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The Potential Impacts of COVID-19 on the Global Value Chains: GVC Positioning and Linkages *

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Abstract

Apart from the public health crisis entailed by the Coronavirus Disease 2019 (COVID-19) pandemic, it has also propagated a pandemic-induced economic shock globally. One transmission channel is via the inter-country linkages arising from the trade in intermediate inputs, which is a pertinent characteristic of global value chains (GVCs), and resulting in a "supply-chain contagion" as termed by Baldwin and Tomiura (2020). In this paper, we propose measures of bilteral downstreamness and upstreamness, the extent of a country's GVC participation, and the position of a country in GVCs by leveraging upon the gross export decomposition framework as laid out by Borin and Mancini (2019), which builds upon the work done by Koopman et al. (2014). By applying a regional lens to our analysis, we also identify key intermediary nodes that intermediate GVC-related flows within their region and across regions. Through this, we investigate the trade linkages of countries and discuss the potential impact of COVID-19 on GVCs.

Key Words: COVID-19; global value chain (GVC); gross export decomposition; GVC position; upstream/downstream trade partners

JEL Classification: F14; F15

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1 Introduction

The Coronavirus Disease 2019 (COVID-19) has spread rapidly around the globe, being characterised by the World Health Organisation (WHO) as a pandemic on March 11, 2020. Till date, we have seen more than 48 million cases and more than a million deaths worldwide[1]. Beyond being a severe public health crisis, COVID-19 has also resulted in adverse economic ramifications. According to IMF (2020), global growth is estimated to come in at -4.4% in 2020 and 5.2% in 2021, with the recovery path back to pre-pandemic levels of economic activity prone to facing setbacks. During the earlier days of the COVID-19 pandemic, strict lockdown measures were imposed across many countries in the first half of 2020, which restricted economic activity to a substantial degree. Consequently, trade in intermediate goods may have been a transmission channel propagating the economic malaise as countries faced a reduction in the supply of intermediate inputs used in industries around the world and this supply-side shock spread through the global supply chains, resulting in a "supply-chain contagion" (Baldwin and Tomiura, 2020).

COVID-19 has shown the susceptibility of international supply chains to such shocks, given the practices of cost optimisation, just-in-time production, and minimal inventory holding by firms (Javorcik, 2020). As firms have their operations spread across the world, they may be at risk of the disturbances caused by sudden, unexpected events. Even if it were merely a single part of the supply chain that has broken down, it may result in injurious effects seen worldwide (Backer and Flaig, 2017). Further, should disruptions occur in countries that are key suppliers of intermediate inputs, the effect would cascade down to firms that rely on supply chains to obtain the parts that they require (Gopinath, 2020). Indeed, with a more integrated world, shocks occurring in a single country can propagate through the global production network to other countries. In the simulations done by Sforza and Steininger (2020), global production linkages between countries accounted for a considerable share of the expected impact from the production disruption caused by COVID-19. Similarly, Bonadio et al. (2020) highlighted that the economic impact arising from a lockdown is channeled across countries through global supply chains.

Such "supply-chain contagion" is unsurprising given that we have witnessed the fragmentation of production processes into stages that are performed across countries but yet integrated with one another, over the past few decades. In addition to the several case studies done to analyse the value chains of specific manufactured products, such as those by Dedrick, Kraemer and Linden (2010), Sturgeon, van Biesebroeck and Gereffi (2008), and

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[1]Per the situation update as of November 5, 2020, according to the European Centre for Disease Prevention and Control

Ali-Yrkkö et al. (2011), the decomposition by Timmer et al. (2014) noted that 85% of the 560 product chains studied registered a higher share of foreign value-added over the period of 1995–2008, which signalled the ubiquity of such international production fragmentation. Literature has also highlighted that GVCs are mostly regional in nature, such as Baldwin and Lopez-Gonzalez (2015) and Criscuolo and Timmis (2018), with GVC-related trade tending to occur within Factory Asia, Factory Europe, and Factory North America. Thus, when considering "supply-chain contagion", there is a need to factor in a regional dimension to it as well (Baldwin and Tomiura, 2020).

Interestingly, Bonadio et al. (2020) noted that the renationalisation of supply chains may not necessarily leave a country better off – reducing the dependency on foreign inputs and switching over to domestic inputs may not protect a country as a country's lockdown will also affect its domestic sectors. On this note, Miroudot (2020) underscored that robustness of supply chains does not equate to self-sufficiency or fully localised production. Rather, such a strategy may be unoptimal for robustness as the crisis may happen domestically instead. Furthermore, they highlighted the distinction between resilience and robustness in supply chains, where the former is "the ability to return to normal operations over an acceptable period of time, post-disruption" while the latter is "the ability to maintain operations during a crisis", although strategies to promote resilience and robustness may at times be the same. To promote robustness, firms may have a more diversified list of suppliers and a more wide-ranging production network across countries to better calibrate their production when a disaster happens in a location.

Given the importance of these inter-country and inter-industry linkages, there has been multiple literature on the measurement of a country's participation in global value chains, such as the depth of integration, and the (relative) position of a country and/or a sector in GVCs. This body of works includes Hummels, Ishii and Yi (2001), Koopman et al. (2010), Daudin, Rifflart and Schweisguth (2011), Johnson and Noguera (2012), Antràs et al. (2012), Fally (2012), Miller and Temurshoev (2017), Wang et al. (2017), and Antràs and Chor (2018). Through this paper, we analyse various aspects of a country's GVC participation such as its positioning and linkages in order to shed light on the potential implications of COVID-19 on GVCs. To this end, we leverage the recent work of Borin and Mancini (2019), which provides a measure for value-added that cross national borders more than once and the share of GVC-related trade components through their decomposition of bilateral trade flows. We utilise their gross export decomposition for our analysis, and also layered on a regional lens in our discourse to better understand how countries and/or regions are related to one another through GVCs.

After highlighting the gross export decomposition framework in Section 2, we leverage

it to analyse the key downstream and upstream partners of each region (Sections 3 and 4. Following which, we delve into the extent of GVC participation of our selected economies from Factory Asia, Factory Europe, and Factory North America, as well as their backward and forward linkages in Section 5. Noting the possibility of sectoral heterogeneities, we also provide a sectoral view of GVCs in Section 6. We then conclude by highlighting potential implications of what our results could mean in this present COVID-19 crisis.

2 ICIO Tables and Accounting Framework

2.1 ICIO Tables

To track input-output linkages worldwide, Inter-Country Input-Output (ICIO) tables have been developed in recent years through the combination of a variety of sources including national accounts, country-level input-output tables, and standard trade statistics. National input-output tables are harmonized and reconciled with bilateral trade data in goods and services by end-use category. While country-wise input-output tables are available at dis-aggregated levels and for an extended period, most global input-output tables have been constructed at a level of aggregation higher than available in primary sources and cover only the post-1990 period (some only for certain benchmark years) (Johnson, 2018).

At present, there are six major ICIO tables: Global Trade Analysis Project (GTAP), World Input-Output Database (WIOD), OECD-WTO TiVA Database, Eora Multi-Region Input-Output Table (MRIO), IDE-JETRO Asian Input-Output Table, and EXIOBASE Multi-Regional Environmentally Extended Supply and Use / Input Output (MR EE SUT/IOT) database.[2]

For our analysis, we use the 2018 OECD-WTO TiVA Database, with the OECD ICIO tables covering 64 economies (and one ROW) in 36 sectors for the period 2005–2015.[3] The OECD ICIO tables have a more balanced coverage of both Asian and European countries. The detailed methodology and assumptions underlying the construction of the OECD ICIO tables can be found in OEC, and differences between the 2016 and 2018 editions can be found in OECD (2018).

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[2]GTAP: www.gtap.agecon.purdue.edu. WIOD: www.wiod.org. OECD-WTO TiVA: oe.cd/tiva. Eora MRIO: worldmrio.com. IDE-JETRO: www.ide.go.jp/English/Data/Io. EXIOBASE: www.exiobase.eu.

[3]Available at https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm.

2.2 Gross Export Decomposition Framework

In addition to the construction of input-output tables, new methods have been developed to account for gross trade flows. Koopman, Wang and Wei (2014) provides a useful accounting framework to decompose a country's aggregate gross exports into domestic value-added (DVA), foreign value-added (FVA) and pure double-counting components. Borin and Mancini (2019) further provides accounting frameworks for such decomposition with respect to each trading partner and sector.[4]

As highlighted by Nagengast and Stehrer (2016), decomposition of a country's bilateral gross exports (instead of aggregate gross exports as in Koopman et al. (2014)) requires one to clearly identify the bilateral export flow that a value-added component is assigned to and the other bilateral export flows where the component is labeled as purely double counted (DC) from the world GDP perspective, if the value-added component crosses country borders several times. The assignment rule depends on whether one takes the source-based or the sink-based approach: In the source-based approach, a domestic value-added (DVA) component is attached to the bilateral gross exports the first time the value-added component leaves the country of origin while it becomes a domestic double-counted (DDC) component for the subsequent times it leaves the country of origin. A foreign value-added (FVA) component is attached to the bilateral gross exports the first time the value-added component is re-exported and becomes a foreign double-counted (FDC) copmonent for the subsequent times it crosses the borders of other countries. The assignment is reversed under the sink-based approach, which is based on the last time the value-added component leaves the country of origin (DVA) or is re-exported (FVA).

As underscored by Borin and Mancini (2019), the source-based approach is "designed to examine the production linkages and the country/sector participation to different types of production processes and to study the features of the production processes in which export flows are involved". As such, we utilise the source-based approach to study such production linkages and because our proposed formulas require information on bilateral value-added trade. Since it traces the value-added flows that cross country borders for the first time, the source-based approach will also help identify the value-added flows that cross country borders only once (thus associated with traditional trade) and other value-added flows (that cross country borders more than once and hence can be regarded as GVC-related trade).

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[4]In particular, the framework by Koopman, Wang and Wei (2014) decomposes a country's aggregate gross exports by source and destination of embedded value added, into nine components (of DVA, FVA, or purely double-counted terms). This is further generalized by the literature (e.g., Wang, Wei and Zhu, 2013) to bilateral and sector-level trade. Most recently, Borin and Mancini (2019) refined this by using the two distinct perspectives of Nagengast and Stehrer (2016) while correcting some value-added assignments in the original decomposition.

Under Borin and Mancini (2019), the traditional trade components of country s' exports to country r are cumulatively known as $DAVAX_{sr}$, which measures what is fully produced in s and absorbed in importer r and the intermediate inputs that are fully produced in s and used by importer r to produce final goods for its own domestic market. GVC-related trade of country s to r would then be the portion of s' gross exports to r less $DAVAX_{sr}$.

Table 1 provides a summary of the interpretation of each term under the source-based decomposition of gross exports. Figure 1 provides an illustration of the source-based assignment of value-added in bilateral exports.

3   Key Downstream Partners

We define the bilateral downstreamness of country r to s as:

$$D_{sr}^{\mathcal{G}} = \frac{DC_{sr}^{\mathcal{G}} - \mathbf{1}[r \in \mathcal{G}](DAVAX_{sr})}{\sum_c \{DC_{sc}^{\mathcal{G}} - \mathbf{1}[c \in \mathcal{G}](DAVAX_{sr})\}} \tag{1}$$

where $DC_{sr}^{\mathcal{G}}$ is the domestic content of country s in the gross exports of country s to r finally absorbed in the set of destinations $\mathcal{G}$. $\mathbf{1}[\cdot]$ is an indicator function, with value 1 if the importer is part of the final destination market. This helps to exclude the domestic content of the exporter that is associated with "traditional trade" and un-associated with GVC trade. Thus, the numerator in (1) is equivalent to domestic contents of s that are further exported by the bilateral importer r.

The formula measures the proportion of a country's domestic content in all its gross exports intermediated by a bilateral importer and can be adapted to focus on the specific destinations of absorption. A country r is a more critical downstream partner to country s if it intermediates a larger share of exporter s's domestic content (absorbed in $\mathcal{G}$). This is calculated for each of the country's importers and respective destinations. The bilateral importers are ranked by the importer's share in intermediating the domestic content for absorption in each destination market.

For brevity, Table 2 reports the top-5 downstream trade partners of the "Asia", "Europe", and "North America" entities, which were constructed by summing across the respective economies, in 2005 and 2015. We consider three sets of destination markets: the world, within the country's region, and outside the country's region. The first row shows the relative shares of these markets in a country's gross exports. Under Appendix A.1, we highlight the top-3 downstream partners of the selected economies, including a "Rest of Asia" and "Rest of Europe" entity to account for the other countries within the respective regions that were not explicitly featured.

3.1 Asia

China was the top downstream partner of Asian economies, intermediating the highest proportion of domestic content destined for the world, regional, and non-regional markets. In 2005, China intermediated 18.35% of Asian domestic content destined for the world, more than twice that of the 2nd downstream partner (i.e., Korea). While China's share reduced to 15.87% in 2015, it remained almost double of Korea's, which was still the 2nd downstream partner. As per Appendix A.1.1, the smaller percentage of domestic content intermediated for absorption in the world was observed in Singapore and the Rest of Asia.

The reliance on China was more salient in facilitating extra-regional absorption – in 2005 and 2015, China's share of Asian domestic content intermediated for non-Asian absorption was higher than that seen for intra-regional absorption, which was unlike the other key Asian downstream partners featured. Furthermore, the gap between the proportion intermediated by China and that of the 2nd downstream partner (i.e., Korea in 2005 and US in 2015) was approximately 10-11 percentage points (pp) in 2005 and 2015, unlike the gap seen for regional absorption, which shrunk from 4pp to less than 1pp. Consequently, China's dominance in facilitating outside-Asia absorption was translated into the dependency on China identified for world absorption. This might hint of China's stronger extra-regional trade links, relative to other Asian economies. As detailed in Appendix A.1.1, China was one of the few Asian economies having non-Asian partners in its list of top-3 downstream partner.

Apart from China, Korea played an important intermediary role too, albeit more so for regional absorption. In terms of extra-regional absorption, US and Mexico were important downstream partners for Asia. While the Rest of the World (ROW) was the 5th downstream partner, as it is an aggregation of the remaining economies not reflected as individual entities in the OECD ICIO tables, we note that the following partner was Germany (4.22%).

3.2 Europe

Germany played a pertinent role for European economies – akin to that of China for Asian economies – facilitating the largest proportion of European domestic content for downstream absorption across all three markets. Germany played a stronger intermediary role over time, facilitating a larger share of domestic content intended for downstream absorption in European and non-European destinations, even as Europe's 2nd downstream partner intermediated a smaller proportion. Consequently, the gap between both parties grew from 4pp to 6pp for within-region absorption and 1pp to 4pp for outside-region absorption. Notably, the European countries were more dependent on Germany for regional absorption than Asian economies on China. Apart from Germany, France also played a role for regional absorption,

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albeit waning over time.

With respect to non-European absorption, Germany's position as the foremost downstream partner was supported by it being the only European economy (apart from the Rest of Europe) to have non-European partners in its list of top-3 downstream partners, as per Appendix A.1.2, thus exhibiting stronger extra-regional linkages. Interestingly, looking at non-European economies that were key downstream partners for non-European absorption, US faded in importance over time while China rose to prominence, emerging as the 2nd downstream partner of Europe. This alluded to the increasing weight that China might play in global value chains and its role in potentially connecting regions together.

3.3   North America

The North American members cumulatively intermediated 35.76% and 61.68% of regional domestic content destined for world and regional absorption respectively in 2005. Correspondingly, these percentages reduced by 4pp and 2pp in 2015. In terms of extra-regional absorption, US was the top downstream partner, facilitating the downstream absorption of 10.27% and 9.56% of domestic contents in 2005 and 2015 respectively. This was congruent with US exhibiting the most extra-regional linkages, as detailed in Appendix A.1.3.

More intriguing was that the downstream intermediary role played by China for non-regional absorption waxed over time and became comparable to US' in 2015, with their percentages differing by less than 1pp. Moreover, emergence of China was seen strongly, as it intermediated a larger share of domestic content over time, irrespective of the destination market. Furthermore, as seen in Appendix A.1.3, China was one of the top-3 downstream partners for the whole of North America for all destination markets, underscoring the importance of China in global value chains.

3.4   Discussion

Across economies, their respective top-5 downstream partners (top-3 in the case of North America) were all regional economies, specifically when the domestic content was destined for regional markets. With respect to the downstream intermediation for non-regional absorption, the primary partner of the respective regions were also regional economies. Thus, these partners played a dual role as compared to the other regional nodes, distinguishing themselves by facilitating absorption in markets both inside and outside their respective regions.

For the Asian economies, China was the key intermediary for all Asian economies and it played an even more pronounced role in facilitating absorption outside Asia. Nonetheless,

Korea played a prominent role alongside China for within-Asia intermediation. Turning to the European economies, while Germany and France were both key partners, the former stood more prominent for both European and non-European absorption. For the North American countries, while Mexico and Canada intermediated a much larger amount of North American domestic content intended for within-region absorption, this might have been due to the size of US' trade flows and the intermediary role played by them for US. As seen from Appendix A.1.3, US played a more significant role for Canada and Mexico than vice versa. Moreover, US stood out as a key regional partner in facilitating non-regional absorption. Nevertheless, while European and North American economies were reliant on specific partners to access outside-region markets, they were less so compared to Asia, given that the downstream partners maintained less concentrated shares to those seen in Asia.

Consequently, the network of supply chains seems to be arranged tightly within the region, where substantial amount of further processing is done by a handful of key regional intermediaries, and with even fewer key intermediaries connecting the region for extra-regional absorption. Germany and US serve as the connectors for Europe and North America, featuring in the list of top-5 partners facilitating extra-regional absorption for regions apart from their own as well (omitting ROW in the case of Asia). More conspicuously, China rose to prominence outside Asia over the years as well, by surfacing as the 2nd most important downstream partner for non-regional absorption for Europea and North America in 2015, despite not featuring in their respective top-5 list in 2005. China was also an important partner of North America in facilitating regional absorption. This alluded to the increasing weight of China in global value chains by bringing regions together through its extra-regional linkages, especially with the key regional nodes such as Germany for Europe and US for North America, as per Appendix A.1.

Hence, any shocks affecting China's economic activities would reverberate more strongly through the global value chains, given its global eminence. China is key in further processing domestic content of Asian economies to be passed on in the global value chains, connecting Asian economies with one another as well as to extra-regional partners. Furthermore, it is an important intermediary for non-Asian economies to pass on their domestic content to extra-regional partners. As such, unsurprisingly, during the initial phases of the COVID-19 pandemic and with its lockdown measures, it became a bottleneck within the supply chains, impacting both Asian and non-Asian economies. Economies providing their inputs to China for further processing would face disruptions as China's economic activities were restrained.

Similarly, given that the critical partners of the European and North American nations – Germany and US respectively – are key downstream intermediaries, the regional dependencies on these nodes may constrict the supply chain networks for the regions. With COVID-19

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being a global pandemic, all the primary nodes within the network were affected and correspondingly, shocks propagated through the economies. Beyond the signficant deterrence of inter-regional flows as COVID-19 affected entire regions and resulted in a restriction of economic activities, shocks would also be promulgated strongly within the region since the top-5 partners were largely regional partners.

4   Key Upstream Partners

We define the bilateral upstreamness of country s to r as:

$$U_{sr}^{\mathcal{G}} = \frac{FC_{sr}^{\mathcal{G}\circ} - \mathbf{1}[r \in \mathcal{G}]FC_{sr}^{r}}{\sum_{c}\{FC_{cr}^{\mathcal{G}\circ} - \mathbf{1}[r \in \mathcal{G}]FC_{cr}^{r}\}} \tag{2}$$

where $FC_{sr}^{\mathcal{G}\circ}$ is the foreign content originating from the set of countries in $\mathcal{G}$ that are embedded in the gross exports of country s to r. This includes the foreign contents absorbed in r (components 7*–8*) but also those re-exported by country r and absorbed in third countries (component 9*). In obtaining $FC_{sr}^{\mathcal{G}\circ}$, country s cannot be a source of origin even if it belongs to the set of $\mathcal{G}$. $\mathbf{1}[\cdot]$ is an indicator function, with value 1 if the importer is part of $\mathcal{G}$. This removes r's content embedded in s's exports to r since there is no clarity on whether s is upstream to r or vice versa. Thus, the numerator in (2) captures the third-party contents passed on from exporter s to importer r. An exporter s that passes on a larger share of all third-party contents to importer r is deemed more important an upstream partner to r.

While Equation 2 focuses on the intermediary role played by country s in passing on foreign content, another upstream role played by country s is in passing on its own domestic content for further processing and production by r. Hence, we define another measure of bilateral upstreamness of country s to r as:

$$\tilde{U}_{sr}^{\mathcal{G}} = \frac{\mathbf{1}[s \in \mathcal{G}](DC_{sr} - (DAVAX_{sr}))}{\sum_{c}\{\mathbf{1}[c \in \mathcal{G}](DC_{cr} - (DAVAX_{sr}))\}} \tag{3}$$

where DC_{sr} is the domestic content of country s in its exports to r, and $DAVAX_{sr}$ is the content of country s directly absorbed by bilateral importer r (i.e., traditional trade). $\mathbf{1}[\cdot]$ is an indicator function, with value 1 if the exporter is part of $\mathcal{G}$.

Tables 3 and 4 report the top-5 upstream trade partners of the "Asia", "Europe", and "North America" entities in 2005 and 2015 according to Equations 2 and 3 respectively. Like the case of downstream partners, we consider three sets of origin markets: the world, within the country's region, and outside the country's region. The first row shows the relative shares of these markets in a country's gross imports. Under Appendix A.2, we highlight the

top-3 downstream partners of the selected economies, including a "Rest of Asia" and "Rest of Europe" entity to account for the other countries within the respective regions that were not explicitly featured.

4.1 Asia

China mounted in importance over time as an upstream partner for Asia, in terms of both passing on third-party contents and contributing its domestic content to Asia's gross exports. Over the period of 2005-2015, China intermediated a slightly larger share of foreign content originating from the world, surpassing Korea as the top upstream partner of Asia. This movement was largely due to China's growing significance in passing on non-Asian foreign content – whilst China's share of intermediation reduced by 2pp for Asian foreign content, it grew by 2pp for non-Asian foreign content, hence replacing Korea as Asia's top upstream partner for extra-regional contents. Notwithstanding these movements, China still remained as the primary upstream partner for passing on Asian foreign content and intermediated a larger share of Asian foreign content than non-Asian foreign content. Its role as an upstream intermediary was nonethless slightly lesser relative to its downstream role.

Beyond just an intermediary for third-party contents, China's burgeoned in its upstream importance of passing on domestic content to Asian economies for further processing and production over time – relative to the total domestic content provided on by the world and regional economies to Asian economies for further processing and production, China's share doubled to 14.25% and 29.76% respectively. In comparison with all economies, China passed on the 2nd most amount of domestic content to Asian economies, with its share being almost the same as ROW, which was ranked 1st[5]. China was the most important upstream partner amongst other regional economies, overtaking Japan's position as Japan's share halved over the years and China's became 11pp higher than Japan's in 2005.

Apart from China, Japan and Korea were important upstream partners too – Japan was centred about passing on its domestic content to Asian economies for further processing while Korea's role was more twofold in terms of passing on domestic and third-party contents to Asian economies. US also contributed significantly in terms of its domestic content used by Asian economies for further processing and exporting – 10.07% and 19.33% of such domestic content from the world and from non-Asian partners was from US respectively in 2015. Germany, on the other hand, played a more balanced role in terms of contributing domestic content (6.74% of the total non-Asian domestic content) and passing on foreign content (5.81% of non-Asian foreign content, placing it just behind Taiwan) to Asian economies.

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[5]Given that ROW is an aggregation of countries that are not represented as individual entities under the OECD ICIO tables, China could in fact be counted as the 1st upstream partner.

4.2 Europe

Germany intermediated the highest share of overall foreign content for Europe, with the economies becoming more dependent on Germany as an upstream partner for regional third-party contents over the years, evident by the widening gap between the shares of Germany and France (i.e., the 2nd upstream partner) as the former's increased while the latter's decreased. This resulted in Germany's share being more than double of France's in 2015. However, in terms of non-European foreign content, China replaced Germany as Europe's top partner, with the former's share growing by around 2pp while the latter's was relatively stable. Consequently, given the more prominent role of China, coupled by the slipping importance of France in both regional and extra-regional intermediation, China replaced France as Europe's 2nd upstream partner for passing on world-originated foreign content.

From the perspective of domestic content passed on to European economies for further processing and production, Germany remained as the most upstream partner of Europe, accounting for 12.61% of such domestic content passed on by all trading partners to Europe. In comparison with other European partners, Germany's share of domestic content was almost twice that of UK, which was Europe's 2nd upstream partner. Amongst non-European partners, US and China were both essential. Between 2005 and 2015, US' share rose from 24.84% to 27.91%. More strikingly, China's almost doubled from 8.31% to 16.35%. While US' role remained significant in contributing its domestic content, China's grew in importance and became more twofold over time, evident in its intermediary role in passing on non-European foreign content whilst contributing its own domestic content to the European economies.

4.3 North America

Even as US maintained its lead over Mexico in intermediating the most North American third-party contents, its share of upstream intermediation of extra-regional foreign content dipped over time whilst that of Mexico grew from 8.20% to 11.39%. As a result, Mexico over-took US to become the 2nd upstream partner for non-regional foreign content and became the 2nd upstream partner for overall foreign content in tandem, with a share of 11.72%, around 4pp higher than US'. Even then, US' role remained pronounced as an upstream partner contributing its domestic content for further processing by other North American countries – amongst the contribution of domestic content by North American countries, it had the largest proportion at 66.45% in 2015, remaining at around thrice that of Canada, the 2nd upstream partner. Consequently, comparing against all trading partners, US remained with the topmost contribution, at 26.69% in 2015.

China's increase in stature was striking, with its share of overall domestic content passed on to North America for further processing burgeoning from 7.77% in 2005 to 18.89% in 2015, jumping from the 4th to the 2nd most important upstream partner. This was also reflected by China accounting for 31.57% of non-North American domestic content received by North America in 2015, which was more than double is share in 2005. China was again important not only in terms of its provision of domestic content, but also its upstream intermediary role of passing on foreign content, with it accounting for 17.16% of overall foreign content intermediation in 2015. Not only did it intermediate the highest share of extra-regional foreign content (17.23% in 2015), but it also intermediated the 3rd most share of regional foreign content (16.00% in 2015), which was close in size to Mexico's and above Canada's. The diminishing role of US as an upstream intermediary for foreign content might thus be due to the more pronounced role played by Mexico and China over time.

4.4   Discussion

The top-5 upstream partners of Asia, Europe, and North America to access foreign content were mostly regional economies. However, differing from the case of downstream partners, Asia displayed lesser reliance on key partners, largely ascribed to a more diffused extra-regional intermediation. There was a smaller disparity between the overall share intermediated by China and that of Korea – even as China was still the primary node for Asia in terms of within- and outside-Asia intermediation, Korea played a comparable extra-regional intermediary role to China. More interestingly, even as regional partners were still important, China was the foremost upstream partner for Europe and North America for extra-regional foreign content. Moreover, the latter was more reliant on China given the larger share intermediated by China, and the wider gap between China and the following partner. Thus, the significance of China and its role in bridging regions was more pronounced from the upstream perspective.

Over time, the role of China of an upstream partner expanded beyond just being an intermediary but also a contributor of domestic content to Asia and the other two regions – albeit less important for Europe than North America – for further processing and production. On the other hand, Japan provided its domestic content to Asian economies (and to a lesser extent, Europe and North America too) for further processing but did not intermediate much foreign content, hence being more insular in its role. For Europe, Germany was not only central in providing its domestic content to fellow economies but also a key intermediary of foreign content originating from within and outside Europe. To a smaller degree, it also provided its domestic content to Asia and North America. France played a

secondary role compared to Germany, while UK was similar to Japan in being more insular and mainly providing its domestic content. For North America, US domestic content were used more extensively for further processing and production relative to US-intermediated foreign content. Its domestic content was also further processed in Asia and Europe quite substantively. While US was key in intermediating within-region foreign content, Mexico seemed more critical to North America to gain access to non-regional foreign content.

Taken together, regional economies were typically more important as downstream and upstream intermediary, irrespective of whether the destination and origin markets were within or outside the region, and in contributing its domestic content as inputs for production. Certain economies played overlapping roles within their respective regions, whilst also serving as connectors of their regions, distinguishing them from the other partners. Thus, shocks to these economies would fetter their ability to pass on intermediate inputs for further processing before final absorption, resulting in disruptions to the global value chains.

As the COVID-19 outbreak first promulgated in China, coupled with its dominant role in global value chains, the initial supply-side shock resulting from its lockdown was first experienced in Asia, before spreading towards the other regions. This shock was twofold – it was unable to pass on third-party contents as well as its own domestic content to Asia and beyond. Furthermore, as the COVID-19 outbreak soon extended its reach beyond the Asian economies and became a global pandemic, it was unsurprising that a second round of supply-side shocks propagated through the network of the global value chains. Primary nodes such as Germany and US, as well as secondary nodes such as France and UK were impacted quite severely, with these countries implementing some form of lockdown measures. As the primary nodes were critical in connecting regions together, facilitating the movement of intermediate inputs across regions, as well as supplying domestic contents for further integration, this curtailed both intra- and extra-regional flows. Thus, this constituted to bottlenecks within the supply chain as their ability to pass on intermediate inputs were diminished.

5 GVC Participation

We report four indices in Tables 5, 6, and 7, which measure a country's participation in global value chains, and are visualised accordingly in Figures 2, 3, and 4.

$$BackwardLinkages_s = \sum_{r \neq s} FC_{sr}/E_{s^*}, \tag{4}$$

$$ForwardLinkages_s = \sum_{r \neq s} [DC_{sr} - (1a_{sr}^* + 2a_{sr}^*)]/E_{s^*}, \tag{5}$$

$$GVC_s = ForwardLinkages_s + BackwardLinkages_s, \tag{6}$$

$$Downstreamness_s = BackwardLinkages_s/GVC_s, \tag{7}$$

where E_{s^*}, FC_{s^*}, and DC_{s^*} are respectively the total gross exports, as well as the foreign and domestic contents in the total gross exports of country s.

