COST EFFICIENCY STUDY OF THE BAHAMAS TELECOMMUNICATIONS COMPANY LIMITED (BTC)

CONSULTATION DOCUMENT

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UTILITIES REGULATION & COMPETITION AUTHORITY

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1 Introduction

The purpose of this consultation paper is twofold:

- to explain URCA's understanding of the current efficient cost levels and productivity levels of the Bahamas Telecommunications Company Limited (BTC); and
- to determine whether there is a need for any efficiency adjustments to be made to BTC's cost base, required for URCA's regulatory decision making.

As part of URCA's review of BTC's draft Reference Access and Interconnection Offer (RAIO), URCA determined that the charges contained in BTC's current RAIO are, in the most part, cost oriented.[1] However, as BTC's Accounting Separation (A/S) is undertaken on a historic cost accounting (HCA) basis, it may be the case that the resulting RAIO charges are not fully reflective of an efficient level of costs required to deliver these services.[2]

Given the above, URCA undertook, as part of the RAIO review, a very high-level assessment of BTC's draft RAIO charges and unit costs relative to a set of comparator operators.[3] This analysis indicated that BTC's unit costs and interconnection charges were above those of comparator operators considered in the analysis.[4] Given the indicative nature of these results, URCA concluded at the time, that further, more in-depth investigation of BTC's cost levels was required to ensure that, going forward, BTC's RAIO charges would only reflect efficient costs.[5]

Efficiency analysis is an ongoing exercise beneficial to both the licensee and the regulator and this will continue to be conducted by URCA and relevant licensees on a regular basis, as necessary.

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1 Most charges are based on BTC's 2009 accounting separation (A/S) results, with a few being determined based on international benchmarking or an internal costing exercise.

2 The A/S model allocates BTC's total historic costs to individual products and services. As these historic total costs need to reconcile back to BTC's statutory accounts, the A/S exercise does not remove from BTC's cost base any potential inefficiencies in BTC's operations and network structure.

3 As part of the draft RAIO review, two benchmarks were undertaken based on 2009 data: (i) a comparison of BTC's draft RAIO charges relative to interconnection charges from other regional and small island operators and (ii) a partial efficiency benchmark based on average cost per line and line per employee ratios.

4 This indicative analysis showed that BTC's total fixed and mobile connections per employee were 63% below the sample average and 30% below the Caribbean average. BTC's reported average costs per line was in excess of the sample and regional average, with only Bermuda Telecommunications Company and an aggregate value for Cable and Wireless other Caribbean operations reporting higher costs.

5 See, for example, page 51 of ECS 01/2011, available at URCA's website: www.urcabahamas.bs.

Efficiency adjustments are typically derived from an efficiency study, which can either seek to estimate the relative or absolute efficiency of the operator concerned. Estimating absolute efficiency would require a detailed bottom-up cost model of BTC's network, in order to compare this to the results of the top-down model. In contrast, a relative efficiency approach compares the efficiency of BTC with comparable operators, using operational and costing information on both BTC and the comparators. As part of its review of BTC's RAIO, URCA concluded that a relative efficiency study is likely to be most appropriate. This is because developing a detailed bottom-up cost model is a resource-intensive exercise and subject to a number of uncertainties.

There is a range of methodologies that are used to determine the relative efficiency of electronic communications operators. As such, the analysis presented in this consultation therefore compares BTC's financial and operational performance in 2010 relative to those exhibited by a range of comparator operators. The consultation also reviews recent trends in BTC's productivity and compares those to productivity trends in other sectors in The Bahamas and those of electronic communications operators elsewhere.

URCA is inviting comments and submissions from members of the public, licensees and other interested parties on this consultation document, using the questions posed by URCA throughout this document as a guide and reference to the contents of this document.

Upon conclusion of this consultation, URCA will issue a statement on the results of the consultation and next steps, taking into account responses received from stakeholders on this consultation document. The statement will also include a decision on whether, going forward, there is a need for any efficiency adjustments to RAIO charges based on BTC's A/S unit cost results (including the required level of such an adjustment, amongst others).

1.1 How to Respond to this Consultation

Responses to this consultation document should be submitted to URCA by 5:00 p.m. on 30 March 2012. Persons may send their written responses or comments to the Director of Policy and Regulation, either:

- by hand, to URCA's office at UBS Annex Building, East Bay Street, Nassau; or
- by mail to P.O. Box N-4860, Nassau, Bahamas; or
- by fax, to (242) 393-0153; or
- by email, to info@urcabahamas.bs.

URCA reserves the right to make all responses available to the public by posting responses online on its website at www.urcabahamas.bs. If a response is marked confidential, reasons should be given to facilitate evaluation by URCA of the request for confidentiality. URCA may publish or refrain from publishing any document or submission, at its sole discretion.

1.2 Structure of the Remainder of this Document

The remainder of this consultation document is structured as follows:

- Section 2 provides an overview of the rationale for undertaking efficiency studies both, in general and in the specific context of The Bahamas;
- Section 3 discusses common approaches to undertaking efficiency studies of electronic communications operators;
- Section 4 presents URCA's approach to assessing BTC's relative efficiency and its recent productivity trends;
- Section 5 sets out the preliminary results of the efficiency analysis; and
- Section 6 discusses potential regulatory implications based on the preliminary results.

2 Rationale for Efficiency Studies

2.1 Efficiency Review in Regulatory Decision-making

Efficiency reviews are regularly employed by regulatory authorities to support their price setting decisions. In fully competitive markets, prices are commonly equal to the efficient cost of providing these services and, in general, cost oriented prices are considered to maximize welfare. However, an operator's actual cost base may not always be considered to represent a reasonable cost base for setting regulated prices as these costs may include inefficiently incurred costs arising from potential current operational inefficiencies or past inefficiencies in investment. As such, regulatory authorities need to validate whether the costs reported by the regulated operator reflect efficiently incurred costs. As stated above, these assessments can be carried out by either undertaking a detailed 'bottom-up' assessment of the operator's cost base (often referred to as an 'absolute' efficiency assessment) or by comparing the reported costs to a group of comparator operators (i.e., by assessing its 'relative' efficiency). Details on different approaches to efficiency studies are discussed in Section 3.2.

In cases where following such an efficiency study there is reasonable certainty that costs are above an efficient level, the regulatory authority may apply efficiency adjustments to the operator's observed cost base or unit costs to ensure that the resulting regulated charges only reflect efficiently incurred costs. As such, the main outputs of efficiency studies are operator-specific efficiency adjustment factors, which help inform regulatory pricing decisions, such as wholesale or retail price setting decisions.[6]

2.2 Efficiency Reviews in the Context of The Bahamas

As part of its SMP Final Decision, URCA has imposed a set of regulatory requirements on BTC including, amongst others:

(i) the preparation of separated accounts,

(ii) the publication of a reference access and interconnection offer (RAIO), and

(iii) offering interconnection on a cost oriented basis.[7]

URCA's Access and Interconnection Guidelines further make reference to the fact that cost oriented interconnection charges should only reflect efficiently incurred

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6 It is important to note that efficiency studies do not determine any regulated prices per se. Instead they aim to inform the need and level of efficiency adjustment factors to be considered when determining efficient, cost-oriented prices from a top-down cost study.

7 ECS 11/2010, available at URCA's website: www.urcabahamas.bs.

costs of providing these services.[8] In addition, BTC's fixed and mobile retail voice services are subject to retail price regulation; price changes require prior approval by URCA, based on its Retail Pricing Rules.[9]

In URCA's January 2011 Final Decision on BTC's draft RAIO (ECS 01/2011) URCA concluded that a more in-depth analysis of BTC's cost levels was required so as to ensure that, going forward, BTC's RAIO charges would reflect efficient costs.[10]

Further, URCA notes that as part of Cable and Wireless Communications' (CWC) recent acquisition of a 51% share of BTC, CWC has written-down some of BTC's fixed asset values due to the "obsolete" nature of much equipment and technology purchased by BTC over recent years.[11] This appears to support the need, at least prior to the write-down taking effect in BTC's 2011 separated accounts, to make adjustments to BTC's cost base in order to ensure that any cost oriented charges reflect the costs that would be incurred by an efficient operator in The Bahamas.[12]

In addition to ensuring that interconnection rates are reflective of efficiently incurred cost, efficiency considerations may also become important in forward-looking (retail) price controls.

Given the above, URCA has undertaken an efficiency study of BTC, taking into account:

(i) BTC's relative efficiency performance, and

(ii) BTC's recent productivity trends.[13]

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8 ECS 14/2010, available at URCA's website: www.urcabahamas.bs.

9 ECS 15/2010, available at URCA's website: www.urcabahamas.bs.

10 See, for example, page 51 of ECS 01/2011, available at URCA's website: www.urcabahamas.bs.

11 An article published by The Tribune newspaper of The Bahamas on 26 May 2011 reported on statements made by CWC executives during a recent investors' presentation that could impact on the reporting of BTC's financial performance in its statutory accounts. According to the article, CWC has written-down the value of BTC fixed assets from a book value of B$384 million to B$259 million as at the acquisition date of 6 April 2011. In addition to the write-down on fixed assets, write-downs have also been recorded on the value of some BTC current assets, although the value of customer relationships and contracts, and trademarks, has been increased. Taken together, this has resulted in a write-down of BTC's total book value from B$401 million to B$273 million. CWC is quoted in the article as relating the write-downs to the amount of obsolete assets in BTC's network and inventories.

12 Efficiency adjustments may still be required after the write-down has taken effect. This is because the write down will not affect directly BTC's operating costs. However, it is likely to be necessary to update any efficiency adjustment factor at that time.

