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ISSUES IN COST OF CAPITAL ESTIMATION FOR THE PORT OF MELBOURNE

PREPARED FOR THE ESSENTIAL SERVICES COMMISSION

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CONTENTS

1	**Introduction**	**1**
1.1	Port of Melbourne tariff compliance statement	1
1.2	Requirements of the pricing order – return on capital	1
1.3	Our terms of reference	2
1.4	Key findings	3
2	**Well accepted approaches**	**5**
2.1	Meaning of well accepted approaches	5
3	**Beta comparators**	**8**
3.1	Comparator set	8
3.2	Are railroads appropriate comparators?	8
3.3	Expanding the comparator set	15
3.4	Summary of findings on comparators	23
4	**Approaches to gamma**	**25**
4.1	Approaches to gamma	25
5	**Sensitivity testing**	**26**
5.1	Comparator sample sensitivity scenarios	26
5.2	Gamma sensitivity scenarios	27
5.3	Impact of sensitivities on WACC	27
A	**Competition risks faced by the Port**	**29**
Synergies' contentions		29
ACCC view on port competition		30
Competition and systematic risk		30
B	**Comparators considered by Synergies**	**36**
C	**Comparator exclusion on the grounds of statistical significance**	**38**

Tables

Table 1: Summary and overview of findings 3

Table 2: Well accepted approach to estimating the return on equity 6

Table 3: Synergies' sample sets for railroads and ports 11
Table 4: Synergies railroads 13
Table 5: Port of Melbourne and railroad comparison - summary 15
Table 6: Ports comparators 18
Table 7: Rail comparators 21
Table 8: Australian regulatory approaches to gamma 25
Table 9: Asset betas resulting from different samples 27
Table 10: Pre-tax nominal WACC 28
Table 11: Tariffs 33
Table 12: Final sample used by Synergies 36
Table 13: Companies excluded by Synergies on the basis of statistical significance 37
Table 14: Comparator asset beta summary under different approaches to statistical significance 43

1 INTRODUCTION

1.1 Port of Melbourne tariff compliance statement

On 31 May 2019, the Port of Melbourne operator (the Port) provided the Essential Services Commission (Commission) with a Tariff Compliance Statement (TCS). This is as required by clause 7.1.1 of the pricing order made pursuant to section 49A of the *Port Management Act 1995* (Vic).

The Tariff Compliance Statement relates to prices that apply for the provision of prescribed services from 1 July 2019. Amongst other things, the TCS:

- sets out information detailing the basis by which adjustments to Prescribed Service Tariffs have been made, including the cost building blocks that have been applied and the basis on which the rate of return has been determined; and
- explains how the Prescribed Service Tariffs comply with the pricing order, including the Pricing Principles and Cost Allocation Principles.

1.2 Requirements of the pricing order – return on capital

The Pricing Order contains two specific Clauses that are pertinent to the return on the capital base.

Clause 4.1.1 specifies that the Port Licence Holder (the port) should calculate an Aggregate Revenue Requirement (ARR) using an accrual building block methodology, which should comprise (amongst other things):

> *4.1.1 (a) an allowance to recover a return on its capital base, commensurate with that which would be required by a benchmark efficient entity providing services with a similar degree of risk as that which applies to the Port Licence Holder in respect of the provision of the Prescribed Services*

Further guidance on this calculation is provided at clause **4.3.1** of the Pricing Order:

> *4.3.1 Subject to clause 4.3.2, in determining a rate of return on capital for the purposes of clause 4.1.1(a) the Port Licence Holder must use one or a combination of well accepted approaches that distinguish the cost of equity and debt, and so derive a weighted average cost of capital.*

Clause 4.3.2 states that the rate of return to be calculated for the purposes of clause 4.1.1(a) must be determined on a pre tax, nominal basis.

1.3 Our terms of reference

The Commission has provided interim feedback on aspects of the Port's TCSs by publishing commentary prior to its five-yearly inquiries. The Commission has previously noted that the purpose of this commentary is neither to provide an exhaustive compliance assessment, nor to make findings as to whether there has been any non-compliance with the pricing order. The feedback is designed to ensure that the Port has an opportunity to understand, given the Commission's current state of knowledge, the matters the Commission is likely to consider in assessing the Port's compliance with the pricing order as part of the five-yearly inquiries.

In order to inform the Commission's interim commentary on the Port's 2019-20 TCS, the Commission has sought a report from Frontier Economics that addresses the matters set out below:

1. Which of the Port's approaches to estimating the return on equity are well accepted by reference to the Commission's preliminary view on "well accepted" approaches? In answering this question, we were:
    a. Advised that the Commission's preliminary view is that, in the regulatory framework established by the pricing order, the requirement to use "one or a combination of well accepted approaches" is a requirement to use an approach that is broadly or generally recognised as being used, or appropriate for use, to estimate the return on capital in the context of an economic regulatory regime which has objects such as efficiency and principles such as that a regulated service provider should be provided with a return commensurate with a benchmark efficient entity providing services with a similar degree of risk.
    b. Instructed to set out in table format which of the Port's approaches to estimate the return on equity is well accepted by academics, finance practitioners or regulators by reference to the Commission's preliminary view on "well accepted" as described in 1a.
2. An assessment of the Port's use of comparators for the purposes of estimating the equity beta, an whether:
    a. Railroads are appropriate comparators for ports; and
    b. Whether it is possible to expand the sample of relevant port comparators by using additional industry classification systems apart from the Global Industry Classification Standard?
3. Provide a table identifying those:
    a. Australian regulators that currently adopt a "utilisation" approach to estimating gamma which considers the extent to which investors can utilise the imputation credits they receive to reduce their tax or obtain a refund (based on equity ownership or tax statistics or other relevant measure); and
    b. Australian regulators that currently adopt an "implied market value" approach to estimating gamma which is based on market valuation studies.
4. A sensitivity analysis of the Port's beta, having regard to the issues raised by the Commission in its 2018-19 interim commentary on "Exclusion of firms with statistically insignificant betas" (page 62).
5. Sensitivity analyses that shows the impact on the Port's estimate of WACC in the 2019-20 TCS of:
    a. Excluding the railroad comparators used by Synergies;
    b. Including any comparators that were excluded by Synergies on the basis that their beta estimates were not statistically significant; and
    c. Assuming an estimate of gamma of 0.25 and 0.4.

    We were instructed that when conducting these sensitivity analyses, we should not update Synergies' Fama-French Model WACC estimates.

In formulating our advice, we have had regard to:

- The **Port's 2019-20 TCS** and supporting report by the Port's adviser, **Synergies** (Appendix N to the 2019-20 TCS);[1] and
- The **Commission's interim commentary reports** published in 2017 and 2018.

1.4 Key findings

A summary of our findings is presented in the following table.

Table 1: Summary and overview of findings

ISSUE	FINDINGS
Which of the Port's approaches to estimate the return on equity are well accepted by reference to the Commission's preliminary view on "well accepted" approaches?	See **section 2**. Only the SL-CAPM is well accepted by academics, finance practitioners and regulators. The Black CAPM and Fama-French three factor models are not well accepted by regulators, but are well accepted by academics.
Provide an assessment of the Port's use of comparators for the purposes of estimating the equity beta and: a. whether it is reasonable to include the railroad comparators used by the Port b. whether it is possible to expand the sample of relevant port comparators by using additional industry classification systems apart from the Global Industry Classification Standard?	See **section 3**. a. Our analysis suggests there is evidence that North American railroads are not reasonable comparators to the Port. The nature of risks appears quite different, with most risks being higher than the Port. b. We use three further classification systems in our analysis. Using the different classification system, we find that the comparator set can be expanded slightly. In addition, we also find some companies in Synergies final comparator set should not have been included.
Identify which Australian regulators currently adopt a "utilisation" approach to estimating gamma and which adopt an "implied market value" approach.	See **section 4**. All regulators in Australia other than IPART adopt a utilisation approach, while IPART uses the implied market value approach.

[1] Synergies, Determining a WACC estimate for Port of Melbourne, May 2019 (**Synergies report**).

ISSUE	FINDINGS
A sensitivity analysis of the Port's beta, having regard to the issues raised by the Commission in its 2018-19 interim commentary on "Exclusion of firms with statistically insignificant betas" (page 62) Sensitivity analyses that shows the impact on the Port's estimate of WACC in the 2019-20 TCS of: a. Excluding the railroad comparators used by Synergies; b. Including any comparators that were excluded by Synergies on the basis that their beta estimates were not statistically significant; and c. Assuming an estimate of gamma of 0.25 and 0.4.	See **section 5.** We compare outcomes compared to the asset beta used by Synergies from: 1. The final sample used by Synergies; 2. The sample if the significance filter were to be removed; 3. The sample if rail comparators were excluded; and 4. The sample if rail comparators were excluded and the significance filter were to be removed. We also compare two gamma sensitivities. All other variables are kept constant as in the point estimate column of Table 5 of the Synergies report. The results are set out in **Table 10**, and indicate a range between 7.24% and 11.00%. By way of comparison, the Port's WACC estimate for the 2019-20 TCS was 10.46%.

2 WELL ACCEPTED APPROACHES

2.1 Meaning of well accepted approaches

The term “well accepted approaches” is not defined in the Pricing order.

We are advised that the Commission’s preliminary view is that well accepted should be considered in the context of the regulatory framework established by the pricing order. The requirement to use “one or a combination of well accepted approaches” is therefore a requirement to use an approach that is broadly or generally recognised as being used, or appropriate for use, to estimate the return on capital in the context of an economic regulatory regime which has objects such as efficiency and principles such as that a regulated service provider should be provided with a return commensurate with a benchmark efficient entity providing services with a similar degree of risk.

The Commission has requested that we set out in table format which of the Port’s approaches to estimate the return on equity, as outlined in the table below, is well accepted by academics, finance practitioners or regulators by reference to the Commission’s preliminary view on “well accepted” as described above.

When considering regulatory practice, we were instructed by the Commission to consider the following jurisdictions:

- Australia;
- United Kingdom (UK);
- United States (US);
- New Zealand; and
- Canada.

Table 2: Well accepted approach to estimating the return on equity

	WELL ACCEPTED BY: ACADEMICS	FINANCE PRACTITIONERS	ECONOMIC REGULATORS IN AUSTRALIA OR REGULATORS IN THE UK, US, NZ OR CANADA
SL CAPM	Yes – However, there is a strong consensus in the academic literature that that the empirical performance of the SL CAPM is poor – hence the development of other models like the Black CAPM and Fama-French model.	Yes – However, there is also some evidence that practitioners recognise the weaknesses of the SL CAPM. For example, some valuation experts in Australia make 'adjustments' to SL CAPM estimates.	Yes – Used universally in Australia, UK and New Zealand. Also gaining wider acceptance amongst US and Canadian regulators.
Black CAPM	Yes – The Black CAPM now appears in standard undergraduate textbooks.	No clear evidence of explicit use. Some finance professionals appear to use risk-free rates in excess of spot rates, which would be consistent with Black CAPM.	AER gave some consideration to theoretical foundations of Black CAPM in its 2013 Guideline. However, in the 2018 Guideline, the AER stated that it will no longer give weight to the Black CAPM in estimating beta or adjust the equity beta estimate.[2] Regulators in UK and New Zealand do not use the Black CAPM. As cited by Synergies, there is some historical evidence that some regulators in the US and Canada have accepted the ECAPM (an empirical application of Black CAPM) as relevant to the estimation of the cost of equity.[3] Some Canadian regulators have considered and rejected the ECAPM recently.[4] Synergies does not

[2] The AER's final guideline explanatory statement indicated that:

- "In this final decision, for the reasons stated in our draft decision and based on the further assessment of the submissions received in response to our draft decision, we do not consider the low beta bias and Black CAPM model are relevant to the estimation of equity beta." AER regulatory guideline explanatory statement, p. 101.
- "Overall, we are not persuaded that we should use the low beta bias or the Black CAPM to adjust our return on equity estimate.." AER regulatory guideline explanatory statement, p. 203

[3] For example, the New York Public Service Commission, which accepts evidence from a range of models in estimating the cost of equity. Staff inputs into a 2015 decision made use of zero-beta CAPM estimates as well as standard CAPM estimates (1/3 weight) and dividend growth models (2/3 weight). New York Public Service Commission, *Order Approving Electric And Gas Rate Plans In Accord With Joint Proposal*, June 15 2016.