The *BackwardLinkages* draws from the "vertical specialisation" of Hummels, Ishii and Yi (2001) and is revised to measure the proportion of foreign contents (i.e., both foreign value-added and double-counted) in a country's gross exports. The *ForwardLinkages* looks at the proportion of domestic content, less the "traditional trade" components (i.e., traversing only once across country borders before being directly absorbed by the bilteral importer), leveraging on Borin and Mancini (2019), in a country's gross exports. The *GVC* index thus cumulates the two linkages as a measure of GVC-related exports. Given that *BackwardLinkages* measures the foreign content portion of GVC-related exports, *Downstreamness* thus measures the proportion of foreign contents in the GVC-related exports of country s, where a larger value implies that a country is located relatively downstream in the global value chains, as the country has more foreign contents than domestic contents in its GVC-related exports (i.e., the country has more backward linkages than forward linkages).

Using these indices, we discuss the cross-sectional patterns and longitudinal trends of the selected countries' participation in global value chains over the period of 2005-2015. We study a few aspects of a country's participation, including its degree of forward and backward linkages, and its movement upstream or downstream along the global value chains. We also seek to understand if there are regional influences to the extent of an economy's participation. As such, we decomposed in three ways the *BackwardLinkages*, *ForwardLinkages*, and *GVC* indices into the proportions attributed to within- or outside-region: according to the origin of the foreign content and the destination of the domestic content (Figure 2 and Table 5), the destination of both the foreign and domestic contents (Figure 3 and Table 6), and lastly, the embedded foreign and domestic contents in the exports to immediate trading partners (Figure 4 and Table 7).

5.1 GVC Participation with the World

Over the period of 2005-2015, the Asian economies integrated less foreign content into the production of exports and participated less in GVC-related trade, with Vietnam and Japan as the only exceptions. Vietnam's *BackwardLinkages* and *GVC* saw an increase from 36.08% to 44.52% and 47.52% to 53.59% respectively. Japan's *BackwardLinkages* and *GVC*, while remaining low, saw an increase from 10.18% to 13.23% and 31.22% to 32.68%. Conversely, China's *BackwardLinkages* and *GVC* declined significantly, from 26.27% to 17.32% and 39.68% to 32.72%. Nonetheless, in 2015, Asian economies had a higher-than-average extent of backward linkages and GVC-related exports, except China and Japan. Unlike the Asian economies, all the European economies had a lower-than-average extent of foreign content integration into the production of exports and participation in GVC-related trade, notwithstanding that most European economies saw their *BackwardLinkages* and *GVC* values increasing over time by around 1-3pp. Only Spain posted a relatively stable *BackwardLinkages* of 22.99% in 2005 and 22.7% in 2015. Among North American economies, Mexico and Canada increased their *BackwardLinkages* and *GVC* over time. Mexico's grew even larger from 33.98% to 36.10% and 40.87% to 43.48% correspondingly. While remaining relatively low, Canada's increased from 19.59% to 21.20% and 29.98% to 33.75%. Conversely, US' *BackwardLinkages* and *GVC^{BM}* decreased from 10.76% to 9.48% and 29.91% to 28.15%, being the lowest among the selected set of countries.

Amid these movements, the Asian economies, with the exception of Japan and China, generally remained having the highest integration of foreign contents in their gross exports and participation in GVC-related trade in 2015. They tend to be followed by the European economies and subsequently, the North American economies, with the exception of Mexico. The European economies had relatively similar values of *BackwardLinkages* and *GVC*, compared to the disparate nature of the North American economies. On average though, the European economies had a lower extent of backward linkages than the North American economies, as Mexico skewed it upwards. In 2015, the countries with the top-5 highest and lowest *BackwardLinkages* were correspondingly Vietnam, Singapore, Malaysia, Mexico, and Thailand, as well as US, Japan, UK, China and Germany.

Consequently, Asian economies had the most substantial movements along global value chains. Vietnam moved relatively downstream, with *Downstreamness* increasing from 0.76 to 0.83, while Japan remained relatively upstream, despite gaining more backward linkages over time. Its *Downstreamness* stayed relatively low, despite increasing from 0.33 to 0.40. On the other hand, China shifted relatively upstream through the years, with *Downstreamness* decreasing from 0.66 in 2005 to 0.53 in 2015. In terms of downstreamness, the Asian economies were the most downstream, again with the exception of China

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and Japan. Following which, the North American countries, except US, were the most downstream, and thereafter, the European countries. In 2015, the top-5 upstream countries were US, Japan, UK, China, and Germany, and top-5 downstream countries were Vietnam, Mexico, Thailand, Singapore, and Malaysia.

Given the strong upward movement of China – gaining substantially more forward linkages relative to backward linkages over time – its importance as a source of intermediate inputs within global value chains has grown, passing on more of its domestic contents to its trading partners for further processing and subsequent production. This is consistent with the observation in Section 4 that Chinese domestic content became more important in global value chains as both Asia and non-Asia processed and embedded a higher proportion of them into their exports. Hence, during the initial phases of the COVID-19 pandemic, the lockdown measures imposed by China propagated supply-side shocks through the global value chains. While China may have eased its lockdown measures, some degree of restrictions on economic activities across most countries due to the COVID-19 pandemic would likely continue, China included. The more upstream a country is relative to its trading partners within global value chains, the more likely it would be a source of supply-side shock as the curtailment of economic activities imply that it is less able to pass on their domestic content to trading partners for their processing and production. As the top-5 upstream countries are spread out across the regions, coupled by the COVID-19 pandemic striking globally, any supply-side shock would likely be intensified too. Conversely, countries that are relatively more downstream may be more susceptible to such supply-side shocks, as they are more reliant on the third-party contents in their production of their exports. Hence, we expect Asian economies – particularly Malaysia, Singapore, Thailand, Vietnam – as well as Mexico to be the most affected by such supply-side shock occurring within the network of global values chains.

5.2 Regional Influence on GVC Participation

Looking at the origin of the foreign content and destination of the domestic content embedded in their exports, European economies displayed the most intra-regional linkages in their GVC participation, with more than 50% of GVC attributed within the region, while North American and Asian economies were more extra-regional (i.e., less than 50% of GVC ascribed within the region). This was amid European and North American countries becoming less intra-regional, and Asian economies becoming more intra-regional, except China and Taiwan. For both Asia and North America, their backward and forward linkages were on average more centred about non-regional origins and destinations. Consequently, this might imply that

they might be more affected by shocks happening outside their region, and vice versa for Europe. For instance, Japan (60.60%), Singapore (61.43%), and US (77.09%) had a high proportion of extra-regional foreign content embedded in their exports, which might result in them being more adversely affected by supply constrictions happening outside the region, such as when economic activities are curtailed through lockdown measures, especially for trade-dependent nations like Singapore. On the flipside, countries such as Malaysia (56.70%), Thailand (53.67%), Vietnam (67.99%), and Canada (50.29%) were more reliant on within-region foreign content, which might then imply that regional recovery matters more to them, especially for the more trade-reliant Southeast Asian countries. Similarly, as all the featured European economies had a majority of their foreign content originating within Europe, from a supply angle, regional shocks and recovery might affect them more.

Turning to the destination of both foreign and domestic contents, the GVC-related exports of Asian economies were intended mainly for non-Asian absorption, albeit with a decrease in proportion over time. For instance, China had 72.41% of cumulated foreign and domestic contents destined outside Asia in 2015, which was the highest proportion seen amongst all the selected economies. For the European and North American countries, the proportion of GVC-related exports destined for regional markets decreased over the years. This resulted in the European countries, except Spain, shifting from having a majority proportion to European markets to non-European markets in 2015. While North America maintained an average proportion of slightly more than 50% of foreign and domestic contents to regional markets, US had just 31.35% of its GVC-related exports destined for North America, which seemed to reflect that US might be a much larger source of demand for Canada and Mexico than vice versa. Given that most of the selected economies, except Spain, Canada, and Mexico, had a huge dependence on non-regional demand for their GVC-related exports, the resumption of GVC-related activities might be more dependent on a pick up in non-regional demand.

Focusing on the immediate trading partner receiving the foreign and domestic contents embedded in one's GVC-related exports, countries generally had a higher proportion of GVC-related exports made to regional than extra-regional partners. Only Asia saw an increase in the average proportion over time while Europe and North America saw the converse. Nonetheless, the European economies, and Canada and Mexico remained having one of the highest proportions. China and US stood out with the two highest share of GVC-related exports made to non-regional partners, standing at 64.01% and 73.55% respectively in 2015. Furthermore, they had the largest percentages in terms of non-regional trading partners constituting the immediate recipients of their domestic contents, which seemed congruent with Section 4 as they were key contributor of domestic contents to economies outside their

respective regions too.

In light of COVID-19, it seemed that Europe may be the most affected by regional happenings compared to Asia and North America given stronger intra-regional linkages – if more regional economies were to remained close or slow to reopen, their GVC network may be the most affected. Coupled with how they may have became slightly more dependent on extra-regional demand, they may thus be squeezed on both ends if the global situation does not improve. On the other hand, Asian economies seemed more dependent on the external economic recovery from both a supply and demand perspective, while Canada and Mexico seemed more likely to be dependent upon the recovery of US. In addition, supply-related shocks may be propagated outward more so by countries such as China and US, as evident with the initial lockdown in China affecting Asian economies severely and thereafter having a knock-on effect on non-Asian countries as the shock permeated outward.

6 Sectoral View of Global Value Chains

We delve into the GVC participation of the selected countries from a sectoral perspective. The bilateral gross exports of a country s is disaggregated according to the exporting sector. In equation (8), we define $\widetilde{\mathbf{B}}_{cc} \equiv (\mathbf{I} - \mathbf{A}_{cc})^{-1}$ for $c = s, t$. Recall that it is the local Leontief matrix of country c. The decomposition of equation (8) by sector of exports is obtained by expanding $\mathbf{V}_c \widetilde{\mathbf{B}}_{cc}$ (a $1 \times G$ vector) to a $G \times G$ diagonal matrix with each element of $\mathbf{V}_c \widetilde{\mathbf{B}}_{cc}$ placed along the principal diagonal and zeros elsewhere.

6.1 GVC Participation

Given the sectoral disaggregation, we calculate the GVC participation index GVC as in equation (6) for each export sector. For example, component 1a* of country s's exports of electronics includes country s's DVA from all its domestic sectors embodied in electronics exports (as s's final goods) directly absorbed by the bilateral importer r. Similarly, component 2a* of country s's exports of electronics includes country s's DVA from all its domestic sectors embodied in electronics exports (as intermediate inputs for further processing in the bilateral importer) and absorbed by the bilateral importer as r's local final goods/services. The remaining components consist of country s's domestic contents embedded in country s's exports of electronics not directly absorbed by bilateral importers, and also foreign contents in s's exports of electronics. The resulting GVC index measures how much of country s's electronics exports were GVC-related trade.

We grouped the selected countries according to their region and presented the results in

Table 8. For example, the selected 5 Europeans countries – France, Germany, Italy, UK, and Spain – were grouped as "Europe (5)". Apart from featuring the overall GVC percentages, we also calculated the pp attributed to the region and outside the region for each sector. The decomposition is per the first decomposition featured in Section 5 (i.e., according to the origin of the foreign content and the destination of the domestic content). Each sector's pp attributed to the region (outside region) was obtained by multiplying the overall GVC pp with the percentage share of the GVC-related components associated with the region (outside region). We highlighted the overall GVC participation of the manufacturing and services sectors, as well as the 10 individual sectors with the highest GVC percentages (for the world) and pp (for within- and outside-region).

Across all 3 groupings, their manufacturing sectors participated more in GVC-related trade than the services sectors. The European economies had the highest degree of GVC participation with respect to the world for the manufacturing sectors (43.29%) while the Asian economies had the largest extent for the services sectors (33.44%). The North American economies had the lowest level of participation for both manufacturing and services, congruent with the initial observation that they participated the least in GVC-related trade compared to the selected Asian and European economies.

The European economies had a higher degree of GVC participation with regional partners for manufacturing and services, which is consistent with the previous observation of European economies having more intra-regional linkages in their GVC participation. While the Asian and North American economies were more extra-regional in their participation, the former was less so than the latter. Furthermore, both saw a higher pp attributable to manufacturing than services regardless of whether the participation is with respect to the region or outside the region. Interestingly, there was quite a substantial disparity between the intra- and extra-regional GVC participation for North American countries for the services sectors.

Unsurprisingly, most of the top-10 sectors featured were manufaturing sectors – in fact, basic metals appeared across all 3 groupings from the world, within region, and outside region perspectives. Some manufacturing sectors, such as chemicals and pharmaceutical products, and computer, electronic, and optical products saw a degree of variance in GVC participation. For the former sector, it was one of Asia and Europe's top-10 sectors for world, and within- and outside-region GVC participation. In all instances, it was above the respective overall manufacturing benchmark. Nonetheless, the overall GVC participation observed by Asia was driven largely by the extra-regional participation of 31.98pp compared to the intra-regional participation of 16.88pp. On the other hand, Europe's overall GVC participation for the sector was driven by both within- and outside-region participations, with a more equal split of 24.84pp to 21.45pp. For the latter sector, it featured across all three regions in terms of

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extra-regional GVC participation, being above the overall manufacturing benchmark, with North America having the highest at 35.94pp, followed by Asia at 27.16pp, and Europe at 24.17pp. However, only Asia and North America featured the sector for intra-regional GVC participation, with Asia at 25.90p and North America at 12.82pp. While Asia had a more equal split in terms of its intra- and extra-regional GVC participation for the sector, the bulk of North America's GVC participation in the sector was driven extra-regionally.

On services, financial and insurance activities also displayed some interesting variations. It was significantly involved in extra-regional GVC participation, featuring under Asia and North America's top-10 extra-regional list with an associated pp that was higher than the respective overall services benchmark. However, its within-regional pp was considerably smaller and hence, it was not featured under the overall top-10 sectors.

6.2 Downstream Partners

We identified the top-3 downstream partners for the selected countries, based on the region's top-5 manufacturing and top-3 services sectors with the highest level of GVC participation in 2015. We varied the sectoral selection according to whether the analysis was with respect to a country's relation to all its trading partner (i.e., the world), regional trading partners (i.e., within region), and extra-regional trading partners (i.e, outside region). Instead of showing an aggregated regional entity, we displayed the downstream partners for each country to depict certain heterogeneities observed from the sectoral lens.

Supplementing the analysis from Section 3, we observed some interdependencies between the regional nodes, which helped further distinguish which economies were the primary regional nodes. In the case of Asia, China distinguished itself as the primary Asian node, with Korea heavily dependent on China as a key downstream intermediary while China was less reliant on Korea. Germany was recognised as the primary European node, as France was more reliant on Germany than vice versa too. Turning to North America, US stood out as the primary node, as Canada and Mexico were more reliant on US.

6.2.1 Asia

As seen from Table 9, the top-5 manufacturing sectors were the same across all three perspectives – world, within region, and outside region. China was a dominant partner, featuring commonly as a top-3 downstream partner for the Asian economies irrespective of whether the absorption was intended for the world, within the region, or outside the region. This was especially so for the manufacturing sectors, with significant dependency upon China – this was observed pertinently for sectors, such as chemicals and pharmaceutical products, and com-

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puter, electronic, and optical products. Coupled with the high proportion of GVC-related domestic content intermediated by China destined for the world, Asian, and non-Asian markets, there was substantial disparity between China's share and that of the 2nd downstream partners. Moreover, the dependency on China was starker from the extra-regional perspective, congruent with that seen in Section 3.1. For instance, China intermediated 58.11%, 51.91%, and 60.38% of Malaysia's domestic content embedded in their exports of computer, electronic, and optical products for final absorption in the world, Asia, and outside Asia respectively, which was 5-6 times more than its second downstream partner. The percentages were even larger for its East Asian neighbours, reaching above 70% for Korea and Taiwan.

Interestingly, for the services sector, while China's role as a key downstream partner was attenuated, Singapore's role was accentuated albeit to a weaker extent compared to that of China for the manufacturing sector. For instance, looking at other business services, Singapore was the foremost partner for all the Asian economies, except Vietnam, in facilitating overall absorption of domestic content. This was most prominent for Japan, with Singapore intermediating 30pp more than its 2nd downstream partner. Under the transportation and storage services, apart from being the top overall intermediary for all, except China, Singapore's role was more pronounced for intra-regional than extra-regional intermediation. Similarly, for financial and insurance activities, Singapore facilitated a higher proportion of intra-regional than extra-regional intermediation, implied by the latter being smaller than its shares of world intermediation. The weaker dependency from the extra-regional perspective could possibly be due to the presence of other competing financial hubs outside the region, such as Ireland, Luxembourg, and UK. Given Singapore's role in the services sector, especially for within-region intermediation. These observations might account for why Singapore emerged as Asia's 5th downstream partner for overall downstream intermediation and 4th downstream partner for regional downstream intermediation, as per Table 2, in 2015.

The sectoral lens made evident certain heterogeneities in the Asian economies' dependency on key partners, such as China and Singapore being more relevant for manufacturing and services respectively. Hence, China seemed to play a bigger role as a manufacturing hub while Singapore as a services hub. On the other hand, Korea was more balanced in terms of its role across manufacturing and services sectors, while playing a lesser role compared to both in the respective sectors.

6.2.2 Europe

As seen from Table 10, the top-3 services sectors were identical irrespective of whether the destination market was the world, Europe, or outside Europe. Germany and France were both key partners of the European nations, and their shares of intra-regional intermediation

tend to be slightly higher than that for extra-regional intermediation in most instances, irrespective of manufacturing or services sectors. This was congruent with what was highlighted in Section 3.2. For example, Germany intermediated 13.73%, 15.24%, 12.45% of UK's domestic contents embedded in rubber and plastic products exports destined for absorption by the world, European, and extra-European markets. The sectoral view yielded an interesting insight of France being highly dominant in other transport equipment, with a significant concentration of shares. For example, France intermediated 44.42% of Spain's domestic content meant for absorption in the world, compared to its 2nd partner at 14.7%. This sector also highlighted the interdependency between Germany and France – France intermediated 64.55% of Germany's domestic content meant for the world while Germany intermediated 34.68% of France's domestic content.

Germany and France appeared more important in manufacturing than services sectors (albeit the difference was to a lesser degree as observed for China). For one, they appeared less frequently in the list of top-3 downstream partners for the selected economies under the services sector, with other downstream partners featured more prominently. For instance, Ireland was the top partner for France, Italy, and UK in passing on their domestic contents embedded in their exports of other business services for absorption in the world, Europe, and outside Europe, with a higher share of intra-regional than extra-regional absorption. For financial and insurance activities, Luxembourg was the eminent downstream partner for the European economies from the world, intra-regional, and extra-regional perspective, for instance, with shares going up to 58.36%, 67.58%, 43.73% respectively for Italy. The shares intermediated by Luxembourg were sizeable and even larger when it came to the intermediation of domestic content for absorption within Europe than outside Europe. This might thus explain the emergence of Ireland as the 5th downstream partner for overall downstream intermediation and Luxembourg as the 3rd downstream partner for within-region downstream intermediation for Europe, as per Table 2, in 2015.

The sectoral decomposition brought to fore other non-European countries that were key downstream partners in the context of extra-regional absorption, specifically China and US. For example, China displayed its dominance in the intermediation of extra-regional absorption of domestic content in exports of computer, electronic, and optical products, which was congruent with the role it played for Asian economies. On the other hand, US appeared only under manufacturing sectors such as coke and refined petroleum products and other transport equipment, and to a lesser degree too. This was congruent with the observations of the rising role of China and waning role of US in extra-regional intermediation for Europe, as highlighted in Section 3.2. Notwithstanding this, the sectoral decomposition also contrasted these European countries from the Asian economies, with the former depicting

stronger intra-regional linkages than the latter: while most of the top-3 downstream partners of the former were fellow regional neighbours, the Asian economies had a more diverse mix of regional and non-regional economies as their top-3 downstream partners.

6.2.3   North America

Following the disaggregation of the North American entities, both US and Mexico emerged as key downstream partners, with US being even more important for extra-regional intermediation than Mexico. US' exhibited significant dominance for both Canada and Mexico – for instance, US facilitated a corresponding 71.54% and 53.45% of Canada and Mexico's domestic contents embedded in exports of motor vehicles, trailers, and semi-trailers meant for absorption in the world. US' share of extra-regional intermediation was higher than that of intra-regional intermediation too. Looking at electircal equipment as an example though, Mexico's intra-regional intermediation share for electrical equipments was higher than its extra-regional share. In general though, intra-regional dependencies was seen for intra-regional absorption, with multiple instances where the 1st and 2nd partners were the respective countries' North American partners, and cumulatively intermediating a gargantuan share of domestic content – in several sectors, the share was more than 60% and it went up to more than 90-97% for motor vehicles, trailers, and semi-trailers.

On the services sector, while US facilitated a larger proportion of intra-regional than extra-regional absorption of Canada and Mexico's domestic contents embedded in their exports of transportation and storage services[6], and other business services, it was otherwise for the financial and insurance activities sector.

While Mexico's importance was seen more keenly for manufacturing than services sectors, US was chief across both manufacturing and services sectors. Moreover, the extra-regional role played by US as highlighted in Section 3.3 might have been contributed more by the manufacturing than services sectors. Correspondingly, this might have accounted for the slightly reduced extra-regional share of US noticed in Table 2, given that China emerged as key partner for the manufacturing sectors. For instance, China featured strikingly under computer, electronic, and optical products, being the 2nd downstream partner facilitating world and extra-regional absorption for all the North American countries. On the services sector, US also depended on China and Singapore to facilitate the world and extra-regional absorption

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[6]We would like to highlight that transportation and storage was in fact the 4th-ranked services sector according to the GVC measure. The 3rd most GVC-involved sector from the within-region perspective was public admin. and defence; compulsory social security (Sector 32). However, under the OECD ICIO tables, in 2015, only Canada registered non-zero data in the calculation of the domestic content embedded in its exports. In Canada's case, the top-3 downstream partners were USA (29.71%), UK (12.35%), and Ireland (6.57%).

of its domestic content embedded in exports of transportation and storage. Ireland, Luxembourg, and Singapore were also key partners for world and extra-regional absorption of domestic content embedded in financial and insurance activities, and other business services.

6.3 Upstream Partners

We identified the top-3 upstream partners for the selected countries in 2015, using the same set of top-5 manufacturing and top-3 services sectors as per Section 6.2. Once again, the interdependencies between the regional nodes yielded similar observations. For instance, China and Korea were more similarly dependent on each other for upstream intermediation as compared to the downstream intermediary role. However, the reliance became more distinct when it came to the provision of domestic content, with Korea more dependent on China's domestic content than vice versa. For Europe, France was more dependent on Germany for third-party and domestic contents than vice versa. For North America, Mexico and Canada were more dependent on US for third-party and domestic contents than vice versa. Furthermore, while Section 4.4 noted that Mexico played a more critical role than US in terms of non-regional foreign content intermediation, this might have been due to the volume attributed to the US. By looking at the individaual countries, we noticed that Canada and Mexico were highly dependent on US to access extra-regional foreign content than vice versa.

6.3.1 Asia

While China was important in intermediating foreign content irrespective of origin, it was to a lesser degree and focused even more narrowly on the manufacturing sectors compared to that seen in Section 6.2.1. China's dominance was seen most keenly in the computer, electronic, and optical products, for instance, intermediating up to 54.49% of all foreign content for Japan. Even though Section 4.1 noted that China's dominance was less acute for extra-regional intermediation, the sectoral perspective highlighted that its role, at least for the manufacturing sectors, was comparable for both intra- and extra-regional intermediation. Other East Asian economies surfaced as key upstream intermediaries for foreign content embedded in one's imports of manufacturing products, such as Korea and Taiwan. Taiwan surfaced more frequently as a top-3 partner for intra-regional than extra-regional intermediation, in sectors such as chemicals and pharamceutical products, basic metals, and computer and electronic, and optical products, intermediating a larger within-region share. This might explain why Taiwan was ranked more highly as an upstream partner for within-regional intermediation, as seen in Table 3, in 2015. We also observed that Singapore

surfaced as an important upstream intermediary, serving its role across both manufacturing and services sectors, albeit more so for the latter. Singapore intermediated a larger share of regional foreign content as well, for instance, looking at transportation and storage, and financial and insurance activities.

In terms of the upstream role in providing of one's domestic content for further processing, China emerged top once again, especially for the manufacturing sectors. However, Japan's role was prominent here as its importance was more evenly spread out across manufacturing and services sectors. Apart from USA and Germany being featured in a manner consistent with Section 4.1, UK also emerged as an important supplier of its domestic contents to Asian economies under financial and insurance activities, congruent with its position as a financial centre.

The sectoral perspective reinforces the roles played by upstream partners in providing domestic content and third-party contents in Asia – while China played a twofold role, Japan was more critical for the former. Korea's role was more twofold as well, albeit to a lesser degree, while Singapore and Taiwan were more centred about the latter. Furthermore, the respective roles played by the East Asian economies, apart from Japan, were highly concentrated upon the manufacturing sectors. While being more balanced, Singapore was still slightly more inclined towards the services sector and Japan towards the manufacturing sectors.

6.3.2 Europe

For the European countries, they were reliant on Germany, and to a lesser extent, France for the upstream intermediation of foreign content. Germany was slightly more prominent in the manufacturing sectors than France – for instance, it passed on the most third-party contents to the other four countries through their imports of chemical and pharmaceutical products. It was also dominant in the motor vehicles, trailers, and semi-trailers sector, where it intermediated the largest share of European foreign content for the rest. Germany also intermediated a larger share of intra-regional than extra-regional foreign content, seen for instance for the rubber and plastic products, and basic metals sectors. Thus, the role that Germany played in the manufacturing sectors might have contributed to the observed dominance of Germany, especially for intra-regional intermediation, as observed in Section 4.2.

Turning to the services sector, Luxembourg was the top upstream partner for all the European countries, irrespective of whether the third-party contents were from within or outside the region, for the financial and insurance sector. It established itself as a key hub, for instance, intermediating 77.72% of all foreign content received by Italy through its imports of financial and insurance services, with larger shares for within-region intermediation. On the

other hand, Ireland featured more commonly as a top-3 partner across the various services sectors, irrespective of perspectives, and mainly for Italy, Spain, and UK. Hence, the role played by Luxembourg and Ireland might have contributed to their upstream intermediary roles recognised as per Table 3.

Germany was also a key provider of its domestic content to the European countries for further processing and it was more eminient in the manufacturing sectors once again. On the other hand, UK was more centred about the services sectors such as financial and insurance activities, and other business services. While US and China were both featured, US was more important as an upstream supplier of inputs than China, given that it featured more readily in the world-perspective, and across both manufacturing and services sectors. China was featured more prominently when comparing it against only non-European economies and was more centred about the manufacturing sectors again. Hence, this concurred with the results seen in Table 3 that US was more crucial to European economies than China as a source of inputs for their further processing.

6.3.3 North America

US and China were both key upstream intermediaries and providers of domestic contents for the North American countries – US was unsurprisingly more dominant and featured across both manufacturing and services sectors, while China's role was more concentrated on the manufacturing sectors. China's dominance was recognised in the computer, electronic, and optical products, and electrical equipment. It was the foremost upstream intermediary of total and non-regional third-party contents embedded in their imports, as well as the top provider of domestic content for further processing in comparison with all and non-regional trading partners of the North American countries. China was also featured more strikingly under the outside-region perspective, which was congruent with its importance in non-regional intermediation as per Section 4.3.

Additionally, we noticed countries like Ireland and Luxumbourg as upstream intermediaries under the financial and insurance, and other business services sectors, consistent with Section 6.3.2, which might indicate their status as nodes for those sectors. Furthermore, UK was again depicted as being a key partner under the financial and insurance sector as well, emphasising its role as a financial centre. Among the European economies though, Germany featured the most readily in this sectoral perspective, consistent with the results from Table 3.

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7 Conclusion

In this paper, we find that the key downstream and upstream intermediaries of each region were largely regional economies. However, what distinguished the respective primary nodes of each region are the interrelations between themselves and other regional nodes, as well as their role in connecting their respective regions to non-regional markets. These primary nodes are China, Germany, and US for Asia, Europe, and North America respectively. Hence, the network of linkages seemed configured such that economies have multiple nodes facilitating within-region movements while being connected outside the region through a single key regional partner. These primary nodes are also more upstream, displaying relatively more forward linkages than backward linkages. Thus, they played a critical, two-fold role – apart from being important intermediaries in facilitating the flow of inputs between countries, they contributed their domestic contents for further processing and production both intra- and extra-regionally – and consequently, shocks to these nodes are expected to propagate strongly through supply chains. More notably, China rose in prominence over the years, evolving into the global node that bridged regions together, specifically from the upstream perspective. China was the foremost upstream intermediary of extra-regional third-party contents across all three regions and also, exhibited a strong upstream movement over the years.

As the COVID-19 pandemic struck globally, especially the key regional nodes, it is unsurprising that the effects were felt strongly across the world. The sectoral analysis signalled that the manufacturing sectors may be the most affected by shocks to GVC, as the manufacturing sectors were more involved in GVC-related trade and the regional nodes, especially China and Germany, had a larger role in the manufacturing than services sectors too. There were certain sectoral heterogeneities observed as well – for example, Asian economies dominated the intermediary role for the computer, electronic, and optical products sector, while European and North American countries for the motor vehicles, trailers, and semi-trailers, and other transport equipment sectors. Hence, disruptions to GVC may vary according to the sectors, depending on which regions are hit the hardest. For the services sectors, we see economies such as Singapore, Ireland, Luxembourg, and UK surfacing as well.

In this present crisis, tighter international cooperation is all the more important, not only from the public health perspective, but also to minimise further possible disruptions to GVC. Even though Europe exhibited stronger intra-regional linkages than Asia and North America, regional recovery in itself may be insufficient. This is because China has grown considerably in clout over the years, anchoring its role in GVC. Furthermore, economies generally have a larger dependence on non-regional markets for the absorption of GVC-

related components in their exports. In timing the reopening of the economies, it is thus important for economies to be in tandem with that of the primary nodes – China, Germany, and US – to minimise the fettering of GVC-related activities. Otherwise, if these primary nodes were to maintain stringent lockdown measures that curtail economic activities, the provision and/or intermediation of domestic and third-party contents will be stymied – economies will then be less able to access intermediate inputs and/or access final destination markets. These primary nodes should ideally have their domestic situation under control as well, to avoid a constant back-and-forth tightening and reopening of the economies that may propagate shocks through the network of linkages and weigh further on the supply chains.