13 Efficiency studies can either seek to estimate the relative or absolute efficiency of the operator concerned. Estimating absolute efficiency would require a detailed bottom-up cost model of BTC's network in order to compare this to the results of the top-down model. In contrast, a relative efficiency approach compares the efficiency of BTC with comparable operators, using

Consultation Question 1:

Do you agree with URCA's rationale for investigating BTC's cost efficiency? Please detail your response in full.

operational and costing information on both BTC and the comparators. In its Final Decision on BTC's RAIO, URCA stated its preference for a relative efficiency analysis.

3 Common Approaches to Relative Efficiency Studies

3.1 Assessing BTC's Relative Efficiency

Utility regulation aims to proxy the outcome of competitive markets and therefore seeks to ensure that regulated prices are based on efficient costs. In this context, regulatory authorities will consider achieving two types of efficiency:

- Productive efficiency, which relates to an efficient use of economic resources so that production takes place at minimum cost (i.e., maximum output from least input).
- Allocative efficiency, which occurs when resources are allocated across different products in a way that maximizes the net benefit attained by customers through the consumption of such products.

Furthermore, in the longer run, price regulation also needs to take dynamic efficiency into account. Dynamic efficiency occurs when productive and allocative efficiency is maximized over time. This concept especially takes investment and innovations into account.

3.2 Common Approaches

Determining the efficiency of an operator requires a review of its costs. As part of a relative efficiency analysis, this is undertaken by comparing the cost of that operator with the costs observed for other operators. However, any observed differences in costs may be caused by many factors. Thus, as part of any relative efficiency analysis it is important to isolate, as much as possible, the impact of factors which affect the costs of the operator and are under the control of management,[14] from those which the operator has no influence over.[15]

Separating these factors requires the use of quantitative techniques, which in turn requires decisions on two dimensions:

- whether to adopt a total factor or partial efficiency approach; and
- whether to undertake a parametric or non-parametric assessment.

Each of these dimensions is further discussed below.

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[14] Endogenous cost drivers can include, amongst others, operational decisions, number of staff, and its choice of technology.

[15] Exogenous cost drivers can include, for example, an operator's geographic, topographic or demographic operating environment.

3.2.1 Total Factor vs. Partial Efficiency Approach

In theory, assessing an operator's efficiency should be assessed based on a total factor productivity approach, as this approach aims to take into account the full range of inputs used and outputs produced by the operator. However, due to data availability this is not always possible. In contrast, a partial efficiency approach aims to partly overcome this likely limitation by focusing on specific input-output ratios. Both approaches are further explained below.

Total Factor Productivity Approach

An operator uses labour and capital inputs to produce a number of different outputs, such as retail and wholesale services (for example, connection services, call services and data services). As such, it is desirable to assess the operator's overall efficiency level by taking into account the full range of inputs used and outputs produced by the operator. A total factor productivity (TFP) approach attempts to model the complete relationship between the level of inputs and the total output of the operator.

TFP is commonly considered to be the efficiency with which inputs are used to generate outputs. For example, if two operators use the same amount of inputs but achieve different levels of output it is assumed that these differences in output are due to differences in TFP. As such, the relative level of TFP is determined by how efficiently and intensely the inputs are used to generate outputs. In the context of a relative efficiency analysis, the TFP approach is commonly implemented based on a cross-sectional TFP analysis.[16] Under this approach, overall productivity is modelled as the relationship between total inputs and total outputs for each operator. By comparing the relative productivity of each operator against the operator that appears to have the highest productivity, the level of inefficiency of the operators of interest can be determined. The analysis is commonly based on a single year (i.e., it only assesses static productivity). However, it can also be undertaken based on a multi-year time period as this may make the results more robust. Undertaking a cross-sectional TFP analysis requires a significant amount of operational and financial data of different operators in order to model accurately the complete relationship between inputs and outputs.[17]

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16 An alternative approach is to compare changes in the aggregate level of inputs over time against changes in the aggregate level of outputs over time for a single operator (commonly, referred to a time-series TFP analysis). This approach only provides information on the productivity movements of the operator over time. In turn, this may provide a guide to the expected future rate of productivity gains, which is often used in the context of price cap regulation. It does not, however, enable an assessment of the operator's level of efficiency at a given point in time.

17 Most comparative TFP analysis for communication operators relies on financial and operational data on US operators (Local Exchange Carriers), published by the U.S. Federal Communications Commission.

Partial Factor Productivity Approach

An alternative approach is to determine an operator's efficiency based on partial productivity ratios. This approach measures relationships between key inputs and key outputs. For example, common productivity ratios in the communications sector include costs per line and lines per employee.

This approach is attractive due to its practicality, transparency and widely understood outputs, and requires less information than a TFP approach.

Some regulatory authorities have also undertaken a more detailed review of partial cost ratios of regulated operators (such as average total staff cost per employee and average total IT costs per employee) and compared these to similar ratios in other industries or operators in other jurisdictions. Although this approach allows for a more rigorous assessment of the operator's (operating) costs, it is commonly constrained by the availability of the data for the comparator companies.

Summary overview – TFP vs. Partial Factor Productivity

The main advantages and disadvantages of the total and partial factor productivity approaches are summarised in Table 1 below.

Table 1: Main Advantages/Disadvantages of TFP vs. Partial Factor Productivity Approaches

	Main advantages	Main disadvantages
Cross sectional Total Factor Productivity Analysis	o Approach based on sound economic theory and available empirical evidence o Aims to measure overall performance of operators	o Significant data requirements for both benchmarked and comparator operators o Data availability limits set of comparator operators (often only US carrier data are available) o Requires determining the correct production function that reflects the actual relationship between input and output o Limitations in the context of multi-product companies, such as communications operators
Partial Factor Productivity	o Commonly applied approach, based on well-defined methodologies o Requires less input data from operators (relative to comparative TFP analysis)	o Concept does not necessarily cover overall productivity of operators including any trade-offs between inputs

3.2.2 Parametric vs. Non-parametric Approaches

There are different ways to determine the relative efficiency of communications operators, as follows:

- o parametric (or econometric) analysis; and
- o non-parametric (or benchmarking) analysis.

Parametric Analysis

A parametric (or econometric) approach aims to test and measure the relationship between a dependent variable (i.e., the operator's costs) and several independent variables (i.e., its outputs and other likely cost drivers, such as operational, geographic and demographic variables, and regulatory obligations). These independent variables commonly comprise both: (i) factors that are under the control of the operator (such as, number of staff and coverage level); and (ii) exogenous factors (such as, demographic characteristics or economic variables).

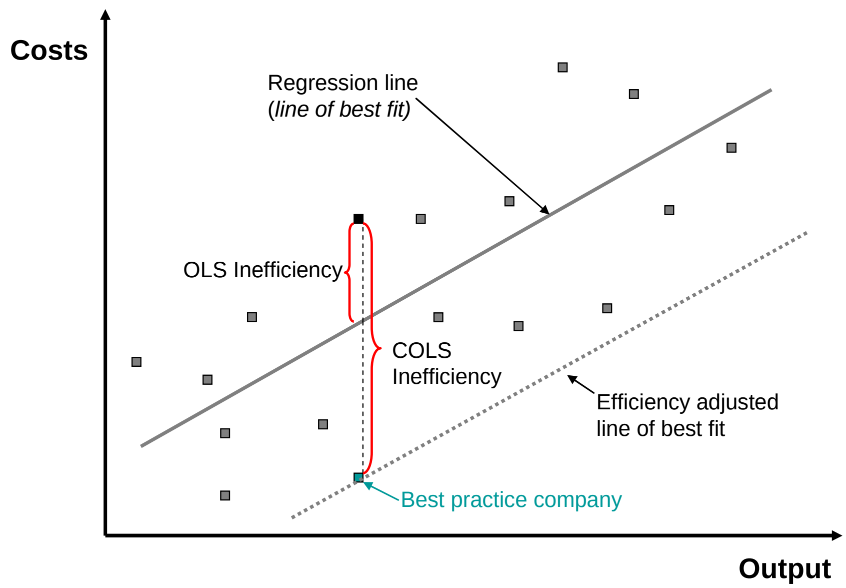
There are several econometric techniques available for carrying out parametric efficiency analysis, varying in the degree of complexity and resulting efficiency estimates. In particular:

- **Ordinary Least Squares (OLS).** This is the most typical, and basic econometric method. Under this approach, a 'line of best fit' is obtained which minimises the (squared) distance between it and the actual observations (see Figure 1 below).

- **Corrected Ordinary Least Squares (COLS).** Under a COLS approach a best practice benchmark is developed through a parallel downward shift of the OLS line of best fit so that the curve passes through the point representing the operator with the lowest average cost (given the output combination). This leads to larger inefficiency values than under the OLS approach. Figure 1 below provides an illustrative example of how efficiency is measured under regression analysis (OLS and COLS).

- **Stochastic Frontier Analysis (SFA).** The more recent stochastic frontier approach to efficiency measurement recognises that not all of the difference between an operator's actual costs and the line of best fit is due to inefficiency. Some of it may be explained by purely random or stochastic events (such as, unusual weather conditions or unexpected changes in demand) or measurement errors. Consequently, the error component in the model is made up of two elements - genuine inefficiency and random fluctuations.

Figure 1: Benchmarking using OLS and COLS Regression Analysis



Econometric analysis can be subject to hypothesis testing to determine the robustness of results. However, in the electronic communications industry, parametric techniques are severely limited by the lack of granular data. As the underlying cost and operational data for each comparator operator has to commonly be extracted from publicly available sources, the availability might be limited. This may result in not being able to meet the minimum sample requirements for econometric analysis.