[4] For example, Synergies cites the Alberta Utilities Commission's 2016 decision, although in its 2018 cost of capital decision, the Commission found (at 373) that: "…the Commission will not assign significant weight to the ECAPM results in this proceeding". Alberta Utilities Commission, *2018 Generic Cost of Capital*, August 2, 2018.

	WELL ACCEPTED BY:		
			acknowledge that. Further, some examples cited by Synergies relate to consultants/experts proposing the use of estimates derived using the ECAPM, rather than direct evidence of US or Canadian regulators actually accepting and using the ECAPM. Synergies has not provided evidence that the ECAPM has widespread acceptance amongst regulators overseas.
Fama-French Three Factor Model	Yes – The Fama-French Model appears in standard undergraduate textbooks and in academic research. The Fama-French Model has become the 'benchmark' for estimating expected returns in academic papers.	No clear evidence of widespread use by valuation experts. However, there are a number of traded index funds designed using the Fama-French Model. And some academic surveys of finance practitioners (e.g., CFOs) has identified use of the model by professionals. Some finance practitioners appear to apply adjustments to risk premiums to reflect company size.	Not used by regulators in Australia, UK or New Zealand. There is no clear evidence of widespread use by regulators in the US or Canada, although some Canadian regulators have indicated tentative support for the use of such models as part of a broader set of evidence on return on equity.[5]

Source: Frontier Economics

[5] For example, Alberta Utilities Commission, *2018 Generic Cost of Capital*, August 2, 2018, at 486 and 487.

3 BETA COMPARATORS

3.1 Comparator set

For the purposes of its beta analysis adopted in the TCS, Synergies has used 19 comparators in total comprising:

- 11 Marine Ports Services comparators; and
- 8 Railroad comparators.

The Commission has asked us to advise on:

- whether it is reasonable to include the railroad comparators used by Synergies? This question is addressed in Section 3.2.
- whether it is possible to expand the sample of relevant port and/or rail comparators by using additional industry classification systems apart from the Global Industry Classification Standard? This question is addressed in Section 3.3.

3.2 Are railroads appropriate comparators?

3.2.1 Objective of comparator analysis

The equity beta is conventionally estimated as the coefficient of the regression of company returns against market wide returns. In order to perform this calculation, it is necessary to have share price data on the company of interest. However, rather than using an estimate of the firm's own beta, it has become more common in regulatory practice to use a benchmark approach, which identifies the beta of an efficient comparator firm. This is adopted because:

- such an approach provides good incentive properties for the regulated firm to finance itself efficiently,
- it can produce more statistically reliable results than use of a single firm regression; and
- often, the regulated company is not a listed firm, in which case the required stock return data in unavailable.

The comparator analysis approach necessarily involves identifying a suitable sample of listed comparators**.**

In circumstances where there are no ideal benchmark comparators, our view is that the best approach to beta estimation is to consider a broad set of comparators, and to weight these comparators according to the closeness of their fit with Port's activities. The objective should be that by developing a weighted set of comparators, the comparator set will be a representative sample of the market risks faced by the Port. An alternative approach, which is proffered by Synergies, is to take into account qualitatively the closeness of comparators by choosing an asset beta from a range defined by a full sample set. We consider this approach could in principle also produce reasonable results consistent with the objectives of establishing the cost of capital for a benchmark efficient entity.

3.2.2 Choice of comparators and filters

As we have described above, the choice of comparators is defined by firms that must face "a similar degree of risk" as that which applies to the Port.

In economics, the concept of 'risk' simply means the likelihood of an economic outcome that differs from the expected outcome.[6] In the context of the return on capital, risk refers to the spread of possible returns around the return required by investors, and the link between that spread in returns and the state of the economy. A firm is considered to be 'riskier' if it performs very well when the broad market is up and poorly when the broad market is down.

This means that an appropriate sample of suitable comparators, for the purposes of beta estimation, should reflect businesses that are likely to face a similar distribution of possible returns as the Port License Holder in respect of the Prescribed Services. This is generally how most regulators approach the task of comparator sample selection. The pragmatic approach that most regulators follow is to search for businesses that are largely involved in the same (or similar) commercial activities as the regulated business. The rationale for this is that firms in the same industry are likely to have operations that involve a similar degree of risk.[7]

In the case of the Port License Holder, this means identifying companies that provide services that are similar to the Prescribed Services (e.g., wharfage and channel services). The most obvious starting point will therefore be listed ports.

It may be desirable to supplement the sample by also considering beta estimates for other infrastructure businesses (e.g., rail networks, airports, energy networks, water companies) on the basis that these businesses are also likely to have similar risks deriving from:

- Large sunk investments in order to deliver services, just as is required in order to provide the Prescribed Services offered by the Port License Holder; and
- Stable cash flows, which is likely to also be true of the cash flows generated by the Prescribed Services offered by the Port License Holder.

The drawback of doing this is that the returns of infrastructure businesses in other industries will be driven by different demand and supply factors to those faced by the Port License Holder. However, if faced with too small a sample of ports comparators, it would be reasonable to supplement the sample with a next-best set of comparators drawn from other industries with similar risk characteristics.

3.2.3 Should railroads be included as comparators?

Synergies has included certain railroads in its comparator sample. It suggests that:

- For rail businesses, Australian regulators have generally adopted an international sample of rail and port businesses (ERA for a freight rail network and ACCC for the Interstate network).
- Marine ports and terminals are a primary comparator set from a first principles analysis due to similar market exposure to container freight trade. However, terminal operators are not infrastructure providers providing Prescribed Services.
- Freight railroads (in particular, North American Class I railroads) are also a primary comparator set due to their freight-focussed business model, strong market position and below rail infrastructure services.

[6] See, for example, Damodaran, A., 2001, Corporate Finance: Theory and Practice, 2nd edition, John Wiley: New Jersey, chapter 6.

[7] Of course, other exogenous factors, such as macroeconomic conditions (e.g., interest rates, business cycles) and the regulatory and legislative environment, can also drive outcomes. Some of these factors will be common to all businesses within the same industry or (to the extent that they differ between jurisdictions) will average out with a large enough sample of comparators.

3.2.4 Approaches of other regulators do not support the inclusion of railroads

It is not entirely clear that Synergies' conclusion about the comparability of rail with ports services is well-founded. The ARTC decision relating to the interstate freight network uses rail comparators only[8] and the ERA's sample for ARC infrastructure includes only one port among 10 rail comparators – with the only port reporting the lowest asset beta in the sample.[9]

In developing its comparator set for these entities (Synergies prepared reports for both ARTC and ARC infrastructure), Synergies has previously suggested in relation to its comparator set for ARTC that:

> *An asset beta for ARTC of 0.80 has been estimated based on a comparator set comprised of **North American Class I railroads and Aurizon**. This is in line with the approach adopted by the ACCC in the 2008 IAU, and is also largely consistent with the methodology employed in ERA rail decisions.*[10]

it appears that Synergies had the opportunity to include ports as comparators but elected not to do so (see **Table 3**). It therefore appears to be suggesting that while railroads are good comparators for ports, ports are not good comparators for railroads.[11] It is not obvious that this asymmetry is supported by evidence relating to risk characteristics.

[8] https://www.accc.gov.au/system/files/ARTC%20-%20IAU%20-%202018%20Draft%20Decision.pdf, p. 135.

[9] https://www.erawa.com.au/cproot/20655/2/2018-and-2019-Rail-WACC-Final-Determination.PDF, p. 58.

[10] Synergies, *The Rate of Return to Apply to ARTC's Interstate Network*, February 2018, p. 3.

[11] This approach would be reasonable if there were many more rail comparators than port comparators. However, that does not appear to be the case.

Table 3: Synergies' sample sets for railroads and ports

	ARTC INTERSTATE NETWORK 2018	ARC INFRASTRUCTURE 2018	PORT OF MELBOURNE 2019
RAIL	CSX	CSX	CSX
	Genesee & Wyoming Inc.	Genesee & Wyoming Inc.	Genesee & Wyoming Inc.
	Kansas City Southern	Kansas City Southern	Kansas City Southern
	Norfolk Southern Corporation	Norfolk Southern Corporation	Norfolk Southern Corporation
	Union Pacific Corporation	Union Pacific Corporation	Union Pacific Corporation
	Canadian National Railway Company	Canadian National Railway Company	Canadian National Railway Company
	Canadian Pacific Railway Limited	Canadian Pacific Railway Limited	Canadian Pacific Railway Limited
	Aurizon Holdings	Aurizon Holdings	Aurizon Holdings
PORTS		Port of Tauranga	Port of Tauranga
			Qube
			Hamburger Hafen und Logistik
			Sakurajima Futo Kaisha
			Rinko Corporation
			Dongbang Transport Logistics
			China Merchants Port Holding Company
			COSCO Shipping Ports
			Dalian Port
			Hutchinson Port Holdings Trust
			Global Ports Investments

Source: Frontier Economics analysis

3.2.5 Similar risks for freight railroads and ports?

The inclusion of railroads has a material influence on the sample results:

- Within the Marine Ports and Services sector, the 5-year median asset beta across all firms in the sample is 0.53 with an average of 0.68.
- The median asset beta for Railroads is 0.94 with an average of 0.87.[12]
- Across the whole sample, the values are 0.76 (5 year) and 0.72 (10 year).

In our view, this provides some indication that railroads may be subject to different levels of systematic risk to ports.

Synergies uses an asset beta of 0.7. Its approach was to keep railroads in its sample, and it chose the value of 0.7 on the basis that the empirical evidence appears to directly support an asset beta estimate of at least 0.7 and an upper bound of at least 0.75. Synergies considers whether there are any factors from the first principles analysis that suggest that Port's systematic risk is different from the average of the sample. In that regard, it notes:

- the key differentiator is the prospect of competition from a second port, which increases Port's exposure to trade flows reflecting domestic and international economic conditions;
- an asset beta of 0.7 is consistent with the most recent regulatory review (by the ERA of Western Australia) of a similar freight business in Australia, Arc Infrastructure, which on a first principles basis could be expected to have lower systematic risk than the Port.

In Appendix A, we have analysed the claims in relation to actual and potential competition faced by the port. We find that the port's actual or potential future exposure to competition cannot support a higher-than-average beta.

In relation to Arc Infrastructure, we note that the ERA's beta estimate is dominated by the inclusion of the US and Canadian railroads, which have estimated asset betas of more than one. Hence, the comparability of the ARC Infrastructure approach is also fundamentally a question about the comparability of the Port to the US and Canadian railroads.[13]

The question of the inclusion of railroads ultimately reduces to whether these comparators are likely to face risks that are sufficiently similar to those faced by the Port. However, we also recognise that this need not be an "all or nothing" question, as the results can be considered with either a lesser weight than closer comparators or be used to assist in the choosing a point value from with a broader comparator range. We now further consider this threshold question, based on first principles analysis.

