assets, or higher bilateral dependency, hierarchy governance will be more efficient for economising on the sum of transaction and production costs (Williamson, 1981, 1991).

The modular type of governance, which cannot be explained by the theory of transaction-cost economics, was incorporated from studies on 'mundane transaction costs'. While transaction-cost economics draws attention to the costs of dealing with the risk of opportunism,[17] Baldwin and Clark (2002, 2006) focus on 'mundane transaction costs', or the costs of tasks required for mundane transactions, such as standardisation; counting;[18] and compensation; in addition to the transfer of material, energy, information, and money. A transaction between subnetworks consisting of complex

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[16] Williamson (1991: 281) states that 'asset specificity has reference to the degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value.' Asset specificity includes (i) site specificity, (ii) physical asset specificity, (iii) human-asset specificity, (iv) brand name capital, (v) dedicated assets, and (vi) temporal specificity. See De Vita, Tekaya, and Wang (2011) for more details.

[17] Such costs include both the ex-ante (pre-contract) costs of safeguarding by drawing up and negotiating contracts, and the ex-post (harmonizing) costs of mitigating the risk of opportunism (Williamson, 1981).

[18] 'Counting' quantifies 'a number, weight, volume, length of time, or flow' of a transferred object (Baldwin and Clark, 2002: 12).

and interdependent transfers in order to minimise 'mundane transaction costs' is called a 'system exhibiting modularity'.[19]

The focus on the supplier's capability as a factor in determining governance type was introduced by a managerial framework called the 'resource-based view' of firms. The essential concept of the resource-based view is that 'firms must in certain instances depend on external resources' because the acquisition of the capabilities needed to engage in certain VCs may be 'difficult, time-consuming, and effectively impossible for some firms' (Gereffi, Humphrey, and Sturgeon, 2005: 81). Thus, it is a rational strategy for a business that supports core competencies to integrate vertically,[20] and to rely on the market for its other functions (Prahalad and Hamel, 1990: 83). In fact, Gereffi, Humphrey, and Sturgeon (2005: 81) note that 'firms which rely on the complementary competencies of other firms and focus more intensively on their area of competence will perform better.'

The Interrelationship between Upgrading and Governance

The governance pattern and the possibility or efficiency of the supplier's upgrading can influence each other (Humphrey and Schmitz, 2000b, 2002a, 2002b; Dolan and Humphrey, 2004; Kaplinsky, Terheggen, and Tijaja, 2011; Lee, Gereffi, and Beauvais, 2012). Case studies by Dolan, Humphrey, and Harris-Pascal (1999), and Dolan and Humphrey (2000, 2004), which analysed the fresh fruit and vegetable (FFV) trade between the UK and Kenya/Zimbabwe, are frequently cited as representative examples of such an interrelationship in agri-food GVCs.[21]

Supermarkets in the UK, which are major importers of African FFVs, strengthened their explicit coordination within the chain, in this case with positive outcomes, by establishing standards and directly monitoring suppliers to ensure that they responded to domestic social needs such as high-quality food, consistent year-round supplies, and high-value finished products.[22] Such coordination

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[19] According to Baldwin and Clark (2002: 35), 'a complex system is said to exhibit modularity if its parts operate independently, but still support the functioning of the whole.'

[20] Prahalad and Hamel (1990: 81) define 'core competencies' as 'the collective learning in the organisation, especially how to coordinate diverse production skills and integrate multiple streams of technologies.' And they give three criteria for identifying core competencies: Such a competency must 'provide potential access to a wide variety of markets', 'make a significant contribution to the perceived consumer benefits of the end product', and be 'difficult for competitors to imitate' (1990: 83). For example, core competencies were embodied in NEC's 'digital technology, especially VLSI [very-large-scale integration] and systems integration skills'; Honda's 'engines and power trains'; and Canon's 'optics, imaging, and microprocessor controls' (1990: 83).

[21] For example, see Humphrey and Schmitz (2002a), Gereffi, Humphrey, and Sturgeon (2005), and Humphrey and Memedovic (2006). Loconto and Dankers (2014) note how often Dolan and Humphrey (2000) had cited by studies regarding voluntary standards. Although supermarket- or buyer-driven VCs are frequently mentioned, these are not the only forms of agri-food VCs. Lee, Gereffi, and Beauvais (2012) mention not only buyer-driven chains, but also 'producer-driven' chains, led by processors, and 'bilateral oligopolies', led by both retailers and processors. Reardon et al. (2009) and Reardon and Timmer (2014) describe the transition of a 'food system' as an interactive change involving the wholesale, processing, and retail sectors.

[22] The standards for food quality and safety, particularly private standards, are thought to be an essential factor affecting inter-firm transactions in the agri-food sector (Kaplinsky and Morris, 2001; Humphrey and Schmitz, 2001; Gereffi, Humphrey, and Sturgeon, 2005; Humphrey and Memedovic, 2006; Henson and Humphrey, 2009; Lee, Gereffi, and Beauvais, 2012). In addition, the UK government established comprehensive standards for food hygiene and safety in the Food Safety Act 1990 (Dolan and Humphrey, 2000, 2004).

affected wholesale markets and importers in the UK, as well as exporters and FFV producers in African countries.

The growers had to meet the requirements regarding production and post-harvest practices, health and safety, and ethical trade. This demand for higher standards encouraged upgrading in the FFV sector by introducing 'cool chains' and the diversification of products. By contrast, small growers and small and medium-sized exporters who could not meet such requirements were excluded from the chains.[23]

When explicit coordination is strong, the buyer can support a supplier's processes and product upgrading so as to secure raw materials more efficiently. However, such conditions are thought to actually hinder the supplier's functional upgrading and to lock the supplier into lower-profit functions in the chain.[24]

Studies have recommended several strategies for releasing lock-ins to enable functional upgrading by suppliers, such as 'strategic intent and substantial investment' to acquire new functions; the diversification of buyers to reduce explicit coordination (Humphrey and Schmitz, 2000b); and entrance into a different sector or market by utilising knowledge or capabilities obtained in a supplier's original sector, referred to as 'inter-sectoral upgrading' (Table A.1.1; Humphrey and Schmitz, 2004).[25]

In recent years, GVC studies that emphasise international trade rather than upgrading and governance have become prominent.[26] These studies often focus on the contribution of economic activities in each country to international trade, based on an analysis of inter-country input–output data (De Backer and Miroudot, 2013; Kuroiwa, 2016; Greenville et al., 2017a, 2017b).[27] For example, indices such as the participation index clarify the strength and extent of inter-country economic activities (De Backer and Miroudot, 2013; Greenville et al., 2017a, 2017b). We can see this as a result of the diversification of the GVC concept and the tendency to emphasise empirical studies, rather than as the result of a decrease in the significance of basic concepts of upgrading and governance.

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[23] Kaplinsky, Terheggen, and Tijaja (2011) analysed timber VCs in Gabon and cassava VCs in Thailand, and suggested, by contrast, that lower standards could facilitate the participation of developing countries and small firms in GVCs. The question of how to insert small and medium-sized producers into 'high-value agro-food chains' has been one of the major topics of recent GVC studies (Gereffi and Fernandez-Stark, 2016). Fernandez-Stark, Bamber, and Gereffi (2011) suggest that constraints on access to markets, training, collaborative networks, and finance need to be removed to increase the competitiveness of farmers and enable their participation in higher-value VCs.

[24] Humphrey and Schmitz (2000b, 2002a, 2002b) present a captive or quasi-hierarchical chain in the Sinos Valley shoe cluster, in Brazil, as an example of a lock-in. US footwear manufacturers helped Brazilian producers 'in the choice of technology and organisation of production, inspected quality on site, organised transport and payment arrangements.' However, an attempt by Brazilian producers to advance into design and marketing was 'not put into practice, mainly because a small number of very influential export manufacturers did not support them.' (Humphrey and Schmitz, 2000b, 22–23).

[25] There are further recommendations, such as moving 'into functions which the lead firms governing the chain are willing to relinquish' (Humphrey and Schmitz, 2002a: 31), and 'intelligent mediation by public actor' or public assessments of 'different claims and their validity and likely impact' (Schmitz, 1999b: 1644).

[26] Those GVC studies can be positioned in the genealogy of international trade theory. Inomata (2017) regards the GVC as a paradigm of post-new-new trade theory.

[27] Studies based on international trade theory often imply the importance of international specialisation and trade activation.

1.2. VCD Handbooks

The concept of the GVC, including its key components—upgrading and governance—has been enthusiastically adopted, although possibly based on their own interpretations, mainly by donor organisations since the middle of the 2000s (Stamm and von Drachenfels, 2011). The perspective of the GVC mixed with other concepts, mainly from development studies, has generated various methodologies for evaluating VCs.

The methodologies of VC analysis have been presented in practical handbooks, manuals, and reports on VCD as a part of procedures for interventions into VCs, agricultural VCs in particular. [28] The goals of VCD literature generally surround pro-poor development, although 'clear-cut definitions of VCD are scarce in the guides' (Donovan et al., 2013: 17).[29] Most VCD handbooks focus on increasing the incomes of marginalised peoples, especially small-scale farmers.

This section starts by summarising a particular form of VCD analysis that is a distinguishing characteristic of VCD literature. Then, it provides an overview of the aspects of VC that VCD handbooks tend to emphasise.[30]

The Framework of VCD Analysis

There are roughly three steps in the analytical procedures proposed in VCD handbooks: VC selection, VC mapping, and further analysis based on the mapping.

First, a VC, subsector, or commodity, is selected according to the goals and target groups of the VCD (Da Silva and De Souza Filho, 2007; Herr and Muzira, 2009; Donovan et al., 2013). Many handbooks assume that the VC is selected based on the opinions of stakeholders or on a comprehensive market analysis using macro-level data. One important criterion for VC selection is the stable growth of the consumer markets (Haggblade and Gamser, 1991; GTZ, 2007).[31] Other criteria include the potential for poverty alleviation, intervention, and outreach, as well as the priorities of government policy (GTZ, 2007; M4P Project, 2008). According to the criterion of poverty alleviation potential, for example, labour-intensive products such as coffee and organic fruits/vegetables can be selected for small-scale farmers to enable their participation in the chain (GTZ, 2007; M4P Project, 2008; Fernandez-Stark and Bamber, 2012).

The second step is the mapping of the selected chain, subsector, or agri-food products based on interviews with VC actors.[32] VC mapping clarifies the inter-firm or inter-sectoral flow of agri-food products, and identifies the main actors and structures of the VC (Asian Development Bank [ADB],

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[28] The methodologies of VC analysis have been systematically summarized, especially by the Making Markets Work Better for the Poor (M4P) Project (2008) and Coulibaly et al. (2010).

[29] According to Gereffi (2014: 19), 'much of the literature that uses the GVC moniker misses the point and doesn't apply the framework consistently'.

[30] The concepts of VCD found in various handbooks have been summarized in several studies, such as Stamm and Von Drachenfels (2011); Nang'ole, Mithöfer, and Franzel (2011); and Donovan et al. (2013).

[31] Markets that are newly developed or regarding which future prospects are unclear can experience short-term shocks that cannot be withstood by asset-poor farmers (Fernandez-Stark and Bamber, 2012).

[32] Although VC mapping is stressed in many VCD handbooks, it is not the original method of VC analysis, nor is it an inherent part of it. See the subsector analysis in Haggblade and Gamser (1991).

2005; Da Silva and De Souza Filho, 2007; GTZ, 2007). As an example, Figure A1.2 shows the mapping of the cassava VC in northern Viet Nam.

Figure A1.2. Example of VC Mapping: The Cassava VC in Northern Viet Nam
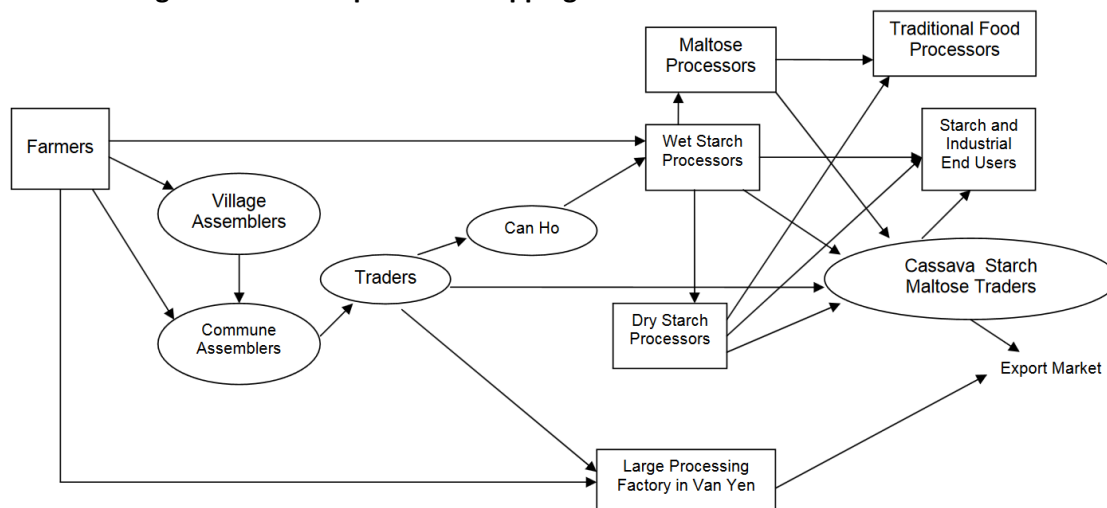
Source: Asian Development Bank (ADB), 2005: 13.

The third step, based on the VC map, entails a more detailed description of the whole chain or of specific parts of it by using data such as the quantities and prices of products; number of firms and employees; and the incomes, costs, and profits—mainly collected from stakeholders in the chain.[33] An analysis of the social and economic issues surrounding each actor in the chain would clarify effective strategies and leverage points for intervention. (ADB, 2005; GTZ, 2007; M4P Project, 2008; Herr and Muzira, 2009).[34]

The Perspectives on the VC in VCD literature

We can divide VCD literature into two types, depending on what aspects of the VC concept is emphasised. The first type pays more attention to the organisational arrangement of local industries, including specialisation and cooperation amongst firms (Webber and Labaste, 2010), as well as knowledge and technology (M4P Project, 2008), similar to the GVC and IC/TC literature. This type of literature implicitly or explicitly adopts the view that understanding governance is important for understanding the VC.[35] Furthermore, this type of literature stresses rules and regulations, particularly standards, as a factor affecting explicit coordination.[36]

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[33] This procedure can be interpreted as a part of VC mapping. Several studies that use the System Dynamics Model, such as Rich et al. (2011) and Hamza and Rich (2015), focus on the structure of a VC as obtained from the VC map, rather than on the detailed information from stakeholders.

[34] The SWOT matrix (of Strengths, Weaknesses, Opportunities, and Threats) is often introduced as a method for such analysis, for instance, by Da Silva and De Souza Filho, 2007; GTZ, 2007; and by Coulibaly et al., 2010.

[35] However, it is the small handbooks that have delved into the mechanisms of governance, upgrading, and their interrelationships.

[36] Inter-firm contracts (vertical collaboration), producer groups, and agricultural cooperatives (horizontal collaboration) (GTZ, 2007), as well as firms linked by mutual trust, are also important factors related to governance (M4P Project, 2008).

