EUROPEAN REGIONAL DEVELOPMENT FUND

EMPTY CONTAINER REPOSITIONING FOR SCOTTISH SHIPPERS

March 2014

Final report

LO·PINOD
LOGISTICS OPTIMISATION FOR PORTS

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

SEStran
South East of Scotland Transport Partnership

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1. Introduction

SEStran is the Statutory Regional Transport Partnership for South East Scotland. SEStran was established under the Transport Scotland (2005) Act as the strategic transport planning authority for an area covering the eight local authorities of Borders, East Lothian, West Lothian, Midlothian, Edinburgh, Fife, Falkirk and Clackmannanshire. SEStran aims to develop a sustainable transportation system for SE Scotland that will enable business to function effectively, and provide everyone living in the region with improved access to healthcare, education, public services and employment opportunities. The development of SEStran's Regional Transport Strategy (RTS) was an historic opportunity to plan for the transport needs of 1.5 million people, living in Scotland's most economically vibrant region. It is a blueprint for transport development in South East Scotland that will form the core of our work for the next 15 years.

SEStran is working with local authority partners to make the objectives of the RTS a reality in South East Scotland. However, in this time of fiscal retrenchment they are also seeking additional sources of funding to enable them to carry forward major transport initiatives. So far, SEStran has been successful in bidding for EU match funding to roll out a range of projects that will contribute towards the goal of building a sustainable transportation system for the region.

One such project is LO-PINOD (Logistics Optimisation for Ports Intermodality: Networks, Opportunities, Developments). The LO-PINOD project was created to facilitate co-operation amongst regional ports leading to a sharing of best practice, enhancement of multi-modal capabilities, increase in throughput, delivery of new and innovative services and a more prominent role within the local community. This polycentric development initiative will improve accessibility to more isolated regions, lessen the environmental impact of freight transport and spread growth and opportunity more evenly around the North Sea Region. Project partners include a range of ports, local community authorities and other relevant organisations in each of the North Sea Region countries of Belgium, Denmark, Germany Netherlands, Norway, Sweden and the UK.

The project itself focuses on four main areas:

1. Improving multi-modal landside links: Optimising road, rail and inland shipping links to regional ports. Co-ordinating and enhancing associated national policies and investment programmes.

2. Developing regional ports: Creating efficient and diversified trans-shipment nodes through joint initiatives and knowledge sharing. This includes benchmarking and implementing best practice as well as developing new markets and business opportunities.
3. Enhancing access by sea: Developing maritime connections with the main hub ports.
4. Improving linkages with towns: Allowing the port to take a more prominent place in the local community.

A need was identified among project partners to analyse the role of empty container repositioning in the North Sea, as a problem of particular relevance for regional ports. SEStran is leading this piece of work and has commissioned the Transport Research Institute at Edinburgh Napier University to carry out this piece of research. The work is initially based on empty container repositioning in Scotland (and the wider UK), but once the report is finalised the results will be shared with project partners. Sharing the results will be beneficial in two ways. First, as an exemplar of issues faced by several partners and an analysis of best practice in resolving them, which can then be applied in other contexts. Second, as a precursor to expanding the analysis to include connections to partner regions with a view to developing a pilot project of mutual benefit to partners.

The report will begin with an introduction to the role of empty container repositioning in global maritime trade, followed by an outline of the problem and cost of empty repositioning in Scotland. The available data will be described in section 4, before an overview of the UK container port system, including capacity and port development strategies. Section 6 will present a detailed analysis of the movement of empty containers in the UK and especially to and from Scottish ports. Inland movements of maritime containers in the context of all unitised trade flows will then be discussed, before summarising the findings from the desktop research. Section 9 presents the findings from the expert interviews with key stakeholders, and the findings from the desktop and interview research are then used to derive six potential scenarios for further consideration in section 10. Analysis of these scenarios is presented in the form of a SWOT analysis in section 11. Conclusions from this analysis are then drawn in the final section.

2. The role of empty container repositioning in global maritime trade

Global container movements are increasing at an exponential rate in comparison to actual trade, due to increasingly complex liner networks and the need for transhipment. This means that a loaded shipment may travel much further than necessary if it were to go directly between the two ports nearest to the origin and destination. Figure 1 shows total container handlings at world ports, divided into full and empty, as well as incidence of empty movements and transhipment.

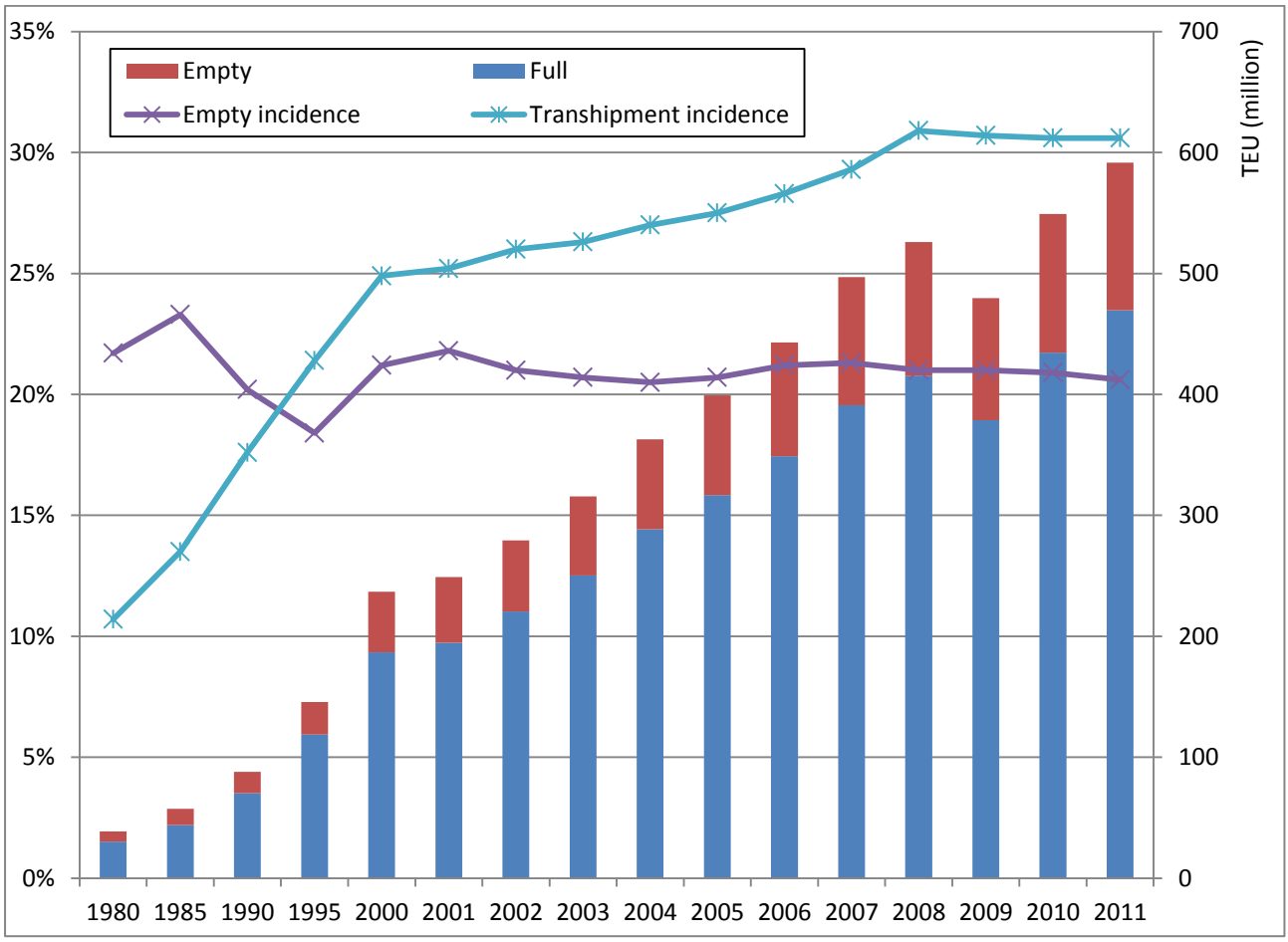

Figure 1. Loaded and empty container movements as shares in total world container movements
Source: authors, based on Drewry (2013)

The figure shows that, while the number of empty container handlings has risen sharply, the percentage of total handlings has changed little since 2000. The interesting statistic is the increasing incident of transhipment, meaning that in 2011 30.6% of container handlings at world ports were not genuine trade but containers being transhipped as part of a hub-and-spoke or similar liner strategy.

For the purposes of this study, the figure also reveals the importance of empty movements. In an ideal scenario, a loaded container would travel from origin to destination, where it would be stripped and then reloaded for export to a new destination. In practice, there is not always an export load waiting; therefore, once a container has been emptied the empty box will be taken back to the nearest port or nominated depot. It may then wait there for a period of time until a local exporter requires it, or it may be sent back or "repositioned" to the Far East, where most exporting is done. Western countries generally are net importers, meaning there are not enough export loads to fill all the containers that arrive here with imported goods. Even if an export load is likely to be available, if the container must sit idle for more than 1-2 weeks then the loss of revenue becomes an issue and the container owner would rather send the container to China where a load will definitely be found.

The problem arising from this system is that containers cost money to move, so the more empty or unproductive moves that take place, the higher the cost. The total cost in 2008 for worldwide empty container repositioning (both land and sea movements) was estimated as US$33 billion (Drewry, 2009). Initially this cost is borne by the shipping line, but, particularly in difficult economic periods, this cost is often passed on to the shipper. Thus exporters in a peripheral country like Scotland who require the provision of empty boxes have to pay this additional cost, which disadvantages them and penalises their trade costs compared to their competitors located near large ports with a large supply of empty containers without an additional cost.

It has been estimated that there exist about three containers for every container slot in the world fleet, to account for overland movements as well as taking up the slack in the system (Rodrigue, 2013). In 2008, at the peak of world container shipping just before the recession, there were about 28 million TEU of containers in existence (UNCTAD, 2009). Most of these are controlled by shipping lines, either through ownership or by leasing them from container leasing companies, who provide flexibility for shipping lines who do not want to take the risk of purchasing too many containers. Shipping lines own approximately 62% and the remaining 38% is owned by leasing companies (Theofanis & Boile, 2009).

The problem with this system as far as this study is concerned is that each container is owned (or at least controlled) by a separate shipping line. So if a Scottish exporter is looking for empty equipment and locates some boxes owned by shipping line A at the nearby port, if the exporter is a customer of shipping line B then those boxes are not available to this exporter. The exporter will have to pay shipping line B to bring an empty container, while the

empty boxes belonging to shipping line A may be unproductively repositioned elsewhere to serve shipping line A's customers. This results in additional movements and costs. There have been some attempts in the industry to solve this problem, through the use of box pools (so-called "grey boxes" because containers are normally clearly branded for each shipping line), but the problem has not yet been resolved.

Some innovative ideas that have been suggested include foldable containers and 20ft containers that can join together to form a 40ft container (so-called "tworty" boxes). Even with the additional handling costs, the large reduction in transport costs means that both options provide the possibility of significant cost savings. This is particularly the case with the foldable containers, whereas the tworty depends heavily on the equipment type requirements on a specific route. However, neither of these are realistic options at present, because sufficient numbers have not been made available in the industry.

The process of transporting and opening foldable containers is depicted in Figure 2. The figure shows that several empty containers could be transported in place of one regular empty container. Similarly, a tworty could resolve imbalances to some degree by sending two 20ft containers in one direction and a 40ft in the other direction, for regions that have an imbalance of one or the other (Figure 3). It is not clear, however, that this is the issue in Scotland. It is, on the whole, the lack of maritime containers inbound of any kind, rather than specific types.

Figure 2. Stacking, transporting and opening foldable containers
Source: Konings (2005)

Figure 3. Handling a "tworty" container
Source: www.tworty.com

The applicability of foldable containers has been studied by Konings (2005a&b) and Shintani et al. (2012). While it has been shown that the concept itself is feasible and could save money, widespread adoption of these containers by container lessors and shipping lines is required before the value can be exploited by Scottish shippers. At present, foldable containers are substantially more expensive than regular containers (about double the cost – prices fluctuate but in the region of $4,000 compared to $2,000), and enough must be purchased in order for the potential benefits to outweigh the additional complexity of management, for instance by having enough to bundle together and to serve customers without requiring micromanagement. Furthermore, it is not simply the purchase price itself that is the issue; a high purchase price means that lessors will charge a higher rental price, meaning that they must be used intensively and not delivered on speculative routes where they may sit idle for a period of time before being required. This idle time is already a problem with regular containers; with a higher lease charge it would be unsustainable.

These issues could be addressed by a pool of shippers purchasing their own containers, but that could only work on a regular loop back and forth between two destinations. This

would involve additional costs and management, compared to regular containers which are repositioned by shipping lines for any customer as required.

3. The problem and cost of empty repositioning in Scotland

Unlike the UK as a whole, Scotland is a net exporter, therefore the disadvantage to Scottish shippers due to paying for the repositioning of empty containers is well known. The situation has, however, become more acute due to the current economic situation. Northbound flows are predominately in 45ft pallet-wide road trailers and southbound flows are in 20ft and 40ft deepsea boxes either through Scottish ports or by rail to English ports. Scottish exporters have to pay shipping lines to bring empty maritime boxes to Scotland, so this is a direct cost to Scottish shippers and by extension the Scottish economy. Thus both industry and government stakeholders have an interest in solving this problem.

The subject has been considered from several perspectives but a solution has not been identified. Ultimately, someone will have to pay that repositioning cost to bring empties to Scotland unless someone starts importing more products in these containers. As the market has not provided a solution, this subject needs more detailed analysis on innovative ways to solve the problem. How can it be done? Who will pay?

The Freight Transport Association (FTA) surveyed its members on empty container repositioning in 2012, asking some specific questions about flows, container types, peaks and troughs (see Table 1).

Table 1. List of questions from FTA report

Questions for	No.	Questions
Shipping lines	1	What is the number of TEUs and in what format (20' / 40') that have to be re-positioned annually to Scotland?
	2	What are the seasonal peaks and troughs?
Exporters	3	What are the major export ports of departure from UK and route to port e.g. rail or coastal shipping and numbers of TEU?
	4	What are the major peak times of seasonal export demand?
	5	Would it be possible to share flows with other exporters?
	6	What sizes of ISO container are required?
Retail importers	7	What are the main inbound flows to Scotland in destination and TEU terms?
	8	Are outbound or return flows balanced and where do they go?
	9	What are the major peak times of seasonal import demand?
	10	What is the container or load platform format required?
Logistics service providers	11	What crossover is there between inbound retailer and exporter customers?
	12	What opportunity is there to balance retail empty southbound legs with empty repositioning export trades northbound legs?
	13	What opportunity is there to balance the equipment and its suitability (ISO / Curtain-sided / 20' / 40')?
Government	14	What scope is there for Government to assist?
	15	What are the legitimate expectations for Government to do?

While these questions are aimed at individual interest groups such as exporters and importers, the findings from this study will be able to contribute towards answering some of them. While available data tends to be at an aggregate level, total empty container movements through ports will be assessed, including container types, seasonal fluctuation and imbalances in either direction. The report will then discuss the potential roles of key industry players as well as government in addressing the problem, in the process of formulating potential scenarios to be taken forward in further research.

4. The use of data in this analysis

Due to commercial sensitivity, high quality data on freight movements in the UK are difficult to acquire. Container flows at UK ports are generally discussed as annual throughput figures, but as they are not disaggregated it is not possible to look in detail at some key issues affecting UK trade. This report will contribute towards filling this gap.

The datasets used have been obtained from the UK Department for Transport (DfT) and Maritime Cargo Processing (MCP) and describe container traffic at UK ports. Few studies on UK container flows have been performed, and these have mostly been based on estimates and surveys, without detailed disaggregated data. This report uses data for 2000 to 2011 (DfT)

and 2009 and 2010 (MCP), the latter disaggregated to the level of the individual container movement. The official DfT figures are used for total port throughput, empty movements and port range movements. The MCP dataset contains variables recorded in the port community system, including direction (inbound, outbound), container type, full/empty and weight. The database included 5,935,669 unique records of container movements, which translates into 9,817,643 TEU.

The comparison of the DfT and MCP datasets revealed some discrepancies in total numbers, which probably related to different recording methods and differences in the conversion of movements to TEU. Moreover, the MCP dataset does not provide full coverage of UK ports, or full coverage of all terminals at each port (for detailed comparison of datasets see the appendix). The strength of the MCP data is in its depth, which provides ample data for analysing the spread of data values across the total. Of the ports included, the dataset covers 84% (2010) and 85% (2009) of total TEU moved through UK ports. Of the top ten ports, Southampton and Belfast are excluded and Tilbury and Hull have low coverage in the MCP data (see appendix). As the MCP data only covers two years the analysis of temporal changes is based on DfT data. Finally, as these data are commercially sensitive, results are presented as aggregates or percentages to protect commercial interests.

5. Overview of the UK container port system

In 2011, UK ports handled a total of 8.1m TEU, split into 4.1m inbound and 4m outbound or 5.9m loaded and 2.2m empty. Figure 4 shows that the top 5 ports were responsible for 86% of all container movements, displaying the high concentration in the container port sector.

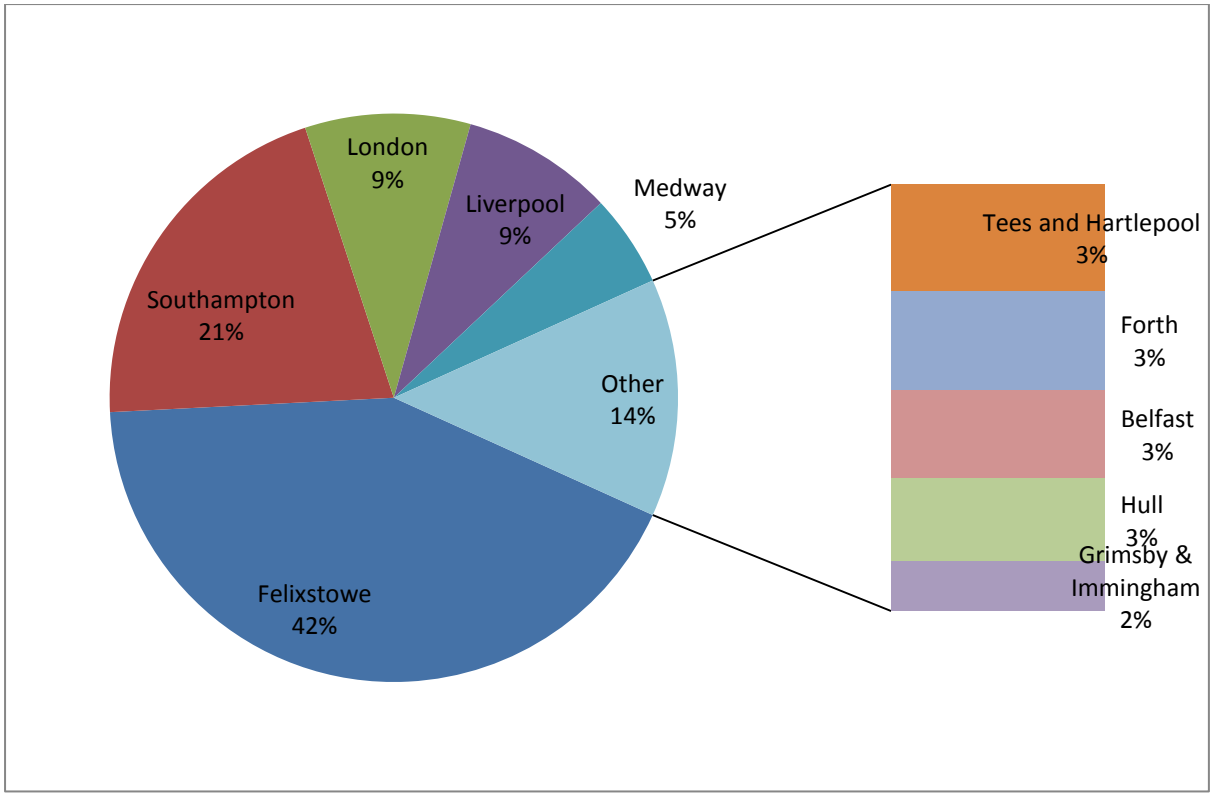

Figure 4. Shares in container traffic, 2011
Source: Authors, based on DfT, 2012

Figure 5 shows the evolution of UK port traffic over the last decade.