3.2.6 Railroads included in the sample

The railroads included in Synergies' comparator sample are summarised in **Table 4**. Of note, only one is in Australia and seven are railroads in the US (5) and Canada (2).

[12] Synergies, p. 153.

[13] A further issue here is the ERA concluded that in relation to the Port of Tauranga "…it was expected that it would have a lower level of systematic risk, given the diverse nature of port operations covering road, rail and shipping." At 279.

Table 4: Synergies railroads

FIRM	LOCATION	5 YR ASSET BETA	10 YR ASSET BETA
Aurizon Holdings	Australia	0.38	0.44
CSX Corporation	US	0.98	1.00
Genesee & Wyoming Inc.	US	1.04	1.08
Kansas City Southern	US	0.73	1.06
Norfolk Southern Corporation	US	1.11	0.93
Union Pacific Corporation	US	0.94	0.93
Canadian National Railway Company	Canada	0.80	0.52
Canadian Pacific Railway	Canada	0.94	0.83
MEAN		**0.87**	**0.85**
MEDIAN		**0.94**	**0.93**

Source: Synergies

To reach a view on the comparability of these entities, and where they should be placed relative to the Port, we now consider the characteristics of these entities and their risk profile in comparison to the Port.

Aurizon

Aurizon is the only listed 'pure play' railroad in Australia. Aurizon operates a below rail network (the Central Queensland Coal Network) and rail haulage operations to deliver coal on the CQCN plus the Hunter Valley, plus a bulk haulage operation. Aurizon has recently exited its intermodal business.

Aurizon's bulk business includes haulage of a range of bulk commodities such as iron ore, base metals, minerals, grain and livestock across Western Australia, Queensland and New South Wales.

While Aurizon's commodities transported are trade-exposed, there are certain features of Aurizon's coal business which mean it carries different systematic risk from other freight railways or ports. This includes its longer-term user contracts and regulation under a revenue cap which provide for a degree of revenue smoothing. Moreover, Aurizon only earned a small share of its revenues from its intermodal (containerised) business.

While we generally consider that Aurizon's systematic risk tends to be understated by regulators such as the QCA, we conclude that these differences mean Aurizon is not an obvious or close comparator to the Port.

US and Canadian railways

At face value, the asset betas of the US and Canadian railroads are significantly higher than the port comparators, and the gearing ratios are generally lower.[14] It is also apparent that the US railways have substantially higher equity betas when compared to those in Australia. This has previously been the subject of some commentary, with:

- McKenzie and Partington stating "they are different [to other jurisdictional rail providers] in some fundamental respect, rendering a comparison inappropriate".[15]
- IPART suggesting that this is because a substantial portion of their revenues are subject to competition from other railroads and other forms of transport. The ACCC has also previously found that North American railways were likely to have higher market risk compared to ARTC as they often compete with one another due to parallel infrastructure.[16]

We understand McKenzie and Partington to be suggesting that the data on equity betas and gearing is sufficient of itself to indicate that these railroads are quite different from a lower risk, higher geared railroad such as Aurizon.

We consider there are three basic characteristics that differentiate US and Canadian railroads from the Port:

- They do not operate in the same industry sector;
- They are not 'landlord' type operators of infrastructure but operate 'above and below' rail operations (vertically integrated); and
- They operate in a different jurisdiction.

These factors should not necessarily mean these comparators should be accorded no weight. If there are a sufficient number of other similarities, it might be reasonable to include these comparators and to potentially quantitatively or qualitatively take into account differences from the Port.

Other factors which we further consider are:

- **The extent of competition facing these railways.** Appendix A explains that the Port faces little competition. In contrast, other regulators have found that the North American railroads face significant competition for intermodal traffic, and more limited competition for bulk freight. This would mean that, other things being equal, the Port would be lower risk than the North American railroads.
- **Cost structure.** On cost structure, railroad operations (i.e., operation of rolling stock) has a higher proportion of operating cost to fixed cost than does below rail operation (i.e., track only). This would mean such railroads have slightly lower operating leverage than does the Port, and so reduce their relative risk.
- **The composition of freight**. The freight composition of the US railroads contains a materially greater proportion of bulk freight than containerised (intermodal) freight than does the Port. This is highlighted in the comparisons in Table 3. This raises the question as to whether there are differences in systematic risk between bulk freight and container freight businesses. In some circumstances (e.g., for single commodity rail lines used for export) bulk freight can be quite risky: the TPI railway in the Pilbara is accorded a high asset beta on this basis by the ERA. In other circumstances, there may be factors other than economic activity driving bulk freight (e.g., agricultural products are supply-driven). It appears that this cannot be resolved unless there is significantly more detail on the particular characteristics of each railway.

[14] Synergies, p. 119.

[15] McKenzie & Partington, sub no. 65 to the QCA p.27

[16] ACCC, Draft Decision - Australian Rail Track Corporation Limited Interstate Access Undertaking, April 2008, p.155.

- **Contracting arrangements**. On contracting arrangements, we understand there is likely to be considerable variation in the terms and conditions offered to customers of US railroads. The Port's current charges are predominantly traffic-based, without long term contracts, which provides less certainty of revenues in the event of economy downturns (or upturns).

Table 5 presents a summary of the characteristics of the Port and railroad comparators used by Synergies.

Table 5: Port of Melbourne and railroad comparison - summary

	PORT OF MELBOURNE	AURIZON	US & CANADIAN RAILROADS
Industry sector	Ports	Freight rail	Freight rail
Predominant revenue sources	Containers	Bulk freight (coal)	Bulk freight (varied sources)
Long term contracts with customers	No	Yes	Mixture of short term and longer term
Integrated into transport	Landlord only	Track plus transport	Track plus transport
Operating leverage	High	Medium-high	Medium
Exposed to competition / regulation	Minor degree	Minor degree Heavily regulated	Significant degree Lightly regulated

Source: Frontier Economics

3.2.7 Conclusions

From this analysis, it is not obvious that North American railroads belong in the comparator set for the Port. The nature of risks appears quite different, with most risks being higher than the Port (operating leverage is the possible exception).

In our opinion, further justification would be required for the Port to retain these comparators in its set on the basis of similar risks. Alternatively, the Port should only:

- place very low weight on the observed betas of North American railways; and
- include the betas as upper bound values only and choose a beta value towards the lower end of a range that included such railways.

3.3 Expanding the comparator set

3.3.1 Background

Synergies has used a reputable industry classification system known as the Global Industry Classification Standard (GICS) to identify the comparators it has employed in its beta analysis. However,

GICS is only one of a number of such classification systems. Other systems include the Bloomberg Industry Classification System (BICS), the Thomson Reuters Business Classification (TRBC) system and the Industry Classification Benchmark (ICB) system.

In response to the Commission's request, we have investigated whether it is possible to expand the comparator sample using multiple classification systems. In doing so, we have analysed the Ports and Railroads comparator samples separately.

3.3.2 Ports comparators

Sample selection process

The comparator selection process for the Ports sample begins by obtaining the set of businesses in relevant categories using a range of classification systems. The initial sample of firms we identify comprises:

- Businesses in the Marine Ports & Services category under the Bloomberg Industry Classification Standard (BICS);
- Businesses in the Marine Transportation category under the Industry Classification Benchmark (ICB);
- Businesses in the Marine Ports & Services category under the Global Industry Classification Standard (GICS); and
- Businesses in the Marine Ports Services category under the Thomson Reuters Business Classification (TRBC).

Combining the four samples yields a total of 1,030 businesses. The International Securities Identification Number (ISIN) is code that uniquely identifies specific securities issued. We obtain the ISIN of each business and remove any errors (such as duplicates and businesses that do not return a valid ISIN). This process reduces the sample to 649 firms.

We then filter the firms by excluding firms that satisfy any of the following conditions:

- The country of the security[17] is not one in the FTSE Developed country classification, as applied by Synergies.[18]
- The security was inactive as of 30 April 2019 or earlier.[19, 20]
- The start date was May 2018 or later.[21, 22]

After excluding firms that fail any of the three filters above, 224 firms remain in the sample.

Next, we investigate each of these firms' activities to exclude any that are unlikely to be involved in the provision of Port services. In order to do this, we obtain descriptions of each of the companies, as published by Thomson Reuters and Bloomberg. We then search systematically both sets of descriptions, keeping only those firms whose descriptions contain the word "Port" in either of the two descriptions. We also perform spot checks of the excluded firms to investigate whether the key word

[17] As determined by Datastream field "GGISO".

[18] Synergies, p. 221.

[19] Datastream field WC07015 ("inactive date").

[20] Synergies excluded Prumo Logistica on the basis of being "Now delisted". Synergies, p. 233.

[21] Datastream field "BDATE".

[22] Synergies excluded GMexico Transportes on the basis of insufficient data, being listed in November 2017. Synergies, p. 238.

filter has inadvertently excluded relevant firms that should be retained. This results in 73 firms remaining in the sample.

Once the list of potential comparators had been filtered to include only those 73 firms which refer to Port activities, we then filter each of the Thomson Reuters and Bloomberg descriptions manually. This process looked for references to either port operation or ownership. For example, the following description led to a classification of **port operator**.

> *Global Ports Holding PLC is an international cruise port operator. The Company provides an integrated platform of cruise ports serving cruise liners, ferries, yachts and mega-yachts. Global Ports Holding also engages in the commercial port operations.*

Only in instances where there is a clear reference to port ownership is a company classified as a **port owner** (example below).

> *Mercantile Ports and Logistics Limited (MPL) develops, owns, and operates port and logistics facilities. The Company offers transportation, logistics, and port operation services. MPL provides its services in Guernsey and India.*

It is possible that some companies own the port they operate but that this is not clear from the description.

Companies that were in the potential list but did not have descriptions which refer to operating or owning a port were tagged for their activity, such as transportation and logistics. These are currently excluded from our list of comparators for consideration.

Table 6 below presents the Ports comparators that we have identified using the process described above and indicates whether these were also identified by Synergies.

Table 6: Ports comparators

FIRM	SYNERGIES
China Merchants Ports Holding Company	Final sample
COSCO Shipping Ports	Final sample
Port of Tauranga	Final sample
Hutchison Port Holdings Trust	Final sample
Ocean Wilsons Holdings	Excluded - holding company
China Infrastructure & Logistics Group Lt/CIG Yangtze Ports PLC	Excluded - missing data
Global Ports Holding PLC	Excluded - holding company
Global Ports Investments	Final sample
Marsden Maritime Holdings Limited	Excluded - holding company
Mercantile Ports and Logistics Limited	Excluded - statistically insignificant
South Port New Zealand Limited	Excluded - statistically insignificant
Xinghua Port Holdings Limited	Not considered
PYI Corporation Limited	Not considered
Bremer Lagerhaus-Gesellschaft AG	Excluded - statistically insignificant

Source: Frontier Economics, Synergies[23]

Three comparators in **Table 6** were supposedly excluded by Synergies on the basis of being holding companies. However, we note that some holdings companies were in fact retained by Synergies in the final sample. While a holding company could be excluded on the basis of diversified subsidiaries, or 'duplication' of other firms in the sample,[24] this aspect of corporate structure should have little bearing on the relevance as a comparator.

We also note that:

- Marsden Maritime, Ocean Wilsons and Global Ports Holding Limited failed Synergies' statistical significance requirement;[25]
- Xinghua Port Holdings Limited has insufficient data in order to derive reliable beta estimates;

[23] In addition, US listings of China Merchants Ports Holdings Company, COSCO Shipping Ports Limited, Port of Tauranga Limited and Hutchison Port Holdings Trust were excluded as duplicate listings. CK Hutchison Holdings Limited was excluded as Hutchison Port Holdings Trust was retained.