Non-parametric Analysis

An alternative approach to determining the relative efficiency of a communications operator is to undertake benchmarking analyses. These non-parametric approaches can be divided into (i) 'standard' benchmarking techniques, and (ii) adjusted benchmarking analyses.

Standard Benchmarking Analysis

Benchmarking is a useful tool for reviewing the relative performance of an operator by comparing its required inputs to produce a given level of outputs with those used by other operators (in that country or across several countries). The resulting productivity figures for each operator can then be used to assess the efficiency of that operator compared to others.

Benchmarking can either be undertaken on a basis of a single indicator (e.g., lines per employee or costs per line) or by taking several indicators into account.

- **Single Indicator Benchmarking**. Benchmarking is a particularly practical approach to measuring relative efficiency and is a widely used tool in the context of communications regulation. It can be undertaken on a national or international basis. International benchmarks are useful when there are no comparable national operators within the country as is currently the case in The Bahamas.
- **Multiple Indicator Benchmarking**. The Data Envelopment Analysis (DEA) is a generalisation of the single indicator benchmarking. It is ideally applied to evaluate production processes where several inputs determine multiple outputs, as a single benchmarking approach would not be sufficient to reflect all these different effects. The DEA program instead identifies efficient operators for each partial output-input dimension. A linear combination is then used to determine an efficiency frontier from these 'best-practice' operators. Each operator is finally compared to a virtual operator on the efficiency frontier, which has similar structural conditions (i.e., a point on the frontier that is closest to the operator). The inefficiency of that operator is then defined by the distance to the efficiency frontier.

Despite its practical benefits, undertaking a standard benchmarking analysis also has a number of limitations.[18] To overcome some of the limitations, more sophisticated benchmarking approaches, such as adjusted benchmarking analysis, have been developed. These approaches attempt to control for the exogenously driven differences between operators included in the sample by adjusting the actual incurred costs of each comparator operator and, thus, they are likely to provide more informative results.

Adjusted Benchmarking

Recognising the likely limitations of a standard benchmarking approach outlined above has led to the development of the adjusted benchmarking approach. This approach attempts to control for some of the exogenously driven differences between operators included in the sample by adjusting the incurred costs of each comparator operator. It is thus likely to provide more informative results. As such, it resembles a blended approach of the standard benchmarking analysis and econometric analysis.

The adjusted benchmark approach is performed in two steps:

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[18] For example, a commonly recognised limitation of benchmarking is that it requires a homogeneous sample in order to be able to attribute any observed performance differences within the sample to the operators (rather than being externally driven). In heterogeneous samples, it is difficult to interpret any observed performances differences within the sample as these may be driven by exogenous factors.

- **Determination of required adjustment factors.** As a first step, a regression analysis is undertaken to determine the required adjustment factors for each operator. The regression estimates the statistical relationship, if any, between the costs of the operators within the sample and exogenous factors over which an operator has no influence.[19] Examples for these independent variables include, amongst others, variables covering the geographic, economic and environmental differences across the operators under consideration. Based on the established statistical relationship between the costs and the relevant cost drivers, an operator-specific adjustment factor for each of these cost drivers is calculated, reflecting how much the cost of the operators need to be adjusted to control for the observed differences in operating environments relative to the benchmarked operator.[20]
- **Determination of adjusted cost measures.** Once the relevant adjustment factors have been identified, they are applied to the unadjusted costs of each operator. The resulting adjusted cost measures therefore reflect the cost that each comparator operator would have faced, if it were to operate in the same environment as the benchmarked operator. ***As such, only the costs of the comparator operators are adjusted, whereas the cost of the benchmarked operator(s) remains unchanged*.**[21] The aim is therefore to develop a comparable set of costs or performance measures that takes account of any operational differences between the operators.

Although the adjusted benchmarking approach seeks to overcome some of the main shortcomings of a conventional benchmarking approach (and maintaining all its advantages), there are certain disadvantages associated with such an approach. As for the parametric analysis, a potential disadvantage associated with an adjusted benchmarking approach is the minimum sample of comparator operators that is required for the regression analysis. As the underlying cost and operational data for each comparator operator has to be commonly extracted from publicly available sources, the availability might be limited. This is especially relevant in The Bahamas as the number of reasonable comparator operators in similar operational environments with publicly available information is limited. Furthermore, the aim of

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19 Regression analysis allows to (i) test whether there is any statistically significant relationship between any dependent variable and the independent variable and, if so, (ii) to estimate the size and direction of this relationship. As such, it allows determining whether a particular element has a statistically significant impact on the operators' costs.

20 Note that in some cases the benchmarked operator's cost may also require an adjustment to control for a particular exogenous factor affecting its operational performance. For example, if the benchmarked operator was located in an archipelago and this was found to have a statistically significant impact on the cost of operators within the benchmarking sample, then any resulting adjustment factor would also have to apply to the benchmarked operator.

21 With the exception of the situation set out in the previous footnote.

the estimation is to try to find a relationship between potential cost drivers of operators. However, some of these potential cost drivers are not easily captured in a variable, such as the regulatory environment of operators. As a result, some of these potential cost drivers cannot be easily estimated and thus, controlled for in the analysis.

Summary Overview

The main advantages and disadvantages associated with all benchmarking and econometric approaches are set out in Table 2 below.

Table 2: Main Advantages/Disadvantages of Different (parametric and non-parametric) Approaches to Measuring Relative Efficiency

Approach	Main advantages	Main disadvantages
Ordinary or Corrected Least Squares (OLS, COLS)	o Allows for simultaneous significance testing and estimation of the impact of endogenous and exogenous cost drivers	o Estimations need to be founded on an underlying econometric model[22] o Minimum sample requirements apply (i.e., to generate robust results a data set of sufficient size is required)
Stochastic Frontier Analysis (SFA)	o Takes into account that the difference between an operator's actual costs and the line of best fit is not necessarily due to inefficiency by taking random or stochastic events or measurement errors into account.	o Relies on a strong statistical assumption on the distribution of the error terms, which is difficult to verify and may be rejected by the data o As for OLS and COLS, this approach requires a minimum sample size
Standard Benchmarking	o An easy to apply approach which can provide indicative insights into the relative performance of an operator (based on partial performance ratios) o Transparent approach, based on publicly available information for comparator operators o Tested and applied in utility regulation	o Requires a homogeneous sample in order to be able to attribute any observed performance differences within the sample to the operators (rather than being externally driven) o In heterogeneous samples, it is difficult to interpret any observed performances differences within the sample as these may be driven by exogenous factors
Data Envelopment Analysis (DEA)	o Enhanced benchmarking techniques which allows to benchmark production processes were several inputs determine multiple outputs o DEA thereby also shows by how much less efficient firms need to decrease their input (or increase their outputs) in order to also be regarded as efficient o Transparent approach, based on publicly available information for comparator operators. Again tested and applied in utility regulation	o Can also not control for exogenously driven differences between operators o Required financial and operator data may not always be available

22 OLS and COLS models can test whether a hypothesis generated from a theoretical model can be rejected or confirmed. For this, a theoretically based hypothesis is necessary.

Adjusted Benchmarking	o Advanced benchmarking approach aiming to control for exogenous cost drivers in heterogeneous benchmarking samples o Transparent approach, based on publicly available information for comparator operators	o Unlikely to control for all exogenous cost drivers (as some observed performance differences may be driven by exogenous factors) o As for other approaches, the required financial and operator data may not always be available

3.3 URCA’s Preferred Approach

In theory, relative efficiency should be measured using TFP as this aims to capture all inputs utilised by BTC to deliver its entire range of services offered. In The Bahamas, BTC is the only vertically integrated operator of fixed and mobile networks and services and any comparison would therefore have to be on an international basis. In this context the use of TFP approaches becomes challenging, as the required operational and financial information for a suitable set of comparator operators is not publicly available.[23] Furthermore, the available accounting data from different jurisdictions may need to be “normalised” and made comparable, prior to being used in any form of comparative analysis.

Based on the advantages and disadvantages of each available approach and taking into account the limited data available, an adjusted benchmarking analysis approach was adopted for both BTC’s fixed network and mobile network efficiency analyses. This approach is further described in Section 4, followed by an overview of the preliminary results of the efficiency study in Section 5.

Table 3: Summary Overview of Approach for the Relative Efficiency Study

Business Segment	Approach	Cost/Output Measure
BTC’s Fixed Business	Adjusted Benchmarking Analysis	Average cost per fixed line
BTC’s Mobile Business	Adjusted benchmarking analysis	Average cost per minute
BTC’s Fixed and Mobile Business	Adjusted benchmarking analysis	Total (fixed and mobile) connections per employee

Consultation Question 2:

Do you agree with URCA’s preferred approach for the efficiency study, taking into account URCA’s rationale for the study and the current data availability? Please detail your response in full.

23 A common constraint to any international relative efficiency analysis is the financial and operational data availability for suitable comparator companies. An efficiency analysis often rely on statutory accounting information. This requires the accounts to be publicly available, as well as the required information to be presented in a sufficiently disaggregated format. The cost and output information needs to be available on a segment level for multiple service operators (i.e., the fixed network and the mobile network) and on a country level in case of multi-national operators.

4 Assessing BTC's Cost Efficiency

This Section sets out URCA's approach to the review of BTC's efficiency. This is undertaken in two steps. First the approach for the relative efficiency analysis of BTC's fixed and mobile business segments is presented. This is followed by an overview of the approach to reviewing BTC's recent productivity trends.