The second type of VCD literature stresses various strategies for rural development, including the formation of industrial clusters, rather than identifying aspects of technologies for upgrading (GTZ, 2007; Herr and Muzira, 2009).[37] The analytical perspective and approach to intervention are broader in this literature. For example, Altenburg (2007) mentions general policies for developing the private sector—such as improving the business environment and policies on trade, investments, and taxes— as methods for supporting pro-poor VCs (Table A1.4). Fernandez-Stark and Bamber (2012) and Bamber et al. (2014) argue for various factors, such as macroeconomic stability, labour costs, and investment in irrigation systems to enhance the competitiveness of small and medium-sized producers, and for including them in regional and global VCs (Bamber et al., 2014). These arguments seem to exceed the framework of upgrading and governance, which were the focuses of the earlier GVC studies.

Table A1.4. Major Policy Options for Influencing VCs

General private sector development policies and support programmes
● Creation of an enabling environment for the private sector
● Trade and investment policies and export-promotion programmes
● Tax policy
● Policies and programmes for skills development and innovation
● Financial and nonfinancial business services
● Support of local economic development
● Marketing

Specific VC support activities
● Awareness raising and matching (information and motivational events for suppliers; subcontracting exchange schemes; supplier fairs and exhibitions)
● Support for spillovers from lead firms (co-financed grant schemes for private sector-led initiatives; tax and financial incentives to induce TNCs; corporate social responsibility movement)
● Access to VC finance (receiving credit from business partners; making the firm creditworthy to financial institutions; developing financial products that support VC integration)
● Promotion of inclusive standards (promoting standards and labels; reforming and sensitising target groups and supporting poor producers, helping set up inclusive low-cost certification systems, and promoting group certification)
● Franchise development (organising events for building awareness of the potential benefits of franchising, reviewing the existing legal regulations regarding the franchising of businesses)

TNC = transnational corporation, VC = value chain.
Source: Altenburg (2007: 39–50).

1.3. Other Studies Stressing the Agri-food Procurement System in the ASEAN Region

There are many studies that do not explicitly use the term 'VC', but have similar perspectives to those in the literature mentioned above on agri-food GVCs.[38] Those studies focus on the transformation or

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[37] The definition of 'upgrading' varies in VCD literature. For example, GTZ (2007) defines it as 'improving business linkages, associations, and partnerships', 'strengthening service supply and demand', and 'introducing standards and improving policies and the business environment of the chain' (11).

[38] Some examples are Dolan and Humphrey (2000); Humphrey and Memedovic (2006); Kaplinsky, Terheggen, and Tijaja (2011); and Gereffi and Lee (2012).

'modernisation' of food retail, or agri-food system;[39] dissemination of private standards; and the exclusion or inclusion of small-scale producers.[40]

Studies on the Transformation or 'Modernisation' of the Agri-food System

In Southeast Asia, as in other regions, there has been a rapid growth of supermarkets, called the 'supermarket revolution', accompanied by income growth, urbanisation, and an increase in foreign direct investment and domestic investment (Reardon et al., 2009; Reardon, Timmer, and Minten, 2012).[41] Reardon, Timmer, and Minton (2012) mention that buyers change their supply sources from traditional spot markets to distribution centres and networks, preferred supplier systems, and to dedicated wholesalers; and this shift is accompanied by the spread of private standards,[42] as part of the supermarket revolution.[43] Such a view of procurement system modernisation has raised concerns about the exclusion of small-scale or asset-poor producers and processors, and has generated discussions on how such firms can be included in the chain (Reardon and Timmer, 2007; Reardon et al., 2001, 2009; and Swinnen, 2014).[44]

Reardon and Timmer (2007) and Reardon et al. (2009) have proposed a model to explain the dynamism of the procurement system by focusing on buyers' and suppliers' incentives and capacities to adopt new technologies.[45] For example, investment in wholesale market systems and in other market infrastructure would stimulate buyers and enhance procurement modernisation (Reardon, Timmer, and Minten, 2012). Small-scale suppliers could participate in this system, depending on such resources as farmers' assets;[46] collective capital;[47] and access to assistance with credit, inputs, and information (Reardon et al., 2009). Reardon, Timmer, and Minten (2012) mention several strategies

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[39] Reardon and Timmer (2014: 11) use 'food system' as 'a general term for food supply chains and markets'.

[40] Reardon and Timmer (2007, 2014); Reardon et al. (2009); Reardon, Timmer, and Minten (2012); Maertens and Swinnen (2015); and Swinnen (2014). Many of these studies use the term 'chain' or 'supply chain', instead of 'value chain'.

[41] Fresh products mainly come from small producers, and are purchased by supermarkets mostly at traditional wholesale markets. By contrast, processed products from medium-sized and large companies tend to be purchased from modern retailers (Reardon, Timmer, and Minten, 2012; Reardon and Timmer, 2014). The transition of supermarket procurement from traditional to modern suppliers has been recognized as 'a crucial vector of change in agrifood systems' (Reardon and Timmer, 2007: 2835).

[42] A shift from no standards or public standards to private standards is stressed as an aspect of procurement system modernisation (Reardon et al., 2009).

[43] Reardon, Timmer, and Minten (2012) describe the modernisation of the procurement of fresh products as a gradual shift from the most traditional sources to the most modern. Similarly, Gómez and Ricketts (2013) classify the types of 'food value chains' as follows: (i) traditional, (ii) modern, (ii) modern (supplier) to traditional (buyer), and (iv) traditional (supplier) to modern (buyer).

[44] Exclusion from a specific sector does not necessarily mean that the 'modernisation' of the agri-food system has had negative effects on employment. The modernisation of the chain can actually increase the demand for labour and labourers' incomes in related sectors, such as the food processing and export sectors (Maertens and Swinnen, 2009; Broeck, Swinnen, and Maertens, 2017).

[45] To be precise, this is an issue about 'decisions of adoption of ''technologies'' (of procurement and output marketing)' by the buyer and supplier (Reardon et al., 2009: 1720).

[46] Farmers' assets include land and non-land resources like irrigation, infrastructure, education, and knowledge (Reardon et al. 2009; Reardon, Timmer, and Minten, 2012). Furthermore, labour can be one such asset. Small-scale farms can be appropriate for labour-intensive field management, which may be needed by modern buyers (Reardon et al., 2009; Fernandez-Stark and Bamber, 2012)

[47] Collective capital includes 'vehicles and warehouses owned by the cooperative, and access to public infrastructure such as roads' (Reardon et al., 2009: 1721).

emerging in Asia for increasing the suppliers' capacities: developing 'rural business hubs' or clusters consisting of farmers, small retailers, and complementary services and products;[48] establishing collection centres and providing assets and services to small farmers who lack them; and forming farmer market cooperatives.

Empirical Studies on the Agri-food Sector's Procurement System in the ASEAN Region

Empirical studies on the procurement system of the agri-food sector—including the issues of the supermarket revolution, private standards, and small farmer exclusion—have used many different methods. We can broadly classify these studies into two categories.

The first is a comprehensive description of the agri-food sector and related issues in specific countries by using macro-level data. A typical example is Gulati et al. (2005), which summarises information about income, trade policies, foreign direct investment, agricultural production, and farm sizes in selected Asian countries, including Indonesia, Philippines, Thailand, and Viet Nam. The United Nations Conference on Trade and Development (UNCTAD) (2007) describes the general situation regarding private standards, particularly national schemes to implement good agricultural practices in the FFV sectors and in FFV trade in Malaysia, Thailand, and Viet Nam. The World Bank (2007) analyses the supermarket revolution of Indonesia by using macro-level information.

The second category comprises micro-level empirical studies on specific issues. Many of these studies are based on interviews with actors in the chain or on sample surveys in selected villages, and they often use econometric methods. Table A1.5 shows selected issues addressed in these micro-level studies of ASEAN countries. Micro-level studies focus on the interaction between the transformation of the procurement system and the activities of firms, and on the structure of the procurement systems.

Table A1.5. Issues of Selected Empirical Studies Related to FVCs in ASEAN countries

Structures of 'modern' and traditional FVCs
● The differences in organisation between the traditional chain and the 'modern' chain that is driven by the supermarket. The function of farmers' organisations as suppliers to supermarkets in Viet Nam (Moustier et al., 2010).
● Management conditions, including assets such as irrigation pumps, for tomato farmers, by distribution channel in Indonesia (World Bank, 2007). Clarification of the modernisation of the food retail sector in Viet Nam (Wertheim-Heck, Vellema, and Spaargaren, 2015).
Effects of the transformation of FVCs on firms
● The effects of supermarkets on revenue and profit of traditional traders/suppliers providing goods mainly to small stores and households in Indonesia (Suryadarma et al., 2010). Impacts of contract farming, direct sales, and spot marketing on household incomes of vegetable producers in Viet Nam (Wang, Moustier, and Loc, 2014).
● The effects of the size, colour, and quality of chili on its farm gate price in both traditional and modern markets in Indonesia (Chang, Di Caprio, and Sahara, 2015).

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[48] Reardon, Timmer, and Minten (2012: 12336) mention that these 'rural business hubs' are emerging mainly in India, 'but may be useful nodal development strategies, for example for regional economic corridor projects underway in Southeast Asia and southern Africa.'

The behaviour of firms driving the FVC transformation
● Factors affecting market channel choice of sweet pepper farmers in Thailand (Schipmann and Qaim, 2011). ● The effects of global GAP adoption on the management of small-scale fruit and vegetable farms, and the factors influencing the adoption of standards in Thailand (Kersting and Wollni, 2012). The effects of producers' assets and farm sizes on the selection of species and feed for shrimp aquaculture in Indonesia (Yi, Reardon, and Stringer, 2018). ● Food-shopping behaviour of consumers in wet markets and supermarkets in Thailand (Gorton, Sauer, Supatpongkul, 2011) and Viet Nam (Figuié and Moustier, 2009).

FVC = food value chain, GAP = good agricultural practices.

Sources: See citations in this table.

1.4. Summary

● The term 'VC' denotes a wide range of sequential activities from pre-production to production, processing, distribution, consumption, and post-consumption, although it does not provide a specific analytical perspective.

● Earlier studies on the GVC and VCD, as well as studies on the transformation of the agri-food procurement system, provide specific perspectives from which to analyse the FVC.

● GVC literature has focused on the interrelationship between upgrading and the organisational arrangement (i.e. governance). The complexity of the buyers' requirements for suppliers and the suppliers' capability to meet them will affect the organisational arrangements and technological transfers.

● VCD handbooks differ in their perspectives on VCs, although many of them use a methodology for visualising VCs called 'VC mapping'. Several VCD handbooks emphasise theories regarding upgrading and governance, found mainly in the GVC literature. However, most of the VCD literature presents various ways of conducting studies on pro-poor development.

● There are many studies that do not explicitly use the term 'VC', but have similar perspectives as those found in the GVC literature on agri-food products. A representative example is a study on the transformation of procurement systems driven by the modernisation of downstream sectors, such as supermarkets.

Appendix 2

Data Classification

This report used data from various sources, such as the multi-region input–output table (MRIO) of Eora26,[49] ILOSTAT,[50] tariff schedules, United Nations (UN) Comtrade,[51] and FAOSTAT.[52] For a consistent interpretation of data classified into different categories, we summarised activity- and item-based classifications of FVC-related sectors and created new categories, such as 'item category level 1' (IC1) and 'item category level 2' (IC2).

2.1. Activity-based Classifications

Table A2.1 shows the activity-based classifications of all the sectors covered by Eora26, which is an inter-country input–output (ICIO) table that uses the International Standard Industrial Classification of All Economic Activities (ISIC), Revision 3. In this report, we mainly focused on three sectors: agriculture, fishing, and food and beverages.

Table A2.2 shows the activity-based classifications of selected industries related to agri-food production and distribution according to Eora26, and the corresponding categories under ISIC revisions 3 and 4. The agricultural, forestry, and fishing sectors of ISIC revisions 3 and 4 include the activities of processing on farms or the preparation of products for the first markets. Food manufacturing includes grain milling, which means that milled grain is produced in the food sector, rather than in the agricultural sector. The farming of livestock and the production of raw milk and eggs are included in the agricultural sector. However, the production of fresh meat is considered an activity of the food sector. So, for example, the production of smoked meat from fresh meat implies an intra-sector linkage (within the food sector), rather than inter-sector linkage between the agricultural and food sectors.

We do not take into account the following sectors specified in ISIC Revision 4 (noted here with their ISIC Revision 4 codes): the 'manufacture of chemicals and chemical products' (20), including fertilisers and pesticides; 'manufacture of coke and refined petroleum products' (19), including motor fuel and light, medium, and heavy fuel oil; 'electricity, gas, steam and air conditioning supply' (35); and 'civil engineering', (42), including roads and railways (Department of Economic and Social Affairs, UN Secretariat, 2008: 108, 109, 166, 173). Although those sectors are important for the development of entire economies, including the FVCs, the range of topics would have been too broad to cover in this report.

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[49] Eora (2017), *Eora26*, https://worldmrio.com/eora26/ (accessed 21 February, 2018). See Lenzen et al. (2012) and Lenzen et al. (2013) for more detail about Eora.
[50] ILOSTAT is the database of the International Labour Organization (ILO). ILO (2019), *ILOSTAT Database*, https://www.ilo.org/ilostat (accessed 31 May, 2018).
[51] UN Comtrade is the United Nations database for statistics on international trade. UNSD (2017), *UN International Trade Statistics (UN Comtrade) Database*, https://comtrade.un.org/ (accessed 26 February, 2018).
[52] FAOSTAT is the database of the Food and Agriculture Organization of (FAO) of the United Nations. FAO (2019), *FAOSTAT: Food and agriculture data*, http://www.fao.org/faostat/en/ (accessed 27 September, 2018).

Table A2.1. Activity-based Sectors in Eora26

1. Agriculture	10. Transport equipment	20. Post and telecommunications
2. Fishing	11. Other manufacturing	21. Financial intermediation and business activities
3. Mining and quarrying	12. Recycling	
4. **Food & beverages**	13. Electricity, gas and water	22. Public administration
5. Textiles and wearing apparel	14. Construction	23. Education, health and other services
6. Wood and paper	15. Maintenance and repair	
7. Petroleum, chemical, and non-metallic mineral products	16. Wholesale trade	24. Private households
	17. Retail trade	25. Others
8. Metal products	18. Hotels and restaurants	26. **Re-export & re-import**
9. Electrical and machinery	19. Transport	

Source: Eora (2018).

Table A2.2. Activity-based Data Classifications for Major Industries Targeted in this Report

Sectors in Eora26		Category of ISIC Rev. 3 Section (Level 1)		Division (Level 2)		Category of ISIC Rev. 4 Section (Level 1)		Division (Level 2)	Group (Level 3)	
Production										
1	Agriculture	A	Agriculture	01	Agriculture	A	Agriculture	01	Crop production	011	Non-perennial crops
										012	Perennial crops
										013	Plant propagation
									Animal production	014	Animals
									Mixed farming	015	Mixed farming
					Service				Support activities	016	Support and post-harvest activities
			Hunting		Hunting		Hunting		Hunting	017	Hunting
			Forestry	02	Forestry		Forestry	02	Forestry	021	Silviculture etc.
					Logging				Logging	022	Logging
										023	Non-wood forest products
					Service				Support activities	024	Support activities
2	Fishing	B	Fishing	05	Fishing		Fishing	03	Fishing	031	Fishing
									Aquaculture	032	Aquaculture
					Service						
4	Food and beverages	D	Manufacturing	15	Food	C	Manufacturing	10	Food	101	Meat
										102	Fish
										103	Fruit and vegetables
										104	Oils and fats
										105	Dairy products
										106	Grain mill products
										108	Animal feeds
										107	Other foods
									11 Beverages	110	Beverages
				16	Tobacco				12 Tobacco	120	Tobacco
					Other manufacturing				Other manufacturing	(Omitted)	
Distribution										
16	Wholesale	G	Wholesale, retail and repair	51	Wholesale	G	Wholesale and retail	46	Wholesale	(Omitted)	
17	Retail			52	Retail			47	Retail	(Omitted)	
					Repair						
				50	Automotive fuel				Automotive fuel		
					Motor vehicles and motorcycles			45	Motor vehicles and motorcycles	(Omitted)	
18	Hotels and restaurants	H	Hotels and restaurants	55	Hotels and restaurants	I	Accommodation and food service	55	Accommodation	(Omitted)	
								56	Food and beverage service	(Omitted)	

ISIC = International Standard Industrial Classification (of All Economic Activities), Rev. = Revision.