[24] As with CK Hutchison Holdings and Hutchison Port Holdings Trust.

[25] Analysis of "5-year Bloomberg rail and MPS beta information (2019-20 TCS) - Revised response.xlsx", 25 October 2019.

- PYI Corporation Limited, which was excluded by Synergies, owns a number of port assets. However, it is also heavily diversified into logistics services, engineering and port/property development activities. Hence, it is unclear whether this firm is too diversified for inclusion in the sample.

Several port comparators in the final sample of Synergies are not present in **Table 6**:

- Qube Holdings – classified as logistics;
- Hamburger Hafen und Logistik – classified as logistics;
- Dalian Port – dropped as country of security (ISIN) is China (not FTSE Developed);
- Dongbang Transport Logistics – classified as logistics;
- Rinko Corporation – classified as transportation and real estate; and
- Sakurajima Futo Kaisha– classified as transportation and warehousing.

This suggests that Synergies may have included some firms in its comparator sample that ought to have been excluded (for instance, because their main activities are not relevant to the activities of a port operator or port owner).

New comparators

In total there are four additional Ports firms that may be included in the final sample. Three of those firms may have been excluded by Synergies because they are holding companies. It appears that the fourth firm was previously not considered by Synergies. Descriptions of these companies are presented below.

- **Xinghua Port Holdings (Hong Kong/China)**

Xinghua Port Holdings Ltd. owns and operates two ports: Changshu Xinghua Port Co., Ltd (CXP) and the adjacent Changshu Changjiang International Port Co., Ltd (CCIP).

The Company provides cargo processing, stevedoring, bonded warehousing, port to door delivery, re-packing and bagging, vanning of containers, and other related services. Xinghua Port Holdings offers services worldwide.

Xinghua Port Holdings Ltd. is an investment holding company mainly engaged in the operation and management of ports. The Company's ports are multi-purpose ports. It handles a range of cargo types including pulp and paper cargo, steel cargo, logs, project equipment, containers, and other general cargo including borax cargo, marbles and sodium sulphur. Steel cargo includes cold and hot rolled coils, steel plates and galvanised coils. Project equipment include train carriages, long steel pipes and windmill blades. Its customers' industries including international shipping, pulp and paper cargo, logs, steel cargo, project equipment and other general cargo. The customers are mainly located in the east and central People's Republic of China (PRC), which mainly includes Jiangsu, Zhejiang and Anhui provinces.

- **Marsden Maritime Holdings Limited (New Zealand)**

Marsden Maritime Holdings Ltd. Marsden Maritime Holdings Ltd. Is a port company with various business activities in the Greater Marsden Point Area, including port operator, Northport Ltd. The Company's operations principally comprise approximately 50% stakeholding in the deep water port facility at Marsden Point together with substantial land holdings in the adjacent area. The Company's principal operating segments comprises Port Related Operations, encompassing the Company's stakeholding in Northport Ltd); Property Holdings, comprising the Company's industrial subdivision and farmland at Marsden Point); Marina & Commercial, and Other Activities, comprising of overheads associated with the Company's support functions. The Company operates the Marsden Cove marina complex, which consists of approximately 220 berth marina and adjoining commercial complexes.

Marsden Maritime Holdings Limited operates a marina port in New Zealand where the Company provides cargo handling, marine salvage, storage and port operation services. The Company owns a fleet of tug vessels for the provision of towage and handling charter services.

- **Global Ports Holding (United Kingdom)**

Global Ports Holding PLC. Global Ports Holding PLC is a United Kingdom-based independent cruise port operator. The Company has its presence in the Mediterranean, the Atlantic and Asia-Pacific regions, including commercial port operations in Turkey and Montenegro. It operates in two Segments: Cruise port operations and Commercial port operations. The cruise port operations segment includes Creuers, Valletta Cruise Port and Ege Ports-Kusadasi. Its commercial port operations segment includes Port Akdeniz-Antalya and Port of Adria-Bar. As an independent cruise port operator, the Company holds a position in the cruise port landscape, with an integrated platform of cruise ports serving cruise liners, ferries, yachts and mega-yachts. Its portfolio includes over 15 ports in eight countries. The Company also offers commercial port operations, which specialize in container, bulk and general cargo handling.

Global Ports Holding PLC is an international cruise port operator. The Company provides an integrated platform of cruise ports serving cruise liners, ferries, yachts and mega-yachts. Global Ports Holding also engages in the commercial port operations.

- **Ocean Wilsons Holdings (Brazil)**

Ocean Wilsons Holdings Ltd. is an investment holding company. The Group's operations include towage, lighterage contracting, stevedoring, ship building and repairing, tug and launch services, warehousing and agricultural merchanting. The Group has operations in Bermuda and Brazil.

Ocean Wilsons Hldgs Ltd. Ocean Wilsons Holdings Limited is an investment holding company. The Company, through its subsidiaries, is engaged in the provision of maritime and logistics services in Brazil. Its segments include maritime services and investments. The maritime services segment provides towage, port terminals, ship agency, offshore, logistics and shipyard services in Brazil. The investment segment holds a portfolio of international investments. Its subsidiaries are Wilson Sons Limited, Ocean Wilsons (Investments) Limited, WILSON SONS DE ADMINISTRACAO E COMERCIO LTDA, VIS LIMITED and EADI SANTO ANDRE TERMINAL DE CARGA LTDA. Wilson Sons Limited's activities include harbor and ocean towage, container terminal operation, offshore oil and gas support services, construction, logistics and ship agency. Ocean Wilsons (Investments) Limited is an investment company, which holds a portfolio of international investments. EADI SANTO ANDRE TERMINAL DE CARGA LTDA is engaged in bonded warehousing business.

3.3.3 Railroads comparators

Sample selection process

The comparator selection process for the Rail sample begins by obtaining the set of businesses in relevant categories using a range of classification systems. The initial sample comprised:

- Businesses in the Rail Freight category under the BICS system;
- Businesses in the Railroads category under the ICB system;
- Businesses in the Railroads category under the GICS system; and
- Businesses in the Ground Freight and Transportation category under the TRBC system.

Combining the four samples yielded 686 businesses. The International Securities Identification Number (ISIN) of each business was obtained and any errors (e.g., duplicates and businesses that do not return a valid ISIN were removed), yielding 416 firms.

For each of these firms, we then filter the firms by excluding firms that satisfy any of the following conditions:

- The country of the security[26] is not one in the FTSE Developed country classification, as applied by Synergies.[27]
- The security was inactive as of 30 April 2019 or earlier.[28,29]
- The start date was May 2018 or later.[30,31]

After excluding firms that fail any of the three filters, 171 firms remain in the sample. For the remaining comparators we obtain the Thomson Reuters and Bloomberg company descriptions, and apply a filter, keeping only those firms whose descriptions contain the word "Rail" in either of the two descriptions. This resulted in 66 firms remaining in the sample.

The company descriptions were examined in detail manually, removing those firms primarily engaged in passenger transportation and logistics, or those that had incomplete data.[32] We find four additional firms that should be retained in the final sample.

Table 7 presents the comparators we have identified using the process described above, and identifies those comparators that were also considered by Synergies.

Table 7: Rail comparators

FIRM	SYNERGIES
Union Pacific Corporation	Final sample
CSX Corporation	Final sample
Norfolk Southern Corporation	Final sample
Canadian National Railway Company	Final sample
Canadian Pacific Railway Limited	Final sample
Kansas City Southern	Final sample
Genesee & Wyoming Inc.	Final sample
Aurizon Holdings	Final sample
Getlink SE	Not considered
Pioneer Railcorp	Not considered
Gold Bond Group Ltd	Holding company

[26] As determined by Datastream field "GGISO".

[27] Synergies, p. 221.

[28] Datastream field WC07015 ("inactive date").

[29] Synergies excluded Prumo Logistica on the basis of being "Now delisted". Synergies, p. 233.

[30] Datastream field "BDATE".

[31] Synergies excluded GMexico Transportes on the basis of insufficient data, being listed in November 2017. Synergies, p. 238.

[32] As per Table 45 of Synergies.

FIRM	SYNERGIES
Knighthawk Inc.	Not considered

Source: Frontier Economics and Synergies

One comparator in **Table 7**, Gold Bond Group Ltd, was excluded by Synergies on the basis of being a holding company. However, we note that holdings companies were retained by Synergies in the final sample. While a holding company could be excluded on the basis of diversified subsidiaries, or 'duplication' of other firms in the sample,[33] this aspect of corporate structure should have little bearing on the relevance as a comparator. We note that:

- Gold Bond Group and Pioneer Railcorp would fail the statistical significance test applied by Synergies;[34] and
- Knighthawk Inc. has insufficient data to obtain reliable beta estimates.

New comparators

In total there are four additional firms that may be included in the final sample. One is dropped by Synergies because it is a holding company. The remaining three firms were previously not considered by Synergies. Descriptions of these companies follow.

- **Gold bond group (Israel)**

Gold Bond Group Ltd. Gold Bond Group Ltd is an Israel-based holding company, which operates through its subsidiary, Conterm Ltd. The Company operates a container and cargo terminal under the supervision of the customs authorities, and the ports and trains authority. It specializes in handling cargo of hazardous materials. The terminal has a private railroad extension that expedites the shipment of containers to all parts of Israel. Conterm Ltd provides a large cargo terminal managed by an advanced computer system, which maintains ongoing communication with its service personnel and clients. It offers also distribution and VAT services.

The Gold Bond Group Ltd. provides cargo handling services as well as storage and transport of all types of goods.

- **Knighthawk (Canada)**

Knighthawk Inc.. KnightHawk Inc. (KnightHawk) is a Canada-based company, which operated a short line railroad, carrying freight within British Columbia, Canada. The Company operated through the rail freight and related services segment.

KnightHawk Inc. is an air cargo carrier. The Company delivers freight both domestically and trans-border between Canada and the United States.

- **Pioneer Railcorp (United States)**

Pioneer Railcorp. Pioneer Railcorp is a United States-based company. The Company operates in two business segments: railroad operations and railroad equipment leasing. Railroad operations are provided by the Company's wholly owned short line railroad subsidiaries whose rail system provides shipping links for customers along its routes and interchanges with five major railroads, Burlington Northern Santa Fe Railroad (BNSF), CSX Transportation (CSX), Canadian National Railway Company (CN), Norfolk Southern Railway (NS) and Union Pacific Railroad (UP). In addition, the Company's

[33] As with CK Hutchison Holdings and Hutchison Port Holdings Trust.

[34] Analysis of "5-year Bloomberg rail and MPS beta information (2019-20 TCS) - Revised response.xlsx", 25 October 2019.

railroad subsidiaries have interchanges with two smaller railroads, the Kansas City Southern Railway (KCS) and the Arkansas & Missouri Railroad (AM). PRC's rail system is primarily engaged in carrying freight. The Company's railroad equipment leasing operation provides locomotives, railcars and other railroad-related vehicles and equipment to its operating railroad subsidiaries.

Pioneer Railcorp is a railroad holding company. The Company provides short line railroad service in the United States. Pioneer also leases railroad equipment, such as locomotives, railcars, and other railroad related vehicles and equipment to the Company's subsidiaries and unaffiliated third parties.

