



Port Freight Investment Model

A Cebr report for Maritime UK

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Cebr

1 The effect of port freight investment on capacity

As outlined in the Maritime 2050 report¹, the UK relies significantly on the Maritime Sector for trade. 95% of the UK's trade volume is transported by ships. Shipping also provides 48% of the UK's food supply and 25% of the country's energy supply.² It is estimated that by 2050 tonnage passing through UK ports could be 39% greater than current levels.³ As such, it is vitally important that UK ports can handle this volume that passes through them in an efficient manner. The focus of this analysis is purely on the economic impact of varying volumes of goods passing through UK ports.

This section looks into the impact of port freight investment on capacity throughput in UK ports. We compute impacts from the investment on national GDP, port revenues and port GVA. It is worth noting that the transmission mechanism modelled is port freight investment increasing capacity, and this in turn having the aforementioned benefits to GDP, ports revenue and GVA. As such, we are solely focusing on the 'volume' benefits of investment, including investment in activities such as pilotage and stevedoring. Investment with the aim of supporting 'value' activities, such as cargo storage revenue and container destuffing is not considered as part of this analysis, as it is much less directly related to changes in capacity. Given this, our analysis on port freight investment likely understates the total economic contribution supported by additional port investment.

There is currently significant investment in ports, both major and minor, throughout the UK. In 2018, the British Ports Association conducted a study, which showed that there were 1.7bn port projects in the pipeline.⁴ This analysis will provide impact assessments on the current outturn of investment and under three capital expenditure (CapEx) scenarios:

- If CapEx had been 10% greater than outturn;
- If CapEx had been 20% greater than outturn; and
- If CapEx had been 40% greater than outturn.

Due to the sensitive and competitive nature of port investment plans, we only present the impacts in relation to the different CapEx scenarios and aggregate investment. Aggregate data on investment and depreciation was provided for UK Major Ports Group Members and select other large port operators. The data showed that, on average, CapEx was £540 million and was 200% of depreciation over the three years.

We have not attempted to forecast or extrapolate investment impacts beyond the three years as CapEx can be volatile and year to year variations large. Thus, extrapolating impacts would likely incur large errors and would be unlikely to provide useful insight. Rather this analysis presents the impact of port freight investment in 2015, 2016 and 2017.

¹ Department for Transport. (2019). 'Maritime 2050'.

² Ibid.

³ Ibid.

⁴ British Ports Association. (2018). 'UK Port Infrastructure Project Pipeline Analysis Report'.

Our analysis employs two scenarios to estimate the impact of port freight investment on GDP, revenue and GVA. Principally, our analysis relies on the estimation of capacity change as a result of the investment. The two scenarios employed are:

- 1) Port freight investment has a capacity elasticity of 0.11 i.e. for a 1% increase in investment, the capacity UK ports can handle increases by 0.11%.⁵
- 2) Port freight investment has a capacity to capital stock relationship of 0.09 i.e. when the capital stock of UK ports increase by 1%, capacity handled increases by 0.09%. This was derived from calculating the capital stock from the depreciation data provided from UK Major Ports Group and using the ratio between it and total throughput in UK ports.

1.1 Impact on GDP

Port freight investment is far reaching beyond ports; there is an impact on the whole of the economy as a result of the additional throughput the ports can handle. Park and Seo (2016) found a container throughput elasticity on GDP of 0.06 i.e. for every 1% increase in container throughput, GDP in the country increases by 0.06%.⁶ This is the primary metric of how we estimate the port freight investment impact on GDP.

The CapEx in each year increases the capacity UK ports can handle. This is detailed below in Table 1 for both scenarios. For the GDP impact, this capacity is then computed as a percentage of total volume of maritime trade in each year – it is the additional volume for that year as a result of the productive investment. This volume is then multiplied by the elasticity found in Park and Seo’s study to produce a percentage increase in GDP for the given year. This then can be used to derive the absolute value that the investment attributed to GDP in each year, due to the increased capacity supported.