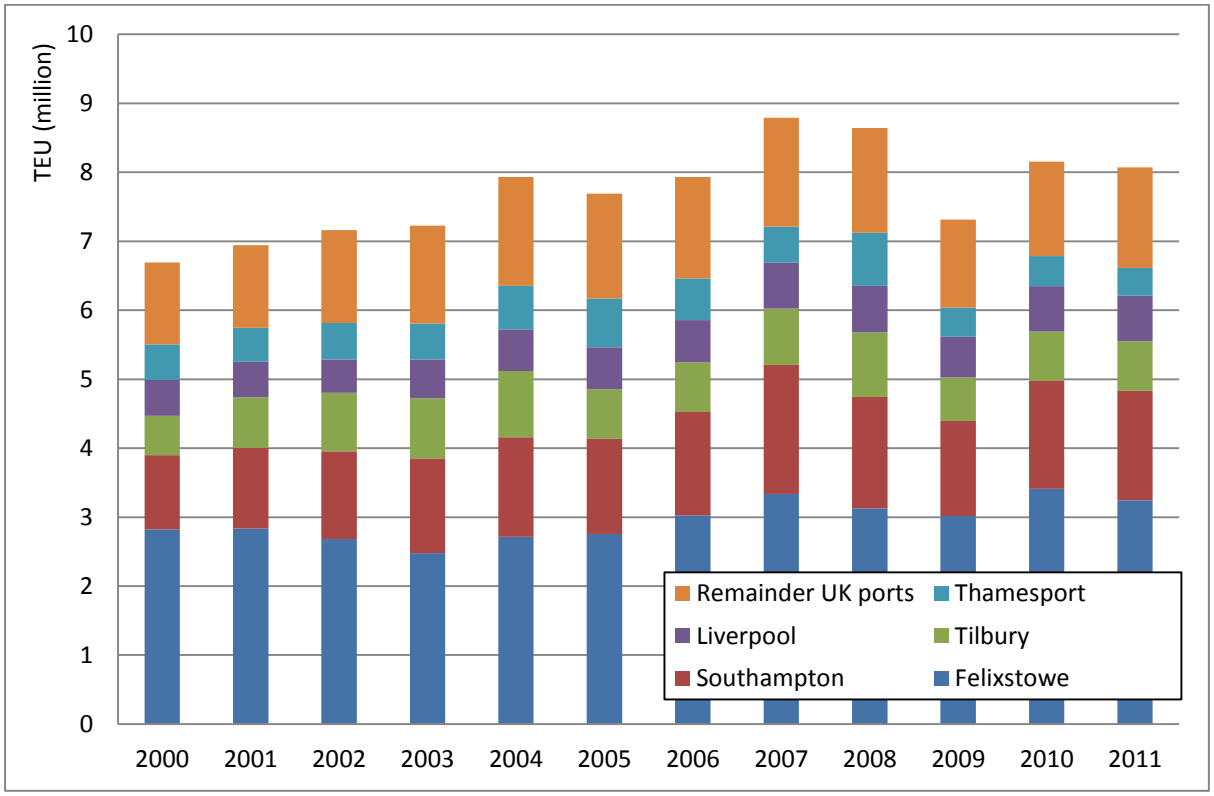

Figure 5. UK container port traffic by major port, 2000-2011
Source: Authors, based on DfT, 2012

Figure 5 shows that, while the trend in container port traffic has been broadly positive, a small dip was recorded in 2005 as well as the more noticeable drop due to the recession in 2008/9, and even the recovery observed in 2010 dropped slightly in 2011.

With 3.2m TEU in 2011, Felixstowe is by far the busiest container port, with double the throughput of its closest competitor Southampton. Analysis of time series data (Figure 6) shows that there has been little change in this dominance over time.

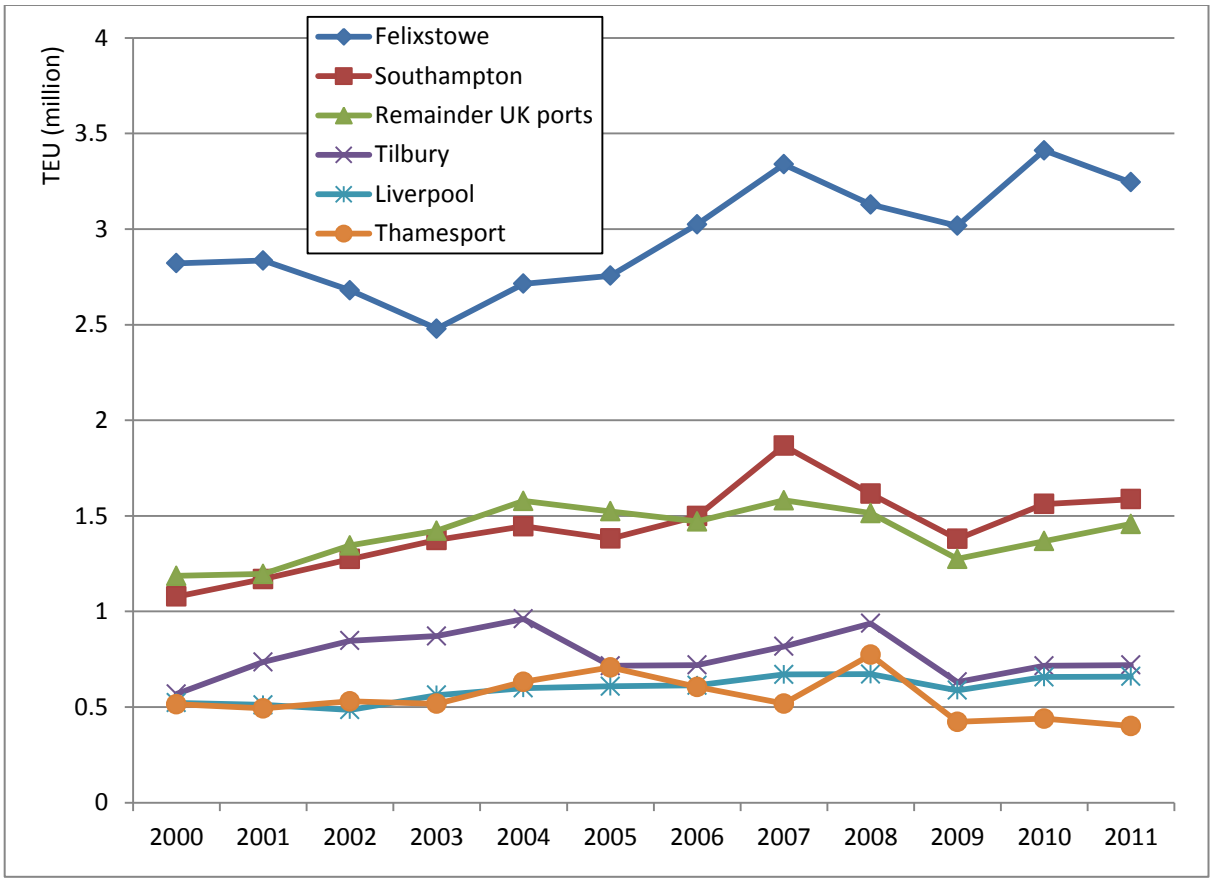

Figure 6. Time series line plot of major ports

Analysis of the port ranking based on containerised port throughput and its evolution reveals that the UK port system in the top five ports (Felixstowe, Southampton, London Tilbury, Medway Thamesport and Liverpool) has been consistent, and, as shown in previous analyses (Pettit & Beresford, 2008; Overman & Winters, 2005), has almost been stagnant in this form over recent decades. Thus the UK port system can be seen as a mature port system. While regional ports have lost their importance to the larger southeast ports, overall growth in maritime flows has meant that most ports have still experienced growth, and indeed some ports have seen increases in specific trades (Pettit & Beresford, 2008).

Interesting developments can be seen when analysing the evolution of the port system ranking of secondary ports (Figure 7). The rise in the importance of Tees and Hartlepool in the container port market, moving from 15th to 6th position in the period between 2000 and 2011 is striking, particularly as the port has managed this improvement in ranking during the financial crisis.

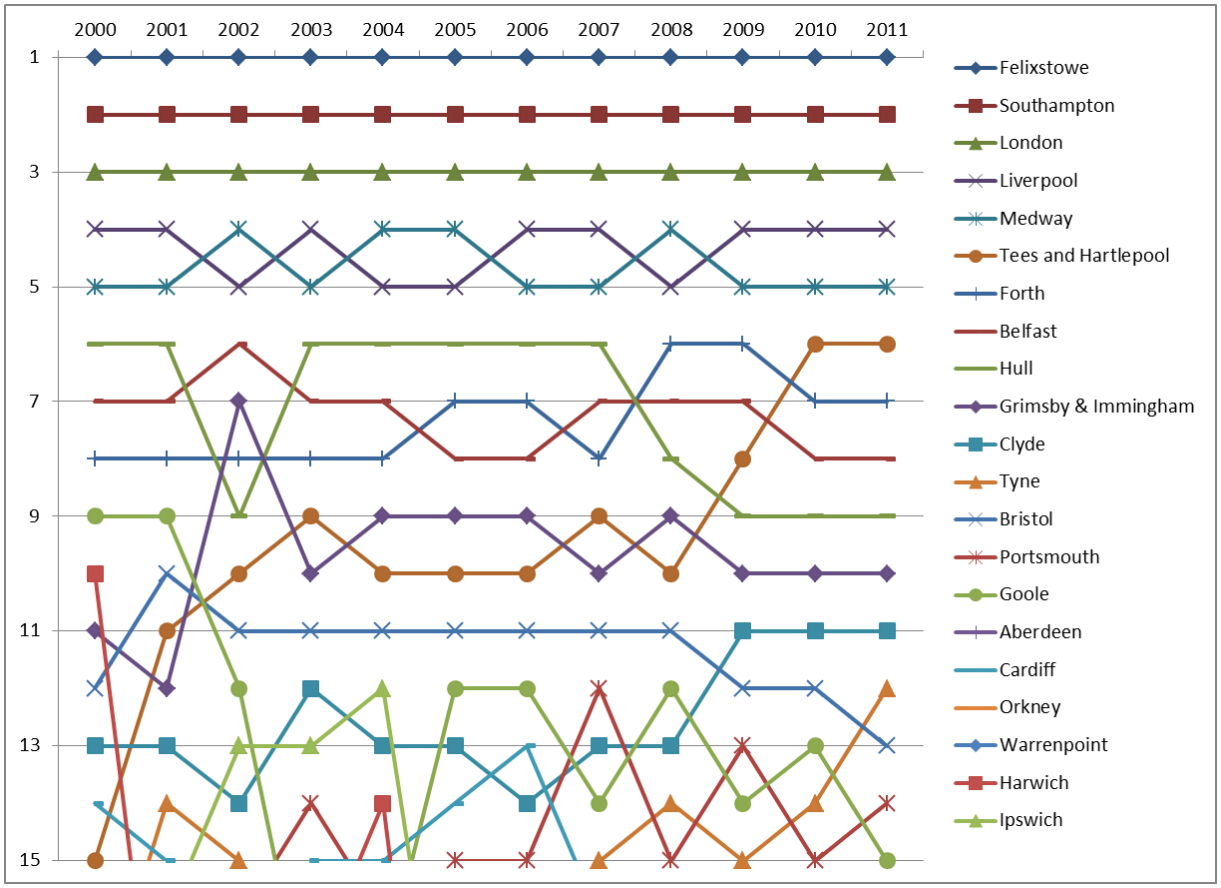

Figure 7. Port ranking, based on containerised port throughput, 2000-2011
Source: Authors, based on DfT, 2012

Figure 8 shows that Teesport is the best-performing of the secondary ports during the recession. This success is particularly evident in relation to the lower rankings of Forth Grangemouth and Hull. It could be that its port-centric strategy of attracting tenants to its distribution centres is partly responsible for this growth, however that alone would not explain the significant increase in throughput at the port.

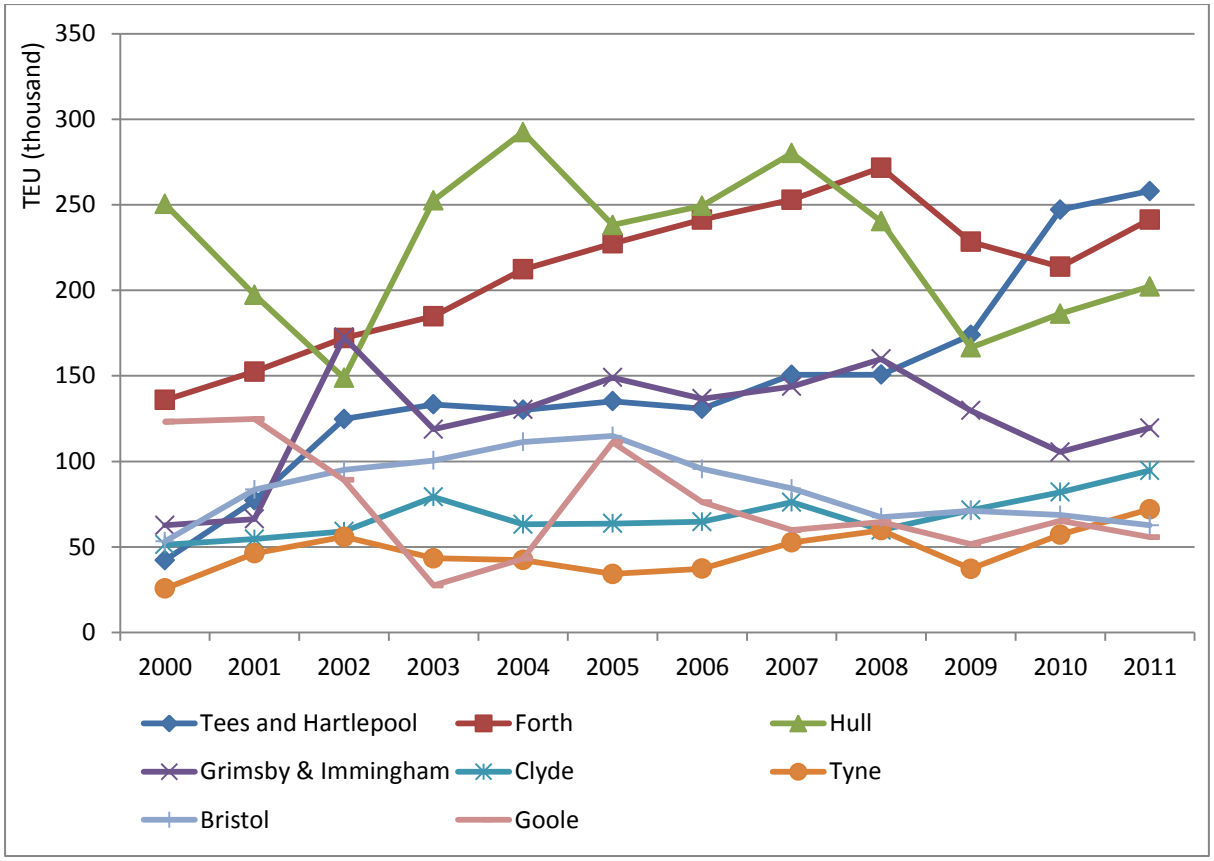

Figure 8. Throughput 2000-2011 at secondary UK ports
Source: authors based on DfT, 2012

The figure also shows that, while most ports have followed a similarly steady upwards progression, some have experienced dramatic spikes, particularly the Humber ports of Hull, Grimsby and Goole. Wilmsmeier and Monios (2013) argued that developments like those in Tees and Hartlepool reflect that a number of ports have successfully taken on the "challenge of the periphery" and now seek a strategy that allows them to develop into new regional centres.

Figure 9 maps all container movements through UK ports in 2011.

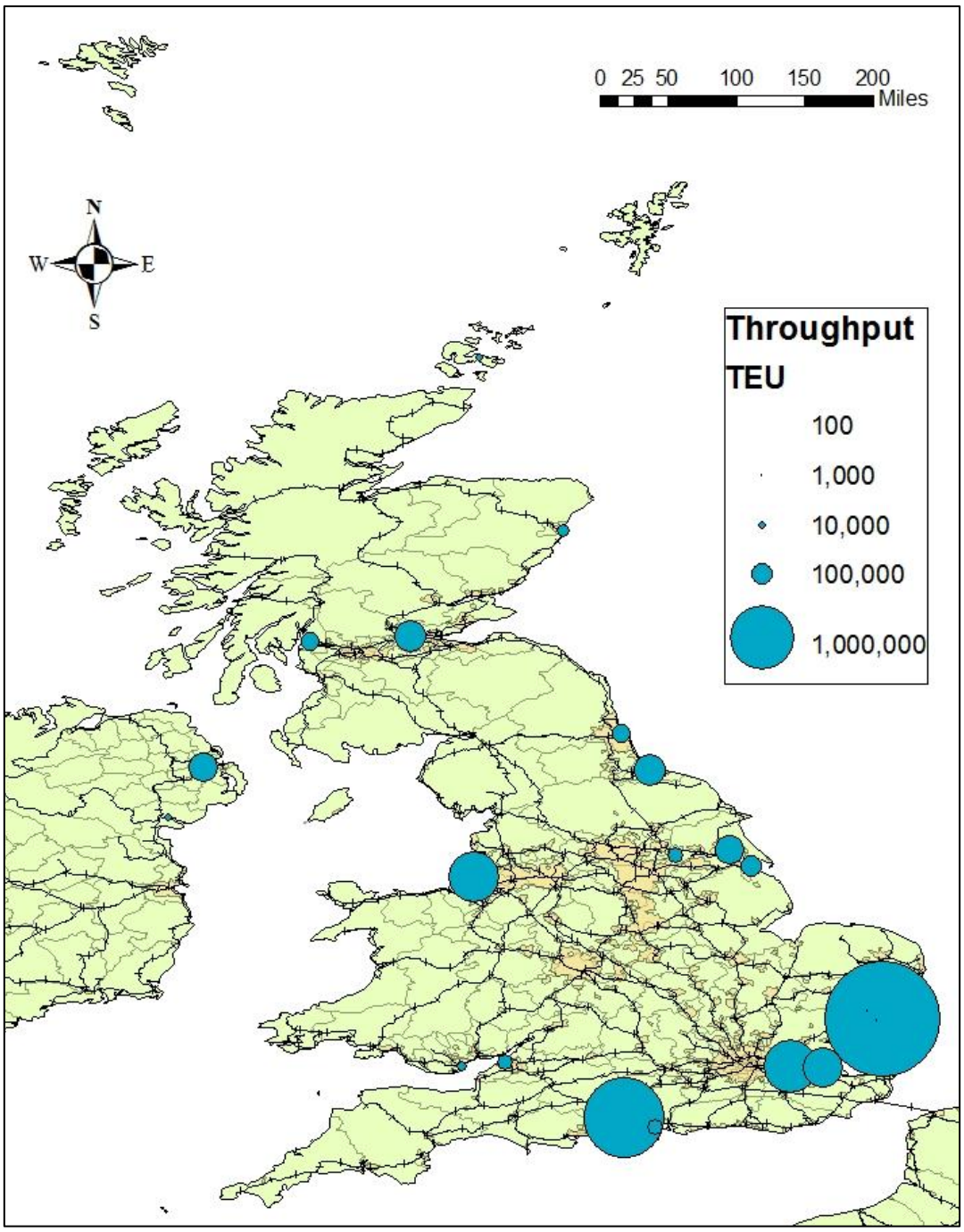

Figure 9. Map of UK showing all container ports in 2011
Source: authors

From a European perspective, the UK port range experienced a loss in market share from over 15% in 1996 to around 9% in 2008 (Notteboom, 2010). The principal load centres on the southeast coast were particularly prone to infrastructure capacity deficits, which resulted in shipping lines starting to tranship UK cargoes in other ports in the Hamburg-Le Havre range instead of calling at UK ports directly. To address this problem, several UK ports pursued ambitious expansion projects. Recent and current major developments are Felixstowe (now

complete, with further approval to construct an additional container terminal at Bathside Bay, Harwich, which has since been postponed due to current market conditions) and London Gateway (under construction). The Dibden Bay development at Southampton was rejected but the port is planning development within its existing footprint. All these developments will support the dominance of existing deepsea ports. Indeed, the danger now is of over-capacity, due to such expansion in tandem with 3.5m TEU of new capacity at the London Gateway development, the first berths of which are due to open in 2013. Rate wars resulting from this overcapacity in the southeast may bring European traffic back to the UK port range in the short term but such a strategy could be unsustainable and may not be enough to reverse the decline.

