DECONSTRUCTING CONTAINER FORECASTING: COMMODITY-BASED SUPPLY CHAIN ANALYSIS FOR SOUTH AFRICA

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Introduction

The demand for intermodal transport as a logistics solution has increased sharply over the past decade due to the time efficiencies, flexibility and economies of scale that it offers (Peetermans and Sellnick: 2010, Berwick: 2001). Intermodal discussions nevertheless often focus only on international maritime trade – limiting the dialogue to ISO container sizes, port container terminal and port/modal interfaces. However, in 2013 the domestic use of containers for inland transportation outstripped the use of import/export containers in the USA (and is now close to 50% of all containers transported) (Intermodal Association of North America: 2013) while in Europe domestic container movements are gaining popularity (Silborn: 2008). Optimising these container operations is a supply-side contribution to national logistics efficiency. As such, three applications of containers in national supply chain systems need to be discussed:

1. Containers that cross the quay wall. This mainly deals with the import/export and transhipment movements and issues relating to container vessel and port capacity. Here, the capacity and efficiency of port handling equipment and operations come into play.
2. The hinterland movement of containers that cross the quay wall. This deals with road and rail transport, inland waterways and even the shunting of carloads onto ships. Issues relating to the capacity and efficiency of the modal

interfaces (port/rail, port/road, and road/rail) must be considered.

3. Purely domestic container movements and the capacities and efficiencies of the relevant intermodal interfaces (i.e. intermodal terminals)

In South Africa, the discussion around containers has focussed almost exclusively on one type of container movement: containers that cross the quay wall. This was due mainly to the relatively small portion of hinterland or domestic containers transported on rail when compared to container movements inside the port. This discussion however needs to be expanded to touch on the three applications of containers in domestic supply chain systems since a holistic approach is required to drive down overall logistics costs, which needs to be supported by appropriate investments.

In this paper, the global trends relating to these applications are discussed. This is followed by an analysis of the status quo in South Africa, and a subsequent forecast for South Africa TEU demand informed by the global and local trends.

Global trends

Containers over the quay wall

Global container volumes (in Twenty Foot Equivalent units, TEU) handled by ports rose from 71 million in 1985 to 750 million in 2012, and is estimated to grow to 818 million in 2014 (Figure 1). In 2012, this translated into 3.8 billion tonnes of cargo, compared to the 5.5 billion tonnes of international trade cargo that was not containerised (Drewry).

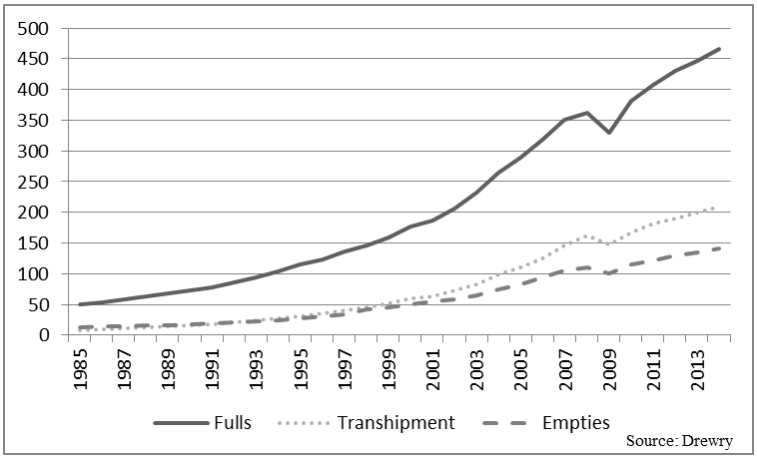


Figure 1: Global container volume growth (TEU) from 1985 – 2014

The growth in container volumes was driven by the growth in international trade as well as increase in the propensity to containerise commodities previously handled as break-bulk. The impact of these trends is however flattening out, as discussed below.

International trade as a percentage of GDP grew slowly from 1% in 1820 to 10% in 1970, but growth since then accelerated with globalisation and the specialisation of trade and is now at 32% (International Monetary Fund, 2013 and Van Den Berg and Lewer, 2007). It reached this level before the 2008 recession and is not forecasted to rise in the next 5 years. Therefore, global trade growth (relative to GDP) as a multiplier of container growth has receded. In fact, trends such as reshoring could actually reduce global trade growth (Havenga, Simpson and De Bod, 2013) and therefore become a negative multiplier to global container growth.