Table 1: Port freight investment impact on capacity in UK ports, 2015 to 2017

	Data provided			Capacity increase from investment, 000s tonnes	
	CapEx, £m	Depreciation, £m	CapEx as % of depreciation	Scenario (1)	Scenario (2)
2015	561	254	194%	62,776	50,519
2016	546	272	205%	61,103	49,172
2017	507	286	200%	56,815	45,722

Source: UK Major Ports Group data on investment, United Nations, Cebr analysis

Table 2 and Table 4 below breakdown the port freight investment impacts for Scenario 1) and Scenario 2) under the different CapEx situations. Supplementary tables, 3 and 5, are included to highlight the additionality of the greater CapEx scenarios. The way in which to interpret this data is that under standard CapEx in Scenario 1), the aggregate gain to the economy from port freight investment is £438 million (Table 2). The aggregate impact under ‘CapEx + 40%’ of £528 million implies that the gain to the economy over the three years would have been £90 million greater than the outturn – Table 3 strips this

⁵ United Nations. (2012). ‘Investment and port traffic: an analysis of the situation in Spain’.

⁶ Park. J. & Seo. Y. (2016). ‘The impact of seaports on the regional economies in South Korea: Panel evidence from the augmented Solow model’.

out and displays just the additionality from the counterfactual CapEx. Again, this is purely the increase in GDP that arises from the increased capacity supported by the additional CapEx.

Table 2: Port Freight Investment Impact on UK GDP under Scenario 1)

	Additional GDP from Port Freight Investment, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	147	161	176	205
2016	149	152	154	157
2017	142	160	162	165
Aggregate effect on GDP	438	474	492	528

Source: UK Major Ports Group data on investment, Park, J., & Seo, Y., United Nations, Cebr analysis

Table 3: Scenario 1) impact – additionality from greater CapEx compared to baseline, £m

	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	0	15	29	59
2016	0	3	5	8
2017	0	18	20	23
Aggregate	0	36	54	90

Source: UK Major Ports Group data on investment, Park, J., & Seo, Y., United Nations, Cebr analysis

Under Scenario 1), where capacity is derived from an investment–capacity elasticity, the impact of the port freight investment on GDP is significant. Actual CapEx outturn accounted for £438 million of GDP over the period. This means that, on average, for every £1 of CapEx, GDP increased by £0.27 over the three years. It is worth noting that this is in effect the immediate impact of the port freight investment. Investments tend to accrue over a longer time frame and hence the immediate impact may not be completely indicative of the true effect of the investment as it is only capturing a single point in time.

Unsurprisingly where CapEx is greater than outturn, the investment’s impact on GDP is greater, reaching an aggregate additional impact of £90 million if CapEx had been 40% greater each year. This is effectively the potential foregone GDP from a lower CapEx in port freights handling.

Table 4 and Table 5 display the same analysis but under Scenario 2) – where capacity is derived from the capital stock to volume relationship. This is marginally smaller than the elasticity used in Scenario 1) and hence produces smaller impacts on GDP as a result. The impacts found however, are still large: where under the actual CapEx, the GDP impact over the three years amounts to £352 million. If CapEx had been 40% greater than the outturn in Scenario 2), GDP over the three years could have potentially been £72 million greater.

It is clear that port freight investment that increases the capacity capability of a country is beneficial to the entire economy. Park and Seo describe this relationship as a catalyst for economic activity and that it should be noted by policymakers when making decisions about investments.⁷

Table 4: Port Freight Investment Impact on UK GDP under Scenario 2)

	Additional GDP from Port Freight Investment, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	118	130	142	165
2016	120	123	124	127
2017	114	129	130	133
Aggregate effect on GDP	352	381	396	425

Source: UK Major Ports Group data on investment, Park. J., & Seo. Y., United Nations, Cebr analysis

Table 5: Scenario 2) impact – additionality from greater CapEx compared to baseline, £m

	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	0	12	24	47
2016	0	3	4	6
2017	0	15	16	19
Aggregate	0	29	44	72

Source: UK Major Ports Group data on investment, Park. J., & Seo. Y., United Nations, Cebr analysis

1.2 Impact on revenue

One of the major facets ports generate revenue through is the trade they facilitate through the cargo that passes through them. The UK ports industry is the second largest in the EU. It is estimated that 5% of the world's total maritime freight traffic will pass through UK ports at some point in its journey,⁸ emphasising the important role UK ports play. This through traffic generates revenue and the ports ability to adequately handle greater throughput will therefore increase revenue potential for the UK ports industry in the future.