While the dependencies on key nodes may have largely been due to the consideration for efficiency within global value chains – having a higher degree of reliance on regional partners seems sensible given geographical proximity and lower transportation costs, albeit other factors – there may be a need to balance efficiency with some degree of resilience and robustness, as seen from the above analyses and the current crisis. For example, it may be reasonable to have a more diversified set of regional partners with a more diffused concentration of shares for within-region intermediation. This will help to ameliorate some degree of regional risk. In terms of outside-region intermediation, it may be beneficial for economies to strengthen their own extra-regional linkages instead of depending on key nodes, to ameliorate the concentration risk, especially when these partners overlap with the partners for within-region intermediation. As such, going forward, a new normal may see coutries re-evaluating and reconfiguring their supply chain networks, balancing efficiency with resilience and robustness. This provides an interesting area to explore, such as balancing the costs incurred from the reduction of efficiency against the benefits gotten from an improvement of supply chain resilience and robustness.

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Appendix

A.1   Key downstream partners of selected economies (2005, 2015)

A.1.1   Asia

China was a top-3 downstream partner of all Asian economies, intermediating the highest proportion of domestic content destined for regional and non-regional markets in most instances. Asian economies, except Singapore and the Rest of Asia, grew more dependent on China, with the share intermediated by China increasing. These percentages were disproportionately large, especially for the East Asian economies. For example, 50.62% of Taiwan's and 42.65% of Korea's overall domestic content meant for further processing were intermediated by China in 2015. The respective shares were 42 and 35 pp more than their respective 2nd downstream partners. This was similar for other Asian countries, such as Thailand, with China intermediating 23.35% of its domestic content destined to all markets in 2015, 16pp above its 2nd downstream partner.

China was even more salient as a downstream partner facilitating outside-Asia absorption, with its shares of domestic content intermediated for extra-regional absorption across all Asian economies being higher than that seen for intra-regional absorption. This dependency on China for extra-regional absorption grew over the period of 2005-2015, for instance, increasing by 10pp for Malaysia and 8pp for Taiwan from 2005. This could be due to China's stronger extra-regional trade links, compared to the other Asian economies – it was one of the few Asian economies with non-Asian partners (i.e., Mexico and US) in the list of top-3 downstream partners. US appeared consistently as China's top-3 partners in 2015, being the most important partner for outside-Asia absorption, and 2nd most important partner for world and within-Asia absorption.

Korea and Singapore also exhibited stronger extra-regional trade links, having non-Asian partners in their top-3 lists – Mexico and US, and Ireland and Luxembourg respectively. Notwithstanding so, they were relatively more prominent for intra-regional than extra-regional intermediation compared to China, and appeared frequently as the top-3 partners of the other Asian economies, albeit less so than China. Korea's intermediary role was pronounced for the East Asian economies, being second to China as a key downstream partner for Japan and Taiwan. For instance, Korea intermediated 14.01% of Japan's domestic content destined for Asian markets in 2015, which was also smaller than the 9.48% to non-Asian markets. Korea was also China's most important partner for its domestic content destined for the world (11.55%) and Asian markets (17.45%) in 2015.

On the other hand, Singapore's intermediary role was more diffused across the Asian

economies. Despite China and Korea's being foremost for East Asian markets, Singapore still played a role as the top-3 downstream partner for Japan and Taiwan. Singapore's prominence is more acutely noticed in Southeast Asia and the Rest of Asia – in 2015, Singapore intermediated 17.59% and 9.76% of Malaysia's domestic content respectively destined for Asian and non-Asian markets. Though the latter percentage pales in comparison with China's, the former proportion is close to China's 18.13%. In fact, for the Rest of Asia, Singapore intermediated the largest percentage of domestic content for final absorption in Asia (17.23%) instead of China (9.77%).

A.1.2 Europe

Apart from being their top-3 downstream partners in 2005 and 2015, Germany also intermediated the largest proportion of domestic content meant for European and non-European destinations in most cases. European nations, except UK, increased their dependency on Germany over time. In 2015, Germany became Spain's most important partner while remaining the most important partner for France, Italy, and Rest of Europe. Germany's position as a key downstream partner in facilitating within-Europe absorption was most stark for the Rest of Europe – the share intermediated by Germany rose from 16.13% to 17.91%, whilst that of its 2nd most important partner decreased from 7.53% to 5.62%.

Germany was the only European economy (apart from the Rest of Europe) to have non-European partners in its list of top-3 downstream partners, exhibiting stronger extra-regional linkages. Correspondingly, the waxing importance of Germany was evident in facilitating non-European absorption, intermediating a larger proportion over the period of 2005-2015. Moreover, when comparing the difference in shares intermediated by Germany against that of the 2nd ranked partners, the European economies displayed dependencies on Germany. For instance, looking at the Rest of Europe, the share of domestic content destined for non-European markets intermediated by Germany grew by 3pp, with its share being 8-9pp greater than the following two downstream partners. For France, Germany intermediated 13.37% of domestic contents meant for non-European absorption, with the following two partners trailing behind by 6-7pp. However, the dependence of European economies on Germany was lesser than Asia's on China, as seen from the shares being less concentrated and the magnitude of the changes being smaller. For example, Spain saw Germany (11.78%) and France (11.23%) being closely matched in their importance as downstream partners for accessing extra-regional markets.

Another key downstream partner for the European economies was France. In 2015, France was the 2nd downstream partner, after Germany, to intermediate the domestic content of Italy and Spain for final absorption in both European and non-European markets. Further-

more, France was Germany's foremost partner in intermediating domestic content for world and within-Europe absorption, and 2nd partner for outside-Europe absorption. However, its importance diminished over time, intermediating a decreasing share of domestic content destined for European and non-European markets for Germany, Italy, Spain, and the Rest of Europe. It also lost its position as one of the top-3 partners of the Rest of Europe.

Looking at non-European economies that were key downstream partners for non-European absorption, the US faded in importance over time (as seen from Germany and UK's top-3 partners). Instead, China rose to prominence in 2015, appearing as one of the top-3 partners for Germany and the Rest of Europe. More strikingly, China was the most important partner of Germany for non-European absorption, alluding to China's role in bridging regions together.

A.1.3   North America

US was the most important downstream partner of Canada and Mexico, facilitating the most intra- and extra-regional absorption of domestic content in 2005 and 2015. Both displayed immense dependency on the US, though it waxed for Canada and waned for Mexico. Nonetheless, in 2015, US intermediated a gargantuan share of Canada (60.38%) and Mexico's (53.74%) domestic contents destined for regional markets in 2015. For domestic content destined for absorption outside the region, US intermediated 50.80% and 48.22% of their respective domestic contents.

US exhibited the most extra-regional linkages – in 2015, its top-3 partners intermediating its domestic content destined outside North America were all non-North American countries, namely China, Ireland, and Germany. While Canada and Mexico depended substantially on US for their domestic content to be absorbed in extra-regional markets, they also relied on other non-North American countries.

Once again, the importance of China in global value chains is apparent, with China as an important partner for the North American countries. By 2015, China was one of the top-3 downstream partners for the whole of North America, irrespective of the destination of their domestic content. This contrasted with China being on the list only for Canada and US in 2005, and solely for intra-regional absorption.

A.2   Key upstream partners of selected economies (2005, 2015)

A.2.1   Asia

China was a notable upstream partner of Asian economies, albeit to a lesser degree than its downstream role. China was a top-3 partner for all of them, except Singapore, and

its importance mounted over time as they obtained an increasing share of foreign content across originating markets through it. For instance, China became Vietnam's leading upstream partner, intermediating 22.22% of world-originated foreign content in 2015, despite being unfeatured in 2005. Once again, the dependency was seen clearly amongst East Asian economies, such as Korea, which saw China passing on 21.8% of world-originated foreign content to it, almost 14pp more than its 2nd partner (i.e., Japan), in 2015. While China's share rose by 4pp, Japan's share reduced by a similar magnitude from 2005. The dependency was slightly weaker among Southeast Asian economies and the Rest of Asia, except Thailand, which saw China increasing its share of world-originated foreign content passed on to Thailand and was 10pp more than its 2nd partner (i.e., Japan) in 2015. These were irrespective of foreign content origin.

While China generally intermediated a larger share of Asian foreign content than non-Asian foreign content, China's significance in passing on non-Asian foreign content grew ubiquitously across Asian economies. For the Southeast Asian countries, China passed on the most non-Asian foreign content to Vietnam (22.37%) and Thailand (18.19%) in 2015, despite not being their top-3 partners in 2005. Among East Asian economies, China's share rose by 6-7pp for Korea and Taiwan, while it grew by 8pp for the Rest of Asia grew by 8pp.

Apart from China's role in intermediating third-party contents, Asian economies also became more dependent on Chinese domestic content for further processing and production. This is evident from its rise over the years and emergence as a top partner for most Asian economies, except Singapore, in 2015. For instance, China emerged as the foremost partner of Rest of Asia in 2015, providing 18.72% of the total domestic contents that were passed on by the world, when it was previously unfeatured in 2005. Also, relative to the total domestic contents that were passed on by Asian partners, China accounted for 42.90%, up from the 23.88% in 2005.

Japan was also an important upstream partner, its role being more pronounced in terms of passing on its domestic content for further processing and production by the other Asian economies, although its prominence diminished over time while China's grew. Taking Korea as an example, Japanese domestic content was used most extensively in 2005, accounting for 19.94% of all other domestic contents used in 2005. However, in 2015, Japan lost its position as one of the top-3 partners when comparing to all other domestic contents and its share in comparing amongst Asian domestic contents shrunk from 44.48% to 20.80%. In terms of upstream intermediation, Japan was ranked just behind China for East Asian economies – Korea and Taiwan – and Thailand.

Another noteworth mention was Korea, who was a key upstream intermediary for Japan and Taiwan too, whilst intermediating a share comparable to China for Vietnam in 2015.

More pertinently, Korea was China's most important upstream partner in 2015, passing on the most foreign content originating from the world, Asia, and outside Asia. While it pales in comparison with Chinese and Japanese domestic contents, Korean domestic content was also utilised in other Asian economies, emerging as the foremost partner for China and 2nd partner for Vietnam in comparison with all other domestic contents. Relative to Asian domestic contents, Korea emerged as a top-3 partner for the East Asian economies, as well as Vietnam.

A.2.2   Europe

Germany and to a lesser extent, France, were key upstream partners of European economies. In 2005 and 2015, Germany was a top-3 partner for all of them and intermediated the most foreign content in most instances. The share of European foreign content intermediated by Germany increased by approximately 1-3pp across France, Spain, UK, and the Rest of Europe. Germany's shares were concentrated to some degree as well. This was most stark for the Rest of Europe, with Germany being 9pp above its 2nd and 3rd upstream partner – China and France – in 2015. Germany's role, however, seemed more significant in passing on European than non-European foreign content, as it was the top upstream partner for passing on within-region foreign content across all European economies but not so for extra-regional foreign content in 2015. When Germany was the top partner, the maximum gap with the 2nd partner was 11pp for within-region intermediation (for the case of Rest of Europe) but was narrower at only 2pp for outside-region intermediation (for the case of France and Rest of Europe).

France saw its importance diminish over time, passing on a smaller share of foreign content across all European economies. This was seen for both European and non-European foreign content. Consequently, this general pattern saw France shifting down the ranks. For example, it intermediated 11.69% of all foreign content for Spain in 2015, down from 15.33% in 2005. For within-region and outside-region intermediation, the share declined by 4 and 3pp respectively. Germany and China replaced France as Spain's primary partner for European and non-European foreign content respectively. France also lost its role as Germany's top upstream partner, with its shares falling by 2pp irrespective of origin over the period of 2005-2015. China became Germany's primary partner in 2015 for passing on non-European foreign content, at 10.06%. The role played by China was evident in passing on non-European foreign content to all European economies, being either the 1st upstream partner (for Germany, Spain, and UK) or 2nd to Germany (for France, Italy, and the Rest of Europe). China rose in importance over time, such as China emerging as Spain's 1st partner in 2015 despite not being one of its top-3 partners in 2005, and its shares increasing by 2pp

for Germany and 3pp for the Rest of Europe.

Turning our attention to the provision of domestic contents, Germany stood out once again as a key partner, such as accounting respectively for 17.52% and 15.09% of all domestic contents that were passed on by the world to France and the Rest of Europe for further processing and production. Juxtaposing the roles of intermediating foreign contents and providing one's own domestic contents, UK became noticeable as a top-3 partner for the latter than the former. This was similarly so for US, with its domestic content being important for European countries even as it did not play a key intermediary role. In terms of non-European domestic content passed on for further processing and production, while China was also featured, Chinese domestic content was less important than US'.

A.2.3 North America

While Canada and Mexico still relied substantially on the US for foreign content, the share of foreign content intermediated by the US diminished over time. The declining share of US was observed for both regional and extra-regional foreign contents. The shares intermediated by US for all foreign content declined 5-6pp, falling by 2pp for within-region foreign content and 5-7pp for extra-regional foreign content. Irrespective of the origin of the foreign content though, US remained as the primary partner, with its substantial shares and sizeable differences with the 2nd upstream partner of Canada and Mexico (i.e., China). Nonetheless, despite the existing dependency on the US, these gaps narrowed over the period of 2005-2015.

This might be attributed to Mexico and China's more pronounced role within the region. While US' shares were generally declining in terms of intermediating both regional and non-regional foreign content, Mexico and China saw their shares increasing over time. Interestingly, while the North American countries were still more important in intermediating regional foreign content, China begun playing a greater role in passing on foreign content originating from within the region. For example, the share intermediated by China grew between 4 and 9pp (for the case of Canada and Mexico). China intermediated a sizeable share of non-regional foreign content, at 16.34% for US, being its 1st partner, and 22.51% for Mexico. China's role in passing on non-regional foreign content was almost the most conspicuous for Mexico, growing by almost 10pp.

Unsurprisingly, US' domestic content was crucial for Canada and Mexico, accounting for 53.77% and 46.06% of all domestic contents passed on by the world for further processing and production respectively. Similar to the other regions, Chinese domestic content also became more important over time, with China becoming the top partner for US at 20.84% and 2nd partner for Mexico at 23.61% of all domestic contents passed on by the world.

Table 1: Decomposition of gross exports by source-based approach

Gross exports from country s to r	DVA		(1a*) in final goods exports $\mathbf{Y}_{sr}$ directly absorbed by bilateral importers
			(2a*) in intermediate exports $\mathbf{A}_{sr}$ absorbed by direct importers as local final goods $\mathbf{Y}_{rr}$
		in intermediate exports $\mathbf{A}_{sr}$ *absorbed by bilateral importer r*	(1b*) as s's final goods $\mathbf{Y}_{sr}$ after additional processing stages
			(2b*) as local final goods $\mathbf{Y}_{rr}$ but only after further processing stages
			(3c*) as final goods from third countries $\mathbf{Y}_{kr}$
		in intermediate goods exports $\mathbf{A}_{sr}$ *absorbed by third countries*	(1c*) as s's final goods $\mathbf{Y}_{sk}$ after additional processing stages
			(2c*) as local final goods $\mathbf{Y}_{kk}$
			(3a*) as final goods from direct bilateral importer $\mathbf{Y}_{rj}$
			(3b*) as final goods from direct bilateral importer $\mathbf{Y}_{rl}$ but only after further processing stages
			(3d*) as final goods from other third countries $\mathbf{Y}_{kl}$
		in intermediate goods exports $\mathbf{A}_{sr}$ *absorbed at home*	(4a*) as final goods of the bilateral importer $\mathbf{Y}_{rs}$
			(4b*) as final goods of the bilateral importer $\mathbf{Y}_{rs}$ but only after additional processing stages
			(4c*) as final goods of a third country $\mathbf{Y}_{ks}$
			(5*) as domestic final goods $\mathbf{Y}_{ss}$
	FVA, $\mathbf{V}_{t\neq s}$		(7*) in exports of final goods $\mathbf{Y}_{sr}$
			(8*) in exports of intermediate goods $\mathbf{A}_{sr}$ directly absorbed by the importing country $\mathbf{Y}_{rr}$
		in intermediate exports $\mathbf{A}_{sr}$ re-exported by r	(9a*) via final goods exports $\mathbf{Y}_{rj}$
			(9b*) via intermediate exports $\mathbf{A}_{rj}$
	purely double-counted components		(6*) of domestic content
			(9c*–9d*) of foreign content

To supplement the table above, we repeat the BM source-based decomposition framework below for easy reference. Suppose the world consists of N countries and G sectors. Define $\mathbf{Y}_{sr}$ to be the demand vector of final goods produced in country s and consumed in country r (of dimension $G \times 1$). Let $\mathbf{A}$ be the global matrix of input coefficients (of dimension $NG \times NG$), so that $\mathbf{B} \equiv (\mathbf{I} - \mathbf{A})^{-1}$ is the global Leontief inverse matrix. In addition, let $\mathbf{V}_s$ denote the value-added shares embedded in each unit of gross outputs produced by country s (of dimension $1 \times G$), $\mathbf{E}_{sr}$ the vector of bilateral gross exports from country s to country r (of dimension $G \times 1$), and $\mathbf{u}_G$ a $1 \times G$ unit row vector.

The source-based approach decomposes the bilateral exports between country s and country r into domestic value added (component 1^* to 5^*), domestic double counted (component 6^*), foreign value added (components 7^* to $9b^*$), and foreign double counted (components $9c^*$ and $9d^*$) as follows:

$$
\begin{aligned}
\mathbf{u}_G \mathbf{E}_{sr} \;=\; & \overset{\mathbf{1a*}}{\mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{Y}_{sr}} \\[2mm]
+\; & \mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \left[\overset{\mathbf{1b*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \mathbf{B}_{js} \mathbf{Y}_{sr}} + \overset{\mathbf{1c*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k \neq s,r}^{N} \mathbf{B}_{js} \mathbf{Y}_{sk}} \right] \\[2mm]
+\; & \mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \left[\overset{\mathbf{2a*}}{\mathbf{Y}_{rr}} + \overset{\mathbf{2b*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \mathbf{B}_{jr} \mathbf{Y}_{rr}} + \overset{\mathbf{2c*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k \neq s,r}^{N} \mathbf{B}_{jk} \mathbf{Y}_{kk}} \right] \\[2mm]
+\; & \mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \left[\overset{\mathbf{3a*}}{\sum_{j \neq s,r}^{N} \mathbf{Y}_{rj}} + \overset{\mathbf{3b*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{l \neq s,r}^{N} \mathbf{B}_{jr} \mathbf{Y}_{rl}} \right. \\[2mm]
& \left. + \overset{\mathbf{3c*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k \neq s,r}^{N} \mathbf{B}_{jk} \mathbf{Y}_{kr}} + \overset{\mathbf{3d*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k \neq s,r,l}^{N} \sum_{l \neq s,r}^{N} \mathbf{B}_{jk} \mathbf{Y}_{kl}} \right] \\[2mm]
+\; & \mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \left[\overset{\mathbf{4a*}}{\mathbf{Y}_{rs}} + \overset{\mathbf{4b*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \mathbf{B}_{jr} \mathbf{Y}_{rs}} + \overset{\mathbf{4c*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k \neq s,r}^{N} \mathbf{B}_{jk} \mathbf{Y}_{ks}} \right] \\[2mm]
+\; & \mathbf{V}_s (\mathbf{I} - \mathbf{A}_{ss})^{-1} \mathbf{A}_{sr} (\mathbf{I} - \mathbf{A}_{rr})^{-1} \overset{\mathbf{5*}}{\sum_{j \neq r}^{N} \mathbf{A}_{rj} \mathbf{B}_{js} \mathbf{Y}_{ss}}
\end{aligned}
$$

$$+ \quad \mathbf{V}_s(\mathbf{I} - \mathbf{A}_{ss})^{-1} \overset{\textcolor{red}{6*}}{\sum_{t \neq s}^{N}} \mathbf{A}_{st}\mathbf{B}_{ts}\mathbf{E}_{sr}$$

$$+ \quad \sum_{t \neq s}^{N} \mathbf{V}_t(\mathbf{I} - \mathbf{A}_{tt})^{-1}\mathbf{A}_{ts}(\mathbf{I} - \mathbf{A}_{ss})^{-1} \left[\overset{\textcolor{red}{7*}}{\mathbf{Y}_{sr}} + \mathbf{A}_{sr}(\mathbf{I} - \overset{\textcolor{red}{8*}}{\mathbf{A}_{rr}})^{-1}\mathbf{Y}_{rr} \right]$$

$$+ \quad \sum_{t \neq s}^{N} \mathbf{V}_t(\mathbf{I} - \mathbf{A}_{tt})^{-1}\mathbf{A}_{ts}(\mathbf{I} - \mathbf{A}_{ss})^{-1}\overset{\textcolor{red}{9a*}}{\mathbf{A}_{sr}}(\mathbf{I} - \mathbf{A}_{rr})^{-1} \sum_{j \neq r}^{N} \mathbf{Y}_{rj}$$

$$+ \quad \sum_{t \neq s}^{N} \mathbf{V}_t(\mathbf{I} - \mathbf{A}_{tt})^{-1}\mathbf{A}_{ts}(\mathbf{I} - \mathbf{A}_{ss})^{-1}\overset{\textcolor{red}{9b*}}{\mathbf{A}_{sr}}(\mathbf{I} - \mathbf{A}_{rr})^{-1} \sum_{j \neq r}^{N} \mathbf{A}_{rj} \sum_{k}^{N} \sum_{l}^{N} \mathbf{B}_{jk}\mathbf{Y}_{kl}$$

$$+ \quad \sum_{t \neq s}^{N} \mathbf{V}_t(\mathbf{I} - \mathbf{A}_{tt})^{-1} \left[\sum_{j \neq t,s}^{N} \overset{\textcolor{red}{9c*}}{\mathbf{A}_{tj}}\mathbf{B}_{js}\mathbf{E}_{sr} + \mathbf{A}_{ts}(\mathbf{I} - \mathbf{A}_{ss})^{-1} \sum_{t \neq s}^{N} \overset{\textcolor{red}{9d*}}{\mathbf{A}_{st}}\mathbf{B}_{ts}\mathbf{E}_{sr} \right], \qquad (8)$$

where (i) $\mathbf{B}_{ts}$ is the country-t to country-s section in the global Leontief matrix $\mathbf{B}$, which corresponds to the total input requirement from each sector of country t to produce one unit of final demand in each sector of country s, and (ii) $\mathbf{A}_{sr}$ is the country-s to country-r section in the inter-country input coefficient matrix $\mathbf{A}$, which corresponds to the direct input requirement from each sector of country s to produce a unit of gross output in each sector of country r. Given that the source-based approach targets the first time a DVA leaves its country of origin or the first time a FVA is re-exported, it uses the local Leontief matrix $(\mathbf{I} - \mathbf{A}_{ss})^{-1}$, pre-multiplied by the value-added share vector $\mathbf{V}_s$. At the same time, it allows for all possible forward linkages by which such VA components can be routed (including repeatedly through the same country of origin or the same re-exporter), as captured by the global Leontief matrix $\mathbf{B}$ before the final demand vector $\mathbf{Y}$.

Figure 1: Source-based assignment of value-added in bilateral exports
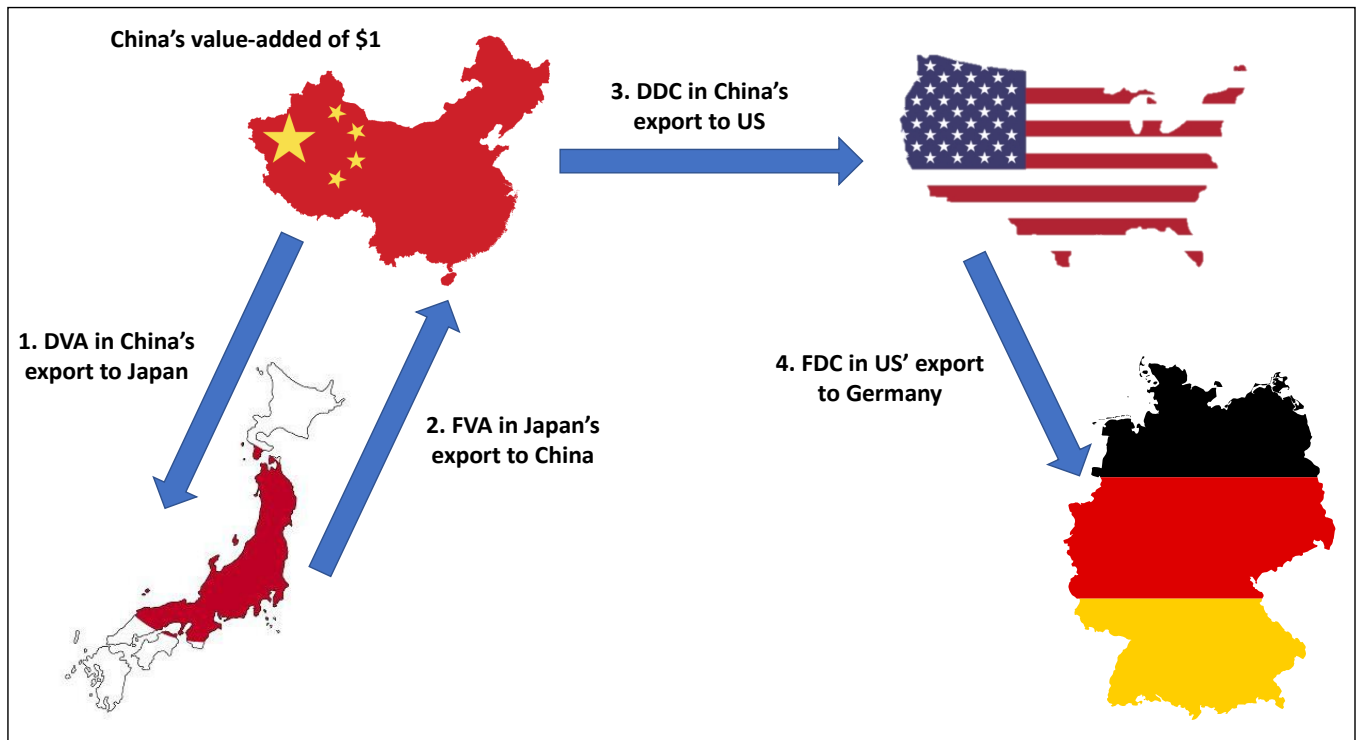
Table 2: Key downstream trade partners of selected regions (2005 and 2015)

ASIA	2005			2015		
	World	Within Region	Outside Region	World	Within Region	Outside Region
% of gross exports to countries in $\mathcal{G}$	100	42.39	57.61	100	42.35	57.65
1st downstream partner	CHN (18.35)	CHN (16.6)	CHN (18.97)	CHN (15.87)	CHN (12.76)	CHN (17.26)
2nd downstream partner	KOR (8.85)	TWN (12.72)	KOR (7.63)	KOR (8.56)	KOR (12.47)	USA (7.23)
3rd downstream partner	TWN (7.70)	KOR (12.37)	USA (7.34)	USA (6.7)	TWN (8.36)	KOR (6.81)
4th downstream partner	USA (6.76)	MYS (8.60)	TWN (5.95)	ROW (5.24)	SGP (7.67)	MEX (6.44)
5th downstream partner	MYS (6.55)	THA (6.37)	MYS (5.84)	SGP (4.86)	MYS (6.58)	ROW (5.29)

EUROPE	World	Within Region	Outside Region	World	Within Region	Outside Region
% of gross exports to countries in $\mathcal{G}$	100	66.17	33.83	100	59.55	40.45
1st downstream partner	DEU (10.84)	DEU (12.26)	DEU (9.13)	DEU (11.76)	DEU (12.94)	DEU (10.73)
2nd downstream partner	FRA (7.31)	FRA (8.34)	ROW (8.10)	FRA (5.90)	FRA (6.46)	CHN (6.25)
3rd downstream partner	ITA (5.89)	ITA (6.59)	FRA (6.08)	ITA (4.92)	LUX (6.12)	ROW (6.05)
4th downstream partner	ROW (5.87)	BEL (6.14)	USA (5.77)	ROW (4.69)	BEL (5.73)	FRA (5.40)
5th downstream partner	GBR (4.81)	ESP (5.24)	ITA (5.06)	IRL (4.62)	NLD (5.29)	USA (4.64)

NORTH AMERICA	World	Within Region	Outside Region	World	Within Region	Outside Region
% of gross exports to countries in $\mathcal{G}$	100	44.76	55.24	100	37.76	62.24
1st downstream partner	CAN (13.58)	CAN (26.52)	USA (10.27)	MEX (11.61)	MEX (27.96)	USA (9.56)
2nd downstream partner	MEX (11.94)	MEX (24.98)	ROW (6.98)	CAN (10.20)	CAN (22.43)	CHN (8.91)
3rd downstream partner	USA (10.23)	USA (10.18)	DEU (5.96)	USA (9.57)	USA (9.59)	IRL (6.80)
4th downstream partner	ROW (5.73)	CHN (4.74)	CAN (5.28)	CHN (8.58)	CHN (7.87)	ROW (5.50)
5th downstream partner	CHN (4.89)	ROW (3.77)	KOR (5.13)	IRL (5.95)	IRL (4.11)	DEU (5.33)

Table 3: Key upstream trade partners of selected regions based on Equation 2 (2005 and 2015)