Figure 2 shows that global container penetration reached 66% in 2011, up from 39% in 1990. Penetration increased by 22% in the period 1990 to 2003 (1.6% p.a.), but only by 4% between 2003 and 2011 (less than 0.5% p.a.). It is currently estimated that the saturation point will be reached in 2017, meaning that the percentage of certain

commodities transported in containers will not grow any more. This would effectively remove the container penetration multiplier relative to GDP and container volumes will then grow linearly with the GDP. In addition, emphasis on cost efficiency has driven consolidation and tighter packaging solutions. As a result, the average container is now fully packed weighing in at about 8.8 tonnes. Thus the contribution that the container load factor made to the container growth multiplier is also disappearing.

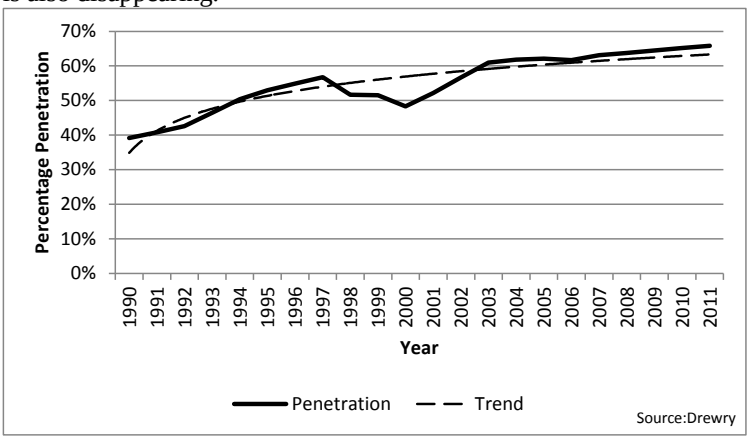


Figure 2: Percentage of global tonnes shipped in containers

Across the board, the factors that caused global container volumes to grow at a more rapid rate than global GDP are diminishing, which will flatten out the rate of global container growth.

Hinterland movement of containers that crossed the quay wall

The rail market share for hinterland container movements has grown significantly in the recent past and major growth is forecasted for the future. Statistics documenting trends in the hinterland movement of containers however only exist for a few countries and global comparisons are not yet possible. In the United Kingdom, 19% of all container tonnes imported to or exported from the ports were transported in the hinterland by rail. This is forecasted to grow to

49% in the next 20 years. Similarly, 37% of all tonne-kilometres in the UK that originate or terminate in the port currently occur on rail and this is forecasted to grow to 65% (Plummer, 2013). In Israel current hinterland containers on rail is 8% and is targeted to grow to 25% by 2020 (Goldberg, 2013). Western Australia's railway market share for hinterland container movement has risen from 2% ten years ago to 14% and the short term target is to reach 30% (Buswell, 2013). The figure for Spain has grown from 3% to 12% over the last five years (Castillo-Manzano, González-Laxe and López-Valpuesta, 2013). The figure for Mexico is 33%, for Canada 77% on the country's West Coast and 48% on the East Coast and for the USA 67% on the West Coast and 17% on the East Coast (Ogard, 2013).

Purely domestic container movements

Purely domestic container movement statistics are only available for the USA and parts of Europe. Growth for purely domestic container movements (13.7%) from 2011 to 2012 has been four times more than that of containers that cross the quay wall (3.5%), reaching 3.6 million in 2012 compared to the 5.1 million for maritime containers. This implies that domestic containerisation propensity lags that of global trade. Notably, it has been the only rail segment that has not shown a decline on a quarterly basis over the last decade – not even in the depths of the recession. The estimated growth for 2013 is 9%, compared to the 1.3% growth forecasted for containers crossing the quay wall (Maloy, 2012).

