

## **ERIA Discussion Paper Series**

**No. 390**

### **Feeling the Pulse of Global Value Chains: Air Cargo and COVID-19\***

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July 2021

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**Abstract:** *This paper focuses on air cargo market development, with special attention to the connections between countries in Asia, the European Union, and the United States. Before the coronavirus disease (COVID-19) crisis, we show that participation in global value chains played a crucial role in how countries in Asia increased their exposure to the European Union market, which was hit hardest by the COVID-19 crisis. Analysing the effects of the crisis in 2020 – using a fuzzy set complexity approach and recent high frequency data on air cargo transport – we show that such demand effects, together with domestic contraction conditions, explain a large share of the variation in air cargo dynamics across countries in Asia. However, we also show that implementing best practices in pandemic control positively impacts air cargo recovery for countries that cannot rely on export market rebounds. After reviewing the convergence in air cargo business models since 2010, the paper continues to assess recovery options. The main conclusion is that business models will converge on long haul point to point models that combine passengers and cargo, moving away from the current hub and spoke system.*

**Keywords:** Air cargo, ASEAN, COVID-19

**JEL Codes:** F15, F53, R41

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\* This research was conducted as a part of the project of Economic Research Institute for ASEAN and East Asia (ERIA) ‘ERIA Research on COVID-19 and Regional Economic Integration’. Opinions expressed in this paper are the sole responsibility of the authors and do not reflect the views of ERIA.

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## **1. Introduction**

The airline industry is one of the sectors hardest hit by the coronavirus disease (COVID-19) pandemic. At the end of August 2020, the number of flights worldwide was down by more than 50%, while profits and solvency across the industry were substantially harmed by the sequence of lockdowns. Airlines have reacted to the crisis by cutting down on capacity and putting aeroplanes out of service early. Governments have responded by supporting national carriers, which puts recent liberalisation efforts into jeopardy. However, there are substantial differences within the industry. Whereas passenger travel has been hard hit by the pandemic, the air cargo market has bounced back quite rapidly because of rising e-commerce and is expanding. At the end of 2020, loading rates had not only recovered to pre-pandemic levels but they were higher in volume terms than at the end of 2019 on specific routes (e.g. across the Atlantic). There are also substantial differences across the globe. Whereas the European Union (EU) has experienced consistent travel restrictions and is expected to undergo a prolonged economic contraction, countries in Asia are already recovering after the hard lockdowns at the start of the pandemic.

For several reasons, studying the air cargo industry before and during the pandemic (and thinking about exit scenarios) is interesting as a case study which offers broader lessons. The industry has witnessed similar (although arguably not as severe) crises before both with respect to healthcare (recall the severe acute respiratory syndrome (SARS) of 2004 and the swine flu (H1N1) of 2009) as well as the financial crisis of 2008. Tanrıverdi, Bakır, and Merkert (2020) took stock of the lessons from these episodes to inform us of the consequences and suggest a way forward in the current pandemic. Furthermore, the air cargo industry is at the forefront of being shaped by many of the major trends that are causing business models to change. A substantial number of futurists – see Galloway (2020) – argue that the current crisis will speed up existing trends in technological change such as the use of big data, artificial intelligence, and blockchain technology as well as the more general

digitalisation and ‘servicification’<sup>3</sup> of the economy. As a consequence, the flywheel effect of these technologies is likely to give big tech companies (Amazon and others) a major role in the air cargo industry. The last reason is that the reaction to the economic effects of the pandemic will involve a complex interplay between private and public actors. At the height of the pandemic, we witnessed increased public actor engagement in the airline sector spurred by vested national interests. Because airlines and air cargo are the pulse of international trade and global supply chains, such complex interaction between governments and private companies in the airline industry will inform us about many of the more general tensions that will arise from the economic consequences of the pandemic in the years ahead. Getting international coordination right in a fundamentally uncooperative (or Nash equilibrium) world will be a key challenge in dealing with the economic consequences of the pandemic. For example, in an early attempt to map out these tensions, Macilree and Duval (2020) analysed the political constellation of international collaboration in the airline industry and called for a much more substantial role and power for coordinating institutions such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA).

This paper will take stock of the recent academic literature that deals with the air cargo industry just before and during the pandemic in 2020 to derive lessons for the exit strategy, in order to inform a broader public as well as aviation specialists. We start by reviewing the state of affairs running up to the pandemic and focus on the evolution of cargo traffic on the major routes from Asia as a powerhouse of global value chains (GVCs) to Europe and the United States (US). We continue by studying the business model changes over the decade to 2020. After that, we examine the pandemic’s impact, using new high-frequency primary cargo data, and look at how various countries have coped with the pandemic. We streamline this analysis by deploying a fuzzy set approach. Lastly, we evaluate how the crisis is likely to impact air cargo operators’ business models and the most likely emerging trends. The paper concludes by looking at the lessons learnt for policy and seeing what they mean

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<sup>3</sup> Servicification occurs as manufacturers increasingly buy and sell services themselves.

for viable exit routes back to profitability when the 2020 pandemic is relegated to the history books.

## **2. Air Cargo Dynamics in the Run-Up to the COVID-19 Crisis**

In this section, by considering three topics organised in three subsections, we discuss the dynamics of the air cargo market in the run-up to the 2020 crisis, with emphasis on the Association of Southeast Asian Nations (ASEAN) Member States (AMS). The first subsection provides an analysis of the direction of air cargo trade from AMS. The point will be made that European destinations have become more important over time. In the second subsection, we look closer into the various business models of the air cargo industry in the run-up to the pandemic. After that, we discuss the main features of the current policy environment.

### **2.1. Air cargo traffic dynamics from the ASEAN region**

It is a well-established stylised fact that air cargo flows are heavily influenced by the dynamics of international trade in manufactures. Kupfer et al. (2017) integrated much of the literature on this topic and showed that global trade flows are indeed the main driver for air cargo transport. In addition, they showed that changes in oil prices are an amplifier, as air cargo incurs a high fuel cost relative to other means of transportation. The logic that bilateral gross domestic product (GDP) positions shape trade flows, which in turn determine air cargo flows, follows from the specification of the gravity model. In a recent panel estimation setting for the 18 largest air cargo markets, Alici and Akar (2020) showed that, at the individual export market level, growth in GDP can be considered an additional driver for volumes of air cargo.

As the levels of GDP in export markets are primary explanatory variables for trade flows, we would expect North America and Europe to be the main trading partners of Asian countries. The value added from the air cargo industry (not the goods shipped) can be approximated by looking at the balance of payments statistics, zooming in on cargo fees documented under trade in

services. At the bilateral trade level, such bilateral service flows are recorded in the Organisation for Economic Co-operation and Development (OECD) Extended Balance of Payments Services (EBOPS) database, updated until 2018. By checking bilateral imported trade in services in the run-up to the COVID-19 crisis, we calculate the change in market shares and growth rates for countries in the ASEAN region (Table 1).

**Table 1: Asia’s Air Cargo Services Export Market Share in the US and the EU-28**

Country	United States		European Union	
	Market share (1)	RCA change (2)	Market share (3)	RCA change (4)
<b>ASEAN</b>				
Indonesia	-	-	0.22	-5.05
Malaysia	0.10	-3.83	1.37	-1.63
Philippines	0.56	-0.03	0.08	1.45
Singapore	4.31	-0.78	3.70	2.78
Thailand	0.35	-0.51	1.32	-0.90
<b>Other Asia Pacific</b>				
Australia	1.70	0.65	0.95	0.65
Hong Kong	7.23	2.19	4.07	-0.93
Japan	8.78	-0.67	3.56	0.59
Rep. of Korea	12.77	-0.21	4.51	1.24
Taiwan	8.15	0.37	4.02	1.36

ASEAN: Association of Southeast Asian Nations, EU = European Union, RCA = revealed comparative advantage, US = United States.

Notes: RCA change is the index of revealed comparative advantage, which is the growth in air cargo services of a country to the US or the EU over the world growth of air cargo imports of the US and the EU. Market share refers to the average air cargo services exports to the respective market divided by world exports. Revealed comparative advantage change is the growth rate in exports during 2012–2018 over the growth rate from the world minus 1. The EU-28 refers to the 28 member countries of the European Union before the United Kingdom left in January 2020.

Source: OECD (n.d.), EBOPS bilateral trade database for 2012–2018.

[https://stats.oecd.org/Index.aspx?DataSetCode=TISP\\_EBOPS2010](https://stats.oecd.org/Index.aspx?DataSetCode=TISP_EBOPS2010) (accessed 24 March 2021).

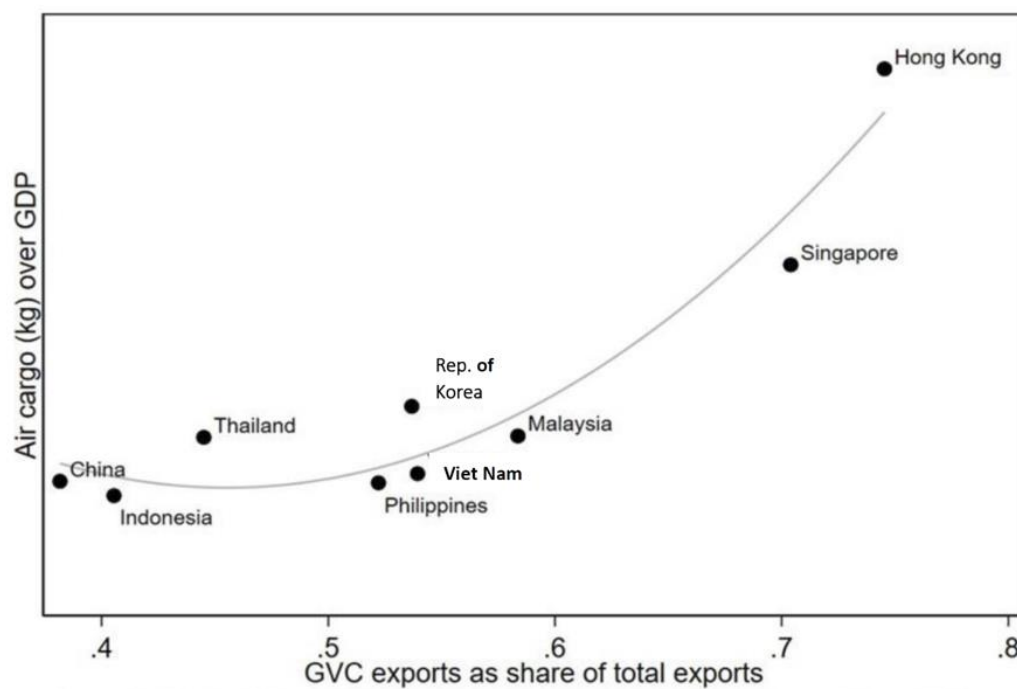
For countries in the ASEAN region and other countries in Asia, we calculated the market share (as an average over 2012–2018) by dividing the bilateral air cargo services from the balance of payments statistics for that particular country by the total world imports in cargo services. We also calculated the growth rate in cargo services coming from AMS to the US and the EU relative to the overall growth rate of imports in cargo services. As can be observed in columns 1 and 3, Singapore is by far the largest exporter of air cargo services to both the US and the EU. The market shares of Malaysia and Thailand in the EU are substantially higher than their market shares in the US. As can be observed in column 1, especially for the US, there is a considerable gap between Hong Kong, Taiwan, and the Republic of Korea (henceforth, Korea) when compared to the AMS. When we focus on the EU, these differences in market share for AMS relative to traditional exporters are far smaller, and they reflect differences in GDP levels quite closely, leading to the conclusion that the EU market is relatively important for AMS.