4.1 Assessment of BTC's Relative Efficiency

Having reviewed the merits of each of the common approaches for conducting relative efficiency analyses and the availability of the data required to undertake each approach, URCA has adopted an adjusted benchmarking approach (see Section 3.3 above). Separate relative efficiency benchmarks were conducted for BTC's fixed and mobile businesses.

Undertaking an adjusted benchmarking analysis involves the five main analysis steps set out in Figure 2.

Figure 2: Adjusted Benchmarking Analysis Steps

Each analysis step is discussed in more detail below, providing an overview of the analysis undertaken within each step.

4.1.1 Step 1: Determining the Benchmarking Sample

As an initial step, URCA identified the set of comparator operators against which BTC's performance would be assessed. **URCA reiterates that this process was partly determined by the availability of the required data for each operator. In particular, the sample selection process was constrained by two issues: (i) many operators do not publish statutory accounts (which are generally the only source of information for financial data) and/or (ii) the published accounts are not sufficiently disaggregated (i.e., providing separate financial information for each country and business segment of the operator).**[24]

The resulting benchmarking samples for the fixed and mobile network operator efficiency analysis (excluding BTC itself) are presented in Table 4 below.

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[24] In particular, many operators are active in more than one jurisdiction and/or more than one business segment (i.e., fixed voice services, mobile voice services, data services and/or cable TV services). However, their published statutory accounts do not necessarily provide financial information disaggregated into each of these geographic and/or business units.

Table 4: List of Comparator Operators for BTC's Fixed and Mobile Business Segments

Fixed Operator Unit Cost Analysis	Mobile Operator Unit Cost Analysis	Total Connections per Employee Analysis
BTC-M3, Bermuda	BTC-M3, Bermuda	BTC-M3, Bermuda
C&W Barbados	C&W Jamaica	C&W Barbados
C&W Jamaica	Digitel Telecom, Philippines	C&W – Caribbean[25]
Digitel Telecom, Philippines	Indosat, Indonesia	C&W Macau
Indosat, Indonesia	O2 Telefonica, Czech Rep	C&W Monaco & Islands
Invitel, Hungary	Slovak Telekom	C&W Panama
Jordan Telecom	Telecom Argentina	Jordan Telecom
Lattelecom , Latvia	T-Hrvatski, Croatia	O2 Telefonica, Czech Rep
O2 Telefonica, Czech Rep	TP SA, Poland	Slovak Telekom
OTE, Greece	Vivacom, Bulgaria	Telecom Argentina
Slovak Telekom		T-Hrvatski, Croatia
Telecom Argentina		TP SA, Poland
Telmex, Mexico		Vivacom, Bulgaria
TEO, Lithuania		
T-Hrvatski, Croatia		
TP SA, Poland		
Vivacom, Bulgaria		

4.1.2 Step 2: Defining Suitable Output and Cost Measures

The adjusted efficiency benchmarking is undertaken on the basis of cost efficiency and labour productivity measures. The former compares the average costs per unit of output produced (i.e., average cost per connection or average costs per minute) across operators and the latter compares total units of output per unit of labour (i.e., number of lines per employee).

There are, in theory, several output and cost measures applicable in the context of communications service provision. However, in practice, the choice is determined by data availability for each measure and the identification of the output measure that can be considered the main driver of cost.

Cost Measures

A suitable cost measure should reflect the total level of costs incurred by operators in providing their services. It must further be publicly available on a reliable basis for all operators within the benchmarking sample.

25 Cable and Wireless Group only publish aggregated financial and operational information across all its Caribbean operations. Although three of its Caribbean subsidiaries (i.e., Jamaica, Barbados and St Kitts & Nevis) also publish annual accounts separately, only that of C&W Barbados contains employment information. As such, URCA has included both C&W Barbados and C&W Caribbean into the lines per employee benchmarking analysis.

For the two unit cost efficiency analyses, URCA has developed a total cost measure based on the following three components.[26]

- **Operating expenditure** is a key component of any operator's total cost base. Operating costs are commonly available from published statutory accounts.
- **Depreciation** measures the costs of using tangible assets over several periods. Depreciation ensures that these costs are allocated to periods in which the tangible assets are used. Depreciation costs are commonly available from published statutory accounts.
- **Return on Capital Employed (ROCE)** captures the required return on any investment made independently of the financial structure of the operators and should result in the measured cost being invariant under build or buy decisions. Note that the ROCE is not readily available in financial accounts. As such, it is necessary to derive it based on the weighted average cost of capital (WACC) and the net assets of each operator as stated in the balance sheet of each operator's financial accounts. All but the WACC is commonly available in financial accounts. To ensure consistency,[27] the WACC values for BTC's fixed and mobile businesses, as determined by URCA,[28] have been applied across all operators within the sample.

Given the above, the total costs measure underlying both unit cost efficiency benchmarking analyses is based on the following formula:

Total costs = Operating costs + Depreciation + WACC * Net Assets

For BTC's fixed and mobile businesses, the relevant cost measures were informed by the disaggregated data contained in its A/S submissions for 2009 and 2010. For the efficiency study, URCA has only considered the cost directly attributable to either BTC's fixed or mobile businesses. Further, as part of its sensitivity checks, URCA has tested for the impact of CWC's recently announced asset write-downs. However, taking these asset write-downs into account had no impact on the main conclusions from the study (see next Section).

The cost data for all comparator operators is sourced from their statutory accounts, converted into Bahamian Dollars, based on year end exchange rates.

Once the total cost measure has been determined, it is necessary to define the relevant output measures for both the unit cost calculations as well as the labour productivity analysis.

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26 Note that the above cost measure excludes cost items, such as taxes, which are typically considered to be outside the control of the firm and therefore do not relate to efficiency. It also excludes exceptional items that do not represent the underlying trend in operating costs.

27 Applying the same WACC across all operators within the benchmarking sample helps to control for underlying differences in risk premia across countries which are not within the control of the operators.

28 ECS 23/2009, available on URCA's website at www.urcabahmas.bs. Note that the actual benchmarking analysis is undertaken based on BTC's 2010 A/S submission.

Output Measures

There are several output measures that could form the basis for the benchmarking analysis including, amongst others, total connections, total voice or data traffic, total leased lines or network coverage.

After careful deliberation and taking data availability into account, URCA has decided to undertake the analysis based on the following three cost and output ratios:

- the number of fixed voice connections as the main output measure for the fixed operator analysis;[29]
- total (annual) traffic volumes as the main output measure for the mobile operator analysis; [30] and
- the number of fixed and mobile connections per employee as the main output measure for the lines per employee analysis.[31]

All three output measures reflect that most of the costs of fixed and mobile operators are related to the access network, for which the key cost drivers are the number of lines in fixed networks and call traffic for mobile networks.

4.1.3 Step 3: Identification of Cost Adjustments

The objective of the cost adjustment process is to account for any differences in the observed cost of the operators within the sample that are not attributable to the operators themselves (i.e., are caused by exogenous factors such as their operating environment). Ideally, this process should control for all exogenous cost drivers (with all remaining differences in unit costs or output measures being attributable to operator's relative efficiency levels). However, in practice, the possible adjustments are dependent on the availability of the information required to undertake the adjustment process. Below, URCA sets out the potential cost drivers considered within the efficiency analysis.

Further, prior to applying any adjustments, the set of potential cost drivers need to be tested for their relevance to the particular set of operators considered in the analysis. This can be achieved with the help of regression analysis, which allows

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[29] Total fixed access lines is a key output for fixed network operators, which is readily available from publicly available sources (such as, the operators' financial accounts, propriety third party databases and other publicly available data sources). This is not consistently the case for the other fixed network output measures.

[30] As most mobile networks are dimensioned to meet expected (peak) demand, annual traffic is a key cost driver of mobile network operators.

[31] URCA recognises that lines per employee analysis commonly focus on fixed networks only. However, it was not possible to review total fixed lines per employee across operators as BTC is not able to provide disaggregated staff data for its fixed and mobile businesses. As such, URCA has conducted this analysis for joint fixed and mobile operators only (i.e., by using a total fixed and mobile connections per employee measure).

testing for both the statistical significance of any potential driver and the direction and size of any relationship within the sample. This process is also further discussed below.

Cost drivers considered within the benchmarking analysis

Table 5 below provides an overview of the potential adjustment factors URCA has considered as part of the three benchmarking analyses. These represent URCA's view of likely cost drivers for which data is available for all operators (or countries) within the benchmarking samples.

Table 5: Potential Cost Adjustments Considered within the Efficiency Study

Potential cost driver	Potential cost driver
Total population[32]	Fixed and mobile penetration rates
Population density	Geography of the country (i.e., whether it is an archipelago)
GDP per capita	Land area
Level of urbanisation	
Fixed & mobile operator	

Relevant Adjustment Factors for each Benchmarking Sample

As a next step, URCA tested the statistical significance of each potential cost or output driver discussed above. This was undertaken separately for each of the three benchmarking samples. Testing the statistical significance and the resulting direction and size of any relationship is best undertaken with the help of regression analysis.[33]

Within its analysis, URCA has tested the statistical relationship of all the potential cost drivers listed in Table 5 above. This involved testing different combinations of potential dependent and independent variables and testing various functional forms of the cost and output regressions.[34] Based on the outcome of this process the best possible model specification for each of the three benchmarking samples was

32 Ideally this should reflect the network coverage of the relevant operator (as some operator's networks do not cover a country's entire population). However, network coverage data is not always available for all operators.

33 A regression analysis allows testing for the existence of any statistical relationship between operators' costs (i.e., as a 'dependent' variable) and a range of potential exogenous (and endogenous) cost drivers (referred to as 'independent' variables). As part of the analysis one can determine: (i) whether there is any statistical significant relationship between the cost measure and a potential cost driver; and if so, (ii) what the relevant size and direction of this relationship is (via the regression coefficient).

