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Unlocking the Upstreamness Benefits in Global Value Chains

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KEY MESSAGES

- Upstreamness reflects the position of an industry or economy in the supply chain. Producers are more upstream if they specialise in producing intermediate goods. And they are less upstream (or more downstream) if most of their output goes directly to the end user.
- Participating in global production networks offers advantages to both upstream suppliers and downstream users. In Asia, both advanced and emerging economies have shifted upstream in global value chains (GVCs), meaning they now provide intermediate inputs to other economies.
- The degree of upstreamness is closely related to the strength of forward linkages. In the context of international trade, the greater the share of an economy's industrial output that is being used as intermediate inputs by its trade partners, the higher the upstreamness.
- Using data from domestic input–output tables, we explore the upstreamness of industries in APEC economies. Generally, an economy's primary sectors (such as mining) are more upstream while its service sectors are among the least upstream.
- In certain cases, an economy's unique economic structures contribute to variations in the relative upstreamness values of different sectors. In Viet Nam, for example, the dominance of the textile and computer industries has made them among the most upstream sectors in the economy.
- An analysis of trade data on the upstreamness positions of APEC members reveals that some economies export relatively upstream products, such as mining products. Others report higher import upstreamness, which would imply more downstream-oriented exports or production.
- Exploring the benefits and challenges of upstream and downstream positions provides insights into business strategies. For example, upstream firms may face less competition but must optimise resource efficiency. Downstream firms have access to diverse customer bases but grapple with supply inconsistencies and constraints from deficiencies in upstream technological capacity.
- Government policy plays an important role in shaping the dynamics of businesses positioned upstream and downstream in the value chain. In particular, government policy could focus on the leverage points in a supply chain, that is, the pivotal areas within a complex system where a small change can lead to significant impacts.

Introduction

In today's interconnected world, the dynamics of global value chains (GVCs) are evolving rapidly. The advent of technology, coupled with decreased transportation costs, has fuelled a shift toward more fragmented supply chains, with businesses outsourcing specific production stages to international partners, optimising costs and efficiency.

Participating in global production networks offers advantages to both upstream suppliers and downstream users. In Asia, both advanced and emerging market economies have shifted upstream in GVCs, meaning they now provide intermediate inputs to other economies (rather than processing inputs from more upstream economies).¹ Transitioning to a higher upstream position in production is linked to an increasing portion of GVC value added being captured, particularly when combined with enhanced productive knowledge and capabilities.²

Understanding business positions in the context of an upstream or downstream perspective involves navigating the complexities of the production network. Businesses must strategically position themselves based on industry context, resources and goals.

This policy brief aims to explore the degree of upstreamness across various industries in APEC member economies, analysing the potential benefits and challenges associated with different levels of upstreamness and providing policy implications.

The next section delves into the concept of upstreamness and subsequently analyses the industrial positioning of several APEC economies based on domestic input–output data. The brief will then illustrate some of the benefits and challenges of being located in upstream and downstream positions. Moving forward, policymakers can play a pivotal role by incentivising sustainable practices, addressing supply chain resilience and fostering collaborative partnerships.

Definition and relevance of upstreamness

Upstreamness reflects the position of an industry or a producer in the supply chain. Intuitively, economies are perceived to be more upstream if they specialise in the production of intermediate goods. In contrast, sectors

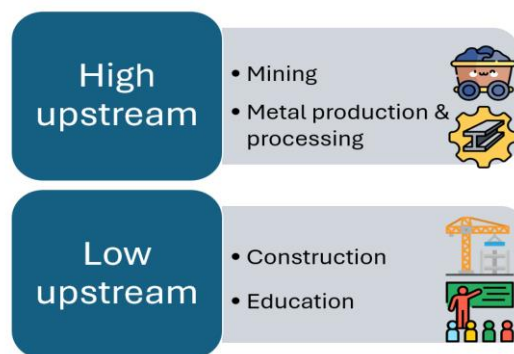


Figure 1. Examples of high and low upstream industries

can be considered to be less upstream (or more downstream) if most of their output goes directly to the end user.³

A more precise definition explains upstreamness as the distance between a production sector and the final use for consumption.⁴ In a sector with a higher level of upstreamness, the production activity is far from the final product. An example would be industries producing raw materials for further processing in other downstream sector(s). In contrast, a sector with a lower upstreamness level represents the last few stages of final assembly. Examples include labour-intensive manufacturing processes.⁵

Upstreamness has been measured using a scale where the lowest value is 1, the case where the product is consumed directly without any intermediate processing. The index range can theoretically go as high as infinity if a product goes through many production stages before reaching the final consumer. To illustrate, in Indonesia, the measure of an industry's upstreamness ranges from a minimum of 1 (activities of households as employers) to a high of 3.69 (mining support service activities).⁶

Industries or sectors like mining, which mainly produce raw materials and use fewer intermediate inputs but provide many intermediate outputs, are seen as upstream and kickstart the supply chain. The metal production and processing industry, which relies heavily on intermediate inputs and generates many intermediate outputs, is regarded as relatively

¹ K. Cheng et al., "Reaping the Benefits from Global Value Chains," Working Paper WP/15/204, International Monetary Fund (IMF), 2015.

² Cheng et al., "Reaping the Benefits from Global Value Chains."

³ P. Antràs et al., "Measuring the Upstreamness of Production and Trade Flows," *American Economic Review* 102, no. 3 (2012): 412–6, <https://doi.org/10.1257/aer.102.3.412>

⁴ Antràs et al., "Measuring the Upstreamness."

⁵ P. Antràs and D. Chor, "On the Measurement of Upstreamness and Downstreamness in Global Value Chains," Working Paper 24185, 2018, <https://doi.org/10.3386/w24185>

⁶ The mean value across the 45 industries is 2.00, with a standard deviation of 0.68.

upstream, being positioned in the middle of a complex supply chain network.⁷

On the other hand, the construction industry uses a significant portion of intermediate inputs and produces mostly final goods. Positioned at the end of the supply chain, it is seen as having low upstream activity. This is also true for the education sector.⁸

There are interconnections among these industries and sectors. The iron ore mining sector supplies raw materials to the metal production and processing industry. In turn, the construction industry utilises products from metal production and processing, such as steel beams, for the structural support in buildings and bridges. The education sector also relies on the construction industry to build schools and libraries, which are essential for delivering its services.