	2005			**2015**		
ASIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	47.00	53.00	100	46.65	53.35
1st upstream partner	KOR (10.38)	CHN (15.18)	KOR (9.56)	CHN (11.30)	CHN (13.43)	CHN (10.35)
2nd upstream partner	CHN (10.10)	TWN (13.72)	CHN (7.98)	KOR (10.33)	KOR (11.19)	KOR (9.95)
3rd upstream partner	TWN (9.39)	KOR (12.36)	TWN (7.58)	SGP (7.34)	TWN (8.66)	SGP (6.86)
4th upstream partner	SGP (7.22)	MYS (9.75)	SGP (7.52)	TWN (6.82)	SGP (8.42)	ROW (6.68)
5th upstream partner	ROW (6.41)	THA (6.52)	ROW (7.49)	ROW (6.30)	MYS (7.34)	TWN (6.01)
EUROPE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	69.50	30.50	100	65.61	34.39
1st upstream partner	DEU (11.21)	DEU (12.91)	DEU (9.21)	DEU (11.31)	DEU (13.62)	CHN (9.78)
2nd upstream partner	FRA (7.34)	FRA (8.24)	CHN (8.04)	CHN (5.89)	FRA (6.32)	DEU (9.01)
3rd upstream partner	ITA (6.00)	ITA (6.64)	FRA (6.29)	FRA (5.62)	LUX (5.78)	IRL (5.30)
4th upstream partner	ROW (4.83)	BEL (6.17)	ROW (5.67)	IRL (5.12)	BEL (5.73)	ROW (5.08)
5th upstream partner	BEL (4.79)	ESP (5.12)	ITA (5.25)	NLD (4.95)	ITA (5.35)	FRA (4.93)
NORTH AMERICA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	32.46	67.54	100	31.25	68.75
1st upstream partner	CHN (14.46)	USA (19.86)	CHN (14.75)	CHN (17.16)	USA (19.7)	CHN (17.23)
2nd upstream partner	USA (8.94)	MEX (17.23)	USA (8.31)	MEX (11.72)	MEX (17.21)	MEX (11.39)
3rd upstream partner	MEX (8.69)	CAN (9.85)	MEX (8.20)	USA (8.00)	CHN (16.00)	USA (7.32)
4th upstream partner	CAN (7.42)	CHN (9.56)	CAN (7.28)	CAN (6.18)	CAN (9.53)	CAN (5.99)
5th upstream partner	ROW (5.79)	ROW (5.50)	ROW (5.81)	DEU (5.34)	KOR (3.77)	DEU (5.48)

Table 4: Key upstream trade partners of selected regions based on Equation 3 (2005 and 2015)

ASIA	2005			2015		
	World	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	47.00	53.00	100	46.65	53.35
1st upstream partner	JPN (15.46)	JPN (32.20)	ROW (23.23)	ROW (14.45)	CHN (29.76)	ROW (27.75)
2nd upstream partner	ROW (12.08)	CHN (15.93)	USA (21.69)	CHN (14.26)	JPN (18.68)	USA (19.33)
3rd upstream partner	USA (11.28)	KOR (13.25)	SAU (9.98)	USA (10.07)	KOR (13.26)	AUS (7.52)
4th upstream partner	CHN (7.65)	TWN (11.25)	AUS (7.03)	JPN (8.95)	TWN (10.04)	SAU (6.87)
5th upstream partner	KOR (6.36)	SGP (5.33)	DEU (6.08)	KOR (6.36)	IDN (5.29)	DEU (6.74)
EUROPE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	69.5	30.5	100	65.61	34.39
1st upstream partner	DEU (13.16)	DEU (19.44)	USA (24.84)	DEU (12.61)	DEU (19.87)	USA (27.91)
2nd upstream partner	USA (8.02)	GBR (10.95)	ROW (24.33)	USA (10.20)	GBR (10.97)	ROW (20.19)
3rd upstream partner	ROW (7.86)	FRA (10.30)	CHN (8.31)	ROW (7.38)	FRA (9.68)	CHN (16.35)
4th upstream partner	GBR (7.41)	ITA (8.02)	JPN (8.26)	GBR (6.96)	ITA (6.60)	JPN (4.93)
5th upstream partner	FRA (6.98)	RUS (6.36)	CAN (3.51)	FRA (6.15)	RUS (6.32)	SGP (3.86)
NORTH AMERICA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	32.46	67.54	100	31.25	68.75
1st upstream partner	USA (29.35)	USA (68.52)	ROW (14.97)	USA (26.69)	USA (66.45)	CHN (31.57)
2nd upstream partner	CAN (9.15)	CAN (21.37)	CHN (13.59)	CHN (18.89)	CAN (22.22)	ROW (9.53)
3rd upstream partner	ROW (8.56)	MEX (10.11)	JPN (13.13)	CAN (8.92)	MEX (11.33)	JPN (6.90)
4th upstream partner	CHN (7.77)	N.A.	DEU (7.83)	ROW (5.70)	N.A.	DEU (6.69)
5th upstream partner	JPN (7.51)	N.A.	GBR (5.85)	MEX (4.55)	N.A.	KOR (4.33)

Figure 2: GVC participation (2005, 2010, and 2015) by origin and destination
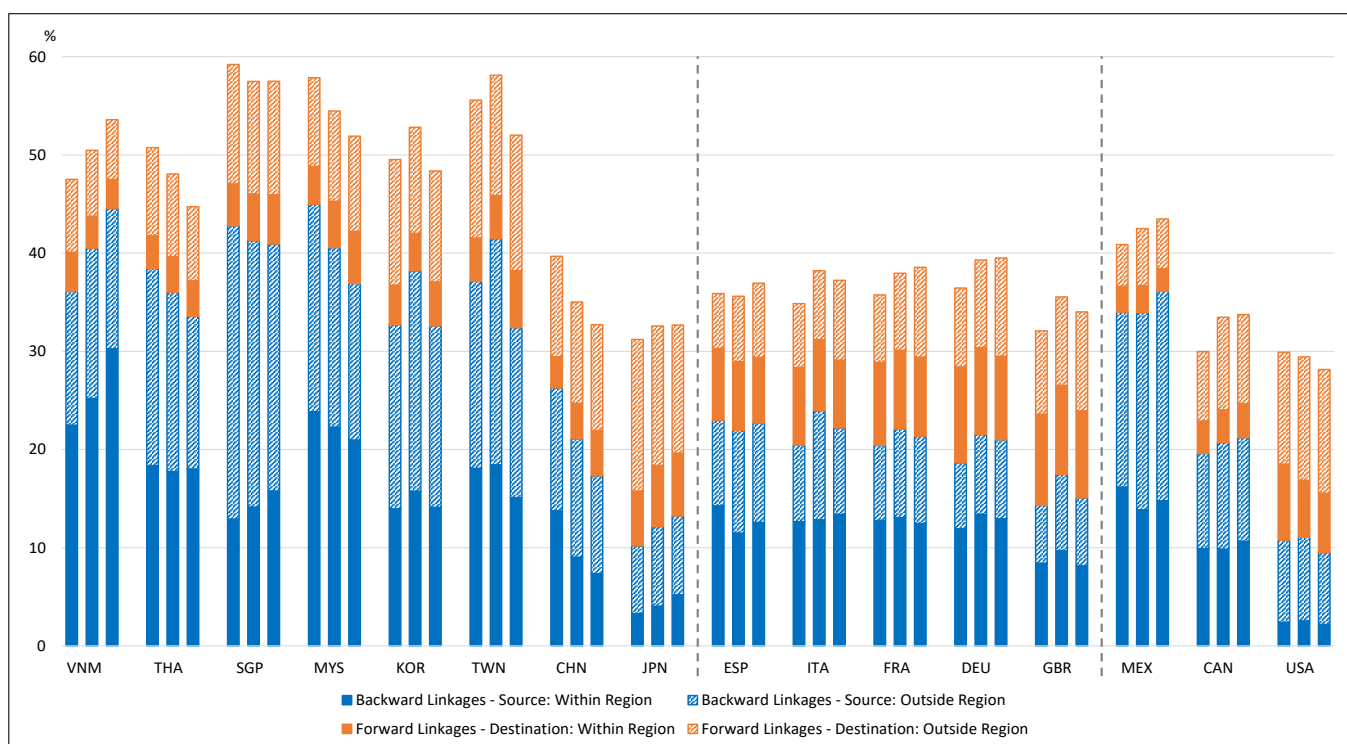
Note: Backward linkage is measured by VS in equation (4); forward linkage is measured by GVC^{BM} in equation (6) net of VS in equation (4). Countries in each region have been arranged in order of most to least downstream.

Figure 3: GVC participation (2005, 2010, and 2015) by destination only
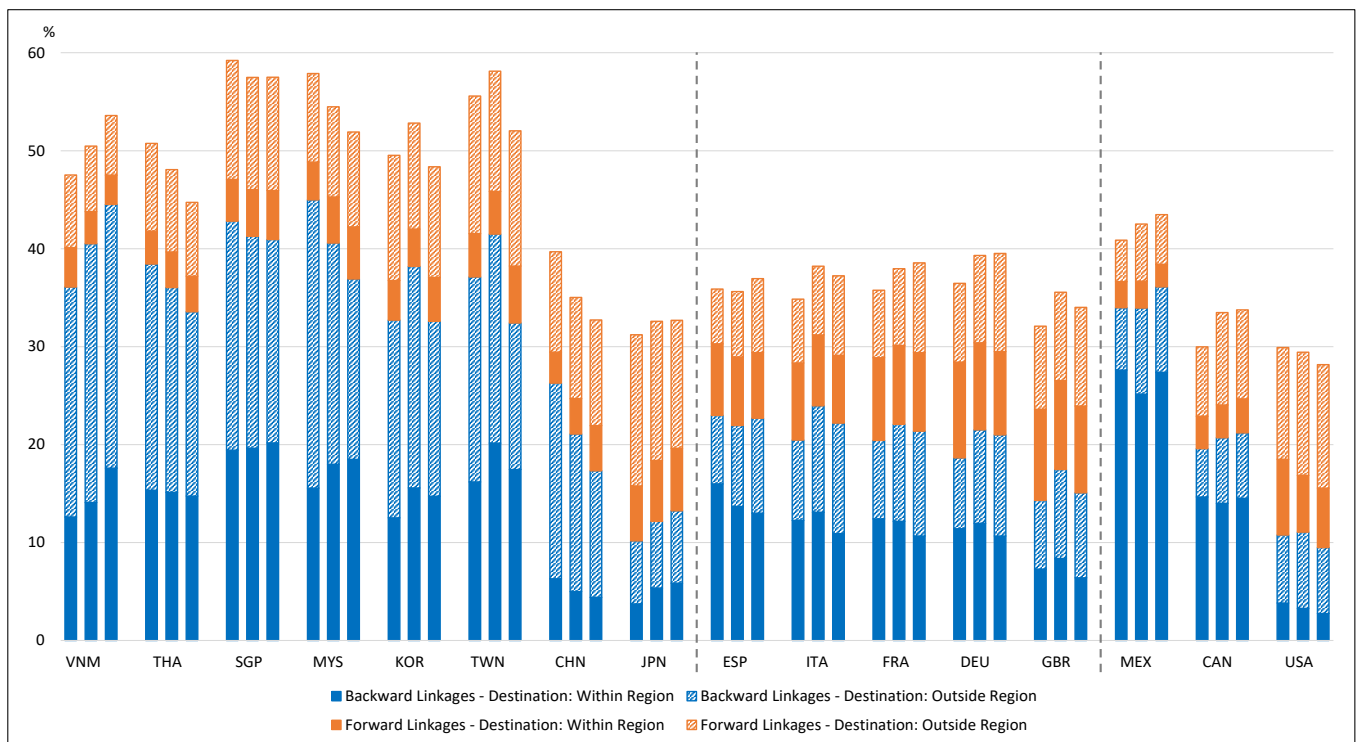
Note: Backward linkage is measured by VS in equation (4); forward linkage is measured by GVC^{BM} in equation (6) net of VS in equation (4). Countries in each region have been arranged in order of most to least downstream.

Figure 4: GVC participation (2005, 2010, and 2015) by immediate trading partner
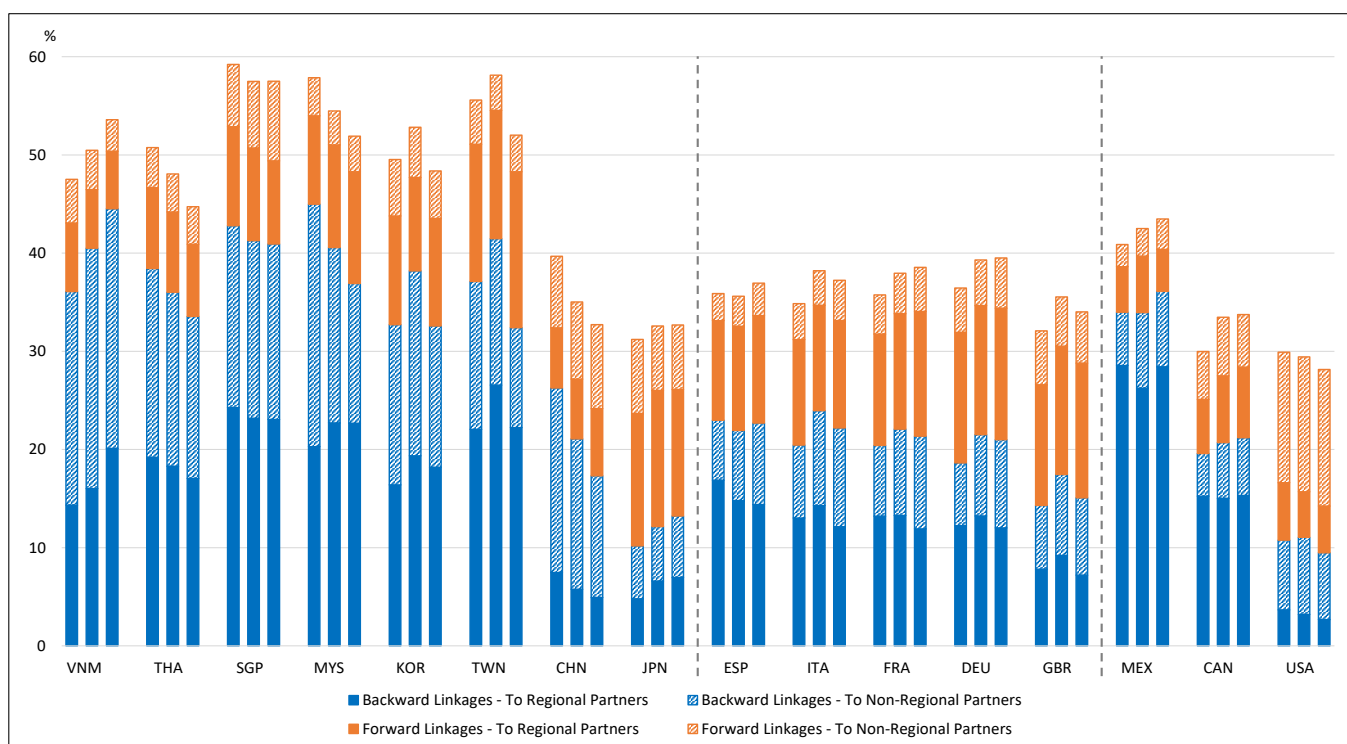
Note: Backward linkage is measured by VS in equation (4); forward linkage is measured by GVC^{BM} in equation (6) net of VS in equation (4). Countries in each region have been arranged in order of most to least downstream.

Table 5: Participation in GVC (2005, 2010, and 2015) by origin and destination

	2005				2010				2015			
CHINA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	26.27	13.41	39.68	66.20	21.08	13.94	35.02	60.20	17.32	15.40	32.72	52.93
Within Region	52.40	23.71	42.70		42.81	25.91	36.08		42.39	29.98	36.55	
Outside Region	47.60	76.29	57.30		57.19	74.09	63.92		57.61	70.02	63.45	
JAPAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	10.18	21.04	31.22	32.60	12.16	20.42	32.58	37.32	13.23	19.45	32.68	40.48
Within Region	32.40	26.60	28.49		33.31	30.47	31.53		39.40	32.88	35.52	
Outside Region	67.60	73.40	71.51		66.69	69.53	68.47		60.60	67.12	64.48	
KOREA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	32.71	16.83	49.54	66.03	38.19	14.62	52.81	72.31	32.58	15.79	48.37	67.37
Within Region	42.71	23.98	36.35		41.27	26.09	37.06		43.30	28.37	38.43	
Outside Region	57.29	76.02	63.65		58.73	73.91	62.94		56.70	71.63	61.57	
TAIWAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	37.12	18.47	55.59	66.77	41.49	16.64	58.12	71.38	32.42	19.61	52.03	62.31
Within Region	48.73	23.95	40.49		44.47	26.23	39.25		46.59	29.61	40.19	
Outside Region	51.27	76.05	59.51		55.53	73.77	60.75		53.41	70.39	59.81	
MALAYSIA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	44.99	12.89	57.88	77.73	40.57	13.91	54.48	74.47	36.91	15.00	51.92	71.10
Within Region	52.97	29.90	47.84		54.93	33.77	49.53		56.79	35.36	50.60	
Outside Region	47.03	70.10	52.16		45.07	66.23	50.47		43.21	64.64	49.40	
SINGAPORE	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	42.80	16.42	59.22	72.27	41.27	16.22	57.49	71.79	40.93	16.57	57.50	71.18
Within Region	30.19	25.91	29.00		34.24	29.32	32.85		38.57	30.27	36.18	
Outside Region	69.81	74.09	71.00		65.76	70.68	67.15		61.43	69.73	63.82	
THAILAND	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	38.43	12.32	50.75	75.72	36.02	12.04	48.06	74.95	33.56	11.16	44.72	75.05
Within Region	47.78	27.26	42.80		49.27	30.30	44.52		53.67	32.64	48.43	
Outside Region	52.22	72.74	57.20		50.73	69.70	55.48		46.33	67.36	51.57	

	2005				**2010**				**2015**			
VIETNAM	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	36.08	11.44	47.52	75.93	40.51	9.97	50.48	80.25	44.52	9.07	53.59	83.07
Within Region	62.28	35.07	55.73		62.21	32.80	56.4		67.99	32.82	62.04	
Outside Region	37.72	64.93	44.27		37.79	67.20	43.6		32.01	67.18	37.96	
FRANCE	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	20.42	15.33	35.75	57.12	22.08	15.88	37.96	58.17	21.36	17.19	38.55	55.41
Within Region	62.53	55.09	59.34		59.26	50.57	55.62		58.37	46.79	53.21	
Outside Region	37.47	44.91	40.66		40.74	49.43	44.38		41.63	53.21	46.79	
GERMANY	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	18.64	17.81	36.46	51.14	21.51	17.80	39.31	54.71	20.99	18.53	39.52	53.11
Within Region	64.02	54.83	59.53		62.29	49.91	56.68		61.71	45.96	54.33	
Outside Region	35.98	45.17	40.47		37.71	50.09	43.32		38.29	54.04	45.67	
ITALY	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	20.46	14.39	34.85	58.71	23.96	14.26	38.22	62.69	22.20	15.04	37.23	59.61
Within Region	61.85	54.74	58.92		53.57	50.79	52.53		60.36	45.98	54.55	
Outside Region	38.15	45.26	41.08		46.43	49.21	47.47		39.64	54.02	45.45	
SPAIN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	22.99	12.89	35.88	64.07	21.95	13.67	35.61	61.62	22.70	14.25	36.94	61.44
Within Region	62	56.59	60.06		52.32	51.29	51.92		55.41	47.01	52.17	
Outside Region	38	43.41	39.94		47.68	48.71	48.08		44.59	52.99	47.83	
UK	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	14.3	17.78	32.08	44.59	17.45	18.09	35.54	49.11	15.08	18.94	34.01	44.33
Within Region	58.84	52.31	55.22		55.56	50.17	52.82		54.02	46.83	50.02	
Outside Region	41.16	47.69	44.78		44.44	49.83	47.18		45.98	53.17	49.98	
CANADA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	19.59	10.39	29.98	65.35	20.7	12.77	33.48	61.84	21.2	12.55	33.75	62.81
Within Region	50.57	31.86	44.09		47.64	26.16	39.44		50.29	27.56	41.84	
Outside Region	49.43	68.14	55.91		52.36	73.84	60.56		49.71	72.44	58.16	
MEXICO	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	33.98	6.89	40.87	83.13	33.95	8.56	42.51	79.85	36.1	7.38	43.48	83.02
Within Region	47.61	38.37	46.05		40.85	32.06	39.08		40.95	31.05	39.27	
Outside Region	52.39	61.63	53.95		59.15	67.94	60.92		59.05	68.95	60.73	

USA	2005				2010				2015			
	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	10.76	19.15	29.91	35.98	11.05	18.38	29.43	37.56	9.48	18.67	28.15	33.67
Within Region	22.34	40.45	33.94		23.03	31.58	28.37		22.91	32.51	29.28	
Outside Region	77.66	59.55	66.06		76.97	68.42	71.63		77.09	67.49	70.72	

Table 6: Participation in GVC (2005, 2010, and 2015) by destination only

	2005				2010				2015			
CHINA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	26.27	13.41	39.68	66.20	21.08	13.94	35.02	60.20	17.32	15.40	32.72	52.93
Within Region	23.95	23.71	23.87		23.71	25.91	24.59		25.46	29.98	27.59	
Outside Region	76.05	76.29	76.13		76.29	74.09	75.41		74.54	70.02	72.41	
JAPAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	10.18	21.04	31.22	32.60	12.16	20.42	32.58	37.32	13.23	19.45	32.68	40.48
Within Region	36.66	26.60	29.88		43.99	30.47	35.52		44.16	32.88	37.45	
Outside Region	63.34	73.40	70.12		56.01	69.53	64.48		55.84	67.12	62.55	
KOREA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	32.71	16.83	49.54	66.03	38.19	14.62	52.81	72.31	32.58	15.79	48.37	67.37
Within Region	38.29	23.98	33.43		40.78	26.09	36.71		45.23	28.37	39.73	
Outside Region	61.71	76.02	66.57		59.22	73.91	63.29		54.77	71.63	60.27	
TAIWAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	37.12	18.47	55.59	66.77	41.49	16.64	58.12	71.38	32.42	19.61	52.03	62.31
Within Region	43.63	23.95	37.09		48.59	26.23	42.19		53.87	29.61	44.73	
Outside Region	56.37	76.05	62.91		51.41	73.77	57.81		46.13	70.39	55.27	
MALAYSIA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	44.99	12.89	57.88	77.73	40.57	13.91	54.48	74.47	36.91	15.00	51.92	71.10
Within Region	34.56	29.90	33.52		44.34	33.77	41.64		50.08	35.36	45.83	
Outside Region	65.44	70.10	66.48		55.66	66.23	58.36		49.92	64.64	54.17	
SINGAPORE	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	42.80	16.42	59.22	72.27	41.27	16.22	57.49	71.79	40.93	16.57	57.50	71.18
Within Region	45.38	25.91	39.98		47.55	29.32	42.40		49.26	30.27	43.79	
Outside Region	54.62	74.09	60.02		52.45	70.68	57.60		50.74	69.73	56.21	
THAILAND	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	38.43	12.32	50.75	75.72	36.02	12.04	48.06	74.95	33.56	11.16	44.72	75.05
Within Region	39.87	27.26	36.81		42.00	30.30	39.07		43.94	32.64	41.12	
Outside Region	60.13	72.74	63.19		58.00	69.70	60.93		56.06	67.36	58.88	

	2005				**2010**				**2015**			
VIETNAM	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	36.08	11.44	47.52	75.93	40.51	9.97	50.48	80.25	44.52	9.07	53.59	83.07
Within Region	34.95	35.07	34.98		34.74	32.80	34.36		39.52	32.82	38.39	
Outside Region	65.05	64.93	65.02		65.26	67.20	65.64		60.48	67.18	61.61	
FRANCE	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	20.42	15.33	35.75	57.12	22.08	15.88	37.96	58.17	21.36	17.19	38.55	55.41
Within Region	60.81	55.09	58.36		55.05	50.57	53.17		49.91	46.79	48.52	
Outside Region	39.19	44.91	41.64		44.95	49.43	46.83		50.09	53.21	51.48	
GERMANY	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	18.64	17.81	36.46	51.14	21.51	17.80	39.31	54.71	20.99	18.53	39.52	53.11
Within Region	61.20	54.83	58.09		55.69	49.91	53.07		50.86	45.96	48.56	
Outside Region	38.80	45.17	41.91		44.31	50.09	46.93		49.14	54.04	51.44	
ITALY	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	20.46	14.39	34.85	58.71	23.96	14.26	38.22	62.69	22.20	15.04	37.23	59.61
Within Region	59.92	54.74	57.78		54.64	50.79	53.21		49.10	45.98	47.84	
Outside Region	40.08	45.26	42.22		45.36	49.21	46.79		50.90	54.02	52.16	
SPAIN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	22.99	12.89	35.88	64.07	21.95	13.67	35.61	61.62	22.70	14.25	36.94	61.44
Within Region	69.53	56.59	64.88		62.37	51.29	58.11		57.24	47.01	53.30	
Outside Region	30.47	43.41	35.12		37.63	48.71	41.89		42.76	52.99	46.70	
UK	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	14.30	17.78	32.08	44.59	17.45	18.09	35.54	49.11	15.08	18.94	34.01	44.33
Within Region	50.94	52.31	51.70		47.94	50.17	49.07		42.38	46.83	44.86	
Outside Region	49.06	47.69	48.30		52.06	49.83	50.93		57.62	53.17	55.14	
CANADA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	19.59	10.39	29.98	65.35	20.70	12.77	33.48	61.84	21.20	12.55	33.75	62.81
Within Region	74.77	31.86	59.90		67.61	26.16	51.79		68.39	27.56	53.21	
Outside Region	25.23	68.14	40.10		32.39	73.84	48.21		31.61	72.44	46.79	
MEXICO	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	33.98	6.89	40.87	83.13	33.95	8.56	42.51	79.85	36.10	7.38	43.48	83.02
Within Region	81.28	38.37	74.04		74.08	32.06	65.61		75.84	31.05	68.24	
Outside Region	18.72	61.63	25.96		25.92	67.94	34.39		24.16	68.95	31.76	

USA	2005				2010				2015			
	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	10.76	19.15	29.91	35.98	11.05	18.38	29.43	37.56	9.48	18.67	28.15	33.67
Within Region	35.60	40.45	38.71		29.62	31.58	30.84		29.08	32.51	31.35	
Outside Region	64.40	59.55	61.29		70.38	68.42	69.16		70.92	67.49	68.65	

Table 7: Participation in GVC (2005, 2010, and 2015) by immediate trading partner

	2005				2010				2015			
CHINA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	26.27	13.41	39.68	66.20	21.08	13.94	35.02	60.20	17.32	15.40	32.72	52.93
Within Region	28.47	45.74	34.31		27.34	43.75	33.87		28.45	44.47	35.99	
Outside Region	71.53	54.26	65.69		72.66	56.25	66.13		71.55	55.53	64.01	
JAPAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	10.18	21.04	31.22	32.60	12.16	20.42	32.58	37.32	13.23	19.45	32.68	40.48
Within Region	47.05	64.15	58.58		54.30	67.84	62.79		52.72	66.20	60.74	
Outside Region	52.95	35.85	41.42		45.70	32.16	37.21		47.28	33.80	39.26	
KOREA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	32.71	16.83	49.54	66.03	38.19	14.62	52.81	72.31	32.58	15.79	48.37	67.37
Within Region	50.12	65.84	55.46		50.70	65.08	54.68		55.84	69.36	60.25	
Outside Region	49.88	34.16	44.54		49.30	34.92	45.32		44.16	30.64	39.75	
TAIWAN	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	37.12	18.47	55.59	66.77	41.49	16.64	58.12	71.38	32.42	19.61	52.03	62.31
Within Region	59.42	75.64	64.81		64.01	78.44	68.14		68.56	80.95	73.23	
Outside Region	40.58	24.36	35.19		35.99	21.56	31.86		31.44	19.05	26.77	
MALAYSIA	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	44.99	12.89	57.88	77.73	40.57	13.91	54.48	74.47	36.91	15.00	51.92	71.10
Within Region	45.12	69.84	50.63		55.98	75.19	60.88		61.44	75.75	65.58	
Outside Region	54.88	30.16	49.37		44.02	24.81	39.12		38.56	24.25	34.42	
SINGAPORE	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	42.80	16.42	59.22	72.27	41.27	16.22	57.49	71.79	40.93	16.57	57.50	71.18
Within Region	56.71	61.34	57.99		56.17	58.26	56.76		56.37	51.12	54.85	
Outside Region	43.29	38.66	42.01		43.83	41.74	43.24		43.63	48.88	45.15	
THAILAND	**Backward Linkages**	**Forward Linkages**	**GVC**	**Downstreamness**	**(4)**	**(5)**	**(6)**	**(7)**	**(4)**	**(5)**	**(6)**	**(7)**
World	38.43	12.32	50.75	75.72	36.02	12.04	48.06	74.95	33.56	11.16	44.72	75.05
Within Region	49.95	66.75	54.03		50.77	67.85	55.05		50.83	65.90	54.59	
Outside Region	50.05	33.25	45.97		49.23	32.15	44.95		49.17	34.10	45.41	

	2005				**2010**				**2015**			
VIETNAM	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	36.08	11.44	47.52	75.93	40.51	9.97	50.48	80.25	44.52	9.07	53.59	83.07
Within Region	39.74	61.00	44.86		39.54	59.77	43.54		45.17	64.58	48.45	
Outside Region	60.26	39.00	55.14		60.46	40.23	56.46		54.83	35.42	51.55	
FRANCE	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	20.42	15.33	35.75	57.12	22.08	15.88	37.96	58.17	21.36	17.19	38.55	55.41
Within Region	64.70	73.99	68.69		60.20	74.00	65.97		55.81	73.92	63.89	
Outside Region	35.30	26.01	31.31		39.80	26.00	34.03		44.19	26.08	36.11	
GERMANY	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	18.64	17.81	36.46	51.14	21.51	17.80	39.31	54.71	20.99	18.53	39.52	53.11
Within Region	65.64	74.59	70.01		61.48	73.84	67.08		57.28	72.33	64.34	
Outside Region	34.36	25.41	29.99		38.52	26.16	32.92		42.72	27.67	35.66	
ITALY	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	20.46	14.39	34.85	58.71	23.96	14.26	38.22	62.69	22.20	15.04	37.23	59.61
Within Region	63.66	74.60	68.18		59.64	75.23	65.46		54.69	72.85	62.02	
Outside Region	36.34	25.40	31.82		40.36	24.77	34.54		45.31	27.15	37.98	
SPAIN	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	22.99	12.89	35.88	64.07	21.95	13.67	35.61	61.62	22.70	14.25	36.94	61.44
Within Region	73.43	78.66	75.31		67.42	77.53	71.30		63.44	76.78	68.59	
Outside Region	26.57	21.34	24.69		32.58	22.47	28.70		36.56	23.22	31.41	
UK	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	14.30	17.78	32.08	44.59	17.45	18.09	35.54	49.11	15.08	18.94	34.01	44.33
Within Region	54.52	69.14	62.62		52.73	72.30	62.69		47.80	72.51	61.56	
Outside Region	45.48	30.86	37.38		47.27	27.70	37.31		52.20	27.49	38.44	
CANADA	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	19.59	10.39	29.98	65.35	20.70	12.77	33.48	61.84	21.20	12.55	33.75	62.81
Within Region	77.85	53.02	69.25		72.57	53.26	65.20		72.23	57.24	66.65	
Outside Region	22.15	46.98	30.75		27.43	46.74	34.80		27.77	42.76	33.35	
MEXICO	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	33.98	6.89	40.87	83.13	33.95	8.56	42.51	79.85	36.10	7.38	43.48	83.02
Within Region	84.07	67.27	81.24		77.35	67.26	75.32		78.75	57.97	75.22	
Outside Region	15.93	32.73	18.76		22.65	32.74	24.68		21.25	42.03	24.78	