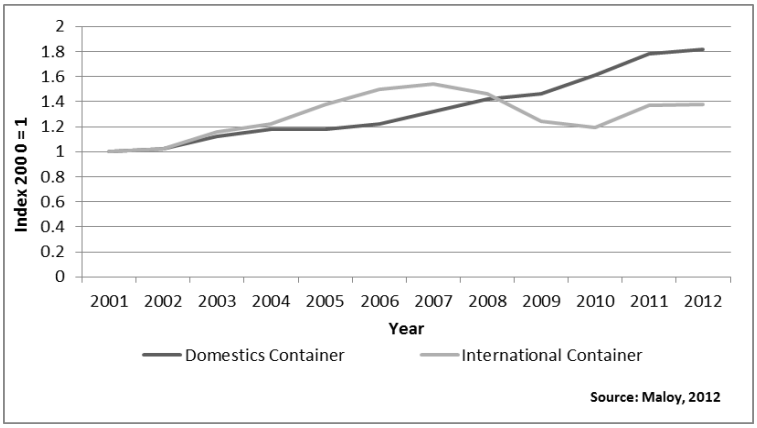


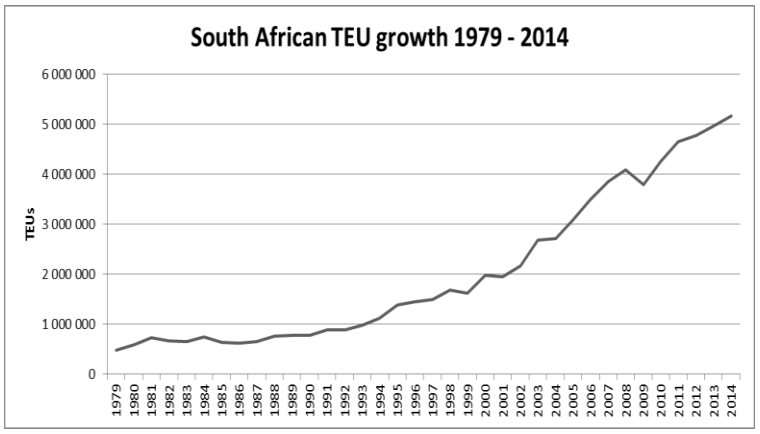
Figure 3: The rise of domestic intermodal container volumes in the USA

European domestic intermodal has grown with 25.5% between 2005 and 2011. The equivalent of 11 million TEU's is currently being shipped domestically in Europe (Géhénot, 2013). This is a relatively high number for a continent that typically has low average transport distances. Intermodal container transport efficiencies can therefore also be garnered over shorter corridors.

South African container trends

Containers over the quay wall

South Africa's TEU volumes grew from 0.47 million in 1979 to 4.77 million in 2012 and are forecasted at 5.16 million in 2014 (Figure 4).



Source: Drewry

Figure 4: South African TEU growth 1979 - 2014

Hinterland movement of containers that crossed the quay wall

The hinterland movement of containers should consider the modal split of containers leaving the port as well the long distance movement of containers travelling on corridors. Of the 964 000 full containers that were exported through South African ports, 145 000 (15%) arrived at the ports by rail. Rail removed 202 000 of the 1 405 000 containers (14%) that were imported through South African ports.

Error! Reference source not found. shows the rail market share statistics for selected South African ports. Durban, the country's major gateway port for containers is connected to the economic heartland, Gauteng, by a well-developed corridor and therefore it is intuitive that it would have the highest rail market share.

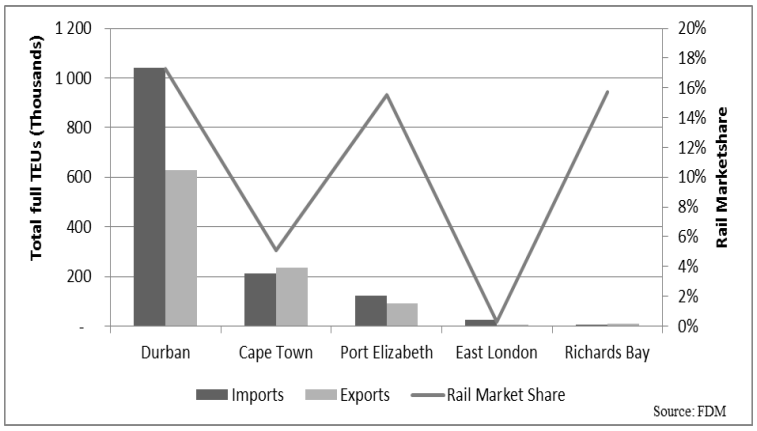


Figure 5: Rail market share of hinterland containers that crossed the quay wall at South African ports