The degree of upstreamness is closely related to the strength of forward linkages. In the context of international trade, forward linkages represent the share of an economy's industrial output that is being used as intermediate inputs by its trade partners.⁹ Conversely, backward linkages occur when an economy imports intermediate inputs for use in the domestic production of exports.¹⁰ Economies with strong forward linkages are more likely to be upstream in GVCs¹¹ and are considered key economies that are regarded as appropriate targets for economic stimulation due to their high connectivity as suppliers to other sectors.¹²

Contribution of upstreamness to growth

In general, participating in global production networks benefits both upstream suppliers of intermediates and downstream users of foreign inputs as it allows

economies to specialise in areas of comparative advantage and enjoy economies of scale and scope.¹³

However, not all supply chains are identical and firms at the top or the very end of a GVC may capture the most value depending on the nature of the supply chain. In producer-driven GVCs, lead firms are located upstream, controlling product design and the bulk of assembly. In contrast, in buyer-driven GVCs, retailers and branded-goods marketers have control over production, which can be completely outsourced.¹⁴

Upstream industries are likely to have higher nominal output volatility, and economies with more upstream export profiles exhibit higher export volatility.¹⁵ An economy whose main industries are located upstream in the GVC is susceptible to demand shocks originating from downstream economies.¹⁶ This is because small fluctuations in consumer demand can amplify swings in order volume for upstream producers – a phenomenon referred to as the bullwhip effect.¹⁷

An example of the bullwhip effect was seen in Singapore in 2020. In March and April of that year, eggs were often absent from grocery shelves, both online and in physical stores. The scarcity encouraged distributors to boost their inventories. However, just a few months later, in June, distributors found themselves discarding over 250,000 eggs due to an oversupply situation as a result of a long and complex supply chain.¹⁸

This dramatic shift, from shortage to excess, underscores the vulnerability of supply chains to disruptions. While the egg scarcity was not necessarily triggered by the pandemic, the impacts of the pandemic magnified its effects.

During the pandemic, firms that were unable to secure the inputs for production experienced a slowdown of business activities due to supply chain disruption. Order backlogs and delayed delivery times were common. On

⁷ C. Scarffe, "The Position and Length of Canadian Supply Chains," Government of Canada, July 2022, <https://www.international.gc.ca/trade-commerce/economist-economiste/supply-chain-chaine-appvisionnement.aspx?lang=eng>

⁸ Scarffe, "The Position and Length of Canadian Supply Chains."

⁹ R. Lanz and R. Piermartini, "Specialisation within Global Value Chains: Transport Infrastructure Matter Upstream," *The World Economy* 44, no. 8 (2021): 2410–32.

¹⁰ Asian Infrastructure Investment Bank (AIIB), "Asian Infrastructure Finance 2021: Sustaining Global Value Chains" (Beijing: AIIB, 2021), <https://www.aiib.org/en/news-events/asian-infrastructure-finance/2021/introduction/index.html>

¹¹ J. Wuri, T. Widodo, and A.S. Hardi, "Speed of Convergence in Global Value Chains: Forward or Backward Linkage," *Heliyon* 9, no. 7 (2023): e18070, <https://doi.org/10.1016/j.heliyon.2023.e18070>

¹² R. E. Miller and P.D. Blair, *Input–Output Analysis: Foundations and Extensions, 2nd ed.* (Cambridge, MA: Cambridge University Press, 2009).

¹³ IMF, "Reaping the Benefits from Global Value Chains," in *Regional Economic Outlook, Asia and Pacific – Stabilizing and Outperforming Other Regions* (Washington, DC: IMF, 2015), <https://doi.org/10.5089/9781498339841.086>

¹⁴ H.T. Banh, P. Wingender, and C.A. Gueye, "Global Value Chains and Productivity: Micro Evidence from Estonia", Working Paper WP/20/117, IMF, 2020.

¹⁵ M. Olabisi, "Input–Output Linkages and Sectoral Volatility," *Economica* 87, no. 347 (2020): 713–46, <https://doi.org/10.1111/ecca.12327>

¹⁶ K. Suganuma, "Upstreamness in the Global Value Chain: Manufacturing and Services," Discussion Paper 2016-E-2, Institute for Monetary and Economic Studies (IMES), Bank of Japan, Tokyo, 2016, <https://www.imes.boj.or.jp/research/papers/english/16-E-02.pdf>

¹⁷ X. Wang and S.M. Disney, "The Bullwhip Effect: Progress, Trends and Directions," *European Journal of Operational Research* 250, no. 3 (2016): 691–701, <https://doi.org/10.1016/j.ejor.2015.07.022>

¹⁸ Jones Lang LaSalle (JLL), "Too Many Eggs: Supply Chain Shocks Arise from COVID-19," 10 July 2020, <https://www.jll.com.sg/en/trends-and-insights/investor/too-many-eggs-covid-19-turns-focus-on-the-bullwhip-effect>

the other hand, a firm in a higher position in a supply chain is less likely to be affected by an exogenous supply shock, allowing it to maintain production at a normal speed.¹⁹

In the last two decades, advanced economies have largely moved downstream. Meanwhile, many emerging economies, including China, have moved upstream.²⁰ For China, moving upstream has meant upgrading its production capabilities to reduce its reliance on imported intermediate goods. India, however, has moved downstream with shifts in key industries, and high-technology products dominating its GVC exports.

For example, it exports refined petroleum products and automobile vehicles.²¹ At the same time, its sectors remain heavily reliant on imported raw materials and intermediate inputs.²²

APEC economies' upstreamness position

To examine the upstreamness position of industries in APEC economies, we used the method in Antràs et al.²³ We drew the data, which cover a total of 45 industries, from the OECD Input–Output Tables (2021 edition).