Major port developments have also been approved at Liverpool, Teesport and Bristol. Liverpool is the fourth busiest container port in the UK, and with capacity of approximately 1m TEU, receives direct calls from deepsea lines, especially in the transatlantic trade. Its 2010 throughput was 657,264 TEU. A new development is being proposed to expand the port with a new terminal that would add approximately 500,000 TEU capacity to the total. Teesport has already upgraded the container terminal in 2003 to a nominal capacity of 235,000 TEU, of which 247,132 TEU was used in 2010. If expansion plans go ahead, the port will have capacity of 1.5m TEU. The port can handle vessels up to 3,500 TEU, meaning that it could accommodate some feeder vessels that may cascade down once larger vessels enter service on the mainlines. The port of Bristol is currently a small container port (68,673 TEU in 2010) but it has plans to invest £600m in a new deepsea container terminal with a capacity of 1.5m TEU.

In Scotland, Babcock is going through the planning system to obtain approval for a proposed container port at Rosyth, with a first stage capacity of 450,000 TEU, with the potential for 600,000 TEU in the future. According to the application, the new terminal would be able to take ships up to 1,600 TEU, which will improve scale economies and thus lower the cost per container for Scottish container movements. The new container port will also provide competition for the port of Grangemouth, which can be expected to improve service and lower costs for port users in response.

All of these developments may not go ahead (or at least may wait until the market picks up), but they suggest an expectancy of increased feeder traffic for which regional ports want to be well-placed to compete. Moreover, while regional port development can take a number of shapes, it is notable that the concept of port-centric logistics is the common thread linking

most proposed developments of regional ports as northern gateways (in addition to logistics hubs proposals at the Humber and Workington/Carlisle). This can be a useful way to anchor traffic at a specific port, but several operational challenges must be overcome to insert a port-centric warehouse into a company's distribution network (Mangan et al., 2008; Pettit & Beresford, 2009; Monios & Wilmsmeier, 2012).

Finally, geographical specialisation at UK ports must be considered, as potential for improving availability of empty equipment is related to an understanding of which UK ports handle traffic to/from which ports. Figure 10 shows that the greatest share of container traffic in the UK originates in or is destined for Asia (41%), followed by Europe (26%) and domestic traffic (7%).

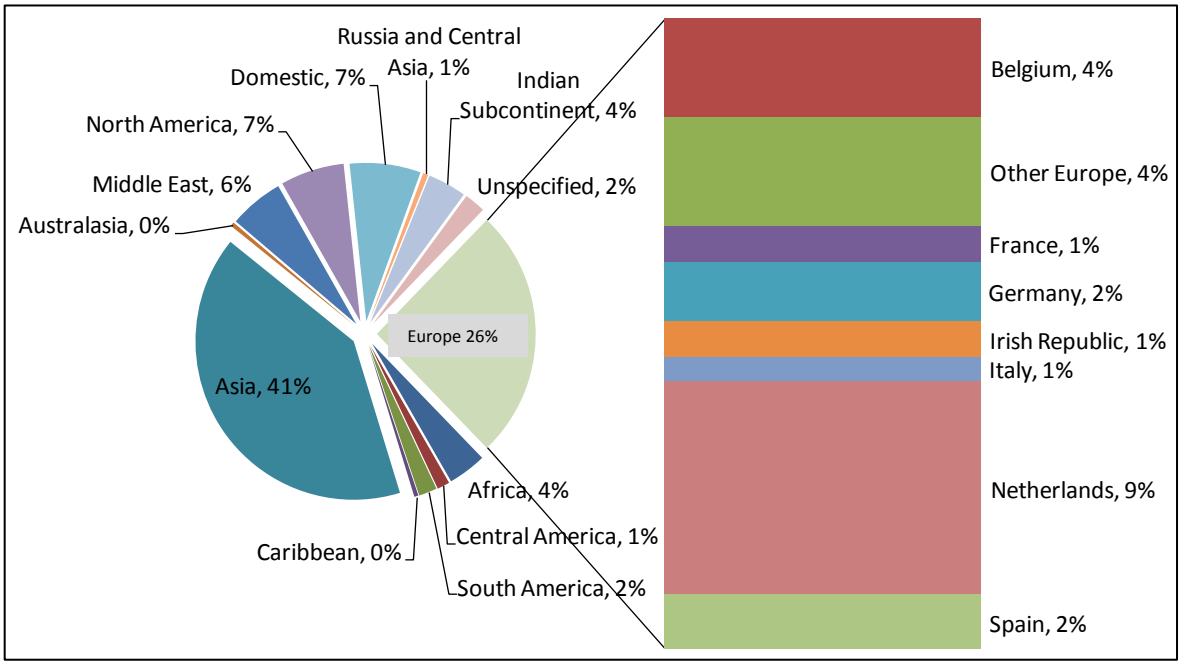

Figure 10. Container trades by region, 2010
Source: Authors, based on DfT, 2011

In a port level analysis (Figure 11) a strong geographical specialisation of UK ports becomes clear.

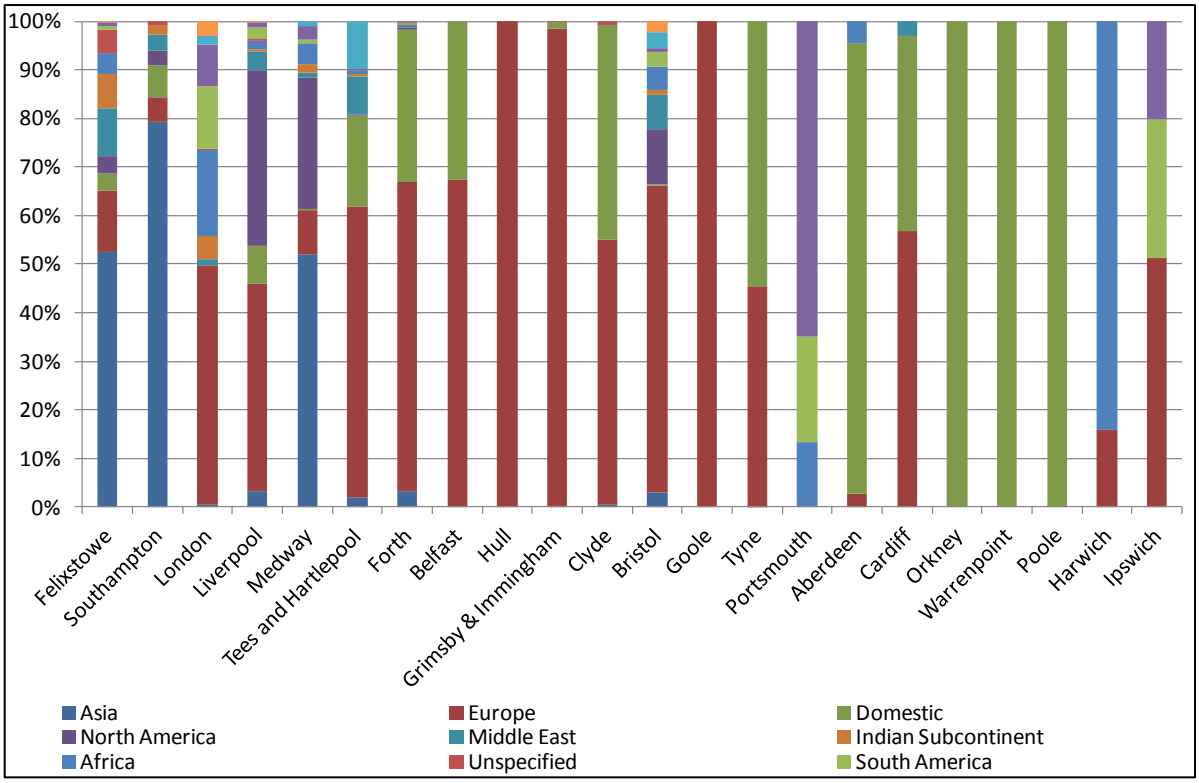

Figure 11. Regional specialisation in the UK port system, 2010

Source: Authors, based on DfT, 2011

Container trade with Asia is concentrated in three ports (Felixstowe, Southampton and Medway Thamesport), while Liverpool is a centre for North American and European trade. It is also interesting that over 50% of container traffic in London Tilbury originates in or is destined for Europe, reflecting its importance for short sea intra-European movements. Further, in the emerging secondary ports, European traffic outweighs domestic container traffic, reaching over 50% of all traffic in these ports.

6. Empty container movements at UK ports

There are six EU countries with annual throughput of more than 8 million TEU (this makes a convenient point for comparison as the next is France with just over 4 million). Figure 12 reveals that, while other European countries also handle significant volumes of empty containers, the percentage is highest in the UK (among countries handling more than one million TEU annually).

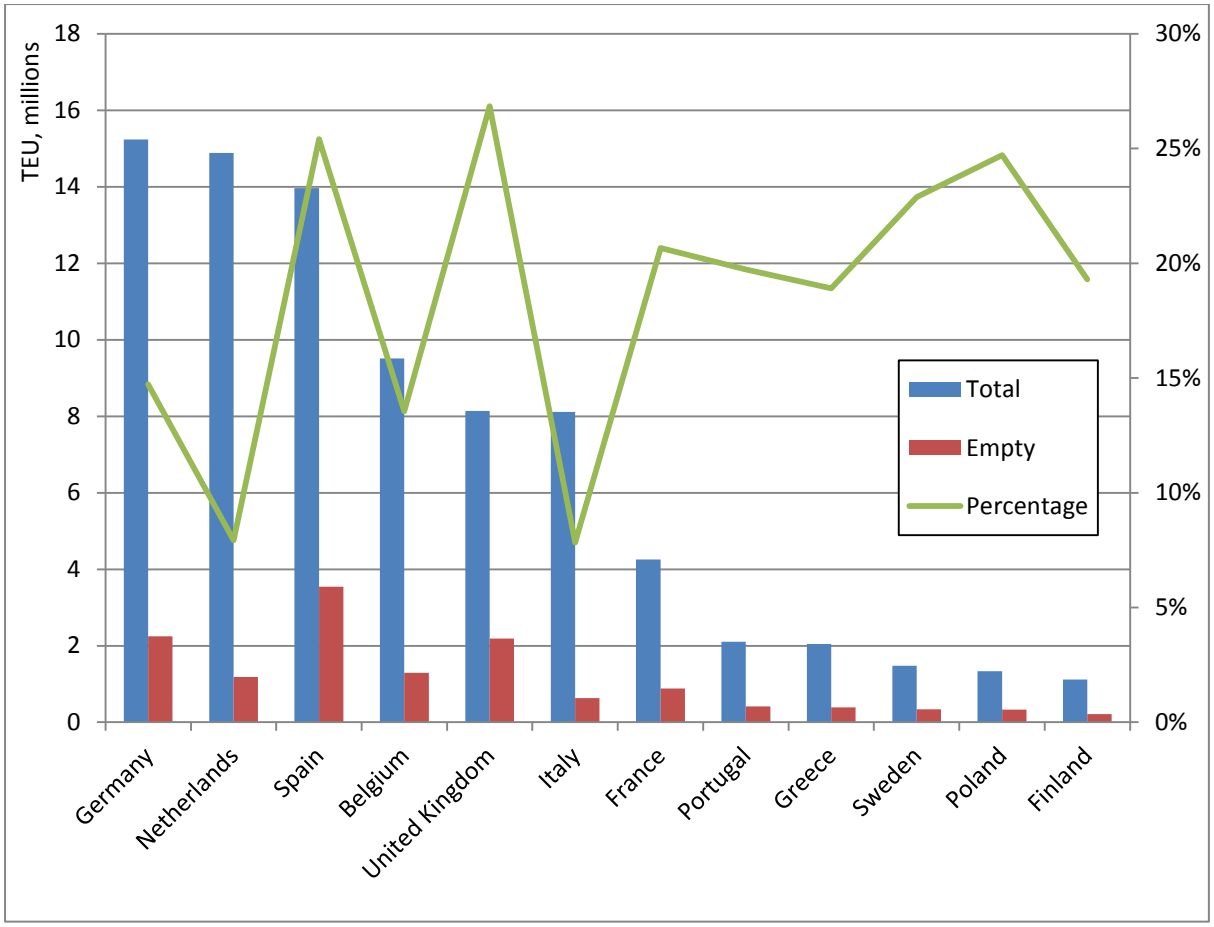

Figure 12. Total and empty container throughput at EU countries, 2011
Note: the figure only shows countries handling more than one million TEU annually
Source: authors, based on Eurostat, 2012

Figure 13 shows total inbound and outbound container flows at UK ports since 2000.

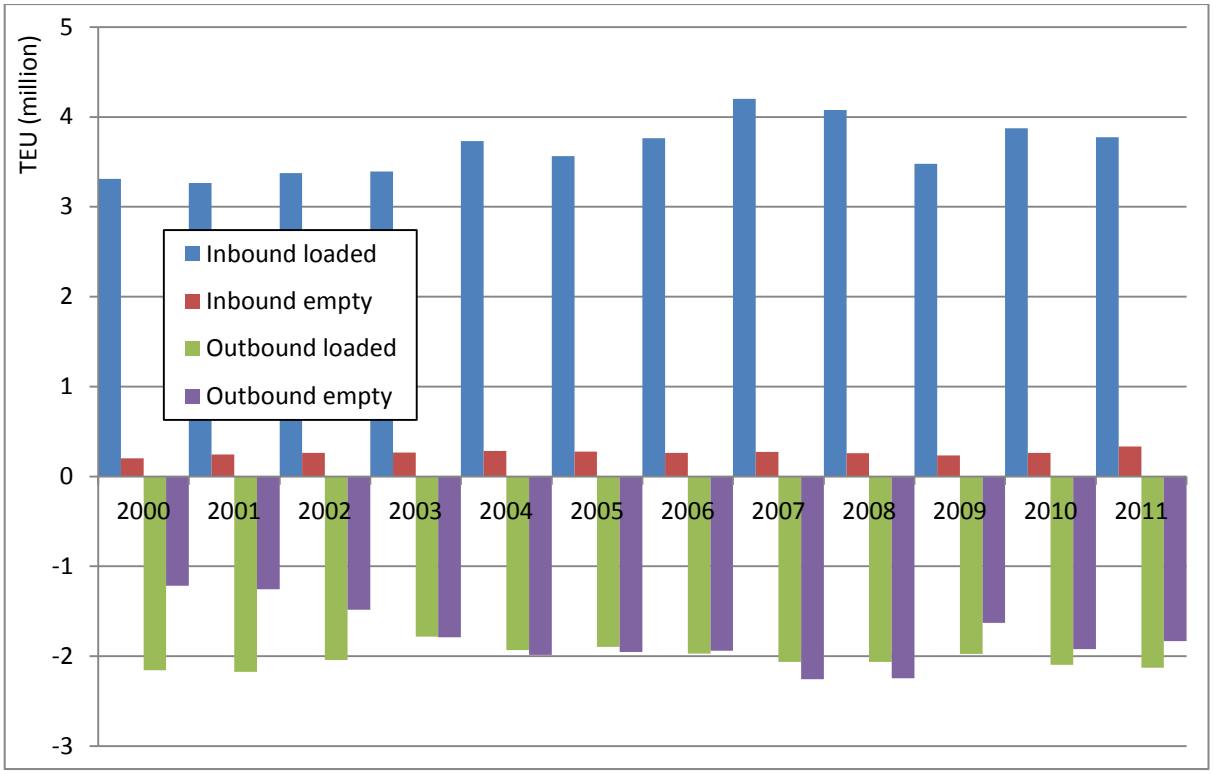

Figure 13. Full and empty movements at all UK ports by direction
Source: authors, based on DfT, 2011

The figure shows that inbound and outbound flows are relatively matched overall. Of total flows of 8.1m TEU in 2011, total inbound flows of 4.1m TEU matched total outbound flows of 4.0m TEU. However, the problem is that total loaded movements accounted for only 5.9m TEU, leaving 2.2m TEU of unproductive empty movements.

The figure shows that imports are almost exclusively laden (representing imported goods), while outbound flows are more balanced between full and empty containers (reflecting the large volume of empty containers being repositioned back to the Far East). Thus the UK is shown to be a net importer of goods, in common with many European countries. Some of the empty outbound containers represent repositioning around the UK, for example from Felixstowe to Grangemouth, which is the focus of this study. The majority of outbound empty movements will be going via deepsea routes back to the Far East, as the UK does not produce sufficient exports to fill these containers. As can be seen from Figure 14, however, Scottish ports import a disproportionate number of empty containers to fill with whisky exports. Scotland's problem is thus the reverse of the rest of the UK: it is a net exporter (by sea), thus it has a deficit of imported containers.

Figure 14 shows empty movements by port and direction in 2011, with Felixstowe and Southampton truncated for ease of presentation.

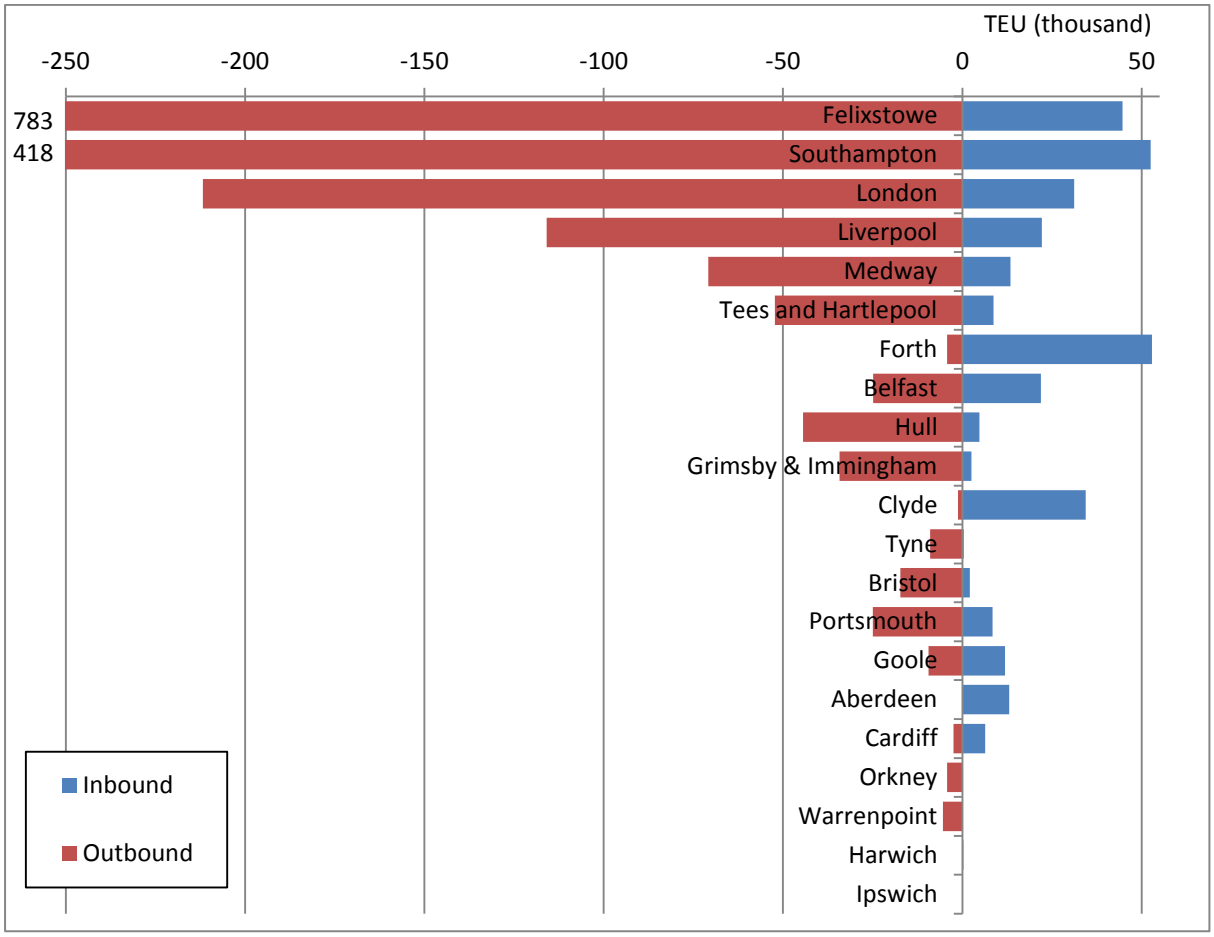

Figure 14. Empty movements 2011, by port and direction (with Felixstowe and Southampton truncated)
Source: authors, based on DfT, 2012

The figure shows that the only ports that import more empties than they export are Forth Grangemouth, Greenock/Clyde, Goole, Aberdeen, Cardiff and Harwich. The Scottish ports have a significant imbalance, with Grangemouth and Greenock showing serious imbalances.