When analysing the corridor flow segment of hinterland movements the question of where a container was stuffed or destuffed arises. Import containers destined for Gauteng may be destuffed in Durban before being transported on the KwaZulu-Natal – Gauteng (Natcor) corridor, but this does not change the fact that the contents of that container still travelled on the corridor, albeit in a "virtual" container. Similarly, the contents of export containers from Gauteng that is transported via Natcor to Durban only to be stuffed into physical containers in Durban also travelled on the corridor in a virtual container. As such it is necessary to analyse hinterland *content flow* in order to understand potential on the corridors and not just the physical flow of boxes. The map in Figure 6 graphically depicts the flow of container content on the country's major corridors.

Source: FDM

Figure 6: Flow of hinterland container content on the major corridors in 2012

Figure 7 shows the rail market share for the content of hinterland movements on the major corridors in 2012. Most contents flow on Natcor, with some contribution from the Cape Town – Gauteng corridor (Capecor) and the Gauteng to PE corridor (Southcor). The coastal flows are shorter regional haul away from the ports (such as for instance Cape Town to George or Durban to Port Shepstone) an a low rail market share is expected (even though movements of the same distance is targeted in places such sa Europe, the United Kingdom and Israel).

It is estimated that in 2012, 13% of export containers that travelled on Natcor were only stuffed in Durban and 33% of import cargo, destined for Gauteng, was destuffed already in Durban. The rail market share for Natcor is higher than for the other corridors at 25%, but it is still below its potential. Preliminary indications on Natcor show that currently 282 000 import/export containers are on rail and 766 000 import/export containers (or container contents) are on road – the latter volumes could be attracted to rail.

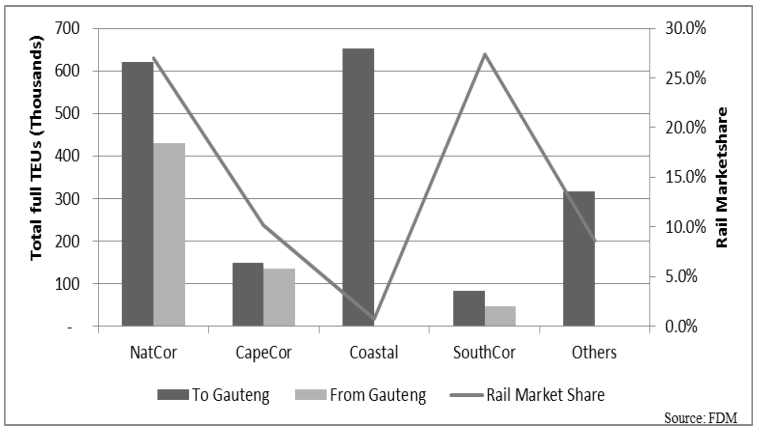


Figure 7: Rail market share of hinterland movements on the major South African corridors (2012)

Purely domestic containers

In South Africa, the practice of using intermodal containers for purely domestic movements is still in its infancy. An estimated 10 000 containers moved through the Belcon terminal in the Western Cape to do this work. A pilot project between Transnet Freight Rail (TFR) and selected logistics service providers also proved the concept.

There is massive potential for growth in this segment with an enough cargo to fill 1 100 000 domestic intermodal containers currently on road. The recent Memorandum of Understanding (MOU) between TFR and Imperial Logistics is sure to spur growth in the movement of domestic intermodal containers.

Container penetration and demand

There are a number of factors supporting container growth in South Africa:

1. Large-scale port expansion projects will attract larger ships, bringing with them the potential for larger regional feedering

and relay transhipment business. This trend could however be impacted by investments in other ports;
2. The development of a number of inland container hubs and dry ports in the Gauteng area will encourage more gateway/hinterland container traffic to move onto rail;
3. The Durban – Gauteng logistics corridor will be a natural gateway for land-based freight flows into and from SADC, tying into the vision of the development of the North-South corridor into Sub-Saharan Africa; and
4. South Africa's strategic position on a number of international and regional shipping trade routes remains an important advantage in establishing freight hubs at the ports of Ngqura and Durban.
5. The development of domestic intermodal solutions have a large potential to grow the use of containers

Given these trends, it is critical to determine container penetration statistics for South Africa in order to ensure informed forecasting. This is however far more complex than merely applying the 66% global average (3.8 billion tonnes of cargo containerised versus 5.5 billion tonnes of cargo not containerised). The vibrant mineral export lines and massive crude and fuel imports, together 136 million tonnes or 60% of total traded cargo, skew the statistics. A commodity-disaggregated approach was followed to analyse South African penetration (Figure 8).