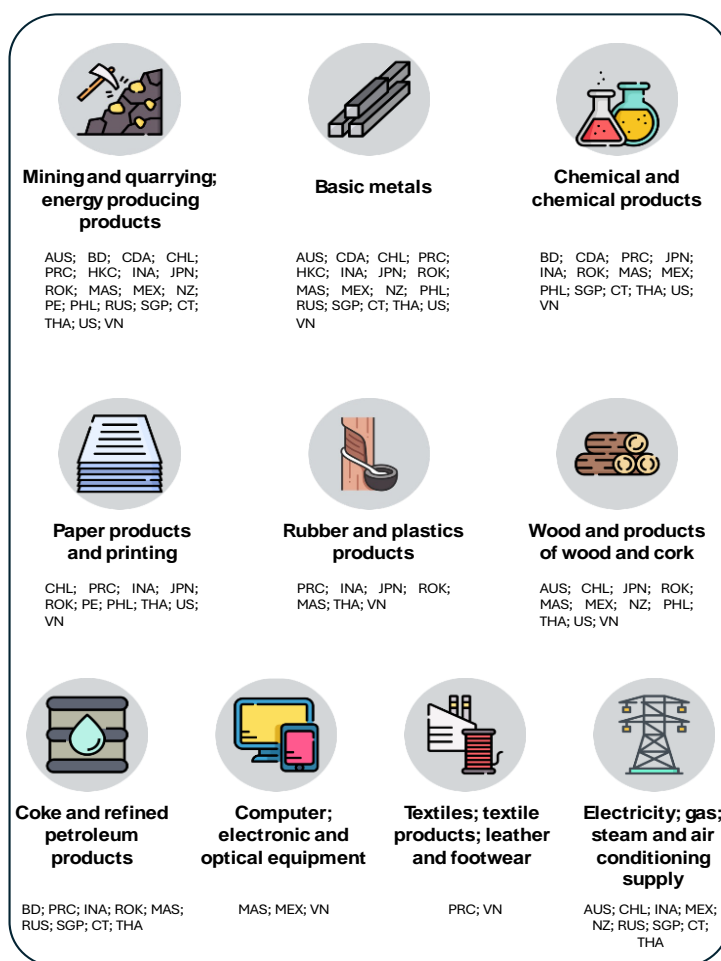


Figure 2. The most upstream sectors in APEC economies (2018)

AUS=Australia; BD=Brunei Darussalam; CDA=Canada; CHL=Chile; PRC=China; HKC=Hong Kong, China; INA=Indonesia; JPN=Japan; ROK=Korea; MAS=Malaysia; MEX=Mexico; NZ=New Zealand; PE=Peru; PHL=the Philippines; RUS=Russia; SGP=Singapore; CT=Chinese Taipei; THA=Thailand; US=United States; VN=Viet Nam

Note: Data cover 20 APEC economies. For illustrative examples of upstreamness values for selected APEC economies, see Appendix, Table A1. Source: Authors' calculations based on the OECD Input–Output Tables database (2021).

¹⁹ D. Rees and P. Rungcharoenkitkul, "Bottlenecks: Causes and Macroeconomic Implications," *BIS Bulletin*, 11 November 2021, <https://www.bis.org/publ/bisbull48.htm>

²⁰ AIIB, "Asian Infrastructure Finance 2021."

²¹ AIIB, "Asian Infrastructure Finance 2021."

²² R. Mazumdar and M. Khurana, "Global Value Chain Integration: Enhancing India's Exports," Working Paper 92, Export-Import Bank of India, Mumbai, 2019, <https://www.eximbankindia.in/Assets/Dynamic/PDF/Publication-Resources/ResearchPapers/121file.pdf>

²³ Antràs et al., "Measuring the Upstreamness."

The analysis confirms that a great number of the most upstream sectors in the APEC region are primary sectors, such as mining and extractive activities (Figure 2; see also Appendix, Table A1). This finding corresponds with the view that more capital-intensive sectors, such as those involved in processing raw materials, tend to be located further away from the final demand or the end customer.²⁴ Indeed, it is argued that upstreamness has a positive correlation with physical capital intensity and a negative correlation with skill intensity in manufacturing.²⁵ China is the largest exporter of raw plastic sheeting and plastic lids, which explains the relatively upstream value of the plastic sector compared to other sectors.²⁶

The upstreamness of a sector also depends on the nature of the domestic economic structure. For example, in Viet Nam, the textile industry is the most upstream sector in the economy, followed by rubber and computer products. This is because Viet Nam, as one of the largest exporters of textile products in the world, has attracted many investments in factories in upstream sectors, such as fabrics and dyeing.²⁷

In terms of the least upstream sectors, in 2018, most APEC economies were very downstream in sectors such as public administration and defence; compulsory social security; education; human health and social work activities; arts, entertainment and recreation; accommodation and food service activities; other

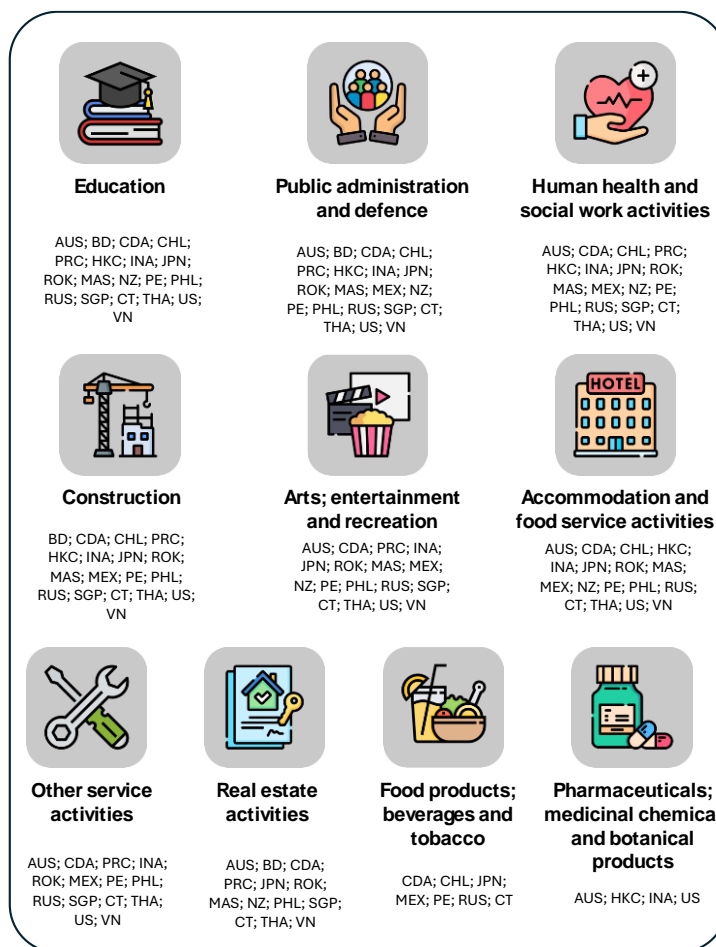


Figure 3. The most downstream sectors in APEC economies (2018)

AUS=Australia; BD=Brunei Darussalam; CDA=Canada; CHL=Chile; PRC=China; HKC=Hong Kong, China; INA=Indonesia; JPN=Japan; ROK=Korea; MAS=Malaysia; MEX=Mexico; NZ=New Zealand; PE=Peru; PHL=the Philippines; RUS=Russia; SGP=Singapore; CT=Chinese Taipei; THA=Thailand; US=United States; VN=Viet Nam

Note: Data cover 20 APEC economies. Excluding sector 'Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use'. For illustrative examples of upstreamness values for selected APEC economies, see Appendix, Table A2. Source: Authors' calculations based on the OECD Input-Output Tables database (2021).

