5. CONTAINER PORT VOLUMES

5.1 From Container Flows to Port Volumes

The forecasts discussed in previous chapters refer to the volume of containerized cargo that is shipped internationally. This information is difficult to obtain, and the values are subject to considerable measurement error. The most commonly quoted statistics on the size of the global container market refer to the number of container handling movements in ports, which is a more readily observable magnitude.

Port cargo handling volumes differ from the number of container movements because:

- Each container is counted at least twice, once at the port of export and once at the port of import;
- Some containers are trans-shipped at intermediate ports en route to their destination, in which case the container is counted twice more in port statistics: once as it is taken off the vessel and once as it is put back on;
- Port statistics also include empty containers loaded and unloaded in the port;

In addition, port statistics also include the movement of domestic containers, which are not included in the current study.

5.2 Empty Containers

Empty container movements at present constitute approximately 20 per cent of the world total international container port throughputs.

Excess capacity is likely to be a feature of liner shipping for the foreseeable future. This will continue to place pressure on operating margins, and provide a strong incentive for shipping lines to minimize logistics costs, of which empty container movements are a major component. At the same time, increasingly sophisticated container tracking and management procedures should provide opportunities for realizing economies in this area.

In the MPPM models, the approach to estimating the volume of empty containers handled in each port is simple. This approach is illustrated diagrammatically in Figure 5-1.

- The major direction for container movements is identified at each port: these may be either import direction, or the export direction.
A percentage of empty containers is added to this major flow. The MPPM models have the capacity to vary this percentage from port to port. However, in previous studies we have found this to be a particularly unstable variable, and therefore difficult to predict with confidence. In this study, we have therefore chosen to apply a global average percentage to most ports: this was set at 3.5 per cent.

Thirdly, the number of empty containers in the minor flow direction is estimated by subtracting the number of full containers in the minor flow direction from the total number of containers in the major flow direction. The assumption is therefore that total flows (full plus empties) are balanced in each port. This assumption is unrealistic with regard to any particular port in any particular year. However, given the difficulty of predicting the actual ratio in future years, the minor impact that imbalances have on overall volumes, and the fact that globally a balance must be maintained, the simplifying assumption was felt to be justified.

![Figure 5-1: Estimation of empty container movements: MPPM models](image-url)

Figure 5-2 shows the ratio of empty containers to the total container port throughput over the last 20 years. It can be seen that up to around 1996 there was a clear declining trend in this ratio, and increasingly sophisticated container logistics gradually reduced the number of ‘unproductive’ empty container movements. The empty container incidence has exceeded 20 per cent since 1998, due to the emergence of very pronounced imbalance in the two main Asian trades with Europe and North America caused by the Asian currency crisis. As a result, the past imbalance of
container flows continued and repositioning of empty containers remained a major concern for carriers.\textsuperscript{13}

In fact, in spite of rising trade imbalances on those two key routes, carriers have well managed to restrain the global empty incidence over the last few years. While this is partly due to more balanced flows in intraregional trades – especially intra-Asia, but it is more likely because carriers have been devoting considerable energy and investment to better matching of equipment flows and to sophisticated yield management systems.

\textbf{Figure 5-2: Share of empty container movements (1985–2004)}

\textit{(Percentage of total port handling)}

![Graph showing share of empty container movements (1985–2004)]

\textit{Source}: Drewry Shipping Consultants.

As discussed in the Chapter 4, trade imbalances on the trans-Pacific and Asia-Europe routes are expected to be worsening as the Asian export growth continues to outstrip import increases. It would therefore seem inevitable that carriers are going to be hard pressed to reduce the empty incidence through various means of improving equipment management systems.

\textsuperscript{13} There are considerable costs associated with repositioning of empty equipment including an allowance for terminal handling, the costs of restowage, administration, container storage, ship’s time, equipment per diems and repair, it is estimated that this cost carriers somewhere in the region of US$ 14.9 billion in 2004. In addition, there is overland repositioning, too, and while necessarily speculative, inland (intra-zonal) imbalance costs are estimated at another US$7.7 billion, for a total empty container cost – direct and indirect – of an estimated US$22.6 billion. (Drewry, 2003)
Our estimates of empty container movements in 2015 suggest that the previous declining trend will plateau. They are consistent with the assumption that carriers will do well to hold the empty incidence at current levels of under 21 per cent, but that the significant reduction in unproductive movements that characterized the 1985-1995 period is unlikely to be repeated.