USA	2005				2010				2015			
	Backward Linkages	Forward Linkages	GVC	Downstreamness	(4)	(5)	(6)	(7)	(4)	(5)	(6)	(7)
World	10.76	19.15	29.91	35.98	11.05	18.38	29.43	37.56	9.48	18.67	28.15	33.67
Within Region	34.04	30.55	31.80		28.98	25.20	26.62		28.27	25.52	26.45	
Outside Region	65.96	69.45	68.20		71.02	74.80	73.38		71.73	74.48	73.55	

Table 8: Participation in GVC by top-10 sectors (2015)

	Participation of Asia (8)							
Sector	World	GVC	Sector	Within Region	(pp)	Sector	Outside Region	(pp)
5 to 20	Overall Manufacturing	41.32%	5 to 20	Overall Manufacturing	16.66	5 to 20	Overall Manufacturing	24.65
23 to 36	Overall Services	33.44%	23 to 36	Overall Services	11.87	23 to 36	Overall Services	21.57
9	Coke and refined petroleum products	72.18%	15	Computer, electronic and optical products	25.90	9	Coke and refined petroleum products	55.68
15	Computer, electronic and optical products	53.07%	2	Mining and extraction of energy producing products	23.28	13	Basic metals	35.27
13	Basic metals	52.19%	22	Construction	20.05	4	Mining support service activities	33.18
10	Chemicals and pharmaceutical products	48.86%	3	Mining and quarrying of non-energy producing products	17.27	10	Chemicals and pharmaceutical products	31.98
22	Construction	48.45%	13	Basic metals	16.92	22	Construction	28.40
4	Mining support service activities	47.7%	10	Chemicals and pharmaceutical products	16.88	11	Rubber and plastic products	27.49
2	Mining and extraction of energy producing products	45.03%	11	Rubber and plastic products	16.72	15	Computer, electronic and optical products	27.16
11	Rubber and plastic products	44.21%	9	Coke and refined petroleum products	16.51	29	Financial and insurance activities	27.05
3	Mining and quarrying of non-energy producing products	42.04%	27	Telecommunications	15.88	14	Fabricated metal products	25.79
14	Fabricated metal products	40.13%	16	Electrical equipment	14.99	24	Transportation and storage	25.11

	Participation of Europe (5)							
Sector	World	GVC	Sector	Within Region	(pp)	Sector	Outside Region	(pp)
5 to 20	Overall Manufacturing	43.29%	5 to 20	Overall Manufacturing	23.26	5 to 20	Overall Manufacturing	20.03
23 to 36	Overall Services	29.13%	23 to 36	Overall Services	15.08	23 to 36	Overall Services	14.05
9	Coke and refined petroleum products	68.48%	13	Basic metals	30.60	9	Coke and refined petroleum products	39.23
13	Basic metals	61.98%	9	Coke and refined petroleum products	29.25	13	Basic metals	31.37
11	Rubber and plastic products	51.06%	11	Rubber and plastic products	29.06	15	Computer, electronic and optical products	24.17
3	Mining and quarrying of non-energy producing products	49.11%	8	Paper products and printing	26.23	3	Mining and quarrying of non-energy producing products	24.13
2	Mining and extraction of energy producing products	47.48%	18	Motor vehicles, trailers and semi-trailers	25.93	19	Other transport equipment	23.02
4	Mining support service activities	46.76%	2	Mining and extraction of energy producing products	25.02	2	Mining and extraction of energy producing products	22.45

Sector	World	GVC	Sector	Within Region	(pp)	Sector	Outside Region	(pp)
10	Chemicals and pharmaceutical products	46.30%	3	Mining and quarrying of non-energy producing products	24.97	11	Rubber and plastic products	22.00
19	Other transport equipment	45.77%	4	Mining support service activities	24.85	4	Mining support service activities	21.92
16	Electrical equipment	45.5%	10	Chemicals and pharmaceutical products	24.84	16	Electrical equipment	21.70
8	Paper products and printing	44.31%	16	Electrical equipment	23.80	10	Chemicals and pharmaceutical products	21.45

			Participation of North America (3)					
Sector	World	GVC	Sector	Within Region	(pp)	Sector	Outside Region	(pp)
5 to 20	Overall Manufacturing	39.31%	5 to 20	Overall Manufacturing	14.52	5 to 20	Overall Manufacturing	24.79
23 to 36	Overall Services	21.91%	23 to 36	Overall Services	0.06	23 to 36	Overall Services	16.39
13	Basic metals	54.76%	18	Motor vehicles, trailers and semi-trailers	21.58	4	Mining support service activities	37.13
15	Computer, electronic and optical products	48.76%	13	Basic metals	20.28	15	Computer, electronic and optical products	35.94
18	Motor vehicles, trailers and semi-trailers	46.93%	11	Rubber and plastic products	19.49	13	Basic metals	34.48
16	Electrical equipment	45.82%	9	Coke and refined petroleum products	18.22	3	Mining and quarrying of non-energy producing products	32.16
3	Mining and quarrying of non-energy producing products	45.22%	16	Electrical equipment	17.48	16	Electrical equipment	28.34
4	Mining support service activities	43.65%	14	Fabricated metal products	16.93	29	Financial and insurance activities	28.24
11	Rubber and plastic products	42.61%	6	Textiles, wearing apparel, leather and related products	14.93	18	Motor vehicles, trailers and semi-trailers	25.35
14	Fabricated metal products	41.94%	3	Mining and quarrying of non-energy producing products	13.06	14	Fabricated metal products	25.01
9	Coke and refined petroleum products	41.04%	22	Construction	12.90	17	Machinery and equipment, nec	23.89
6	Textiles, wearing apparel, leather and related products	37.27%	15	Computer, electronic and optical products	12.82	10	Chemicals and pharmaceutical products	23.40

Table 9: Key downstream trade partners for selected sectors in Asia (2015)

With All Trading Partners (i.e., World)							
CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	SGP (31.77)	IND (11.21)	USA (10.59)	KOR (17.02)	KOR (17.01)	HKG (14.44)	SGP (38.91)	SGP (22.62)
2nd downstream partner	HKG (16.77)	KOR (9.58)	MEX (8.42)	ROW (9.39)	MEX (14.32)	KOR (10.32)	HKG (35.28)	HKG (13.88)
3rd downstream partner	VNM (12.25)	TWN (8.51)	ROW (7.13)	THA (8.13)	USA (12.6)	SGP (7.46)	LUX (3.82)	KOR (9.47)
JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	SGP (23.71)	CHN (25.68)	CHN (20.42)	THA (18.67)	CHN (50.07)	SGP (20.09)	LUX (23.69)	SGP (42.6)
2nd downstream partner	AUS (18.99)	KOR (17.13)	KOR (19.36)	CHN (17.89)	KOR (11.43)	ROW (13.23)	SGP (19.69)	NLD (12.2)
3rd downstream partner	HKG (14.24)	TWN (16.48)	TWN (12.12)	KOR (14.7)	TWN (9.52)	TWN (12.12)	GBR (10.12)	USA (6.37)
KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	CHN (26.58)	CHN (40.79)	CHN (28.88)	CHN (19.1)	CHN (76.51)	SGP (15.78)	SGP (29.31)	SGP (24.16)
2nd downstream partner	SGP (11.74)	TWN (8.36)	VNM (9.65)	THA (9.55)	VNM (4.43)	ROW (14.72)	IRL (13.16)	USA (8.4)
3rd downstream partner	AUS (8.73)	VNM (6.06)	MEX (8.9)	VNM (8.41)	MEX (4.3)	CHN (12.82)	LUX (11.6)	JPN (8.23)
TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	SGP (40.84)	CHN (47.44)	CHN (26.08)	CHN (24.34)	CHN (71.58)	SGP (23.4)	LUX (41.83)	SGP (27.73)
2nd downstream partner	MYS (12.99)	VNM (9.6)	USA (9.23)	THA (12.06)	KOR (10.72)	CHN (11.8)	SGP (12.78)	KOR (11.03)
3rd downstream partner	VNM (12.55)	THA (5.15)	KOR (8.08)	MYS (7.27)	MYS (3.94)	HKG (10.62)	IRL (11.05)	CHN (7.34)
MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	SGP (48.66)	CHN (25.69)	CHN (12.61)	IND (19.1)	CHN (58.11)	SGP (31.59)	SGP (26.61)	SGP (36.32)
2nd downstream partner	IDN (11.49)	THA (12.36)	THA (9.59)	THA (14.2)	MEX (10.29)	CHN (11.48)	LUX (14.27)	NLD (10.06)
3rd downstream partner	KOR (7.31)	IDN (6.88)	USA (7.34)	KOR (11.26)	THA (5.67)	ROW (8.15)	RUS (9.97)	HKG (5.04)
SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	MYS (21.36)	CHN (18.64)	MYS (17.6)	MYS (22.13)	CHN (27.16)	ROW (12)	LUX (55.14)	NLD (12.21)
2nd downstream partner	IDN (20.92)	DEU (9.9)	CHN (14.32)	HKG (14.5)	MYS (19.47)	DNK (11.83)	HKG (7.88)	USA (8.27)
3rd downstream partner	ROW (11.14)	MYS (8.61)	THA (12.72)	IND (11.02)	KOR (12.73)	JPN (7.83)	GBR (4.42)	IRL (7.83)
THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	SGP (36.29)	CHN (32.43)	CHN (16.17)	JPN (11.78)	CHN (52.26)	SGP (15.47)	IRL (41.9)	SGP (25.31)
2nd downstream partner	VNM (27.1)	VNM (10.34)	JPN (8.85)	IND (10.22)	MEX (9.63)	ROW (13.74)	HKG (19.49)	NLD (7.57)
3rd downstream partner	MYS (7.22)	MYS (8.53)	MYS (8.74)	HKG (10.15)	MYS (7.59)	CHN (10.49)	SGP (9.39)	USA (6.95)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st downstream partner	ROW (31.26)	CHN (21.67)	JPN (15.71)	THA (17.92)	CHN (38.56)	SGP (23.98)	SGP (26.17)	KOR (32.36)
2nd downstream partner	SGP (18.32)	IND (10.21)	CHN (13.26)	KOR (14.33)	KOR (11.36)	KOR (12.48)	LUX (14.28)	SGP (17.38)
3rd downstream partner	MYS (17.15)	JPN (9.35)	KOR (9.12)	MYS (10.2)	MYS (8.49)	ROW (11.43)	ROW (6.88)	NLD (5.7)

With Regional Trading Partners (i.e., Within Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Telecommunications	IT and other information services
1st downstream partner	SGP (33.62)	TWN (14.53)	USA (10.73)	KOR (19.67)	KOR (29.22)	HKG (22.33)	HKG (74.51)	SGP (30.06)
2nd downstream partner	HKG (19.13)	KOR (13.79)	JPN (10.71)	THA (10.26)	TWN (14.1)	KOR (14.12)	SGP (10.42)	JPN (17.67)
3rd downstream partner	VNM (11.58)	THA (8.62)	KOR (10.62)	VNM (9.93)	USA (8.47)	SGP (10.46)	KOR (3.72)	KOR (10.34)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	AUS (24.92)	TWN (25.2)	KOR (23.72)	THA (21.65)	CHN (36.51)	SGP (23.9)	SGP (30.02)	SGP (52.4)
2nd downstream partner	SGP (24.56)	KOR (22.1)	TWN (18.75)	KOR (15.82)	KOR (18.2)	TWN (15.6)	HKG (23.75)	MYS (9.36)
3rd downstream partner	HKG (15.89)	CHN (19.02)	CHN (15.74)	TWN (15.48)	TWN (17.16)	ROW (12.76)	KOR (12.97)	CHE (4.93)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	CHN (19.03)	CHN (34.63)	CHN (28.47)	CHN (16.19)	CHN (71.42)	SGP (20.21)	SGP (34.09)	SGP (45.91)
2nd downstream partner	SGP (14.52)	TWN (14.54)	VNM (14.84)	THA (12.75)	TWN (8.06)	ROW (15.35)	HKG (9.62)	CHN (7.07)
3rd downstream partner	AUS (13.64)	VNM (7.99)	USA (6.59)	VNM (11.46)	VNM (6.33)	JPN (11.54)	JPN (9.12)	MYS (6.09)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	SGP (41.84)	CHN (39.78)	CHN (24.04)	CHN (19.3)	CHN (59.47)	SGP (28.83)	HKG (35.11)	SGP (27.04)
2nd downstream partner	MYS (15.22)	VNM (12.63)	KOR (11.81)	THA (15.27)	KOR (19.67)	HKG (14.26)	SGP (32.34)	JPN (19.15)
3rd downstream partner	VNM (11.45)	MYS (8.06)	JPN (9.69)	MYS (11.14)	MYS (6.22)	JPN (8.14)	MYS (5.78)	MYS (15.23)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	SGP (49.97)	CHN (19.88)	THA (13.18)	THA (17.26)	CHN (51.91)	SGP (38.56)	SGP (55.21)	SGP (54.45)
2nd downstream partner	IDN (13)	THA (16.51)	SGP (11.72)	KOR (13.31)	TWN (9.35)	THA (8.49)	HKG (19.58)	AUS (3.96)
3rd downstream partner	KOR (7.22)	TWN (9.02)	CHN (10.76)	SGP (11.69)	KOR (9.13)	ROW (7.82)	ROW (3.73)	CHE (3.63)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	MYS (24.84)	CHN (16.53)	MYS (24.94)	MYS (28.16)	MYS (23.2)	ROW (11.89)	HKG (27.26)	MYS (24.01)
2nd downstream partner	IDN (23.91)	MYS (14.63)	THA (15.33)	HKG (15.06)	KOR (17.58)	HKG (10.3)	MYS (15.16)	JPN (11.81)
3rd downstream partner	AUS (10.91)	THA (10.01)	CHN (10.58)	IDN (10.44)	CHN (16.77)	MYS (9.25)	IDN (8.38)	AUS (10.43)

THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	SGP (39.12)	CHN (24.86)	MYS (13.83)	JPN (14.18)	CHN (44.47)	SGP (19.89)	SGP (36.23)	SGP (22.12)
2nd downstream partner	VNM (25.98)	MYS (12.67)	CHN (13.39)	MYS (12.39)	MYS (12.35)	ROW (13.92)	HKG (12.76)	HKG (15.25)
3rd downstream partner	MYS (8.89)	VNM (12.51)	JPN (12.01)	HKG (10.85)	KOR (10.72)	HKG (12.49)	ROW (10.05)	MYS (11.4)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st downstream partner	ROW (26.61)	CHN (16.66)	JPN (21.99)	THA (20.32)	CHN (31.96)	SGP (29.42)	HKG (46.2)	JPN (31.67)
2nd downstream partner	MYS (21.96)	JPN (12.68)	KOR (12.3)	KOR (15.67)	KOR (21.14)	KOR (14.2)	SGP (19.37)	SGP (18.42)
3rd downstream partner	SGP (20.54)	THA (12.06)	CHN (11.26)	MYS (14.32)	MYS (13.57)	ROW (11.14)	KOR (6.19)	AUS (11.4)

With Non-Regional Trading Partners (i.e., Outside Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Financial and insurance activities
1st downstream partner	SGP (30.15)	IND (13.39)	MEX (10.62)	KOR (15.68)	MEX (18.95)	USA (9.36)	HKG (10.36)	SGP (35.45)
2nd downstream partner	HKG (14.71)	ROW (7.57)	USA (10.55)	ROW (9.57)	USA (14.44)	MEX (8.96)	MEX (8.59)	HKG (30.8)
3rd downstream partner	VNM (12.83)	KOR (7.56)	CAN (7.7)	THA (7.05)	KOR (11.55)	KOR (7.97)	KOR (8.36)	LUX (5.9)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	SGP (22.94)	CHN (29.44)	CHN (22.67)	CHN (20.72)	CHN (56.52)	CHN (24.06)	SGP (17.51)	LUX (28.89)
2nd downstream partner	AUS (13.58)	KOR (14.32)	KOR (17.26)	THA (16.93)	KOR (8.21)	KOR (9.05)	ROW (13.54)	SGP (14.1)
3rd downstream partner	HKG (12.73)	TWN (11.56)	TWN (8.93)	KOR (14.04)	TWN (5.88)	IRL (8.32)	TWN (9.77)	GBR (11.47)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	CHN (31.6)	CHN (43.65)	CHN (29.03)	CHN (20.47)	CHN (78.31)	CHN (46.21)	CHN (15.01)	SGP (21.98)
2nd downstream partner	SGP (9.9)	TWN (5.49)	MEX (11.22)	IND (8.68)	MEX (5.33)	VNM (6.81)	ROW (14.35)	IRL (16.36)
3rd downstream partner	JPN (5.54)	VNM (5.16)	VNM (7.87)	USA (8.1)	VNM (3.75)	MEX (5.11)	SGP (13.12)	LUX (14.95)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	SGP (39.91)	CHN (51.05)	CHN (26.84)	CHN (26.91)	CHN (76.43)	CHN (39.12)	SGP (19.93)	LUX (48.8)
2nd downstream partner	VNM (13.57)	VNM (8.17)	USA (9.31)	THA (10.42)	KOR (7.14)	IRL (14.59)	CHN (14.63)	IRL (12.42)
3rd downstream partner	MYS (10.93)	IND (4.99)	MEX (7.67)	USA (7.07)	MYS (3.03)	SGP (6.8)	HKG (8.29)	SGP (8.79)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	SGP (47.45)	CHN (28.82)	CHN (13.4)	IND (23.17)	CHN (60.38)	CHN (30.17)	SGP (27.07)	SGP (20.3)
2nd downstream partner	IDN (10.11)	THA (10.12)	THA (8.05)	THA (12.52)	MEX (12.81)	SGP (8.56)	CHN (13.92)	LUX (18.45)
3rd downstream partner	KOR (7.4)	IND (7.09)	USA (7.76)	CHN (10.94)	USA (5.29)	IRL (7.37)	ROW (8.37)	RUS (11.16)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	IDN (18.06)	CHN (19.57)	CHN (16.26)	MYS (18.16)	CHN (33.48)	IRL (46.9)	DNK (14.63)	LUX (61.17)
2nd downstream partner	MYS (18.03)	DEU (11.92)	MYS (13.78)	IND (14.18)	MYS (17.2)	NLD (9.5)	ROW (12.06)	HKG (4.95)
3rd downstream partner	ROW (13.94)	BEL (7.97)	THA (11.36)	HKG (14.13)	KOR (9.79)	DEU (5.34)	JPN (7.09)	GBR (4.57)

THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	SGP (33.9)	CHN (36.48)	CHN (17.38)	IND (13.01)	CHN (55.24)	CHN (25.79)	ROW (13.63)	IRL (49.53)
2nd downstream partner	VNM (28.03)	VNM (9.18)	USA (8.59)	JPN (10.29)	MEX (12.13)	IRL (6.39)	SGP (12.82)	HKG (13.57)
3rd downstream partner	ROW (8.13)	IND (8.55)	ROW (8.33)	HKG (9.72)	USA (5.93)	VNM (6.33)	CHN (12.4)	SGP (6.83)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st downstream partner	ROW (34.9)	CHN (24.35)	CHN (14.09)	THA (16.5)	CHN (41.14)	CHN (25.06)	SGP (20.47)	SGP (19.38)
2nd downstream partner	SGP (16.58)	IND (12.76)	JPN (13.1)	KOR (13.54)	MEX (9.77)	KOR (9.13)	ROW (11.61)	LUX (18.1)
3rd downstream partner	MYS (13.39)	JPN (7.58)	DEU (8.72)	IND (10.39)	KOR (7.54)	JPN (6.62)	KOR (11.37)	ROW (6.15)

Table 10: Key downstream trade partners for selected sectors in Europe (2015)

With All Trading Partners (i.e., World)

FRANCE	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	BEL (22.82)	DEU (16.72)	DEU (17.97)	DEU (26.17)	DEU (34.68)	ROW (17.19)	LUX (31.67)	IRL (17.88)
2nd downstream partner	DEU (15.65)	ITA (8.63)	ESP (9.61)	ITA (15.4)	CHN (14.84)	BEL (10.05)	IRL (18.38)	BEL (14.04)
3rd downstream partner	NLD (10.46)	ESP (7.02)	ITA (7.91)	ESP (10.08)	USA (10.92)	DEU (6.61)	GBR (8.27)	NLD (9.68)

GERMANY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	FRA (10.92)	CHE (8.76)	CZE (10.64)	AUT (11.23)	FRA (64.55)	DNK (18.52)	LUX (44.41)	NLD (11.85)
2nd downstream partner	NLD (9.7)	FRA (8.6)	CHE (8.15)	FRA (10.95)	CHN (4.91)	ROW (7.4)	IRL (16.52)	LUX (8.62)
3rd downstream partner	BEL (9.15)	ITA (6.9)	FRA (7.78)	ITA (9.66)	GBR (4.74)	SGP (7.02)	GBR (6.7)	FRA (8.32)

ITALY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	ROW (14.83)	DEU (16.12)	DEU (18.03)	DEU (20.58)	FRA (28.12)	DEU (11.59)	LUX (58.36)	IRL (17.55)
2nd downstream partner	FRA (13.38)	CHE (13.19)	FRA (12.09)	FRA (11.84)	GBR (9.49)	ROW (9.84)	IRL (26.19)	GBR (10.37)
3rd downstream partner	ESP (10.08)	FRA (8.13)	ESP (7.14)	ESP (5.91)	DEU (6.91)	FRA (8.34)	DEU (1.83)	DEU (8.54)

SPAIN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	PRT (13.97)	FRA (10.77)	FRA (16.52)	ITA (14.49)	FRA (44.42)	ROW (17.37)	LUX (32.57)	FRA (13.7)
2nd downstream partner	FRA (11.84)	DEU (10.11)	PRT (14.79)	FRA (13.62)	GBR (14.72)	FRA (11.01)	IRL (11.49)	DEU (9.94)
3rd downstream partner	ROW (9.95)	CHE (9.89)	DEU (12.18)	PRT (13.37)	ITA (9.46)	BEL (10.52)	GBR (9.19)	GBR (9.58)

UK	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	IRL (30.95)	DEU (14.84)	DEU (13.73)	DEU (11.91)	FRA (32.68)	ROW (15.52)	LUX (45.75)	IRL (24.94)
2nd downstream partner	BEL (16.05)	CHE (8.61)	IRL (12.65)	IND (11.46)	DEU (15.87)	DNK (12.13)	IRL (13.29)	FRA (9.58)
3rd downstream partner	USA (9.81)	USA (7.01)	FRA (9.5)	HKG (9.77)	USA (8.29)	SGP (9.7)	DEU (6.1)	LUX (8.25)

With Regional Trading Partners (i.e., Within Region)

FRANCE	Paper products and printing	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	DEU (22.54)	BEL (28.86)	DEU (18.56)	DEU (27.62)	ESP (28.02)	BEL (16.03)	LUX (40.54)	IRL (17.96)
2nd downstream partner	ESP (12.47)	DEU (17.03)	ESP (11.57)	ITA (15.88)	DEU (17.9)	ROW (13.66)	IRL (16.57)	BEL (17.35)
3rd downstream partner	BEL (12.12)	NLD (12.39)	ITA (8.05)	ESP (12.1)	BEL (10.87)	DEU (8.88)	BEL (7.41)	NLD (12.5)

GERMANY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	POL (12.77)	CZE (11.89)	CZE (14.47)	AUT (13.85)	CZE (11.2)	DNK (18.56)	LUX (53.71)	NLD (14.61)
2nd downstream partner	FRA (9.59)	FRA (10.82)	POL (9.87)	FRA (12.18)	ESP (11.15)	FRA (7.49)	IRL (14.06)	LUX (11.9)
3rd downstream partner	AUT (9.38)	BEL (10.77)	FRA (8.23)	ITA (10.02)	HUN (7.44)	ROW (6.21)	GBR (5.13)	BEL (8.62)

ITALY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	DEU (17.87)	FRA (15.61)	DEU (18.73)	DEU (21.22)	DEU (23.27)	DEU (13.88)	LUX (67.58)	IRL (17.89)
2nd downstream partner	FRA (14.52)	ESP (13.17)	FRA (13.09)	FRA (12.8)	ESP (12.13)	FRA (9.64)	IRL (21.24)	GBR (9.44)
3rd downstream partner	ESP (7.82)	ROW (9.79)	ESP (8.63)	ESP (6.92)	FRA (9.97)	ROW (7.24)	DEU (1.59)	LUX (9.4)

SPAIN	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	PRT (26.24)	PRT (20.11)	FRA (18.25)	PRT (16.8)	DEU (26.67)	BEL (15.15)	LUX (42.29)	FRA (14.87)
2nd downstream partner	FRA (18.46)	FRA (15.32)	PRT (18.19)	FRA (15.55)	FRA (14.42)	FRA (12.97)	IRL (10.45)	NLD (11.83)
3rd downstream partner	DEU (12.43)	MAR (7.92)	DEU (12.84)	ITA (15.42)	ITA (10.56)	ROW (12.63)	GBR (7.43)	DEU (10.54)

UK	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	IRL (23.25)	IRL (34.21)	DEU (15.24)	DEU (16.97)	DEU (23.29)	ROW (14.08)	LUX (57.3)	IRL (27.19)
2nd downstream partner	DEU (14.08)	BEL (20.58)	IRL (12.7)	ESP (7.8)	ESP (13.65)	DNK (13.04)	IRL (11.65)	LUX (12.24)
3rd downstream partner	FRA (7.55)	NLD (9.5)	FRA (10.98)	CHE (7.46)	BEL (11.49)	IRL (7.78)	DEU (5.81)	FRA (10.71)

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With Non-Regional Trading Partners (i.e., Outside Region)

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FRANCE	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	BEL (17.42)	DEU (17.4)	DEU (24.96)	CHN (26.92)	DEU (27.57)	ROW (19.28)	LUX (20.73)	IRL (17.8)
2nd downstream partner	DEU (14.42)	ITA (7.78)	ITA (15)	KOR (10.55)	CHN (19.69)	CHN (7.01)	IRL (20.61)	BEL (10.7)
3rd downstream partner	USA (9.9)	ESP (7.69)	ESP (8.4)	DEU (6.39)	USA (12.97)	BEL (6.52)	GBR (10.3)	DEU (8.5)

GERMANY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	FRA (11.03)	CHE (9.2)	FRA (9.92)	CHN (33.31)	FRA (64.14)	DNK (18.49)	LUX (31.29)	NLD (8.96)
2nd downstream partner	ROW (9.9)	FRA (7.31)	ITA (9.35)	KOR (9.41)	CHN (6.62)	SGP (9.01)	IRL (19.99)	FRA (8.01)
3rd downstream partner	NLD (8.6)	CZE (6.66)	AUT (9.04)	MYS (6.75)	USA (4.83)	ROW (8.03)	GBR (8.91)	IRL (7.72)

ITALY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	ROW (18.55)	DEU (17.36)	DEU (20.03)	CHN (20.18)	FRA (29.08)	ROW (11.69)	LUX (43.73)	IRL (17.21)
2nd downstream partner	FRA (11.74)	FRA (11.13)	FRA (11.01)	TWN (7.76)	GBR (10.01)	DEU (9.96)	IRL (34.04)	GBR (11.31)
3rd downstream partner	KOR (8.41)	ROW (6.15)	ROW (7.45)	MEX (7.13)	USA (8.24)	FRA (7.41)	GBR (2.46)	DEU (8.32)

SPAIN	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	USA (12.01)	FRA (14.9)	ITA (13.77)	CHN (16.16)	FRA (45.72)	ROW (20.62)	LUX (20.87)	FRA (12.61)
2nd downstream partner	ROW (11.43)	PRT (11.62)	FRA (12.1)	MEX (12.57)	GBR (15.4)	FRA (9.66)	IRL (12.74)	GBR (10.11)
3rd downstream partner	PRT (10.18)	DEU (11.56)	DEU (11.69)	PRT (9.86)	ITA (8.85)	BEL (7.35)	GBR (11.31)	DEU (9.36)

UK	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st downstream partner	IRL (28.11)	IRL (12.62)	IND (14.09)	CHN (23.51)	FRA (32.31)	ROW (16.21)	LUX (30.6)	IRL (22.86)
2nd downstream partner	USA (14.72)	DEU (12.45)	HKG (12.19)	KOR (9.4)	DEU (12.95)	SGP (11.97)	IRL (15.44)	FRA (8.55)
3rd downstream partner	BEL (12.12)	FRA (8.23)	DEU (9.34)	DEU (7.67)	USA (9.53)	DNK (11.7)	SGP (7.62)	SGP (8.13)

Table 11: Key downstream trade partners for selected sectors in North America (2015)