Notes: The categories of Eora26 correspond to those in ISIC Revision 3, Level 2 (Lenzen et al., 2013). Inessential information was omitted from certain cells for the purpose of simplification.

Sources: Department of Economic and Social Affairs, UN Secretariat (2008); Eora (2018); Lenzen et al. (2013).

2.2. Item-based Classifications (IC1 and IC2)

As shown in Table A2.3, we established the classifications of IC1 (item category level 1) and IC2 (item category level 2) to allow a consistent interpretation of the product data in the Harmonized Commodity Description and Coding Systems, or 'Harmonized System' (HS),[53] FAOSTAT's Food Balance Sheet (FBS), and the FAOSTAT Commodity List (FCL), based on their corresponding classifications of agri-food products (Table A2.4). IC2 was mainly based on the 'groups' in the Central Product Classification (CPC), Version 2.1. The IC2 group for aquatic products was created mainly based on the 'divisions' of the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP).[54] The IC2 groups of vegetable and livestock products and processed food, nei, can be broken down into FBS groups, FBS items, and then into more detailed groups (i.e. FCL, FCL classified according to United Nations Broad Economic Categories: BEC, HS). Similarly, the IC2 group of aquatic products can be converted into FBS groups, and then broken down into FCL, 'adjusted ISSCAAP groups', adjusted ISSCAAP groups classified according to BEC, and HS.

Processed foods are classified into the same categories (IC1 or IC2) of main ingredients. For example, although HS 2012 190211 Pasta may contain eggs, it is included in FCL 122 Macaroni and IC2 11 Cereals, as the main ingredient is generally wheat. When the main ingredients cannot be easily identified, as in the case of HS 190220 Pasta, which is stuffed with meat and other substances, the food is classified in the category of FCL 1232 Food preparations, nes, and IC2 43 Food, nei.[55] IC1 Processed food, nei, is a special category for sugar, fat and oils, and for highly processed or unclassifiable products such as alcoholic beverages, infant food, and yeast.

Table A2.3. Classifications of Production Categories of Agri-food Products

IC1		IC2		FBS group (FAOSTAT)	
1	Vegetable products	11	Cereals	2905	Cereals - excluding beer
		12	Oil and sugar crops	2913	Oil crops
				2908	Sugar crops
		13	Vegetables	2907	Starchy roots
				2911	Pulses
				2918	Vegetables
		14	Fruits and nuts	2912	Tree nuts
				2919	Fruits - excluding wine
		15	Stimulants and spices	2923	Spices
				2922	Stimulants
2	Livestock products	21	Meat	2943	Meat
				2945	Offals
		22	Milk	2948	Milk - excluding butter
		23	Eggs	2949	Eggs
3	Aquatic products	31	Freshwater fishes	2960	Fish, seafood
		32	Marine fishes		
		33	Crustaceans		
		34	Molluscs		

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[53] In this report, only those items categorized as Food and Beverages of The United Nations Broad Economic Categories (BEC), including subcategories 111, 112, 121, 122, are used when HS six-digit products are aggregated.

[54] The ISSCAAP *divisions* are larger categories that contain the ISSCAAP *groups*.

[55] The abbreviation 'nes' means 'not elsewhere specified,' and 'nei' means 'not elsewhere included'. Thus, 'nes' and 'nei' have essentially the same meaning.

		35	Other meats	2961	Aquatic products, other
		36	Aquatic plants		
		37	Aquatic animal products, nei*		
		38	Fishes, nei	2960	Fish, seafood
4	Processed food, nei	41	Sugar	2909	Sugar & Sweeteners
		42	Fat and oils	2946	Animal fats
				2914	Vegetable oils
		43	Food, nei	2928	Miscellaneous
		44	Alcoholic beverages	2924	Alcoholic beverages

FBS = Food Balance Sheet (FAOSTAT) , IC1 = item category level 1, IC2 = item category level 2, nei = not elsewhere included.

Notes: Categories and numbers of IC1 and IC2 were established by author for this study. FAOSTAT is the database of the Food and Agriculture Organization of the United Nations. The category 'aquatic animal products, nei' is not analysed in this report because it does not include products for food consumption.

Source: FAO (2019).

Table A2.4. The Main Corresponding Tables Used in This Paper

Correspondence	Source	Websites
HS2012→HS2007→FCL→FBS items→FBS groups	FAO (2019)	Production/Trade/Food Balance > Definitions and standards > Item/Item Group, http://www.fao.org/faostat/en/#data
HS2007→FCL (nonaquatic products)	FAO (a)	Correspondence tables, http://www.fao.org/economic/ess/ess-standards/commodity/fr/
HS2012→ISSCAAP groups (aquatic products)	FAO (b)	ISSCFC, http://www.fao.org/tempref/FI/DOCUMENT/cwp/handbook/annex/ANNEX_RII.pdf (linked from Statistics > Standards http://www.fao.org/statistics/standards/en/)
HS2012→HS2007→HS2002, BEC (Revision 4)	TSB, UNSD	Conversion and correlation tables, https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp

BEC = Broad Economic Categories, United Nations Statistics Division (UNSD); FAO = Food and Agriculture Organization (United Nations); FBS = Food Balance Sheet (FAOSTAT); FCL = FAOSTAT Commodity List; HS = Harmonized Commodity Description and Coding Systems, or 'Harmonized System'; ISSCAAP = International Standard Statistical Classification of Aquatic Animals and Plants; ISSCFC = International Standard Statistical Classification of Fishery Commodities; TSB = Trade Statistics Branch (under the UNSD).

Sources: See the middle column in this table.

The ISSCAAP divisions corresponding to the IC2 groups were adjusted in this report. There are aquatic products that can be classified into multiple ISSCAAP divisions based on the HS six-digit items. To achieve a one-to-one correspondence with those items, we created new ISSCAAP division-level categories. HS six-digit aquatic items were placed in the IC2 level, corresponding to the new ISSCAAP divisions (Table A2.5). IC2 'Fishes, nei' (38), was created for HS six-digit aquatic items that could not be classified in any specific category. In addition, the IC1 category of oil and fats, from aquatic products, was moved from 'Aquatic products' (3) to 'Processed food, nei' (4).

Table A2.6 summarises the items in the FCL and ISSCAAP groups classified according to the three-digit BEC categories, FBS groups, and the adjusted ISSCAAP divisions.

Table A2.5. Newly Classified HS Six-digit Level Aquatic Items

	IC2		HS 2012	Examples
Categories for miscellaneous commodities	33	Crustaceans	030614, 030624, 160510	Crabs, frozen, not frozen
			030617, 030627	Shrimps and prawns, frozen, not frozen
			030619, 030629, 160540	Crustaceans, frozen, not frozen, prepared, not prepared, nei
	34	Molluscs	030791, 030799, 160559	Molluscs, line, not live, prepared, not prepared, nei
	36	Aquatic plants	121221	Seaweeds, fit for human consumption
	35	Aquatic animals, nei	160569, 210390	Aquatic invertebrates, prepared or preserved, nei, Mixed condiments and seasonings
Additional category to IC2	38	Fishes, nei	030199, 030289, 030389, 030390, 030439, 030449, 030459, 030469, 030489, 030499, 030520, 030539, 030544, 030549, 030559, 030569, 160419, 160420, 160432	Fish, live, nei, Fish, fresh or chilled, nei, Fish, frozen, nei, etc.
Replaced category	42	Fat and oils	150410, 150420, 150430	Fish, liver oil, Fish, body oil, Fats, marine mammals

HS = Hamonized System, IC2 = item category level 2, nei = not elsewhere included.

Sources: UNSD (2017); TableA2.4.

Table A2.6. Items from FCL and ISSCAAP Groups Classified according to Three-digit BEC Categories, FBS Group, and Adjusted ISSCAAP Divisions

IC1 and IC2	FBS groups (FAOSTAT)/ ISSCAAP divisions		Primary products		Processed products	
			For industry (BEC 111)	For household use (BEC 112)	For industry (BEC 121)	For household use (BEC 122)
1 Vegetable products						
11 Cereals	2511	Wheat and products	Wheat		Flour, wheat; Bran, wheat; Gluten, wheat; Food preparations, flour, malt extract	Macaroni; Bread; Bulgur; Pastry; Cereals, breakfast; Mixes and doughs
	2513	Barley and products	Barley		Malt	Barley, pearled
	2514	Maize and products			Flour, maize; Bran, maize	Germ, maize
	2515	Rye and products	Rye			
	2516	Oats				Oats rolled
	2517	Millet and products	Millet		Bran, millet	
	2518	Sorghum and products	Sorghum			
	2520	Cereals, other	Buckwheat; Quinoa; Fonio; Triticale; Canary seed; Grain, mixed		Flour, fonio	Cereal preparations, nes
	2805	Rice	Rice, paddy; Rice, husked			Rice, milled/husked; Rice, broken; Bran, rice
12 Oil and sugar crops	2536	Sugar cane	Sugar cane			
	2537	Sugar beet	Sugar beet			
	2555	Soybeans	Soybeans			Soya sauce; Soya paste
	2556	Groundnuts	Groundnuts, with shell; Groundnuts, shelled			Peanut butter
	2557	Sunflower seed	Sunflower seed			
	2558	Rape and mustard seed	Rapeseed; Mustard seed			Flour, mustard
	2559	Cottonseed	Cottonseed			
	2560	Coconuts (incl copra)	Coconuts; Coconuts, desiccated; Copra			
	2561	Sesame seed	Sesame seed			
	2563	Olives (incl preserved)		Olives		Olives preserved
	2570	Oil crops, other	Poppy seed		Flour, oilseeds	
13 Vegetables	2531	Potatoes and products		Potatoes; Potatoes, frozen	Flour, potatoes; Tapioca, potatoes	
	2532	Cassava and products		Cassava		
	2533	Sweet potatoes		Sweet potatoes		
	2534	Roots, other		Yautia (cocoyam); Taro (cocoyam); Roots and tubers, nes	Flour, roots and tubers, nes	
	2535	Yams		Yams		
	2546	Beans		Beans, dry		
	2547	Peas		Peas, dry		
	2549	Pulses, other and products		Broad beans, horse beans, dry; Chickpeas; Cowpeas, dry; Pigeon peas; Lentils; Bambara beans; Pulses, nes	Flour, pulses; Bran, pulses	
	2601	Tomatoes and products		Tomatoes		Juice, tomato; Tomatoes, paste; Tomatoes, peeled

IC1 and IC2	FBS groups (FAOSTAT)/ ISSCAAP divisions	Primary products		Processed products	
		For industry (BEC 111)	For household use (BEC 112)	For industry (BEC121)	For household use (BEC 122)
1 Vegetable products					
13 Vegetables 2605	Vegetables, other	Chicory roots; Carobs	Cabbages and other brassicas; Artichokes; Asparagus; Lettuce and chicory; Spinach; Cassava leaves; Cauliflowers and broccoli; Pumpkins, squash and gourds; Cucumbers and gherkins; Eggplants (aubergines); Chillies and peppers, green; Onions, shallots, green; Garlic; Leeks, other alliaceous vegetables; Beans, green; Peas, green; Vegetables, leguminous, nes; Carrots and turnips; Sweet corn frozen; Mushrooms and truffles; Vegetables, fresh, nes; Vegetables, frozen		Sweet corn prep or preserved; Mushrooms, dried; Mushrooms, canned; Vegetables, dehydrated; Vegetables in vinegar; Vegetables, preserved, nes; Vegetables, temporarily preserved; Vegetables, preserved, frozen; Vegetables, homogenized preparations; Coffee, substitutes containing coffee
14 Fruits and nuts 2551	Nuts and products	Nuts, prepared (exc. groundnuts)	Brazil nuts, with shell; Cashew nuts, with shell; Chestnut; Almonds, with shell; Walnuts, with shell; Pistachios; Kola nuts; Hazelnuts, with shell; Areca nuts; Brazil nuts, shelled; Cashew nuts, shelled; Almonds shelled; Walnuts, shelled; Hazelnuts, shelled; Nuts, nes; Nuts, prepared (exc. groundnuts)		Nuts, prepared (exc. groundnuts)
2611	Oranges, mandarins		Oranges; Tangerines, mandarins, clementines, satsumas		Juice, orange, single strength; Juice, orange, concentrated
2612	Lemons, limes, and products		Lemons and limes		Juice, lemon, concentrated
2613	Grapefruit and products		Grapefruit (inc. pomelos)		Juice, grapefruit; Juice, grapefruit, concentrated
2614	Citrus, other		Fruit, citrus, nes		Juice, citrus, single strength
2615	Bananas		Bananas		
2616	Plantains		Plantains		
2617	Apples and products		Apples		Juice, apple, single strength; Juice, apple, concentrated
2618	Pineapples and products		Pineapples		Pineapples canned; Juice, pineapple; Juice, pineapple, concentrated
2619	Dates		Dates		
2620	Grapes and products (excl wine)		Grapes; Raisins		Juice, grape
2625	Fruits, other	Fruit, prepared nes	Pears; Quinces; Apricots; Apricots, dry; Cherries, sour; Cherries; Peaches and nectarines; Plums and sloes; Plums dried (prunes); Fruit, stone, nes; Strawberries; Raspberries; Gooseberries; Blueberries; Watermelons; Melons, other (inc. cantaloupes); Figs; Mangoes, mangosteens, guavas; Avocados; Persimmons; Kiwi fruit; Papayas; Fruit, tropical fresh, nes; Fruit, dried, nes; Fruit, prepared, nes	Flour, fruit	Juice, plum, single strength; Juice, fruit, nes; Fruit, prepared, nes; Fruits, nuts, peel, sugar preserved; Fruit, cooked, homogenised preparations