Figure 15 shows time series data for Scotland's primary container port of Grangemouth, analysing empty and loaded in both directions.

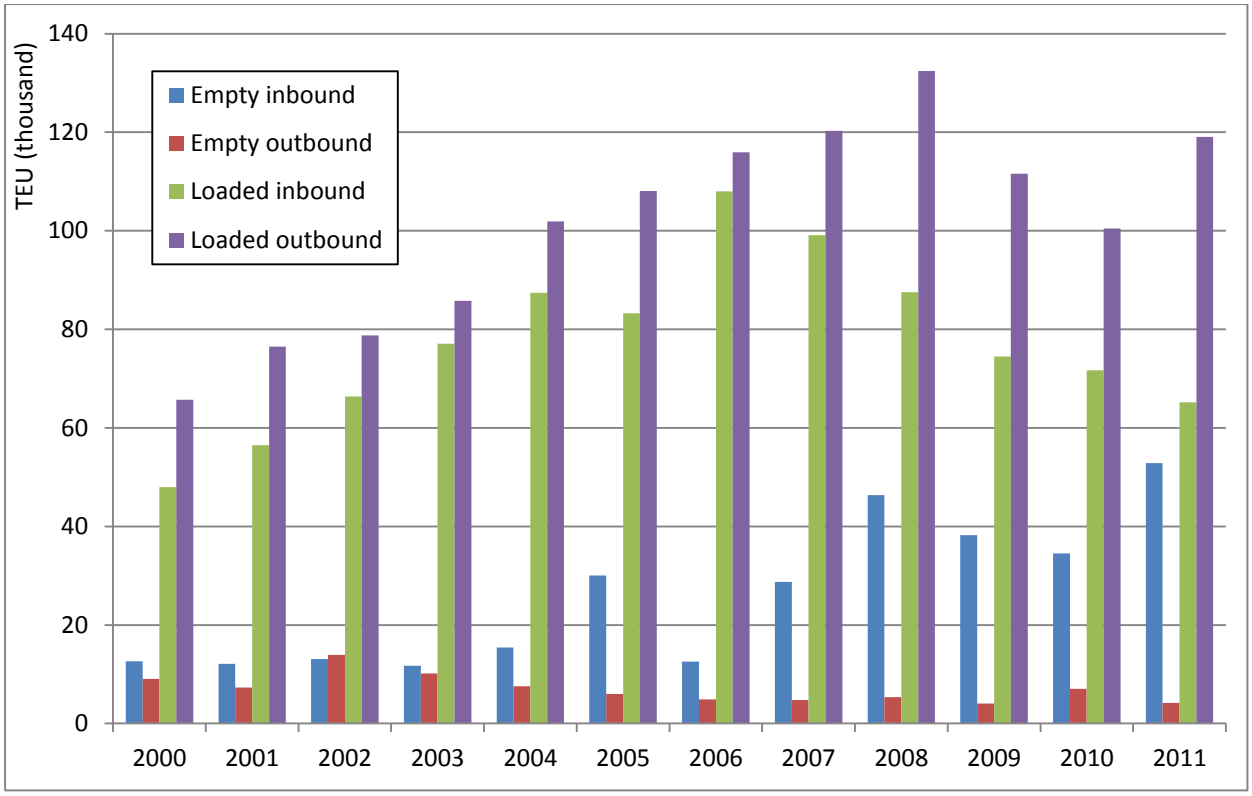

Figure 15. Empty and loaded container flows by direction at the port of Grangemouth 2000-2011
Source: authors, based on DfT (2012)

There are several findings to be drawn from this chart. First, why is Grangemouth exporting any empty containers at all, when many are still being imported? Those containers should be retained in Scotland to be filled with exports. However, as is common the world over, it is likely that they are owned by different carriers. For example, if a shipper is a Maersk customer and Maersk has no empty containers in Grangemouth, it will import them, even if there are 20 Evergreen containers sitting idle on the quayside. This problem remains unresolved despite various attempts to promote container pools and so-called "grey boxes." Second, Scotland does not move enough of its imports through its ports. The graph shows this number declining steadily since 2006. This could mean that Scotland is importing fewer units, which is not the case. What it means is that a greater proportion of goods coming into Scotland do so overland in road trailers, via distribution centres centralised in the Midlands. This issue will be discussed in a later section of the report. The third issue of note is to consider where these empty imports are coming from. They could be from any port, within the UK or from the continent. This will also be considered later.

Figure 15 shows that, since 2006, the number of loaded inbound has decreased by almost 43,000. Likewise, the number of empties imported has risen by 40,000, almost the same

amount. 2006 was a good year from this perspective because the flows were much more balanced. The current situation is markedly different. This discrepancy is particularly visible in Figure 16, showing how in 2006, only 12,557 empty containers were brought into Grangemouth, but as inbound loaded containers declined, the number of empty imports tripled.

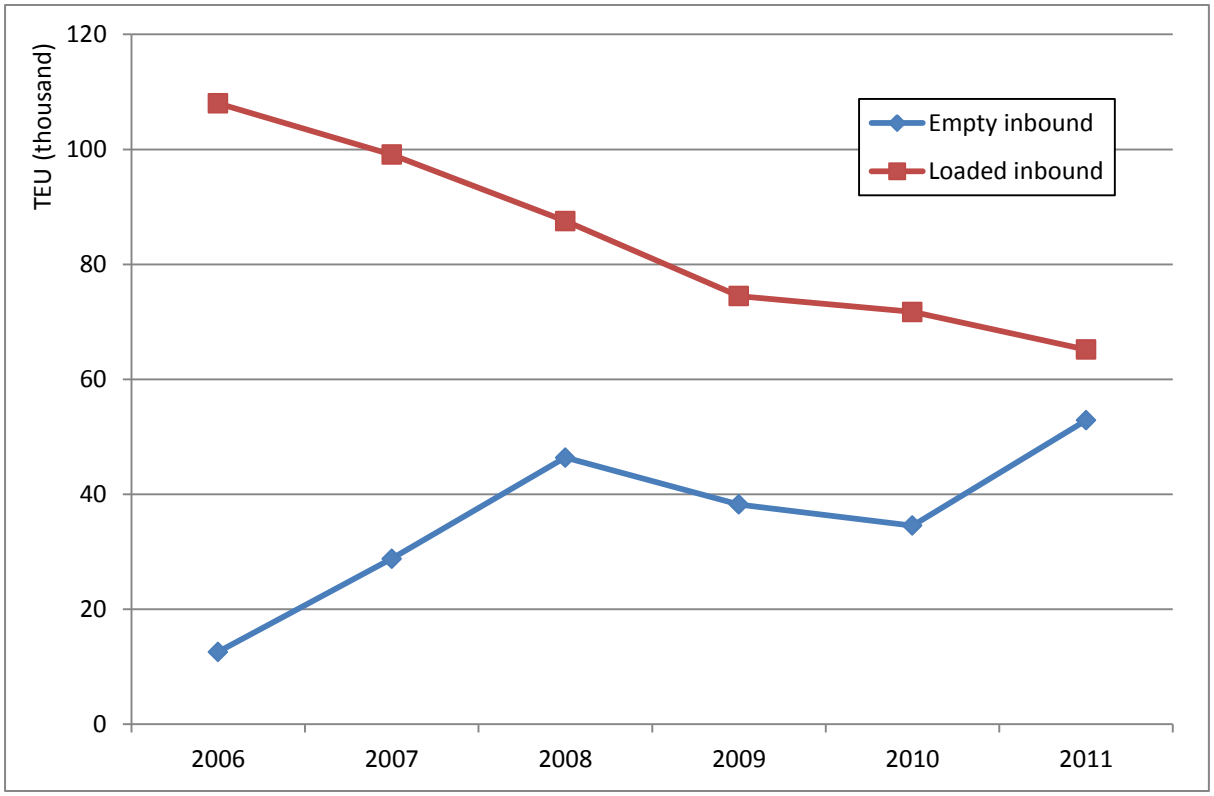

Figure 16. Inbound containers at Grangemouth 2006-2011
Source: authors, based on DfT (2012)

Greenock/Clydeport is Scotland's second-busiest container port, located on the west coast. Figure 14 above revealed that it also imports a significant number of empty containers. Figure 17 shows a time series for Greenock.

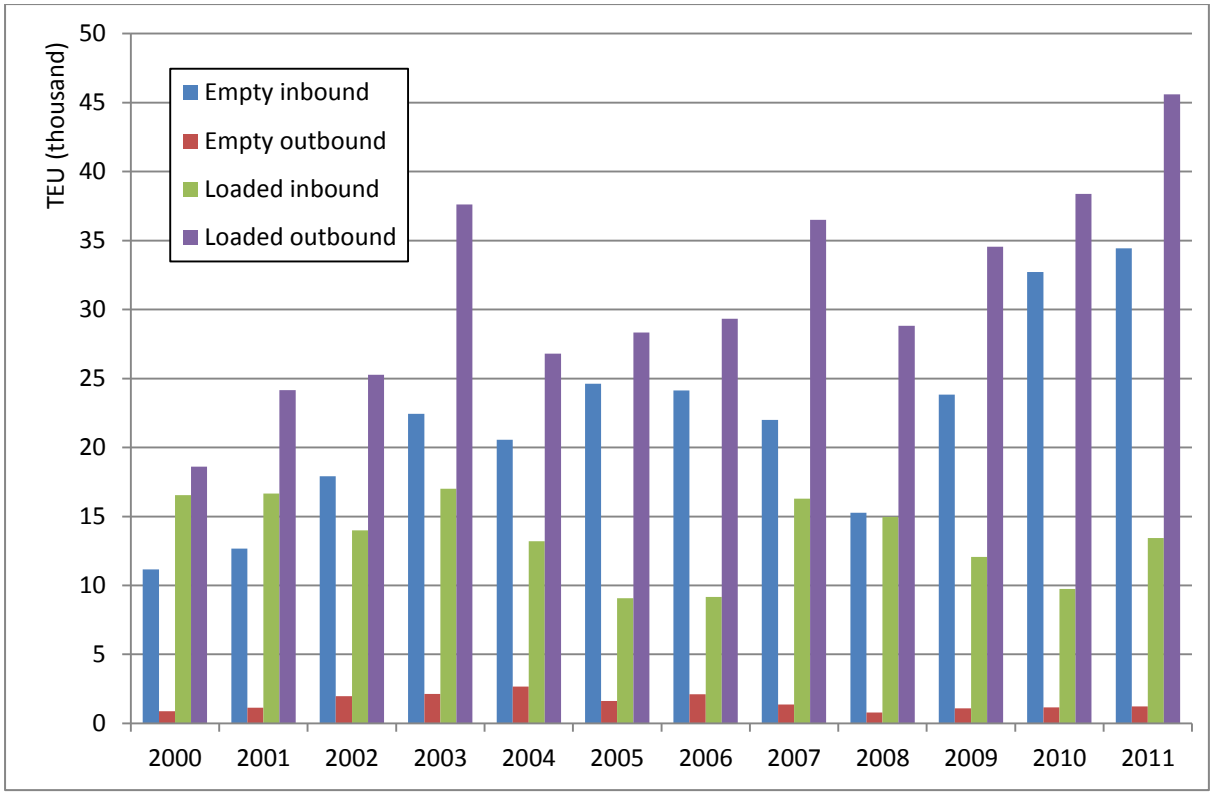

Figure 17. Empty and loaded container flows by direction at the port of Greenock 2000-2011
Source: authors, based on DfT (2012)

The analysis reveals that, like Grangemouth, a small number of empty containers are sent outbound, despite a significant number of empties being imported. Like Grangemouth, loaded exports have risen sharply, tripling since 2000. Again like Grangemouth, inbound loaded containers have fallen, but in the case of Greenock it is only a small decline.

Figure 18 shows that a similar discrepancy between loaded and empty inbound containers can be observed at Greenock as at Grangemouth.

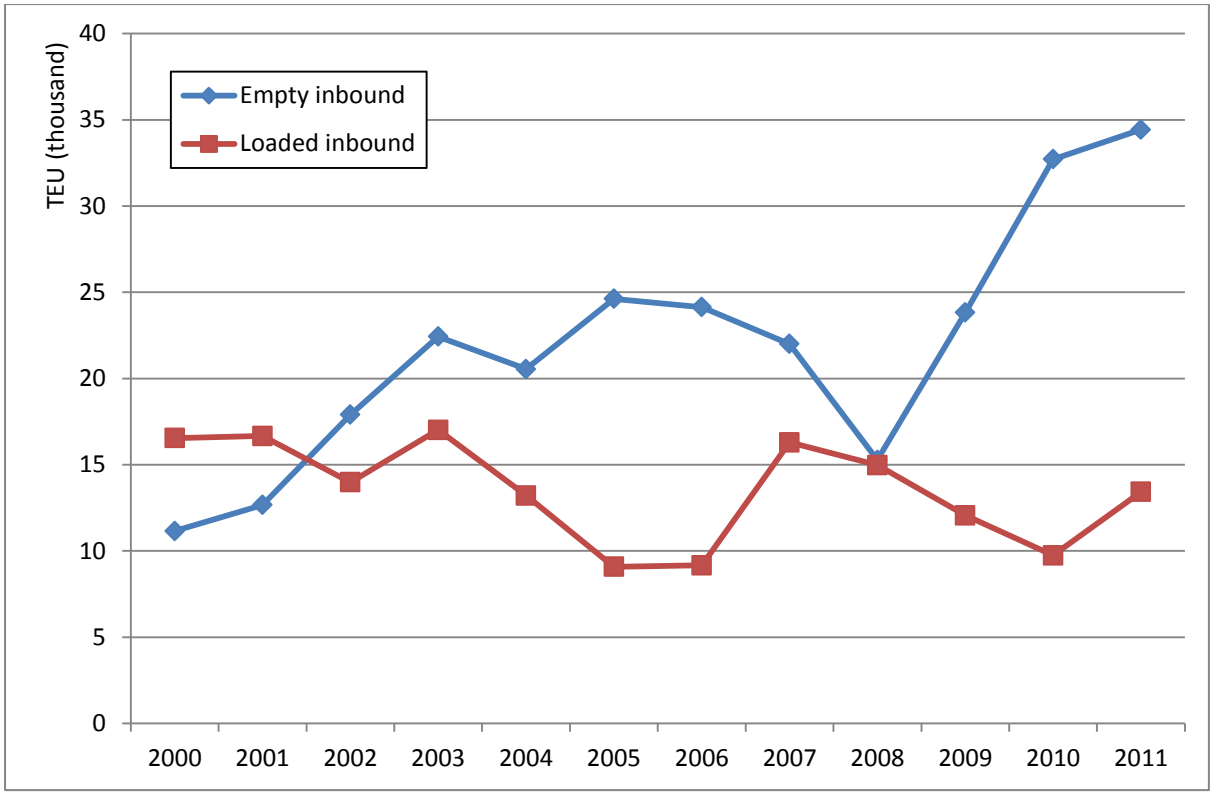

Figure 18. Inbound containers at Greenock 2000-2011
Source: authors, based on DfT (2012)

The discrepancy is not as large as with Grangemouth, but the trend is the same, with loaded inbound falling and empty inbound rising.

The reasons behind the Scottish empty container imbalance relate to the structure of trade in the UK. Northbound imports to Scotland come mostly as 45ft pallet-wide road trailers or swap bodies (and now rail containers) as they are retail and other movements from distribution centres in the Midlands. The majority of Scotland's exports leave as 20ft/40ft maritime containers either through ports or on rail. Thus empty boxes must be repositioned to Scottish ports such as Grangemouth, incurring additional costs to Scottish exporters. This equipment mismatch is also a problem in countries such as the United States where 40ft deep-sea boxes are transloaded into 53ft domestic containers for inland movement. However, 53ft maritime containers are now being constructed in China, so this may soon come to influence global standards.

While the majority of empty containers being repositioned to Grangemouth and Greenock are coming from UK ports (and are thus classed as domestic in DfT figures), Figure 19 and Figure 20 show that some are coming from feeder vessels from European ports.