When we look at the market share dynamics in columns 2 and 4, there are different outcomes across the AMS. All AMS lost market share in the US over 2012–2018, whereas they gained market share in Europe, especially Singapore and the Philippines. For other countries in Asia, Hong Kong is the main winner in terms of market share in the US, but it lost out in Europe. By contrast, market share growth for Korea and Taiwan is much more prominent in Europe than in the US. As a conclusion, for AMS, the EU is not only an important cargo destination – it has also been the most important growth market.

The Asia-Pacific region is a powerhouse in GVCs, with solid communications and electronics positions. The increased importance of GVC participation in explaining trade patterns is emphasised in recent publications of multinational institutions as well much of the academic literature. As a case in point, the World Development Report 2020 focused exclusively on this issue (World Bank, 2020). The emphasis on GVC participation follows a long-term interest amongst economists (Kohler and Yalein, 2018) studying the contractual issues underlying GVC development. Ponte, Gereffi, and Raj-Reichert (2019) collected much of the business study analysis of GVCs to provide a

comprehensive overview of the contributions from social sciences. The increased interest in recent years is facilitated by improved data on GVCs following the development of international input–output tables (Timmer et al., 2014). Shepherd, Shingal, and Raj (2016) tapped into the recent emphasis on participation in GVCs as a dominant factor for the increase in international trade, to show that participation in GVCs is closely connected to the rise in air transport activity. As the ASEAN region and China are considered to be the ‘factory of the world’ when it comes to manufactured products, their role in GVCs generates inbound and outbound air cargo flows. In the electronics sector, Asia has a dominant position in GVC tasks, especially for products such as smartphones and laptops that use air cargo as the primary transport mode.

**Figure 1: Air Cargo Flows and Participation in Global Value Chains**



GDP = gross domestic product, GVC = global value chain, kg = kilogramme.  
 Source: World Bank (2020), World Development Report 2020 Chapters and Data.  
<https://www.worldbank.org/en/publication/wdr2020/brief/world-development-report-2020-data> (accessed 2 April 2021).

To highlight the relationship between GVC participation and air cargo, we use the data set in the Appendix to the World Development Report 2020 (World Bank, 2020). For the measurement of GVC participation, we have made use of

the conventional definition that, from an input–output perspective, GVC trade crosses more than one border before being consumed. There are two parts to GVC trade that, when combined, make up total participation in GVCs: (i) *backward* participation, which measures foreign inputs that are used in exports; and (ii) *forward* participation, which is the domestic value added in goods that are exported to other countries and then exported for final consumption to a third country. Although GVC data are provided on a country–industry level, we have aggregated GVC participation using industry exports as weights. We use the *share* of trade connected to participation in GVCs over total exports as the measure of GVCs’ importance for a particular country. We then connect the ratio of GVC participation to the ratio of air cargo over GDP, which measures air cargo’s relative importance to the national economy.

Figure 1 shows a clear connection between the relative importance of GVC participation in exports and the significance of air cargo movements. A higher level of GVC participation leads to a higher share of air cargo flows relative to GDP. We observe considerable variations in countries with a positive correlation between the relative importance of GVC trade in exports and air cargo flows. On the left side, although China’s position in GVCs is rapidly improving, the share of GVC exports in the total exports is low because of the high level of exports in which the use of foreign inputs is low (the flip side being that the domestic labour value added component is high). By contrast, trading hubs such as Hong Kong and Singapore score at high levels on the degree of GVC participation. Then, in the middle segment, are the countries which mostly add value through production processes that use inputs imported from abroad (backward participation) and produce components to be used as inputs for exports in other countries (forward participation). As an extension of this analysis (and not reported), we have also looked at the growth rate of air cargo and GVC participation, which shows that countries with low levels of GVC participation in Asia experience a rapid increase in air cargo flows as a share of GDP.



## **2.2. Business model dynamics in the air cargo industry**

Traditionally, air cargo is seen as a by-product of passenger travel, as most freight is shipped in the bodies of airliners carrying people to foreign destinations. However, over time, dedicated integrated air cargo handlers (FedEx, DHL) have gained in importance next to dedicated cargo subsidiaries of airlines also engaged in passenger travel (Emirates, Qatar Air). In an early attempt to classify business models for air cargo handling in combination with passenger flights, Dewulf, Meersman, and Van de Voorde (2014) differentiated between carriers which offer very basic air cargo services and those with dedicated air cargo units. Doganis (2006) created a typology in which he differentiated between the outsourcing and subsidiary activities of airlines when dealing with cargo. For air cargo handling, based on the famous Business Model Canvas (BMC), Reis and Silva (2016) identified no less than 10 different business models where they generated a split between ‘combination carriers’ and dedicated air cargo handlers. In their BMC set-up, the primary differentiating factor is the activities that airlines conduct for various customer segments. Dewulf, Meersman, and Van de Voorde (2019) updated their earlier work by performing a cluster analysis of revealed strategies to develop 10 generic business models, mainly based on resource commitment (stage theory) and GVC integration of services. Urban et al. (2018) also used the BMC approach to map out various business models in the airline industry, starting from the partitioning of low-cost carriers and full-service national carriers to come up with seven distinguishing business models. They showed an increasing convergence between low-cost and full-service network models, which is in line with the expectations of previous literature, e.g. Daft and Albers (2015). However, they also distinguished between various types of low-cost business models and considered the recent rise in the market shares of integrators.

Although creating a typology of business models in the air cargo industry is a significant achievement, a business model’s relative importance may change over time. Daft and Albers (2015) analysed the dynamics of business models in the airline industry and pointed to convergence on a limited set of viable options. Merkert, Van de Voorde, and de Wit (2017) concluded that two

viable constellations are emerging over time. The first one is integrated full-service delivery by companies such as FedEx and DHL that organise around GVCs. Malighetti et al. (2019) studied the integration of air cargo services for the Asian market to show that the dynamics towards the integration of GVCs are especially important in the Chinese market, in which airport centrality plays a vital role. The second emerging dominant model is the increased popularity of combining passenger and cargo flights due to wide-body planes' improved efficiency. Budd and Ison (2017) showed that full cargo airlines come under increasing pressure from more efficient operators of combi aircraft that carry both passengers and freight in wide-bodied planes: new generations of aeroplanes have an abundant cargo capacity which, combined with innovations in engines, makes volume and not weight the restricting factor. This increased efficiency of passenger flights to carry cargo creates opportunities to capture a profit margin over marginal cost and thereby contribute to fixed costs, which puts heavy competitive strains on 'air cargo only' business models.

Two additional forces that shape air cargo carriers' business models in the period running up to the COVID-19 crisis are worth mentioning. The first is that technological innovation, especially in energy consumption, sharply increased the opportunities for long-haul flights. Yuen et al. (2017) pointed out that such designs are especially important for the business travel market, which may combine with air cargo handling for long-haul point-to-point delivery and last-mile delivery systems on the ground. A crucial aspect is that such long-haul point-to-point routes may focus on highly profitable return flights, e.g. not needing stopovers in the Middle East on routes between Europe and ASEAN. The second development is the emerging downstream integration of platforms such as Amazon in the air cargo market. With the rise of e-commerce, it is a logical step for platform operators to extend their already superior capabilities in warehouse logistics to air cargo handling and to move to a business-to-consumer (B2C) delivery mode including last mile delivery.<sup>4</sup>

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<sup>4</sup> See Lee (2020) and Schwieterman et al (2021) for an account of the rapid expansion of Amazon in air cargo.

In case study analysis, these trends in the business models of integration and combination are confirmed for several leading air cargo handlers in the Asia region. Ayasanond (2019) analysed the strategic challenges of Thai Airways to verify that the integration of supply chains and the growth in online technologies have a significant impact on operations and the business model. They also pointed out that the ASEAN Open Skies policy (OSP) of recent years and the deregulation of international business more generally (often with the use of free trade agreements (FTAs)) have had a significant impact on air cargo operations. Rayinah and Chalid (2020) assessed the air cargo model of Garuda Indonesia to show that the non-integration of its services and the concentration on managing an air cargo terminal service adds little to profitability, in which case the company is better off outsourcing the business. In a vision for Viet Nam's logistics strategy, Banomyong (2017) noted the limited capacity in transport services as a stumbling block for achieving higher levels of integration and upgrading of GVC participation by Viet Nam. Relaxing this constraint would also be especially important for upgrading the many small and medium-sized enterprises in the logistics sector and improving their connections to international cargo transport systems.

From this subsection on business models in the air cargo industry, three main conclusions stand out. Firstly, GVC logistics integration drives many of the dynamics of business models in air cargo handling. This is especially the case for the ASEAN region, which is the heartland of many GVCs in electronics using air cargo. Increasingly, full cargo-only carriers (often subsidiaries of national carriers) are out-competed by more efficient integrated companies, some of which are multinational firms in their own right. Secondly, with the rise of e-commerce, most orders in the B2C market are taken up through online web shops and platforms. The forward integration of these platforms is a competitive shift in the air cargo market which will heavily affect air cargo operators. Thirdly, technological progress in aviation technology, especially wide-bodied planes, has improved the competitiveness of business models that combine cargo and long-haul passenger flights, which may create strategic opportunities for passenger carriers in the ASEAN region, especially in combination with alliance partners in Europe.

### **2.3. Policy collaboration and restrictions in the air cargo industry**

The airline industry is of great importance to the economy in Asia, especially in terms of its participation in GVCs. In this section, we take a closer look at the degree of liberalisation in this sector from two perspectives. The first perspective is normative, in the sense of what the data say about trade liberalisation in services in the aviation sector. In the second part, we look at the political economy aspects, which are very informative when it comes to the actual policy outcomes.