To derive the revenue impact, we utilise the investment-capacity relationship detailed earlier and then multiply it by an average value of maritime tonnage passing through ports. This value was derived from Eurostat and HMRC Oversea Trade Statistics data to create a weighted average unit ton price of maritime trade for each year.

⁷ Park. J. & Seo. Y. (2016). 'The impact of seaports on the regional economies in South Korea: Panel evidence from the augmented Solow model'.

⁸ Department for Transport. (2019). 'Maritime 2050'.

Table 6 illustrates the direct impact of the port freight investment on revenues. To reiterate, investments accrue over time and it is not to be expected to have a 100% return in the first year. As such, under actual CapEx, revenues in the port industry from the investment amounted to £106 million in 2017, which equates to 2.2% of total ports industry revenue. If CapEx had been 40% greater in 2017, revenues could have been £17 million larger at £123 million, equating to 2.6% of ports industry revenue.

Table 6: Port Freight Investment direct impact on revenue under Scenario 1)

	Scenario 1) Direct revenue impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	101	112	122	142
2016	109	111	112	115
2017	106	119	121	123
2017 investment revenue as % of ports industry revenue	2.2%	2.5%	2.5%	2.6%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

In addition to this, we have calculated an aggregate revenue impact from the port freight investment. This has been done through applying an aggregate revenue multiplier consistent with the rest of the industry analysis. This multiplier includes the direct, indirect and induced impacts from the investment. The direct impact is the immediate effect of the investment on the port industry, via the increase in capacity. The indirect effect of the investment is the impact through the supply chain of the ports industry, impacting suppliers and producers. Finally, the induced impact is the effect on the producers and suppliers employees up the supply chain of the ports industry. Using this analysis provides a wider view of the potential impact of the port freight investment compared to only looking into the direct effect.

As such, Table 7 below presents the aggregate revenue impact from port freight investment under Scenario 1). It is clear that the aggregate impact of the investment is significant under the actual CapEx, amounting to £274 million, £168 million greater than the direct impact found in Table 6. If CapEx had been 40% greater in 2017, the aggregate revenue impact would have been £44 million greater, equating to 2.6% of the aggregate revenue impact of the ports industry, 0.4% more than the actual CapEx impact proportion.

Table 7: Port Freight Investment aggregate impact on revenue under Scenario 1)

	Scenario 1) Aggregate revenue impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	262	289	315	367
2016	282	288	291	297
2017	274	309	312	318

2017 investment revenue as % of ports industry revenue	2.2%	2.5%	2.5%	2.6%
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Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

The aggregate revenue impact from the port freight investment means that in 2017 for every £1 invested, a further £0.54 is supported in revenue.

As before, the same analysis has been conducted for Scenario 2) which provides a slightly more conservative estimate of the impact of port freight investment. This is detailed below in Table 8 and Table 9 for the direct and aggregate impacts respectively. Notably, under this scenario, the direct revenue impact is approximately £20 million less than in Scenario 1) for the actual CapEx each year, accounting for 1.8% of the total ports industry revenue in 2017 compared to 2.2%.

Table 8: Port Freight Investment direct impact on revenue under Scenario 2)

	Scenario 2) Direct revenue impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	82	90	98	114
2016	88	90	90	92
2017	85	96	97	99
2017 investment revenue as % of ports industry revenue	1.8%	2.0%	2.0%	2.1%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

The aggregate revenue impact of the port freight investment under Scenario 2) is still significant, peaking at £227 in 2016 for actual CapEx. In 2017, had CapEx been 40% greater, an additional £36 million may have accrued, amounting to £256 million as a result of the investment compared to the outturn. It is not surprising to see that additional investment, and the additional capacity it supports, is expected to reap greater returns.

Under Scenario 2), the aggregate revenue impact from the port freight investment means that in 2017 for every £1 invested, a further £0.39 is supported in revenue.