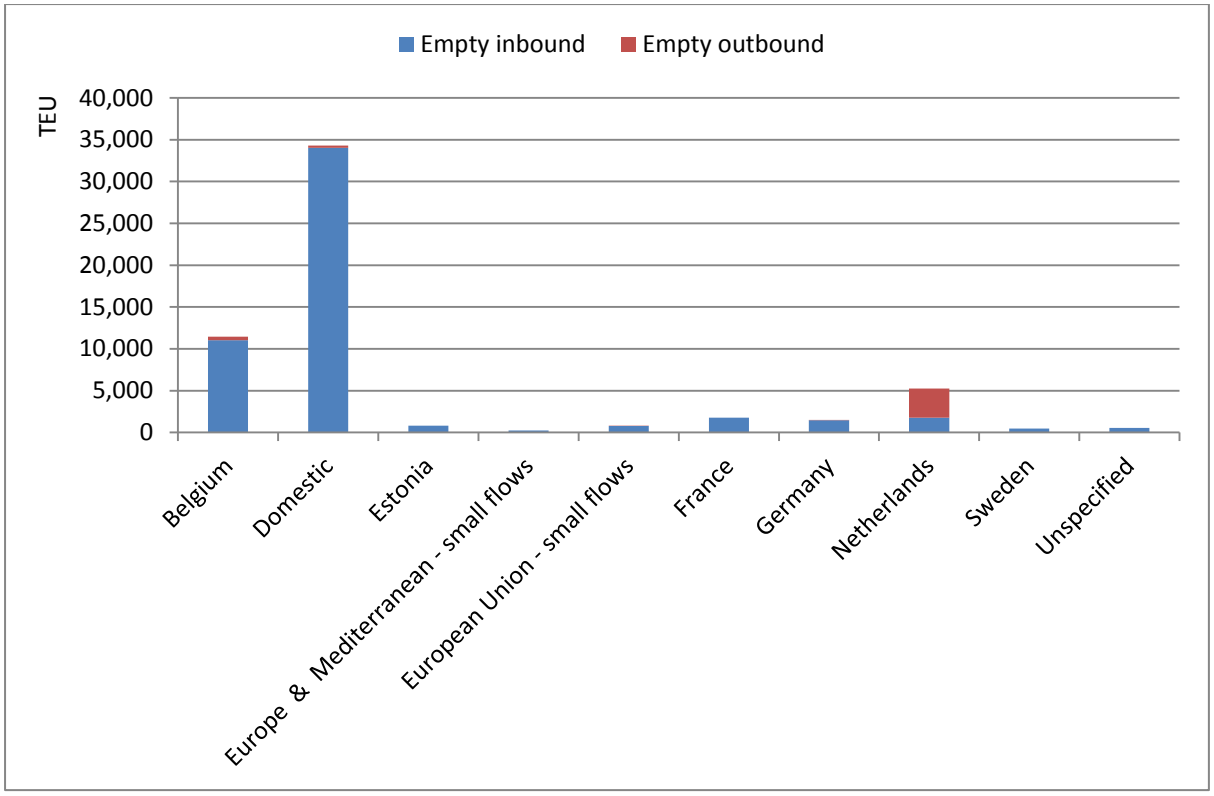

Figure 19. Empty inbound and outbound at Grangemouth 2011, by country of loading/unloading
Source: authors, based on DfT (2012)

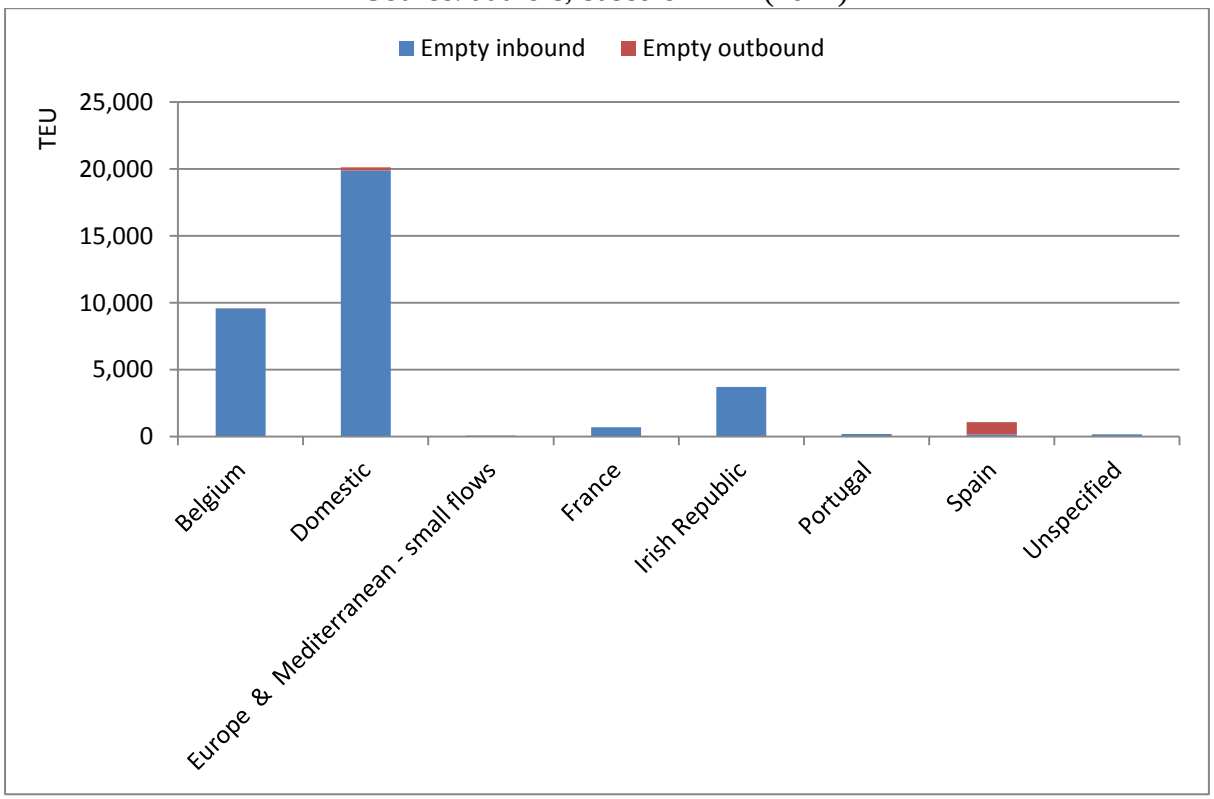

Figure 20. Empty inbound and outbound at Greenock, 2011, by country of loading/unloading
Source: authors, based on DfT (2012)

The figures reveal that other European ports are sending empty containers to Scottish ports, particularly Belgium and the Netherlands to Grangemouth and Ireland to Greenock. These are not so surprising; what is of special interest is that 3,508 TEU of empty containers left Grangemouth for Dutch ports in 2011.

The figures above show the need for empty repositioning through Scottish ports and thus reveal the impact on peripheral areas of the UK due to centralisation of flows in the Midlands. There is an ongoing discussion in the industry at the moment about how to solve this problem on north-south flows in the UK; one proposal involves sharing of boxes and transloading at one end of the chain, although barriers exist to this operation (Monios, 2012). To understand this issue further, greater detail is required on the types of containers moving on particular links, as container and wagon mismatches undermine attempts by industry players to match inbound and outbound flows, or primary and secondary distribution.

Figure 14 above shows that other ports besides the large southeastern ports are repositioning empties outbound, including ports closer to Scotland. Significantly, Teesport exported 52,299 TEU of empty containers in 2011; these could come to Scotland for limited expense rather than sending them south. Indeed, some of the empties that Scottish ports import currently may actually be coming from there. Current available data cannot answer this question, but it remains an issue to be considered in the interviews. A greater understanding of this issue could lead to better strategy in terms of consolidating these boxes to bring them north for lower expense.

The report will now present an analysis of the MCP data to look in detail at empty movements by port and month, allowing identification of spikes in demand by time series analysis. The limitations of these data were explained earlier in the report. In particular, as shown in the appendix, the coverage of Greenock in the MCP dataset is rather low, averaging only 37% across 2009 and 2010. It should also be noted that these data are a couple of years old; they are thus useful for suggesting general trends but cannot be assumed to present the current situation with precision.

Figure 21 shows container movements by month at all UK ports, averaging the data for 2009 and 2010.

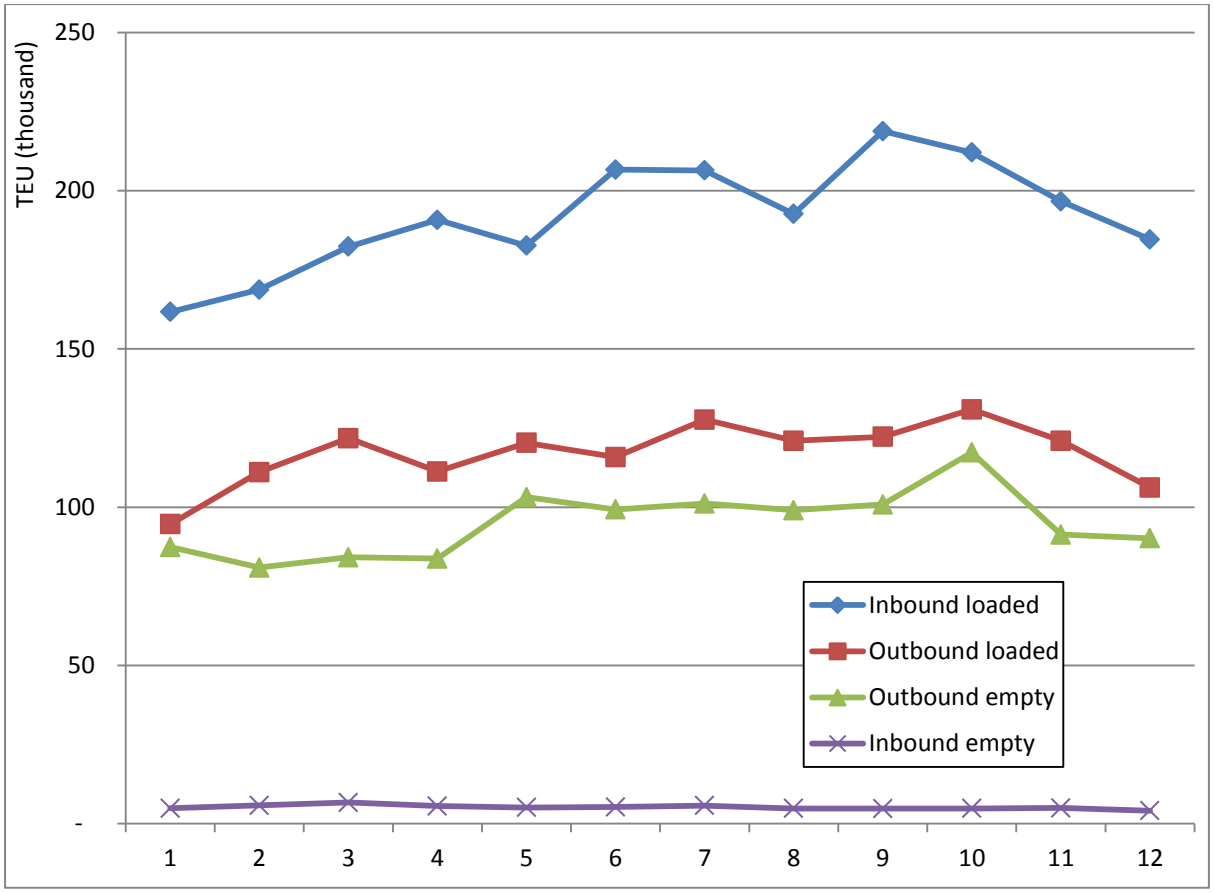

Figure 21. Container movements by month, all UK ports, average of 2009 and 2010
Source: authors, based on MCP

The analysis reveals a general upward trend throughout the year until September/October. The main peak observed is the increase in loaded inbound containers in September, followed by a corresponding increase in outbound containers (both loaded and empty) shortly after.

Figure 22 shows flows by month at the port of Grangemouth.

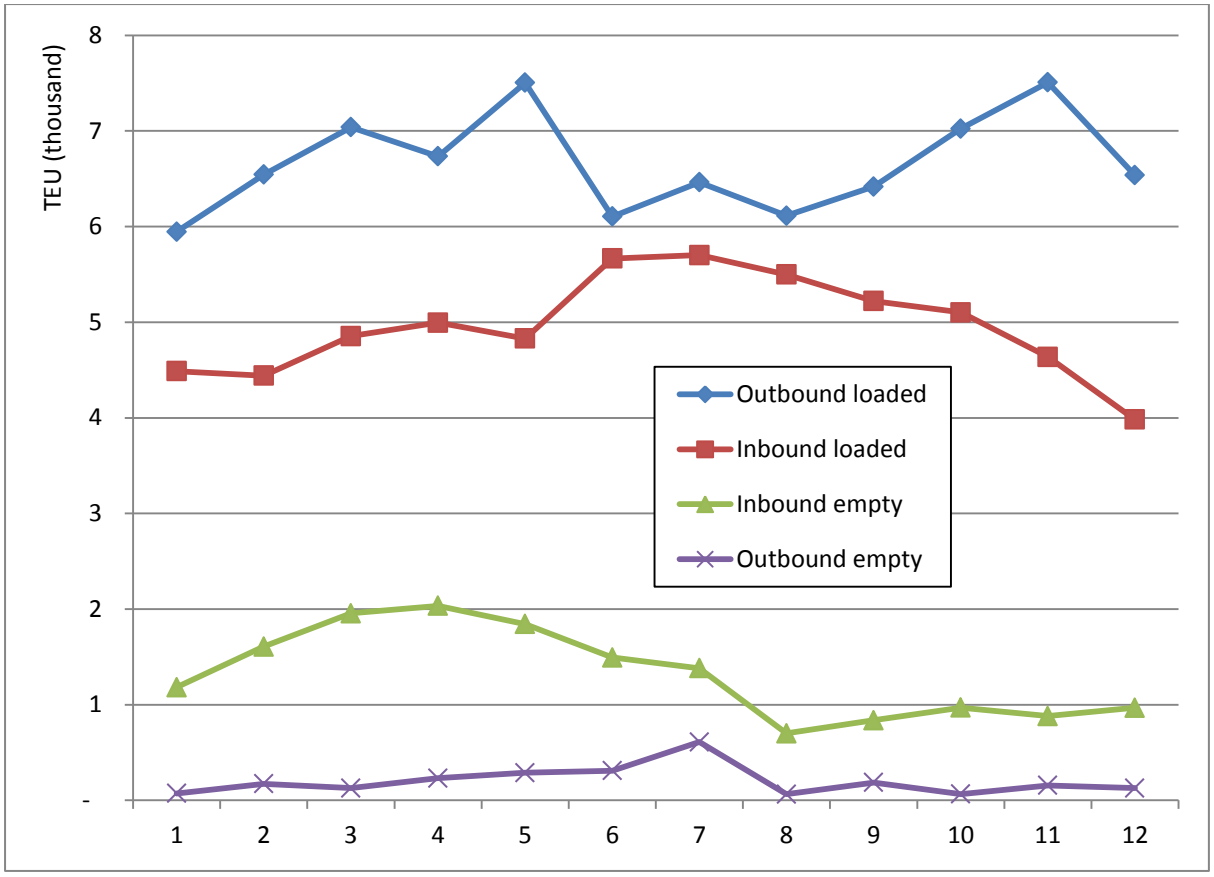

Figure 22. Container flows at Grangemouth by month, average of 2009 and 2010
Source: authors, based on MCP

The figure shows that the inbound empty flows drop by half in the second half of the year. Figure 23 reveals that this drop in requirements for empties is mostly 40ft containers.

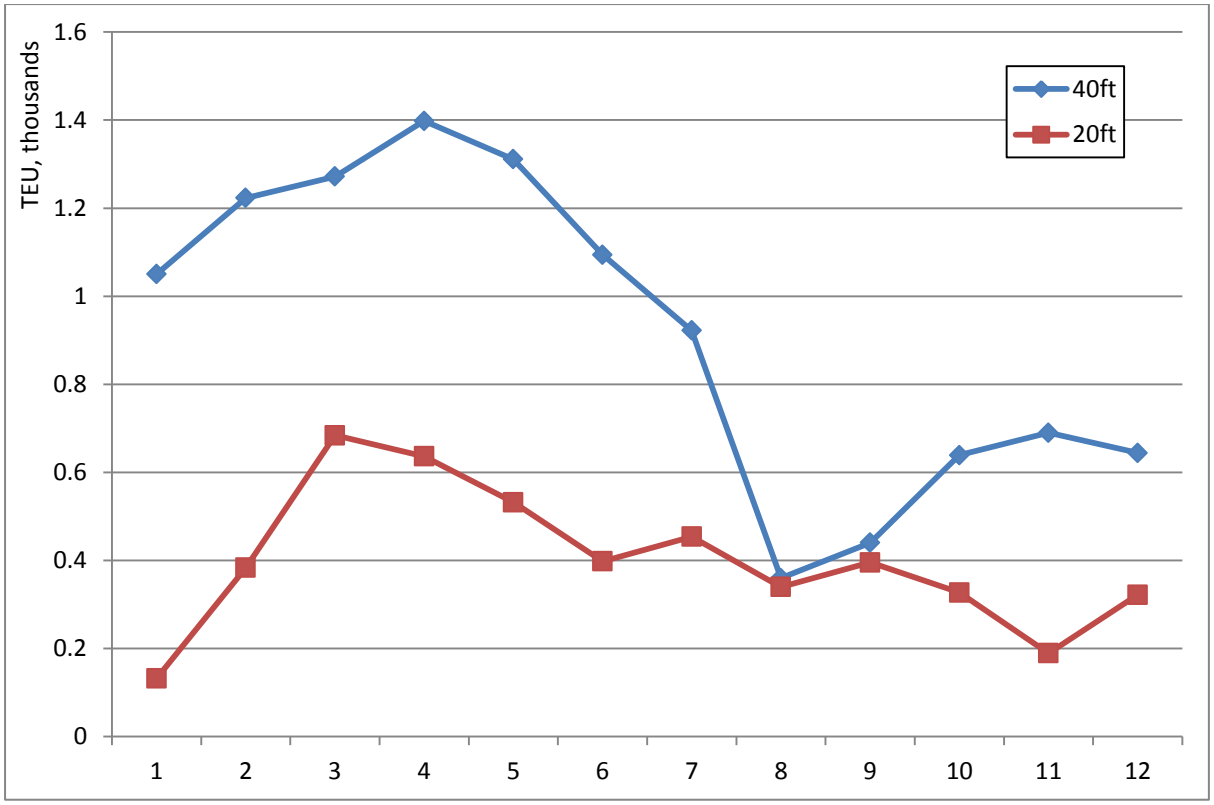

Figure 23. Empty inbound container flows at Grangemouth by month and length, average of 2009 and 2010
Source: authors, based on MCP

Figure 24 shows the same data for Greenock.

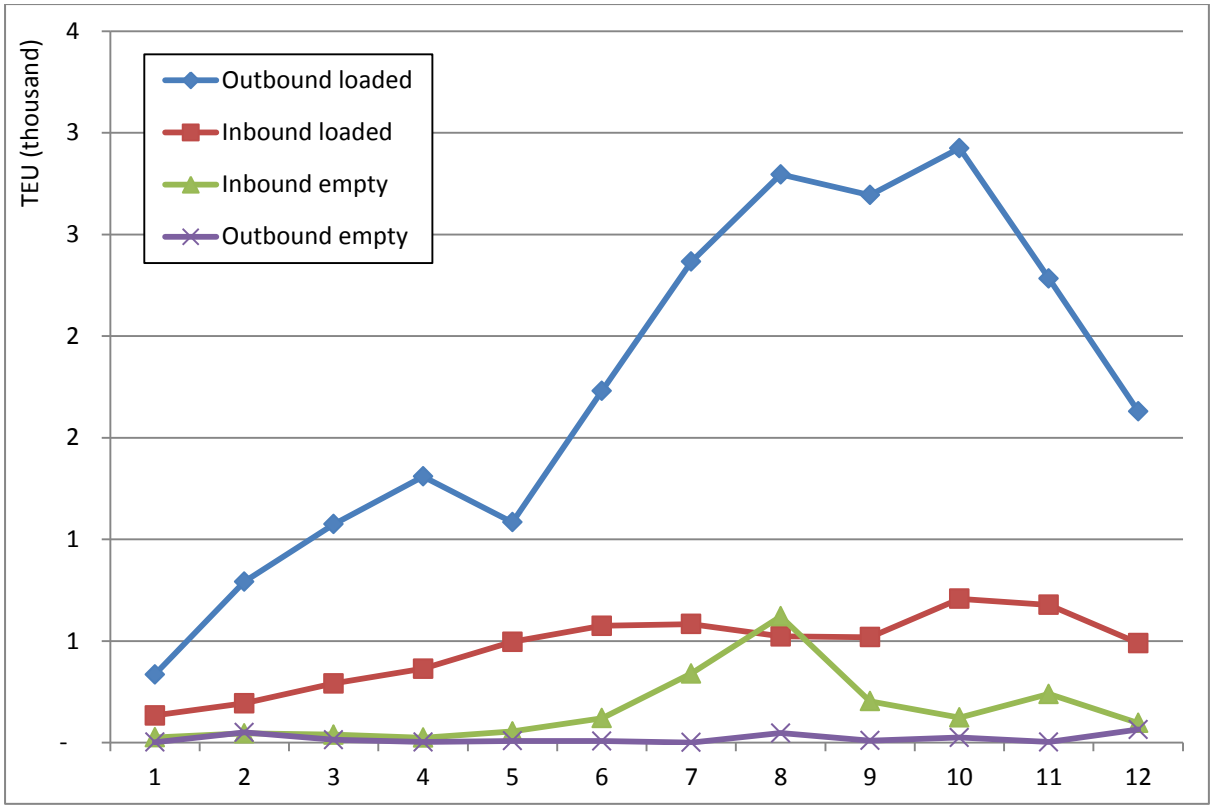

Figure 24. Container flows at Greenock by month, average of 2009 and 2010
Source: authors, based on MCP

By contrast with Grangemouth, this figure reveals that inbound empty container flows peak in July and August, corresponding to a similar (though much higher) peak for loaded exports at this time. However, it must be recalled that only low coverage exists in the dataset for Greenock. As can be seen, outbound loaded in this figure are far higher than the combination of inbound loaded and empty. If the total yearly figure (from the DfT data) is used, then total outbound loaded does indeed match total inbound loaded and empty, as should be the case (allowing for small discrepancies from time lags and so on). Therefore these MCP data for Greenock should only be used with care. They are of more value for examining depth and spread of container types than for overly specific analysis. See the appendix for more discussion of this point.