IC1 and IC2		FBS groups (FAOSTAT)/ ISSCAAP divisions	Primary products		Processed products	
			For industry (BEC 111)	For household use (BEC 112)	For industry (BEC121)	For household use (BEC 122)
1 Vegetable products						
15 Stimulants and spices	2630	Coffee and products	Coffee, green; Coffee, roasted			Coffee, roasted; Coffee, extracts
	2633	Cocoa beans and products	Cocoa, beans		Cocoa, paste; Cocoa, powder and cake; Chocolate products, nes	Chocolate products, nes
	2635	Tea (incl mate)		Tea; Maté		Tea, mate extracts
	2640	Pepper		Pepper (Piper spp.)		
	2641	Pimento		Chilies and peppers, dry		
	2642	Cloves		Cloves		
	2645	Spices, other	Vanilla	Vanilla; Cinnamon (canella); Nutmeg, mace and cardamons; Anise, badian, fennel, coriander; Ginger; Spices, nes		
2 Livestock products						
21 Meat	2731	Bovine meat			Meat, cattle; Meat, extracts	Meat, cattle; Meat, cattle, boneless (beef and veal); Meat, beef, dried, salted, smoked; Meat, beef, and veal sausages; Meat, beef, preparations; Meat, homogenised preparations
	2732	Mutton & goat meat			Meat, sheep	Meat, sheep; Meat, goat
	2733	Pig meat			Meat, pig	Meat, pig; Bacon and ham; Meat, pig, preparations
	2734	Poultry meat				Meat, chicken; Fat, liver prepared (foie gras); Meat, chicken, canned; Meat, duck; Meat, goose and guinea fowl; Meat, turkey
	2735	Meat, other			Meat, horse	Meat, bird, nes; Meat, rabbit; Meat, game; Meat, dried nes; Meat, nes; Meat, nes, preparations; Snails, not sea
	2736	Offals, edible				Offals, edible, cattle; Offals, sheep, edible; Offals, pigs, edible; Offals, liver geese; Offals, liver duck
22 Milk	2848	Milk (excl butter)		Milk, whole fresh cow; Milk, skimmed cow; Yoghurt; Buttermilk, curdled, acidified milk	Whey, condensed; Milk, skimmed dried; Milk, products of natural constituents, nes	Milk, whole condensed; Milk, whole evaporated; Milk, whole dried; Cheese, whole cow milk; Ice cream and edible ice
23 Eggs	2744	Eggs	Egg albumin	Eggs, hen, in the shell; Eggs, other bird, in the shell	Eggs, liquid; Eggs, dried	
3 Aquatic products						
31 Freshwater fishes	11*	Carps, barbels and other cyprinids		Fresh		Frozen
	12*	Tilapias and other cichlids		Fresh		Fresh; Frozen
	13*	Miscellaneous freshwater fishes		Fresh; Cured		Fresh; Frozen; Frozen, dried, or cured, nei
	21*	Sturgeons, paddlefishes				Preparations, nei
	22*	River eels		Fresh		Preparations nei; Frozen
	23*	Salmons, trouts, smelts		Fresh		Fresh; Preparations, nei; Non-classified; Frozen
32 Marine fishes	31*	Flounders, halibuts, soles		Fresh		Fresh; Frozen
	32*	Cods, hakes, haddocks		Fresh; Dried; Cured		Fresh; Frozen; Frozen, dried, or cured, nei
	33*	Miscellaneous coastal fishes		Fresh		Frozen
	34*	Miscellaneous demersal fishes		Fresh		Fresh; Frozen
	35*	Herrings, sardines, anchovies		Fresh; Cured		Preparations, nei; Non-classified; Frozen
	36*	Tunas, bonitos, billfishes		Fresh		Fresh; Preparations, nei; Frozen

IC1 and IC2	FBS groups (FAOSTAT)/ ISSCAAP divisions	Primary products		Processed products	
		For industry (BEC 111)	For household use (BEC 112)	For industry (BEC121)	For household use (BEC 122)
3 Aquatic products					
32 Marine fishes	37*	Miscellaneous pelagic fishes	Fresh		Preparations nei; Frozen
	38*	Sharks, rays, chimeras	Fresh; Non-classified		Frozen
	39*	Marine fishes not identified	Non-classified	Meals	Fresh
33 Crustaceans	43*	Lobsters, spiny-rock lobsters	Non-classified; Frozen		Preparations, nei; Non-classified
	45*	Shrimps, prawns	Non-classified; Frozen		Preparations, nei
	101*	Crabs, nei	Non-classified; Frozen		Preparations, nei
	102*	Shrimps and prawns, nei	Non-classified; Frozen		
	103*	Crustaceans, nei	Frozen		Preparations, nei; Non-classified
34 Molluscs	52*	Abalones, winkles, conchs	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	53*	Oysters	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	54*	Mussels	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	55*	Scallops, pectens	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	56*	Clams, cockles, arkshells	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	57*	Squids, cuttlefishes, octopuses	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	104*	Molluscs, nei	Fresh; Frozen, dried, or cured, nei		Preparations, nei
35 Aquatic animals, nei	76*	Sea-urchins and other echinoderms	Fresh; Frozen, dried, or cured, nei		Preparations, nei
	77*	Miscellaneous aquatic invertebrates	Non-classified		Preparations, nei
	107*	Miscellaneous aquatic products, food			Preparations, nei
36 Aquatic plants	105*	Seaweeds, food, nei	Non-classified		
38 Fishes, nei	109*	Fish and fish products, nei		Fresh; Dried; Cured	Fresh; Preparations, nei; Non-classified; Frozen; Frozen, dried, or cured, nei
4 Processed food					
41 Sugar	2541	Sugar non-centrifugal			Sugar non-centrifugal
	2542	Sugar			Sugar Raw Centrifugal; Sugar refined	Sugar refined; Sugar confectionery
	2543	Sweeteners, other	Sugar crops, nes		Fructose chemically pure; Molasses; Fructose and syrup, other; Sugar, nes; Glucose and dextrose; Lactose	Maple sugar and syrups; Beverages, nonalcoholic
	2745	Honey		Honey, natural		
42 Fat and oils	2571	Soya bean oil			Oil, soybean	Oil, soybean
	2572	Groundnut oil			Oil, groundnut	Oil, groundnut
	2573	Sunflower seed oil			Oil, sunflower	Oil, sunflower
	2574	Rape and mustard oil			Oil, rapeseed	Oil, rapeseed
	2575	Cottonseed oil			Oil, cottonseed	
	2576	Palm kernel oil			Oil, palm kernel	
	2577	Palm oil			Oil, palm	
	2578	Coconut oil			Oil, coconut (copra)	
	2579	Sesame seed oil			Oil, sesame	
	2580	Olive oil			Oil, olive residues	Oil, olive, virgin
	2582	Maize germ oil			Oil, maize	Oil, maize

IC1 and IC2		FBS groups (FAOSTAT)/ ISSCAAP divisions	Primary products		Processed products	
			For industry (BEC 111)	For household use (BEC 112)	For industry (BEC121)	For household use (BEC 122)
4 Processed food						
42 Fat and oils	2586	Oil crops oil, other			Cocoa, butter	Oil, vegetable origin, nes; Margarine, liquid; Margarine, short
	2737	Fats, animals, raw			Fat, pigs; Fat, nes, prepared	
	2740	Butter, ghee				Butter, cow milk; Ghee, butteroil of cow milk
	111*	Fish, body oil			Oils	
	112*	Fats, marine mammals			Oils	
43 Food, nei	2680	Infant food				Infant food
	2928	Miscellaneous			Food Preparations, nes	Food Preparations, nes
44 Alcoholic beverages	2655	Wine				Wine; Vermouths and similar
	2656	Beer				Beer of barley
	2657	Beverages, fermented				Beverages, fermented rice
	2658	Beverages, alcoholic				Beverages, distilled alcoholic

BEC = Broad Economic Categories, United Nations Statistics Division (UNSD); FBS = Food Balance Sheet (FAOSTAT); FCL = FAOSTAT Commodity List; IC1 = item category level 1; IC2 = item category level 2; ISSCAAP = International Standard Statistical Classification of Aquatic Animals and Plants; nei = not elsewhere included; nes = not elsewhere specified.

Notes: The four-digit codes in this table represent FBS commodity groupings. With regard to aquatic products, the two-digit codes represent ISSCAAP divisions and the three-digit codes represent newly created categories (see Table A2.5).

Sources: Tables A2.3, A2.4, and A2.5.

3.1. Estimation of the Populations by Per Capita GDP

The population of each country by per capita gross domestic product (GDP) was estimated based on the total population and mean of per capita GDP. We assumed the log-normal distribution for each population distribution by per capita GDP. The probability density function of per capita GDP x is given from

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma x} \exp\left[-\frac{(\log x - \mu)^2}{2\sigma^2}\right], \quad x > 0 \quad \text{......} (1)$$

Parameters μ and σ are estimated from

$$\mu = \log E(x) - \frac{\sigma^2}{2},$$

$$\sigma = \sqrt{\log\left[\left(\frac{V(x)}{E(x)}\right)^2 + 1\right]}.$$

where $E(x)$ and $V(x)$ denote mean and variance of per capita GDP x, respectively. $E(x)$ is an exogenous variable. $V(x)$ is estimated to match the Gini coefficient, and that was calculated by the following equation (2):

$$\text{Gini} = 1 - 2\int_0^1 L(F)\,dF \approx 1 - 2\sum_{k=1}^n \frac{L(a_{k-1}) + L(a_k)}{2n} \quad \text{......} (2)$$

The Gini coefficient is estimated as the area under Lorenz curve $L(F)$ by the trapezoidal rule. The distance from a_{k-1} to a_k is a small share of the population, dividing the total population from 0 to 1 by n, and $0 = a_0 < a_1 < \ldots < a_n = 1$. n is 5,000 in this report. $L(a_k)$ denotes the cumulative value of x_k divided by $\sum x_k$, where x_k is estimated by the inverse cumulative distribution function of lognormal distribution shown as equation (1). The size of each population under specific ranges of x was estimated based on the share of the population multiplied by the total population.

We estimated each country's population by per capita GDP in 2018 and 2022. The mean of per capita GDP in 2022 in terms of the local currency units (LCUs) was deflated to the 2018 levels by the GDP deflator. Both sets of data were collected from the World Economic Outlook (WEO) database, October 2018, of the International Monetary Fund (IMF). The data for each total population was collected from the United Nations Department of Economic and Social Affairs (UN DESA). The Gini coefficient in 2018 and 2023 was estimated by the extrapolation of power approximation of the data from the

Standardized World Income Inequality Database (SWIID), Version 7.1 (Solt, 2018). Table A3.1 shows the approximate periods and Gini coefficients used in this report.

Table A3.1. Gini Coefficient Used for the Estimation of the Populations by Per Capita GDP

Item	Malaysia	Thailand	Indonesia	Philippines	Viet Nam	Lao PDR	Cambodia	Myanmar
Gini coefficient, 2018	41.3	39.2	39.6	41.5	38.1	35.8	33.8	34.4
Gini coefficient, 2023	40.7	37.9	41.1	41.3	38.4	36.3	33.0	35.1
Approximated period	2005–2016	2005–2013	2005–2017	2005–2015	2005–2016	2005–2013	2005–2012	2010–2015

GDP = gross domestic product.
Source: Estimated based on Solt (2018).

3.2. Input–Output Analysis Based on Eora26

Annual Changes in Values

In this section, 'change' in tables denotes the annual average change from 2000 to 2015 estimated via the fitting of the linear trend by using Eora26 data from 2000, 2005, 2010, and 2015. Data is converted from US dollars to LCUs and deflated by the GDP deflator to the 2015 real value in each country. The exchange rates and GDP deflator were obtained from the IMF's WEO (IMF 2018).

Breakdown of Final Demand

The final demand observed in the Eora26 database consists of several items, which are listed in Table A3.2. The preliminary estimation of the production inducement coefficients suggested that strong assumptions had been imposed on the estimations of individual final consumption of some items in Eora26. Thus, in this paper, we aggregated detailed items into the following three categories: household final consumption (a), other consumption (b+c), and capital formation (d+e+f).

Table A3.2. Classifications of Domestic Final Consumption in Eora26

Final consumption expenditure	
a. Household final consumption	9.39 Consumption of goods and services is the act of completely using up the goods and services in a process of production or for the direct satisfaction of human needs or wants. The activity of consumption consists of the use of goods and services for the satisfaction of individual or collective human needs or wants.
b. Non-profit institutions serving households	
c. Government final consumption	
Capital formation	
d. Gross fixed capital formation	10.64 Gross fixed capital formation in a particular category of fixed asset consists of the value of producers' acquisitions of new and existing products of this type less the value of their disposals of fixed assets of the same type.
e. Changes in inventories	10.118 Changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period.
f. Acquisitions less disposals of valuables	9.36 Acquisitions of goods and services by institutional units occur when they become the new owners of the goods or when the delivery of services to them is completed.

Note: See European Commission et al. (2009) for a description of each item.

The Effects of an Increase in Final Demand on Production and Value Added

A one-unit increase in final demand in a certain sector will increase production in this sector by one unit (direct effect). At the same time, intermediate inputs from various sectors, including the original sector, will increase production in that sector (indirect effect). The indirect effect can be broken down into the initial effect, expressed by the share of intermediate input in production or input coefficients (primary effect), and the further demand for intermediate inputs (secondary and subsequent effects). The sum of the direct and indirect effects is expressed as a value in the Leontief inverse matrix (total effect).

The Leontief inverse matrix $L = (I - A)^{-1}$ can be derived from the input–output table $Ax + f = x$ as a component of the column vector of production value x as follows:

$$x = (I - A)^{-1}f$$

where *I* denotes the identity matrix, *A* denotes the input coefficient matrix, and f denotes the column vector of final demand. The power of the dispersion index (Rasmussen, 1956), often defined as a backward linkage index, is expressed as the sum on each column in *L*. The backward linkage index becomes large in sectors that need a large value in intermediate inputs.

The effect of the change in final demand on value added (VA) in each sector is estimated from the total effect multiplied by the VA rate. The effect on the VA becomes large when the indirect effect or VA rate is large.

3.3. Analysis of Employees Based on ILOSTAT and Eora26

Estimation of the Number of Employees and Per Capita Employee Compensation

We estimated the number of employees in sectors corresponding to selected sectors as defined by Eora26; and we collected the numbers of employees classified by levels 1, 2, and 3 of the International Standard Industrial Classification of All Economic Activities (ISIC), revisions 3 and 4, using a dataset for employment by sex and economic activity from the International Labour Organization (ILO) and the United Nations Statistics Division (UNSD).[56] Table A3.7 shows the correspondence between the sectors as defined by Eora26 and number of employees as classified by ISIC. The sectors of economic activity almost match those of employment.

Time series data on the numbers of employees in the Lao People's Democratic Republic (Lao PDR), Cambodia, and Myanmar could not be obtained. Thus, we used the estimated numbers of employees based on data of the ILO model for several aggregated sectors in those three countries.[57] First, we

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[56] For the ILO, the data came from 'Employment by sex and economic activity – ILO modelled estimates, May 2018', under 'ILO modelled estimates' (ILO, 2019). For the UNSD, the data came from 'UN data, Total employment, by economic activity', under 'Labour market' (UNSD, 2019). Note that the data source of the UNSD is the ILO.

[57] The data came from 'Employment by sex and economic activity – ILO modelled estimates, May 2018', under 'ILO modelled estimates' (ILO, 2019).

used as reference values the data from the ILO or UNSD for the base years in Lao PDR, Cambodia, and Myanmar: 2010, 2012, and 2015, respectively. Next, we gauged the average annual change rates of employees based on estimates by the ILO model. Finally, we estimated the numbers of employees based on the reference values and estimated average annual change rates. Table A3.4 shows the aggregated categories and periods of the estimates.

To estimate the data for per capita compensation, we divided the total compensation figures obtained from Eora26 by the number of employees in each sector. Total and per capita compensation were converted from US dollars to LCUs by using the exchange rates in each year and deflating the results through the GDP deflator to 2015 levels. The exchange rates and GDP deflator were estimated or obtained from the IMF.