- **Getlink (France)**

Getlink SE Formerly known as Getlink. Getlink SE, formerly known as Groupe Eurotunnel SE, is a France-based company, which brings together a group of companies active in the fields of infrastructure management and transport operations. Its various entities share the attention to quality and customer service, with priority given to safety. The Company manages and operates the Channel Tunnel between the United Kingdom and France and its railway infrastructure. The Company is also engaged in the passenger and freight transport between continental Europe and the United Kingdom. In addition, it provides ferry transport through the Channel. Getlink SE has direct and indirect stakes in a number of companies, including The Channel Tunnel Group Limited, France Manche SA and Europorte SAS, among others.

Getlink S.E. provides transportation services. The Company offers mobility infrastructure such as passenger vehicles like shuttle, railway networks, and road freight activities. Getlink serves customers in France and United Kingdom.

3.4 Summary of findings on comparators

3.4.1 Reasonableness of Railroad comparators used by Synergies

Synergies includes railroads as comparators to the Port. Synergies suggests that the case for including railroads are that freight railroads bear similar risks to the Port due to freight traffic, strong market position and ownership of below rail operations. Further, it suggests that other regulators have included port comparators when assessing betas for railroads.

The decisions of other regulators in relation to rail businesses do not support a view that railroads and ports are necessarily good comparators, with recent freight rail decisions either excluding or placing very little weight on ports. Our analysis further suggests that while there are some broad similarities, there are some clear points of difference between the Port and North American railroads which mitigate against their inclusion as comparators.

In our view, given that the inclusion of these asset betas materially increases the average or median beta of the data set, it is incumbent on the Port to provide a more specific justification for the inclusion of these firms in the comparator set.

3.4.2 Revision of comparator sample by considering other classification systems

If Synergies' rule of excluding comparators whose beta estimates are not statistically significant is maintained, then we find that one additional potential Railroads comparator, Getlink SE, should be considered.

If Synergies' statistical significance filtering rule is removed, then we find that, in addition to Getlink SE, three additional potential Ports comparators (Marsden Maritime, Ocean Wilsons and Global Ports

Holding Limited) and two additional Railroads comparators (Gold Bond Group and Pioneer Railcorp) should be considered.

We have identified six companies in Synergies' Ports comparator sample that should likely be excluded because they either do not appear to be port owners or operators, or because they do not operate in a developed economy.

4 APPROACHES TO GAMMA

4.1 Approaches to gamma

The Commission has requested that we provide a summary, in tabular form, of:

- Australian regulators that currently adopt a "utilisation" approach to estimating gamma which considers the extent to which investors can utilise the imputation credits they receive to reduce their tax or obtain a refund (based on equity ownership or tax statistics or other relevant measure); and
- Australian regulators that currently adopt an "implied market value" approach to estimating gamma which is based on market valuation studies.

This information is contained in **Table 8**.

Table 8: Australian regulatory approaches to gamma

REGULATOR	UTILISATION APPROACH OR MARKET VALUE APPROACH?
IPART[35]	Market value approach
AER[36]	Utilisation approach
ERA[37]	Utilisation approach
QCA[38]	Utilisation approach
ESC (water)[39]	Utilisation approach
ICRC[40]	Utilisation approach
ESCOSA[41]	Utilisation approach, but ESCOSA has indicated that it will review its approach in the forthcoming (2020) review of SA Water's prices
OTTER[42]	Utilisation approach

Source: Various regulatory decisions cited

[35] IPART, Review of our WACC method, Final Report, February 2018, pp. 81-83.

[36] AER, Rate of return instrument, Explanatory Statement, December 2018, pp. 307-382.

[37] ERA, Final Gas Rate of Return Guidelines, Explanatory Statement, 18 December 2018, pp. 254-285.

[38] QCA, Queensland Rail's 2020 Draft Access Undertaking, Draft Decision, April 2019, p. 39.

[39] ESC, Melbourne Water Price Review 2016, Final Decision, June 2016, p. 53.

[40] ICRC, Regulated water and sewerage services prices 2018–23, Final Report, May 2018, pp. 121-127.

[41] ESCOSA, SA Water Regulatory Determination 2020: Guidance Paper 5 – The cost of funding and using assets, November 2018, p. 20.

[42] OTTER, 2018 Water and sewerage price determination investigation, Final Report, May 2018, p. 171.

5 SENSITIVITY TESTING

We have been asked by the Commission to examine how the weighted average cost of capital (WACC), estimated by Synergies for the 2019-20 Tariff Compliance Statement,[43] would change if the sample used for beta estimation were to change, or if the value of imputation credits (gamma) were to change. This section presents the results of those sensitivity analyses.

5.1 Comparator sample sensitivity scenarios

The Synergies report uses a final sample of 8 railroad and 11 ports comparators. These comparators, and estimated 5-year asset betas, are presented in Appendix B. We note that 27 comparators were excluded by Synergies solely on the basis of statistical significance, as seen in Tables 44 and 45 of the Synergies report.[44,45] These comparators are also presented in Appendix B.

The exclusion of comparators by Synergies was addressed by the Commission in its 2017-18 TCS commentary, and further addressed by Synergies. In Appendix C, we analyse the use of the statistical significance filters used by Synergies and find these are problematic.

We consider four samples to estimate beta, and compare to the asset beta used by Synergies:

1. The final sample used by Synergies;
2. The sample if the significance filter were to be removed;
3. The sample if rail comparators were excluded; and
4. The sample if rail comparators were excluded and the significance filter were to be removed.

We note that the average asset beta using the final sample of Synergies, 0.76, is somewhat higher that used by Synergies in determining the point estimate WACC, 0.7.[46] That is, Synergies has exercised some qualitative judgement in arriving at a final point estimate for the asset beta.

We cannot replicate this qualitative judgment in our analysis. Therefore, for the purposes of undertaking sensitivity analysis, we have adopted as the relevant point estimate the mean (equally-weighted) asset beta for each comparator sample scenario considered.[47] The results are presented in **Table 9** below.

[43] Synergies, Determining a WACC estimate for Port of Melbourne, May 2019 (Synergies report).

[44] This includes one firm excluded for a negative beta.

[45] Four of these firms had incomplete data related to gearing for the five year sample period, and so are excluded from analysis.

[46] Synergies report, p. 17.

[47] That is, a rail comparator and a port comparator receive the same weight.

Table 9: Asset betas resulting from different samples

	Used by Synergies in 2019-20 TCS	Average across Synergies sample	Remove significance filter	Remove Rail comparators	Remove Rail comparators and significance filter
Asset beta	0.7	0.76	0.48	0.68	0.39
Sample size	19	19	42	11	31

Source: Frontier Economics of Synergies

5.2 Gamma sensitivity scenarios

Synergies use a gamma value of 0.25 in determining WACC.[48] The Commission has asked us to also consider alternative values of 0.40 and 0.50.[49]

5.3 Impact of sensitivities on WACC

For each of the four beta sensitivities and two gamma sensitivities we determine the pre-tax nominal WACC of the Port, keeping all other variables constant as in the point estimate column of Table 5 of the Synergies report.

In the 2019-20 TCS, Synergies weights the results from three different models to estimate the return on equity:

- Sharpe-Lintner CAPM – 90% weight;
- Black CAPM – 5% weight; and
- Fama-French Model – 5% weight.

We have been instructed by the Commission to not update Synergies' Fama-French Model estimates, when conducting these sensitivity analyses. Hence, the sensitivity results we present adopt the Fama-French Model return on equity estimates proposed by Synergies. The impact of the Fama-French Model is likely to be small, given it receives a weight of only 5% in the overall WACC calculation.

The results, shown in **Table 10**, show that the:

- alternative samples yield lower estimates of WACC than the Synergies point estimate of 10.46%;[50] and
- higher estimates of gamma lead to lower estimates of WACC.

[48] Synergies report, p. 17.

[49] See Table 32 of the Synergies report for the current Australian regulatory status of gamma.

[50] Synergies report, p. 18.

Table 10: Pre-tax nominal WACC

	ASSET BETA APPROACH				
GAMMA	**Synergies Values**	**Synergies Average**	**Remove significance filter**	**Remove Rail comparators**	**Remove Rail comparators and significance filter**
0.25	**10.46%**	11.00%	8.38%	10.28%	7.57%
0.4	9.97%	10.49%	8.01%	9.80%	7.24%

Source: Frontier Economics analysis

A COMPETITION RISKS FACED BY THE PORT

Synergies' contentions

In its submission to the Commission, and as for previous years, Synergies has maintained its contention that the Port faces the threat of competition, and that this threat is likely to affect the systematic risk of the benchmark efficient entity materially.[51] Synergies uses its "first principles analysis" to provide context that can inform an assessment of where beta might sit within a range (that is, whether a factor puts upward or downward pressure on the beta for the firm).[52]

Synergies' argues that:

- The prospect of the second port in the Melbourne region constrains Port's market power as the prospect of a second port brings substitution risk as well as potentially providing Port's counterparties (shipping, logistics, and, to a certain extent, stevedoring companies) more countervailing power in negotiations.
- The credible threat of a second port (the development of which can be brought forward in time) is sufficient to impact the beta.
- The Port must make investment decisions across long-term horizons and therefore a significant change in the demand outlook even 40 years into the lease impacts on investment decisions today.
- The Victorian Government can act relatively quickly to develop a new port in the future.

Synergies also states that:

- The Port has lost trade to ports in Adelaide, Geelong and Port Botany—and such lost trade represents a material competitive constraint on the Port; and
- The Port cannot price discriminate effectively based on the location or makeup of goods.

Synergies' arguments with respect to lost trade and substitution specifically are that:

- An appraisal of the Port's competitive pressures is a complex exercise, because the degree of contestability differs both by cargo type and by destination. As demonstrated in Table 24 of the latest Synergies report, the Port's liquid bulk, dry bulk and break bulk trades (which account for approximately 13% of total revenue tonnes) are all subject to some form of competition from other ports.
- Container traffic is also subject to competition from a variety of Australian ports (Adelaide and Botany for imports, Botany and Adelaide for exports, and both Station Pier and direct calls for the Tasmanian trade). Nevertheless, a significant proportion of Port's volumes are not contestable, with 87% and 54% of imported and exported containers, respectively, destined for or originating from the Melbourne metropolitan region

Synergies' argument with respect to price discrimination is that Port cannot price discriminate, which means that the benefits of price competition to capture marginal trades are transmitted across the entire Port customer base.

Synergies also states that the regulatory environment restricts the ability of Port to exert market power.[53]

[51] Synergies, *Determining a WACC estimate for Port of Melbourne A report prepared in context of the Pricing Order for the 2019-20 Tariff Compliance Statement*, May 2019 (Synergies)

[52] Synergies, at p. 154.

[53] Synergies, at p. 159.

ACCC view on port competition

Before considering Synergies arguments in detail, we consider that it is first relevant to consider the ACCC's views that it expressed in relation to the Port of Melbourne transaction. The ACCC noted that there may be some competition between ports, but this is limited and will likely remain so in the future. The ACCC took into consideration:

- …the "physical distance between ports and high domestic transport costs, which means most port users don't have a choice but to use their closest port. A group of exporters in Southern NSW are contestable between the Port of Melbourne and Port Botany. However, their decisions on which port to use are influenced by a number of factors, most of which are not factors within the control of the ports"
- "…in relation to competition for transhipments, ports have limited influence on a shipping line's choice of port for transhipment and in some situations Australian container ports compete with international ports for transhipments…", and
- "…in relation to competition to attract investment and custom of port users, there are other factors outside the port's control which are key to determining where and how a port user will invest, including the location of key customers and forecast growth in demand."[54]

These factors all continue to be relevant to the Port.