With All Trading Partners (i.e., World)							
CANADA	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	USA (53.26)	USA (42.76)	USA (26.33)	USA (41.02)	USA (71.54)	USA (23.16)	LUX (43.53)	USA (30.4)
2nd downstream partner	MEX (25.05)	CHN (22.01)	CHN (25.08)	MEX (23)	MEX (18.55)	ROW (12.72)	USA (13.77)	GBR (9.78)
3rd downstream partner	ROW (8.46)	GBR (6.91)	MEX (13.47)	CHN (6.19)	ROW (2.05)	HKG (7.72)	IRL (7.28)	FRA (6.45)
MEXICO	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	USA (49.12)	USA (69.9)	USA (49.51)	USA (63.16)	USA (53.45)	USA (42.79)	IRL (40.14)	USA (25.88)
2nd downstream partner	CAN (14.65)	ROW (4.01)	CHN (21.73)	CAN (9.37)	CAN (21.24)	CAN (10.03)	ROW (17.51)	DEU (9.52)
3rd downstream partner	ROW (8.48)	CHN (3.93)	CAN (6.34)	CHN (5.81)	DEU (5.13)	CHN (7.05)	USA (12.85)	CAN (6.76)
US	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	MEX (36.23)	MEX (22.24)	CHN (29.19)	MEX (47.53)	MEX (38.65)	CHN (12.83)	LUX (28.88)	IRL (16.28)
2nd downstream partner	CAN (24.95)	CAN (18.31)	MEX (15.86)	CAN (9.32)	CAN (32.36)	SGP (11.81)	IRL (26.56)	NLD (11.26)
3rd downstream partner	CHN (5.55)	CHN (12.09)	KOR (11.13)	CHN (7.25)	DEU (8.29)	ROW (11.65)	GBR (5.66)	SGP (10.88)

With Regional Trading Partners (i.e., Within Region)							
CANADA	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Electrical equipment	Motor vehicles, trailers and semi-trailers	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Other business sector services
1st downstream partner	USA (86.71)	MEX (46.81)	USA (47.15)	MEX (47.33)	USA (70.34)	USA (51.99)	USA (33.5)	USA (39.73)
2nd downstream partner	ROW (2.9)	USA (43.62)	CHN (21.06)	USA (34.09)	MEX (26.56)	MEX (16.04)	MEX (10.81)	GBR (10.6)
3rd downstream partner	CHN (1.81)	ROW (3.3)	MEX (14.84)	CHN (4.98)	CHN (0.67)	CHN (9.62)	ROW (8.79)	IRL (5.32)
MEXICO	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st downstream partner	USA (31.33)	USA (47.48)	USA (74.07)	USA (60.99)	USA (53.01)	USA (53.97)	USA (45.96)	USA (30.89)
2nd downstream partner	SGP (23.44)	CAN (30.98)	CAN (7.61)	CAN (21.61)	CAN (36.65)	CAN (16.94)	CAN (24.96)	CAN (19.87)
3rd downstream partner	KOR (16.55)	CHN (4.36)	CHN (3.74)	CHN (5.77)	CHN (2.29)	CHN (7.62)	CHN (6.8)	DEU (6.83)
US	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st downstream partner	MEX (37.33)	MEX (52.4)	MEX (41.65)	MEX (70.6)	MEX (48.47)	MEX (39.97)	MEX (23.6)	CAN (21.08)
2nd downstream partner	CAN (27.44)	CAN (33.36)	CAN (27.97)	CAN (13.04)	CAN (42.67)	CAN (23.29)	CAN (21.31)	IRL (19.59)
3rd downstream partner	COL (6.19)	CHN (3.06)	CHN (8.45)	CHN (4.15)	DEU (2.5)	CHN (8.35)	CHN (13.66)	SGP (8.19)

					With Non-Regional Trading Partners (i.e., Outside Region)			
CANADA	Basic metals	Fabricated metal products	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st downstream partner	USA (40.88)	USA (60.25)	USA (27.39)	USA (45.14)	USA (73.33)	USA (20.3)	LUX (46.45)	USA (28.34)
2nd downstream partner	CHN (22.42)	CHN (6.07)	CHN (24.82)	MEX (8.53)	MEX (6.68)	ROW (13.8)	USA (12.76)	GBR (9.6)
3rd downstream partner	GBR (8.04)	MEX (5.38)	KOR (6.89)	KOR (7.01)	ROW (4.45)	HKG (8.51)	IRL (6.53)	FRA (6.89)
MEXICO	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	USA (68.06)	USA (72.5)	USA (49.29)	USA (64.14)	USA (53.92)	USA (41.37)	IRL (39.35)	USA (24.47)
2nd downstream partner	ROW (4.9)	ROW (6.63)	CHN (21.1)	CHN (5.83)	DEU (8.38)	CHN (7.16)	ROW (18.28)	DEU (10.27)
3rd downstream partner	CHN (4.02)	CAN (3.18)	KOR (4.45)	ROW (5.67)	CHN (4.99)	ROW (7.09)	USA (12.75)	SGP (6.15)
US	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st downstream partner	CHN (14.57)	MEX (15.26)	CHN (29.63)	MEX (22.79)	DEU (20.78)	SGP (13.95)	LUX (32.19)	IRL (15.44)
2nd downstream partner	CAN (11.71)	CAN (12.36)	KOR (13.56)	CHN (10.57)	MEX (17.48)	ROW (13.59)	IRL (24.84)	NLD (12.77)
3rd downstream partner	IND (11.03)	KOR (9.06)	MYS (9.27)	KOR (8.19)	CHN (10.27)	CHN (12.52)	GBR (5.32)	SGP (11.57)

Table 12: Key upstream trade partners for selected sectors in Asia based on Equation 2 (2015)

	With All Trading Partners (i.e., World)							
CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	KOR (46.87)	TWN (19.05)	KOR (17.03)	KOR (14.51)	KOR (29.92)	HKG (11.91)	LUX (16.83)	HKG (17.71)
2nd upstream partner	SGP (10.64)	KOR (17.81)	THA (13.94)	CAN (14.37)	TWN (22.17)	ROW (10.75)	HKG (16.2)	SGP (8.4)
3rd upstream partner	USA (8.05)	SGP (7.39)	TWN (12.36)	JPN (12.22)	MYS (13.25)	KOR (8.05)	SGP (15.8)	USA (7.63)
JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	KOR (36.61)	IRL (18.29)	CHN (23.21)	KOR (21.16)	CHN (54.49)	SGP (20.27)	LUX (36.37)	USA (17.53)
2nd upstream partner	USA (12.78)	CHN (10.08)	THA (17.99)	CHN (12.86)	TWN (7.39)	KOR (11.54)	IRL (16.3)	SGP (8.54)
3rd upstream partner	ROW (11.35)	CHE (7.79)	VNM (12.89)	TWN (8.28)	KOR (5.43)	DNK (10.52)	GBR (12.91)	KOR (6.12)
KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (15.56)	JPN (17.04)	CHN (19.67)	CHN (31.23)	CHN (46.54)	SGP (14.37)	LUX (20.04)	USA (17.21)
2nd upstream partner	SGP (13.01)	CHN (15.18)	JPN (19.01)	JPN (16.17)	TWN (13.04)	HKG (9.08)	SGP (14.53)	ROW (9.37)
3rd upstream partner	IND (10.7)	DEU (8.86)	TWN (7.7)	IND (6.1)	SGP (10.38)	ROW (9.05)	USA (11.7)	IRL (7.63)
TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	KOR (28.22)	JPN (17.72)	JPN (24.86)	JPN (24.13)	CHN (39.7)	HKG (19.44)	LUX (39.92)	USA (11.72)
2nd upstream partner	ROW (12.98)	KOR (14.88)	CHN (17.87)	CHN (20.32)	SGP (17.16)	JPN (14.98)	IRL (22.08)	HKG (10.41)
3rd upstream partner	IND (9.79)	CHN (14.44)	THA (11.65)	KOR (10.71)	KOR (11.76)	SGP (14.13)	HKG (6.98)	JPN (10.22)
MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	SGP (48.47)	SGP (18.87)	THA (33.72)	CHN (17.93)	CHN (29.92)	SGP (30.69)	SGP (20.86)	SGP (19.49)
2nd upstream partner	TWN (13.79)	TWN (11.57)	CHN (14.94)	IND (13.16)	SGP (27.44)	HKG (11.23)	LUX (20.21)	USA (8.34)
3rd upstream partner	KOR (9.68)	KOR (9.84)	VNM (7.52)	KOR (12.32)	TWN (8.74)	ROW (6.05)	IRL (19.65)	JPN (7)
SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	TWN (18.74)	KOR (13.27)	MYS (28.58)	CHN (18.48)	CHN (17.26)	ROW (10.06)	LUX (26.22)	JPN (12.67)
2nd upstream partner	KOR (12.91)	MYS (7.89)	CHN (9.71)	MYS (16.07)	MYS (13.74)	DNK (10.03)	HKG (11.19)	USA (12.44)
3rd upstream partner	THA (11.97)	FRA (7.45)	THA (8.21)	JPN (14.05)	KOR (11.81)	KOR (7.18)	IRL (10.78)	NLD (5.89)
THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	SGP (28.73)	CHN (13.55)	CHN (21.09)	JPN (22.71)	CHN (39.76)	SGP (19.6)	SGP (17.69)	SGP (16.87)
2nd upstream partner	ROW (21.26)	SGP (12.13)	MYS (14.44)	CHN (17.07)	MYS (14.04)	ROW (15.72)	LUX (17.58)	ROW (8.78)
3rd upstream partner	KOR (19.47)	TWN (10.11)	JPN (12.61)	KOR (13.88)	SGP (10.94)	HKG (6.37)	IRL (13.93)	USA (8.29)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	THA (28.41)	TWN (20.7)	KOR (26.15)	CHN (35.68)	CHN (39.36)	SGP (29.58)	LUX (63.08)	SGP (20.51)
2nd upstream partner	SGP (26.42)	KOR (15.17)	CHN (19.73)	KOR (26.04)	KOR (28.99)	KOR (13.15)	IRL (5.85)	THA (8.78)
3rd upstream partner	TWN (18.55)	CHN (13.41)	THA (19.61)	TWN (9.38)	SGP (8.3)	DNK (6.78)	SGP (5.37)	USA (6.81)

With Regional Trading Partners (i.e., Within Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Telecommunications	IT and other information services
1st upstream partner	KOR (35.78)	TWN (24.08)	THA (21.36)	KOR (18.38)	KOR (29.93)	HKG (20.58)	HKG (19.68)	SGP (25)
2nd upstream partner	SGP (22.86)	KOR (19)	KOR (18.21)	TWN (17.13)	TWN (24.02)	SGP (11.93)	THA (14.72)	IRL (14.92)
3rd upstream partner	ROW (8.7)	SGP (11.19)	TWN (15.72)	JPN (14.96)	MYS (15.84)	ROW (10.16)	ROW (11.56)	IND (14.86)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	KOR (28.18)	CHN (12.91)	THA (21.63)	KOR (23.02)	CHN (58.68)	SGP (25.56)	USA (14.34)	IRL (50.24)
2nd upstream partner	ROW (18.04)	KOR (10.45)	VNM (20.62)	TWN (10.46)	TWN (7.68)	HKG (15.11)	VNM (14)	SGP (10.46)
3rd upstream partner	MYS (11.05)	TWN (9.92)	CHN (16.54)	THA (7.65)	KOR (6.09)	KOR (11.14)	ROW (12.28)	USA (7.2)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	SGP (23.42)	JPN (21.69)	JPN (21.81)	CHN (21.67)	CHN (47.92)	SGP (19.9)	USA (24.01)	IND (27.52)
2nd upstream partner	ROW (21.79)	CHN (15.15)	CHN (16.11)	JPN (18.25)	TWN (14.86)	HKG (17.2)	THA (13.21)	SGP (20.49)
3rd upstream partner	MYS (12.09)	SGP (8.99)	THA (11.27)	MYS (8.18)	SGP (8.22)	ROW (8.7)	ROW (11.75)	IRL (9.77)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	KOR (21.76)	JPN (21)	JPN (26.95)	JPN (24.31)	CHN (41.63)	HKG (31)	ROW (17.91)	IRL (47.34)
2nd upstream partner	ROW (20.35)	KOR (17.62)	THA (15.97)	CHN (13.1)	SGP (13.65)	SGP (16.55)	USA (16.1)	IND (16.62)
3rd upstream partner	JPN (9.33)	CHN (14.31)	CHN (14.81)	KOR (12.76)	KOR (13.65)	JPN (14.07)	THA (13.7)	SGP (7.13)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	SGP (64.57)	SGP (21.92)	THA (40.58)	KOR (13.8)	CHN (33.95)	SGP (36.64)	SGP (17.92)	SGP (28.55)
2nd upstream partner	TWN (9.57)	TWN (12.86)	CHN (11.65)	IND (12.67)	SGP (20.98)	HKG (18.72)	USA (16.21)	IND (24.96)
3rd upstream partner	ROW (4.83)	KOR (10.64)	VNM (11.32)	TWN (11.56)	TWN (9.94)	ROW (5.4)	ROW (11)	IRL (11.83)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	TWN (19.02)	KOR (17.1)	MYS (36.5)	MYS (26.59)	CHN (20.89)	ROW (10.58)	MYS (23.37)	IND (29.25)
2nd upstream partner	MYS (18.49)	MYS (14.75)	THA (10.72)	JPN (12.83)	MYS (16.77)	MYS (8.63)	USA (15.65)	MYS (11.89)
3rd upstream partner	THA (15.09)	TWN (9.67)	IDN (8.92)	IDN (12.79)	KOR (14.62)	JPN (8.13)	ROW (14.63)	USA (10.52)

THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	SGP (39.67)	SGP (14.64)	MYS (19.23)	JPN (20.64)	CHN (42.82)	SGP (25.05)	ROW (20.25)	SGP (27.19)
2nd upstream partner	ROW (23.75)	CHN (12.92)	CHN (18.12)	KOR (14.98)	MYS (15.81)	ROW (14.49)	MYS (17.41)	IND (17.31)
3rd upstream partner	KOR (10.85)	MYS (12.49)	JPN (13.44)	TWN (11.03)	SGP (8.07)	HKG (11.06)	SGP (13.39)	USA (14.34)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	SGP (36.69)	TWN (22.58)	KOR (26.02)	KOR (29.75)	CHN (41.64)	SGP (37.32)	THA (35.68)	IRL (33.33)
2nd upstream partner	THA (29.49)	KOR (15.72)	THA (25.12)	CHN (23.51)	KOR (31.37)	KOR (12.59)	USA (10.87)	IND (27.13)
3rd upstream partner	TWN (15.84)	CHN (12.44)	CHN (16.3)	TWN (13.03)	SGP (6)	HKG (10.59)	SGP (10.11)	SGP (9.23)

With Non-Regional Trading Partners (i.e., Outside Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Financial and insurance activities
1st upstream partner	KOR (48.31)	TWN (17.63)	KOR (16.57)	CAN (16.33)	KOR (29.9)	KOR (9.75)	ROW (10.94)	LUX (18.85)
2nd upstream partner	SGP (9.06)	KOR (17.48)	DEU (11.95)	KOR (13.77)	TWN (20.8)	DEU (6.84)	HKG (9.13)	IRL (13.77)
3rd upstream partner	USA (8.86)	JPN (6.75)	TWN (11.05)	JPN (11.7)	MYS (11.33)	ROW (6.7)	USA (8.6)	HKG (12.93)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	KOR (37.78)	IRL (20.89)	CHN (27.64)	KOR (20.54)	CHN (50.05)	SGP (15.34)	SGP (18.55)	LUX (38.6)
2nd upstream partner	USA (14.05)	CHN (9.44)	THA (15.57)	CHN (14.67)	TWN (7.09)	ROW (6.77)	DNK (11.74)	IRL (18.15)
3rd upstream partner	IND (11.63)	CHE (8.79)	VNM (7.76)	TWN (7.56)	CHE (6.45)	USA (6.58)	KOR (11.67)	GBR (12.76)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (14.51)	JPN (15.55)	CHN (21.65)	CHN (33.96)	CHN (45.15)	SGP (9.55)	SGP (12.31)	LUX (22.71)
2nd upstream partner	USA (11.77)	CHN (15.19)	JPN (17.45)	JPN (15.57)	SGP (12.54)	ROW (8.39)	DNK (9.55)	IRL (13.49)
3rd upstream partner	IND (11.33)	DEU (10.24)	DEU (8.25)	IND (5.81)	TWN (11.22)	JPN (7.58)	ROW (9.18)	SGP (11.93)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	KOR (29.23)	JPN (16.5)	JPN (23.54)	JPN (24.07)	CHN (37.75)	SGP (18.62)	JPN (15.43)	LUX (42.61)
2nd upstream partner	ROW (11.82)	CHN (14.49)	CHN (19.82)	CHN (22.9)	SGP (20.69)	JPN (11.59)	HKG (13.75)	IRL (24.81)
3rd upstream partner	IND (10.22)	KOR (13.85)	THA (8.91)	KOR (9.98)	KOR (9.86)	ROW (9.3)	SGP (12.93)	SGP (5)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	SGP (44.88)	SGP (17.6)	THA (28.36)	CHN (20.52)	SGP (34.39)	SGP (23.34)	SGP (27.91)	IRL (22.98)
2nd upstream partner	TWN (14.73)	TWN (11.03)	CHN (17.51)	IND (13.35)	CHN (25.59)	THA (9.69)	HKG (7.72)	LUX (22.42)
3rd upstream partner	KOR (10.77)	CHN (9.63)	KOR (5.95)	KOR (11.75)	TWN (7.44)	ROW (4.91)	ROW (6.35)	SGP (16.76)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	TWN (18.69)	KOR (12)	MYS (23.15)	CHN (21.41)	NLD (19.15)	ROW (8.52)	DNK (11.32)	LUX (29.43)
2nd upstream partner	KOR (13.63)	FRA (8.95)	CHN (10.78)	JPN (14.55)	CHN (13.82)	IRL (8.1)	ROW (9.88)	IRL (12.28)
3rd upstream partner	THA (11.41)	USA (6.81)	DEU (7.95)	MYS (11.75)	MYS (10.87)	JPN (8.08)	KOR (6.88)	GBR (9.83)
THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	SGP (26.19)	CHN (13.81)	CHN (23.01)	JPN (23.58)	CHN (36.02)	SGP (16.43)	SGP (17.2)	LUX (19.67)
2nd upstream partner	KOR (21.47)	SGP (11.07)	JPN (12.08)	CHN (19.82)	SGP (14.44)	JPN (10.14)	ROW (16.27)	IRL (16.49)
3rd upstream partner	ROW (20.69)	TWN (9.49)	MYS (11.34)	KOR (13.43)	MYS (11.87)	ROW (8.94)	KOR (5.17)	SGP (14.2)
VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	THA (28.16)	TWN (19.84)	KOR (26.24)	CHN (40.34)	CHN (36.36)	KOR (16.32)	SGP (26.03)	LUX (66.01)
2nd upstream partner	SGP (24.13)	KOR (14.92)	CHN (22.24)	KOR (24.63)	KOR (25.85)	THA (11.23)	KOR (13.41)	IRL (6.45)
3rd upstream partner	TWN (19.15)	CHN (13.85)	THA (15.59)	JPN (8.68)	SGP (11.33)	CHN (9.37)	DNK (7.99)	SGP (4.01)

Table 13: Key upstream trade partners for selected sectors in Asia based on Equation 3 (2015)

	With All Trading Partners (i.e., World)							
CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	ROW (31.78)	KOR (14.45)	JPN (21.68)	JPN (13.92)	KOR (29.97)	USA (19.48)	USA (37.28)	USA (28.43)
2nd upstream partner	RUS (16.17)	JPN (13.98)	KOR (17.13)	AUS (12.61)	TWN (26.39)	ROW (10.81)	HKG (9.71)	DEU (8.29)
3rd upstream partner	USA (15.38)	USA (12.77)	DEU (10.03)	USA (11.34)	JPN (9.94)	JPN (7.82)	SGP (9.47)	HKG (7.57)
JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (33.53)	CHN (26.59)	CHN (46.24)	CHN (18.1)	CHN (62.06)	KOR (11.55)	USA (44.05)	USA (41.82)
2nd upstream partner	USA (16.53)	USA (20.8)	THA (9.6)	KOR (11.04)	TWN (7.71)	ROW (11.08)	GBR (21.41)	GBR (7.56)
3rd upstream partner	RUS (10.92)	DEU (6.9)	IDN (7.26)	RUS (9.02)	USA (7.46)	USA (10.23)	CHE (5.52)	ROW (4.81)
KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (36.57)	CHN (25.26)	CHN (31.61)	CHN (42.23)	CHN (50.27)	CHN (14.73)	USA (52.75)	USA (37.68)
2nd upstream partner	RUS (17.48)	JPN (23.77)	JPN (30.6)	JPN (15.65)	TWN (12.72)	JPN (13.49)	GBR (11.31)	ROW (8.32)
3rd upstream partner	SAU (10.26)	USA (16.55)	USA (8.09)	USA (6.14)	USA (8.83)	USA (12.26)	HKG (6.16)	JPN (6.7)
TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (40.95)	JPN (24.05)	JPN (38.02)	CHN (28.05)	CHN (44.74)	JPN (32.49)	USA (31.15)	USA (30.27)
2nd upstream partner	RUS (11.75)	CHN (23.59)	CHN (26.74)	JPN (24.7)	JPN (12.56)	HKG (8.85)	GBR (12.68)	JPN (16.98)
3rd upstream partner	SAU (9.99)	USA (13.92)	USA (7.41)	IDN (7.84)	KOR (9.35)	CHN (8.5)	HKG (9.14)	ROW (7.79)
MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (30.62)	CHN (18.91)	CHN (30.45)	CHN (28.04)	CHN (32.37)	CHN (11.02)	USA (41.82)	USA (23.37)
2nd upstream partner	SGP (15.3)	USA (10.04)	THA (17.16)	AUS (13.69)	SGP (16.15)	SGP (10.1)	SGP (13.51)	JPN (14.84)
3rd upstream partner	CHN (7.65)	JPN (8.73)	JPN (10.72)	JPN (12.61)	USA (13.92)	JPN (9.4)	GBR (12.97)	GBR (9.93)
SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (17.92)	USA (18.8)	CHN (19.81)	CHN (25.72)	CHN (20.68)	JPN (14.9)	USA (23.63)	USA (26.55)
2nd upstream partner	MYS (15.01)	SAU (10.8)	MYS (14.61)	IDN (18.65)	USA (16.47)	USA (11.82)	GBR (13.15)	JPN (22.11)
3rd upstream partner	RUS (11.11)	CHN (8.78)	JPN (12.27)	JPN (16.46)	KOR (12)	ROW (11.55)	IND (9.38)	GBR (5.5)
THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (61.61)	CHN (25.31)	CHN (34.69)	CHN (25.94)	CHN (43.67)	ROW (19.53)	USA (36.12)	USA (21.32)
2nd upstream partner	MYS (7)	JPN (14.3)	JPN (22.05)	JPN (25.56)	JPN (11.31)	JPN (9.89)	GBR (9.53)	ROW (9.54)
3rd upstream partner	SAU (6.7)	USA (10.17)	MYS (5.71)	AUS (10.59)	TWN (7.86)	CHN (9.44)	SGP (9.49)	JPN (7.67)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 29	Sector 31
1st upstream partner	THA (34.53)	CHN (29.01)	CHN (35.94)	CHN (55.42)	CHN (42.62)	CHN (21.47)	JPN (22.56)	USA (22.67)
2nd upstream partner	CHN (25.52)	KOR (10.98)	KOR (21.57)	KOR (13.69)	KOR (24.14)	KOR (11.77)	USA (20.35)	SGP (10.6)
3rd upstream partner	SGP (8.59)	TWN (7.91)	JPN (13.11)	JPN (9.45)	TWN (5.39)	SGP (9.84)	GBR (7.6)	RUS (6.77)

With Regional Trading Partners (i.e., Within Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Transportation and storage	Telecommunications	IT and other information services
1st upstream partner	KOR (48.87)	KOR (28.7)	JPN (34.55)	JPN (46.16)	KOR (36.38)	JPN (26.4)	HKG (36.23)	IND (64.46)
2nd upstream partner	JPN (11.1)	JPN (27.76)	KOR (27.31)	KOR (26.1)	TWN (32.04)	KOR (20.38)	IDN (10.34)	SGP (10.1)
3rd upstream partner	MYS (8.78)	TWN (15.19)	THA (12.45)	TWN (10.2)	JPN (12.06)	HKG (13.48)	SGP (8.51)	JPN (7.34)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	KOR (25.23)	CHN (55.45)	CHN (55.96)	CHN (38.49)	CHN (75.58)	KOR (27.61)	PHL (23.79)	IND (50.15)
2nd upstream partner	IND (22.7)	KOR (13.21)	THA (11.62)	KOR (23.49)	TWN (9.39)	CHN (23.79)	HKG (16.74)	SGP (17.06)
3rd upstream partner	MYS (21.24)	TWN (7.29)	IDN (8.79)	IDN (15.96)	KOR (5.21)	SGP (18.56)	KOR (14.85)	CHN (12.54)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	MYS (28.54)	CHN (42.29)	CHN (41.68)	CHN (63.2)	CHN (62.51)	CHN (34.13)	JPN (32.32)	IND (74.24)
2nd upstream partner	IND (24.19)	JPN (39.8)	JPN (40.35)	JPN (23.43)	TWN (15.81)	JPN (31.26)	IDN (16.77)	SGP (9.08)
3rd upstream partner	JPN (19.47)	SGP (3.28)	TWN (4.58)	IND (4.67)	JPN (9.08)	HKG (9.3)	PHL (12.78)	CHN (7.02)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	KOR (21.34)	JPN (37.95)	JPN (47.45)	CHN (39.4)	CHN (54.69)	JPN (51)	JPN (24.66)	IND (63.69)
2nd upstream partner	IND (21.12)	CHN (37.23)	CHN (33.38)	JPN (34.7)	JPN (15.36)	HKG (13.9)	HKG (14.08)	SGP (11.68)
3rd upstream partner	MYS (17.24)	KOR (12.53)	KOR (7.19)	IDN (11.02)	KOR (11.43)	CHN (13.33)	IDN (13.66)	JPN (11.2)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	SGP (28.45)	CHN (30.77)	CHN (38.15)	CHN (42.59)	CHN (42.65)	CHN (21.51)	SGP (21.53)	IND (71.64)
2nd upstream partner	CHN (14.22)	JPN (14.2)	THA (21.5)	JPN (19.16)	SGP (21.28)	SGP (19.71)	HKG (18.17)	SGP (12.14)
3rd upstream partner	THA (12.11)	SGP (13.57)	JPN (13.44)	IND (12.62)	TWN (12.62)	JPN (18.36)	IDN (16.25)	JPN (6.2)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	MYS (28.31)	CHN (22.54)	CHN (29.49)	CHN (34.12)	CHN (33.45)	JPN (36)	IDN (28.29)	IND (68.05)
2nd upstream partner	CHN (19.97)	JPN (20.59)	MYS (21.75)	IDN (24.74)	KOR (19.41)	CHN (11.87)	MYS (18.15)	JPN (11.72)
3rd upstream partner	THA (13.95)	KOR (19.47)	JPN (18.26)	JPN (21.83)	TWN (19.15)	KOR (11.84)	IND (13.56)	KOR (5.38)

THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	MYS (32.15)	CHN (38.21)	CHN (42.91)	CHN (37.29)	CHN (52.79)	JPN (21.64)	SGP (24.96)	SGP (46.76)
2nd upstream partner	JPN (17.72)	JPN (21.59)	JPN (27.27)	JPN (36.75)	JPN (13.67)	CHN (20.64)	IDN (20.52)	JPN (25.06)
3rd upstream partner	KOR (17.11)	KOR (7.86)	MYS (7.06)	KOR (9.95)	TWN (9.5)	SGP (12.39)	IND (13.26)	IND (22.44)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 24	Sector 27	Sector 28
1st upstream partner	THA (38.2)	CHN (39.28)	CHN (39.97)	CHN (63.69)	CHN (49.87)	CHN (32.8)	HKG (25.31)	IND (86.14)
2nd upstream partner	CHN (28.23)	KOR (14.86)	KOR (23.98)	KOR (15.73)	KOR (28.24)	KOR (17.99)	SGP (17.71)	SGP (4.01)
3rd upstream partner	SGP (9.5)	TWN (10.72)	JPN (14.58)	JPN (10.86)	TWN (6.3)	SGP (15.04)	IND (13.88)	JPN (2.81)

With Non-Regional Trading Partners (i.e., Outside Region)

CHINA	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Financial and insurance activities
1st upstream partner	ROW (44.95)	USA (25.72)	DEU (26.92)	AUS (18.05)	USA (40.88)	USA (28.67)	USA (27.68)	USA (51.07)
2nd upstream partner	RUS (22.88)	ROW (20.27)	USA (26.7)	USA (16.24)	DEU (17.99)	DEU (9.12)	ROW (15.36)	CHE (10.99)
3rd upstream partner	USA (21.75)	SAU (12.49)	ITA (6.01)	CAN (13.5)	CHE (8.57)	AUS (9.08)	AUS (10.12)	GBR (9.53)

JAPAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (45.01)	USA (39.96)	USA (37.57)	RUS (17.03)	USA (41.67)	USA (29.69)	ROW (19.04)	USA (50.64)
2nd upstream partner	USA (22.2)	DEU (13.26)	DEU (15.01)	USA (16.95)	CHE (17.93)	AUS (11.82)	USA (17.58)	GBR (24.61)
3rd upstream partner	RUS (14.66)	FRA (9.19)	GBR (6.08)	BRA (12.48)	DEU (10.33)	ROW (10.98)	DEU (12.32)	CHE (6.35)

KOREA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (44.88)	USA (41.09)	USA (33.48)	USA (18.49)	USA (45.11)	USA (32.86)	USA (21.56)	USA (65.28)
2nd upstream partner	RUS (21.46)	DEU (17.34)	DEU (20.36)	ROW (13.48)	DEU (13.31)	ROW (11.8)	ROW (17.59)	GBR (13.99)
3rd upstream partner	SAU (12.6)	FRA (5.74)	FRA (6.13)	AUS (12.49)	CHE (7.17)	DEU (8.02)	DEU (12.46)	CHE (4.28)