#### **2.3.1. Liberalisation of restrictions in ASEAN**

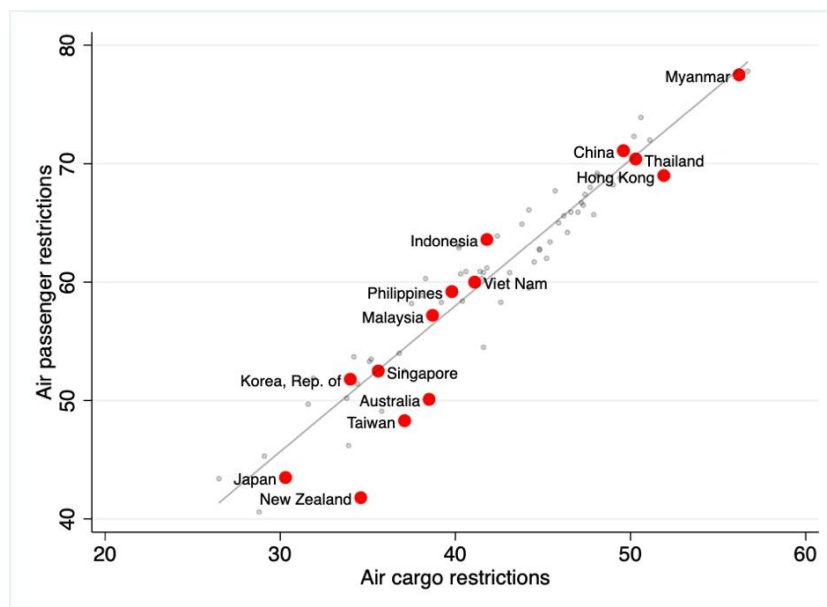
The rights to fly between countries are managed in a complex system of bilateral agreements, which apply preferential access to routes to airlines from partner countries. The identity of those airlines (akin to a rule of origin) is determined by the extent of their ownership and control in the partner country. Access to domestic markets is also often restricted, even to airlines which have the right to fly internationally. However, the application of these regimes varies between passenger traffic and cargo traffic. The latter tends to be more liberal, as we discuss in more detail below.

On one level, a high degree of restriction reduces the volume of traffic and the size of markets, and thereby the scope for entry and competition. The effects of reform are estimated to be significant. For example, Borchert et al. (2017) found that economies with highly restrictive air transport regimes have 40% fewer flights than liberal ones. Zhang and Findlay (2014) found that both departure and arrival economies' air transport policies matter in promoting the movement of people and that tourist flows (compared with total passenger flows) are more sensitive to changes in aviation policy. Abate and Christidis (2020) found that a more liberal approach by the EU to external air transport markets has led to a significant fall in fares and a rise in traffic flows. Liberalisation, therefore, creates opportunities for the application of all the business models we have so far discussed.

There have been efforts to develop a more open regime between countries. Arrangements in Europe are the best example (Lieshout et al., 2016). The US has also pursued Open Skies regimes (Morrison and de Wit, 2019). In ASEAN, there have also been commitments to open aviation markets. The assessment of Zen et al. (2019) was that agreements in ASEAN are now in place for open arrangements for traffic to and from capital cities (and beyond) in the region. However, some major airports are not included in this network of open arrangements and there is no agreement on travel between international and domestic points. Restrictions on the ownership of recognised airlines also remain. Indicators of the degree of restrictiveness of both passenger and cargo regimes are shown in Figure 2 (higher scores indicate higher degrees of restrictiveness). Overall, air transport is relatively highly restricted, given the possible range of scores from zero to 100.

There are differences in the treatment of passenger flows and air cargo. Figure 2 shows that the relationship between the index for passenger movement and that for air freight is linear (higher values of the former are also associated with higher values of the latter) but that the latter lies below the 45-degree line (so freight scores are about 30% lower than passenger scores, according to the methodology applied here) and the slope is flatter than a 45-degree (cargo scores increase more slowly). Figure 2 also shows the detail available for East Asian economies, which are spread across the values observed in the global data set (e.g. 40%–70% for passenger movements). The air freight index is 66%–76% of the passenger index. Higher-income countries (except Hong Kong) tend to have more liberal regimes, but the difference in the treatment of passengers and freight is similar across levels of development.

**Figure 2: Passenger and Cargo Overall Services Trade Restrictiveness Index**

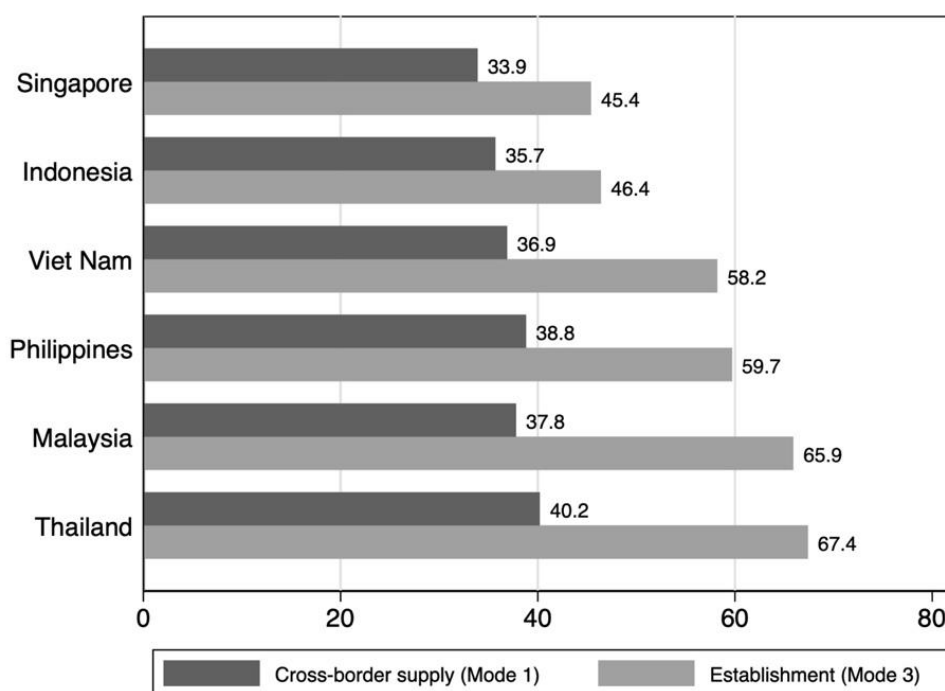


Source: World Trade Organization and World Bank Services Trade Policy Database (n.d.), <https://i-tip.wto.org/services/default.aspx> (accessed 24 March 2021).

Trade in services is traditionally categorised into different ‘modes’. For air cargo especially, mode 1 (cross-border supply) and mode 3 (foreign establishments) are important. Mode 1 is connected to the ability to ship cargo, whereas mode 3 deals with the competitive environment in which foreign companies are allowed to compete (e.g. in facility management at local airports) and participate in domestic carriers. According to data on the components of the services trade restrictiveness index (see Figure 2), the driver of the difference is the treatment of the cross-border delivery of air freight services (airlines based in one country providing services into and out of another). This suggests that a more liberal ‘rule of origin’ is applied to cargo flights. The regimes applying to foreign investment in air transport services in these economies and those related to the movement of people in the provision of the services are generally the same for both passenger and freight movement. More detail on the cargo restrictions in AMS is provided in Figure 3, where we show the service trade restrictiveness index for modes 1 and 3 in relation to the averages for all the countries in the database (the third bar marked ‘World’). We observe that, as noted above, compared with the world average, most Asian

countries show especially high restrictions on foreign establishment in the air cargo industry. These data have a number of implications. One interesting conclusion is that there is not much difference between the policy stances across the AMS, with the exception of Thailand. Hence, differences in the policy treatment of air cargo are unlikely to explain substantially different trajectories in resilience later on. More generally, the lower degree of restrictions on the full cargo model may provide its proponents with an advantage. The more liberal rule of origin assists in the operation of cargo specialist services. This increases the likelihood at least of the survival of that model, and possibly of a larger share of the market than otherwise. However, since restrictions on cross-border supply are close to average, whereas for several countries the restrictions on establishment are much higher, then when discussing exit routes from COVID-19 through policy intervention, a more liberal stance with respect to mode 3 should be considered as a viable route.

**Figure 3: Restrictions on Air Cargo Cross-Border Supply and Right of Establishment for ASEAN Member States**



Source: World Trade Organization and World Bank Services Trade Policy Database (n.d.), <https://i-tip.wto.org/services/default.aspx> (accessed 24 March 2021).

### **2.3.2. Political economy of air cargo liberalisation**

Participation in multinational trade negotiations is a major reason why trade restrictions have been considerably reduced over the last 30 years. In such negotiations, the main channel is that countries can win concessions from other countries by lowering protection. This provides a motive for policymakers to reduce restrictions to counter domestic interests that seek to limit imports. This argument is at the heart of the seminal Bagwell and Staiger (2004), who argued that countries have a reason to set a positive optimal tariff if there is market power. In international negotiations, this motive disappears and the optimal tariff is no longer a Nash equilibrium so that free trade may be achieved. This line of thinking is extended by the equally seminal paper by Grossman and Helpman (1995), who argued that in a situation where the selection of a tariff is the outcome of the interaction of domestic interest groups and policymakers, then international negotiations can break the power of groups that try to restrict international trade. The main reason for this effect is that it, from the domestic perspective, adds a pro free trade pressure group: foreign firms with export interests.

An important qualification is that, based on international trade theory, it is clear that free trade is optimal when it comes to industrial products. This is certainly not the case for services, where much of the protection comes from differences in domestic legislation (Francois and Hoekman, 2010). Such legislation is necessary for markets to function properly. There are three levels at which domestic legislation can restrict trade in services. Firstly, domestic legislation can intentionally or unintentionally discriminate against foreign companies. Here, we must bear in mind that the provision of services requires foreign establishment in many cases and that restrictions often relate to restrictions on setting up such businesses offshore (through foreign direct investment). A second level is that legislation can be more or less demanding, for example with respect to consumer protection. As a result, national companies are set up differently from foreign companies, limiting access, especially for countries with less strict regulation. A third level is that if legislation differs between countries, multinational enterprises (MNEs) have



high costs in setting up services because they have to consider different supply methods. Differences in national legislation can therefore discriminate against companies that operate internationally and favour local companies that only operate in a single market.

Because services have become so much more important in the modern economy and because restrictions on trade in industrial products have been significantly reduced, the most recent trade negotiations at the level of the World Trade Organization (WTO) and regional treaties tend to focus on liberalising trade in services. In the academic literature, therefore, an important question is to what extent the core understanding of political economy of the authors described above needs to be adapted to these new realities. Consequently, there is an emerging literature that deals with so-called deep integration – agreements in the field of legislation, especially the coordination of legislation between countries. Although much of this literature does not refer explicitly to trade in services, it does have a lot to say on international trade in services because it is there that legislation and differences in legislation between countries play such a big role. Interestingly, many of these new contributions show that the political economy drivers for liberalising trade in services are substantially different from those for liberalising trade in industrial products.

With the recent turmoil in negotiations on comprehensive regional agreements such as the Transatlantic Trade and Investment Partnership and the EU–Canada Comprehensive and Economic Trade Agreement, considerable attention has been paid to the lowering effect of international negotiations on standards when it comes to service provision. An important aspect of international negotiations, especially when it comes to complex legislative issues, is the strength of business lobbies, and the public and policymakers' lack of information. Staiger and Sykes (2016) argued that the harmonisation of regulation and the extension of FTAs to services reduce the general direction of liberalisation through regional treaties. The reason is that too many issues are being discussed, involving too many parties. They argued that a narrow scope of focus, as is the norm in the WTO, is one reason for its success. They also argued that national and even local legislation gives much room for the implicit

protection of local companies, through its biased implementation and interpretation. Grossman, McCalman, and Staiger (2021) argued that the power of business lobbies has the potential to strengthen such processes, resulting in higher levels of protection from international coordination when compared to decentralised policymaking outcomes. Maggi and Ossa (2020) extended the argument by looking at political economy motives when there are differences in the level of policymaking. They argued that when it comes to coordinating policy applied at the level of final consumption, business interests collaborate across countries to keep such restrictions low. However, when it comes to the processes by which such services are delivered, business interests are opposed, so that firms from countries with restrictive process rules lobby to raise those restrictions in other countries so as to create a 'level playing field', i.e. equal treatment for all.