²⁴ Antràs et al., 'Measuring the Upstreamness.'

²⁵ Antràs et al., 'Measuring the Upstreamness.'

²⁶ Data from the Observatory of Economic Complexity (OEC).

²⁷ H. Van, "Vietnamese Textile and Garment Producers on Track with 2021's Goal," *Vietnam Investment Review*, 15 November 2021, <https://vir.com.vn/vietnamese-textile-and-garment-producers-on-track-with-2021s-goal-89194.html>

service activities; and construction (Figure 3, see also Appendix, Table A2).

The services sectors appear here because they generally have fewer production stages than other sectors, and those services are provided directly to the customer and located close to the final demand or end customer.²⁸ Similarly, the construction sector is often localised and very close to the domestic final demand.²⁹

'Pharmaceuticals, medicinal chemical and botanical products' and 'food products, beverages and tobacco' are sectors with lower values on upstreamness in some economies, showing that the sectors are generally closer to the consumers. However, zooming in to the pharmaceuticals industry, five economies exhibit relatively high upstreamness, namely, China; Korea; Malaysia; Singapore; and Viet Nam. This reflects the complexity of the pharmaceutical GVC, with a producer-driven model for branded products, a buyer-driven model for quality generics with decentralised production networks, or a non-driven model for low-value generics led by domestic companies. The strategic model(s) seen in an economy affects the position of its pharmaceutical sector in terms of upstreamness.³⁰

Thus, China, as the dominant global source of active pharmaceutical ingredients (APIs), supplying over 40 percent of the global volume in 2019, with a trade value of USD 49 billion, has a relatively high upstreamness value for the sector.³¹ The US, on the other hand, has a significant pharmaceutical trade deficit, highlighting the important role international trade plays in the US pharmaceutical market, with net imports reaching USD 38 billion in 2015 (0.2 percent of GDP).³²

Upstreamness in GVC-intensive manufacturing sectors

In terms of GVC-intensive manufacturing sectors, Japan has relatively higher upstreamness value in motor vehicles while Viet Nam is located at a relatively more upstream position for the computer, electronic and

optical equipment industries. Viet Nam's position could reflect the economy's role as a parts and components supplier for electronics GVCs, with the domestic electronics industry its dominant export earner.³³

The position of the US in the computer supply chain is more downstream. Leading multinational corporations in the electronics sector, such as Apple, often focus on marketing, branding, research, design and new product development.³⁴ Most of these activities involve intangible assets that generate value such as patents, trademarks, copyrights and brand names.³⁵ Therefore, substantial exports from these multinational corporations may not be captured by official trade statistics. For example, one study notes that four US factoryless companies exported USD 27.9 billion in services related to intangible assets, which are not considered US exports in official trade statistics.³⁶

Linking trade and upstreamness

Using trade data, we explored the relative upstreamness positions of APEC economies along global production processes. This was done through calculating export (import) upstreamness, a measure that indicates the average position of an economy's exports (imports) within global production processes.³⁷ The measure is calculated as a weighted average, taking into account the upstreamness of each industry and the value of sectoral trade within the economy's overall trade portfolio.

The measure quantifies how early or late in the production process the exported (imported) goods are. In the context of exports, a higher value for export upstreamness suggests that an economy's exports primarily consist of raw materials or intermediate goods used in subsequent production stages. Conversely, a lower value for export upstreamness indicates that the

²⁸ T. Fally, "Production Staging: Measurement and Facts," 2012.

²⁹ J. Hagemeyer and M. Ghodsi, "Up or Down the Value Chain? A Comparative Analysis of the GVC Position of the Economies of the New EU Member States," *Central European Economic Journal* 1, no. 48 (2017), <https://sciendo.com/article/10.1515/ceej-2017-0003>

³⁰ W. Raza et al., "Post Covid-19 Value Chains: Options for Reshoring Production Back to Europe in a Globalised Economy" (European Union, 2021), <https://doi.org/10.2861/428>

³¹ Raza et al., "Post Covid-19 Value Chains."

³² OECD, "Pharmaceutical Innovation and Access to Medicines" (OECD Health Policy Studies, Paris: OECD Publishing, 2018), <https://doi.org/10.1787/9789264307391-en>

³³ H. Herr, E. Schweissheim, and T. Vu, "The Integration of Vietnam in the Global Economy and Its Effects for Vietnamese Economic Development," Working Paper 44, Global Labour University (GLU), Geneva, 2016, https://global-labour-university.org/wp-content/uploads/fileadmin/GLU_Working_Papers/GLU_WP_No.44.pdf

³⁴ United Nations Industrial Development Organization (UNIDO), "Global Value Chains and Industrial Development: Lessons from China, South-East and South Asia," UNIDO, 2018, https://www.unido.org/sites/default/files/files/2018-06/EBOOK_GVC.pdf

³⁵ J.G. Cummins, "A New Approach to the Valuation of Intangible Capital," in *Measuring Capital in the New Economy*, ed. C. Corrado, J. Haltiwanger, and D. Sichel (University of Chicago Press, 2005), <http://www.nber.org/chapters/c10618>

³⁶ Y. Xing, D. Dollar, and B. Meng, "Trade in Intangible Assets along Global Value Chains and Intellectual Property Protection," in *Global Value Chain Development Report 2021: Beyond Production*, ed. Y. Xing, E. Gentile, and D. Dollar (Asian Development Bank et al., 2021), https://ir.ide.go.jp/?action=repository_uri&item_id=52902&file_id=22&file_no=1

³⁷ Using the method in Antràs et al., "Measuring the Upstreamness."

Economy	Export Upstreamness (U_x)	Import Upstreamness (U_M)	Difference (U_M-U_x)
Australia	2.57	1.94	-0.63
Brunei Darussalam	3.17	1.89	-1.28
Canada	2.42	2.11	-0.31
Chile	2.69	1.98	-0.71
China	3.20	3.07	-0.13
Hong Kong, China	2.11	2.23	0.12
Indonesia	2.31	2.15	-0.16
Japan	2.40	2.45	0.06
Korea	3.08	3.17	0.09
Malaysia	3.37	3.14	-0.23
Mexico	2.02	2.06	0.04
New Zealand	1.69	1.97	0.28
Peru	2.05	1.84	-0.21
The Philippines	1.86	1.86	-0.00
Russia	3.02	2.00	-1.01
Singapore	4.32	4.23	-0.10
Chinese Taipei	3.14	3.21	0.07
Thailand	2.07	2.69	0.62
United States	1.89	1.83	-0.06
Viet Nam	4.80	4.51	-0.28
APEC average*	2.69	2.52	-0.18
World average**	2.60	2.47	-0.13

Table 1. Export and import upstreamness for APEC economies (2018)

* The APEC average is weighted based on total exports and imports, respectively. It is tabulated based on data from all APEC member economies except for Papua New Guinea due to the lack of data from the OECD Input–Output Tables database.