It is estimated that by 2017 all commodities that could sensibly be containerised will have reached saturation point, leaving little room for further containerisation.

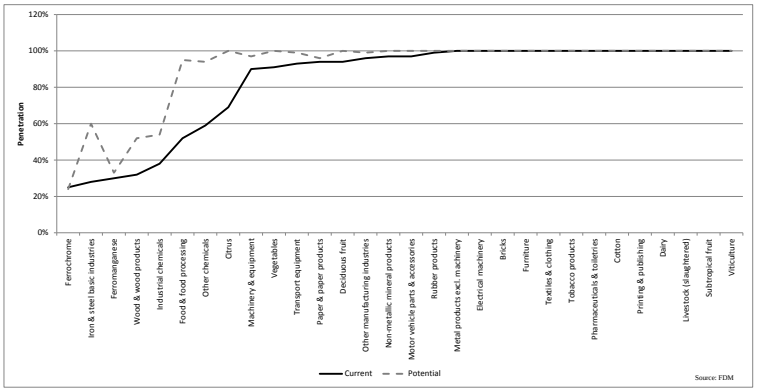


Figure 8: Commodity-disaggregated container penetration statistics (South Africa)

As is the case globally, the factors expected to multiply international container growth in South Africa beyond the natural GDP growth curve are diminishing. If one was to merely extrapolate past growth curves as a basis for forecasting container volumes it would result in the artificial inflation shown in Figure 9. A commodity-centric approach forecasts that containers will grow by 350% over the next 30 years. If a 30 year average was used to extrapolate growth this figure would have been 950% and if a 5 year extrapolation was used 400%.

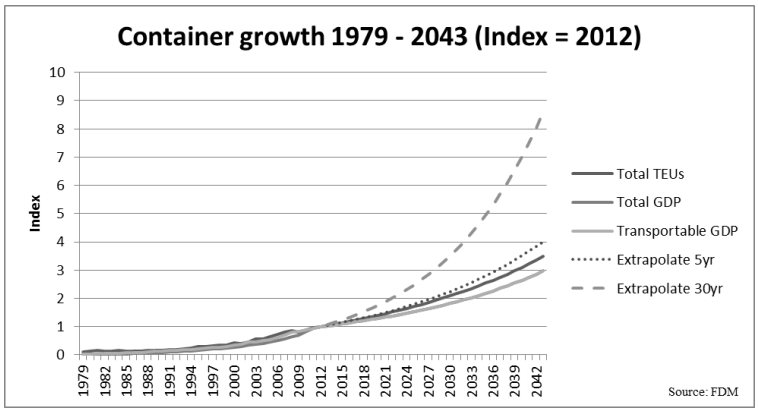


Figure 9: South African container growth estimates

Concluding remarks

Global trends in container transport indicate that the propensity to containerise is reaching maturity and that containerisation growth will decouple from GDP. There is however still significant opportunities to intermodalise domestic freight flows, with recent growth data available for the USA and some European countries, supporting this assertion. In addition, there are substantial opportunities for rail to become the hinterland provider of choice given the intermodal densities developing. Forecasts are however moderated by a medium-term maturity in the propensity to containerise.

South Africa's disaggregated freight flow model confirms that these trends also hold true for South Africa, and facilitate the development of more informed commodity-based container forecasting models for investment purposes (as opposed to over-shooting investment by purely extrapolating historical trends).

Endnote
All data in this article are provided by one of these sources:

1. Drewry published data (available at http://www.drewry.co.uk/ or various reports that Drewry often publish), or information kindly provided directly to the authors by Nishal Sooredoo a researcher at Drewry (referenced "Drewry")
2. The South African National Ports Authority (referenced "NPA")
3. South Africa's Freight Demand Model (developed by the researchers with methodology published in Havenga, 2013 and which is used by South Africa's Railways, Ports and Pipelines for 30 year demand forecast planning)

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