These arguments could also lead to the conclusion that a sectoral approach may be necessary to avoid a multitude of conflicting interests when it comes to the successful liberalisation of services. This line of thinking may also be why, for example, there are bilateral agreements which apply only to air transport services. Political economy considerations thus played a critical role in the ASEAN region, of which the airline industry is a clear example. An OSP has long been a priority within ASEAN, since the importance of air transport was recognised as an essential prerequisite for economic integration. The formal movement started in 1995 and added a focus on cargo in 2002 (Forsyth, King, and Rodolfo, 2006). These agreements mainly consisted of protocols that were to be negotiated and implemented in detail. Although the objective was to have these protocols implemented by 2010, it took until 2016 for the last country (Indonesia) to ratify them. It is no coincidence that Indonesia was the last to ratify them. It is much larger than the other countries in ASEAN, both in terms of population and geographical distribution. Domestic suppliers may have been concerned about their competitiveness compared with other suppliers in the region and may have been reluctant to increase competition on international routes.

One reason why the implementation of OSP-related agreements within ASEAN was difficult is that they did not add much to the bilateral agreements that had already been concluded between the countries. The agreements within ASEAN were, to some extent, about the first five freedoms that had already been established through many bilateral agreements. The sixth freedom is, in a sense, mechanical because it is a combination of the first five. However, it is not evident that the sixth freedom within ASEAN would be an essential proposition because it is not related to flying to countries outside ASEAN. Furthermore, the protocols stopped with these first five freedoms and did not include the higher freedoms. As a result, no domestic market opening was made possible, nor was much work done on the possibilities of competing in other markets via foreign branches and joint ventures.

However, the ASEAN OSP brought a potentially substantial change to two areas. Firstly, the concept of a Community Carrier was introduced. This concept came from the European Union, where the liberalisation of the maximum ownership of foreign participation was extended by no longer considering participation from other member countries as foreign. In other words, domestic shareholdings could then fall below 51%. This provision was also included in the OSP protocols, which potentially made it possible that, although the seventh freedoms were not given, they could be achieved via foreign investment through the strengthening of joint ventures. However, the problem was that the agreement stipulated that licences for such ASEAN Community Carriers should be issued nationally and were not granted automatically. Therefore, unlike in the EU, these rights are not enforceable either at the national level or at the level of ASEAN. A second significant change was the call for a common external policy in the sector. Since the liberalisation of air traffic was already included in ASEAN at an early stage as a prerequisite for the success of regional integration, it was seen by the ASEAN Secretariat at the regional level as a starting point for centralisation of policy. Besides, it was also clear, based on examples from Europe, that common control of airspace would bring considerable efficiency benefits. It was, therefore, a clear case of functionalist shifting of competences to the regional level. It was

also clear that negotiations with parties such as the EU or China could be conducted more efficiently at the regional level. Within ASEAN, however, there was much resistance to shifting these powers to a national level. To this day, negotiations are difficult because on the one hand, ASEAN is a discussion partner, and on the other hand, the national ratification processes do not yet give foreign partners much added value in practice compared with the current situation. We will come back to this point later when we look at the negotiations between the EU and ASEAN.

At the heart of trade's political economy, restrictions are the result of the conflict between different groups within countries and differences between countries. In contrast to the EU, for example, ASEAN has a limited role at the regional policy level through the secretariat. This means that decision-making takes place in an intergovernmental setting, where differences in interests between countries play a major role. Within ASEAN, the differences in relation to liberalising air cargo traffic are substantial. The first factor is the difference in size between countries, as Indonesia, with 260 million inhabitants, is the largest and the most geographically dispersed. This means that Indonesia has a large domestic market for air traffic. Despite recent liberalisation, the national airline (Garuda) may be dominant, but throughout Asia, including Indonesia, there is a strong emergence of low-cost carriers. Therefore, Indonesia, as an attractive domestic market, will view ASEAN integration with suspicion if it means regional competition for domestic subsidiaries – both if they are nationally owned and if they are formed through joint ventures with a significant domestic equity stake. The question quickly arises as to how a perhaps not very efficient airline industry stands to gain from the single market opening within ASEAN. If foreign competition in the domestic market increases, Garuda, for example, would find it difficult to compete in Thailand. But there are more sensitivities and differences between countries. For example, Kuala Lumpur is generally seen as a rather inefficient airport (Huynh, Kim, and Ha, 2020) and Malaysia may therefore fear that stronger internal competition will erode Kuala Lumpur's market position and thus that of the national carriers. For example, the Malaysian market would then become a spoke of another hub,

such as Singapore. As a city state, Singapore has a large network of air links with other countries and less focus on the ASEAN market (although subsidiaries of the national carrier operate on regional routes). Many more contradictions between countries also make it challenging to integrate air traffic in ASEAN. In that respect, it is understandable that the ASEAN Secretariat and perhaps also forces within the sector use international negotiations with, for example, China and the EU, to bring about internal harmonisation and liberalisation.

Conflicts within countries also play an essential role in liberalising air traffic. Again, Indonesia is an interesting example because it has long delayed the implementation of the ASEAN protocols. Conflicts between groups within a country can make it difficult for national governments to establish regional negotiations. In Indonesia, for example, major antagonisms between the interests of Garuda on the one hand and low-cost carriers on the other hand emerged from joint ventures. In addition, Indonesia has Lion Air, a very ambitious carrier that would benefit from far-reaching integration into ASEAN. Permana, Hoen, and Holzacker (2020) showed that this conflict paralysed decision-making at the national level for a long time, which delayed implementing the protocols agreed upon within ASEAN. In any case, it was mainly Garuda that insisted on more time to adapt to the new circumstances. A more general observation is that domestic national carriers often have a firm grip on national policymakers, which is reduced through regional integration, thus the impediments that otherwise apply to entrants such as low-cost carriers are eroded.

We have already argued that, for ASEAN, creating a common external policy in air transport can be seen as a key to achieving internal harmonisation and market facilitation.<sup>5</sup> Two important negotiations have taken place in recent

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<sup>5</sup> When it comes to regional integration, two things are important. Firstly, if regional linkages are established with a specific partner, trade is diverted from traditional partners to this new partner. For example, if there are opportunities to reach the US via China while it is more difficult via Taiwan or Hong Kong, freight will shift to this more efficient route. A second economic principle to consider is double marginalisation. This occurs when several parties in a chain have a monopoly position and can set a high price for their customers. That is inefficient in itself, but it becomes doubly inefficient if several parties do so. In that case, the participants in a specific chain have a great interest in making agreements to avoid this double

years. Firstly, the various AMS, in cooperation with the ASEAN Secretariat, held talks with China. The aspect of different freedoms is interesting here. China is a very large country with a great many airports. Therefore, it is very important that AMS use these airports to reach the Chinese market and other countries via Chinese airports. Especially when it comes to cargo transport, access to Shanghai as a hub is of great importance. For China, the advantage is that there are freedoms within China, allowing flights of Chinese airlines to be combined, which means that flights from China to ASEAN can be economically profitable. Since the Asian market has many fewer freedoms, an imbalance would be created because such combinations are not as easy for the ASEAN airlines internally. This applies to both passenger and cargo transport. In 2010, these negotiations were successfully concluded.

Secondly, a programme was set in motion whereby a comprehensive agreement was to be reached between ASEAN and the EU. From a theoretical point of view, this is very interesting because it is the first time that two regional blocs are trying to conclude an FTA. It is also interesting that the decision-making structure between the two blocs is very different. Whereas ASEAN is organised on an intergovernmental basis, with the Secretariat in a not a very strong position, the situation is reversed in the EU. The European Commission and the European Court of Justice have far-reaching powers regarding the internal market for air transport. It is one of the most advanced forms of integration in service provision within the EU. But this also leads to an interesting aspect: to what extent does the internal decision-making power of the European institutions provide sufficient legitimacy for external policy? Although it seems logical to translate internal competencies into external ones, this is not so obvious.

Ellis (2020) analysed this issue through the Delphi method with senior policymakers. The main conclusion is that there are still many concerns about how far-reaching internal powers can be effectively translated into external powers. An important aspect is that although the internal market is free within

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marginalisation. Making regional agreements in a market where, for example, national airlines have a dominant position, can lead to a combination of trade diversion and double marginalisation.

the EU, the external powers are linked to national governments through bilateral agreements. So, although the European Commission may have broad powers, it is not easy to reconcile them with the many bilateral agreements in the sector – nor is it the case that the common internal policies cancel these agreements. This leads to a complicated constellation for negotiations. Of course, the EU member countries want the European Commission to come home with a bilateral agreement from the European level with AMS that is at least as good but preferably better than the current bilateral agreements. But on the ASEAN side, these new agreements have to be implemented again at each national level, as there is no supranational legislation. However, that would lead to a complicated situation in which the current bilateral agreements would have to be converted to an uncertain state of affairs (where the outcome required adoption of the new agreements by all AMS). In that case, it might be more rational for the EU member countries to wait until there is agreement within ASEAN on regional level competencies before entering into far-reaching agreements between the European Commission and ASEAN.

The intergovernmental nature of decision-making in ASEAN may therefore be creating problems for finalising an agreement on air transport with the EU. Although they are not in the open, other bilateral issues are relevant. For example, it seems that Malaysia is trying to leverage its position in avoiding the protectionist measures of the EU with respect to palm oil. This is probably also an important issue for Indonesia. It seems that both countries, with relatively inefficient airline industries compared with other members of the bloc, want to use the talks to foster their own export interests.

### **3. The Impact of COVID-19 on the ASEAN Cargo Market**

With heavy mobility restrictions imposed as part of the response to the pandemic in many countries, the airline industry is suffering the worst downturn in its history. After the crisis hit in February 2020, 10% of all flights were cancelled in March, which increased to 40% in April and nearly 80% when restrictions hit across the globe. Air cargo was also hit hard initially, although many operators had promoted full cargo models that in theory make it easier to practise social distancing. Air cargo demand fell by 9% in February 2020. In contrast, the grounding of aeroplanes reduced capacity by more than 40% and the price of sending cargo by air tripled by late March. As passenger planes were grounded, cargo airlines brought cargo planes back into service, and even passenger airliners were converted into cargo aircraft. In April 2020, capacity was down 35%–17% from ASEAN to North America, 30% from Asia to Europe, and 35% within Asia.<sup>6</sup>

#### **3.1. The nosedive in the first half of 2020**

The pandemic created enormous problems for many airlines. Focusing on Asia, in April 2020 Virgin Australia reduced its employees by 8,000 (80% of the workforce) and applied for administration; and Thai Airways announced restructuring plans before the bankruptcy court, although the Thai government immediately announced that it would not accept formal bankruptcy. Also in Thailand, NokScoot was liquidated and Air Bangkok had to file for government assistance. In October, AirAsia Japan and Cathay Dragon ceased operations. Cebu Pacific Air from the Philippines cancelled all flights to Manila. Vietnam Airlines announced it would sell its 49% stake in Cambodia Angkor Air. Garuda Indonesia laid off 180 pilots. Korean Air grounded 80% of its international capacity. In the middle of the crisis, Malaysia Airlines received a (hostile) bid from my unknown private equity firm backed by a European bank to save it from bankruptcy. Singapore airlines cut 96% of its flights by the end of April and flew its Airbus A380 planes for indefinite storage to Australia's Alice

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<sup>6</sup> There are many sources for this information, but a general one which summarises a series of reports in the press is Wikipedia (n.d.).