** The world average is weighted based on total exports and imports, respectively, of 66 economies with available export and import data disaggregated at the industry level corresponding to the OECD Input–Output Tables database.

*** The maximum value of export and import upstreamness in 2018 across 66 economies is 13.22 and 12.78 respectively. The minimum value of export and import upstreamness in 2018 across 66 economies is 1.25 and 1.50 respectively. The mean value of export (import) upstreamness across these economies was 2.73 (2.58), with a standard deviation of 1.55 (1.43).

Source: Calculated by the authors using data from the OECD Input–Output Tables database.

exports are closer to final goods ready for consumption. This concept also applies to imports.

In 2018, the mean value of export upstreamness for APEC economies was 2.69, while that for import upstreamness was 2.52 (Table 1). Thus, on average, both the exports and the imports of APEC economies are more upstream than the world average (2.60 and 2.47 respectively). Also notable from Table 1 is that APEC members vary in terms of the upstreamness of their exports relative to their imports.

Relatively greater export upstreamness. Several APEC economies – Australia; Brunei Darussalam; Chile; Russia – exported products that were relatively upstream compared to their imports.

Upon closer examination of these economies' export mix, it becomes apparent that the bulk of their exports are in the mining and quarrying sector, with commodities such as coal, petroleum, gas and metal ores. For example, Australia's mining and quarrying exports accounted for 53.3 percent of total exports while that of Brunei Darussalam accounted for 87.4 percent of total exports.

The relative upstreamness of Chile and Russia may be explained by the contributions of certain sectors. Basic metals, the leading export sector in Chile, accounted for 27.5 percent of total exports while coke and refined petroleum products accounted for 17.0 percent of total

exports in Russia.³⁸ These commodities typically serve as production inputs to a wide range of sectors and the high value of export upstreamness in these sectors further indicates that Chile and Russia are exporters at the upper end of the value chains of these intermediate goods.

Relatively greater import upstreamness. A few APEC members – Hong Kong, China; New Zealand; Thailand – reported higher values for import upstreamness compared to export upstreamness. This is due to the relatively downstream nature of their exports (or production) compared to their imports. High import upstreamness may indicate that more finishing stages of production are now being performed domestically.³⁹

In Hong Kong, China, the largest export sectors are tertiary sectors such as financial and insurance activities, wholesale and retail trade, and repair of motor vehicles, reflecting Hong Kong, China’s position as a global financial hub. Such services are usually delivered straight to the consumer or have fewer production stages. On the other hand, the bulk of the economy’s imports are made up of computer, electronic and optical equipment, as well as food products, beverages and tobacco. These sectors are classified as secondary manufacturing sectors that are further away from the final use compared to the services mentioned earlier. For Thailand, its major imports are from primary sectors like mining and quarrying and from manufacturing sectors like basic metals and chemical products used as production inputs, and hence, its imports are relatively more upstream.

These economies are deemed to be engaged in adding value along the GVC, through processing and assembling the imported intermediate inputs across

Upstream Position	
Benefits	Challenges
<ul style="list-style-type: none"> • Upstream firms in a high-tech industry face less competition because the high cost of capital and specialised knowledge required raise barriers to entry. This could translate into higher prices and better profits. • The availability of essential inputs allows natural resources firms the potential to earn higher margins. • Firms have access to a wide range of downstream customers. For instance, a semiconductor company could sell to multiple smartphone manufacturers, which then compete in the downstream retail market. • R&D investments benefit the operating performance of upstream and midstream firms more in a high-tech industry, as innovation is essential for maintaining competitive advantage. • Upstream firms are less likely to operate in environments characterised by diverse buyers and suppliers, leading to less competition and less uncertainty. 	<ul style="list-style-type: none"> • Upstream manufacturers need to optimise production for resource efficiency. Mining companies are often 10 times more energy-intensive than their customers while energy costs for upstream manufacturers can account for as much as 20 percent of overall production costs. • A demand shock in a destination market would be difficult to contain and may have significant repercussions for upstream firms serving that market. • Demand distortions or demand shocks (the bullwhip effect), can create inefficiencies for upstream firms, resulting in excess inventory or late deliveries. • An industry or product strategically positioned at the upstream of a global value chain (GVC) possesses the capacity to induce disruptive effects throughout the entire chain via spillover mechanisms.

Table 2. Benefits and challenges of an upstream position

Source: C. Arriola et al., “Efficiency and Risks in Global Value Chains in the Context of COVID-19,” Working Paper 1637, Organisation for Economic Co-operation and Development (OECD) Economic Department, 2020, <https://doi.org/10.1787/3e4b7ecf-en>; G20, “Outcome Document and Chair’s Summary” (*G20 Trade and Investment Ministerial Meeting*, Jaipur, Rajasthan, 25 August 2023), https://www.g20.in/content/dam/gtwenty/gtwenty_new/document/G20_Trade_and_Investment_Ministers_Meeting.pdf; R. Metters, “Quantifying the Bullwhip Effect in Supply Chains,” *Journal of Operations Management* 15, no. 2 (1997): 89–100, [https://doi.org/10.1016/S0272-6963\(96\)00098-8](https://doi.org/10.1016/S0272-6963(96)00098-8); S. Mohr et al., “Manufacturing Resource Productivity,” McKinsey Sustainability, 1 June 2012, <https://www.mckinsey.com/capabilities/sustainability/our-insights/manufacturing-resource-productivity#/>; M. Singer and P. Donoso, “Upstream or Downstream in the Value Chain?” *Journal of Business Research* 61, no. 6 (2008): 669–77, <https://doi.org/10.1016/j.jbusres.2007.06.043>; H.-W. Wang, and M.-C. Wu, “Business Type, Industry Value Chain, and R&D Performance: Evidence from High-tech Firms in an Emerging Market,” *Technological Forecasting and Social Change* 79, no. 2 (2012): 326–40, <https://doi.org/10.1016/j.techfore.2011.05.008>; J. Wang, H. Shin, and Q. Zhou, “The Optimal Investment Decision for an Innovative Supplier in a Supply Chain,” *European Journal of Operational Research* 292, no. 3 (2021): 967–79, <https://doi.org/10.1016/j.ejor.2020.11.040>; V. Zavacká, “The Bullwhip Effect and the Great Trade Collapse,” Working Paper 148, European Bank for Reconstruction and Development (EBRD), 2012, <https://www.ebrd.com/downloads/research/economics/workingpapers/wp0148.pdf>

³⁸ Export data disaggregated at the industry level corresponding to the ADB Multi-regional Input–Output (MRIIO) Inter-country Input–(ICIO) tables database.