5.3 Container Port Volumes: World and ESCAP Region

Containerisation International Yearbook reports that the total port handling movements in 2002 were 276.5 million TEU, out of which 242.5 million TEU was international movement excluding domestic cargo - that is, just over three times the total number of international containers shipped.

The study forecast that the total volumes of world international container handing will increase to 576.4 million TEU by the year 2015. This implies an annual average growth rate over the period of 6.9 per cent per annum, which is somewhat higher than the rate at which the global containerized cargo market is expected to grow.

The total volumes of international container handling in the ports of ESCAP countries will increase from 133.7 million TEU in 2002 to 352.3 million TEU in 2015 at an annual average growth rate of 7.7 per cent. It appears likely on this basis that Asian ports share of the world container volumes will continue to grow to 61 per cent in 2015 compared to 55 per cent in 2002.

Figure 5-3 shows subregional container port throughput. The most obvious feature of the figure is the increase in China’s share of total port throughput including Hong Kong, China and Taiwan Province of China, accounting for 48 per cent of total container throughput of the ESCAP region in 2015. To a large extent, this is simply a reflection of the expansion of Chinese imports and exports discussed in Chapter 3. This is buttressed by the development of a major trans-shipment business in China and Hong Kong, China.

South-East Asia’s share of the total market is forecast to remain at a similar level over the period, while the North Asian share is expected to decline. This is consistent with the trend of recent years.

Countries in the South Asia subregion are also expected to experience a high increase rate of port container throughputs during the period from 2002 to 2015, i.e. 8.8 per cent, compared to 7.7 per cent for ESCAP total.
5.4 Patterns of Trans-shipment

5.4.1 New Global Trans-shipment Centres

As size of container ships have increased, and the volume of containers have grown, container shipping networks have increased in complexity as well as in scale. The key development has been the evolution of hub-and-spoke systems with large mainline vessels serving a limited range of major ports to which cargoes are carried from tributary ports by feeder vessels.

Asia has led the world in this type of development. Singapore emerged in the late 1980s as the first port in the world that was dependant primarily on trans-shipment cargoes for its existence. Since then it has been joined by other ports in Asia, including Colombo, several ports in the Persian Gulf, and the new ports of Salalah, Aden and Tanjung Pelepas. In addition, a number of ports that have substantial volumes of hinterland cargo also play a major role in the trans-shipment system: these include ports of Hong Kong, Kaohsiung, Busan, Tokyo, and Port Klang.

Trans-shipment cargoes offer port authorities and terminal operators an opportunity to develop their businesses at a faster rate than the development of their economic
hinterlands would permit. It is therefore not surprising that the competition for this business is fierce and also can be very volatile.

It is therefore particularly useful to obtain some assessment of both the overall scale of this important market sector, and the extent to which individual ports are likely to be successful in it. The study has attempted to explore these issues. It should be borne in mind, however, that it is possible to do so only in so far as the competitive position of individual ports is determined by their quantifiable characteristics, such as location and cost structure. Policy variables, such as the priority that a terminal is willing to accord a shipping line or willingness to make dedicated terminals available to shipping lines, are likely to have an equally important bearing on eventual outcomes.

The study expects major changes in this sector, with patterns of trans-shipment changing rapidly as lines adapt their operating strategies to take full advantage of new opportunities. Well-established feeder operations in some areas will shrink, as volumes grow to the extent that large-scale direct services become viable. However, new opportunities will emerge as secondary ports that at present handle few containers begin to contribute to the feeder pool. This dynamic opportunities will offer opportunities for new emerging trans-shipment hubs: the study suggests that the new ports of Gwangyang (Republic of Korea) and Tanjung Pelepas (Malaysia) and the trans-shipment hub emerging in Shanghai will all capture substantial trans-shipment volumes. The traditional port centres of Singapore, Kaohsiung and Hong Kong are expected to retain their importance throughout the period.