Competition and systematic risk

Monopolies that are able to act entirely without restraint are rare, or non-existent. Competition is invariably a matter of degree, and, clearly, the Port will face some constraints in some areas from other modes of transport or other ports.

The relevant question for the Commission is not whether the Port is or is not a monopoly, but whether it faces sufficient competition such that it would affect the systematic risk of the benchmark efficient entity, and should therefore be taken into account in the selection of parameter values for its estimated WACC.

We consider the two sources of competition identified by Synergies; the future second port, and existing substitution towards other ports for certain kinds of traffic.

The second port argument

Synergies argues that future competition, or the threat of that competition, would constrain the current behaviour of the Port and its ability to manage market risk.

The question of constraint offered by a hypothetical second port requires an assessment of:

- How likely is entry?
- Over what time period is entry likely to occur?
- Would entry constrain prices and affect the Port's beta now?

There seems little doubt that the Victorian Government is not likely to act to support entry in the short to medium term. That is because the best available evidence from Infrastructure Victoria suggests that it

[54] https://www.accc.gov.au/media-release/accc-will-not-oppose-proposals-for-port-of-melbourne-lease and https://www.accc.gov.au/public-registers/mergers-registers/public-informal-merger-reviews/consortium-comprising-gic-gip-and-borealis-proposed-acquisition-of-the-port-of-melbourne.

would not be cost effective for a second major container port to begin operations until 2055, or around 40 years into the port's 50 year least.[55]

The question is then whether the Port is constrained in its ability to raise charges by the prospect of that future entry. In the environment where entry would result in a loss of business to the Port, the Port's strategy would be to assess:

- The benefits that might be earned from charging higher prices up until the point that the new port enters; and
- Future losses of profit from traffic diverted to the new port, factoring in that the Port would likely still have significant transport cost advantages where cargo is bound for the Melbourne area.

In our view, forgoing profits now to maintain profits in the longer term would seem to make little sense for the Port. That is, it seems very unlikely that the Port would consider the trade-off from lower prices now to be "worth it" even if the entry of another Port was certain in future. This follows from discounting and the future value of profits. Consider, for example, that $100 of profit earned in 2019 would be worth only $39 in 2029, $15 in 2039, $6 in 2049 and less than $4 in 2055 if profits are discounted at 10% per year.

To take a specific example, the value of $100 profit earned in each year after 2055 is $32, again using a 10% discount rate. Suppose that new entry at 2055 meant all of these profits were lost. So long as the present value of the stream of profits earned between 2019 and 2055 was more than $32, there would be no incentive to moderate tariffs now. This $32 of lost profits would be more than offset by 5 years of higher profits with a 10% price increase (which has a present value of $41.7).

The example above does not consider whether all of the $100 would be lost, or the likelihood that entry occurs at 2055 (which is uncertain). We do, however, accept that there may be some effect of future entry on prices closer to the time of entry. This might be because some users could more credibly threaten to switch traffic away from the Port once entry occurred; this would ultimately depend on the abilities of the entrant port.

Having said that, if entry did occur, it is not certain that entry would constrain the Port's market power significantly. The Port would still have advantages relating to its location which reduce transportation costs from the Port compared to any competitor. An example in a similar industry is that Melbourne airport's market power remains relatively unconstrained by the presence of Avalon airport, even though both can handle international and domestic passengers.

It therefore appears very unlikely that the threat of entry could materially increase the Port's exposure to systematic risk over the timeframes discussed above, or that it would make it any riskier than comparable companies, holding other things constant.

Trade substitution

At a conceptual level, we agree with Synergies that questions of substitution should be considered with reference to different traffic types, and take into account whether the Port can price discriminate between traffic or users.

Synergies recognises that a significant proportion of volumes are not contestable, particularly imported containers. However, we agree with Synergies that the threat of substitution from port competition could act to constrain the Port if:

[55] See also Delivering the goods: Victorian Freight Plan 2018-50, July 2018, p. 47.

- There was a sufficient proportion of customers that would switch in response to a price increase for services sold by the Port;
- The Port could not otherwise limit the effect of such substitution by targeting price rises to particular trade types (so that it could charge higher prices to those users that could not switch); and
- Those trade types affected by substitution constituted a material share of revenue for the Port.

The first two concepts raise the question of what is a "sufficient proportion" of customers that would be needed to switch, and whether the Port is likely to be constrained from customers that can switch.

Critical and actual loss

Both concepts can be best analysed through "critical loss" analysis, which is widely used in market definition and market power assessments in Australian competition law.[56] Critical Loss analysis identifies, for a given price increase, the amount of sales that could be lost before that price increase becomes unprofitable.

Where there is evidence that the actual loss from a price increase would be likely to exceed the critical loss, we can conclude that substitution is sufficient to dissuade price increases. If there is no ability to price discriminate between users, all users will benefit from the ability of some switchers to respond to price increases. Where some targeting of price changes is possible, the analysis should be applied to groups of users separately.

A principal insight from Critical Loss analysis is that only a relatively small number of customers willing to use alternate sources of supply may be sufficient to protect all customers from the exercise of market power.

To conduct a critical loss analysis, one needs:

- The ***critical loss threshold***: the critical loss threshold calculates the proportion of users that would need to switch for the purported increase to be unprofitable. It is calculated in the form $CL\% = \frac{x}{x+m}$, where x is the percentage price increase, and m is the margin associated with the service supply. Margin is in turn defined as $Margin = \frac{price}{(price - marginal\ cost)}$.
- Estimates of the ***likely actual loss***: This is based on an assessment of the options available to users and groups of users, including the extent to which higher port charges would influence total transport charges

The critical loss threshold can be loosely estimated by taking into account that margins in ports services are likely to be relatively high, given the port's high fixed costs (high operating leverage).[57]

Supposing margins for services are 50%, the critical loss would be: CL% = 10% / (10%+50%) = 10%/60% = 16.7%. This means that if demand was likely to fall by more than 16.7% in response to a 10% price increase, we could conclude the Port was effectively constrained from increasing tariffs for that particular service.

Actual loss

To consider plausible values for actual loss, it is necessary to consider:

[56] See e.g. Australian Competition and Consumer Commission v Liquorland (Australia) Pty Ltd [2006] FCA 826 (30 June 2006)

[57] Synergies at p. 163.

- The Port's different traffic types and its ability to charge separate fees for different kinds of traffic or to different users; and
- the share of port costs in overall transport costs, as changes to port charges must be material enough to provoke a response across the transport chain. So, for example, if port charges are 20% of transport costs, then the end user will only switch to an alternative port if the increase on the 20% is sufficient to outweigh any additional transport costs associated with that alternative port.[58]

Traffic types

In general terms, the Port's wharfage fees outlined in its Reference Tariff highlight the following categories of wharfage and channel fees

Table 11: Tariffs

WHARFAGE FEES	CHANNEL FEES
Containerised – full and empty, inward and outward, full Bass Straight	Shared and dedicated channels
Accompanied passenger vehicles	Vessels of different draught
Liquid bulk	Car carriers
Transhipment	Passenger cruise vessels
Non-containerised/general	Coastal liner vessels
Motor vehicles	
Dry bulk	

Source: Port of Melbourne Reference Tariff Schedule

We understand these wharfage and channel fees combine for almost all of the Port's regulated revenues.

Price discrimination and the materiality of revenues

There appears to be considerable scope for price discrimination - or at least differentiation - in the tariff categories identified. This indicates that the Port's will likely be able to quarantine the effect of competition in some cargoes so that the impact on its overall revenues is minimal.

It is therefore unclear on what basis Synergies states that the "…benefits of price competition to capture marginal trades are transmitted across the entire Port of Melbourne customer base." Given the diversity of tariffs offered, and with no obvious ability of users to switch between traffic types, there is no transmission mechanism.

To take an example, suppose that the dry bulk trade was subject to competition which made price increases infeasible because more than 16.7% of dry bulk customers' volumes could switch to another port. However, revenues associated with the dry bulk trade are less than 5% of total regulated revenues. The Port may be able to increase charges to other users that account for 95% of users.

[58] As an example, consider Port A and Port B. It costs $10 to transport to Port A and $12 to Port B. Port charges are $5 for both ports. If Port A charges rise by $3 to $8, then there will be substitution towards Port B.

Proportion of port charges in transport charges

A factor that is not mentioned by Synergies that increases in port charges will have a less significant impact on end transport charges, because port charges are only one component of the transport cost chain.

The materiality of the port charge will depend on what is being transported, and over what distance. Unfortunately, there is little precise evidence about the proportion of port charges in transport costs; however, for certain high volume journeys the proportion of port costs in total costs is likely to be around 10% of transporting from one port to another.[59]

- The port's charges per inbound container TEU was $121.85 in 2018-19;
- The ACCC reports that stevedore charges are, on average, around $258 per lift in Australian ports;[60]
- Total costs for shipping a container is likely to be upwards of one thousand dollars.[61]

Impact on container trade

In rough terms, inbound and outbound container traffic account for around 60% of the Port's revenues, and are the services for whom competition would have the most impact on the Port's revenues.

- 87% of containers are imported to the Melbourne area (37% of revenue), indicating that insufficient substitution would be likely in response to price rises of 10% or so from the competitive level. This is even without considering the share of port charges in the transport chain—i.e., in practice a 10% price increase to the Port would only constitute a much smaller increase in transport costs to a shipper.
- 54% of containers are exported from the Melbourne area (21% of revenue)
  - Synergies suggests there is greater competition between ports for export containers, and notes "particularly intense competition with Port Botany for containerised exports originating from the Riverina and surrounds". This accounts for approximately 6% of the Port's volumes and includes some Riverina trade that the Port handled in FY18 (approx. 35,000 TEU or 1% of revenue), which has since been lost to Port Botany.[62]
  - According to a critical loss calculation, it seems more plausible that the loss of customers from a 10% price increase on all export containers would be constrained. However, it is likely that only containers which are exported from places that are similar in distance to Melbourne and alternative ports would be likely to see substitution.
  - The evidence presented is that 6% of containers are from the Riverina area where there is competition with Port Botany. This is not likely to be sufficient to indicate a sufficient loss of revenues in response to a price increase, as even at quite high margins, volume reductions of more than 6% would be needed to make price increases unprofitable. This is accentuated by the fact that increases in port charges of say 10% would only likely lead to a 1% price increase or less in the container transport cost.
  - Moreover, even if there were a sufficient number of services exposed to competition, export containers are only worth 20% of revenue, so price increases targeted on other services responsible for the remaining 80% of revenues could still be feasible.

[59] The Bureau of Infrastructure, Transport and Regional Economics estimates 12% in *Waterline 53*, January 2014, p.64

[60] https://www.accc.gov.au/system/files/1465_Container%20stevedoring%20monitoring%20report%202017-18_D08.pdf

[61] Cost of a Shanghai-Melbourne container, 20 foot TEU, UNCTAD maritime review, 2018, https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf, p. 46

[62] Synergies, p. 155.

Similarly, while we note that competition for Bass Strait traffic accounts for 6% of revenues, the Port maintains separate charges for Bass Strait containers,[63] and so again quarantines these from other tariffs and revenues.

Other trades

Synergies notes the potential for competition on other trades, including:

- Motor vehicles (8% of revenue);
- Liquid bulk (4%);
- Dry bulk (5%); and
- Break bulk (1%).

In each case, the Port charges separate tariffs for each kind of cargo and can therefore quarantine the competitive effect (to the extent it exists) by adjusting specific tariffs in response to competition (or lack thereof).