³⁹ L. Alfaro and D. Chor, “Global Supply Chains: The Looming ‘Great Reallocation,’” Working Paper 31661, National Bureau of Economic Research (NBER), Cambridge, MA, 2023, <https://www.nber.org/papers/w31661>

numerous industries before exporting them to end users in global markets.⁴⁰

Balanced import/export upstreamness. Other APEC economies – Mexico; the Philippines; Chinese Taipei; and the US – show little to no difference between the position of their exports and imports along the production line.

In the Philippines, the sectors contributing the largest share of their imports (such as computer, electronic and optical equipment; wholesale and retail trade; and repair of motor vehicles) also accounted for most of their exports. In the case of the US, the low value of both its export and import upstreamness indicates its position as a major importer of finished consumer goods.⁴¹

Overall, within APEC, China has positioned itself more upstream than other economies in both its exports and imports (Table 1). This is in line with our earlier observation that China has been moving upstream, that is, relatively away from the consumer end of the production processes, particularly in the electronics sector. China has become an important production hub of intermediate goods that serve as inputs for other sectors.⁴² On the other hand, the Philippines’ export and import mix in 2018 was the most downstream among APEC members, suggesting that the Philippines is positioned comparatively near the final assembly stages that are closer to end consumers.

Downstream Position	
Benefits	Challenges
<ul style="list-style-type: none"> • Lead firms (positioned downstream) could leverage branding and marketing to capture more benefits and sales. • In buyer-driven global value chains (GVCs), buyer firms control the whole process by building a network of global production and distribution systems, without direct ownership. • Economies focused on downstream activities, such as manufacturing and services, typically grow faster and achieve higher living standards due to specialisation and the increased productivity of workers. • Sales personnel are in a good position to acquire knowledge about consumers to expand sales and differentiate products. • Marketing capabilities enable downstream firms to successfully commercialise R&D-investments-driven technologies into market. • Firms operating downstream can develop more diverse skills sets, such as distribution, marketing and brand development. 	<ul style="list-style-type: none"> • Downstream firms are more likely to face the issue of inconsistency of supply. This is associated with uncertainty stemming from upstream vendors, irregular and indefinite lead times, and price volatility. • Downstream manufacturers are subject to constraints from their suppliers’ technological capacity and the level of upstream competitiveness. More suppliers mean lower prices; fewer suppliers mean higher prices. • The presence of anticompetitive regulations in upstream sectors hurts productivity growth in downstream firms. • Industries or products reliant on multiple inputs across various stages are inherently more vulnerable to experiencing frequent or multiple disruptions.

Table 3. Benefits and challenges of a downstream position

Source: N. Belhocine and D. Garcia-Macia, “Identifying Service Market Reform Priorities in Italy,” Working Paper WP/20/39, International Monetary Fund (IMF), 2020, <https://www.imf.org/en/Publications/WP/Issues/2020/02/21/Identifying-Service-Market-Reform-Priorities-in-Italy-49038>; N. Matsushima and T. Mizuno, “Profit Enhancing Competitive Pressure in Vertically Related Industries,” Discussion Paper 2009-3, Kobe University Graduate School of Business Administration, Kobe, 2009, https://www.b.kobe-u.ac.jp/papers_files/2009_03.pdf; Nielsen, “When It Comes to Brand Building, Awareness Is Critical,” June 2021, <https://www.nielsen.com/insights/2021/when-it-comes-to-brand-building-awareness-is-critical/>; G. Grundvåg Ottesen, “Do Upstream Actors in the Food Chain Know End-users’ Quality Perceptions? Findings from the Norwegian Salmon Farming Industry,” *Supply Chain Management* 11, no. 5 (2006): 456–63, <https://doi.org/10.1108/13598540610682471>; A. Raj et al., “Supply Chain Management during and post-COVID-19 Pandemic: Mitigation Strategies and Practical Lessons Learned,” *Journal of Business Research* 142 (2022): 1125–39, <https://doi.org/10.1016/j.jbusres.2022.01.037>; J.D. Sachs and A. Warner, “Natural Resource Abundance and Economic Growth,” Working Paper 5398, National Bureau of Economic Research (NBER), Cambridge, MA, 1995, <https://doi.org/10.3386/w5398>; N. Shin, K.L. Kraemer, and J. Dedrick, “R&D, Value Chain Location and Firm Performance in the Global Electronics Industry,” *Industry and Innovation* 16, no. 3 (2009): 315–30, <https://doi.org/10.1080/13662710902923867>; H.-W. Wang and M.-C. Wu, “Business Type, Industry Value Chain, and R&D Performance: Evidence from High-tech Firms in an Emerging Market,” *Technological Forecasting and Social Change* 79, no. 2 (2012): 326–40, <https://doi.org/10.1016/j.techfore.2011.05.008>

⁴⁰ D. Chor, K.B. Manova, and Z. Yu, “Growing like China: Firm Performance and Global Production Line Position,” SSRN, 2020, <https://doi.org/10.2139/ssrn.3679997>

⁴¹ P. Antràs and D. Chor, “Organizing the Global Value Chain,” *Econometrica* 81, no. 6 (2013): 2127–204, <https://doi.org/10.3982/ecta10813>

⁴² G. Lai, Q. Nguyen, and A. Bayhaqi, “The FDI Network, Global Value Chain Participation and Economic Upgrading” (Singapore: APEC, May 2022), <https://www.apec.org/publications/2022/05/the-fdi-network-global-value-chain-participation-and-economic-upgrading>

Exploring the benefits and challenges

Tables 2 and 3 illustrate some of the benefits and challenges of being located in the upstream and downstream positions.

In the upstream position, the potential for reduced competition and the ability to command higher prices in certain industries underscore the advantages of being positioned closer to the strategic raw material sources (Table 2). However, having to optimise resource efficiency and mitigate supply chain disruptions pose critical challenges that upstream firms must address to ensure survival and sustainability.