Table A3.3. Correspondence between Eora26 and ISIC on Employee Data

Eora26	ISIC employee data in 2000–2009	ISIC employee data in 2010–2016
Agriculture	Rev. 3, 01	Rev. 4, A – Fishing
Fishing	Rev. 4, 03 or Rev. 3, B or Rev. 3, 05	Rev. 4, 03 or Rev.3, B or Rev.3, 05
Food & Beverages	—	Rev. 4, 10 + Rev.4, 11
Wholesale Trade	—	Rev. 4, 46 or Rev.3, 51
Retail Trade	—	Rev. 4, 47
Hotels & Restaurants	Rev. 4, I or Rev.3, H	Rev. 4, I or Rev. 3, H
Total	Rev. 3	Rev. 4

— = not applicable, ISIC = International Standard Industrial Classification of All Economic Activities, Rev. = Revision.
Sources: Eora (2018); ILO (2019); UNSD (2019).

Table A3.4. Correspondence between Sectors and Periods for the Estimation of Numbers of Employees in Lao PDR, Cambodia, and Myanmar

New category	Agriculture & fishing		Wholesale & retail		Hotels & restaurants		All sectors	
Eora26 ILO model	Agriculture + Fishing ISIC Rev. 4, A		Wholesale Trade + Retail Trade ISIC Rev. 4, G		Hotels & Restaurants ISIC Rev. 4, I		Total Total	
States	Change rate	Employees	Change rate	Employees	Change rate	Employees	Change rate	Employees
Lao PDR	2013–2016	2010–2016	2010–2016	2010–2016	2010–2016	2010–2016	2000–2016	2000–2016
Cambodia	2012–2016	2012–2016	2012–2016	2012–2016	2012–2016	2012–2016	2000–2016	2000–2016
Myanmar	2001–2016	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016

ILO = International Labour Organization, ISIC = International Standard Industrial Classification of all Economic Activities, Lao PDR = Lao People's Democratic Republic, Rev. = Revision.
Note: 'Change rate' denotes an estimation of the average annual change rate based on a specific period and on data from the ILO model. 'Employees' denotes an estimation of the number of employees based on a specific period and the average annual change rate.
Source: Eora (2018); ILO (2019); UNSD (2019).

Analysis of the Interaction amongst Final Demand, the Number of Employees, and Production

In general, the effects of final demand on the number of employees can be measured by input–output analysis under the assumption that the employee coefficient, or the number of employees needed for unit production in each sector, is fixed. However, in reality, the number of employees does not necessarily increase in line with increases in production. This assumption is particularly inappropriate for the agricultural sector, where increases in production are often accompanied by decreases in the number of employees.

Instead of the method described just above for analysing the effects of final demand on the number of employees, which is quite popular, this report focused on breaking down the change in production into its components: change in the total compensation of employees, the number of employees, and per capita compensation.[58] First, the average annual rate of change in production and total employee compensation,[59] and the contribution of employee compensation to production value, were estimated by using Eora26 data for 2000, 2005, 2010, and 2015. The contribution of changes in employee compensation to production is estimated from

$$C = R \times S/100 \quad .$$

where C denotes the contribution of compensation (%), R denotes the average annual rate of change in compensation (%), and S denotes the contribution of compensation to production (%).

Next, we estimated the average annual change rates in the number of employees and per capita compensation. The periods and the numbers of observations undertaken for the estimation are listed in Table A3.5. The product of the number of employees times per capita compensation is the total employee compensation. Thus, changes in the number of employees and/or in per capita compensation are interpreted as contributions to total employee compensation.

Table A3.5. Data Used to Estimate Changes in the Number of Employees and in Per Capita Compensation

State	Item	Agriculture & fishing	(Agriculture)	(Fishing)	Food & beverages	Wholesale & retail	Hotels & restaurants	All sectors
Malaysia	Period	2006–2016	2001–2016	2001–2016	2010–2016	2010–2016	2001–2016	2000–2016
	Obs.	10	15	15	7	7	15	16
Thailand	Period	2006–2016	2002–2016	2002–2016	2011–2016	2011–2016	2002–2016	2000–2016
	Obs.	9	13	13	6	6	13	15
Indonesia	Period	2006–2015	2000–2015	2000–2016	2012–2016	2012–2016	2012–2015	2000–2015
	Obs.	7	13	14	5	5	4	13
Philippines	Period	2012–2016	2012–2016	2012–2016	2012–2016	2012–2016	2012–2016	2000–2016
	Obs.	4	4	4	4	4	4	15
Viet Nam	Period	2010–2016	2010–2016	2009–2016	2010–2016	2010–2016	2009–2016	2000–2016
	Obs.	7	7	8	7	7	8	12
Lao PDR	Period	2010–2016	2010	–	–	2010–2016	2010–2016	2000–2016
	Obs.	7	1	0	0	7	7	17
Cambodia	Period	2012–2016	2004, 2012	2004, 2012	2012	2012–2016	2012–2016	2000–2016
	Obs.	5	2	2	1	5	5	17
Myanmar	Period	2006–2016	2000, 2015	2015	2015	2006–2016	2000–2016	2000–2016
	Obs.	11	2	1	1	11	17	17

− = data not available.

Obs. = number of observations.

Sources: Eora (2018); ILO (2019); UNSD (2019).

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[58] All data (nominal prices in US dollars) was converted into LCUs according to the exchange rates, and then deflated by the GDP deflator for each country to the 2015 level real prices. The source for the exchange rates and GDP deflators was the IMF.

[59] The annual change rates of production, total compensation, number of employees, and per capita compensation were estimated by using a semi-log model of time trends.

3.4. Estimation of Supply–Demand Balance Based on the Food Balance Sheet (FAOSTAT)

The supply and demand balance of agri-food products was described based on the 'items' of the Food Balance Sheet (FBS), from FAOSTAT. The total supply quantity of each product is expressed as

$$SPL_{ttls} = PRD + IMP ,$$

$$SPL_{ttld} = DMD_{dms} + EXP$$

where SPL_{ttls} denotes total supply (supply side), PRD denotes production, IMP denotes import, SPL_{ttld} denotes total supply (demand side), DMD_{dms} denotes domestic demand, and EXP denotes export. SPL_{ttls} does not match SPL_{ttld} , as SPL_{ttls} does not include stock variation. In this report, the values of SPL_{ttld} are used to represent total supply.

Two indicators, PRD/SPL_{ttls} and DMD_{dms}/SPL_{ttld}, or how domestic production and demand contribute to total supply, are the focus. Shares of production and domestic demand in total supply are represented as

$$PRD/SPL_{ttls} = 1 - IMP/SPL_{ttls} ,$$

$$DMD_{dms}/SPL_{ttld} = 1 - EXP/SPL_{ttld} .$$

Items under the FBS were classified using 50% of PRD/SPL_{ttls} and DMD_{dms}/SPL_{ttld} as thresholds (Figure A3.1).

Figure A3.1. Categories of FBS Items and Their Interpretation

	$PRD/SPL_{ttls} < 50\%$	$PRD/SPL_{ttls} \geq 50\%$
$DMD_{dms}/SPL_{ttld} \geq 50\%$	2nd quadrant (Import-oriented)	1st quadrant (Domestic-oriented)
$DMD_{dms}/SPL_{ttld} < 50\%$	3rd quadrant (Trade-oriented)	4th quadrant (Export-oriented)

Source: Author.

3.5. Estimation of Ad Valorem (AV) Equivalents of Tariff Rates

The AV-equivalent tariff rates were used for the estimation of non-price competitiveness (Appendix 3.6). We estimated the average values for 2014–2016 of the AV equivalents of tariff rates for the six-digit level agri-food products under the Harmonized Commodity Description and Coding Systems, or 'Harmonized System' (HS), classified according to the United Nations Broad Economic Categories (BEC) 1, the category of 'Food & beverages'.[60] The numbers of target items are listed in Table A3.6. The values of the AV equivalents of non-AV duties were estimated by dividing non-AV duties by the import

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[60] Tariff rates of the ASEAN Trade in Goods Agreement (ATIGA) and the Association of Southeast Asian Nations (ASEAN) + 1 agreements are imposed on more specific items than are listed in HS six-digit level categories. We used the highest tariff rates on the specific products that fall into each HS six-digit level item as the representative value.

values. We used the tariff rates under the Association of Southeast Asian Nations (ASEAN) Trade in Goods Agreement (ATIGA); and under the ASEAN + 1 regional agreements, including the ASEAN–China Free Trade Area (ACFTA), ASEAN–Korea Free Trade Area (AKFTA), ASEAN–Japan Comprehensive Economic Partnership (AJCEP), ASEAN–India Free Trade Area (AIFTA), ASEAN–Australia–New Zealand Free Trade Agreement (AANZFTA), and the Japan–Indonesia Economic Partnership Agreement (JIEPA), that were applied to the particular trade partners.[61]

Table A3.6. Numbers of HS Six-digit Items

	IC1 groups				
HS	**1. Vegetable products**	**2. Livestock products**	**3. Aquatic products**	**4. Processed food, nei**	**Total**
HS 2012	319	105	217	84	725
HS 2002 (PHL)	272	94	108	82	556

HS = Harmonized Commodity Description and Coding Systems, or 'Harmonized System'; IC1 = item category level 1, nei = not elsewhere included, PHL = Philippines.
Notes: The data for the Philippines is from 2002, and the data for the other ASEAN countries is from 2012.
Source: UNSD (2017).

The tariff rates under the ATIGA and ASEAN+1 agreements were collected from various sources, which are listed in Table A3.7.[62] Malaysia and Singapore impose non-AV tariffs on the alcohol content of several alcoholic beverages. Therefore, the alcohol content of those alcoholic beverages was assumed (Table A3.8).

Table A3.7. Sources of Tariff Schedules, ATIGA and ASEAN + 1 Regional Agreements

Agreements		Sources	Websites
AANZFTA	ASEAN–Australia–New Zealand FTA	New Zealand, Foreign Affairs & Trade, Tariff Schedules (HS 2012)	https://tariff-finder.fta.govt.nz/tariff-schedules/
ACFTA	ASEAN–China FTA	ASEAN	http://asean.org/?static_post=asean-china-free-trade-area-2
AIFTA	ASEAN–India FTA	ASEAN	http://asean.org/?static_post=asean-india-free-trade-area-3
AJCEP	ASEAN–Japan CEP	ASEAN	http://asean.org/?static_post=asean-japan-free-trade-area-2
AKFTA	ASEAN–Korea FTA	CMSMS and AKFTA, Tariff Finder	http://akfta.asean.org/
		Korea Customs Service	https://www.customs.go.kr/kcshome/site/index.do?layoutSiteId=english
		ASEAN, ASEAN Tariff Finder	http://tariff-finder.asean.org/index.php?page=search2
ATIGA	ASEAN FTA	ASEAN, Annex 2 (Tariff Schedules)	http://asean.org/?static_post=annex-2-tariff-schedules
JIEPA	Japan–Indonesia EPA	Japan–Indonesia Economic Partnership Agreement [in Japanese]	http://www.meti.go.jp/policy/trade_policy/epa/epa/id/ [in Japanese]

ASEAN = Association of Southeast Asian Nations, ATIGA = ASEAN Trade in Goods Agreement, CEP =

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[61] We used the tariff rates under the JIEPAfor trade between Indonesia and Japan, instead of the AJCEP, which did not enter into force until 2018.
[62] There are many blanks in the source of AKFTA. Blanks can be interpreted as tariff-free, omission of recording, or ignorable blanks. Blanks were ignored or filled in by referring to data from CMS Made Simple (CMSMS) and AKFTA, Korea Customs Service, and ASEAN Tariff Finder. Tariff rates of the ACFTA in Viet Nam in 2014 were assumed to have the same values as in 2015.

Comprehensive Economic Partnership, CMSMS = CMS Made Simple, EPA: Economic Partnership Agreement, FTA = free trade agreement.
Sources: See the middle column in this table.

Table A3.8. The Assumed Levels of Alcohol Content for the Estimation of Tariff Rates

HS 2007		Alcohol content (%)	HS 2007		Alcohol content (%)
220300	Beer made from malt	5	220710	Undenatured ethyl alcohol (>= 80% vol.)	80
20600	Cider, perry, mead and other fermented beverages	7	220870	Liqueurs and cordials	20
			220890	Ethyl alcohol (< 80% vol.)	40

HS = Harmonized Commodity Description and Coding Systems, or 'Harmonized System'.
Source: Author.

3.6. An Analysis Based on the Trade Matrix of UN Comtrade

Trade Quantities and Prices

In this report, we estimated the trade prices based on the export or import values divided by quantities. We collected the data on trade values and quantities from UN Comtrade.[63] The raw data on HS six-digit level items, including only those items classified under BEC 1 (Food & Beverages) were aggregated into the groups of the FAOSTAT Commodity List (FCL) and the adjusted groups from the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP). The data was further aggregated into item category level 2 (IC2) groups, which reflect the BEC 11 (primary products) and 12 (processed products) classifications.

Prices often become extremely high when the trade quantity is limited. For this reason, the prices of whole items in the IC2 groups appear very high. Thus, items in the FCL and adjusted ISSCAAP groups whose quantities were smaller than 10 tonnes were excluded from the price estimates of the IC2 groups.

Estimation of Non-price Competitiveness in the ASEAN Region

We assumed that the non-price competitiveness of a product exported to an ASEAN country is high when the import quantity of the product is larger than the estimated value based on an approximate line. Conversely, non-price competitiveness is low when the import quantity is smaller than the approximated value. Approximate lines for each item exported from any of the ASEAN+6 countries are determined by the power approximation of the relationship between import quantities and prices in each ASEAN country.

Figure A3.2 shows, as an example, the non-price competitiveness of the coffee extracts imported by Thailand in 2014–2016. The relationship between import prices and quantities exported by ASEAN+6 countries are approximated by the downward-sloping line of a power function (Figure A3.2 A). The coffee extracts imported by each country were classified by price, with the highest and lowest values evenly divided into three categories: low price, mid price, and high price (Figure A3.2 B).

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[63] The values of imports are based on cost insurance and freight (CIF), while exports are based on free on board (FOB).

The import quantities of coffee extracts from Malaysia were remarkably higher than the approximate line, while those from Myanmar were remarkably lower. We may be able to conclude that the deviations reflect the value of imports other than price. Such value may include the product's quality, recognition, convenience, marketing methods, preferential treatment in trade, and other characteristics and methods differentiating the product.

Figure A3.2. An Example of Non-price Competitiveness: Imports of Coffee Extracts by Thailand, 2014–2016

A. Upward/downward Deviation from the Approximate Line   B. Equally Divided Price Ranges
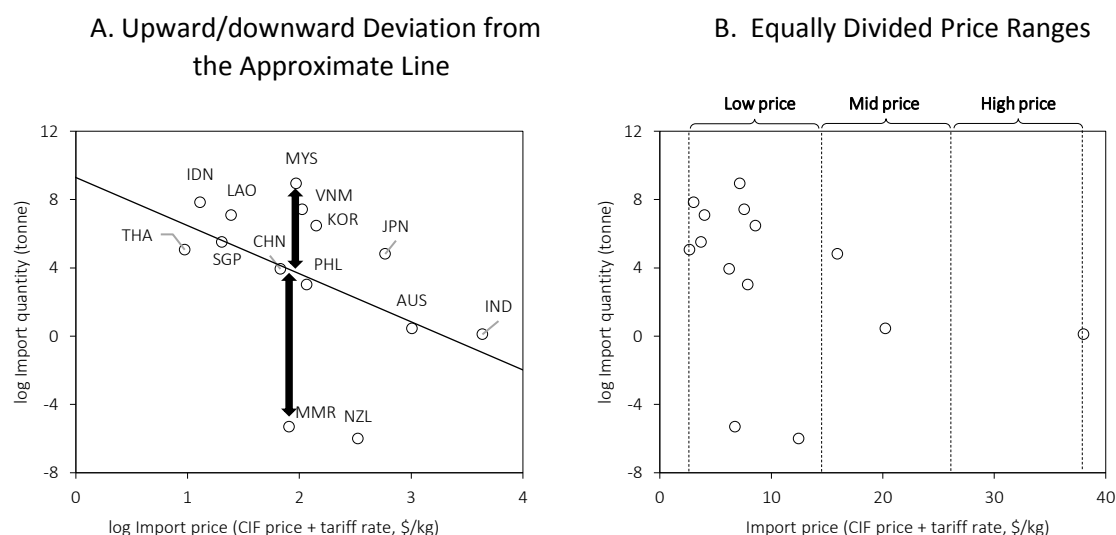
AUS = Australia, CHN = China, CIF = cost, insurance, and freight (included in the import prices), IDN = Indonesia, IND = India, JPN = Japan, kg = kilograms, KOR = Republic of Korea, LAO = Lao People's Democratic Republic, MMR = Myanmar, MYS = Malaysia, NZL = New Zealand, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Viet Nam.