34 To ensure meeting minimum sample requirements for regression analysis and to increase the robustness of each estimation, the regression analysis was undertaken based on information for 2009 and 2010.

chosen. The results were statistically significant for some cost drivers and not statistically significant for others, as illustrated in Table 6 below. [35]

Table 6: Statistical Relevant Exogenous Cost Drivers[36]

Coefficient	Fixed Operator Unit Cost Analysis	Mobile Operator Unit Cost Analysis	Total Connections Per Employee Analysis
GDP p.c.[37]	Statistically significant***	Statistically significant***	*Not statistically significant*
Area[38]	*Not statistically significant*	Statistically significant*	Statistically significant***
Urbanisation[39]	*Not statistically significant*	Statistically significant***	Statistically significant***
Archipelago[40]	Statistically significant***	*Not statistically significant*	*Not statistically significant*

****** significant at a 1% level, ** significant at a 5% level, * significant at a 10% level*

4.1.4 Step 4: Deriving the Adjusted Total Costs and Output Measure

The adjusted cost measures for each operator are then derived by applying each of the relevant operator-specific adjustment factors to its unadjusted costs.[41] This is undertaken in three steps:

35 All remaining potential cost drivers were found not to be statistically significant in any of the three benchmarking samples.

36 Note that the 'archipelago' variable is a binary variable (i.e., all operators either report a "1" value if operating in an archipelago state and "0" value if not). As such, there is only a one-off adjustment applied to the average costs of the fixed operators in an archipelago state.

37 A higher GDP per capita will normally increase total operating costs (in particular, staff-related costs).

38 A country with a larger area will normally lower costs per unit of output due to economies of scale. However, the impact is linked to the underlying population density in that country.

39 In urban areas mobile site costs are often higher and require more cells due to traffic density for mobile networks. There are commonly two diverging effects of urbanisation on fixed network operators' costs: (i) higher population density in urban areas reduces the average cost per line, and (ii) the majority of fixed network infrastructure in urban areas requires underground cabling which is more expensive than aerial cabling. Overall, the former effect outweighs the latter within the benchmarking sample, as many jurisdictions within the sample do not require underground cabling in urban areas.

40 An archipelago environment will normally lead to higher cost per output unit due to the cost of submarine cabling.

41 Note that commonly only the cost measures of the comparator operators are adjusted to better reflect the operating environment in The Bahamas. However, in case of the fixed

1. For each cost driver and operator, the underlying percentage difference between the operator's country and The Bahamas is calculated.
2. The operator-specific adjustment factor is then derived by multiplying the estimated regression coefficient of the cost driver with the corresponding percentage difference to The Bahamas.[42]
3. A total adjustment factor for each operator is derived by adding up all individual, operator-specific adjustment factors calculated for each relevant cost driver.

The total adjustment factor for each operator is then applied to that operator's unadjusted average cost values.

This is further illustrated in the text box below.

operator benchmarking, BTC's costs were also adjusted. This is due to the fact that the 'archipelago' variable was identified as a significant cost driver. As such, BTC's and all other archipelago operators' costs were adjusted downwards to reflect the higher costs of operating in such an environment.

42 A small number of adjustment factors can have a very large impact on the costs. If required, a maximum and minimum cap of 100% is applied to ensure that no single adjustment factor has a too large of an impact on the adjusted cost of an operator (i.e., no single adjustment factor can trigger a change to the unadjusted cost value in excess of +/-100%).

Illustrative example of how the adjusted cost measures are derived

The benchmarking sample specific regression analysis helps to identify the set of statistical significant exogenous cost drivers. The regression coefficients further provide the direction and the size of the underlying impact on costs.

As stated above, the following (average) cost function was established for mobile operator sample:

Average Cost*Mobile***= a + b*(GDPpc) + c*(Area) + d *(Urbanization) + error**

Further assume that the following are the estimated regression coefficients: b=2.0; c=0.5 and d=1.2.

As a first step, for each cost driver and operator, the underlying percentage difference between the operator's country and The Bahamas is calculated. For example:

$$\textbf{Difference}\textit{Country A} = \frac{(\text{GDPpc}_{\textit{Bahamas}} - \text{GDPpc}_{\textit{Country A}})}{\text{GDPpc}_{\textit{Country A}}}$$

Assume that the GDP per capita in The Bahamas was B$110 and that of Country A B$ 100. As such, the difference between the two values is: (110-100)/100 = 10%.

As a second step, the operator-specific adjustment factor is derived by multiplying the regression coefficient of the cost driver with the corresponding percentage difference to The Bahamas. For example:

GDPpc adjustment factor Country A **= Coefficient *GDPpc* *(Difference** Country A**)**

Given our assumptions above, the GDP per capita adjustment factor for Country A is: 1.2 10% = 12%.*

The total adjustment factor for each operator is then derived by adding up all individual, operator-specific adjustment factors calculated for each relevant cost driver

Total adj. factor Country A**=(GDP adj. factor** Country A**) + (Area adj. factor** Country A**) + (Urbanisation adj. factor** Country A **)**

In addition to the above, assume that the area adjustment factor for Country A is -20%, the urbanisation adjustment factor is 10%. This results in a total adjustment factor for Country A of: (12%) + (-20%) + (10%) = 2%.

This total adjustment factor is then applied to the operator in Country A unadjusted costs.

Adj. Average cost = [**1 + Total adj. factor] * Average Cost**

*Assume that the (unadjusted) average costs for operator in Country A is BSD 1.00 per minute. This results in a total adjustment factor for operator in Country A of: (1 + 2%)*1.00 = B$1.02 per min.*

Each adjustment factor may either increase or decrease the total cost of the benchmark operator so that the resulting adjusted total costs of that operator are more reflective of the cost that it would incur in an operating environment as faced by BTC.

4.1.5 Step 5: Deriving Relative Efficiency of BTC

As a final step, the relative cost and operational performance of BTC are assessed. This is undertaken by measuring BTC's average cost levels and lines per employee, relative to those exhibited by the relevant set of comparator operators. This requires two further steps:

- **Defining a target level** for each sample against which BTC's performance will be assessed. Defining the target level determines the strictness of the efficiency analysis. Common efficiency target levels are, amongst others, the median, upper quartile, quantile or decile cost across all comparator operators.
- **Determining BTC's current performance** relative to that target level (i.e., the observed difference between its performance and that exhibited by the defined operator). This will ultimately determine whether any efficiency adjustments are required for BTC and, if so, the size of the adjustments. URCA would like to stress that if BTC were found to outperform its target level, no efficiency adjustment factors would be applied to it.

Although the chosen approach aims to control for as many external cost differences as possible, URCA recognises that the efficiency analysis is constrained by the underlying data availability. As such, some of the observed differences in the (adjusted) cost/output measures are likely to not be reflective of BTC's relative efficiency but instead be driven by external cost drivers not fully being controlled for within the analyses. Recognizing this potential limitation, URCA will endeavour to ensure that any efficiency adjustments applied to BTC represent a conservative measure of its relative inefficiency. This can be achieved by (i) deriving a conservative measure of BTC's total costs; and (ii) setting a less strict efficiency target level for it.

4.2 Review of BTC's Recent Productivity Trends

In addition to assessing BTC's relative productivity, the efficiency study aims to review the trends in BTC's productivity over time. This review contains three elements.

- **BTC Trend Analysis.** As an initial step, the productivity improvements achieved by BTC over the period 2006 to 2009 are reviewed. This is undertaken on two dimensions: (i) BTC's operational performance; and (ii) its average costs. In particular:[43]
  - Total fixed and mobile connections per employee; and
  - Total average cost per (fixed and mobile) connection.

[43] Ideally URCA would also want to review traffic related measures, such as the total average cost per minute. However, URCA understands that the required historic traffic data for BTC is not readily available as BTC has, amongst others, not been measuring intra-island call traffic since these calls are not metered (i.e., are provided free of charge to retail customers).

- **National Benchmarking.** The recent changes in BTC's productivity are then compared to those observed in selected economic sectors or industries within The Bahamas over the same time period. These productivity measures are based on information contained in the National Accounts.[44]
- **International Benchmarking.** BTC's productivity trends are further compared to those exhibited in other jurisdictions. Given data availability, this benchmarking is undertaken for the total fixed and mobile connections per employee measure only.[45]

Consultation Question 3:

Do you agree with URCA's adopted approach for assessing:

- BTC's relative efficiency; and
- its recent productivity trends?

Please detail your response in full.

44 For each sector in the Bahamian economy, a productivity measure was defined as the gross sector output (at market value) per employee, sourced from the National Accounts. The cumulative change in this measure over the four year period between 2006 and 2009 is then compared to BTC's performance.

45 The data for the comparator sample is sourced from the ITU Database.

5 Preliminary Results

Below URCA sets out the preliminary results of the efficiency study, based on the approach set out in the previous Section. First, the relative efficiency analyses results are presented in the following order: (i) fixed operator benchmarking analysis, (ii) mobile operator benchmarking analysis, and (iii) lines per employee benchmarking analysis. The Section concludes with a discussion of BTC's recent productivity trends and those experienced in other Bahamian sectors and by communications operators elsewhere.

5.1 Fixed Operator Analysis

As discussed in Section 4.1, the fixed operator benchmarking analysis compares BTC's average cost per fixed access line to those exhibited by a range of comparator operators. This is undertaken on an unadjusted basis and by controlling for underlying differences in costs due to different operating environments.