Figure 25 shows that, as with Grangemouth, Greenock has a significant difference in requirement for empty containers by 20ft and 40ft.

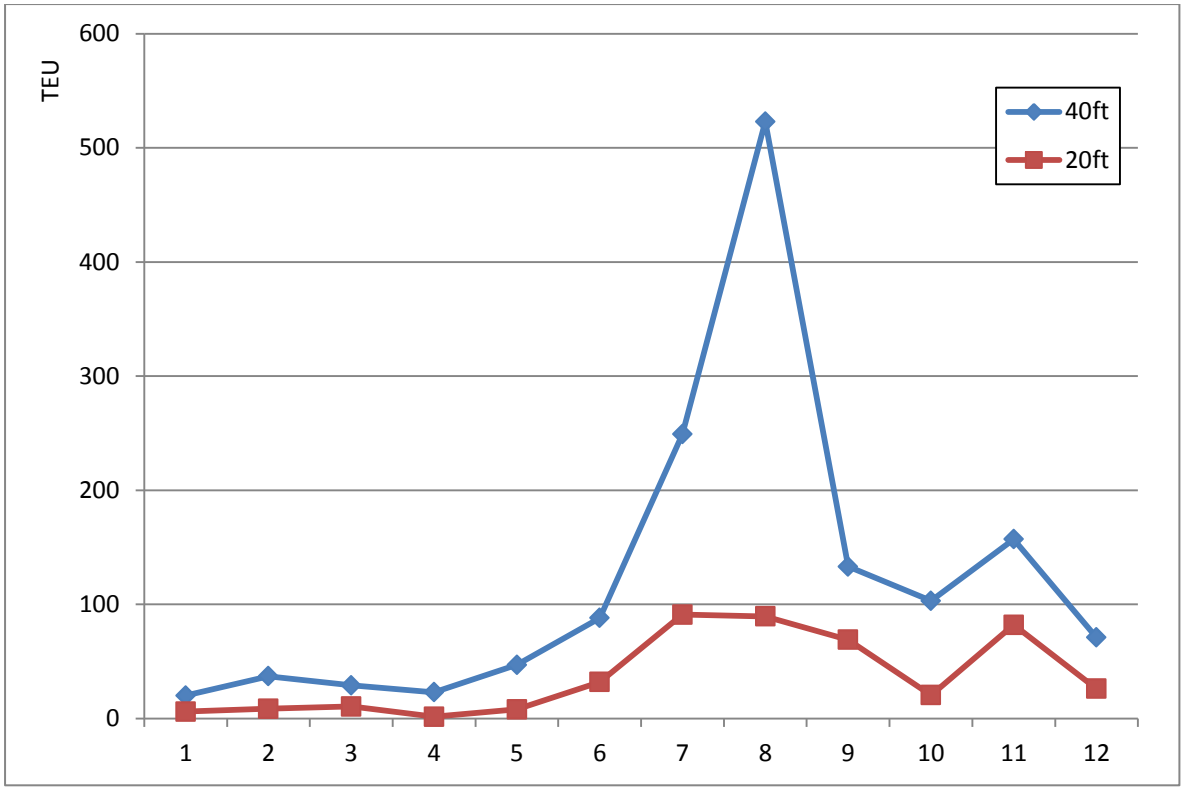

Figure 25. Empty container flows at Greenock by month and length, average of 2009 and 2010
Source: authors, based on MCP

Figure 26 shows the spread of container heights and lengths for inbound empty containers at Scottish ports.

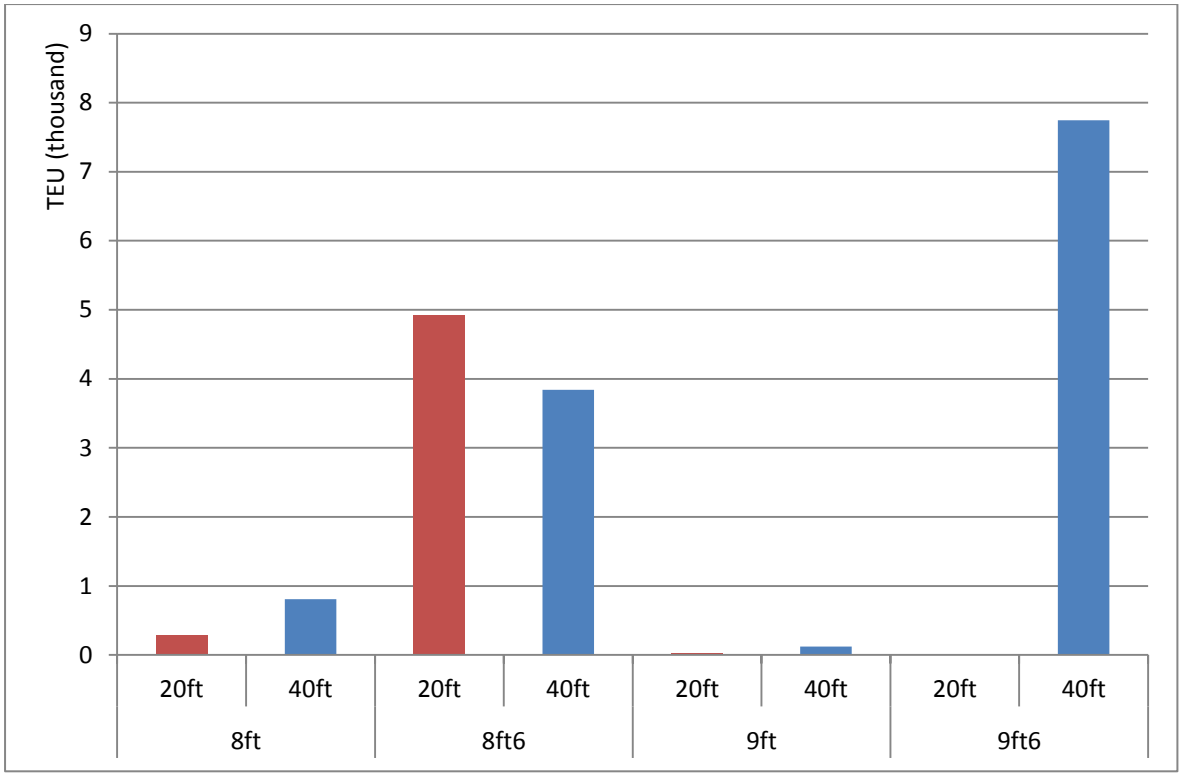

Figure 26. Inbound empty containers at Grangemouth and Greenock by height and length, average of 2009 and 2010
Source: authors, based on MCP

The figure reveals that high cube 40ft containers represent just under half of all inbound empty containers at Scottish ports, with just over half made up of regular height 20ft and 40ft containers. It makes sense for all the high cubes to be 40ft as 20ft containers are mostly used for heavy goods that "weight out" before they "cube out". While it was expected that significant demand for regular height 20ft containers would be coming from the whisky producers (partly because they are heavy loads and partly because with such valuable cargo, a full 40ft container would be an extremely valuable hence less common single consignment size), the large demand for empty 40ft containers means that there is clearly another significant segment of Scottish exporters to be identified.

Figure 27 shows the monthly requirement for high cube containers at Grangemouth and Greenock.

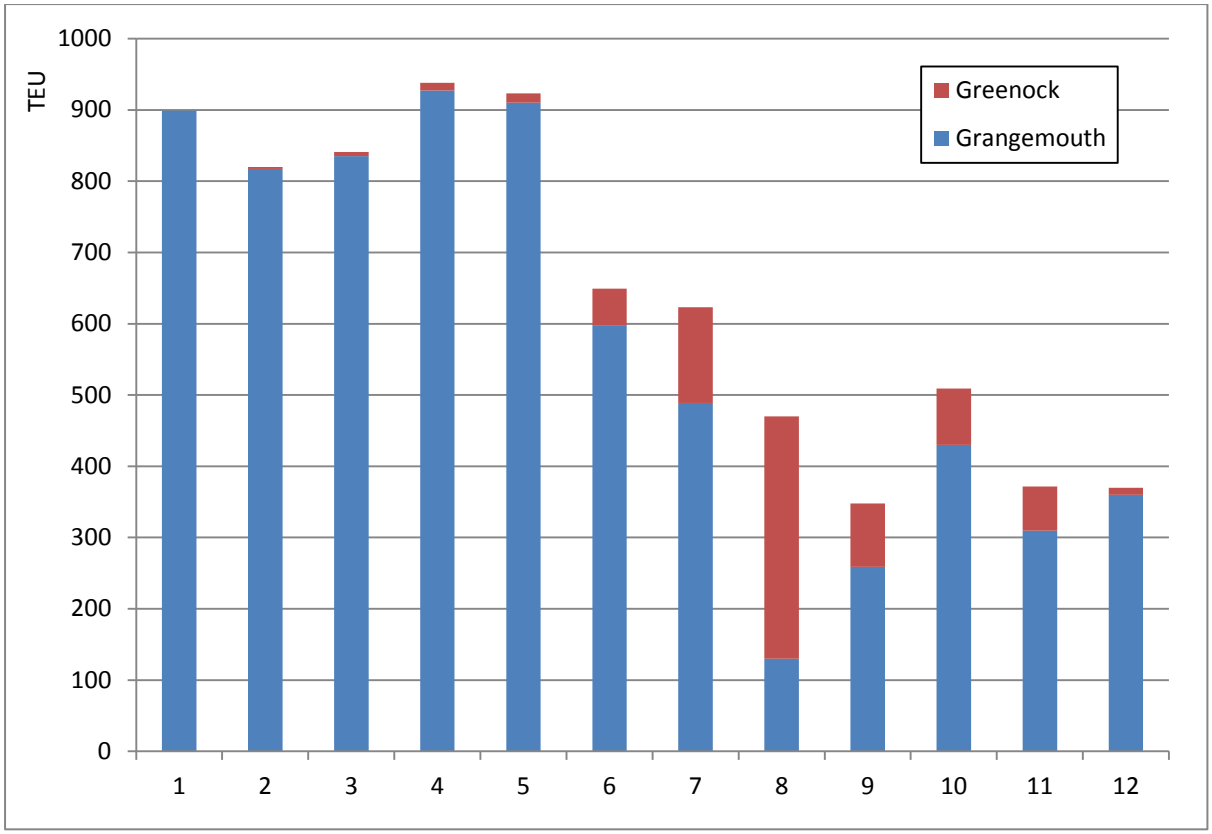

Figure 27. High cube empty container imports at Grangemouth and Greenock by month, average of 2009 and 2010
Source: authors, based on MCP

Interestingly, the analysis reveals a significant drop in imports of empty high cube boxes at Grangemouth in late summer, with a corresponding rise at Greenock. Again, the lack of coverage at Greenock must be noted.

One of the issues needing to be considered is the movement of empty containers from other UK ports to Grangemouth and Greenock. These data cannot show movements between two ports, but the monthly analysis can reveal empty outbound movements at English ports that may be coming to Scottish ports, or if not currently doing so, could be repositioned there. They will be used in discussions with stakeholders on the availability of the correct equipment at suitable locations or moving on suitable services to Scottish ports. The ports used here are the smaller ports, non-south-eastern ports, therefore Felixstowe, Tilbury and Medway Thamesport have been omitted. Figure 28 and Figure 29 present these flows by east and west coast (which, again, are subject to the same caveat about the MCP data coverage).

Figure 28 shows the east coast movements, relevant to the port of Grangemouth.

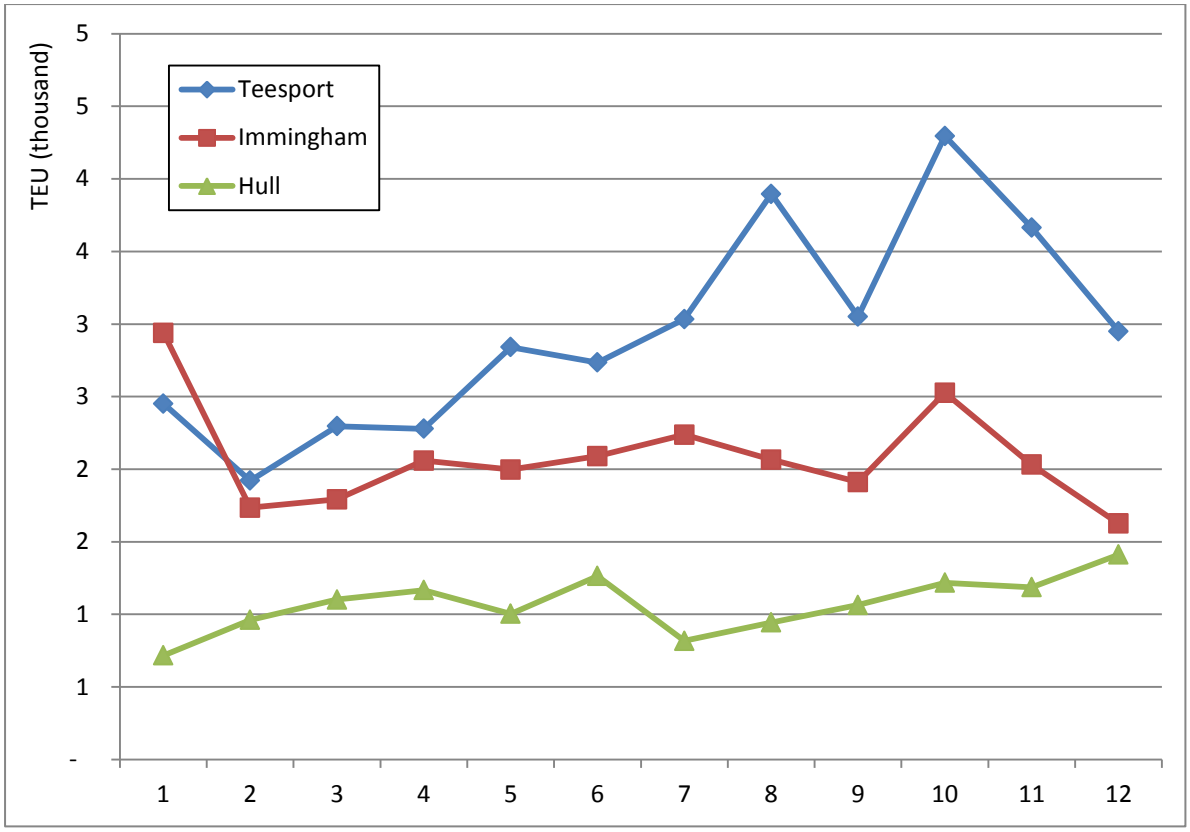

Figure 28. Outbound empty movements at east coast UK ports by month, average of 2009 and 2010
Source: authors, based on MCP

Figure 29 shows the west coast movements, relevant to the port of Greenock. Belfast is not shown due to data limitations, but would also be relevant to this analysis, along with Irish ports.

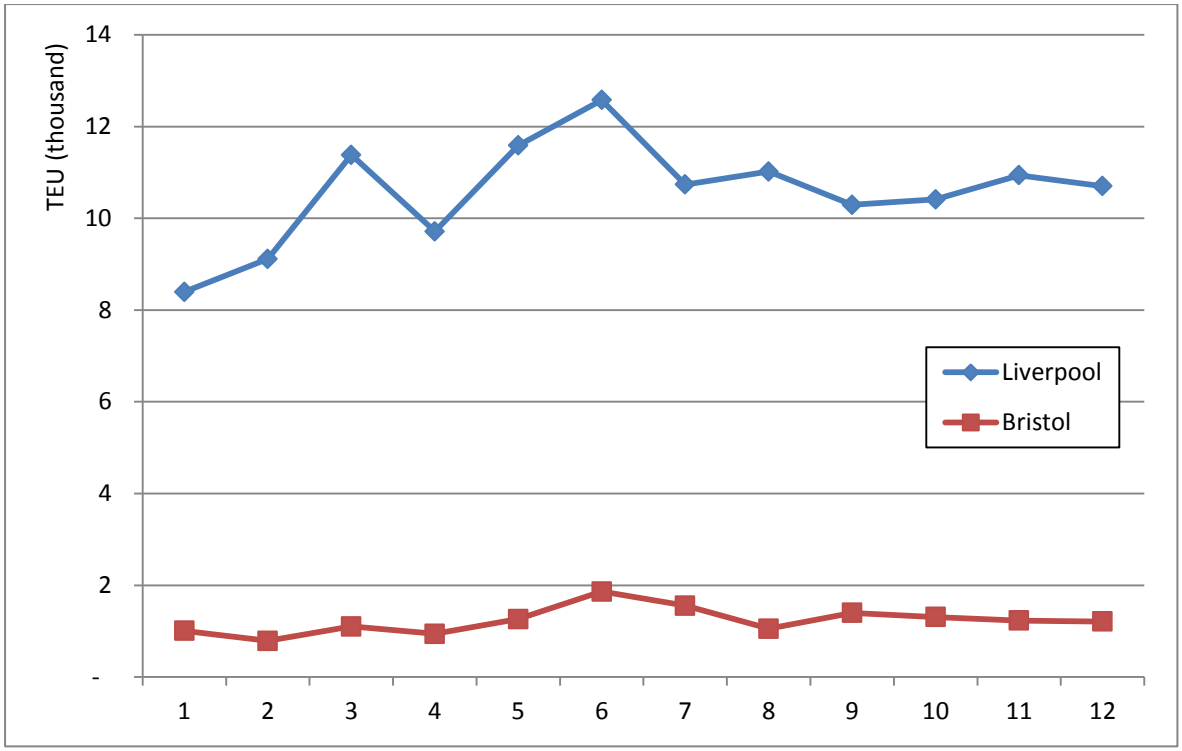

Figure 29. Outbound empty movements at west coast UK ports by month, average of 2009 and 2010
Source: authors, based on MCP

These findings regarding monthly movements will be used in discussions with stakeholders about providing the needed equipment types on services to Scotland, and can also be broken down by week if required for more detailed analysis. The data do not reveal where these empty containers are going. Many will likely be going to the large hub ports for repositioning to the Far East, but some will already be those empties that have been identified coming in to Scottish ports. This point will require to be explored in the interviews.

Finally, the shipping lines currently serving Scottish ports must be identified in order to know who the potential stakeholders will be in the scenario analysis and the interview phase of the project. Table 2 and Table 3 list the current container services calling at Grangemouth and Greenock, respectively.