Notes: The values indicated in these graphs represent the averages for 2014–2016. 'Coffee extracts' is a classification in the FAOSTAT Commodity List, and is classified under United Nations (UN) Broad Economic Categories (BEC) 122.

Source: Estimates based on data from UNSD (2017) and tariff rates in Table A3.7.

Whether the deviation is significantly large is evaluated by externally studentised residuals. The externally studentised residual is estimated from the following double-log model:

$$\log Q_{i,k} = \alpha + \beta \log P_{i,k} + u$$

where *Q* denotes import quantity, *P* denotes import price, which is the sum of the CIF (with cost, insurance, and freight) price and tariff rates, α and β denote parameters. The errors *u* are assumed to be $N(0, \sigma^2)$, and independently and identically distributed. Subscripts *i* and *k* denote the items and exporting country, respectively. The probability of each externally studentised residual is estimated by a t-test.

For the estimation of the non-price competitiveness, the import quantities and values of HS six-digit level categories were aggregated under detailed items, specifically, in FCL groups for vegetable and livestock products and processed food, nei, and in adjusted ISSCAAP groups for aquatic products

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classified under BEC 111, 112, 121, and 122. The import prices in this analysis are the sum of the CIF prices and tariff rates under the ATIGA or ASEAN + 1 regional agreements (Appendix 3.5). In reality, exporters may apply the bilateral agreements, rather than ATIGA and ASEAN + 1 agreements, or they may not apply the agreed tariff rates. Thus, the estimation in this analysis is a value in the hypothetical situation that ASEAN+6 countries minimise export prices by using ATIGA for intra-ASEAN trade and ASEAN + 1 agreements for the trade between the ASEAN and +6 countries.

The items analysed in this report were the major export goods of the ASEAN+6 countries competing in the ASEAN market. The following products were excluded from the analysis: items exported by fewer than 4 out of a total of 16 countries, and items for which the import quantity increases in line with increases in the import price. The proportion of observations for which non-price competitiveness could be estimated for each exporter was around 70% of the total number of observations (Table A3.9).

Table A3.9. The Numbers of Observations for Which Non-Price Competitiveness Could Be Estimated

Exporter	MYS	THA	IDN	PHL	VNM	LAO	KHM	MMR	Total
Obs.	1,607	2,014	1,249	679	1,236	109	184	487	7,565
Obs. for estimation	1,103	1,244	939	518	903	81	133	395	5,316
Share of Obs. (%)	69	62	75	76	73	74	72	81	70

IDN = Indonesia, KHM = Cambodia, LAO = Lao People's Democratic Republic, MMR = Myanmar, MYS = Malaysia, PHL = Philippines, THA = Thailand, VNM = Viet Nam.
Notes: 'Obs.' denotes the total number of observations of detailed commodities classified under BEC three-digit categories for each importing country. 'Obs. for estimation' denotes the number of observations used to estimate non-price competitiveness.
Sources: Estimates based on data from UNSD (2017) and tariff rates in Table A3.7.

3.7. Estimation of Productivity and Comparative Advantage Based on FAOSTAT Data

For each FCL item, we estimated the land/feed productivity, ratio of the yield, Spearman's rank correlation coefficient, and the land area used by producing animals, to estimate productive and comparative advantage. The data is from FAOSTAT, GLEAM-i, and the calculated values noted below.

Estimation of Land and Feed Productivity

This report compares the productivity of FCL items with the land productivity of vegetable products and feed productivity of livestock products within each IC1 and IC2 group. Both land and feed productivity were estimated from production values divided by input quantities (harvested areas and a proxy variable for feed inputs).

The comparison of productivity in terms of production value within each IC1 group can be read as the comparison of profitability of all input costs with the harvested areas or feed inputs. Such an interpretation could apply to the comparison of items within the same IC2 groups for which the production structures may be similar. By contrast, if the production structures are considered very different, any comparisons of productivity in terms of production value cannot serve as comparisons in terms of profitability.

The production values of vegetable and livestock products were estimated based on producer prices multiplied by production quantities obtained from FAOSTAT. The data regarding harvested areas also came from FAOSTAT. The proxy variable of feed inputs was estimated based on the number of producing animals, including slaughtered animals, and on the energy requirements per animal estimated from FAOSTAT data and from the Global Livestock Environmental Assessment Model-interactive (GLEAM-i), Version 2.0, Revision 5, which was developed by the Food and Agriculture Organization of the United Nations (FAO) (2017a, 2017b).

Estimation of Comparative Advantage in Terms of the Ratio of the Yield or Physical Productivity

Comparative advantage in terms of physical productivity can be estimated based on the ratio of the yield, or production quantity per unit area or feed input, in a particular ASEAN country and other ASEAN countries, assuming the Ricardian model.[64]

The comparative advantage of product i can be compared with other products based on the rate of input coefficients expressed as a_i/a_i', where a_i and a_i' denote input coefficients in a particular country and other ASEAN countries, respectively. In this report, harvested areas and the proxy variable of feed are assumed to be representative input goods. Thus, a_i is estimated from the harvested area, or from the proxy variable of feed, divided by production quantity.

The reciprocal of the ratio of the input coefficient a_i'/a_i equals the ratio of the yield, Y_i/Y_i'. Here, product i can be interpreted as indicating a relatively higher productivity than other ASEAN countries in producing j when $Y_i/Y_i' > Y_j/Y_j'$. Y_j' is estimated from the sum of production divided by the sum of the harvested area or the proxy of feed input in other ASEAN countries.

Interpretation Codes A and B for the Classification of Items

Codes for interpretation were prepared to provide an understanding of the combinations of land or feed productivity and comparative advantage in terms of yield (Table A3.10). In this report, there were two criteria dividing items into high or low productivity and comparative advantage. Criteria A represented the median values of productivity and comparative advantage for the categories of vegetable products and livestock products at the IC1 level. Criteria B represents the median values for products listed at the IC2 level.

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[64] Although the revealed comparative advantage (RCA) index is often used to measure comparative advantage, it is not appropriate for measuring the comparative advantage of products mainly destined for domestic markets.

Table A3.10. Combinations of Levels of Productivity and Comparative Advantage in Terms of Yield

			The ratio of the yield or physical productivity	
			High	**Low**
			Higher production quantity per unit area than in other ASEAN countries. The high competitiveness can surface with trade liberalisation in the region.	Lower production quantity per unit area than in other ASEAN countries. The low competitiveness can surface with trade liberalisation in the region.
Land or feed productivity	High	Higher production value per unit area/feed than for other domestic products.	**i.** Active exporting can be promoted due to the high profitability and competitiveness in terms of physical productivity, especially with regional integration.	**ii.** Higher yield or differentiation of products would be needed when the low competitiveness surfaces with regional integration.
	Low	Lower production value per unit land/feed than for other domestic products.	**iii.** Active development of export markets within and outside the ASEAN region could increase land/feed productivity and producers' incomes.	**iv.** The possibility of improving productivity and competitiveness, and the appropriateness of current resource allocation, should be investigated.

Source: Author.

The Proxy Variable of Feed Input to Produce Livestock Products

The proxy variable of feed input is used to estimate feed productivity in terms of production value, and comparative advantage in terms of yield.[65] The productivity of different livestock products in different countries can be compared by dividing the production data by this proxy variable. However, this method was not appropriate for gauging changes in productivity over time, as the input structure of feed and feeding efficiency can change greatly over the long term.

To estimate feed productivity, we used the digestible energy (DE) and metabolised energy (ME) needed for all producing animals, expressed by a unit of pig feed requirements (PU) as the proxy variable for feed input under the assumption that the input costs of feed are proportional to the DE.[66] The numbers of producing animals, including slaughtered animals, were collected from FAOSTAT. The DE per producing animal in 2010 was estimated from GLEAM-i, Version 2.0, Revision 5 (FAO, 2017b).[67] The conversion rates from the DE for producing animal to PUs were estimated by dividing the DE for each producing animal in each country by the DE needed to feed one pig in the ASEAN region for a year (Table A3.10).[68] The number of producing animals in terms of PUs as the proxy variable for feed inputs was obtained from the number of producing animals divided by the conversion rate.

To estimate the conversion rate, we made several assumptions. The DE or ME of meat-producing animals was estimated based on the total number of animals, as all livestock animals, including milk-producing animals and egg-producing birds, were assumed to have been eventually slaughtered to produce meat. The milk-producing animals were classified as 'adult females' to match the corresponding animals in GLEAM-i. Similarly, egg-producing hens were analysed as the sum of 'layers',

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[65] There are various studies applying such conversion from livestock to feed, amongst them Haberl et al. (2007) and Cassidy et al. (2013).

[66] This refers specifically to the DE for cattle, buffalo, sheep, goats, and pigs; and to the ME for chickens.

[67] The DE and ME required for each producing animal were estimated based on the quantity of feed for each animal and the DE and ME of the feed. The values were obtained from GLEAM-i (FAO, 2017b) and applied as default values for exogenous variables in each country.

[68] The average for pigs was 1,089 MJ/head/year (MJ = mega joule).

and 'adult reproductive females' of chickens were classified under the 'backyard' production systems, as under GLEAM-i. The conversion rate of horses was calculated at 22.7 by referring to the data on the daily feed intake of horses in Haberl et al. (2007).[69] We omitted the amount of feed required to produce 'meat, nes', which is observed in FAOSTAT. The conversion rates for producing the meat of ducks, geese and guinea fowls, turkeys, and bird, nes, were assumed to be the same as for chickens. Likewise, the conversion rates for 'eggs, other bird, in the shell' were assumed to be the same as for 'eggs, hen, in the shell'.

Table A3.11. Feed Requirements by Each Animal Expressed by Pig-Feeding Units, 2010

(PU/head)

Products	Animals	SGP*	BRN	MYS	THA	IDN	PHL	VNM	LAO	KHM	MMR	Mean
Meat	Cattle	19.10	–	17.40	19.48	20.63	19.18	19.52	19.71	19.36	17.51	19.10
	Buffalo	–	–	19.71	19.43	20.92	19.59	19.69	20.71	20.56	21.10	20.21
	Pig	1.16	–	1.12	1.05	0.87	1.04	1.43	0.80	0.82	0.71	**1.00**
	Sheep	–	–	2.14	2.13	2.27	2.12	2.16	2.46	1.83	2.14	2.16
	Goat	2.40	–	3.12	1.46	2.91	2.29	2.52	2.37	–	2.13	2.40
	Chicken, etc.	0.09	0.14	0.14	0.23	0.20	0.30	0.36	0.30	0.30	0.29	0.24
	Horse	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70
Milk, whole fresh	Cow	–	–	14.47	17.66	23.15	16.04	16.73	16.02	13.47	14.18	16.46
	Buffalo	–	–	–	–	–	–	23.61	–	–	23.16	23.38
	Sheep	–	–	–	–	2.29	–	–	–	–	2.17	2.23
	Goat	–	–	–	–	3.22	–	–	–	–	2.36	2.79
Eggs, in shell	Hen, etc.	0.31	0.49	0.56	0.58	0.49	0.42	0.44	0.40	0.40	0.37	0.45

– = data not available.
BRN = Brunei, IDN = Indonesia, KHM = Cambodia, LAO = Lao People's Democratic Republic, MMR = Myanmar, MYS = Malaysia, PHL = Philippines, PU = a unit of pig feed requirements, SGP = Singapore, THA = Thailand, VNM = Viet Nam.
Notes: Chicken etc. = chickens, ducks, geese and guinea fowls, and turkeys. Hen etc. = hens and other birds.
*The conversion rates of cattle, total, and goats, total, in Singapore assumed an average value in ASEAN, as the exact rates could not be estimated.
Source: Values estimated based on data from the FAO (2017b, 2019).

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[69] Species-specific daily feed intake of horses was estimated at 10, while that of sheep and goats was estimated at 1. The average value of the DE of sheep and goats estimated for our report was 2.27.

Appendix 4

Agri-food Products Imported in Large Quantities by ASEAN Countries, and Exported from Brunei, Singapore, and the +6 Countries

We found that the member states of the Association of Southeast Asian Nations (ASEAN) imported large quantities of agri-food products from Brunei, Singapore, and the +6 countries: Australia, China, India, Japan, Republic of Korea, and New Zealand (Appendix 3.6). Table A4.1 gives the number of observations that were undertaken for this estimation. Table A4.2 lists representative exports from Singapore and the +6 countries to the ASEAN region by ascending order of p-values smaller than 0.2.

Table A4.3 is a matrix that summarises the items imported in large quantities by the ASEAN countries at significance levels of $p < 0.1$, specifically, those that were exported from all the ASEAN+6 countries other than Lao PDR, Brunei, and the Republic of Korea. No products exported from those three countries met the p-value requirement.

Table A4.1. Numbers of Observations Made to Estimate Non-price Competitiveness

Exporter	BRN	SGP	AUS	CHN	IND	JPN	KOR	NZL	Total
Obs.	107	1,621	1,930	2,238	1,319	1,754	1,393	1,052	11,414
Obs. for estimation	98	1,098	1,263	1,414	966	1,181	987	744	7,751
Share (%)	92	68	65	63	73	67	71	71	68

AUS = Australia, BRN = Brunei, CHN = China, IND = India, JPN = Japan, KOR = Republic of Korea, NZL = New Zealand, SGP = Singapore.

Notes: 'Obs.' refers to the total number of detailed commodities classified as three-digit categories under the United Nations Broad Economic Categories (BEC) for each importing country. 'Obs. for estimation' refers to the number of observations undertaken to estimate non-price competitiveness.

Sources: Estimates based on data from UNSD (2017) and tariff rates in Table A3.7.