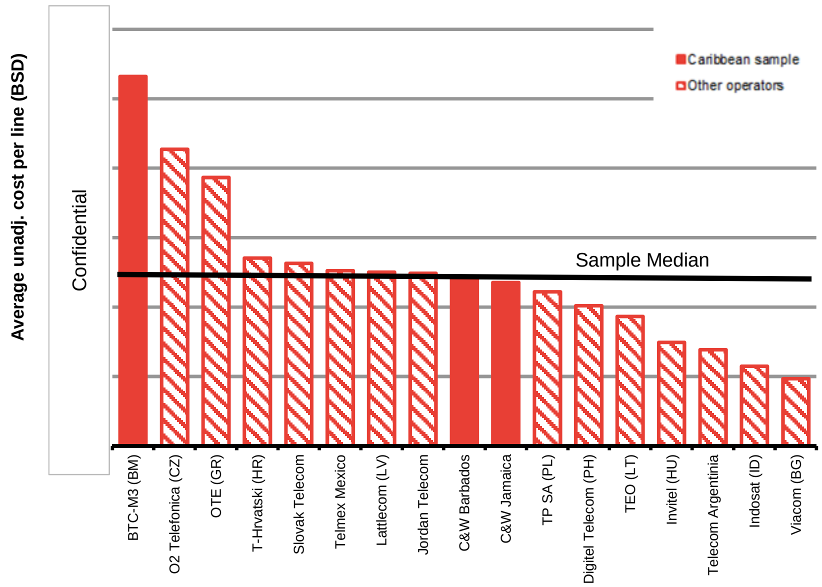
As part of this analysis, URCA undertook several sensitivity checks. In particular, URCA has tested for the impact of CWC's recently announced asset write-downs for 2011. It further assessed BTC's performance when only considering its fixed wholesale business costs. The results for both sensitivity checks are also presented below.

5.1.1 Main Analysis

Unadjusted Average Cost Per Line Benchmark

Figure 3 compares the unadjusted average cost per line of the comparator operators within the benchmarking sample. Although not shown in the graph for confidentiality reasons, BTC's unadjusted average cost is higher than all others in the sample. This includes any of the Caribbean operators and the sample median.

Figure 3: Average Unadjusted Costs Per Line (BSD) – 2010

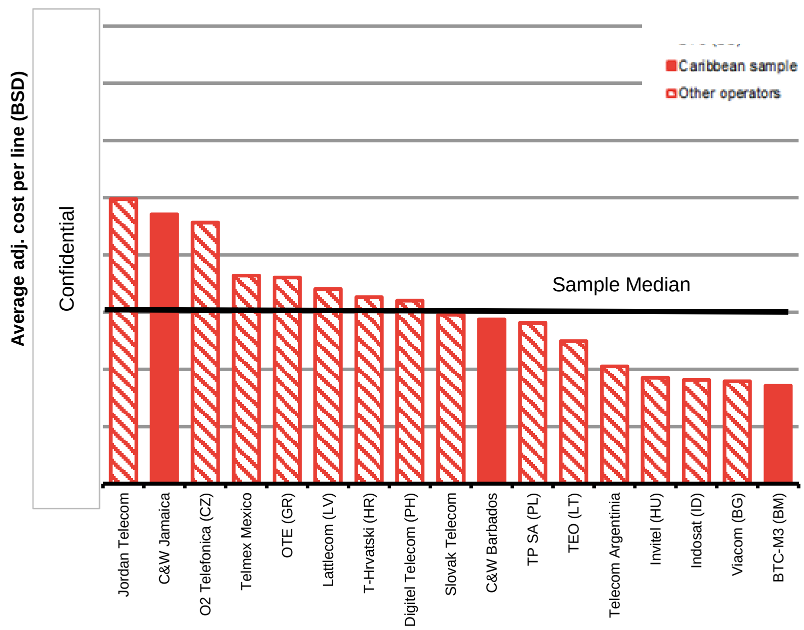


Source: URCA analysis based on available information (November 2011)

Adjusted Average Cost Per Line Benchmark

Figure 4 presents the average cost per line values for comparator operators, taking into account the relevant adjustment factors (i.e., in the fixed benchmarking analysis adjustments were made for underlying differences in GDP per capita and for operating in an archipelago environment). Again, although not shown, BTC's adjusted unit cost value remains above the sample median, although it is no longer the highest in the sample.

Figure 4: Average Adjusted Costs Per Line (BSD) – 2010



Source: URCA analysis based available information (November 2011)

5.1.2 Sensitivity Analysis

To test for robustness, URCA allowed for two sensitivities. First, URCA tested for the impact of the recently announced write-down of BTC's asset values in 2011. This write-down of asset values will reduce BTC's cost of capital employed and thereby the average cost per connection. As a second sensitivity check, URCA compared BTC`s wholesale unit costs to the average costs of the comparator operators. In the context of setting interconnection charges, BTC's wholesale cost efficiency is of particular interest.

Write-down of BTC's Cost Base

As stated above, CWC has recently stated its intent to write down some of BTC's fixed asset values. Although these write-downs are only due to be reflected in BTC's 2011 statutory accounts, URCA has tested, as a sensitivity check, the impact of taking these write-downs into account on BTC's performance in the efficiency benchmarking analysis.[46] However, this has very little impact on the overall result, with BTC still exhibiting a unit cost in excess of the sample median.

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46 As part of this sensitivity analysis URCA classified all affected assets to different accounting categories and allocated all directly attributable categories to either the fixed or the mobile businesses. All remaining categories were allocated based on the total cost ratio between BTC's fixed and mobile businesses. This resulted in a 3% reduction in BTC's fixed business total adjusted costs, relative to those considered in the main analysis discussed above.

Wholesale Unit Cost Benchmark

BTC's performance on a wholesale level is of particular interest in the context of its RAIO. Undertaking an average cost benchmarking analysis on a wholesale cost basis is not possible due to the required information not being publicly available for the comparator operators. As such, URCA has undertaken a sensitivity analysis by comparing BTC's fixed business wholesale unit costs relative to the total (wholesale and retail) costs of the other fixed operators.[47]

Taking this approach, BTC's adjusted average wholesale cost per fixed line is in line with other operators' total unit costs. If BTC's wholesale business were efficient, one would expect its wholesale unit costs to be lower than the total cost per connection of most of the comparator operators.

5.2 Mobile Operator Analysis

As discussed in Section 4.1, the mobile operator benchmarking analysis compares BTC's average cost per minute to those exhibited by a range of comparator operators. This is undertaken on an unadjusted basis and by controlling for underlying differences in costs due to different operating environments.

As for the fixed benchmarking, URCA has undertaken several sensitivity checks within this analysis. In particular, URCA has tested for the impact of BTC's recently announced asset write-downs. It further assessed BTC's performance when only considering its wholesale business costs. The results for both sensitivity checks are presented below.

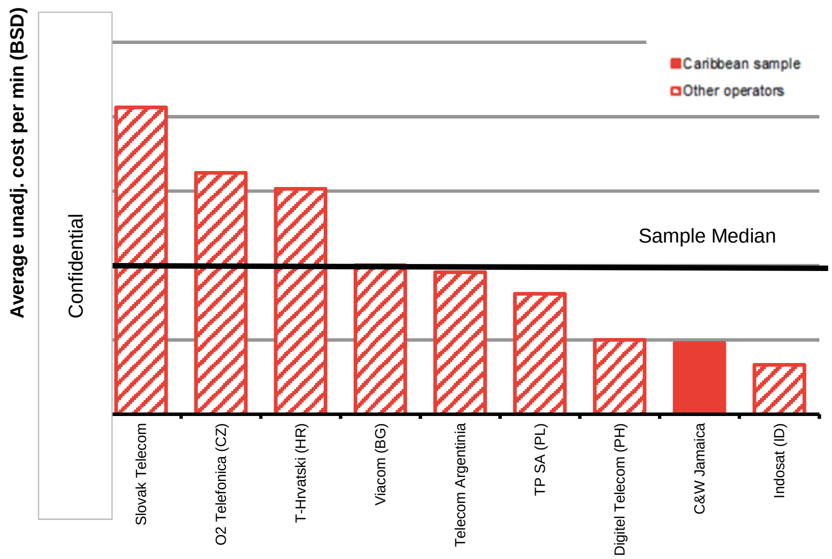
5.2.1 Main Analysis

Unadjusted Average Cost Per Minute Benchmark

Figure 5 compares the unadjusted average cost per minute of the comparator operators within the benchmarking sample. Although not shown on the chart, BTC's unadjusted unit cost would be the highest within the sample.

47 This represents a very conservative benchmark for BTC's wholesale unit costs as the other operators' unit costs contain both wholesale and retail related costs.