TAIWAN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (55)	USA (38)	USA (37.28)	USA (18.45)	USA (48.64)	USA (31.75)	ROW (22.5)	USA (41.52)
2nd upstream partner	RUS (15.79)	DEU (18.76)	ROW (16.09)	AUS (16.62)	DEU (13.02)	ROW (18.53)	USA (21.85)	GBR (16.9)
3rd upstream partner	SAU (13.41)	SAU (11.11)	DEU (15.49)	RUS (12.49)	ISR (10.88)	DEU (7.98)	DEU (9.1)	IRL (8.88)

MALAYSIA	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (66.25)	USA (26.04)	USA (33.5)	AUS (40.06)	USA (57.75)	USA (35.9)	ROW (18.29)	USA (54.19)
2nd upstream partner	USA (12.93)	SAU (19.73)	DEU (18.49)	TUR (15.25)	DEU (15.99)	AUS (13.02)	USA (16.06)	GBR (16.8)
3rd upstream partner	RUS (4.22)	ROW (12.39)	GBR (9.27)	ROW (10.47)	CHE (4.01)	DEU (8.87)	FRA (8.24)	CHE (6.47)

SINGAPORE	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (38.15)	USA (30.81)	USA (36.9)	AUS (18.16)	USA (43.14)	USA (30.46)	USA (20.17)	USA (35.87)
2nd upstream partner	RUS (23.66)	SAU (17.7)	DEU (16.99)	USA (14.04)	DEU (9.8)	ROW (16.48)	ROW (19.7)	GBR (19.95)
3rd upstream partner	USA (12.16)	FRA (11.52)	GBR (8.84)	DEU (12.89)	NLD (7.81)	RUS (7.28)	DEU (8.93)	CHE (11.81)

THAILAND	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (78.77)	USA (30.13)	USA (26.86)	AUS (34.78)	USA (40.92)	USA (27.69)	ROW (35.99)	USA (46.58)
2nd upstream partner	SAU (8.56)	SAU (12.65)	DEU (21.93)	ROW (20.25)	CHE (19.84)	ROW (15.72)	USA (12.8)	GBR (12.29)
3rd upstream partner	USA (5.18)	DEU (12.23)	ITA (6.37)	USA (14.58)	DEU (8.65)	AUS (12.11)	DEU (5.45)	NLD (10.61)

VIETNAM	Sector 9	Sector 10	Sector 11	Sector 13	Sector 15	Sector 23	Sector 24	Sector 29
1st upstream partner	ROW (50.75)	SAU (22.84)	ROW (21.63)	ROW (35.19)	ISR (34.66)	USA (27.61)	ROW (20.61)	USA (34.26)
2nd upstream partner	RUS (22.39)	ROW (17.15)	USA (17.5)	AUS (30.93)	USA (25.21)	ROW (14.17)	USA (12.83)	GBR (12.79)
3rd upstream partner	USA (8.85)	USA (16.84)	DEU (15.3)	USA (6.07)	ROW (18.06)	AUS (6.74)	DEU (8.49)	LUX (8.32)

Table 14: Key upstream trade partners for selected sectors in Europe based on Equation 2 (2015)

With All Trading Partners (i.e., World)							
FRANCE	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	DEU (16.62)	DEU (17.23)	DEU (18.83)	DEU (23.86)	DEU (35.61)	BEL (13.12)	LUX (56.42)	BEL (16.76)
2nd upstream partner	USA (14.14)	IRL (10.3)	ITA (10.47)	BEL (22.59)	USA (20.23)	ROW (7.99)	GBR (7.36)	GBR (11.29)
3rd upstream partner	ESP (11.08)	BEL (9.67)	ESP (7.45)	ITA (11.58)	GBR (10.87)	DEU (6.56)	CHE (6.73)	DEU (11.1)
GERMANY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	NLD (32.7)	NLD (12.21)	POL (9.78)	BEL (13.01)	FRA (52.02)	NLD (8.1)	LUX (63.89)	BEL (11.12)
2nd upstream partner	BEL (19.09)	CHE (10.95)	CZE (9.36)	FRA (11.54)	GBR (12.03)	AUT (6.65)	MLT (11.37)	FRA (9.76)
3rd upstream partner	RUS (7.83)	BEL (9.23)	CHE (8.18)	AUT (9.16)	USA (9.54)	POL (6.36)	GBR (5.99)	USA (7.83)
ITALY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	GRC (17.8)	DEU (16.02)	DEU (20.1)	DEU (15.35)	KOR (30.98)	IRL (8.51)	LUX (77.72)	FRA (10.84)
2nd upstream partner	ESP (12.89)	BEL (11.49)	FRA (8.76)	FRA (11.77)	GBR (10.56)	ROW (8.42)	IRL (13.15)	BEL (10.68)
3rd upstream partner	BEL (10.67)	CHE (10.79)	CHN (6.14)	ROW (6.68)	FRA (8.59)	FRA (7.25)	GBR (2.37)	IRL (9.7)
SPAIN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	PRT (22.38)	DEU (14.07)	DEU (17.3)	FRA (21.09)	FRA (24.74)	FRA (11.13)	LUX (57.75)	FRA (16.5)
2nd upstream partner	ITA (17.77)	FRA (11.06)	FRA (11.56)	DEU (12.03)	GBR (15.82)	ROW (8.41)	IRL (10.08)	GBR (10.72)
3rd upstream partner	USA (9.96)	IRL (10.02)	ITA (11.05)	ITA (11.44)	USA (11.27)	DEU (6.45)	GBR (9.68)	DEU (8.83)
UK	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (12.34)	DEU (14.93)	DEU (18.25)	CAN (15.47)	USA (28.34)	IRL (11.32)	LUX (31.8)	IRL (11.98)
2nd upstream partner	SWE (11.05)	CHE (14.04)	CHN (10.11)	DEU (13.69)	KOR (17.74)	DNK (6.7)	IRL (21.83)	FRA (11.91)
3rd upstream partner	BEL (10.9)	IRL (12.03)	IRL (6.09)	TUR (7.32)	FRA (15.49)	ESP (6.42)	MLT (10.93)	DEU (6.83)
With Regional Trading Partners (i.e., Within Region)							
FRANCE	Paper products and printing	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	DEU (26.28)	DEU (25.88)	DEU (20.76)	DEU (25.99)	DEU (21.5)	BEL (16.98)	LUX (59.7)	BEL (19.41)
2nd upstream partner	BEL (9.97)	BEL (20.01)	ITA (11.92)	BEL (22.97)	ESP (19.87)	DEU (7.92)	DEU (7.2)	DEU (12.19)
3rd upstream partner	ITA (9.58)	ITA (12.23)	ESP (7.64)	ITA (11.89)	CZE (8.74)	ROW (6.49)	CHE (7.05)	LUX (10.92)

GERMANY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	SWE (15.07)	NLD (37.98)	CZE (11.85)	BEL (13.35)	CZE (18.05)	NLD (8.66)	LUX (65.02)	BEL (13.83)
2nd upstream partner	FIN (12.49)	BEL (26.37)	POL (11.66)	FRA (11.81)	HUN (14.78)	AUT (8.64)	MLT (13.61)	FRA (10.76)
3rd upstream partner	POL (9.76)	POL (7.42)	CHE (9.28)	AUT (10.54)	ESP (10.16)	POL (8.62)	GBR (4.88)	LUX (10.33)
ITALY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	DEU (20.13)	BEL (22.75)	DEU (22.29)	DEU (17.94)	DEU (23.39)	IRL (8.48)	LUX (80.26)	BEL (12.61)
2nd upstream partner	SWE (12.42)	GRC (10.82)	FRA (9.84)	FRA (13.45)	ESP (14.84)	DEU (8.33)	IRL (11.14)	FRA (11.55)
3rd upstream partner	FRA (10.01)	RUS (10.37)	POL (7.04)	AUT (7.93)	FRA (10.42)	FRA (7.36)	GBR (2.04)	LUX (10.44)
SPAIN	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	FRA (17)	ITA (24.34)	DEU (19.61)	FRA (24)	DEU (21.89)	FRA (11.95)	LUX (60.4)	FRA (17.54)
2nd upstream partner	DEU (15.25)	BEL (13.14)	FRA (13.12)	DEU (14.08)	FRA (20.74)	BEL (8.12)	IRL (8.7)	BEL (10.31)
3rd upstream partner	FIN (11.88)	PRT (9.74)	ITA (12.91)	ITA (12.64)	CZE (10.49)	DEU (8.03)	GBR (8.25)	LUX (10.17)
UK	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	DEU (19.4)	SWE (20.64)	DEU (22.87)	DEU (19.79)	DEU (30.14)	IRL (11.96)	LUX (32.76)	FRA (14.73)
2nd upstream partner	SWE (11.79)	BEL (17.65)	FRA (7.66)	BEL (9.29)	ESP (14.45)	DNK (8.77)	IRL (18.42)	IRL (11.99)
3rd upstream partner	FIN (10.25)	LTU (9.98)	ITA (7.36)	TUR (8.16)	BEL (10.68)	DEU (7.03)	MLT (15.23)	DEU (8.64)

With Non-Regional Trading Partners (i.e., Outside Region)								
FRANCE	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (21.34)	DEU (16.47)	BEL (22.22)	CHN (40.6)	DEU (28)	ROW (9.56)	LUX (52.5)	BEL (13.76)
2nd upstream partner	ESP (13.73)	CHN (10.3)	DEU (21.73)	CHE (7.07)	USA (25.09)	BEL (9.06)	GBR (8.85)	GBR (12.22)
3rd upstream partner	DEU (11.25)	ITA (8.7)	ITA (11.26)	NLD (6.16)	GBR (11.74)	DEU (5.12)	CHE (6.34)	DEU (9.87)
GERMANY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	NLD (26.67)	CHN (8.62)	BEL (12.68)	CHN (40.18)	FRA (49.62)	NLD (7.57)	LUX (62.57)	USA (11.81)
2nd upstream partner	RUS (11.64)	POL (7.59)	FRA (11.28)	NLD (6.36)	GBR (13.01)	ROW (5.91)	MLT (8.75)	FRA (8.73)
3rd upstream partner	BEL (10.77)	CHE (6.89)	ITA (8.53)	MYS (5.07)	USA (11.75)	SGP (5.88)	GBR (7.29)	BEL (8.35)
ITALY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	GRC (21.55)	DEU (17.33)	DEU (13.01)	CHN (26.02)	KOR (39.26)	ROW (10.36)	LUX (74.57)	IRL (10.04)
2nd upstream partner	ESP (15.5)	CHN (11.24)	FRA (10.26)	NLD (22.86)	GBR (10.11)	IRL (8.54)	IRL (15.66)	FRA (9.93)
3rd upstream partner	RUS (10.71)	FRA (7.39)	CHN (8.29)	DEU (8.04)	USA (8.44)	FRA (7.12)	GBR (2.78)	BEL (8.24)

SPAIN	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	PRT (28.48)	DEU (14.42)	FRA (18.38)	CHN (36.81)	FRA (20.38)	FRA (10.29)	LUX (54.39)	FRA (15.17)
2nd upstream partner	ITA (14.61)	CHN (12.04)	ITA (10.33)	NLD (12.54)	GBR (17.05)	ROW (9.69)	IRL (11.82)	GBR (11.66)
3rd upstream partner	USA (14.08)	FRA (9.61)	DEU (10.11)	DEU (6.03)	USA (14.07)	CHN (7.22)	GBR (11.48)	DEU (8)

UK	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (21.09)	CHN (16.17)	CAN (22.96)	CHN (35.67)	USA (31.49)	IRL (10.79)	LUX (31.07)	IRL (11.98)
2nd upstream partner	KOR (12.23)	DEU (13.8)	DEU (9.93)	NLD (17.8)	KOR (22.1)	USA (8.47)	IRL (24.47)	FRA (9.55)
3rd upstream partner	IND (6.74)	IRL (6.4)	TUR (6.8)	DEU (5.29)	FRA (11.37)	ROW (6.56)	MLT (7.6)	HKG (7.65)

Table 15: Key upstream trade partners for selected sectors in Europe based on Equation 3 (2015)

With All Trading Partners (i.e., World)							
FRANCE	Coke and refined petroleum products	Chemicals and pharmaceutical products	Rubber and plastic products	Basic metals	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (24.21)	DEU (24.2)	DEU (22.43)	DEU (28.04)	USA (36.44)	DEU (11.45)	GBR (21.01)	GBR (20.27)
2nd upstream partner	RUS (21.28)	USA (10.06)	ITA (11.65)	ITA (11.47)	DEU (32)	ROW (9.97)	USA (19.07)	USA (15.27)
3rd upstream partner	ROW (15.02)	ESP (6.69)	CHN (11.28)	BEL (11.08)	GBR (7.24)	BEL (6.96)	CHE (13.36)	DEU (14.66)
GERMANY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	RUS (47.38)	FRA (11.59)	CHN (9.95)	FRA (12.93)	FRA (38.57)	AUT (8.23)	GBR (28.78)	USA (23.57)
2nd upstream partner	NLD (10.67)	USA (10.11)	POL (9.07)	AUT (8.58)	USA (24.04)	NLD (6.83)	USA (19.95)	FRA (10.46)
3rd upstream partner	USA (8.81)	NLD (9.02)	ITA (9.02)	ITA (7.99)	GBR (11.17)	POL (6.78)	CHE (15.47)	GBR (10.33)
ITALY	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	RUS (49.35)	DEU (22.35)	DEU (23.79)	DEU (14.72)	KOR (21.43)	DEU (9.68)	USA (22.18)	USA (14.34)
2nd upstream partner	ROW (17.66)	FRA (13.75)	CHN (12.49)	ROW (11.84)	USA (18.4)	ROW (9.26)	GBR (19.42)	FRA (12.63)
3rd upstream partner	USA (6.07)	BEL (7.02)	FRA (11.22)	FRA (11.3)	GBR (9.46)	FRA (8.58)	LUX (16.61)	GBR (12.31)
SPAIN	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	RUS (19.77)	DEU (18.78)	DEU (19.18)	FRA (20.52)	USA (26.05)	FRA (12.26)	GBR (29.38)	FRA (17.9)
2nd upstream partner	ROW (17.26)	FRA (15.07)	FRA (14.23)	DEU (11.57)	FRA (14.52)	ROW (8.63)	USA (17.32)	GBR (17.06)
3rd upstream partner	USA (17.15)	ITA (7.23)	CHN (12.89)	CHN (11)	GBR (13.59)	USA (8.57)	CHE (11.24)	USA (13.4)
UK	Sector 9	Sector 10	Sector 11	Sector 13	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	RUS (26.43)	DEU (19.57)	DEU (20.65)	DEU (13.04)	USA (54.29)	USA (12.4)	USA (36.03)	FRA (15.41)
2nd upstream partner	USA (20.31)	FRA (12.04)	CHN (19.59)	USA (12.99)	FRA (7.7)	DEU (8.32)	DEU (11.55)	USA (11.17)
3rd upstream partner	ROW (14.3)	USA (10.99)	FRA (7.4)	CAN (12.67)	DEU (7)	FRA (7.77)	JPN (6.35)	DEU (10.02)
With Regional Trading Partners (i.e., Within Region)							
FRANCE	Paper products and printing	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	DEU (31.14)	RUS (45.97)	DEU (30.41)	DEU (33.47)	DEU (43.59)	DEU (18.22)	GBR (31.4)	GBR (29.24)
2nd upstream partner	ITA (13.86)	DEU (18.93)	ITA (15.79)	ITA (13.69)	ESP (17.24)	BEL (11.09)	CHE (19.96)	DEU (21.15)
3rd upstream partner	ESP (11.8)	BEL (9.23)	ESP (10.5)	BEL (13.22)	ITA (8.48)	ITA (8.2)	DEU (18.94)	BEL (12.1)

GERMANY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	SWE (18.13)	RUS (59.58)	POL (12.04)	FRA (15.87)	CZE (13.19)	AUT (12.17)	GBR (40.84)	FRA (17.32)
2nd upstream partner	FIN (13.83)	NLD (13.42)	ITA (11.97)	AUT (10.53)	ESP (11.96)	NLD (10.1)	CHE (21.95)	GBR (17.09)
3rd upstream partner	FRA (10.46)	BEL (10.77)	FRA (10.99)	ITA (9.81)	FRA (10.74)	POL (10.02)	LUX (10.67)	BEL (9.55)

ITALY	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	DEU (24.93)	RUS (74.62)	DEU (32.99)	DEU (23.06)	DEU (42.14)	DEU (14.98)	GBR (27.8)	FRA (18.2)
2nd upstream partner	SWE (14.85)	BEL (5.58)	FRA (15.56)	FRA (17.69)	FRA (12.26)	FRA (13.29)	LUX (23.77)	GBR (17.74)
3rd upstream partner	FRA (14.19)	ESP (3.96)	ESP (6.61)	RUS (10.08)	ESP (11.75)	AUT (8.34)	IRL (14.92)	DEU (17.45)

SPAIN	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	FRA (21.22)	RUS (42.07)	DEU (26.25)	FRA (28.16)	DEU (39.42)	FRA (20.16)	GBR (40.4)	FRA (25.24)
2nd upstream partner	DEU (16.21)	PRT (11.36)	FRA (19.49)	DEU (15.88)	FRA (25.38)	ITA (13.22)	CHE (15.45)	GBR (24.05)
3rd upstream partner	PRT (13.53)	ITA (10.98)	ITA (15.72)	ITA (12.97)	GBR (6.66)	DEU (12.44)	DEU (11.2)	DEU (16.2)

UK	Sector 8	Sector 9	Sector 11	Sector 13	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	DEU (23.71)	RUS (52.06)	DEU (33.89)	DEU (24.69)	DEU (54.61)	DEU (14.16)	DEU (28.81)	FRA (27.65)
2nd upstream partner	SWE (14.57)	SWE (9.54)	FRA (12.15)	TUR (18.13)	ESP (10.83)	FRA (13.22)	FRA (14.47)	DEU (17.98)
3rd upstream partner	FIN (11.58)	BEL (8.85)	ITA (9.05)	FRA (9.38)	FRA (8.19)	ESP (10.8)	IRL (14.26)	ESP (7.89)

With Non-Regional Trading Partners (i.e., Outside Region)								
FRANCE	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Other transport equipment	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (45.08)	CHN (43.05)	USA (27.47)	CHN (61.25)	USA (74.31)	ROW (26.82)	USA (57.66)	USA (49.79)
2nd upstream partner	ROW (27.96)	ROW (15.62)	CHN (19.17)	USA (13.08)	CHN (7.61)	USA (14.62)	HKG (9.7)	ROW (12.7)
3rd upstream partner	SAU (12.36)	USA (11.36)	ROW (14.28)	ROW (3.78)	ROW (3.36)	CHN (11.42)	ROW (9.21)	CAN (6.68)

GERMANY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (43.02)	CHN (40.35)	CHN (23.64)	CHN (60.32)	USA (69.06)	ROW (18.23)	USA (67.55)	USA (59.57)
2nd upstream partner	ROW (24.78)	USA (15.16)	USA (19.33)	USA (11.29)	CHN (10.14)	USA (18.22)	SGP (9.34)	JPN (8.4)
3rd upstream partner	ZAF (5.45)	ROW (6.45)	ROW (17.58)	JPN (5.84)	JPN (6.53)	CHN (16.12)	ROW (5.37)	ROW (6.05)

ITALY	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (52.13)	CHN (44.79)	ROW (32.76)	CHN (68.71)	KOR (38.75)	ROW (26.15)	USA (73.61)	USA (46.8)
2nd upstream partner	USA (17.91)	ROW (11.69)	CHN (25.73)	USA (11.99)	USA (33.27)	USA (21.09)	ROW (10.41)	ROW (21.33)
3rd upstream partner	SAU (15.07)	USA (7.31)	USA (9.04)	JPN (2.87)	CHN (12.4)	CHN (18.38)	CAN (4.73)	BRA (6.03)

SPAIN	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	ROW (32.57)	CHN (47.81)	CHN (40.58)	CHN (70.8)	USA (55.17)	ROW (22.03)	USA (63.54)	USA (46.1)
2nd upstream partner	USA (32.36)	ROW (11.52)	ROW (24.58)	USA (9)	CHN (14.99)	USA (21.87)	ROW (8.77)	ROW (19.1)
3rd upstream partner	SAU (16.18)	USA (5.67)	IND (6.15)	JPN (3.56)	ROW (5.67)	CHN (19.09)	SAU (5.71)	BRA (5.71)

UK	Sector 9	Sector 11	Sector 13	Sector 15	Sector 19	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (41.26)	CHN (50.13)	USA (27.53)	CHN (64.28)	USA (72.4)	USA (30.06)	USA (60.12)	USA (25.24)
2nd upstream partner	ROW (29.06)	USA (13.11)	CAN (26.87)	USA (15.57)	KOR (8)	ROW (17.37)	JPN (10.59)	JPN (13.97)
3rd upstream partner	SAU (12.55)	IND (5.58)	CHN (13.53)	TWN (4.4)	CHN (3.9)	CHN (16.37)	HKG (7.75)	ROW (10.58)

Table 16: Key upstream trade partners for selected sectors in North America based on Equation 2 (2015)

				With All Trading Partners (i.e., World)				
CANADA	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (31.82)	USA (28.18)	CHN (46.31)	CHN (29.39)	USA (55.92)	USA (29.95)	USA (30.93)	USA (35.36)
2nd upstream partner	CHN (18.2)	CHN (10)	MEX (26.12)	MEX (18.58)	MEX (22.27)	HKG (8.74)	LUX (18.03)	GBR (8.55)
3rd upstream partner	MEX (7.35)	ROW (9.08)	USA (4.4)	USA (17.63)	DEU (4.81)	ROW (7.11)	GBR (17.67)	IRL (7.91)
MEXICO	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (29.56)	USA (27.39)	CHN (53.67)	CHN (34.82)	USA (49.84)	USA (21.63)	USA (28.61)	USA (31.04)
2nd upstream partner	CHN (14.63)	KOR (12.71)	MYS (11.14)	USA (16.72)	DEU (5.85)	DNK (11.84)	IRL (14.43)	NLD (10.21)
3rd upstream partner	CAN (9.97)	CAN (11.17)	KOR (9)	KOR (6.88)	CHN (4.62)	DEU (9)	LUX (13.2)	SGP (8.63)
US	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	CHN (19.53)	CAN (26.43)	CHN (43.78)	CHN (36.19)	MEX (32.33)	ROW (7.66)	IRL (27.02)	BEL (11.07)
2nd upstream partner	CAN (12.51)	KOR (8.14)	MEX (26.5)	MEX (21.36)	CAN (13.12)	DNK (7.25)	GBR (25.21)	DEU (8.45)
3rd upstream partner	THA (9.5)	CHN (7.56)	MYS (6.08)	KOR (5.05)	DEU (12.64)	CHN (7.11)	LUX (9.97)	NLD (6.81)

				With Regional Trading Partners (i.e., Within Region)				
CANADA	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Electrical equipment	Motor vehicles, trailers and semi-trailers	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Other business sector services
1st upstream partner	USA (84.82)	MEX (31.61)	USA (25.01)	MEX (43.89)	MEX (54.98)	USA (23.02)	MEX (22.98)	IRL (18.61)
2nd upstream partner	ESP (2.15)	CHN (17.94)	MEX (10.15)	CHN (22.85)	USA (33.4)	MEX (8.72)	USA (16.62)	USA (16.05)
3rd upstream partner	NLD (2.06)	USA (16.11)	ROW (9.14)	USA (12.46)	KOR (3.06)	ROW (7.84)	ROW (9.47)	GBR (9.55)
MEXICO	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st upstream partner	USA (97.85)	CAN (33.83)	USA (33.11)	CHN (39.9)	USA (40.7)	USA (35.34)	USA (33.39)	USA (24.29)
2nd upstream partner	COL (0.74)	USA (20.86)	CAN (25.99)	USA (16.84)	CAN (21.58)	CAN (13.74)	ROW (7.17)	NLD (12.84)
3rd upstream partner	NLD (0.26)	CHN (12.34)	KOR (8.82)	KOR (7.26)	CHN (5.87)	CHN (6.25)	DEU (6.76)	SGP (12.75)
US	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st upstream partner	ESP (31.52)	MEX (24.18)	CAN (23.92)	CHN (42.84)	MEX (39.41)	CAN (15.53)	MEX (22.48)	BEL (11.94)
2nd upstream partner	IND (9.7)	CAN (22.9)	MEX (16.46)	MEX (26.62)	CAN (37.62)	ROW (9.78)	ROW (10.22)	GBR (10.57)
3rd upstream partner	KOR (7.28)	CHN (17.77)	KOR (10.29)	CAN (5.2)	KOR (5.12)	MEX (8.53)	CHN (5.94)	CAN (8.15)

	With Non-Regional Trading Partners (i.e., Outside Region)							
CANADA	Basic metals	Fabricated metal products	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (28.57)	USA (48.1)	CHN (47.78)	CHN (30.57)	USA (60.86)	USA (31.71)	USA (35.98)	USA (38.27)
2nd upstream partner	CHN (10.2)	CHN (14.47)	MEX (23.74)	USA (18.56)	MEX (15.1)	HKG (9.12)	GBR (17.06)	GBR (8.4)
3rd upstream partner	ROW (9.08)	TWN (6.6)	USA (4.67)	MEX (13.99)	DEU (5.32)	ROW (6.8)	LUX (16.5)	IRL (6.3)
MEXICO	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (26.28)	USA (44.15)	CHN (53.75)	CHN (34.15)	USA (51.03)	USA (19.76)	USA (32.09)	USA (32.25)
2nd upstream partner	KOR (13.46)	CHN (11.82)	MYS (10.95)	USA (16.7)	DEU (6)	DNK (12.92)	LUX (12.41)	NLD (9.74)
3rd upstream partner	CHN (10.23)	TWN (6.45)	KOR (8.93)	KOR (6.83)	CHN (4.46)	DEU (9.35)	DEU (11.42)	SGP (7.89)
US	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	CAN (26.54)	CHN (21.82)	CHN (43.65)	CHN (35.98)	MEX (32.03)	ROW (7.61)	IRL (27.01)	BEL (11.06)
2nd upstream partner	KOR (8.04)	TWN (11.73)	MEX (26.56)	MEX (21.2)	DEU (12.98)	DNK (7.33)	GBR (25)	DEU (8.5)
3rd upstream partner	CHN (7.58)	MEX (9.45)	MYS (6.12)	KOR (5.09)	CAN (12.11)	CHN (7.14)	LUX (9.95)	NLD (6.84)

Table 17: Key upstream trade partners for selected sectors in North America based on Equation 3 (2015)

With All Trading Partners (i.e., World)								
CANADA	Rubber and plastic products	Basic metals	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	USA (50.61)	USA (41.19)	CHN (50.94)	CHN (38.87)	USA (68.8)	USA (57.09)	USA (75.83)	USA (68.45)
2nd upstream partner	CHN (23.17)	ROW (11.18)	USA (22.83)	USA (31.6)	MEX (8.1)	CHN (6.36)	GBR (10.1)	GBR (7.08)
3rd upstream partner	JPN (3.22)	ARG (10.65)	MEX (7.65)	MEX (6.44)	JPN (6.03)	ROW (6.32)	CHE (2.66)	FRA (2.52)
MEXICO	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	USA (46.89)	USA (48.29)	CHN (54.19)	CHN (43.69)	USA (56.5)	USA (39.88)	USA (71.86)	USA (40.7)
2nd upstream partner	CHN (19.27)	CHN (12.25)	USA (16.11)	USA (26.96)	JPN (9.58)	CHN (18.91)	GBR (6.23)	ESP (6.06)
3rd upstream partner	CAN (5.5)	JPN (6.1)	KOR (6.95)	JPN (6.73)	CHN (7.48)	DEU (8.12)	DEU (5.61)	SGP (5.86)
US	Sector 11	Sector 13	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	CHN (34.43)	CAN (24.73)	CHN (62.73)	CHN (56.18)	MEX (23.23)	CHN (15.69)	GBR (41.9)	CAN (12.99)
2nd upstream partner	CAN (16.62)	MEX (11.29)	MEX (10.58)	MEX (12.13)	DEU (19.32)	MEX (11.26)	CAN (9.97)	DEU (11.25)
3rd upstream partner	MEX (7.05)	CHN (10.86)	KOR (3.42)	JPN (7.27)	JPN (17.32)	ROW (8.07)	CHE (7.05)	GBR (9.07)

With Regional Trading Partners (i.e., Within Region)								
CANADA	Coke and refined petroleum products	Rubber and plastic products	Basic metals	Electrical equipment	Motor vehicles, trailers and semi-trailers	Wholesale and retail trade; repair of motor vehicles	Transportation and storage	Other business sector services
1st upstream partner	USA (99.99)	USA (95.62)	USA (97.68)	USA (83.06)	USA (89.47)	USA (95.47)	USA (91.71)	USA (99.92)
2nd upstream partner	MEX (0.01)	MEX (4.38)	MEX (2.32)	MEX (16.94)	MEX (10.53)	MEX (4.53)	MEX (8.29)	MEX (0.08)
3rd upstream partner	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
MEXICO	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st upstream partner	USA (99.87)	USA (89.5)	USA (89.29)	USA (97.63)	USA (96.99)	USA (97.09)	USA (97.15)	USA (94.47)
2nd upstream partner	CAN (0.13)	CAN (10.5)	CAN (10.71)	CAN (2.37)	CAN (3.01)	CAN (2.91)	CAN (2.85)	CAN (5.53)
3rd upstream partner	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
US	Sector 9	Sector 11	Sector 13	Sector 16	Sector 18	Sector 23	Sector 24	Sector 31
1st upstream partner	CAN (89.65)	CAN (70.23)	CAN (68.66)	MEX (86.13)	MEX (67.48)	CAN (52.7)	MEX (64.71)	CAN (98.94)
2nd upstream partner	MEX (10.35)	MEX (29.77)	MEX (31.34)	CAN (13.87)	CAN (32.52)	MEX (47.3)	CAN (35.29)	MEX (1.06)
3rd upstream partner	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