Table 9: Port Freight Investment aggregate impact on revenue under Scenario 2)

	Scenario 2) Aggregate revenue impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	211	232	253	296

2016	227	232	234	239
2017	220	248	251	256
2017 investment revenue as % of ports industry revenue	1.8%	2.0%	2.0%	2.1%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

1.3 Impact on GVA

A useful lens in which to view the contribution of the investment to the ports industry and the economy as a whole is to analyse the impact on Gross Value Added (GVA). Mechanically, this is smaller than revenue impact, but in many ways more meaningful as it indicates whether the investment has actually contributed to the production of value within the industry and the UK as a whole.

To compute this, we have utilised the previous analysis of direct revenue impact from the port freight investment and applied a turnover to GVA ratio consistent with the rest of the industry analysis. From there, we have applied GVA aggregate multipliers to derive the aggregate impact of the investment. As for revenue, this is only the aggregate GVA impact supported by the increased capacity, and thus volume of goods that can pass through ports. Investment in 'value' activities, are not captured as part of this analysis.

Table 10 presents the direct GVA impacts under Scenario 1) for the different CapEx situations. It is clear that, although smaller than the direct revenue impact, port freight investment does yield significant GVA returns. In the standard CapEx scenario in 2017, the port freight investment produced a direct GVA impact of £46 million; 2.2% of the total GVA of the ports industry. Had this been 40% larger, the direct GVA impact may have been £7 million larger at £53 million, equating to 2.6% of the total industry GVA.

Table 10: Port Freight Investment direct impact on GVA under Scenario 1)

	Scenario 1) Direct GVA impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	44	48	53	62
2016	46	47	47	48
2017	46	52	52	53
2017 investment revenue as % of ports industry revenue	2.2%	2.5%	2.5%	2.6%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

Table 11 presents the aggregate impacts under Scenario 1) for each CapEx situation. This can be interpreted as the additional value added through the supply chain of the ports industry supported by the additional investment. Similar to the direct impacts, it is clear that the port freight investment does significantly support GVA through the ports industry. In 2017, Under the Standard CapEx scenario, the aggregate impact of the investment is £148 million, equating to 2.3% of the aggregate impact of the ports industry's GVA.

Under Scenario 1), the aggregate GVA impact from the port freight investment means that in 2017 for every £1 invested, a further £0.26 of GVA is supported.

Table 11: Port Freight Investment aggregate impact on GVA under Scenario 1)

	Scenario 1) Aggregate GVA impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	142	156	171	199
2016	147	151	152	155
2017	148	167	169	172
2017 investment revenue as % of ports industry revenue	2.3%	2.6%	2.6%	2.6%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

This analysis also included estimating the impacts under the more conservative Scenario 2) which is detailed in Table 12 and Table 13. The more conservative impacts are still significant, showing under the standard CapEx outturn that the port freight investment had a direct impact of £37 million in GVA; 1.8% of the total direct GVA of the ports industry. Under Scenario 2), had CapEx been 40% greater in 2017, the direct GVA impact would have been £43 million, £6 million greater equating to 2.1% of the total direct GVA of the ports industry.

Table 12: Port Freight Investment direct impact on GVA under Scenario 2)

	Scenario 2) Direct GVA impact, £m			
	Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%
2015	35	39	42	50
2016	37	37	38	39
2017	37	42	42	43
2017 investment revenue as % of ports industry revenue	1.8%	2.0%	2.0%	2.1%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis

The aggregate impact on GVA is detailed in Table 12 below. The aggregate impact is significantly greater than the direct for the standard CapEx, supporting £119 million of GVA in 2017 – 1.8% of the entire industry. With a CapEx 40% greater than the outturn, the aggregate impact could have potentially been £139 million, £20 million greater, accounting for 2.1% of the aggregate impact of the industry.

Under Scenario 2), the aggregate GVA impact from the port freight investment means that in 2017 for every £1 invested, a further £0.21 is supported in GVA.

Table 13: Port Freight Investment aggregate impact on GVA under Scenario 2)

Scenario 2) Aggregate GVA impact, £m			
Standard CapEx	CapEx + 10%	CapEx + 20%	CapEx + 40%

2015	114	126	137	160
2016	119	121	123	125
2017	119	134	136	139
2017 investment revenue as % of ports industry revenue	1.8%	2.1%	2.1%	2.1%

Source: UK Major Ports Group data on investment, United Nations, Eurostat, HMRC Overseas Trade Statistics, Cebr analysis