Table A4.2. Agri-food Products Imported by ASEAN Countries in Larger Quantities Than Estimated Based on Import Prices, in Ascending Order of P-value, 2014–2016

A. Exported from Singapore

IC1	Rank	Low Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Mid Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	High Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	MYS	15	121	Chocolate products nes	3.2	18	0.03	PHL	12	122	Soya sauce	2.1	3	0.06	MMR	15	112	Nutmeg, mace and cardamoms	8.6	0.5	0.11
	2	MMR	13	112	Potatoes	0.5	0.1	0.04	MYS	15	112	Cloves	9.9	4	0.20	MMR	15	122	Tea, mate extracts	9.8	0.6	0.13
	3	KHM	14	122	Juice, orange, single strength	1.0	0.1	0.09								IDN	11	122	Mixes and doughs	3.6	2	0.15
	4	BRN	14	122	Juice, apple, concentrated	1.3	0.2	0.09								MMR	15	121	Chocolate products nes	4.3	0.5	0.15
	5	MYS	14	122	Juice, orange, single strength	0.8	1	0.11														
2 Livestock products	1								MMR	22	121	Whey, condensed	1.1	1	0.06	THA	21	122	Meat, homogenized preparations	10.2	0.0	0.12
	2								MMR	22	122	Milk, whole condensed	2.4	46	0.08							
	3																					
	4																					
	5																					
3 Aquatic products	1	MMR	31	122	Salmons, trouts, smelts	4.4	0.3	0.03	BRN	34	112	Squids, cuttlefishes, octopuses	7.8	0.5	0.20							
	2	BRN	31	122	Salmons, trouts, smelts	7.3	1.0	0.11														
	3																					
	4																					
	5																					
4 Processed food, nei	1	KHM	41	112	Honey, natural	4.5	0.0	0.02	MMR	43	122	Food preparations, nes	8.1	21	0.05	MMR	42	121	Oil, sesame	4.9	0.0	0.06
	2	KHM	44	122	Beverages, distilled alcoholic	4.4	3	0.06	MYS	44	122	Beer of barley	1.6	26	0.05	THA	41	121	Fructose and syrup, other	9.6	0.0	0.06
	3	KHM	44	122	Beer of barley	0.8	25	0.12	MYS	44	122	Beverages, distilled alcoholic	11.4	64	0.06	IDN	41	121	Molasses	98.6	0.1	0.18
	4	IDN	44	122	Beverages, distilled alcoholic	13.7	2	0.14	BRN	41	121	Glucose and dextrose	3.9	0.0	0.13	VNM	43	122	Food preparations, nes	###	94	0.19
	5	IDN	44	122	Beer of barley	1.7	0.3	0.15	BRN	41	122	Beverages, non alcoholic	0.7	18	0.14							

B. Exported from Australia

IC1	Rank	Low Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Mid Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	High Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	BRN	14	112	Grapes	4.2	0.8	0.03	IDN	14	122	Nuts, prepared (exc. groundnuts)	7.5	2	0.05	THA	11	111	Grain, mixed	9.8	0.3	0.04
	2	MYS	11	122	Oats rolled	0.7	13	0.07	BRN	14	122	Juice, lemon, concentrated	5.0	0.0	0.10	MYS	14	112	Nuts, nes	11.5	3	0.07
	3	MYS	11	121	Malt	0.5	3	0.08	THA	14	112	Almonds shelled	8.3	11	0.11	MYS	14	122	Avocados	3.3	2	0.13
	4	MMR	11	122	Barley, pearled	0.5	56	0.08	MYS	11	111	Wheat	0.3	223	0.13	SGP	14	122	Fruit, cooked, homogenized preparations	9.3	0.3	0.17
	5	BRN	14	112	Plums and sloes	3.8	0.0	0.09	MYS	13	112	Vegetables, fresh nes	1.2	2	0.14	MYS	13	112	Pumpkins, squash and gourds	1.5	0.3	0.20
2 Livestock products	1	PHL	21	122	Offals, pigs, edible	1.3	5	0.04	SGP	22	122	Cheese, whole cow milk	5.7	31	0.16	VNM	21	122	Meat, beef and veal sausages	5.4	0.1	0.13
	2	MYS	22	112	Yoghurt	2.6	2	0.05								THA	22	122	Ice cream and edible ice	15.1	0.0	0.17
	3	THA	21	122	Meat, beef, preparations	5.9	6	0.09														
	4	THA	22	112	Yoghurt	2.7	1	0.12														
	5	THA	22	121	Whey, condensed	2.4	4	0.15														
3 Aquatic products	1	SGP	31	112	Salmons, trouts, smelts	6.8	2	0.16														
	2																					
	3																					
	4																					
	5																					
4 Processed food, nei	1	PHL	41	121	Lactose	2.2	0.3	0.04	PHL	41	112	Honey, natural	4.8	2	0.03							
	2	MYS	42	121	Oils	14.2	2	0.05	SGP	44	122	Wine	8.9	53	0.05							
	3	SGP	42	122	Oil, olive, virgin	4.5	0.2	0.07														
	4	SGP	41	121	Lactose	1.3	1	0.14														
	5	MYS	42	122	Oil, vegetable origin nes	3.3	0.1	0.17														

C. Exported from China

IC1	Rank	\multicolumn{6}{c}{Low}	\multicolumn{6}{c}{Mid (Price ranges)}	\multicolumn{6}{c}{High}

IC1	Rank	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	THA	13	122	Mushrooms, dried	7.3	74	0.00	MYS	14	112	Dates	2.3	8	0.06	PHL	13	112	Vegetables, frozen	0.9	3	0.06
	2	MYS	13	122	Mushrooms, dried	5.0	21	0.01	MYS	13	112	Peas, green	2.6	5	0.08	BRN	14	112	Cashew nuts, with shell	9.4	0.1	0.08
	3	MYS	13	122	Mushrooms, canned	1.2	14	0.01	MYS	13	112	Garlic	1.3	137	0.09							
	4	PHL	13	122	Tomatoes, paste	1.0	25	0.01	SGP	13	112	Peas, dry	4.1	0.1	0.12							
	5	SGP	13	112	Roots and tubers, nes	1.5	9	0.02	MYS	13	112	Vegetables, leguminous nes	1.9	0.1	0.14							
2 Livestock products	1	MYS	21	122	Meat, dried nes	4.1	0.5	0.04														
	2	THA	21	122	Meat, nes, preparations	1.4	6	0.04														
	3	MYS	21	122	Meat, beef and veal sausages	3.8	6	0.06														
	4	PHL	21	122	Meat, pig, preparations	0.3	3	0.14														
	5																					
3 Aquatic products	1	MYS	32	122	Cods, hakes, haddocks	3.9	12	0.03	THA	33	112	Shrimps and prawns, nei	17.3	5	0.07							
	2	MYS	32	122	Miscellaneous pelagic fishes	1.6	9	0.06	MYS	33	112	Shrimps and prawns, nei	7.6	88	0.11							
	3	THA	34	112	Abalones, winkles, conchs	28.7	5	0.08	MYS	32	122	Miscellaneous pelagic fishes	2.0	29	0.13							
	4	THA	32	122	Flounders, halibuts, soles	4.1	1	0.11	PHL	33	122	Shrimps, prawns	2.3	0.2	0.15							
	5	MYS	34	112	Scallops, pectens	8.0	7	0.11	MYS	31	122	River eels	16.9	0.3	0.16							
4 Processed food, nei	1	PHL	43	121	Food preparations, nes	2.0	20	0.03	VNM	41	121	Sugar, nes	1.5	13	0.07							
	2	VNM	43	121	Food preparations, nes	4.6	6	0.05	MYS	41	122	Sugar refined	1.0	1.0	0.10							
	3	THA	41	111	Sugar crops, nes	3.3	10	0.07														
	4	IDN	41	121	Glucose and dextrose	0.5	48	0.10														
	5	PHL	41	121	Glucose and dextrose	0.6	44	0.11														

D. Exported from India

IC1	Rank	Impor-ter	IC2	BEC	Detailed commodity name (Low)	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name (Mid)	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name (High)	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	PHL	13	122	Vegetables in vinegar	0.9	0.9	0.01	BRN	12	111	Sesame seed	2.7	0.0	0.07							
	2	BRN	15	112	Anise, badian, fennel, coriander	2.1	0.3	0.02	BRN	15	112	Nutmeg, mace and cardamoms	12.0	0.0	0.11							
	3	MYS	15	112	Anise, badian, fennel, coriander	1.8	34	0.02	MYS	13	112	Chick peas	1.1	2	0.12							
	4	PHL	15	112	Chillies and peppers, dry	2.6	1	0.05	MYS	13	121	Flour, potatoes	1.4	1.0	0.18							
	5	IDN	15	112	Spices, nes	1.2	0.5	0.05														
2 Livestock products	1																					
	2																					
	3																					
	4																					
	5																					
3 Aquatic products	1	THA	33	112	Shrimps and prawns, nei	9.0	22	0.18	THA	38	122	Fish and fish products, nei	1.7	74	0.19	VNM	33	112	Shrimps and prawns, nei	10.2	309	0.02
	2															THA	33	112	Shrimps and prawns, nei	21.6	2	0.15
	3																					
	4																					
	5																					
4 Processed food, nei	1	IDN	42	121	Oil, coconut (copra)	1.4	3	0.08														
	2																					
	3																					
	4																					
	5																					

E. Exported from Japan

IC1	Rank		Low							Mid							High					
		Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	THA	11	121	Flour, fonio	6.1	0.4	0.05	MYS	13	122	Juice, tomato	2.2	0.0	0.09	VNM	12	122	Soya sauce	2.2	0.6	0.08
	2	SGP	11	111	Rice, husked	1.8	2	0.11	IDN	11	122	Bread	5.8	2	0.15	VNM	11	121	Flour, maize	0.7	0.1	0.12
	3	THA	11	121	Flour, maize	1.6	0.1	0.11	SGP	13	112	Beans, dry	9.5	0.1	0.16	THA	14	122	Juice, plum, single strength	12.8	0.1	0.13
	4	THA	12	122	Soya sauce	3.0	8	0.16	THA	13	112	Pumpkins, squash and gourds	5.1	0.0	0.17	BRN	11	122	Rice, milled/husked	3.6	0.1	0.15
	5	SGP	15	122	Tea, mate extracts	13.6	1	0.19	SGP	15	112	Tea	28.7	10	0.18	SGP	13	122	Vegetables, preserved, frozen	5.3	0.4	0.18
2 Livestock products	1																					
	2																					
	3																					
	4																					
	5																					
3 Aquatic products	1	THA	31	122	Salmons, trouts, smelts	2.9	12	0.04	SGP	35	112	Sea-urchins and other echinoderms	###	1	0.09	IDN	38	112	Fish and fish products, nei	24.1	0.4	0.04
	2	THA	34	112	Clams, cockles, arkshells	3.4	0.5	0.07	THA	32	112	Tunas, bonitos, billfishes	67.2	1	0.13	SGP	32	112	Tunas, bonitos, billfishes	50.1	3	0.06
	3	VNM	31	122	Salmons, trouts, smelts	4.7	13	0.07	MYS	34	112	Scallops, pectens	18.5	4	0.19	MYS	31	112	Carps, barbels and other cyprinids	28.7	0.8	0.08
	4	MMR	33	112	Shrimps and prawns, nei	9.9	0.1	0.17								SGP	33	112	Shrimps and prawns, nei	58.3	0.7	0.10
	5															THA	38	112	Fish and fish products, nei	27.7	7	0.10
4 Processed food, nei	1	SGP	41	121	Sugar refined	1.7	0.4	0.17	SGP	44	122	Beverages, fermented rice	11.8	7	0.06							
	2								SGP	41	121	Glucose and dextrose	1.9	0.2	0.07							
	3								MYS	42	122	Oil, sunflower	8.4	0.0	0.12							
	4								THA	41	121	Glucose and dextrose	5.4	0.1	0.16							
	5								THA	43	121	Food preparations, nes	20.8	0.7	0.19							

F. Exported from the Republic of Korea

IC1	Rank		Low							Mid							High					
		Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	SGP	14	122	Juice, citrus, single strength	1.5	0.3	0.12	MMR	14	122	Juice, pineapple, concentrated	1.5	0.1	0.13							
	2	MYS	14	122	Juice, citrus, single strength	2.1	0.0	0.16														
	3	SGP	15	112	Maté	15.3	0.1	0.16														
	4	THA	14	122	Juice, fruit nes	2.3	0.4	0.19														
	5																					
2 Livestock products	1															THA	22	112	Buttermilk, curdled, acidified milk	17.2	0.0	0.18
	2																					
	3																					
	4																					
	5																					
3 Aquatic products	1	MYS	34	112	Oysters	1.8	0.0	0.13	THA	36	111	Seaweeds, food, nei	14.5	37	0.11							
	2								MYS	34	112	Oysters	5.6	2	0.13							
	3																					
	4																					
	5																					
4 Processed food, nei	1	VNM	44	122	Beverages, distilled alcoholic	8.0	0.7	0.13														
	2																					
	3																					
	4																					
	5																					

G. Exported from New Zealand

IC1	Rank	Low Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	Mid Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value	High Impor-ter	IC2	BEC	Detailed commodity name	Price ($/kg)	Value ($ million)	p-value
1 Vegetable products	1	THA	13	112	Peas, dry	1.0	2	0.10	MYS	13	112	Sweet corn frozen	2.1	0.3	0.15	SGP	11	122	Oats rolled	16.7	0.0	0.13
	2	SGP	15	121	Chocolate products nes	2.4	3	0.10	SGP	14	112	Fruit, prepared nes	6.2	0.0	0.17							
	3	BRN	14	112	Persimmons	8.8	0.1	0.11														
	4	KHM	12	111	Soybeans	0.4	0.0	0.11														
	5	SGP	14	112	Avocados	3.6	3	0.13														
2 Livestock products	1	MYS	22	121	Whey, condensed	5.1	19	0.07	VNM	22	121	Milk, products of natural constituents nes	3.4	0.9	0.14	THA	22	122	Milk, whole condensed	14.1	0.1	0.14
	2	THA	22	112	Buttermilk, curdled, acidified milk	3.4	29	0.10	PHL	22	122	Milk, whole evaporated	3.0	1	0.17							
	3	THA	22	122	Milk, whole dried	3.5	135	0.12														
	4	MYS	22	122	Milk, whole dried	3.7	112	0.12														
	5	PHL	22	112	Buttermilk, curdled, acidified milk	2.6	26	0.12														
3 Aquatic products	1	BRN	38	122	Fish and fish products, nei	6.0	0.1	0.12	MYS	34	112	Mussels	5.4	2	0.13							
	2	THA	31	112	Salmons, trouts, smelts	14.3	0.9	0.19														
	3																					
	4																					
	5																					
4 Processed food, nei	1	MYS	42	122	Ghee, butteroil of cow milk	3.9	34	0.07	MMR	42	122	Butter, cow milk	3.9	0.9	0.07	PHL	42	122	Ghee, butteroil of cow milk	3.9	68	0.04
	2	THA	41	121	Lactose	2.0	3	0.11	SGP	44	122	Wine	10.8	16	0.14	MMR	42	122	Ghee, butteroil of cow milk	4.6	0.3	0.13
	3	MYS	42	122	Butter, cow milk	4.0	18	0.16	MYS	41	121	Sugar, nes	2.8	0.3	0.17	KHM	42	122	Butter, cow milk	2.6	0.4	0.18
	4	THA	42	122	Ghee, butteroil of cow milk	4.6	32	0.17														
	5	IDN	41	112	Honey, natural	15.6	0.2	0.19														

BEC = Broad Economic Categories, United Nations Statistics Division (UNSD); BRN = Brunei; IC1 = item category level 1; IC2 = item category level 2; IDN = Indonesia; kg = kilograms; KHM = Cambodia; MMR = Myanmar; MYS = Malaysia; PHL = Philippines; SGP = Singapore; THA = Thailand; VNM = Viet Nam.

Notes: The values in this table represent the averages for 2014–2016. The top five agri-food products within each IC1 group are listed in ascending order of p-value < 0.2 under BEC groups as follows: primary products mainly for industry (111), primary products mainly for household consumption (112), processed products mainly for industry (121), and processed products mainly for household consumption (122). 'Price' refers to the CIF ('cost, insurance, and freight') import price added to the tariffs set by the ASEAN Trade in Goods Agreement (ATIGA) for Brunei and Singapore, and by each ASEAN+1 regional agreement for the + 6 countries (Appendix 3.5). 'Value' refers to the CIF import value without the tariff. The 'p-value' refers to the p-value of the t-stat against the externally studentised residual. See Appendix 2.6. Data category: FAOSTAT Commodity List (FCL) and the adjusted groups of the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) classified under BEC 111, 112, 121, and 122.