63 https://www.portofmelbourne.com/news-publications/publications/reference-tariff-schedule/

B COMPARATORS CONSIDERED BY SYNERGIES

Table 12: Final sample used by Synergies

COMPANY	INDUSTRY	5-YEAR ASSET BETA
Aurizon Holdings	Rail	0.384
CSX Corporation	Rail	0.982
Genesee & Wyoming Inc.	Rail	1.040
Kansas City Southern	Rail	0.731
Norfolk Southern Corporation	Rail	1.107
Union Pacific Corporation	Rail	0.939
Canadian National Railway Company	Rail	0.800
Canadian Pacific Railway	Rail	0.938
Qube Holdings	Port	1.224
Port of Tauranga	Port	0.471
Hamburger Hafen und Logistik	Port	0.530
Sakurajima Futo Kaisha	Port	1.022
Rinko Corporation	Port	0.393
Dongbang Transport Logistics	Port	0.820
China Merchants Port Holding Company	Port	0.793
COSCO Shipping Ports	Port	0.438
Dalian Port	Port	0.791
Hutchinson Port Holdings Trust	Port	0.492
Global Ports Investments	Port	0.515

Source: Synergies report

Table 13: Companies excluded by Synergies on the basis of statistical significance

COMPANY	INDUSTRY	5-YEAR ASSET BETA
Globaltrans Investment	Rail	0.590
VTG AG	Rail	0.178
Center for Cargo Container Traffic TransContainer PJSC	Rail	0.235
Isewan Terminal Service	Port	0.077
Bremer Lagerhaus-Gesellschaft AG	Port	0.009
Eurokai GmbH	Port	0.292
Logistec Corporation	Port	0.576
Salalah Port Services Company SAOG	Port	-0.015
Puerto Ventanas S.A.	Port	0.097
Tradia Corporation	Port	0.225
South Port New Zealand Limited	Port	-0.075
Point Lisas Industrial Port Development Corporation Limited	Port	-0.118
Namyong Terminal	Port	0.303
Mercantile Ports and Logistics Limited (MPL)	Port	0.562
Perak Corporation Berhad	Port	0.580
Dinh Vu Port Investment & Development	Port	0.392
Luka Ploce d.d.	Port	0.237
Dong Nai Port JSC	Port	0.205
Socep S.A.	Port	0.260
PT ICTSI Jasa Prima Tbk	Port	0.873
Doan Xa Port Joint Stock Company	Port	0.164
Taiwan Allied Container Terminal Corp.	Port	0.170
The Vegetexco Port JSC	Port	-0.221

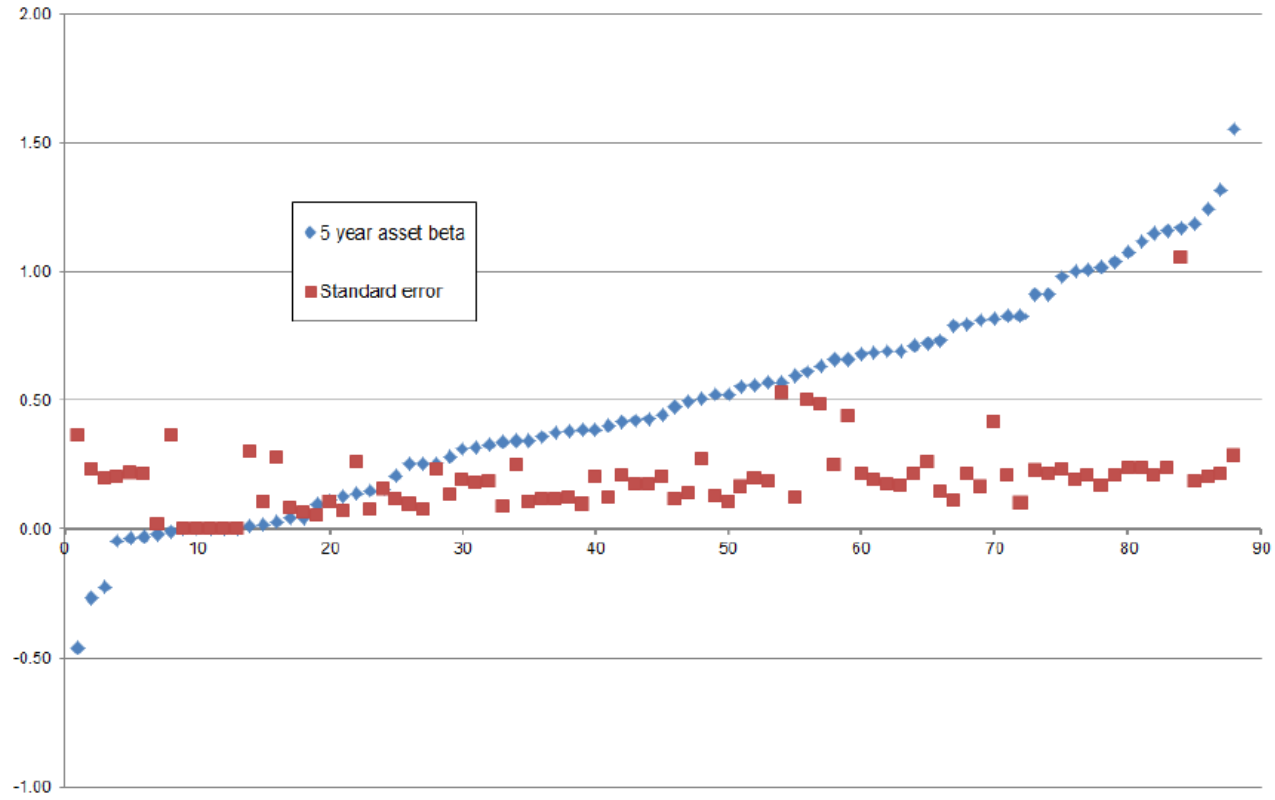
Source: Synergies report

C COMPARATOR EXCLUSION ON THE GROUNDS OF STATISTICAL SIGNIFICANCE

In the 2018-19 TCS, Synergies excluded 31 comparator firms because the beta estimates of those firms were either negative or not statistically significant. The Commission expressed concerns in its interim commentary on the 2018-19 TCS that excluding those firms may have introduced an upward bias in the overall beta estimate. This is because the test for statistical significance considers whether the relevant estimate is statistically different from a value of zero. The Commission contended that such a test is likely to exclude firms with low beta estimates, but include firms with high beta estimates with a similar level of statistical precision.

In support of this argument, the Commission produced **Figure 1**, which plots the 5-year asset beta estimates and associated standard errors for each of the potential comparators in Synergies' sample.

Figure 1: 5-year asset beta estimates and associated standard errors of firms in Synergies' comparator sample



Source: ESC's interim commentary on 2018-19 TCS

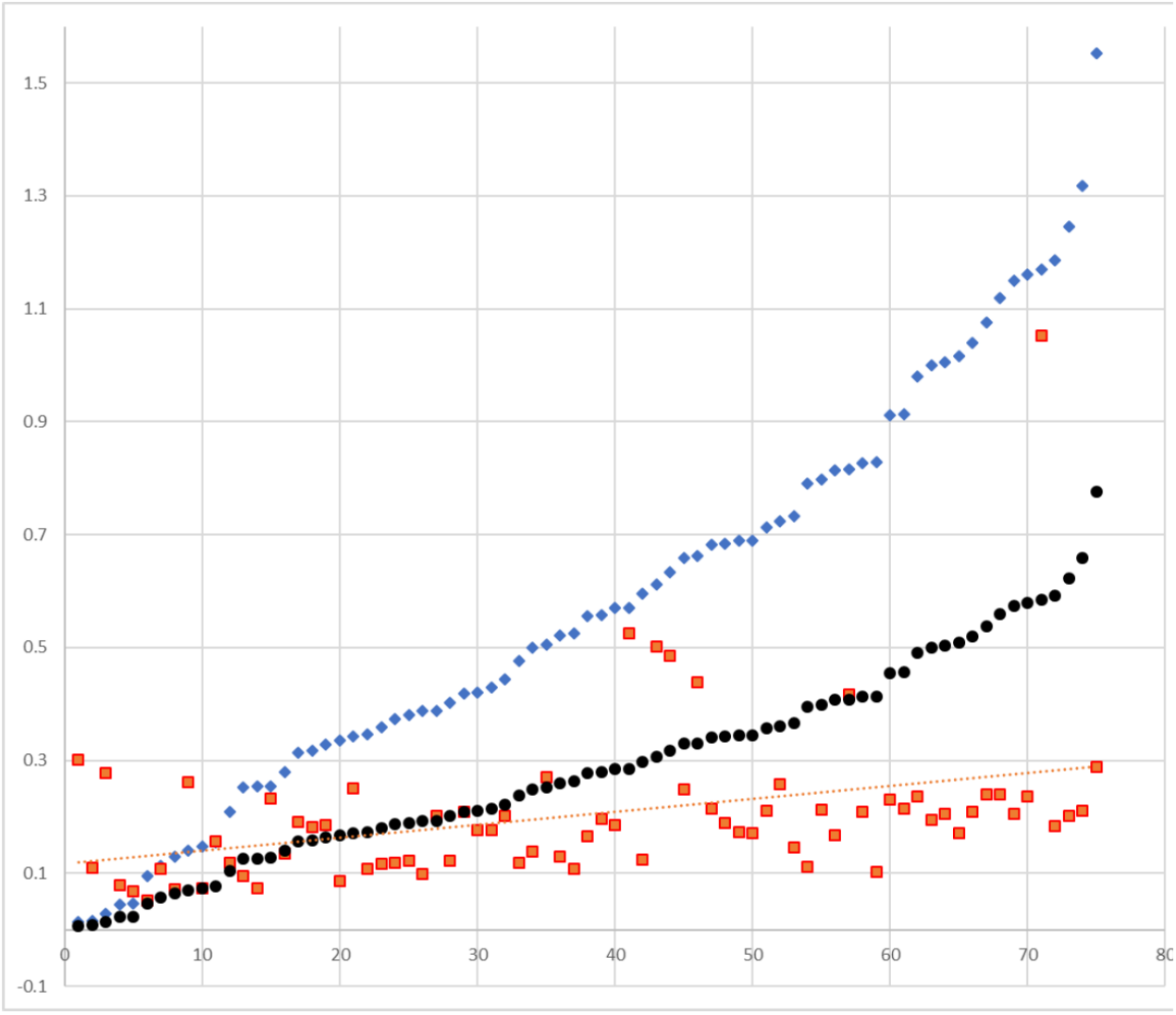
The Commission observed that some firms had very low asset beta estimates, and others had very high asset beta estimates. However, the standard errors of the estimates did not appear to vary much across firms. The Commission argued that, as a result, Synergies' statistical significance test was likely to exclude those firms with the lowest betas. This, in turn, would tend to push up the overall beta estimate.

In the 2019-20 TCS, Synergies maintains that filtering betas on the basis of statistical significance is an important component of the comparator selection process. Synergies argues that:

- Such a filtering process is necessary to exclude firms with statistically noisy returns.

- The Commission's analysis in **Figure 1** was incomplete because it failed to consider the thresholds that would need to be met in order for an estimate to be considered statistically significant. Synergies plots the cut-off for statistical significance using a t-statistic of 2 (the significance threshold it claims it applies when filtering out statistically insignificant beta estimates) against the standard error of each beta. Synergies contends that the cut-off for statistical significance for firms with low beta estimates is low, whereas the cut-off for firms with high beta estimates is high (see the black dots in **Figure 2** below). On this basis, Synergies argues that the statistical confidence of beta estimates does change over the range of beta estimates. The implication is that the fact that some firms with low beta estimates are excluded is appropriate since there is low statistical confidence around the reliability of those estimates.
- Firms with negative beta estimates should be treated as outliers and therefore excluded from the sample—presumably because negative betas are economically implausible and are likely to be due to statistical noise.