Downstream positions offer their respective opportunities and challenges (Table 3). Firms are able to access a diverse customer base. They could realise economic growth through taking advantage of the complex division of labour and they could even create value through building brand awareness. At the same time, the downstream landscape is not without its trials, including inconsistent supply and constraints arising from deficiencies in upstream technological capacity and the degree to which the upstream sectors are competitive (which affect prices, for example).

Recommendations on the way forward

In moving forward, businesses need to carefully evaluate their industry context, resources and strategic goals to determine the optimal positioning within the value chain. Strategic decisions should be underpinned by a thorough understanding of the dynamic trade-offs between the benefits and challenges associated with both upstream and downstream positions. Innovative solutions and collaborations can play a pivotal role in enhancing competitiveness and resilience.

Despite the distinct differences and characteristics of the upstream and downstream sectors, they are best understood as interconnected elements within a complex supply chain system. Disruptions or policy

changes in any segment of the supply chain can trigger spillover effects on the entire supply chain, both domestically and globally.

Such impacts are serious as multinational companies depend on global supply chains to maintain their competitive edge. These global supply chains account for approximately 21 percent of a company's performance, contributing to 16 percent of Amex's, 23 percent of Dell's, 14 percent of FedEx's, 13 percent of Daimler's, 19 percent of Microsoft's, 21 percent of Nestlé's, 22 percent of Siemens' and 21 percent of Unilever's performance.⁴³

Government policy could play an important role in shaping the dynamics of businesses positioned upstream and downstream in the value chain. By providing targeted incentives, governments can encourage upstream sectors or lead firms to adopt and invest in environmentally sustainable practices,⁴⁴ which, in turn, promotes broader environmental responsibility and sustainability across the entire value chain. For example, Germany has launched a EUR 50 billion funding programme to help energy-intensive industries transition to climate neutrality. Through Carbon Contracts for Difference (CCfD), companies receive financial support for adopting eco-friendly technologies like green hydrogen.⁴⁵

Policymakers can develop strategies to enhance supply chain resilience by forging alliances to establish buffer inventories for essential goods; networks to facilitate alternative supply sources; and contingency plans (together with the business sector) for managing and overcoming disruptions.⁴⁶ For example, the government of Singapore has collaborated with the private sector to accumulate reserves of food, essential items (pharmaceuticals, medical supplies, fuel) and vital construction materials. These reserves have been expanded in response to heightened risks of disruption.⁴⁷

Policymakers can also address supply inconsistency issues by facilitating collaborative partnerships between downstream and upstream firms.⁴⁸ This could be achieved through public-private dialogue to identify coordination problems and find solutions that facilitate progress toward agreed-upon development objectives.

⁴³ T. Hult, D. Closs, and D. Frayer, "How Global Should Your Supply Chains Be?" *Global Edge Business Review* 8, no. 2 (2014): 1, <https://globaledge.msu.edu/content/gbr/gbr8-2.pdf>

⁴⁴ P. Chakraborty and C. Chatterjee, "Does Environmental Regulation Indirectly Induce Upstream Innovation? New Evidence from India," *Research Policy* 46, no. 5 (2017), <http://dx.doi.org/10.2139/ssrn.2664131>

⁴⁵ D.C. Chin et al., "Germany Launches EUR 50 Billion Funding Program for Decarbonization of Heavy Industry," Jones Day, July 2023, <https://www.jonesday.com/en/insights/2023/07/germanys-eur-50-billion-decarbonization-program>

⁴⁶ M.L. Pimenta et al., "Supply Chain Resilience in a Covid-19 Scenario: Mapping Capabilities in a Systemic Framework," *Sustainable Production and Consumption* 29 (2022): 649–56, <https://doi.org/10.1016/j.spc.2021.10.012>

⁴⁷ APEC, "Helping Businesses Build and Maintain Open, Secure and Resilient Supply Chains" (Singapore: APEC, 2024), https://www.apec.org/docs/default-source/publications/2024/1/224_psu_resilient-supply-chain.pdf?sfvrsn=c115092d_2

⁴⁸ A. Gurzawska, "Towards Responsible and Sustainable Supply Chains – Innovation, Multi-stakeholder Approach and Governance," *Philosophy of Management* 19 (2020): 267–95, <https://doi.org/10.1007/s40926-019-00114-z>

In Mexico, this was achieved through establishing public–private productivity commissions.⁴⁹ This concept stresses communication among stakeholders in economic activities to address constraints and market failures in new endeavours. Information on weak links and missing inputs is collected at the firm and local authority level for collaborative problem-solving.⁵⁰

Finally, policymakers, when formulating and implementing supply chain policies, should pay particular attention to the leverage points within a supply chain. These points serve as strategic intervention areas within the system where even minor adjustments can trigger significant changes throughout the entire system.⁵¹ For example, creating buffers in inventories and warehouses could improve supply chain resiliency. At the same time, there is a need to be judicious in applying levers of any kind. In the example of the inventory buffers, if they are excessively large, they become costly to maintain and inflexible, and turn obsolete as a strategic tool. Therefore, while leverage points should be considered a crucial strategic tool, their use must be carefully calibrated to avoid issues such as greater inefficiencies and increased costs.⁵²

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⁴⁹ R. Devlin and C. Pietrobelli, "Modern Industrial Policy and Public–Private Councils at the Sub-national Level: Mexico's Experience in an International Perspective," Working Paper 2018-028, United Nations University – Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT), 2018.

⁵⁰ C. Findlay and B. Hoekman, "Value Chain Approaches to Reducing Policy Spillovers on International Business," *Journal of International Business Policy* 4 (2021): 390–409, <https://link.springer.com/article/10.1057/s42214-020-00083-5>

⁵¹ D. Meadows, "Leverage Points: Places to Intervene in a System," The Sustainability Institute, 1999, <https://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>

⁵² A. Leslie, "Finding the Leverage Points," StrategicRISK, 19 December 2006, <https://www.strategic-risk-global.com/cyber-/technology-risks/finding-the-leverage-points/1361986.article>

Appendix

Table A1. The most upstream sectors in selected APEC economies (2018)