Table 2. Shipping lines calling at Grangemouth

Type	Shipping line	Main port	Calls	Vessel(s)
Feeder (open-user)	Unifeeder	Rotterdam/Hamburg	Felixstowe, Immingham, Tees, South Shields, Grangemouth	700-970 TEU
Short sea	Samskip	Rotterdam	Tilbury, Grangemouth, Hull	300/800 TEU
Feeder (open-user)	BG Freight	Rotterdam/Antwerp	Grangemouth, Tees	350/800 TEU
Feeder (open-user)	Concorde container line (+ BG Freight)	Antwerp/Rotterdam	Grangemouth, Tees	slots
Feeder (dedicated)	MSC	Antwerp	Dunkirk, Grangemouth	900 TEU
Feeder (dedicated)	CMA CGM	Zeebrugge	Immingham, Tees, Grangemouth, Rotterdam	700 TEU

Source: authors, based on Alphaliner

Table 3. Shipping lines calling at Greenock

Type	Shipping line	Main port	Calls	Vessel(s)
Feeder (open-user)	X-Press feeders	Southampton	Belfast, Liverpool, Greenock	700 TEU
Feeder (open-user)	BG Freight	Southampton	Liverpool, Greenock	350/800 TEU
Feeder (open-user)	Coastal container line + others (common feeder) Part of BG Freight now	Liverpool	Greenock, Belfast, Dublin, Waterford	260 TEU + slots
Feeder (dedicated)	MSC	Le Havre	Dublin, Greenock	1,750 TEU
Short sea	MacAndrews/CMA CGM/DFDS/Suardiaz	Bilbao	Liverpool, Greenock	750 TEU
Feeder (dedicated)	CMA CGM	Le Havre	Bristol, Greenock	500 TEU

Source: authors, based on Alphaliner

An interesting finding from these tables is that the services are split between short sea intra-European, open-user feeder services and dedicated feeder links of deep sea lines. So a lot of feeder traffic on which empty equipment moves is on multi-user feeder services that carry containers from various shipping lines, providing a degree of flexibility.

The next issue for vessel provision at Scottish ports is the sulphur emission control area (SECA) in the North Sea becoming more stringent in 2015 (Cullinane & Bergqvist, 2014). The western boundary of the SECA zone is at Land's End, but not all vessels entering the zone from the Atlantic may be able easily to switch fuel from HFO to MGO. It depends on whether they have separate "service" fuel tanks. The larger the vessel, the more likely that they have additional tanks, although most vessels built since 1998 will have these due to the introduction of SOLAS 2009, Part C, Regulation 26.11. It is possible that some vessels will only have one service tank and would need to consume the HFO in it before introducing MGO, which would mean they would have to switch some time before entering the SECA, and potentially burn the more expensive MGO for more of their journey (The Standard, 2012). The cost of this fuel is presently double that of HFO. This makes scrubbers more attractive, but scrubber installation on old vessels in considered less financially viable over the life of the ship than just paying the higher fuel price, although this depends on modelling assumptions and the expected life of the vessel (Jiang at el., 2014).

Figure 30 shows the size and age of container vessels calling at Scottish ports in a representative one-month period in 2013.

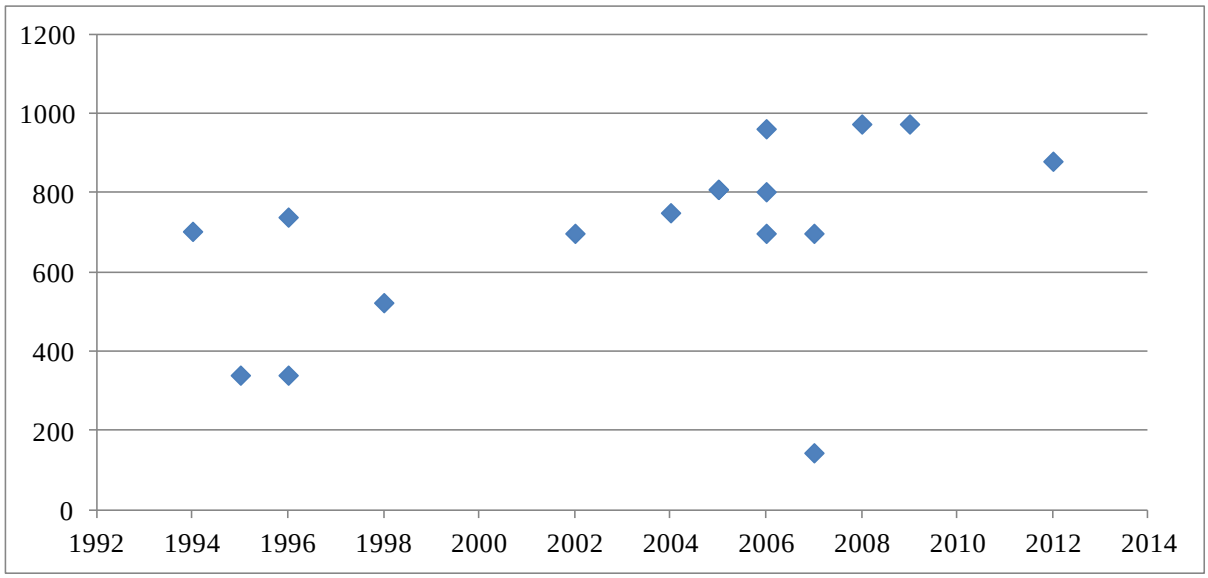

Figure 30. Size and age of container vessels calling at Scottish ports 23 Oct – 22 Nov 2013
Source: authors, based on data from Marine Traffic

The figure reveals that vessel size ranged from 144 TEU to 974 TEU, with an average capacity of 697 TEU. The age distribution shows that most vessels are relatively young, but

with a significant amount of capacity around twenty years old. Vessel owners are unlikely to invest in upgrading engines on such old vessels to meet the new sulphur requirements of 0.10% m/m. The choice is then either to use newer vessels with modified engines including scrubbers or to pay the increased cost of switching from HFO to MGO (Jiang et al., 2014). Either way, feeder costs will increase. If the increased costs of shipping leads to fewer containers exported through east coast ports (i.e. Grangemouth) because shippers utilise rail/road to the south or use feeders through west coast ports, then the whole issue of needing empties on the east coast is changed.

7. Inland container movements

The location of British distribution centres is centralised to a large degree in the Midlands, due to the geographic advantages of reaching the majority of the population at a minimum average distance and time. The UK can be divided into five segments: South England, the Midlands, north England, Scotland and Northern Ireland (see Figure 31).

Figure 31. Map showing five segments of UK market (divided by black lines), key motorways (blue lines) and ferry routes (green lines)
Source: authors, based on Google Maps

The map only shows a few key pieces of information for ease of presentation. The major container ports are in the south (Felixstowe, Southampton, Thamesport and Tilbury), along with the major consumption area of greater London and the southeast. The "golden triangle" distribution area is located in the Midlands, marked in red. The north of England is also a major distribution area, with key hubs located in both the northeast and northwest. What is of interest for this discussion is the distribution patterns. The rail links are not included in this

map, as the aim is to understand the reliance on road distribution. This map shows the key motorways (blue) connecting the golden triangle with the rest of the UK, as well as primary ferry routes (green).

What can be observed from the map is the cross-UK distribution patterns. It is not only Scottish trade that is the issue but trade flows through Northern Ireland and the Republic of Ireland. Scottish trade makes heavy use of the M6/M74 motorway up the west coast, and the M62 is a crucial artery across the north to reach ferry services from the Humber ports to access the continent. Much trade for Northern Ireland and the Republic of Ireland utilises ferry services via Scotland for landbridge access to the continent (via Humber ports or Tyne/Tees), but this traffic also uses links through Dublin to Holyhead. As Scotland only has a population of 5m, the extra 1.7m from Northern Ireland and some of the 4m from the Republic of Ireland can add numbers to achieve economies of scale. For instance, some supermarkets distribute both to Scotland and Northern Ireland from distribution centres located in the west of Scotland. In fact, the west coast port of Cairnryan is by far Scotland's busiest port in terms of unitised flows, due to the high numbers of road trailers (234,706 in 2011, which equates to at least double that if converted to TEU). At the UK level, only 41% of unitised port throughput is composed of container trade. The rest is RoRo traffic, and because of this, Dover is the UK's busiest port by unitised throughput.

As noted earlier, containerised port flows are moved in maritime containers to their inland destination, usually in the Midlands, where they are stripped and then returned to the ports, with or without an export load. Northbound flows from these centralised DCs to Scotland will then be done primarily in road trailers, with some flows now moving in domestic rail containers and swap bodies. Overland rail movement of maritime containers to Scotland is done in direct port services. There are currently daily rail freight services connecting Coatbridge with the ports of Felixstowe, Southampton, Tilbury and Liverpool. However, direct container train services from UK ports to the Midlands have grown over the last decade while direct services from UK ports to Scotland have fallen (Woodburn, 2007). This finding represents the integration of Scottish trade flows into a centralised UK distribution network concentrated in the Midlands and to a lesser extent Yorkshire and Lancashire.

Figure 27 above showed the requirement for high cube containers by Scottish exporters. There are currently still some restrictions for high cubes on normal wagons traversing the East Coast Main Line (ECML), although the West Coast Main Line (WCML) is currently

cleared on all major port routes to the Midlands and all the way up to Scotland. The high cube issue is not a problem for road haulage.

Therefore, other than these direct port services, which account for approximately 70,000 TEU per year, maritime containers do not generally move overland from England into Scotland. This could be done, for instance, by sending maritime boxes emptied in the Midlands northbound to Scotland to get an export load rather than repositioning these empties back to south eastern ports. However, the expense of sending them north overland is likely to be more than shipping existing empties from ports northbound by sea. Moreover, northbound trains are generally full, as it is the southbound leg that has spare space.

Significant road movements take place between Scotland and different parts of England (see Table 4).

Table 4. Road trailer movements between Scotland and rest of UK 2010

Origin/destination	Goods entering Scotland (000t)	Goods leaving Scotland (000t)	Total (000t)	% share	Trailers#	TEU equivalent*
North East	2,845	2,635	5,480	17%	407,832	866,644
North West	7,749	6,140	13,889	43%	1,029,169	2,186,984
Yorkshire & the Humber	2,824	1,980	4,804	15%	354,779	753,905
East Midlands	1,405	1,002	2,407	8%	177,841	377,913
West Midlands	946	812	1,758	5%	130,557	277,433
East	781	652	1,433	4%	106,339	225,969
London	N/A	N/A	0	0%	-	-
South East	N/A	294	294	1%	23,150	49,193
South West	464	N/A	464	1%	32,676	69,437
Wales	415	771	1,186	4%	89,934	191,110
Northern Ireland	181	117	298	1%	21,959	46,663
Total	17,610	14,403	32,013	100%	2,374,235	5,045,250

Source: authors, based on Transport Scotland (2012)
N/A: Sample too small for a reliable estimate
Average payload given by DfT as 14.2t (inbound) and 12.7t (outbound)
* 1 trailer = 2.125 TEU

The results show that the majority of road hauls between Scotland and England are with the north west, followed by the north east and Yorkshire. These flows are primarily road trailers, and there is little evidence of maritime containers moving around by road between Scotland and England. There are also several questions regarding these data as it is based on a survey and only includes UK hauliers. Nevertheless, it could be possible to investigate retaining empty maritime boxes at locations in the Midlands or ideally further north such as Yorkshire

and the North West, and then moving them to Scotland at a potentially lower price than moving empties from Felixstowe and Teesport to Grangemouth.

8. Summary of findings from desktop study

The preceding analysis revealed several key points that will support the generation of potential scenarios to take forward to expert interviews and SWOT analysis. Scotland's primary container ports Grangemouth and Greenock import significant amounts of empty containers, and the container types (length and height) and monthly peaks are known. Likewise, outbound empty movements from English ports are known, and these findings will be used in discussions of potential scenarios to reposition empties between English and Scottish ports.

It has been shown how northern ports are pursuing ambitious development strategies to insert themselves as second-tier hubs, such as Liverpool on the west coast and Teesport on the east coast. These will challenge the role for Scottish ports without sufficient capacity for ever-increasing feeder vessel sizes. A new container port at Rosyth may provide new options for Scottish shippers.

The structure of UK trade was discussed, which is the main cause of the equipment imbalance, and the problem could be mitigated somewhat by strategies such as sharing containers or trailers to match northbound and southbound flows. This will have operational challenges that need to be discussed in the close analysis. Likewise, other logistics strategies for pooling empty containers could involve port-centric logistics strategies and information sharing between container owners or lessors (mostly shipping lines). This finding also feeds back into the knowledge of empty flows in Scotland, as the analysis revealed that some empties are actually exported from Scottish ports. A way for these containers to remain in Scotland should be found, rather than having to import more empty boxes.

Returning to the 15 questions asked by the FTA report (Table 1), answers to some of them can now be provided based on the analysis in this report.

Table 5. Answering the questions from the FTA

Questions for	No.	Questions	Answers
Shipping lines	1	What is the number of TEUs and in what format (20' / 40') that have to be re-positioned annually to Scotland?	In 2011, 100,391 TEU of empty containers were imported into Grangemouth, Greenock and Aberdeen. The split was roughly (using incomplete data from 2009 and 2010) 71% 40ft and 29% 20ft.
	2	What are the seasonal peaks and troughs?	At Grangemouth, inbound empties rise to April and then decline for the rest of the year. At Greenock it is the reverse, with steady levels through the year except for large peaks in June, July and August.
Exporters	3	What are the major export ports of departure from UK and route to port e.g. rail or coastal shipping and numbers of TEU?	N/A
	4	What are the major peak times of seasonal export demand?	N/A
	5	Would it be possible to share flows with other exporters?	This will be examined in the scenario analysis.
	6	What sizes of ISO container are required?	The analysis of Grangemouth and Greenock showed that high cube 40ft containers represent just under half of all inbound empty containers at Scottish ports, with just over half made up of regular height 20ft and 40ft containers.
Retail importers	7	What are the main inbound flows to Scotland in destination and TEU terms?	N/A
	8	Are outbound or return flows balanced and where do they go?	N/A
	9	What are the major peak times of seasonal import demand?	N/A
	10	What is the container or load platform format required?	At an aggregate level, this is known to be 45ft pallet-wide trailers, swap bodies and now rail containers.
Logistics service providers	11	What crossover is there between inbound retailer and exporter customers?	N/A
	12	What opportunity is there to balance retail empty southbound legs with empty repositioning export trades northbound legs?	This will be examined in the scenario analysis.

	13	What opportunity is there to balance the equipment and its suitability (ISO / Curtain-sided / 20' / 40')?	This will be examined in the scenario analysis.
Government	14	What scope is there for Government to assist?	This will be examined in the scenario analysis.
	15	What are the legitimate expectations for Government to do?	This will be examined in the scenario analysis.

9. Interview results

This section presents the results from the interviews with expert stakeholders. Findings are presented according to each of the main stakeholder groups able to take direction action. Strengths and weaknesses of each as well as the practical impediments are presented.

9.1 Shipping lines

The first reason for a lack of empty containers is a case where there is no service linking the relevant supply and demand ports, or a lack of capacity or frequency on such links. If a line is not already serving this location on its main routings, it can position containers there by altering its feeder routings or by using slots on another feeder line, or, if need be, by leasing additional containers. According to the interview results, three scenarios where a shipping line could act are the alteration of service routing, influencing inland depot consolidation and better management of empties at ports.

The Scottish case showed that, while sufficient services exist to Scottish ports, the routings are undesirable. Some services on the east coast move empties from UK ports (including Grangemouth itself) to hub ports on the continent (primarily Antwerp) and then back to Grangemouth. Likewise, on the west coast, the interviews revealed that CMA CGM used to move empties from Liverpool in the UK to Le Havre on the continent then all the way back up the west coast to the Scottish port of Greenock. The shipping line was encouraged through conversations with the port operator to modify their service routing. Now they run a local triangular service linking Liverpool, Greenock and Dublin that then links with the service that joins the UK and the continent, thus removing the distance travelled by the empty containers and lowering costs. Another example was a feeder service at an Irish port not having sufficient turnaround time to drop its loaded containers and pick up empties so the empties were often left on the quay. Stakeholder discussions encouraged the line to alter the schedule so enough time was allowed. Speaking directly to the shipping lines can, therefore, achieve a change of schedule. While this sounds rather obvious, the fact that routing

decisions are taken at a higher level means such local concerns are not always recognised without lobbying by local stakeholders. It must also be added that these scenarios relate to altering routes for specialised container services. According to interviewees, adding an extra leg to the route of a general cargo vessel to move some containers from England to Scotland would not be cost effective.

Inland consolidation is another option where a shipping line can improve empty container availability. Shipping lines can move the inland empties under a variety of organisational models, and they may own their own inland depots or more commonly rent space at an inland port or container facility to store their empty equipment. The selection of merchant or carrier haulage can play a significant role as the high incidence of carrier haulage in the UK means that the shipping line decides the inland haul. The location of the majority of empty equipment that travels inland is in the Midlands, and overland transport from there to Scotland is not any cheaper than moving a box port-to-port by coastal feeder. It could be possible to place containers on empty slots on northbound rail services on the Anglo-Scottish route, but these trains are generally well loaded in that direction. The occasional slot for a handful of containers would not be frequent or regular enough to be built into the management systems of shipping lines.

Better empty management at ports is, in theory, the simplest and easiest option. However, even if successful, this only accounts for a small proportion of required boxes. This has also been tried unsuccessfully before with “grey boxes”. This will only partially resolve the problem, as the shortage in peak season will remain. Yet it only requires administration to be effective and may even provide good PR for shipping lines through the green credentials of reducing empty movements. Another option to improve flexibility is greater use by shipping lines of generic shared user feeder services such as Unifeeder or BG Freight, rather than solely moving their own boxes on their own feeder vessels.

One interviewee suggested that shipping lines could provide better information on box availability to their key customers, through a website or email list. Obviously a shipping line would not make a public announcement of their empty movements, but if they set up a trusted organisation, for example in the Scottish case just a collective of whisky exporters, they could send them daily updates about empty availability to make sure they were all used and none left the port.

9.2 Ports

The scenario of managing empty equipment at ports also involves port actors. Ports with a surplus of outbound empties have an interest in solving the problem, even if it is not directly their problem but that of the shipping lines. Ports charge shipping lines if they leave containers at a port longer than an agreed time. In regions with a surplus of empties, they increase charges to incentivise lines to take them away, but in a region like Scotland with an excess of demand, supportive policies could lower such charges to encourage lines to leave empty equipment at the port until needed. Of course, the carriers may have their own reasons for not wanting to leave the empty at the port awaiting a customer if they can get a load elsewhere.

Similarly, port operators charge fees to incoming vessels as well as container handling charges. One interviewee gave an example of a port in Ireland lowering its charges for empty containers in order to ensure they are brought to that port and thus there for their exporting customers. Such a solution can help a small port retain business from exporters. Before that solution, some shippers had been getting an empty trucked from Dublin and, since the truck was already there with the empty container for them, they would just fill the container and then send it back by truck to Dublin anyway so the port of Cork was losing this business. A regional British port like Teesport would consider such a reduced charge but only if it brought additional business. For example, they might give a discount if northbound empties moved from Teesport to Scottish port Grangemouth and the southbound loaded containers then were feedered from Grangemouth back to Teesport to link with a service there. If the southbound loaded containers from Grangemouth went to another port then there would be no benefit to the operator of Teesport.

9.3 Shippers

It is possible for shippers with complementary equipment requirements to collaborate. In the UK, southbound shippers, particularly whisky exporters, use ISO containers, while northbound flows such as secondary retail distribution moves in road trailers, and to a lesser extent, 45ft curtain-sided swap bodies on rail wagons. A potential solution that has been mooted by stakeholders is the possibility for one or the other to change their equipment usage so that both could use the same. Southbound whisky exporters could send their loads in trailers then transload into containers in the Midlands for onward transport to container ports, and the trailer will then pick up the northbound retail flows. Alternatively, northbound retail flows could move in the empty maritime containers available in the Midlands, then once the

load is deposited in Scotland, the empty container will be available for the southbound whisky flow.

This would be a neat solution for two large sectors to work together rather than many small shippers, and such large shippers enjoy strong bargaining power with liner shipping companies. On the other hand, demand for different container types may vary and it can be difficult to match freight flows. Moreover, whisky exporters retender their carrier contracts every year or two, and a change in carrier thus a change in box ownership could destabilise the northbound retail flows which is undesirable for this sector. Another reason this solution has not yet been put into practice is that southbound whisky cargo is very valuable and opening trailers to reload into containers is not desirable. Competition among shippers within the same industry sector could also be a disincentive, as could be the commercial sensitivity of price negotiations.