Springs. In March 2020, Vietnam Airlines suspended all its flights until the end of April.

By mid-2020, operational capacity in Asia was cut to 51% – although that could be considered mild compared with Europe’s 80% reduction. As the crisis unfolded, wide-body aircraft were hit much harder than narrow-body cargo aircraft, and the combination of passenger and cargo in wide bodies thus broke down, resulting in soaring demand for cargo capacity in narrow-bodied cargo aircraft.

likely to stop the process of convergence of business models of low-cost carriers and full-service network carriers because of the erosion of the middle segment’s profitability, something to which we return in the following sections. They also argued that financial constraints and the increased influence of national governments in decision-making could halt the consolidation under way in the industry following the pandemic.

By the end of 2020, several papers had been published analysing airlines’ strategic responses in the initial stages of the COVID-19 pandemic. Budd, Ison, and Adrienne (2020) showed that contraction of activities and consolidation of positions were the critical responses to the short-term fall in demand, based on an assessment of 40 airlines. Albers and Rundshagen (2020) analysed several potential strategic reactions in the European context, including retrenchment, persevering, innovating, and exit strategies – all of which are also relevant in a global context. They showed that national governments in Europe have played an important role in choosing a specific approach by facilitating (and blocking) one or other of these strategic options. They also argued that the pandemic is likely to stop the process of convergence of business models of low-cost carriers and full-service network carriers because of the erosion of the middle segment’s profitability, something to which we return in the following sections. They also argued that financial constraints and the increased influence of national governments in decision-making could halt the consolidation under way in the industry following the pandemic.

### 3.2. The bounce back

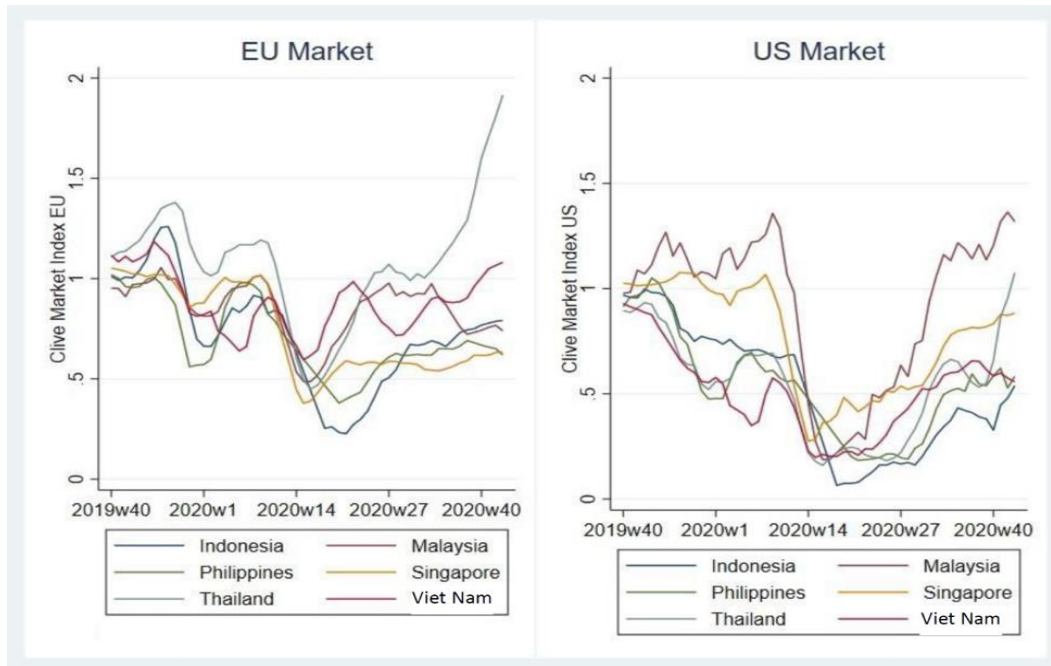
To analyse the effects of the COVID-19 pandemic on air cargo coming from the AMS for the second and third quarters (Q2 and Q3) of 2020, we use the CLIVE database (CLIVE, n.d.), which is constructed based on detailed flight data obtained from CLIVE clients. These clients are airline companies that provide data on load factors, volumes, and weight of cargo. We used CLIVE data streams for analysis, including detailed data for aeroplane loadings and destination data on routes towards the EU and the US.<sup>7</sup>

In Figure 4, the sharp rebound from Thailand is mainly due to success in regaining market share in Europe. Further, when we compare across countries and focus on the two largest exporters by volume (Singapore and Viet Nam), there are remarkable differences. Singapore has largely recovered its exporting position in the US market, whereas it has lagged in returning to its pre-pandemic position in the EU. By contrast, Viet Nam has been very stable during the pandemic and has increased its exports to the European market. Malaysia has been relatively stable in the European market, whereas it is volatile in the US market. Overall, air cargo movements have recovered, but the extent differs substantially across countries within the region and by export market.

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<sup>7</sup> These data refer to both volume and weight, since the volume restriction is the most relevant for modern aeroplanes and a focus on weight alone could create a distorted picture of the COVID-19 impact on air cargo.

**Figure 4: Air Cargo Weight with a Destination in the EU and US Markets**



EU = European Union, US = United States.

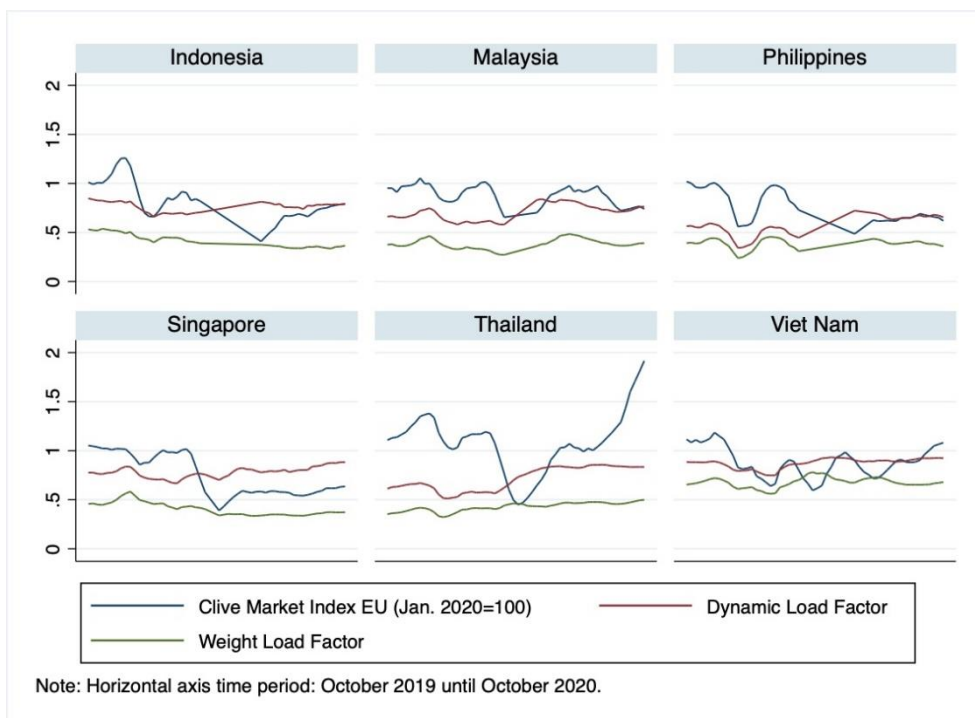
Note: The Clive Market Index (or dynamic load factor) is an aggregate measure, based on flight and shipment data sourced directly from cargo airlines, of the utilisation of capacity in terms of either weight or volume, whichever constraint is met first.

Source: CLIVE (n.d.).

As we have shown, the European market has become more important for many countries in Asia. In Figure 5 (for the same time period as in Figure 4), we look closer into the changes in air cargo flows between ASEAN and Europe. Load factors are often considered as the most important determinant of margins in the industry, but load factors that include metrics on volume are more informative, as only focusing on cargo weight does not take into account that the loading maximum capacity restriction is often on volume and not on weight in modern cargo planes and combined passenger flights. Dynamic loading factors reflect a combination of the effects of changes in the carrying capacity (heavily reduced when the crisis hit and aeroplanes went out of service) and foreign markets' demands (recovering in the second half of the year). In Figure 5, we specifically look at dynamic loading factors determined by volume restrictions for cargo destined for the Middle East and Europe. For all countries in the ASEAN region, we see a sharp drop at the beginning of 2020 because of the COVID-19 crisis. However, the shape of the decline and recovery is quite different across countries. When we observe the drop in volume, for most

countries this is a double dip stemming from the early warnings of COVID-19 and the second drop when the pandemic hits in March. The first volume drop is much more pronounced in the Philippines, Thailand, and Viet Nam than it is in Singapore and Malaysia. When we look at the differences in recovery, the contrast between Singapore (only limited volume recovery) and Thailand stands out. For Thailand, this is because it has been a significant latex producer and shipper, benefiting from increased demand for protective equipment. Hence, the type of products shipped matters for the reaction to COVID-19. Also in Thailand, traditionally low loading factors had much room to improve so that more efficient aeroplane loading could easily follow up on the uptick in demand.

**Figure 5: COVID-19 Effects on Air Cargo from ASEAN to the EU, 2019–2020**



ASEAN = Association of Southeast Asian Nations, EU = European Union.  
Source: CLIVE (n.d.).

As an overall conclusion from Figure 5, load factors have not only recovered but they are substantially higher than before and at the start of the pandemic. We may also observe that the higher loading factor corresponds mostly to the air cargo volume component. Although we cannot be precise, the fact that e-

commerce items shipped and packaged in the AMS are relatively large in volume and low in weight (‘boxes’) points to the fact that, after the initial drop, e-commerce has gained influence in shaping air cargo flights to Europe. As we have observed substantial differences across countries with respect to the initial drop and recovery as well as differences in which export markets have recovered, the next subsection aims to summarise many of the arguments by looking more deeply at which factors shape air cargo flights out of the ASEAN region.

### **3.3. Fuzzy set analysis of the COVID-19 crisis**

As the theoretical sections that discuss air cargo flows in the literature make clear, explaining air freight dynamics is a complex issue. We have seen that various studies connect air cargo volumes to GDP-driven dynamics of the export market and capacity in the domestic market. Then, other studies stress the increased importance of digitisation for business models to compete globally. Further, countries have reacted to the COVID-19 crisis in terms of restrictions and healthcare support interventions. It is interesting to look for marginal effects of the variables on air cargo flows, as is done traditionally in econometric analysis, although for a limited number of countries and with complex interaction between variables, e.g. GDP growth and COVID-19 restrictions. However, it is helpful to embrace complexity and to see which combination of factors explains the dynamics in the air cargo market.