Rank	China	Indonesia	Japan	Korea	Malaysia	The Philippines	Russia	United States	Viet Nam
1	Mining support service activities 5.90	Mining support service activities 3.69	Mining and quarrying, non-energy producing products 3.99	Water transport 5.08	Mining support service activities 5.30	Mining support service activities 3.48	Mining and quarrying, energy producing products 3.92	Basic metals 3.29	Textiles, textile products, leather and footwear 6.73
2	Mining and quarrying, energy producing products 4.94	Mining and quarrying, energy producing products 3.66	Basic metals 3.77	Mining and quarrying, non-energy producing products 4.77	Chemical and chemical products 4.54	Mining and quarrying, energy producing products 3.30	Mining and quarrying, non-energy producing products 3.90	Mining and quarrying, energy producing products 2.88	Rubber and plastics products 6.17
3	Chemical and chemical products 4.53	Paper products and printing 3.20	Mining support service activities 3.38	Mining and quarrying, energy producing products 4.71	Mining and quarrying, energy producing products 4.53	Mining and quarrying, non-energy producing products 3.13	Mining support service activities 3.61	Mining and quarrying, non-energy producing products 2.82	Computer, electronic and optical equipment 6.15
4	Mining and quarrying, non-energy producing products 4.31	Mining and quarrying, non-energy producing products 3.19	Mining and quarrying, energy producing products 3.23	Chemical and chemical products 4.04	Basic metals 4.31	Basic metals 2.53	Warehousing and support activities for transportation 3.43	Postal and courier activities 2.77	Mining support service activities 5.74
5	Coke and refined petroleum products 4.13	Chemical and chemical products 2.81	Paper products and printing 3.12	Basic metals 4.02	Computer, electronic and optical equipment 4.07	Other non-metallic mineral products 2.46	Basic metals 3.42	Warehousing and support activities for transportation 2.76	Chemical and chemical products 5.51
6	Rubber and plastics products 4.05	Electricity, gas, steam and air conditioning supply 2.78	Chemical and chemical products 3.05	Warehousing and support activities for transportation 4.01	Mining and quarrying, non-energy producing products 3.82	Warehousing and support activities for transportation 2.42	Administrative and support services 3.34	Administrative and support services 2.65	Paper products and printing 5.30
7	Textiles, textile products, leather and footwear 3.84	Basic metals 2.69	Motor vehicles, trailers and semi-trailers 3.02	Paper products and printing 3.90	Rubber and plastics products 3.81	Fabricated metal products 2.42	Water transport 3.33	Chemical and chemical products 2.64	Basic metals 5.15
8	Paper products and printing 3.78	Administrative and support services 2.67	Water transport 3.00	Coke and refined petroleum products 3.75	Wood and products of wood and cork 3.80	Chemical and chemical products 2.34	Coke and refined petroleum products 3.24	Paper products and printing 2.63	Fabricated metal products 5.10
9	Basic metals 3.75	Rubber and plastics products 2.57	Wood and products of wood and cork 2.72	Postal and courier activities 3.59	Fabricated metal products 3.80	Wood and products of wood and cork 2.31	Land transport and transport via pipelines 3.17	Fabricated metal products 2.49	Mining and quarrying, non-energy producing products 5.09
10	Postal and courier activities 3.63	Coke and refined petroleum products 2.47	Rubber and plastics products 2.67	Rubber and plastics products 3.58	Coke and refined petroleum products 3.73	Paper products and printing 2.28	Electricity, gas, steam and air conditioning supply 3.05	Wood and products of wood and cork 2.48	Wood and products of wood and cork 4.92

Source: Calculated by authors using the OECD Input–Output Tables database (2021).

Table A2. The most downstream sectors in selected APEC economies (2018)

Rank	China	Indonesia	Japan	Korea	Malaysia	The Philippines	Russia	United States	Viet Nam
1	Construction 1.04	Education 1.04	Public administration and defence; compulsory social security 1.02	Public administration and defence; compulsory social security 1.07	Education 1.07	Motor vehicles, trailers and semi-trailers 1.08	Human health and social work activities 1.05	Human health and social work activities 1.03	Human health and social work activities 1.12
2	Public administration and defence; compulsory social security 1.05	Human health and social work activities 1.09	Human health and social work activities 1.03	Construction 1.11	Public administration and defence; compulsory social security 1.20	Real estate activities 1.11	Public administration and defence; compulsory social security 1.06	Education 1.08	Education 1.21
3	Human health and social work activities 1.05	Public administration and defence; compulsory social security 1.10	Construction 1.05	Education 1.12	Arts, entertainment and recreation 1.22	Public administration and defence; compulsory social security 1.18	Education 1.08	Public administration and defence; compulsory social security 1.18	Arts, entertainment and recreation 1.34
4	Education 1.06	Construction 1.15	Education 1.13	Human health and social work activities 1.14	Human health and social work activities 1.35	Other service activities 1.23	Other service activities 1.10	Other service activities 1.23	Public administration and defence; compulsory social security 1.38
5	Arts, entertainment and recreation 1.40	Other service activities 1.20	Real estate activities 1.30	Real estate activities 1.38	Real estate activities 1.51	Human health and social work activities 1.23	Arts, entertainment and recreation 1.15	Mining support service activities 1.28	Construction 1.42
6	Other service activities 1.60	Accommodation and food service activities 1.24	Arts, entertainment and recreation 1.33	Arts, entertainment and recreation 1.54	Construction 1.51	Construction 1.26	Food products, beverages and tobacco 1.31	Construction 1.29	Other service activities 1.60
7	Real estate activities 1.64	Arts, entertainment and recreation 1.29	Computer, electronic and optical equipment 1.41	Other service activities 1.80	Accommodation and food service activities 1.93	Machinery and equipment, nec 1.28	Accommodation and food service activities 1.36	Pharmaceuticals, medicinal chemical and botanical products 1.29	Real estate activities 1.80
8	Publishing, audiovisual and broadcasting activities 1.69	Fishing and aquaculture 1.38	Accommodation and food service activities 1.46	IT and other information services 2.09	Fishing and aquaculture 2.05	Arts, entertainment and recreation 1.31	Textiles, textile products, leather and footwear 1.40	Textiles, textile products, leather and footwear 1.34	Motor vehicles, trailers and semi-trailers 1.98
9	IT and other information services 1.91	Other transport equipment 1.42	Food products, beverages and tobacco 1.48	Accommodation and food service activities 2.15	Other transport equipment 2.07	Accommodation and food service activities 1.40	Construction 1.46	Arts, entertainment and recreation 1.43	Accommodation and food service activities 2.07
10	Other transport equipment 2.01	Pharmaceuticals, medicinal chemical and botanical products 1.45	Tele-communications 1.50	Machinery and equipment, nec 2.16	IT and other information services 2.07	Education 1.44	Tele-communications 1.62	Accommodation and food service activities 1.46	Tele-communications 2.16

Note: Excluding sector 'Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use'. Source: Calculated by authors using the OECD Input–Output Tables database (2021).