Sources: UNSD (2017); Appendix 3.6.

Table A4.3. Matrix of Agri-food Products Imported by ASEAN Countries in Larger Quantities Than Estimated Based on Import Prices, 2014–2016

(p < 0.1)

		Importer									
		SGP	**BRN**	**MYS**	**THA**	**IDN**	**PHL**	**VNM**	**LAO**	**KHM**	**MMR**
Exporter	**SGP**	—	Juice, apple, concentrated	Chocolate products, nes; juice, orange, single strength; beer of barley; beverages, distilled alcoholic	Fructose and syrup, other	—	Soya sauce	—	—	Juice, orange, single strength; honey, natural; beverages, distilled alcoholic	Potatoes; whey, condensed; milk, whole condensed; salmons / trouts / smelts; food preparations, nes.; oil, sesame
	MYS	Soybeans; watermelons; cocoa, paste; tomatoes; cassava; tapioca, potatoes; coffee, extracts; juice, pineapple; juice, lemon, concentrated; tilapias and other cichlids, herrings; herrings / sardines / anchovies; Fat, nes, prepared; molasses	Cereals, breakfast; coffee, extracts; pastry; Vegetables, preserved, frozen; Spices, nes.; bread; tea, mate extracts; flour, roots and tubers, nes; fish and fish products, nei.	—	—	Coffee, roasted	—	—	Meat, cattle, boneless	—	Soya paste; miscellaneous aquatic products, food; infant food
	THA	Rice, husked	Fruit, stone, nes.; fish and fish products, nei	Flour, fonio; flour, roots and tubers, nes; juice, citrus, single strength; sweet corn prep or preserved; salmons / trouts / smelts; tunas / bonitos / billfishes; sugar refined	—	Fruit, stone, nes	Fruit, dried, nes; flour, fonio; juice, fruit, nes; soya paste; yoghurt	Fruit, dried, nes	—	Spices, nes.; juice, fruit, nes; tea, mate extracts; tea; meat, beef and veal sausages; milk, whole fresh cow; meat, pig, preparations; margarine, short; sugar, refined	—

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		Importer									
		SGP	**BRN**	**MYS**	**THA**	**IDN**	**PHL**	**VNM**	**LAO**	**KHM**	**MMR**
IDN		Areca nuts; cinnamon; lobsters, spiny-rock lobsters	–	Cocoa, powder and cake; crabs, nei; sharks / rays / chimaeras	Cinnamon; coconuts	Nutmeg / mace / cardamons; shrimps, prawns	Cinnamon; cereals, breakfast	–	–	–	–
PHL		–	–	Bananas	–	–	–	–	–	–	–
VNM		–	–	Chilies and peppers, green; miscellaneous freshwater fishes	Chilies and peppers, green; miscellaneous freshwater fishes	–	Tilapias and other cichlids	–	–	Flour, maize	–
KHM		–	–	–	Soybeans	–	–	–	–	–	–
MMR		–	–	–	–	Beans, dry	–	–	–	–	–
AUS		Grapes; oil, olive, virgin; wine	Grapes; plums and sloes	Oats, rolled; malt; nuts, nes; yoghurt; oils	Grain, mixed; meat, beef, preparations	Vegetables, frozen; Nuts, prepared (exc. groundnuts)	Offals, pigs, edible; lactose; honey, natural	–	–	–	Barley, pearled
CHN		Roots and tubers, nes; gluten, whet; garlic; fruit, dried, nes; tangerines / mandarins / clementines / satsumas;	Peas, green; vegetables, dehydrated; cashew nuts, with shell	Mushrooms, dried; mushrooms, canned; cassava; lemons and limes; plums dried; cauliflowers and broccoli; juice, apple, concentrated; sunflower seed; vegetables, temporarily preserved; leeks, other alliaceous vegetables; ginger; peanut butter; vegetables, dehydrated; vegetables, fresh, nes; fruits, nuts, peel, sugar preserved; cabbages and other brassicas; dates; peas, green, garlic; meat, dried, nes; meat, beef and veal sausages; cods / hakes / haddocks; miscellaneous pelagic fishes;	Mushrooms, dried; mushrooms, canned; tomatoes, pastel meat, nes, preparations; sugar crops, nes	Sweet corn, frozen; tea, mate extracts; vegetables, dehydrated; mushroom, dried	Tomatoes, paste; sugar cane; peanut butter; vegetables, dehydrated; apples; vegetables, frozen	Nuts, prepared (exc. groundnuts), sugar, nes	–	–	Tea; juice, orange, single strength

				Importer						
		SGP	**BRN**	**MYS**	**THA**	**IDN**	**PHL**	**VNM**	**LAO**	**KHM**	**MMR**
IND		Anise / badian / fennel / coriander	Anise / badian / fennel / coriander; sesame seed	Anise / badian / fennel / coriander; spices, nes	—	Spices, nes.; oil, coconut	Vegetables in vinegar; chilies and peppers, dry; sesame seed	Shrimps and prawns, nei	—	—	—
JPN		Sea-urchins and other echinoderms; tunas / bonitos / billfishes; beverages, fermented rice; glucose and dextrose	—	Juice, tomato; carps, barbels and other cyprinids; oil, sunflower	Flour, fonio; salmons / trouts / smelts; clams / cockles / ark shells	Fish and fish products, nei.	—	Soya sauce; salmons / trouts / smelts	—	—	—
NZL		—	—	Whey, condensed; ghee, butteroil of cow milk	—	—	Ghee, butteroil of cow milk	—	—	—	Butter, cow milk

— = not applicable.

AUS = Australia, BRN = Brunei, CHN = China, IDN = Indonesia, JPN = Japan, KHM = Cambodia, LAO = Lao People's Democratic Republic, MMR = Myanmar, MYS = Malaysia, NZL = New Zealand, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Viet Nam.

Notes: This table is based on the averages for 2014–2016, for all items for which $p < 0.1$ in tables 2.9 to 9.9. The Lao People's Democratic Republic, Brunei, and the Republic of Korea are omitted from the exporters because no products of theirs matched the condition of $p < 0.1$.

Sources: Tables 2.9 to 9.9; Table A4.2; and raw data used for those tables.

Land or Feed Productivity of Agri-food Products:

Summary of Interpretation B

Table A5 Summary of Interpretation B for Land or Feed Productivity in the ASEAN Countries

IC2	No.	FCL	Singapore	Brunei	Malaysia	Thailand	Indonesia	Philippines	Viet Nam	Lao PDR	Cambodia	Myanmar
11. Cereals	1	Cereals, nes	—	—	iii	—	—	—	—	—	—	iv
	2	Maize	—	—	i	—	iv	iv	—	—	—	i
	3	Millet	—	—	—	—	—	i	—	—	—	iv
	4	Rice, paddy	—	—	—	ii	—	i	i	—	—	i
	5	Sorghum	—	—	—	i	i	—	—	—	—	—
	6	Wheat	—	—	iv	—	—	—	—	—	—	i
12. Oil and sugar crops	7	Castor oil seed	—	—	—	iii	iv	iii	—	—	iii	—
	8	Coconuts	—	—	iii	ii	iii	iii	i	—	i	i
	9	Groundnuts, with shell	—	—	ii	ii	i	ii	i	i	ii	ii
	10	Kapok fruit	—	—	—	iii	—	—	—	—	—	—
	11	Oil, palm fruit	—	—	iv	i	i	ii	—	—	—	—
	12	Oilseeds nes	—	—	—	—	iv	—	—	i	—	—
	13	Seed cotton	—	—	—	iv	iv	iv	—	iv	iv	iii
	14	Sesame seed	—	—	—	i	—	iii	i	iii	ii	—
	15	Soybeans	—	—	—	iv	i	iv	iii	iii	iv	—
	16	Sugar cane	—	—	ii	i	i	i	ii	ii	ii	ii
	17	Sunflower seed	—	—	—	iv	—	—	—	—	—	iii
13. Vegetables	18	Asparagus	—	—	—	ii	i	—	—	—	—	—
	19	Beans, dry	—	—	iv	iv	iv	iv	iv	iii	iii	—
	20	Beans, green	—	—	—	iv	i	iii	—	—	—	—
	21	Cabbages and other brassicas	ii	—	ii	ii	ii	ii	i	—	—	—
	22	Carrots and turnips	—	—	—	i	i	—	—	—	—	—
	23	Cassava	—	iii	iv	iii	iii	iv	iv	i	i	ii
	24	Cauliflowers and broccoli	—	—	i	i	i	—	—	—	—	—
	25	Chillies and peppers, green	—	i	i	i	—	iv	—	iv	—	—
	26	Cow peas, dry	—	—	—	—	iii	—	—	—	—	iv
	27	Cucumbers and gherkins	—	iii	iii	iv	iv	iv	—	—	—	—
	28	Eggplants (aubergines)	—	i	—	i	iv	i	—	—	—	—
	29	Garlic	—	—	—	ii	i	ii	—	—	—	i
	30	Leeks, other alliaceous vegetables	—	—	—	i	ii	—	—	—	—	—
	31	Lettuce and chicory	i	i	iv	i	iv	—	ii	—	—	—
	32	Maize, green	—	—	—	iii	iv	—	—	—	—	—
	33	Mushrooms and truffles	ii	—	—	i	—	—	—	—	—	—
	34	Okra	—	—	i	—	iii	—	—	—	—	—
	35	Onions, dry	—	—	—	i	i	i	iv	—	i	—
	36	Onions, shallots, green	—	ii	—	i	i	—	—	—	—	—
	37	Peas, dry	—	—	—	—	—	—	—	—	—	iv
	38	Peas, green	—	—	i	—	ii	—	—	—	—	—
	39	Pigeon peas	—	—	—	iii	—	—	—	—	iv	—
	40	Potatoes	—	—	iv	i	i	i	i	—	—	—
	41	Pulses, nes	—	—	iii	iv	iii	iv	iii	—	—	—
	42	Pumpkins, squash and gourds	—	i	iv	ii	i	ii	—	—	—	—
	43	Roots and tubers, nes	iii	iv	iv	iv	iv	iv	—	—	i	—
	44	Spinach	iii	iii	iii	—	iv	—	—	—	—	—
	45	Sweet potatoes	—	ii	iv	—	iii	iv	i	i	iv	iv
	46	Taro (cocoyam)	—	—	i	—	iii	—	—	—	—	—
	47	Tomatoes	ii	i	i	i	ii	i	—	—	—	—
	48	Vegetables, fresh nes	—	iii	iv	iv	iv	iv	—	ii	ii	i
	49	Vegetables, leguminous nes	—	i	—	iv	—	—	—	—	—	—

IC2	No.	FCL	Singapore	Brunei	Malaysia	Thailand	Indonesia	Philippines	Viet Nam	Lao PDR	Cambodia	Myanmar
14. Fruits and nuts	50	Areca nuts	—	—	i	iii	iv	—	—	—	—	i
	51	Avocados	—	—	—	—	iv	—	—	—	—	—
	52	Bananas	—	iv	iv	iv	i	i	iv	i	iv	—
	53	Cashew nuts, with shell	—	—	iii	iv	iv	i	iii	—	—	—
	54	Fruit, citrus nes	—	—	i	ii	—	i	—	—	—	—
	55	Fruit, fresh nes	—	iii	—	i	i	iv	—	iv	i	iv
	56	Fruit, tropical fresh nes	—	—	—	iv	iii	i	—	—	—	—
	57	Grapefruit (inc. pomelos)	—	—	iii	ii	—	iv	i	iv	iii	—
	58	Grapes	—	—	—	i	iv	i	—	—	—	—
	59	Lemons and limes	—	iii	i	i	—	i	—	i	iii	—
	60	Mangoes, mangosteens, guavas	—	ii	iii	iv	iv	ii	iii	i	—	—
	61	Melons, other (inc.cantaloupes)	—	—	—	ii	i	—	iv	—	—	—
	62	Nuts, nes	—	—	iii	iv	i	iii	—	iii	—	—
	63	Oranges	—	ii	i	iv	i	ii	ii	ii	ii	—
	64	Papayas	—	ii	iv	i	—	—	—	—	—	—
	65	Pineapples	—	ii	iv	i	i	iv	iv	ii	—	—
	66	Plantains and others	—	—	—	—	—	—	—	—	—	i
	67	Tangerines, mandarins, clementines, satsumas	—	—	i	—	iv	i	—	—	—	—
	68	Watermelons	i	iii	ii	iv	i	i	—	—	—	—
15. Stimulants and spices	69	Chillies and peppers, dry	—	—	iv	iii	—	—	ii	i	iv	iv
	70	Cinnamon (canella)	—	—	—	iii	—	iv	—	—	—	—
	71	Cloves	—	—	iii	—	iii	—	—	—	—	—
	72	Cocoa, beans	—	—	iv	iii	iii	iii	—	—	—	—
	73	Coffee, green	—	—	iii	iv	ii	iv	i	iv	i	i
	74	Ginger	—	—	ii	ii	i	ii	—	—	—	—
	75	Nutmeg, mace and cardamoms	—	—	i	iv	—	iii	—	—	—	—
	76	Pepper (piper spp.)	—	—	ii	ii	i	i	—	i	—	—
	77	Spices, nes	—	—	ii	—	—	—	—	—	—	—
	78	Tea	—	—	i	i	iv	—	iii	ii	—	i
21. Meat	79	Meat, buffalo	—	—	iv	i	i	i	i	ii	i	iv
	80	Meat, cattle	i	—	ii	ii	i	i	i	i	iv	i
	81	Meat, chicken	i	—	iii	iv	iv	iv	iii	iv	i	i
	82	Meat, duck	iii	—	iii	iii	iv	iv	iv	iii	iii	iii
	83	Meat, goat	iv	—	ii	iii	iv	i	i	iii	—	i
	84	Meat, goose and guinea fowl	—	—	—	i	iv	—	i	—	—	—
	85	Meat, horse	—	—	iv	—	iii	iv	iv	—	—	—
	86	Meat, pig	ii	—	i	ii	ii	ii	ii	ii	i	i
	87	Meat, sheep	—	—	i	iv	i	iii	—	—	—	iii
	88	Meat, turkey	—	—	—	—	i	—	—	—	—	ii
22. Milk	89	Milk, whole fresh buffalo	—	—	—	—	—	—	—	—	—	i
	90	Milk, whole fresh cow	—	—	—	—	ii	—	—	—	—	ii
	91	Milk, whole fresh goat	—	—	—	—	i	—	—	—	—	iv
	92	Milk, whole fresh sheep	—	—	—	—	iii	—	—	—	—	iii

— = not applicable, FCL = FAOSAT Commodity List, IC2 = item category level 2.

Notes: The codes are as follows: i = both productivity and ratio of the yield are high; ii = productivity is high, but the ratio of the yield is low; iii = productivity is low, but the ratio of the yield is high; and iv = both productivity and ratio of the yield are low. The interpretation code 'B' reflects the median of the specific products in IC2 included here, while the code 'A', which is not shown in this Appendix, reflects the median of the broader product categories in IC1. See Appendix 3.7. The interpretation code is omitted when there are fewer than three products (as categorized by the FCL) in a country's IC2 grouping.

Source: Tables 2.11 to 9.11.