To this end, business studies increasingly use fuzzy set analysis to analyse complex relations amongst explanatory variables and outcome variables.<sup>8</sup> Its rising popularity comes from the fact that the combination of various components – in constructs like entrepreneurial ecosystems or relations amongst stakeholders, for example – can be treated as a complex system. For economists, the intuition is quite close to asking what *combination* of factors explains which amount of variance in the outcome variable. By considering all potential combinations of the elements, fuzzy set analysis selects those combinations (which should not be excessively overlapping) that contribute a

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<sup>8</sup> Probably without exception, Ragin (2008) is considered to be the bible of fuzzy set analysis.

substantial degree of the variance. For example, one combination of the variables might explain a large chunk of the variance (and econometrics would probably stop at this point), but then other combinations might indicate a relationship with some other part of the distribution of the dependent variable. Hence, quite different sets of factors together explain a substantial degree of variance in the dependent variable. Such combinations of variables that, when in place in combination, explain a substantial part of the variance in the outcome variable are referred to as ‘sufficient conditions’ and create a ‘path’ in the identification of underlying complex factors. Thus, fuzzy set analysis can add value by looking at very different combinations of explanatory variables so that each individual set has significant combined correlation to the outcome. Most interestingly, there is a difference between the *raw* coverage (the part of the variance that is explained by the combination of variables) and the *unique* coverage (the part that is only explained by a specific combination). An interesting result appears when there are, for example, two sets of variables that are quite opposing but that each has a substantial unique coverage. Then, we arrive at two very different ‘paths’ to correlate to the outcome that each may be connected to a different theoretical explanation. Clearly, to have a meaningful analysis of sets, there cannot be too many variables in those sets, as this would block convergence over which factors in combination have explanatory power.

We now examine which factors play a role in explaining cargo flows from the ASEAN region during the COVID-19 pandemic. We look at Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam in Q2 and Q3 2020. To conduct a fuzzy set analysis, we created several variables embedded in the literature described above. Using the CLIVE data set, we examined the market data of the freight from each country entering the US and the EU at several points in time during the COVID-19 crisis. More specifically, we look at the first week of February, the first week of June, and the first week of October; then, we calculate the cargo decline for the period from 1 February to 1 June, and then the increase caused by the bounceback for each country from 1 June to 1 October. We have to anticipate that if the decline in Q2 is not very substantial (e.g. in Viet Nam), the recovery will likely also be less pronounced.

For this reason, we standardise the decline rates of the period from 1 February to 1 January and use that factor as a multiplier for the growth rate in the period from 1 June to 1 October. By doing so, we have 6×2 observations for the air cargo growth rates of these Asian countries. These data involve a combination of decline and adjusted bounceback that provide a realistic way of capturing air cargo growth dynamics.

**Table 2: Fuzzy Set Analysis of Factors Shaping Air Cargo 2020 Dynamics**

Set	Raw coverage	Unique coverage
Supply*Demand	0.638	0.159
Digital*Demand	0.507	0.067
covid*Demand*digital	0.359	0.000
covid*demand*digital*supply	0.356	0.165
Total coverage	0.922	
Solution consistency	0.722	

Source: Authors' analysis.

As for the environment of the complex set, we start with GDP conditions in export markets. To this end, we have collected the quarterly growth rates of the EU and the US and have multiplied those by the share of air cargo for each country based on the CLIVE database. Doing it this way creates a weighted export market GDP measure relevant for air cargo at the start of the period. The intuition is that if, for example, the EU is a relatively important export market for Malaysia when compared with the US, the growth dynamics in the EU should matter more to Malaysia than those in the US market. We consider three other variables. One is the policy stance on combating the COVID-19 crisis. The University of Oxford creates the leading indicator for policy efforts, and we have taken their score at the height of the crisis (1 April) and during the third period of 1 July. Tapping into the discussion that digitisation is important to cushion against the pandemic's effect, we have included another variable concerning the digitisation scores for the countries. Lastly, we include a variable for the quarterly growth rates for the AMS, to take into account supply-

side dynamics. In the fuzzy set results, a first letter that is not capitalised means a low value, so, for example, *covid* indicates low risk whereas *Covid* implies high risk.

The results of the fuzzy set analysis are presented in Table 2. From the analysis, four sets of variables are significantly related to the dynamics of air cargo from the ASEAN region to the EU and the US. Starting at the top, the combination of supply conditions in the domestic market (a low fall in the growth rate in Q2 and a high growth rate in Q3) – together with supportive demand conditions in Europe and the US (recall that these are different for each country based on the relative importance of each of the two markets) – explains a raw coverage of the variance in air cargo dynamics of 0.638 and unique coverage of 0.159. It is important to stress that fuzzy set analysis implies that both the demand and supply conditions in combination must be supportive, and it is not about the interaction of these two factors. The unique coverage for the first line is quite low because positive supply conditions may well be correlated to digitalisation, which is in general helpful to mitigate the effects of COVID-19. The second combination (line) that is a good fit is that of demand conditions and digitisation. The fact that demand conditions reappear in the second row supports the insight that GDP dynamics in export markets are important in explaining air cargo flows. Thus, digitalisation substitutes for domestic supply conditions in this second row when compared with row one. Then, rows 3 and 4 show two sets with equal (reasonably high for additional sets) raw coverage, but the big difference is that the fourth line has a high level of unique coverage and is actually higher than line 1. This is the combination of low demand conditions, low supply conditions, and low digitalisation levels, together with a strong policy response to COVID-19. The unique coverage of this combination is 0.165. This combination seems to be a polar complex set in that a strong response to COVID-19 seems to cushion the impacts on air cargo from the pandemic.



Although fuzzy set analysis is most helpful in exploring data and proposing hypotheses, and not so much in testing them, it is interesting to observe that there seem to be two very distinct paths to recovery. The first path connects quite well to theoretical insights that stress demand conditions in export markets. This implies that even in short periods of time (in contrast to most of the papers that analyse longitudinal data over a substantial number of years) and in extreme conditions like COVID-19, this demand factor is important. This is an important theoretical contribution. The second path that has an equal level of unique coverage is that, when demand and supply conditions are not helpful, superior responses to the COVID-19 crisis created another option for recovery. It is interesting to formulate these experiences in terms of sufficiency. One sufficient condition is to have strong recovery in foreign market and domestic supply conditions. Another sufficient condition is to have good COVID-19 policy in case such conditions are not helping air cargo recovery.

We may also speculate how these exploratory results are connected to the discussion on business models. The path that stresses demand and supply conditions connects to the importance of participation in GVCs, which are served by integrated operators that focus on air cargo only. For this business model, the ability to match the production (supply) and consumption (demand) side would be sufficient to support a rebound. But the other path, which involves weak supply and demand conditions but very stringent and proactive COVID-19 policy, might be especially relevant for countries that have been able to restart mobility and thus revitalise the business model that combines passenger and cargo flights. It would be interesting to see whether this split between the two paths will continue and connect to the two dominating business models that in our opinion will arise in the post-COVID-19 world, and that we will discuss in more detail in the next section.

### **3.4. Policy responses: state aid and mobility restrictions and implications for business models**

As noted earlier, the pre-existing regime that applies to market access assists the development of cargo specialists. However, the response to the experience of the pandemic raises questions about the path of adjustment. In this subsection, we consider the implications of state aid and restrictions on the movement of people, which have been important elements of the pandemic response.

A significant amount of aid has been provided to airlines in response to the effect of the pandemic on passenger movement. Will this limit the development of either of the new models by reinforcing the status quo? IATA estimates that a total of \$173 billion has been provided to airlines, although a significant proportion (about 60%) of this support is (at least currently) expected to be reimbursed. Airlines have also raised debt in capital markets (so their total debt, including that owed to governments (\$96 billion) has risen from \$430 billion to \$651 billion). The level of state aid (as well as its composition) varies by country. IATA also provides a global picture of the range of the value of aid compared with airline revenue (these data are dated May 2020 when the total provision of state aid was \$123 billion). Support can exceed 30% of revenue. Aid is generally likely to be higher in higher-income countries (with high scores in Europe and the US). However, the levels of aid relative to revenue are low across East Asia – the highest ratios are in Korea (11.6%), Japan (9.2%), and Singapore (4%).

In general, the provision of state aid might impede the adjustment process that we discuss. One qualification is that a significant part of the aid is in the form of support for access to debt, and that support is not continuing, so in this situation the provision of aid may impede rather than divert the adjustment. A further complication is that the pattern of aid varies by region. Within Europe or North America, where support is larger, the delay or impediment effects may be larger. Within East Asia, those effects are likely to be less. However, air cargo moves globally, so airlines operating from regions with less support find themselves competing with others that are more supported. This is likely to be

a point of tension at the global level. The risk is that, in the context of the long history of the application of rules on market access, the response to this tension will be more – rather than less – regulation, or the continued provision of subsidies (Morrison and de Wit, 2019).

There is a link between the design of the market access regime and the provision of state aid, as well as feedback from the latter to the former. The market access regime tends to bias the response to shocks towards state aid rather than other market-oriented measures. This is because the regime is based on a ‘rule of origin’ which involves the specification of levels of domestic ownership and control. Other options for responding to a shock could be injections of capital into airline businesses with long-run positive prospects from private investors, including foreign investors. The latter option, however, reduces the extent of local control and may trigger loss of rights to market access. Hence, the airline response is often to seek home government support, rather than a restructuring involving a change in equity and greater foreign participation. In turn, this response tends to reinforce the case for retaining – and adds to the resistance to change – the current market access regime, since trading partners seek to maintain an option to manage the access of foreign air transport providers, some of whom are subsidised, into their own markets.

A key trade policy event in recent years was the endorsement at the WTO level of efforts to facilitate trade in goods and services. Attention has been given to the facilitation of investment flows. A key issue post-COVID-19 will be the facilitation of the movement of people. Currently, significant restrictions remain on the cross-border movement of people, in an attempt to contain the spread of the virus, with the consequences discussed above. The restrictions may be lifted as a result of unilateral action, e.g. the application of vaccines within countries. Arrangements may develop between particular pairs of economies (the formation of ‘bubbles’). There are also proposals for the application of new systems at the level of the individual traveller, rather than at country level, in the form of a travel pass. These involve the collection, storage, and transfer of testing and vaccine information for a traveller, in the context of equivalent standards referring to the way in which the identity of the traveller

is linked to health information. Regional cooperation would assist in the design and implementation of such a regime. But the point remains that healthcare concerns may raise the cost of service provision in general, but probably mostly in the airline industry. Detailed discussion of these options is beyond our scope, but the rate of progress has implications for the evolution of the business models.