Figure 5-4: Trans-shipment ports included in model
5.4.2 Modelling Restriction and Biases

While the MPPM suite allows a fairly detailed representation of the liner shipping system, the network as presented by the MPPM remains a simplified representation of reality.

This simplification has some consequences for the estimation of trans-shipment volumes. The MPPM requires that all of the cargoes generated in the ESCAP region are loaded onto the network. However, some of the smaller services – particularly those that carry a mix of break-bulk and container cargoes – are not included in the network. Therefore, where very small-scale or semi-container operations provide the only direct shipment connections between two ports, the simplified representation of the network in the MPPM cannot capture the direct movement of cargo between the pair of ports. The model must however find a way to reflect this movement, and this route is usually via a trans-shipment port. As a consequence, the MPPM has a tendency to overestimate trans-shipment volumes by a modest amount.

Past experience in using the MPPM indicates that this impact appears to be most pronounced at the ports of Singapore and Hong Kong, both of which are located in regions crisscrossed by networks of minor shipping services. In the case of these two ports, trans-shipment volumes in the calibration year were over-estimated by approximately 10 per cent.

5.4.3 Trans-shipment Volumes

The study estimates that the world total trans-shipment volume of containers will increase from 58 million TEU in 2002 to 152 million TEU in 2015 at an average growth rate of 7.7 per cent per annum.

Figure 5-5 shows the MPPM's estimates for trans-shipment volumes by subregions within the ESCAP region. The study estimates that the total volume of containers trans-shipped within the ESCAP region will increase from an estimated 42.2 million TEU in 2002 to 109.6 million TEU in 2015. The share of trans-shipment in total port volume is expected to remain at around 31 to 32 per cent until 2015. These estimates reflect the underlying assumption used in the study that main features of existing container shipping system, including the traditional role of hub ports in the regions, will continue to be characteristics of the future shipping system through the forecast period.

The most robust conclusion from the analysis is that the South-East Asian ports, such as Singapore, Port Klang and Port of Tanjung Pelepas, are likely to gain significantly from the introduction of very large ships operating on highly streamlined routes and the reduction in direct calls at other neighbouring ports in the subregion.

In East Asia, Shanghai is an obvious candidate for a trans-shipment hub in mainland China with its massive hinterland volumes expected by the end of the forecast period.
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Recent opening of Yangsan Container Terminal is expected to lead to a reduction in the number of direct calls by major services at other ports of mainland China, contributing to the increased trans-shipment opportunity at Shanghai.

Port of Hong Kong is also to command very large gateway volumes, and has a well-established trans-shipment role that could be further enhanced.

**Figure 5-5: Trans-shipment volumes by subregion (2002 – 2015)**

In North Asia, ports of the Republic of Korea are most likely to gain. The study estimates show that although the emergence of Shanghai as a major trans-shipment hub could be a threat, Busan will continue to play an important role in trans-shipment business.

There also appears to be some potential for an increase in volumes at Colombo. It should be noted that the model does not take into account physical constraints in the port: implicitly, it has been assumed that the dredging and other works required to accommodate the largest vessels will be undertaken. The model suggests that, as South Asian volumes grow, the additional of a Colombo call to services between Asia and Europe will become increasingly attractive to lines seeking to fill very large vessels on a streamlined service. The deviation involved in making the call is minimal, and provides access to a range of markets on the West Coast of India and Pakistan.
Figure 5-6 shows the market share of individual trans-shipment ports by trade route. In the Asia-Europe route, ports of Singapore, Hong Kong and Tanjung Pelepas are expected to continue to dominate the trans-shipment business. In the trans-Pacific route, ports of Hong Kong and Busan will handle around 60 per cent of the total trans-shipment volume. In intra-Asian trade, Singapore will dominate the trans-shipment. The study estimates show that ports of Singapore and Hong Kong will remain as the main trans-shipment ports of the region.

Figure 5-6: Trans-shipment shares by trade route (2015)