Figure 5: Average Unadjusted Costs Per Minute (BSD) -2010

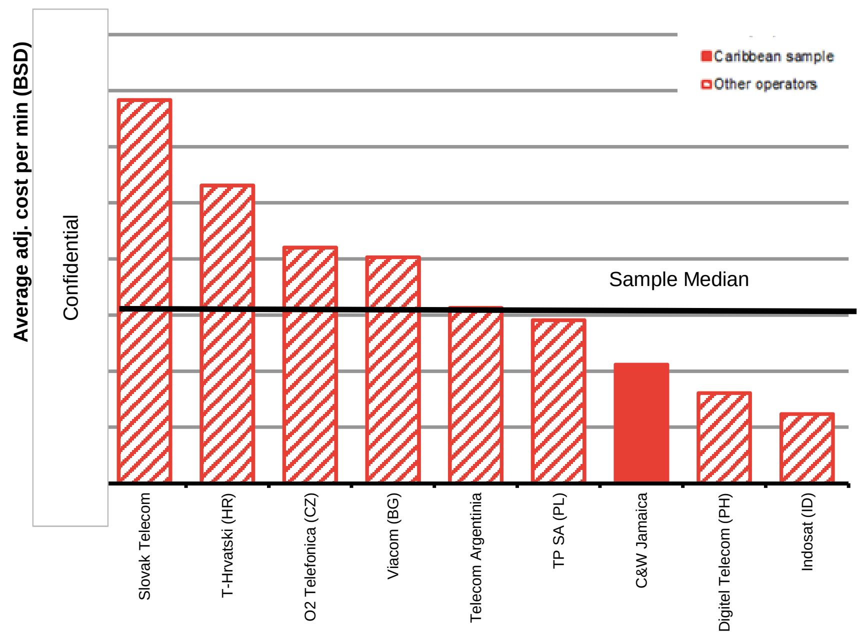


Source: URCA analysis based available information (November 2011)

Adjusted Average Cost Per Minute Benchmark

Figure 6 presents the average cost per minute for BTC and all comparator operators, taking into account the relevant adjustment factors (i.e., in the mobile benchmarking analysis adjustments were made for underlying differences in GDP per capita, total area and the degree of urbanisation). Whilst BTC's average costs per minute remain the highest value within the benchmarking sample, the gap between BTC and others is narrower suggesting that some of the higher cost is related to the higher operating cost environment of The Bahamas.

Figure 6: Average Adjusted Costs Per Minute (BSD) – 2010



Source: URCA analysis based available information (November 2011)

5.2.2 Sensitivity Analysis

As for the fixed operator benchmarking analysis, URCA tests the impact of the two sensitivities within the mobile operator benchmarking: (i) the impact of the announced write-down of BTC's assets; and (ii) the impact of only considering BTC's wholesale related costs.

Write-down of BTC's Cost Base

As a first sensitivity check, URCA has tested for the impact of the announced asset write-downs on BTC's performance in the mobile operator benchmarking analysis. Again, taking these write-downs into account has limited impact on BTC's performance in the adjusted mobile operator benchmarking analysis, with BTC still exhibiting the highest average cost per minute within the sample.

Wholesale Unit Cost Benchmark

As for the fixed operator benchmarking analysis, URCA has undertaken a further sensitivity check by comparing BTC's mobile business wholesale unit costs to the total (wholesale and retail) costs of the other mobile operators within the benchmarking sample. This again represents a very conservative benchmark for BTC's wholesale unit costs as (due to data availability) the other operators' unit costs contain both wholesale and retail related costs.

BTC's mobile wholesale costs are again in line with other operators' total (wholesale and retail) costs. URCA considers this as an indication that BTC's mobile wholesale business is not fully efficient.

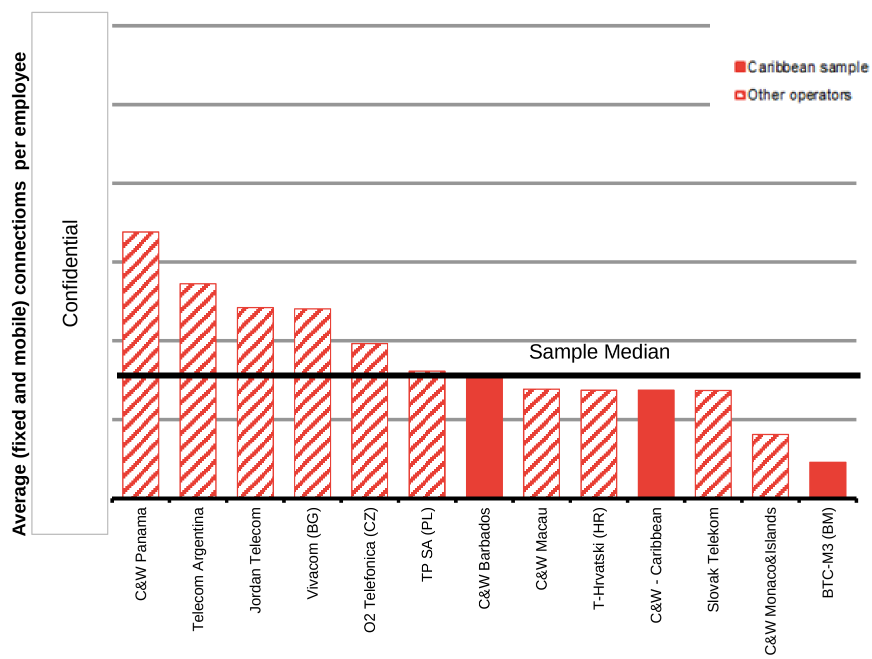
5.3 Total Connections Per Employee Analysis

To assess BTC's operational performance, URCA benchmarked its total (fixed and mobile) connections per employee to those exhibited by other joint fixed and mobile operators.[48] As for the average cost benchmarks, this analysis was undertaken for an unadjusted and adjusted total connections per employee measure.

Unadjusted Connections Per Employee Benchmark

Figure 7 presents the (unadjusted) total connections per employee values of the comparator operators within the benchmarking sample. Although not shown in the chart, BTC's average connections per employee is below the sample median.

Figure 7: Average Unadjusted Connections Per Employee (2010)



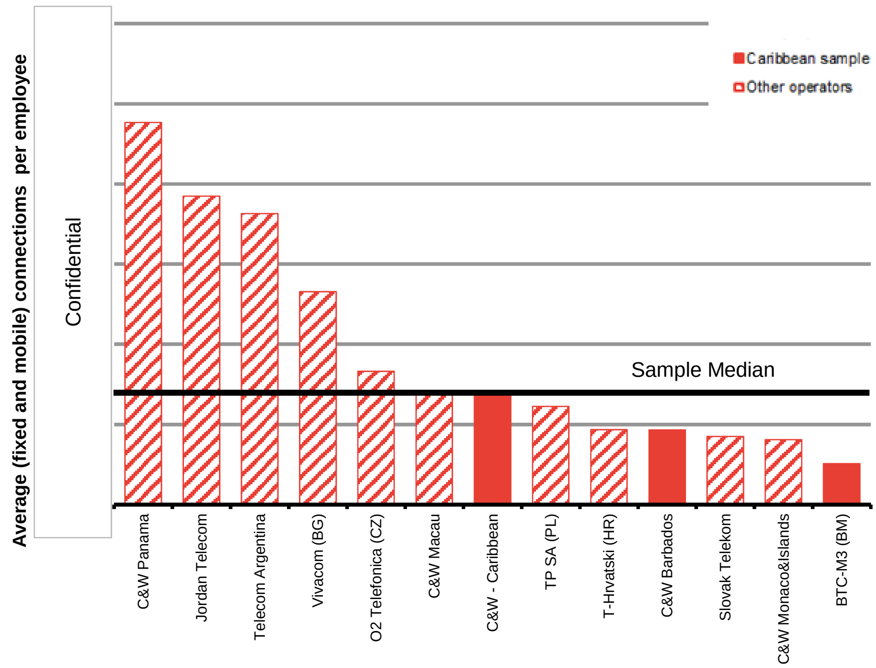
Source: URCA analysis based available information (November 2011)

48 As the number of employees for BTC, as for most operators, is only available on a company-wide level, this analysis was conducted using a total fixed and mobile connections per employee measure. As such, only joint fixed and mobile operators are included in the benchmarking sample.

Adjusted Connections Per Employee Benchmark

Figure 8 presents the total connections per employee values for all comparator operators, taking into account the relevant adjustment factors (i.e., in the lines per employee benchmarking analysis adjustments were made for underlying differences in the total area and the degree of urbanisation). The results of the adjusted benchmarking are similar to those of the unadjusted benchmark above, with BTC still reporting values below the sample median.

Figure 8: Average Adjusted Connections Per Employee (2010)



Source: URCA analysis based available information (November 2011)

5.4 Productivity Trend Analysis

URCA also reviewed recent trends in BTC's productivity over time. This was then compared to productivity trends in other sectors in The Bahamas and that of other communications operators elsewhere.

5.4.1 Review of BTC's Recent Productivity Trends

When interpreting the observed productivity trends, it is important to differentiate between genuine changes in BTC's overall productivity levels and other factors (such as, underlying significant growth in mobile connections over time)[49].

[49] Whereas BTC's total number of fixed access lines has remained fairly stable in recent years, BTC's total mobile connections have been increasing (by approximately 15%, on average, each

BTC's Productivity Trends

URCA analysed the trends in selected financial and operational performance measures for BTC overall, as well as for its fixed and mobile businesses over the period 2006 and 2009.

The main observations of this trend analysis can be summarised as follows:

- **Company-level performance.** While the average revenues per employee and total lines per employee increased considerably over this period, so have the total costs per employee. Total costs per fixed and mobile connections have fallen.
- **Business-segment performance**. As indicated above, these overall productivity improvements are likely to be in part driven by the increase in mobile penetration. As disaggregated employment data for BTC's fixed and the mobile businesses is not available, URCA is unable to assess the development of connections per employee in each segment separately. As such, URCA has focussed on a review of average costs per connection measures for both businesses.[50] In line with expectations, the relative performances of the BTC's fixed and mobile businesses have varied, with the average cost per fixed line having increased by 12% between 2006 and 2009, and the average cost per mobile connection decreased by 39% over the same period. Most of the increase in average cost per fixed line appears to be driven by operating costs. Details of URCA's analysis have been omitted for confidentiality reasons.