#### **4. Scenarios: Air Cargo Business Models after COVID-19**

In this section, we return to the question of the drivers of the evolution of the business models for air cargo supply. Our main interest is in the consequences of the COVID-19 experience, and we return to that shortly. Before that, we note some long-term and more general drivers of change. There is a common consensus on the relevance of four of these. Firstly, technological progress, especially digitalisation, create an environment where software integration takes over a substantial degree of administrative work – called the ‘software eats the world’ effect (Andreessen, 2011). For supply chain management, especially important will be the combination of artificial intelligence and thus predictive power and blockchain technology which may improve contracting. Secondly, with the rise of the service economy, the value added of services in total production is increasing. As many of those services can be delivered digitally (e.g. 3D printing), the volume of manufactured goods shipped is expected to be reduced significantly. Third, rising environmental problems, leading to restrictions on air transport, may affect the air cargo industry. However, environmental concerns will also spur technological innovations in clean energy, which could reduce logistics costs substantially, working as a counterbalancing force. Lastly, the hostile international trade environment will affect trade and logistics costs in the near future. A case in point is the US threat to withdraw from the United Nations Universal Postal Union, which led to higher handling charges, offsetting what was previously argued to be a subsidy for China’s delivery services. A higher level of general international taxation of logistics will mostly change the business model of low-

cost contracting.

We note that, with COVID-19 restrictions approaching a full year of reduced activity and starting to create social and economic havoc, there is a booming and more specific literature on the future of the airline industry after the pandemic (see, for example, the special issue of the *Journal of Air Transport Management* in October 2020). Judging from the (for now mostly popular) literature, there are four strategic lines of consideration, in addition to the policy-related points we made in the previous section. The first is that COVID-19 will accelerate technological trends that include digitisation and automation of freight systems. Prime examples that touch on the air cargo market arise in e-commerce using platforms which increase air cargo traffic exponentially, and the commercialisation of drones to be used for delivery. However, as a second strategic line of thinking, several social trends may be weakened because of the critical reflection on the pandemic's causes and consequences. For example, the increase in urbanisation may be halted and tourism constrained because of increased sustainability awareness and policies supporting this. The third line of thinking is that most technological development is biased to support emerging disruptive business models. We may anticipate even further improvements in videoconferencing, blockchain technology to facilitate supply chain management, and many technology disruptions that we are currently not thinking about. Lastly, and countering several of the above trends, the pandemic may cause financial hardship for many businesses, including the most innovative ones stalling innovation projects. Major companies such as Amazon and Uber are already abandoning and selling their frontier mobility investments in, for example, self-driving cars. Given the complex nature of the post-COVID-19 technological trajectories, health concerns, business model divergence, and political concerns, it is difficult to converge on a single scenario for the air cargo industry to emerge from the COVID-19 crisis.

#### **4.1. The reversal of business model convergence**

Having reviewed a large chunk of the academic literature at the end of 2020, taking stock of the effects of COVID-19 in the airline industry, we propose that there will be further convergence around two business models. The

first business model is point-to-point long-haul passenger flights, which will substantially reduce contact by creating distancing bubbles. Increased investment in long-haul technology for wide-bodied planes will transform the business model for combined passenger–cargo flights. The second business model to emerge is a more substantial role for integrators (air cargo specialist providers, but integrating with other services), where artificial intelligence and big data are combined in the management of software-driven supply chains that reduce human interaction. In general, the convergence in business models that was apparent before the COVID-19 crisis will be reversed because of sharper competitive edges in the post-COVID-19 economic environment. Before the pandemic, there was a consensus that air cargo was moving towards a dominant role for specialised integrators. Both business-to-business (B2B) supply chain integration and B2C e-commerce were handled mostly by companies such as DHL and FedEx. Focusing on the medium term (leaving out issues such as blockchain and drone technology that may affect the industry in the long run), we expect a more robust separation of highly opposing business models which together will capture the bulk of the air cargo market. The dominance of these two business models comes from the current readiness of the companies practising them, together with endogenous technological change coming from healthcare and environmental concerns.

#### **4.2. The long-haul passenger–cargo combination as a viable commercial business model**

Bauer, Bloch, and Merkert (2020) as well as Grimme, Bingemer, and Maertens (2020) analysed the rise of the viability of the ultra long-haul model in the post-COVID-19 world, mostly using the Qantas experience. This model may be a post-pandemic commercially viable alternative for the stopover passenger–cargo combination flights that are historically dominated by Gulf state carriers (owned by governments). The Gulf state passenger–cargo combination flights create a hub-and-spoke system which is expected to be inefficient (and thus costly) in the post-pandemic world, with increased scrutiny of passenger mobility and high investments needed in safe passenger routing and supervision (creating a bubble). The hub-and-spoke network structure's

erosion, with a crowded contractual infrastructure, will create a ‘blue ocean’ opportunity for ultra long-haul flights to create a new global network.<sup>9</sup> Geographically, such investments in ultra long-haul flights may be most interesting to connect Europe and Asia directly. This direct connection will open up air cargo-dominated long-haul flights with ample point-to-point air cargo opportunities because of the two-way passenger traffic.

The ultra long-haul model depends on the growth in passenger movements. Restrictions on the implementation of the travel pass regime or its equivalent impede the opportunity for the application of this model. The alternative cargo specialist model has an advantage in that context, since the movement of people issues apply only to crew rather than a large number of passengers. There are proposals for facilitating the movement of crew through special corridors.

#### **4.3. Digital transformation and Amazon approaching**

The second dominant business model (involving cargo specialists) that we foresee in the near future includes the downstream integration by platforms such as Alibaba, Wish, and Amazon. These platforms connect producers (many located in Asia) to consumers located in the US and Europe. There are a few drivers of the desire of such platforms to make deeper commitments to logistics. The first and probably foremost driver is that superior data availability, and therefore using artificial intelligence for predictive assessment of trade flows, would provide a competitive advantage of platform companies over air cargo integrators, especially in the B2C market. Further, the cost of forward integration in terms of storage location and labour contracts is well worth considering given the growth of e-commerce and, therefore, the consumer market’s stability. As most commentators expect e-commerce to remain after the pandemic, this opens up the viability of creating logistics centres close to consumer hubs that facilitate last-mile delivery and even cater to the emerging

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<sup>9</sup> The notion of ultra long-haul being a ‘blue ocean strategy’ should be credited to Bloch (2020), who related this term to the ‘way out’ for companies stuck in Porter types of strategic options like cost leaders (low-cost specialised air cargo) and product differentiation (full-service cargo carriers).

pick-up culture of goods ordered online.

An additional driver is that the pandemic has taught the major shippers that importing is quite risky. At least, a standard ‘dual distributor model’ is more reliable in the context of an increasingly volatile international trade environment. The evolution of distribution channels from external networks to dual networks, of which one is integrated within the firm, has a long tradition in the field of international business studies. Following the path-breaking work of Arnold (2000), multinational firms often start with low levels of commitment and using importers and distribution networks to tap into local knowledge on marketing and distribution. Over time, international firms increase their understanding of local conditions. There will be an incentive to develop an in-house strategy in which subsidiaries deliver to customers. The in-between option of investing in the distribution network is considered to be effective only in a limited number of situations. In the case of air cargo transport, a collaboration between Amazon and DHL using artificial intelligence and predictive power probably transfers a core asset of Amazon down the supply chain. In that case, the platforms will likely choose to reduce outsourcing of distribution networks to integrated air cargo service providers and instead opt for the in-house organisation of air cargo transfers.

Over the years, it has become increasingly clear that Amazon intends to dominate distribution and not only serve as a platform. It will use its flywheel powers as a platform to extend its reach towards logistics. One of the main strategic innovations of Amazon is that it is not focusing on its core capabilities, as recommended in much of the management literature, but instead tries to build new capabilities that are connected to the core capability in the platform function. To achieve this, Amazon is actively using digitalisation to integrate delivery services, and air cargo is a case in point. As argued by Rodrigue (2020), in the coming years, the fight will be in the open between Amazon on the one hand and FedEx and DHL as specialist logistics providers on the other hand. Amazon is focusing on the B2C part of delivery and logistics. Still, over time, it is very likely to be a significant player in integrating GVCs in the B2B world.

An increasingly hostile international trade environment will support the



trend of in-house air cargo logistics production by large platforms. Much of the current debate centres around the ‘developing country status’ of China in the WTO. Using this status, the cost of delivering goods from China to the US and Europe has been low. This situation changed by the end of 2020, with the application of discriminatory measures and adjustments in the Universal Postal Union, and there is a very active movement in which the platform shippers take into account the changed market circumstances. Costs for importers and domestic shippers are likely to increase further because of the dynamics in the post-COVID-19 world, which may provide extra motivation for the development of systems of within-firm deliveries.

Rounding up the discussion in this section, the technological and political developments are likely to be complementary and, therefore, strengthen opposing trends in business models. The concerns to avoid physical contact will create a movement away from using the hub-and-spoke system in passenger travel, creating a blue ocean opportunity for long-haul travel – especially focusing on the high end of the market. Together with the use of wide-body aircraft and improvements in energy efficiency, there is scope to develop point-to-point air traffic. Cargo is provided jointly with passenger carriage, making this business model more efficient in the post-COVID-19 world. On the other side of the market, we will see intense competition from platform operators and possibly consolidation with integrators to capture B2C delivery in e-commerce as well as fully servicing GVCs.

## **5. Concluding Comments**

At the end of 2020, with the vaccination programme starting around the globe, the end of the pandemic is in sight, with respect to the relaxation of the heavy restrictions incurred by the lockdowns. But the world’s thinking about health issues will change, which will then change the airline industry substantially. In the medium term, much will depend on the shape of the economic recovery. It is very difficult to find common ground in the many opinions on how the economy will evolve in the coming years. Given the

enormous levels of public debt and low profitability of firms, it is heroic to expect a V-shaped recovery. We will probably see a period of low growth, which also points to a slow recovery of air traffic.

Several other trends are here to stay. Although most people have issues with working from home, the efficiency of using digital communication and the awareness of how this can transform the cost of business will make a lasting impact. This will definitely shape travel patterns, which will be more responsive with respect to cost. However, although increased digital interaction may reduce air transport, the growth of e-commerce – and therefore the importance of efficient digitally driven supply chains spanning several countries – is here to stay, increasing the role of air cargo. With respect to the speed of recovery in the air cargo industry, much will depend on how the major players can incorporate technological change into business models.

For business models, we expect a contest between one involving dedicated provision of freight services and another involving the joint carriage of passengers and freight, albeit in a different model than that which is currently dominant. The structure of the policy regime has implications for the way this contest might evolve. A lot of the analysis of the consequences of the COVID-19 experience points to its contribution to the reinforcement of existing trends. Here, we find otherwise. With respect to air cargo, the previous trend in the development of business models for this element of air transport was towards the provision of joint services with the movement of passengers, including through the operation of networks characterised by the use of hubs and spokes. In the context of the COVID-19 experience, for various reasons (both policy and otherwise), we see instead the emergence of two competing business models. One is the continuation of the joint delivery of passenger and cargo services, but via long-haul and point-to-point services rather than hub-and-spoke networks. The other is the development of cargo specialist providers, likely linked to platforms applied to e-commerce and B2B transactions, including within GVCs.