9.4 Public sector actors and industry associations

Public sector actors can come from a variety of organisations and interest groups, such as actual government agencies or other industry or representative groups such as chambers of commerce (which are usually private sector organisations but will be considered in this section).

The Scottish government already operates grant schemes for both infrastructure and operating costs involved in shifting freight flows from road to rail and water. It could be possible for such schemes to be extended to subsidise empty container movements, but they are in most instances already moving by water, so there is no modal shift. Such a scheme could, however, be justified if it were only available to SMEs in the sense that it is supporting local exporters. It would likely be politically and practically difficult to implement and would not be resolving the issue but merely moving the cost from shippers to the taxpayer.

What the public sector and other supporting actors can do, more profitably, is lobby shipping lines and ports with local knowledge and influence their decisions where possible. It was shown above that shipping lines can be encouraged to alter their service routings and schedule times, and ports can be incentivised to provide discounts where it is in their own interests. There is therefore a role to be played by such organisations in sharing information between stakeholders.

10. Identification of potential scenarios

Drawing on the results from the desktop study and the interviews, the following scenarios have been identified as potential ways to address the problem of empty repositioning for Scottish shippers:

1. Service alteration: this could be an alteration of existing feeder services or it could be possible to extend some general cargo services (currently routing Scandinavia-continent-England-Scandinavia) to bring empties from east coast English ports up to Scotland, before then returning to Scandinavia, with or without export loads from Scotland. Using the Rosyth-Zeebrugge ferry could also be an option.
2. Inland consolidation: an inland location could be used to store empties before sending them north to Scotland.
3. Empty management at Scottish ports: keep empties in Scotland and don't send them out.
4. Shipper collaboration: retailer northbound trailers vs southbound whisky maritime boxes - can they collaborate on container usage?
5. Subsidy per container: this would only be for SMEs in order to stimulate Scottish exports.
6. Subsidised vessel: specifically subsidised feeder vessel purely for empties (like the original LO-PINOD Methil container vessel concept).

Each scenario will be analysed via a SWOT analysis. Conclusions will then be drawn, including a longer term view on the possibility of conducting a pilot of one or more scenarios.

11. SWOT analysis of scenarios

The following pages will present a SWOT analysis of each of the six scenarios, based on the findings from the desktop study and the interviews.

Table 6. SWOT analysis of scenario 1

Scenario: Service alteration	
Strengths	Weaknesses
• Builds on existing services so easier to get started • Extra cargo may be welcomed by existing operators running empty legs	• Difficult to alter current feeder services as routing set by global/regional operator • Difficulties in matching freight flows • High operational cost to maintain a fixed schedule service • This scenario may not be any cheaper than the current repositioning cost • General cargo vessels may be unable to carry containers or may only be able to carry a limited number • Using a general cargo vessel to move a few containers would not be cost effective
Opportunities	Threats
• Evidence of feeder services being altered before if it can be shown to be in their interest • May provide extra traffic for the Zeebrugge-Rosyth ferry (if it can make the extra stop in England) • Potential general cargo services have already been identified.	• Will shipping lines (who generally own the containers) be content to use services of other operators? • Competition from neighbouring ports (e.g. triangular service may prefer to drop the empties at Teesport rather than Grangemouth)

Table 7. SWOT analysis of scenario 2

Scenario: inland consolidation	
Strengths	Weaknesses
• Makes use of containers that are already inland and looking for an export load	• Northbound from Midlands may not be any cheaper than just moving by ship those empties already at southern ports • Northbound rail flows are already pretty full – spare capacity is southbound which is not desired
Opportunities	Threats
• If the consolidation location is in the north or northwest of England, this could be attractive to them as they are close to Scotland • Could also provide financial incentives for shippers or inland transport operators to return boxes to specific locations.	• Issue of different companies owning the containers could challenge this • Merchant vs carrier haulage. High incidence of carrier haulage in UK therefore shipping line decides the inland haul. Merchant haulage may be easier to pursue this option. • Organising the location and ownership of empty depot (existing or new) could prove challenging

Table 8. SWOT analysis of scenario 3

Scenario: empty management at Scottish ports	
Strengths	Weaknesses
• A certain number of empty containers are already there and being exported from Scottish ports. So it is the simplest from a practical point of view. • Fewer stakeholders involved. • Probably the cheapest option	• Even if successful, this only accounts for a small proportion of required boxes • This has been tried unsuccessfully before with "grey boxes" • This will only partially resolve the problem, as the shortage in peak season will remain
Opportunities	Threats
• Only requires administration so may be attractive. • May provide good PR for shipping lines	• Shipping lines likely to be unsupportive • Organising the location and ownership of empty depot (existing or new) could prove challenging

Table 9. SWOT analysis of scenario 4

Scenario: shipper collaboration	
Strengths	Weaknesses
• Would be a neat solution for two large sectors to work together rather than many small shippers • Strong bargaining power with liner shipping company	• This has been discussed before through the FTA and not taken up • Demand for different container types may vary • Difficult to match freight flows
Opportunities	Threats
• Good relationships already through previous FTA discussions and SSCF • Could make a good pilot project	• Southbound whisky cargo is very valuable and opening and closing containers is not desirable • Northbound retail flows have no motivation to disrupt their supply chain for the benefit of southbound shippers • Competition among shippers within same industry sector • Commercial sensitivity of price negotiations

Table 10. SWOT analysis of scenario 5

Scenario: subsidy per container	
Strengths	Weaknesses
• Addresses the problem directly • Encourages SMEs • Strengthens Scottish exports, and therefore port traffic	• Could be politically and practically difficult to implement • Complexity of government administration
Opportunities	Threats
• Need to compare this with existing modal shift subsidies like FFG/MSRS.	• Not sustainable? • Doesn't solve the problem but simply shifts the cost to the government • Need cooperation with liner shipping companies • Could only work if it leads to modal shift but these containers are already moving by sea.

Table 11. SWOT analysis of scenario 6

Scenario: subsidised vessel	
Strengths	Weaknesses
• Addresses the problem directly • Takes a holistic view rather than various small subsidies and schemes	• Complex and potentially risky and expensive • A tender would be required (see lessons learned from Methil tender) • May not be any cheaper than current cost
Opportunities	Threats
• Builds on the earlier LO-PINOD coastal vessel • There was already discussion before about extending the original LO-PINOD vessel to Teesport • Multi-purpose vessel could carry containers and other cargo (although this could also be a weakness due to the inherent complexity)	• Seasonal demand fluctuation • Ownership issue, sharing containers, carrier haulage • Operational cost could be too expensive, unless additional revenues could be earned • State aid issues

12. Conclusions and next steps

12.1 Scenarios

The SWOT analysis of the six scenarios has shown that the first can be influenced by regional stakeholders in the right circumstances, although it is only possible with specialised container vessels and general cargo vessels would not be cost effective. The second and third scenarios are not currently feasible because the market is too small, and the fourth scenario is operationally feasible but difficult to implement due to commercial sensitivities. Both the fifth and sixth would be very difficult to implement from a political perspective. In particular, both could only be funded they were producing a modal shift, but as most of these containers are already moving by sea, this would not be the case.

12.2 Generalising the results

The first conclusion from the above analysis must, unfortunately, be pessimistic, as the geographical and economic realities causing the imbalance cannot simply be removed. The only way to resolve the underlying trade imbalance is to balance flows of loaded containers, which means increased containerised imports to exporting regions, either on a global level (e.g. western exports into China) or, in this case, regional (e.g. more containerised imports into an exporting region like Scotland).

The second conclusion relates to feasible practical solutions. Two practical solutions were found in the literature (foldable and “tworty” containers), but require greater availability before they can be used successfully. A new practical option was uncovered in this research, being the sharing of equipment between northbound and southbound shippers, so northbound retail shipments could utilise ISO containers rather than trailers and swap bodies, thus providing availability of empty containers in Scotland for the southbound whisky trade. This is operationally feasible, but commercially and institutionally difficult due to sensitivities involved. It may be possible to run a trial of this operation in a future project to test the feasibility and operational limitations.

Even where immediate solutions are not feasible, the experience from the interviews has shown that the situation can be improved. Local and regional stakeholders can lobby shipping lines and ports to achieve better services and lower costs in some instances, where it is in their interests. This is mostly due to the issue of governance scale, where decisions are often made at the global level and local information can result in a better solution for all involved.

It suggests that greater knowledge sharing and stakeholder interaction can achieve positive results and should be pursued by public sector actors.

A fourth conclusion is that, not only is the imbalance between exporting and importing regions a difficult problem to solve, but that it is likely to get worse for peripheral regions due to the rising size of feeder vessels resulting from the cascading of ships down from other trades, as well as rising costs from sulphur emissions restrictions, thus favouring larger regional ports. It may be in the future that larger continental feeders may call only at Teesport and Liverpool, with onward service to Scotland either overland, or by smaller feeders, which may even be internal moves (e.g. Peel Ports using their own feeder line BG Freight to move containers between their west coast ports of Liverpool and Greenock). Peripheral regions may in future be faced not simply with rising costs of feeder services but fewer direct services, further embedding their peripheral status. Policy actions available to such peripheral regions may therefore be less about reducing empty repositioning costs but more about securing connectivity to second-tier regional hubs.

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Appendix. Cleaning the data from the new dataset

Table 12 shows the availability of port flows in the dataset, ranked in order of 2010 throughput from the DfT figures.

Table 12. List of UK ports by 2010 container throughput and dataset coverage

Rank 2010 (DfT)	Port	2010 throughput TEU (DfT)	Coverage in dataset	2009 throughput TEU (DfT)	Coverage in dataset
1	Felixstowe	3,415,299	106%	3,020,879	106%
2	Southampton	1,563,573	N/A	1,381,419	N/A
3	London (Tilbury)	732,711	7%	646,893	8%
4	Liverpool	661,802	87%	588,053	86%
5	Thamesport (Medway)	440,316	83%	422,814	100%
6	Teesport	252,098	95%	178,410	96%
7	Grangemouth (Forth)	216,747	71%	230,676	71%
8	Belfast	214,467	N/A	212,622	N/A
9	Hull	202,933	21%	182,209	14%
10	Grimsby & Immingham	109,825	97%	133,340	95%
11	Greenock (Clyde)	82,083	45%	71,550	29%
12	Goole	70,354	N/A	55,911	N/A
13	Bristol-Avonmouth	69,271	87%	71,666	86%
14	Tyne-Newcastle	57,219	71%	37,201	70%
15	Portsmouth	52,018	N/A	56,828	N/A
16	Aberdeen	33,514	N/A	27,546	N/A
17	Cardiff	19,992	N/A	15,469	N/A
18	Orkney	12,246	N/A	0	N/A
19	Warrenpoint	8,420	N/A	17,464	N/A
20	Poole	3,445	N/A	0	N/A
21	Harwich	2,435	120%	2,391	66%
22	Ipswich	1,278	67%	445	57%

It can be seen that some ports are missing from the dataset, and others do not have full coverage, and in three cases more than 100% coverage is observed, indicating some unreliable data. However given the size of the database, these discrepancies are not considered serious, probably being related to different recording methods and differences in the conversion of movements to TEU.

TEU figures were calculated according to the first digit of the container type as given by ISO 6346 (1995 & 1984). ISO codes, both current (1995) and previous (1984) were used to analyse container type structures as they provide length, height and width of the containers. According to ISO 6346, agreed in 1995, the first figure in the four digit container number

records the length, the second figure records the height and width (a different figure for different height/width combinations, e.g. 5 is high-cube while E or N is high-cube with larger width), the third figure denotes the type (e.g. G for general container, R for reefer), and the fourth denotes the subset of that category (e.g. G0 is standard, G1 has vents).

As discussed in section 6, the coverage in the MCP dataset of Greenock in particular is rather low, therefore when looking at the monthly breakdown, outbound loaded is far in excess of the addition of inbound empty and loaded, whereas in reality it should match. The following set of figures shows the difference between the DfT and MCP figures for Grangemouth and MCP.

Figure 32 shows the annual DfT figures for the port of Grangemouth.

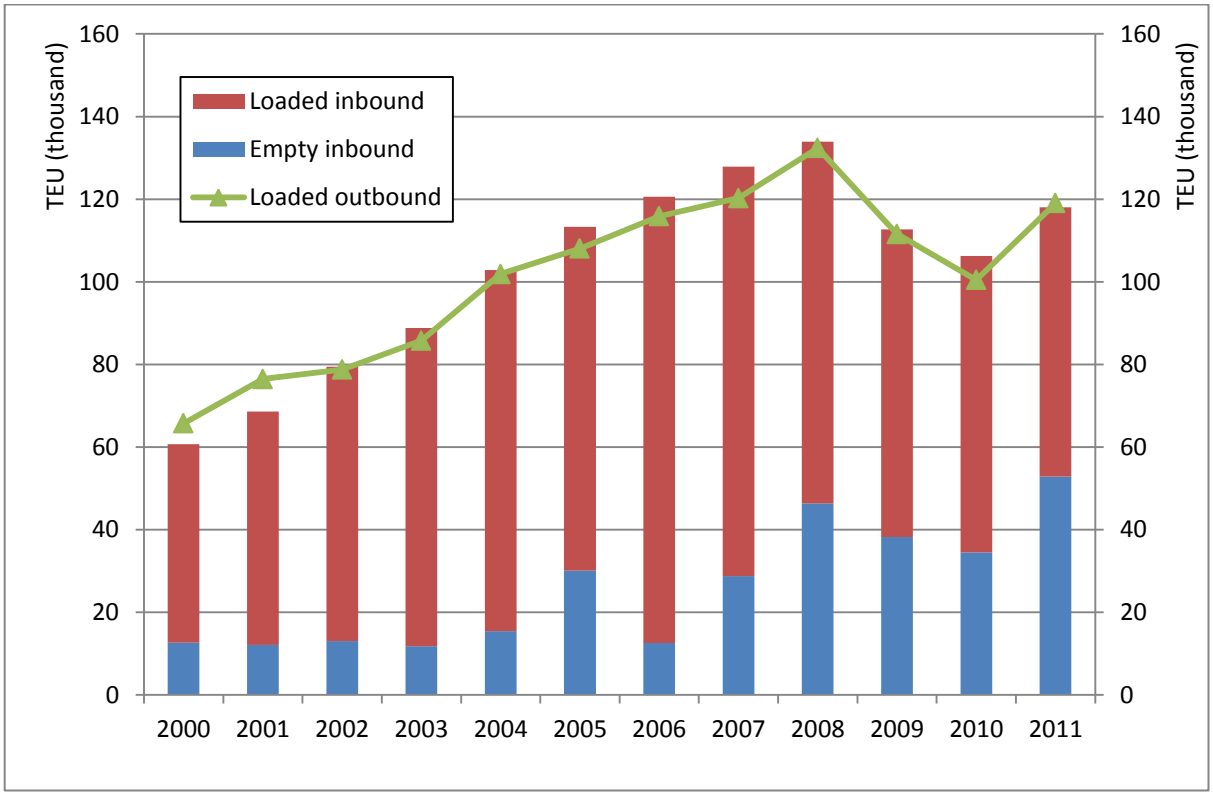

Figure 32. Loaded outbound vs empty and loaded inbound at Grangemouth
Source: authors, based on DfT (2012)

The figure shows that total loaded outbound does indeed match total inbound empty and full movements, as is expected (allowing for small variation due to time lags and other movements). Figure 33 shows the same figures for the port of Greenock.

Figure 33. Loaded outbound vs empty and loaded inbound at Greenock
Source: authors, based on DfT (2012)

Figure 33 reveals that the same holds true for the port of Greenock.

The strength of the MCP data is in its depth, for examining the spread of container types across the total. Another strength is that it is broken down by month, except the coverage is much higher for Grangemouth than for Greenock, as shown in Table 12. Therefore inbound and outbound flows do not always match up and should be read with care.

Figure 34 shows the monthly spread of containers at Grangemouth.

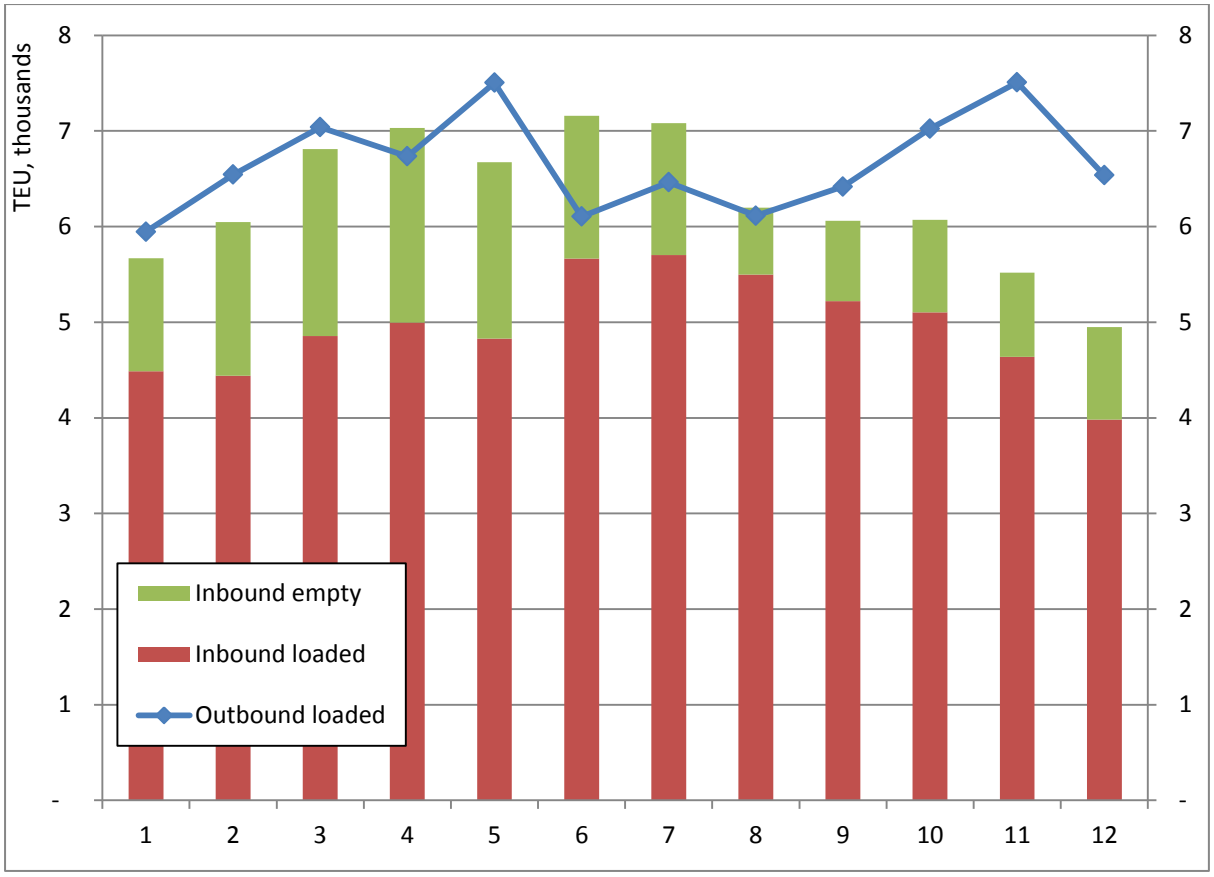

Figure 34. Loaded outbound vs empty and loaded inbound at Grangemouth by month, average 2009 and 2010
Source: authors, based on MCP

The figure shows that, with 71% coverage in the dataset, the figures roughly match as is expected. However, this is not the same for Greenock, as shown in Figure 35.

Figure 35. Loaded outbound vs empty and loaded inbound at Greenock by month, average 2009 and 2010
Source: authors, based on MCP

The discrepancy is clear in this figure, and is a reminder of why care should be taken in using these data.