Figure 2: Synergies presentation of 5-year asset beta estimates, standard errors and cut-offs for statistical significance



Source: Synergies 2019 report, Figure 18, p. 230.

The Commission has asked us to consider the appropriateness of Synergies' statistical significance filtering rule, and then demonstrate empirically the impact of that rule on beta estimates.

Assessment of Synergies' statistical significance filtering rule

The statistical filtering rule applied by Synergies is overly stringent

In Synergies' analysis, the betas for each comparator firm were obtained from Bloomberg as raw betas using five years of monthly returns to March 2019. Synergies excluded firms from the comparator sample if:

- the t-statistic of the beta estimate was less than 2; or
- the R-squared value was less than 0.1 (10%).[64]

Synergies also excluded comparators from the final sample on the basis of a negative beta; the t-statistic for negative beta estimates would be negative and therefore less than 2.[65]

Synergies implies that its statistical criterion is to target beta estimates that are statistically significant at the 5% level.[66] However, that is not in fact what Synergies is doing. In this regard, we note that:

- The statistical significance of an estimate with a t-statistic of 2 (i.e., the cut-off that Synergies applies) depends on sample size. Specifically, the statistical significance threshold decreases as sample size increases. Hence, applying a t-statistic threshold of 2 regardless of sample size will mean that the statistical significance threshold will vary as the sample size change. To the extent that the sample size for individual comparator firms varies (depending on data availability), different statistical significance thresholds would be applied to different firms under Synergies' approach.
- The R-squared requirement of 10% imposes a further requirement on the t-statistic. There is a direct, mathematical relationship between the t-statistic and the R-squared value in a single variable model.[67] In this regard, the commentary in Appendix B.5 of Synergies' report is misleading as it equates a t-statistic of 2 with statistical significance at the 5% level, without reflecting the additional burden of the R-squared requirement.

As shown in **Figure 3** below, the filter as applied requires a t-statistic of more than 2.54 for sample sizes of 59 or 60, if Synergies' R-squared requirement is followed.[68,69] As a consequence, the statistical significance required of such full samples may be as low as 1.4%, compared to 5.5% for sample sizes of 30.[70] The majority of comparators considered by Synergies had a sample size of 60.[71]

[64] Synergies report, p 151.

[65] Synergies report, p 223.

[66] Synergies report, p 229.

[67] We note that the R-squared values supplied by Bloomberg, as provided by the Port to the Commission in the Excel file "*5-year Bloomberg rail and MPS beta information (2019-20 TCS) – Revised response.xlsx*" do not perfectly match the conventional R-squared values. Instead, the measure that Synergies has adopted is non-standard, being derived from two regressions - plus and minus - where the 'plus' regression is for all data points above the mean market return. The fact that Synergies has used a non-standard R-squared measure does not have any bearing on the overall results, but is nevertheless an unexplained and opaque aspect of Synergies' analysis.

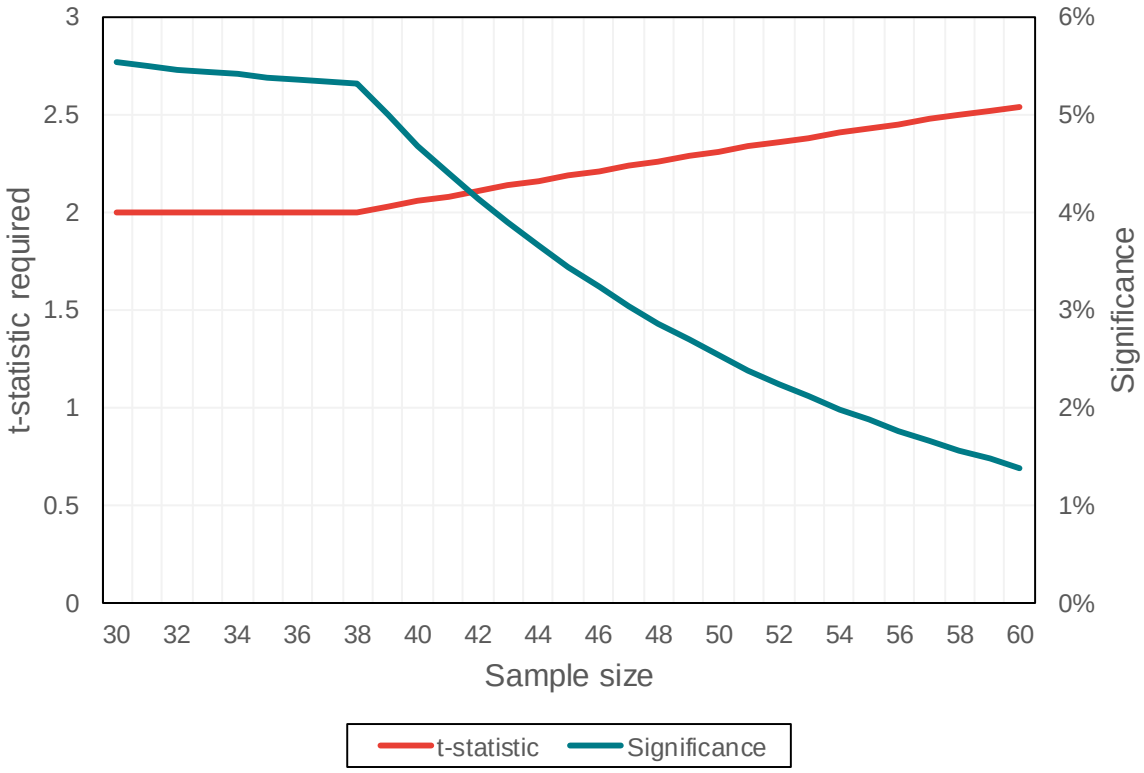
[68] 5 years of monthly returns would yield 60 observations

[69] Using the conventional R-squared equation.

[70] The requirement, as applied, appears to be analogous to a one-sided test. The level of significance may therefore more accurately be stated as 0.7%-2.8%.

[71] 144 of 196 comparators in "5-year Bloomberg rail and MPS beta information (2019-20 TCS) – Revised response.xlsx".

Figure 3: Filter requirements for different sample sizes



Source: Frontier Economics analysis

As a consequence, the test for statistical significance applied by Synergies for most comparators in its sample is much more stringent than the 5% level Synergies suggests that it is targeting.[72] This implies that the number of comparators Synergies has actually excluded from its sample is greater than is implied by the analysis set out in Appendix B.5 of Synergies' 2019 report.

The use of the R-squared rule is likely to introduce an upward bias in Synergies' estimates

As noted above, Synergies requires that an individual beta estimate must have an R-squared of at least 10% before it is included in the sample. The R-squared is a measure of explanatory power. Synergies' intention, therefore, appears to be to exclude any beta estimates that have very low explanatory power.

However, in our view, the use of this requirement is likely to introduce an upward bias in Synergies' overall beta estimate. This is because, for purely mathematical reasons, low beta estimates will have low R-squared values—even if those estimates are highly precise. This is because stocks with low beta estimates will have low t-statistics and, therefore, low R-squared values (due to the relationship between t-statistics, sample size and R-squared described above).

By way of example, consider a stock whose true beta is zero. That is, movements in the returns of this hypothetical stock are completely unrelated to movements in the broader market. Now, suppose that Synergies has estimated the beta of this stock, obtaining an estimate of zero with a trivially small standard error. In other words, Synergies' estimate of this stock's beta, zero, matches exactly its true

[72] In the case of a one-tailed test, which would correspond more closely to the present case, the level of significance would be approximately 0.7%, which would be an unusually strict level of significance.

value, with minimal statistical imprecision surrounding that estimate. It is a mathematical fact that the R-squared associated with this stock's beta estimate of zero will also be zero. This is because a beta estimate of zero means that broader market movements play no role in explaining movements in this particular stock's returns.

Under Synergies' rule of excluding beta estimates with associate R-squared values less than 10%, this stock would be excluded from the sample, even though there is minimal statistical imprecision associated with the estimate.

Stocks with low beta estimates will tend to have low R-squared values, keeping the level of statistical precision constant. Hence, Synergies' approach will tend to filter out such stocks from its comparator sample. There is no analogous statistical filter in Synergies' approach that would exclude high beta stocks. Hence, Synergies' approach is inherently asymmetric, and is therefore likely to introduce an upward bias in its overall estimates.

A better alternative to Synergies' approach would simply be to require a 5% level of significance, for all stocks, regardless of sample size and regardless of the R-squared associated with the estimate.[73] However, this would still not address the bias issue that we discuss above relating to betas which have true values close to zero.

Synergies appears to have applied its statistical filtering rule inconsistently

Synergies' statistical significance filter is used as the sole justification for eliminating 24 Marine and 3 railroad comparators from Synergies' sample, as listed in Tables 44 and 45 in the 2019 Synergies report.[74]

In analysing information provided by the Port, we identified several instances where comparators were retained despite failing the significance criterion, or omitted despite passing the criterion:

- Aurizon Holdings was in the final sample for Railroads, yet had an R-squared of 7.5%;
- Global Ports Investments was in the final sample for Ports, yet had a t-statistic of 1.90; and
- Tradia Corporation was excluded on the basis of statistical significance yet had a t-statistic of 5.6 and an R-squared of 35.2%.

Empirical assessment of the impact of Synergies' statistical significance filter

Using the information provided by the Port, we show in **Table 14** below the impact of different approaches to applying a statistical significance criterion:

- The first scenario presents the outcome of implementing Synergies' statistical filtering rule, and reflects the beta estimates presented in the Synergies report;
- The second scenario presents the outcome if Aurizon Holdings and Global Ports Investments were excluded from the sample, and if Tradia Corporation were to be reinstated in the sample;
- The third scenario presents the outcome if Synergies' statistical significance filter is not applied; and
- The fourth scenario presents the outcomes if a simple 5% level of significance criterion is applied to all comparators.[75]

[73] Of course, stocks with high R-squared are more likely to pass the 5% threshold, all else equal.

[74] It is possible that some of these comparators would have been eliminated for other reasons were statistical significance not a requirement.

[75] This would require a t-statistic of 2.002 or higher for a sample size of 60.

Table 14: Comparator asset beta summary under different approaches to statistical significance

		1. SYNERGIES RULE	2. CORRECT ERRORS	3. IGNORE SIGNIFICANCE	4. USE 5% CRITERION
Rail	Mean	0.87	0.93	0.72	0.79
	Median	0.94	0.94	0.80	0.94
	Max	1.11	1.11	1.11	1.11
	Min	0.38	0.73	0.18	0.18
Ports	Mean	0.68	0.65	0.39	0.60
	Median	0.53	0.66	0.52	0.66
	Max	1.22	1.22	1.22	1.22
	Min	0.39	0.22	-0.22	0.22
Full	Average	0.76	0.76	0.48	0.68
	Median	0.79	0.80	0.73	0.79
	Max	1.22	1.22	1.22	1.22
	Min	0.38	0.22	-0.22	0.18

Source: Synergies and Frontier Economics

As can be seen, correcting the misclassification errors has little impact on results for averages and medians, with the exception of the median ports asset beta. Ignoring the significance criterion results in reducing average and asset betas by substantially, by 0.14 for the rail sample and by 0.29 for the ports sample, and by 0.28 for the full sample. Similarly, applying a 5% criterion reduces average asset betas by 0.08 for rail, ports and full samples.

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