We do not analyse here whether one model is preferred, and their relative shares of various markets will more likely depend on other factors, such as the relative importance of the movement of people and cargo. It is important, however, that the contest between the models continue, since that process drives a more efficient outcome and one more likely to embody continuing pressure for innovation. Our concern is that various policy variables will shape the outcome of the contest or slow down the process. One is the regulatory regime that applies to air transport, which may favour the cargo-only model. Another is that the provision of state aid, in the context of falling passenger numbers, may slow down (or at worst divert) the outcome of the contest. A third is that tardiness in the development of new regimes to facilitate passenger movements will impede the growth of the long-haul joint services model.

## References

- Abate, M. and P. Christidis (2020), ‘The Impact of Air Transport Market Liberalization: Evidence from EU’s External Aviation Policy’, *Economics of Transportation*, 22, 100164.
- Albers, S. and V. Rundshagen (2020), ‘European Airlines’ Strategic Responses to the COVID-19 Pandemic (January–May 2020)’, *Journal of Air Transport Management*, 87, 101863.
- Alici, A. and A.S. Akar (2020), ‘Macroeconomic Determinants of Air Cargo Demand: A Panel Data Analysis’, *International Journal of Shipping and Transport Logistics*, 20(48), pp.11–23.
- Andreessen, M. (2011). ‘Why Software Is Eating the World’, *The Wall Street Journal*, 20 August.  
<https://www.wsj.com/articles/SB10001424053111903480904576512250915629460> (accessed 24 March 2021).
- Arnold, D. (2000), ‘Seven Rules of International Distribution’, *Harvard Business Review*, 78(6), pp.131–37.

- Ayasanond, C. (2019), 'Business Strategies for Enhancing the Competitiveness of Thai Air Cargo Supply Chain Management', International Conference Business Education Social Sciences Tourism and Technology in Japan 2019, 2–29 November, Tokyo-Hokkaido.
- Bagwell, K. and R.W. Staiger (2004), *The Economics of the World Trading System*. Cambridge, MA: MIT press.
- Banomyong, R. (2017), 'Vietnam in 2030: A Logistics and Infrastructure Perspective', in C. Hollweg, T. Smith, and D. Taglioni (eds.) *Vietnam at a Crossroads: Engaging in the Next Generation of Global Value Chains*. Washington, DC: World Bank, pp.69–79.
- Bauer, L.B., D. Bloch, and R. Merkert (2020), 'Ultra Long-Haul: An Emerging Business Model Accelerated by COVID-19', *Journal of Air Transport Management*, 89, 101901.
- Bloch, D. (2020), 'Blue Ocean Aviation Strategy in the Post COVID-19 Era'. Bloch Aviation Advisory.  
<https://www.blochaviationadvisory.com/publications/blue-ocean-aviation-strategy-in-the-post-covid-19-era> (accessed 24 March 2021).
- Borchert, I., B. Gootiiz, A. Grover Goswami, and A. Mattoo (2017), 'Services Trade Protection and Economic Isolation', *The World Economy*, 40(3), pp.632–52.
- Budd, L. and S. Ison (2017), 'The Role of Dedicated Freighter Aircraft in the Provision of Global Airfreight Services', *Journal of Air Transport Management*, 61, pp.34–40.
- Budd, L., S. Ison, and N. Adrienne (2020), 'European Airline Response to the COVID-19 Pandemic – Contraction, Consolidation and Future Considerations for Airline Business and Management', *Research in Transportation Business & Management*, 37, 100578.
- CLIVE (n.d.), CLIVE Data Services. <https://www.useclive.com/clive-data-services.html> (accessed 2 April 2021).
- Daft, J. and S. Albers (2015), 'An Empirical Analysis of Airline Business Model Convergence', *Journal of Air Transport Management*, 46, pp.3–11.

- Dewulf, W., H. Meersman, and E. Van de Voorde (2014), 'From Carpet Sellers to Cargo Stars: Analyzing Strategies of Air Cargo Carriers', *Journal of Air Transport Studies*, 5(1), pp.96–119.
- Dewulf, W., H. Meersman, and E. Van de Voorde (2019), 'The Strategy of Air Cargo Operators: About Carpet Sellers and Cargo Stars', in K. Cullinane (ed.) *Airline Economics in Europe*, Volume 8. Bingley, UK: Emerald Publishing Limited, pp.167–99.
- Doganis, R. (2006), *The Airline Business*, Second edition. Oxon: Psychology Press (Routledge).
- Ellis, D. (2020), 'Internal Versus External European Air Market Realities: The Competitive Divide', *European Transport Research Review*, 12(18), pp.1–11.
- Forsyth, P., J. King, and C.L. Rodolfo (2006), 'Open Skies in ASEAN', *Journal of Air Transport Management*, 12(3), pp.143–52.
- Francois, J. and B. Hoekman (2010), 'Services Trade and Policy', *Journal of Economic Literature*, 48(3), pp.642–92.
- Galloway, S. (2020), *Post Corona: From Crisis to Opportunity*. New York: Penguin Random House.
- Grimme, W., S. Bingemer, and S. Maertens (2020), 'An Analysis of the Prospects of Ultra-Long-Haul Airline Operations Using Passenger Demand Data', *Transportation Research Procedia*, 51, pp.208–16.
- Grossman, G.M. and E. Helpman (1995), 'The Politics of Free-Trade Agreements', *The American Economic Review*, 85(4), pp.667–90.
- Grossman, G.M., P. McCalman, and R.W. Staiger (2021), 'The 'New' Economics of Trade Agreements: From Trade Liberalization to Regulatory Convergence?', *Econometrica*, 89(1), pp.215–49.
- Huynh, T.M., G. Kim, and H.-K. Ha (2020), 'Comparative Analysis of Efficiency for Major Southeast Asia Airports: A Two-Stage Approach', *Journal of Air Transport Management*, 89, 101898.
- Kohler, W. and E. Yalein, eds. (2018), *Developments in Global Sourcing*. Cambridge, MA: MIT Press.

- Kupfer, F., H. Meersman, E. Onghena, and E. Van de Voorde (2017), 'The Underlying Drivers and Future Development of Air Cargo', *Journal of Air Transport Management*, 61, pp.6–14.
- Lee, D. (2020), 'Amazon Braces for Winter Demand Surge with Relentless Expansion', *Financial Times*, 13 October.
- Lieshout, R., P. Malighetti, R. Redondi, and G. Burghouwt (2016), 'The Competitive Landscape of Air Transport in Europe', *Journal of Transport Geography*, 50, pp.68–82.
- Macilree, J. and D.T. Duval (2020), 'Aeropolitics in a Post-COVID-19 World', *Journal of Air Transport Management*, 88, 101864.
- Maggi, G. and R. Ossa (2020), 'The Political Economy of Deep Integration', *NBER Working Paper Series*, No. 28190. Cambridge, MA: National Bureau of Economic Research.
- Malighetti, P., G. Martini, R. Redondi, and D. Scotti (2019), 'Air Transport Networks of Global Integrators in the More Liberalized Asian Air Cargo Industry', *Transport Policy*, 80, pp.12–23.
- Merkert, R., E. Van de Voorde, and J. de Wit (2017), 'Making or Breaking – Key Success Factors in the Air Cargo Market', *Journal of Air Transport Management*, 61, pp.1–5.
- Morrison, W.G. and J. de Wit (2019), 'US Open Skies Agreements and Unlevel Playing Fields', *Journal of Air Transport Management*, 74, pp.30–8.
- Permana, P., H.W. Hoen, and R.L. Holzhaecker (2020), 'Political Economy of ASEAN Open Skies Policy: Business Preferences, Competition and Commitment to Economic Integration', *Journal of Asian Economic Integration*, 2(1), pp.44–61.
- Ponte, S., G. Gereffi, and G. Raj-Reichert, eds. (2019), *Handbook on Global Value Chains*. Cheltenham, UK: Edward Elgar Publishing.
- Ragin, C.C. (2008), *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. Chicago, IL: University of Chicago Press.

- Rayinah and D. A. Chalid, (2020), 'Financial Analysis of Airlines as Air Cargo Terminal Operator (The Case of Garuda Indonesia)', *KnE Social Sciences*, 4(6), pp.642–58.
- Reis, V. and J. Silva (2016), 'Assessing the Air Cargo Business Models of Combination Airlines', *Journal of Air Transport Management*, 57, pp.250–59.
- Rodrigue, J.-P. (2020), 'The Distribution Network of Amazon and the Footprint of Freight Digitalization', *Journal of Transport Geography*, 88, 102825.
- Schwieterman, J.P., J. Walls, B. Gonzalez, and C. Bell (2021), 'Primed and Positioned: Strategic Moves by Amazon Air', Chaddick Policy Brief, 16 February.
- Shepherd, B., A. Shingal, and A. Raj (2016), *Value of Air Cargo: Air Transport and Global Value Chains*. Montreal, QC: International Air Transport Association (IATA).
- Staiger, R.W. and A.O. Sykes (2016), 'The Economic Structure of International Trade-in-Services Agreements', *NBER Working Paper Series*, No. 22960, Cambridge, MA: National Bureau of Economic Research.
- Tanriverdi, G., M. Bakır, and R. Merkert (2020), 'What Can We Learn from the JATM Literature for the Future of Aviation Post COVID-19? A Bibliometric and Visualization Analysis', *Journal of Air Transport Management*, 89, 101916.
- Timmer, M.P., A.A. Erumban, B. Los, R. Stehrer, and G.J. de Vries (2014), 'Slicing Up Global Value Chains', *Journal of Economic Perspectives*, 28(2), pp.99–118.
- Urban, M., M. Klemm, K. O. Ploetner, and M. Hornung (2018), 'Airline Categorisation by Applying the Business Model Canvas and Clustering Algorithms', *Journal of Air Transport Management*, 71, pp.175–92.
- Wikipedia (n.d.), [https://en.wikipedia.org/wiki/Impact\\_of\\_the\\_COVID-19\\_pandemic\\_on\\_aviation](https://en.wikipedia.org/wiki/Impact_of_the_COVID-19_pandemic_on_aviation) (accessed 14 June 2021).

- World Bank (2020), *World Development Report 2020: Trading for Development in the Age of Global Value Chains*. Washington, DC: World Bank.
- Yuen, A., A. Zhang, Y. Van Hui, L.C. Leung, and M. Fung (2017), ‘Is Developing Air Cargo Airports in the Hinterland the Way of the Future?’, *Journal of Air Transport Management*, 61, pp.15–25.
- Zen, F., K. Yamamoto, T. Fujisawa, F. Kimura, I. Isono, and R. Banomyong (2019), ‘Seamless Transport, Logistics Markets, and Physical Connectivity’, in P. Intal and M. Pangestu (eds.) *Integrated and Connected Seamless ASEAN Economic Community*. Jakarta: Economic Research Institute for ASEAN and East Asia (ERIA), pp.172–202.
- Zhang, Y. and C. Findlay (2014), ‘Air Transport Policy and Its Impacts on Passenger Traffic and Tourist Flows’, *Journal of Air Transport Management*, 34, pp.42–8.



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