	With Non-Regional Trading Partners (i.e., Outside Region)							
CANADA	Basic metals	Fabricated metal products	Computer, electronic and optical products	Electrical equipment	Motor vehicles, trailers and semi-trailers	Transportation and storage	Financial and insurance activities	Other business sector services
1st upstream partner	ROW (19.34)	CHN (48.71)	CHN (73.27)	CHN (62.73)	JPN (26.12)	CHN (16.84)	GBR (42.25)	GBR (22.49)
2nd upstream partner	ARG (18.42)	DEU (7.28)	JPN (3.41)	JPN (6.73)	DEU (22.27)	ROW (16.74)	CHE (11.13)	FRA (8)
3rd upstream partner	CHN (14.77)	TWN (6.39)	TWN (3.36)	DEU (6.6)	KOR (17.21)	HKG (6.22)	SGP (7.69)	DEU (7.59)
MEXICO	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	CHN (26.69)	CHN (39.99)	CHN (64.82)	CHN (60.36)	JPN (22.95)	CHN (32.08)	GBR (22.73)	ESP (10.64)
2nd upstream partner	JPN (13.29)	DEU (8.82)	KOR (8.31)	JPN (9.3)	CHN (17.92)	DEU (13.77)	DEU (20.47)	SGP (10.29)
3rd upstream partner	KOR (11.83)	KOR (7.73)	MYS (4.5)	KOR (5.98)	DEU (13.45)	JPN (7.19)	ESP (11.54)	ITA (8.04)
US	Sector 13	Sector 14	Sector 15	Sector 16	Sector 18	Sector 24	Sector 29	Sector 31
1st upstream partner	CHN (16.98)	CHN (46.12)	CHN (70.76)	CHN (65.39)	DEU (29.46)	CHN (18.99)	GBR (47.35)	DEU (12.95)
2nd upstream partner	BRA (9.19)	DEU (7.75)	KOR (3.86)	JPN (8.46)	JPN (26.41)	ROW (9.76)	CHE (7.97)	GBR (10.45)
3rd upstream partner	ROW (9.13)	TWN (6.82)	JPN (3.43)	DEU (4.92)	KOR (13.66)	DEU (7.44)	DEU (6.29)	JPN (10.33)

Table A.1: Key downstream trade partners of selected economies (2005 and 2015)

	2005			2015		
CHINA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	30.19	69.81	100	28.84	71.16
1st downstream partner	KOR (11.64)	KOR (17.32)	USA (11.5)	KOR (11.55)	KOR (17.45)	USA (11)
2nd downstream partner	USA (10.85)	JPN (13.35)	KOR (9.87)	USA (10.22)	USA (8.38)	MEX (10.32)
3rd downstream partner	JPN (8.25)	TWN (12.39)	MEX (6.87)	MEX (7.81)	TWN (8.28)	KOR (9.03)
JAPAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	43.58	56.42	100	49.92	50.08
1st downstream partner	CHN (18.82)	TWN (19.04)	CHN (19.59)	CHN (20.17)	CHN (15.44)	CHN (22.49)
2nd downstream partner	KOR (12.9)	KOR (16.94)	KOR (11.43)	KOR (10.97)	KOR (14.01)	KOR (9.48)
3rd downstream partner	TWN (11.97)	CHN (16.67)	TWN (9.4)	SGP (8.74)	TWN (13.21)	SGP (6.75)
KOREA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	47.92	52.08	100	53.95	46.05
1st downstream partner	CHN (36.53)	CHN (35.08)	CHN (36.99)	CHN (42.65)	CHN (37.67)	CHN (44.63)
2nd downstream partner	TWN (8.6)	TWN (14.94)	TWN (6.6)	VNM (7.32)	VNM (10.17)	VNM (6.19)
3rd downstream partner	USA (5.26)	JPN (7.38)	USA (5.6)	USA (4.44)	TWN (7.15)	MEX (5.61)
TAIWAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	58.08	41.92	100	68.79	31.21
1st downstream partner	CHN (45.32)	CHN (42.41)	CHN (46.24)	CHN (50.62)	CHN (41.24)	CHN (54.57)
2nd downstream partner	KOR (6.93)	KOR (10.31)	MYS (6.24)	KOR (8.35)	KOR (13.99)	KOR (5.98)
3rd downstream partner	MYS (6.92)	MYS (9.1)	KOR (5.87)	VNM (4.11)	SGP (6.48)	VNM (3.66)
MALAYSIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	49.22	50.78	100	63.26	36.74
1st downstream partner	CHN (17.9)	SGP (15.97)	CHN (19.7)	CHN (25.57)	CHN (18.13)	CHN (29.64)
2nd downstream partner	SGP (10.48)	THA (13.83)	THA (8.41)	SGP (12.53)	SGP (17.59)	SGP (9.76)
3rd downstream partner	THA (10.03)	CHN (13.67)	SGP (8.14)	THA (8.14)	THA (10.4)	THA (6.9)

	2005			**2015**		
SINGAPORE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	53.29	46.71	100	53.85	46.15
1st downstream partner	MYS (15.48)	MYS (20.05)	MYS (13.89)	IRL (14.51)	MYS (15.05)	IRL (18.06)
2nd downstream partner	CHN (12.8)	CHN (11.05)	CHN (13.42)	CHN (11.68)	CHN (9.61)	CHN (12.57)
3rd downstream partner	IRL (8.19)	KOR (9.77)	IRL (10)	MYS (9.38)	KOR (9.59)	LUX (7.1)
THAILAND	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	48.16	51.84	100	50.29	49.71
1st downstream partner	CHN (18.86)	MYS (17.33)	CHN (19.97)	CHN (23.35)	CHN (17.73)	CHN (26.07)
2nd downstream partner	MYS (13.52)	CHN (15.9)	MYS (12.1)	MYS (7.71)	MYS (11.94)	VNM (6.65)
3rd downstream partner	JPN (6.54)	SGP (9.07)	JPN (5.77)	VNM (7.56)	VNM (9.44)	ROW (5.87)
VIETNAM	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	39.81	60.19	100	45.41	54.59
1st downstream partner	SGP (18.44)	SGP (28.04)	SGP (13.25)	CHN (19.93)	CHN (15.2)	CHN (22.25)
2nd downstream partner	CHN (10.63)	AUS (14.39)	CHN (11.62)	KOR (10.37)	KOR (13.71)	KOR (8.74)
3rd downstream partner	AUS (9.98)	CHN (8.8)	AUS (7.59)	JPN (8.02)	SGP (11.48)	JPN (7.09)
REST OF ASIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	40.81	59.19	100	40.22	59.78
1st downstream partner	CHN (14.15)	CHN (13.09)	CHN (14.57)	CHN (12.61)	SGP (17.23)	CHN (14)
2nd downstream partner	ROW (8.94)	SGP (11.09)	ROW (9.54)	SGP (11.44)	CHN (9.77)	SGP (8.62)
3rd downstream partner	SGP (7.26)	KOR (10.7)	MYS (6)	ROW (7.71)	KOR (9.26)	ROW (7.79)
FRANCE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	65.64	34.36	100	57.7	42.3
1st downstream partner	DEU (14.19)	DEU (15.81)	DEU (12.2)	DEU (14.47)	DEU (15.71)	DEU (13.37)
2nd downstream partner	ITA (9.74)	ESP (11.68)	ITA (8.42)	BEL (7.98)	BEL (10.83)	ROW (6.94)
3rd downstream partner	ESP (8.64)	ITA (10.82)	ROW (7.83)	ITA (7.05)	ESP (8.96)	ITA (6.65)

	2005			**2015**		
GERMANY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	65.47	34.53	100	57.29	42.71
1st downstream partner	FRA (9.12)	FRA (10.46)	USA (8.05)	FRA (8.33)	FRA (9.04)	CHN (8.84)
2nd downstream partner	ITA (7.18)	ITA (8.09)	FRA (7.49)	CHE (6.35)	CZE (6.96)	FRA (7.72)
3rd downstream partner	CHE (6.45)	AUT (7.74)	CHE (6.15)	CHN (5.92)	AUT (6.82)	CHE (6.52)
ITALY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	64.17	35.83	100	55.43	44.57
1st downstream partner	DEU (12.6)	DEU (14.18)	DEU (10.69)	DEU (13.93)	DEU (15.38)	DEU (12.69)
2nd downstream partner	FRA (12.35)	FRA (14.12)	FRA (10.21)	FRA (9.05)	FRA (10.18)	FRA (8.09)
3rd downstream partner	CHE (6.67)	ESP (8.41)	ROW (8.34)	CHE (7.3)	CHE (7.02)	CHE (7.54)
SPAIN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	74.01	25.99	100	64.53	35.47
1st downstream partner	FRA (15.09)	FRA (17.17)	FRA (12.39)	DEU (12.87)	DEU (14.1)	DEU (11.78)
2nd downstream partner	DEU (11.43)	DEU (12.56)	DEU (9.95)	FRA (12.57)	FRA (14.08)	FRA (11.23)
3rd downstream partner	ITA (8.37)	PRT (10.68)	ROW (8.85)	PRT (8.91)	PRT (11.1)	ITA (7.24)
UK	**World**	**Within Region**	**Outside Resgion**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	54.26	45.74	100	49.8	50.2
1st downstream partner	DEU (10.85)	DEU (12.82)	IRL (9.46)	IRL (13.24)	LUX (19.61)	IRL (12.32)
2nd downstream partner	IRL (10.28)	LUX (11.15)	DEU (8.69)	LUX (12.9)	IRL (14.29)	DEU (8.65)
3rd downstream partner	LUX (7.3)	IRL (11.02)	USA (7.84)	DEU (9.58)	DEU (10.63)	LUX (6.99)
REST OF EUROPE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	68.79	31.21	100	62.73	37.27
1st downstream partner	DEU (14.25)	DEU (16.13)	DEU (12.01)	DEU (16.36)	DEU (17.91)	DEU (14.99)
2nd downstream partner	ROW (6.98)	FRA (7.53)	ROW (9.59)	ITA (5.26)	NLD (5.62)	ROW (6.78)
3rd downstream partner	FRA (6.66)	ITA (6.3)	FRA (5.63)	ROW (5.25)	ITA (5.56)	CHN (5.83)

	2005			**2015**		
CANADA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	74.04	25.96	100	70.16	29.84
1st downstream partner	USA (49.77)	USA (60.49)	USA (44.76)	USA (53.44)	USA (60.38)	USA (50.8)
2nd downstream partner	ROW (5.53)	MEX (8.29)	ROW (6.05)	CHN (8.76)	MEX (10.6)	CHN (8.55)
3rd downstream partner	DEU (4.43)	CHN (4.82)	DEU (5.44)	MEX (3.8)	CHN (9.3)	GBR (3.98)
MEXICO	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	83.46	16.54	100	76.71	23.29
1st downstream partner	USA (56.93)	USA (58.21)	USA (56.13)	USA (49.93)	USA (53.74)	USA (48.22)
2nd downstream partner	CAN (10.34)	CAN (20.76)	ROW (7.69)	CAN (8.04)	CAN (18.97)	CHN (7.22)
3rd downstream partner	ROW (6.42)	ROW (4.38)	ESP (7.53)	CHN (7.21)	CHN (7.17)	ROW (5.16)
USA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross exports to countries in $\mathcal{G}$	100	27.85	72.15	100	23.17	76.83
1st downstream partner	CAN (16.24)	CAN (30.64)	ROW (7.12)	MEX (13.64)	MEX (32.16)	CHN (9.09)
2nd downstream partner	MEX (14.31)	MEX (28.94)	CAN (6.46)	CAN (11.88)	CAN (25.51)	IRL (8.07)
3rd downstream partner	ROW (5.72)	CHN (4.82)	DEU (6.3)	CHN (8.65)	CHN (7.73)	DEU (5.9)

Table A.2: Key upstream trade partners of selected economies based on Equation 2 (2005 and 2015)

	2005			**2015**		
CHINA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	54.87	45.13	100	41.47	58.53
1st upstream partner	TWN (19.1)	TWN (28.26)	KOR (17.28)	KOR (16.14)	KOR (19.35)	KOR (14.99)
2nd upstream partner	KOR (18.65)	KOR (21.75)	TWN (15.05)	TWN (10.9)	TWN (16.01)	TWN (9.06)
3rd upstream partner	JPN (7.3)	MYS (11.3)	JPN (8.06)	DEU (6.54)	MYS (9.35)	DEU (7.98)
JAPAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	36.71	63.29	100	45.47	54.53
1st upstream partner	CHN (18.34)	CHN (29.26)	CHN (14.64)	CHN (19.84)	CHN (22.18)	CHN (18.77)
2nd upstream partner	USA (8.81)	KOR (7.95)	ROW (9.54)	KOR (7.33)	VNM (11.13)	KOR (7.6)
3rd upstream partner	ROW (8.5)	THA (7.31)	USA (9.52)	USA (6.64)	THA (7.48)	USA (6.6)
KOREA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	44.76	55.24	100	45.3	54.7
1st upstream partner	CHN (17.98)	CHN (26.24)	CHN (14.48)	CHN (21.8)	CHN (23.79)	CHN (20.83)
2nd upstream partner	JPN (12.06)	JPN (11.33)	JPN (12.37)	JPN (8)	JPN (8.56)	JPN (7.72)
3rd upstream partner	ROW (9.07)	TWN (10.38)	ROW (10.6)	USA (6.91)	VNM (8.44)	ROW (7.25)
TAIWAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	54.47	45.53	100	52.04	47.96
1st upstream partner	JPN (14.32)	CHN (19.79)	JPN (14.93)	CHN (18.44)	CHN (20.26)	CHN (17.44)
2nd upstream partner	CHN (13.81)	KOR (17.91)	KOR (11.48)	JPN (11.8)	JPN (12.33)	JPN (11.51)
3rd upstream partner	KOR (13.6)	JPN (13.07)	CHN (10.87)	KOR (9.24)	KOR (10.05)	KOR (8.79)
MALAYSIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	59.87	40.13	100	63.5	36.5
1st upstream partner	SGP (19.06)	CHN (21.16)	SGP (22.27)	SGP (21.94)	SGP (21.03)	SGP (22.46)
2nd upstream partner	CHN (13.65)	SGP (13.47)	CHN (9.34)	CHN (15.02)	CHN (17.08)	CHN (13.85)
3rd upstream partner	THA (9.07)	THA (11.8)	THA (7.5)	THA (8.56)	THA (12.32)	TWN (6.75)

	2005			**2015**		
SINGAPORE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	37.16	62.84	100	43.45	56.55
1st upstream partner	MYS (11.75)	MYS (19.59)	ROW (10.23)	MYS (8.67)	MYS (15.32)	ROW (6.99)
2nd upstream partner	ROW (9.38)	USA (9.02)	MYS (9.03)	USA (7.47)	USA (9.48)	TWN (6.75)
3rd upstream partner	USA (8.87)	THA (7.63)	USA (8.82)	ROW (7.07)	JPN (7.43)	USA (6.71)
THAILAND	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	53.89	46.11	100	57.93	42.07
1st upstream partner	MYS (13.65)	MYS (20.13)	JPN (11.4)	CHN (19.01)	CHN (20.42)	CHN (18.19)
2nd upstream partner	CHN (11.57)	CHN (17.47)	MYS (10.25)	JPN (9.38)	MYS (11.9)	JPN (9.42)
3rd upstream partner	JPN (10.78)	TWN (9.61)	ROW (10.01)	SGP (8.68)	JPN (9.31)	SGP (8.47)
VIETNAM	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	74.69	25.31	100	73.3	26.7
1st upstream partner	TWN (19.56)	TWN (22.36)	TWN (18.27)	CHN (22.22)	KOR (23.3)	CHN (22.37)
2nd upstream partner	SGP (15.97)	KOR (13.7)	SGP (18.23)	KOR (19.38)	CHN (21.98)	KOR (17.03)
3rd upstream partner	KOR (11.87)	CHN (12.92)	THA (11.33)	TWN (9.36)	THA (10.17)	TWN (9.25)
REST OF ASIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	41.57	58.43	100	48.15	51.85
1st upstream partner	SGP (15.16)	CHN (16.04)	SGP (16)	CHN (16.14)	CHN (18.14)	CHN (15.19)
2nd upstream partner	CHN (9.73)	SGP (12.89)	ROW (7.95)	SGP (12)	SGP (12.43)	SGP (11.8)
3rd upstream partner	KOR (7.99)	KOR (9.77)	CHN (7.4)	ROW (8.31)	THA (8.53)	ROW (8.74)
FRANCE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.7	31.3	100	64.46	35.54
1st upstream partner	DEU (13.29)	DEU (15.16)	DEU (11.21)	DEU (14.56)	DEU (17.27)	DEU (11.97)
2nd upstream partner	ITA (9.37)	ITA (10.27)	CHN (9.34)	BEL (7.81)	BEL (9.72)	CHN (9.63)
3rd upstream partner	ESP (8.85)	ESP (9.94)	ITA (8.36)	ESP (7.02)	ITA (8.08)	ESP (6.64)

	2005			**2015**		
GERMANY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	70.07	29.93	100	68.19	31.81
1st upstream partner	FRA (8.67)	FRA (9.16)	FRA (8.13)	NLD (7.78)	NLD (8.54)	CHN (10.06)
2nd upstream partner	NLD (7.32)	NLD (7.01)	NLD (7.67)	FRA (6.79)	FRA (7.12)	NLD (7.09)
3rd upstream partner	ITA (5.71)	BEL (6.98)	CHN (7.17)	CHN (6.14)	BEL (6.8)	FRA (6.48)
ITALY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.69	31.31	100	66.82	33.18
1st upstream partner	DEU (13.22)	DEU (14.89)	DEU (11.17)	DEU (11.88)	DEU (13.88)	DEU (9.8)
2nd upstream partner	FRA (10.98)	FRA (11.88)	FRA (9.87)	FRA (8.06)	LUX (9.06)	CHN (8.66)
3rd upstream partner	ROW (6.01)	ESP (5.93)	CHN (7.4)	LUX (7.73)	FRA (8.93)	FRA (7.17)
SPAIN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.62	31.38	100	61.38	38.62
1st upstream partner	FRA (15.33)	FRA (17.7)	FRA (12.54)	FRA (11.69)	DEU (13.65)	CHN (10.63)
2nd upstream partner	DEU (11.18)	DEU (13.1)	ITA (9.75)	DEU (11.27)	FRA (13.64)	FRA (9.73)
3rd upstream partner	ITA (10.65)	ITA (11.41)	DEU (8.9)	ITA (7.32)	ITA (8.46)	DEU (8.86)
UK	**World**	**Within Region**	**Outside Resgion**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	62.6	37.4	100	59.77	40.23
1st upstream partner	DEU (9.91)	DEU (12.56)	CHN (8.76)	DEU (11.81)	DEU (15.21)	CHN (11.02)
2nd upstream partner	FRA (8.58)	FRA (10.58)	USA (8.14)	IRL (8.58)	IRL (8.1)	IRL (9)
3rd upstream partner	IRL (6.43)	BEL (8.11)	DEU (7.42)	CHN (7.15)	FRA (7.83)	DEU (8.88)
REST OF EUROPE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	71.86	28.14	100	66.7	33.3
1st upstream partner	DEU (14.34)	DEU (16.05)	DEU (12.16)	DEU (14.13)	DEU (16.62)	DEU (11.49)
2nd upstream partner	FRA (6.42)	FRA (7.18)	CHN (7.8)	CHN (5.56)	LUX (6.08)	CHN (9.48)
3rd upstream partner	ITA (6.06)	ITA (6.66)	ROW (5.96)	FRA (5.21)	FRA (5.88)	ROW (5.67)

	2005			2015		
CANADA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	59.45	40.55	100	58.18	41.82
1st upstream partner	USA (38.81)	MEX (29.85)	USA (40.97)	USA (34.29)	MEX (30.41)	USA (36.19)
2nd upstream partner	CHN (10.71)	USA (24.81)	CHN (11.07)	CHN (13.52)	USA (22.56)	CHN (13.79)
3rd upstream partner	MEX (9.23)	CHN (8.35)	MEX (6.06)	MEX (10.98)	CHN (11.87)	MEX (7.84)
MEXICO	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	57.15	42.85	100	49.17	50.83
1st upstream partner	USA (36.47)	USA (39.84)	USA (35.83)	USA (30.07)	USA (37.49)	USA (28.78)
2nd upstream partner	CHN (12.4)	CAN (10.37)	CHN (13.05)	CHN (21.9)	CHN (18.37)	CHN (22.51)
3rd upstream partner	KOR (5.57)	CHN (8.95)	KOR (5.55)	KOR (6.08)	CAN (9.98)	KOR (6.26)
USA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	24.21	75.79	100	22.92	77.08
1st upstream partner	CHN (15.4)	MEX (19.84)	CHN (15.52)	CHN (16.95)	MEX (22.37)	CHN (16.94)
2nd upstream partner	MEX (9.77)	CAN (17.9)	MEX (9.48)	MEX (13.82)	CAN (17.39)	MEX (13.59)
3rd upstream partner	CAN (9.29)	CHN (11.06)	CAN (9.05)	CAN (7.72)	CHN (17.3)	CAN (7.47)

Table A.3: Key upstream trade partners of selected economies based on Equation 3 (2005 and 2015)

	2005			2015		
CHINA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	54.87	45.13	100	41.47	58.53
1st upstream partner	JPN (18.12)	JPN (31.29)	USA (19.76)	KOR (13.35)	KOR (29.56)	ROW (21.39)
2nd upstream partner	KOR (14.1)	KOR (24.35)	ROW (18.17)	ROW (11.73)	TWN (22.75)	USA (19.28)
3rd upstream partner	TWN (12.93)	TWN (22.32)	DEU (8.22)	USA (10.57)	JPN (20.63)	AUS (9.49)
JAPAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	36.71	63.29	100	45.47	54.53
1st upstream partner	ROW (16.72)	CHN (41.54)	ROW (25.31)	CHN (21.21)	CHN (51.01)	ROW (28.17)
2nd upstream partner	USA (14.18)	KOR (13.71)	USA (21.46)	ROW (16.46)	KOR (9.42)	USA (20.31)
3rd upstream partner	CHN (14.09)	IDN (12.92)	AUS (8.92)	USA (11.86)	IDN (9.23)	AUS (11.9)
KOREA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	44.76	55.24	100	45.3	54.7
1st upstream partner	JPN (19.94)	JPN (44.48)	ROW (30.03)	CHN (23.43)	CHN (51.95)	ROW (30.29)
2nd upstream partner	ROW (16.56)	CHN (27.84)	USA (23.27)	ROW (16.63)	JPN (20.8)	USA (18.75)
3rd upstream partner	USA (12.83)	TWN (7.08)	SAU (10.32)	USA (10.29)	TWN (6.96)	SAU (9.68)
TAIWAN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	54.47	45.53	100	52.04	47.96
1st upstream partner	JPN (24.77)	JPN (47.44)	ROW (26.46)	ROW (20.65)	CHN (36.49)	ROW (40.32)
2nd upstream partner	ROW (12.64)	CHN (19.05)	USA (21.36)	CHN (17.81)	JPN (27.96)	SAU (17.45)
3rd upstream partner	USA (10.21)	KOR (13.67)	SAU (12.19)	JPN (13.64)	KOR (8.5)	USA (14.62)
MALAYSIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	59.87	40.13	100	63.5	36.5
1st upstream partner	USA (17)	JPN (27.75)	USA (40.46)	CHN (24.04)	CHN (38.15)	USA (27.31)
2nd upstream partner	JPN (16.09)	CHN (19.51)	ROW (9.81)	USA (10.1)	SGP (13.01)	ROW (15.45)
3rd upstream partner	CHN (11.31)	SGP (12.49)	DEU (8.98)	SGP (8.2)	JPN (12.89)	DEU (9.57)

	2005			**2015**		
SINGAPORE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	37.16	62.84	100	43.45	56.55
1st upstream partner	ROW (18.18)	JPN (31.91)	ROW (26.38)	USA (15.2)	JPN (29.2)	USA (25.71)
2nd upstream partner	USA (14.99)	MYS (12.46)	USA (21.76)	ROW (15.14)	CHN (11.97)	ROW (25.6)
3rd upstream partner	SAU (10)	IND (10.03)	SAU (14.51)	JPN (11.93)	IND (11.94)	GBR (6.74)
THAILAND	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	53.89	46.11	100	57.93	42.07
1st upstream partner	JPN (20.46)	JPN (40.34)	ROW (37.02)	CHN (23.34)	CHN (40.49)	ROW (38.63)
2nd upstream partner	ROW (18.24)	CHN (17.14)	USA (17.13)	ROW (16.36)	JPN (24.39)	USA (15.9)
3rd upstream partner	CHN (8.69)	MYS (10.22)	SAU (8.06)	JPN (14.06)	MYS (6.18)	AUS (7.33)
VIETNAM	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	74.69	25.31	100	73.3	26.7
1st upstream partner	CHN (17.13)	CHN (22.46)	ROW (17.75)	CHN (37.68)	CHN (48.94)	ROW (23.54)
2nd upstream partner	TWN (12.7)	TWN (16.65)	USA (12.06)	KOR (13.61)	KOR (17.68)	USA (18.29)
3rd upstream partner	KOR (11.74)	KOR (15.4)	RUS (12.05)	JPN (7.33)	JPN (9.52)	DEU (6.47)
REST OF ASIA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	41.57	58.43	100	48.15	51.85
1st upstream partner	SAU (11.24)	CHN (23.88)	SAU (18.38)	CHN (18.72)	CHN (42.9)	ROW (33.21)
2nd upstream partner	ROW (9.9)	JPN (23.1)	ROW (16.18)	ROW (18.71)	JPN (13.42)	USA (16.21)
3rd upstream partner	USA (9.62)	KOR (10.6)	USA (15.73)	USA (9.13)	SGP (8.83)	SAU (8.64)
FRANCE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.7	31.3	100	64.46	35.54
1st upstream partner	DEU (15.73)	DEU (24.13)	ROW (26.77)	DEU (17.52)	DEU (28.76)	USA (28)
2nd upstream partner	ROW (9.32)	ITA (13.49)	USA (23.66)	USA (10.94)	GBR (11.55)	ROW (20.25)
3rd upstream partner	ITA (8.79)	GBR (11.32)	CHN (8.63)	ROW (7.92)	ITA (10.3)	CHN (16.64)

	2005			**2015**		
GERMANY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	70.07	29.93	100	68.19	31.81
1st upstream partner	FRA (9.05)	FRA (13.53)	ROW (25.75)	USA (8.65)	FRA (11.95)	USA (25.07)
2nd upstream partner	ROW (8.53)	GBR (11.77)	USA (24.05)	FRA (7.83)	GBR (9.13)	CHN (22.67)
3rd upstream partner	USA (7.96)	ITA (9.28)	JPN (10.03)	CHN (7.82)	ITA (7.95)	ROW (15.85)
ITALY	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.69	31.31	100	66.82	33.18
1st upstream partner	DEU (15.04)	DEU (23.54)	ROW (32.69)	DEU (13.88)	DEU (22.06)	ROW (31.54)
2nd upstream partner	ROW (11.81)	FRA (17.08)	USA (14.17)	ROW (11.69)	FRA (13.95)	CHN (21.06)
3rd upstream partner	FRA (10.91)	GBR (8.61)	SAU (9.22)	FRA (8.78)	RUS (13.08)	USA (13.24)
SPAIN	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	68.62	31.38	100	61.38	38.62
1st upstream partner	FRA (14.37)	FRA (22.49)	ROW (38.04)	ROW (14.74)	DEU (21.23)	ROW (33.8)
2nd upstream partner	ROW (13.74)	DEU (20.01)	USA (10.89)	DEU (11.97)	FRA (20.9)	CHN (16.7)
3rd upstream partner	DEU (12.78)	ITA (13.09)	CHN (7.98)	FRA (11.78)	GBR (12.13)	USA (11.74)
UK	**World**	**Within Region**	**Outside Resgion**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	62.6	37.4	100	59.77	40.23
1st upstream partner	USA (12.61)	DEU (20.3)	USA (32.58)	USA (14.25)	DEU (23.2)	USA (32.47)
2nd upstream partner	DEU (12.44)	FRA (13.92)	ROW (12.49)	DEU (13.02)	FRA (13.52)	CHN (19.42)
3rd upstream partner	FRA (8.53)	NOR (12.73)	JPN (10.12)	CHN (8.53)	NOR (8.86)	ROW (12.46)
REST OF EUROPE	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	71.86	28.14	100	66.7	33.3
1st upstream partner	DEU (16.13)	DEU (22.96)	USA (27.83)	DEU (15.09)	DEU (23.31)	USA (31.45)
2nd upstream partner	GBR (8.63)	GBR (12.28)	ROW (22.05)	USA (11.09)	GBR (12.83)	ROW (19.55)
3rd upstream partner	USA (8.27)	FRA (8.72)	JPN (8.48)	GBR (8.31)	FRA (8.73)	CHN (13.67)

	2005			2015		
CANADA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	59.45	40.55	100	58.18	41.82
1st upstream partner	USA (56.02)	USA (95.91)	ROW (17.04)	USA (53.77)	USA (95.17)	ROW (23.04)
2nd upstream partner	ROW (7.09)	MEX (4.09)	CHN (11.44)	ROW (10.02)	MEX (4.83)	CHN (20.02)
3rd upstream partner	CHN (4.76)	N.A.	GBR (10.03)	CHN (8.71)	N.A.	SAU (6.07)
MEXICO	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	57.15	42.85	100	49.17	50.83
1st upstream partner	USA (54.24)	USA (96.08)	CHN (19.54)	USA (46.06)	USA (96.01)	CHN (45.38)
2nd upstream partner	CHN (8.51)	CAN (3.92)	JPN (17.92)	CHN (23.61)	CAN (3.99)	JPN (8.7)
3rd upstream partner	JPN (7.81)	N.A.	KOR (8.45)	JPN (4.53)	N.A.	KOR (7.18)
USA	**World**	**Within Region**	**Outside Region**	**World**	**Within Region**	**Outside Region**
% of gross imports from countries in $\mathcal{G}$	100	24.21	75.79	100	22.92	77.08
1st upstream partner	CAN (18.36)	CAN (70.1)	ROW (17.82)	CHN (20.84)	CAN (68)	CHN (28.42)
2nd upstream partner	ROW (13.16)	MEX (29.9)	JPN (13.11)	CAN (18.14)	MEX (32)	ROW (9.01)
3rd upstream partner	JPN (9.68)	N.A.	CHN (12.41)	MEX (8.54)	N.A.	DEU (7.2)