National Productivity Benchmark

BTC's recent productivity trends were then compared relative to those experienced in other economic sectors in The Bahamas over the period 2006 to 2009. The 'productivity improvement' values for each sector are defined as the change in the value of the total sector output (at current prices) per employee, as contained in the National Accounts. This is measured cumulatively over the entire four year period. The resulting productivity improvements are presented in Table 7.

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year since 2006). This may, for example, result in a downward trend of BTC's total cost per total connection which is not necessarily driven by any productivity improvements. As such, it will become important to differentiate between this connection growth effects and genuine productivity improvements. This requires a detailed breakdown of BTC's cost base over time. However, this information is not available over the analysed time period.

50 Due to historic mobile traffic data not being available, URCA is unable to review the trends in average cost per (mobile) minute as undertaken for the mobile operator benchmarking analysis. Instead, it has analysed the average cost per mobile connection.

Table 7: Productivity Trends of Different Economic Sectors in The Bahamas

Sector/Corporation	Cumulative Productivity Improvements (2006-2009)
Agriculture, Hunting, Forestry & Fishing	6.7%
Community, Social & Personnel Services	-3.9%
Construction	-23.2%
Financing, Insurance, Real Estate & Other Business Services	7.5%
Hotels & Restaurants	-13.7%
Manufacturing	19.4%
Mining, Quarrying, Electricity, Gas & Water	9.1%
Transport, Storage & Communication	3.3%
Wholesale & Retail	11.5%
Total Economy	**2.7%**

Source: Bahamas Department of Statistics

As shown in the table above, the average productivity level across The Bahamas economy has increased by approximately 2.7% over the four year period. However, the productivity trends in the different sectors have varied significantly, ranging from -23.2% in the construction sector to +19.4% in the manufacturing sector. In the Transport, Storage & Communication sector, to which BTC belongs, overall productivity increased by 3.3%.

A general conclusion based on these measures for BTC is challenging. The increased revenues per employee points in the direction that BTC has outperformed other sectors between 2006 and 2009. In the absence of segment-specific staff data, it is difficult to assess the performance of BTC's fixed or mobile business separately (as other unit cost measures are not informative).

International Productivity Benchmark

In addition to the national benchmarking, URCA further compared BTC's recent productivity trends to those experienced in the communication sectors elsewhere. Due to data availability, this analysis focused on the cumulative changes in total (fixed and mobile) connections per employee between 2006 and 2009. The results are presented in Table 8[51].

BTC's total connections per employee increased by 42% over the four-year period, exceeding that in many other countries, including those with similar mobile penetration growth over that period. However, a large share of that growth is driven by its significant growth in mobile connections during that period (as discussed

[51] The ITU Database contains data on a wide range of telecommunications indicators over time across most countries. Although generally included in the database, the information reported for Caribbean jurisdictions is very limited (especially employment data). As such, no regional comparator could be included in the analysis above.

above).

Table 8: International Productivity Benchmark

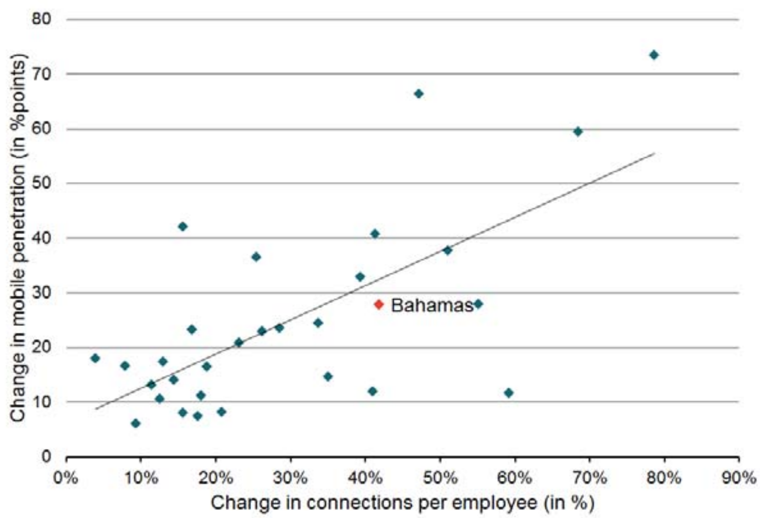
Country	Total connections per employee			Change in mobile penetration
	2006	2009	2006-2009	2006-2009
Oman	664.4	1,186.8	78.6%	73.4 ppt.
El Salvador	1,631.1	2,748.3	68.5%	59.4 ppt.
Comoros	108.6	172.9	59.2%	11.6 ppt.
Qatar	597.4	926.6	55.1%	27.9 ppt.
Croatia	625.8	945.4	51.1%	37.7 ppt.
Macao	677.5	997.4	47.2%	66.3 ppt.
Bahamas/BTC	**299.0**	**424.0**	**41.8%**	**27.9 ppt.**
Moldova	250.7	354.4	41.4%	40.7 ppt.
Belize	309.0	435.6	41.0%	11.9 ppt.
Bulgaria	427.9	596.7	39.4%	32.9 ppt.
Taiwan, China	905.7	1,223.6	35.1%	14.7 ppt.
Austria	719.3	961.3	33.7%	24.4 ppt.
Germany	652.3	838.8	28.6%	23.6 ppt.
Palau	170.4	215.1	26.2%	22.9 ppt.
Bosnia & Herzegovina	429.9	539.4	25.5%	36.5 ppt.
Jordan	919.3	1,132.0	23.1%	20.8 ppt.
Spain	738.6	891.8	20.8%	8.1 ppt.
Belgium	684.8	813.5	18.8%	16.4 ppt.
France	644.5	761.0	18.1%	11.2 ppt.
Iceland	340.6	400.5	17.6%	7.4 ppt.
Mexico	742.2	867.6	16.9%	23.2 ppt.
Bahrain	567.3	656.0	15.6%	8.0 ppt.
Hong Kong	837.2	967.7	15.6%	42.1 ppt.
Faroe Islands	243.4	278.3	14.4%	14.1 ppt.
Malta	289.7	327.4	13.0%	17.3 ppt.
Slovak Republic	591.5	665.8	12.6%	10.6 ppt.
Slovenia	565.5	630.6	11.5%	13.1 ppt.
Australia	316.0	345.7	9.4%	6.1 ppt.
Denmark	537.9	580.4	7.9%	16.6 ppt.
New Zealand	576.8	599.8	4.0%	17.9 ppt.

Source: URCA analysis based on information provided by BTC and ITU data (November 2011)

Figure 9 presents the correlation between the trends in mobile penetration and total connections per employee over the time period across the international benchmark. The chart confirms a generally positive relationship between growth in total connections per employees and mobile penetration growth within our sample. It further confirms that BTC's increase in lines per employee has been less than the average across the sample, taking into account changes in mobile penetration (i.e., it is below the trend line).

Thus, controlling for the underlying growth in mobile penetration levels, BTC's increase in lines per employee has been less than the average across our international benchmarking sample. Further, with 424 connections per employee in 2009, BTC remains at the lower end of the overall sample. This is in line with the findings presented in Section 5.3.

Figure 9: Impact of Change in Mobile Penetration on Operational Cost Measure



Source: URCA Analysis

A general conclusion on BTC's productivity trends based on BTC's productivity development relative to the national and the international benchmarks is challenging. Even if some measures over time seem to suggest that BTC became more productive, this development was predominantly driven by the growth in mobile penetration levels. Once controlling for this underlying growth, BTC's productivity improvement has been less than the average across our international benchmarking sample. Further, as shown in Section 5.3 above, BTC's current operational productivity level (in terms of lines per employee) remains below those experienced elsewhere.

6 Potential Policy Implications

This efficiency study aims to determine whether there is a need for any efficiency adjustments to be made to BTC's cost base required for URCA's regulatory decision making in order to ensure that costs are assessed using an efficient level; and if so, how large these adjustments ought to be (i.e., the efficiency adjustment factors). If required, these efficiency adjustment factors may then inform URCA's process of determining regulated charges (i.e., by applying efficiency adjustment factors to BTC's unit cost results).

The preliminary results presented in the previous Section suggest that, despite some recent improvements, BTC's productivity levels based on 2010 A/S data remain below those of other comparator operators.[52] This holds for both BTC's fixed and mobile business segments. Further, URCA's sensitivity analyses have revealed that, based on a review of BTC's wholesale unit costs, any inefficiencies within BTC's fixed and mobile businesses are unlikely to only relate to its retail operations. This is of particular relevance in the context of BTC's wholesale interconnection services contained in its RAIO.

In addition to determining BTC's interconnection rates, URCA may need to make a wide range of pricing decisions for regulated services going forward. The efficiency adjustments may also form a potential input to those processes. However, the exact process of determining particular regulated prices will be considered on a case-by-case basis and URCA will issue further information on these processes closer to the time of determining the relevant prices. This would cover the full range of factors used to determine the regulated prices, including how any efficiency adjustment should be accounted for.

6.1 Efficiency Considerations for BTC's RAIO services

URCA's analysis to date suggests that, based on 2010 A/S data, BTC's (wholesale) unit costs of both business segments are above those reported by other operators and may therefore not reflect the efficient level of costs required for providing these services. This is the case despite BTC's 2010 A/S statements showing significant reductions in unit costs of interconnection services relative to those underlying the current BTC URCA-approved RAIO charges. This may mean that it is important to make adjustments to BTC's regulated wholesale charges, which are based on its A/S unit cost results to ensure they fully reflect an efficient level of costs.[53]

As set out in Section 4.1, deriving efficiency adjustment factors for BTC would require the definition of a target level against which BTC's performance will be

[52] These findings hold for both, BTC's unadjusted unit costs as well as when taking the relevant cost adjustment factors into account. URCA has further taken a range of sensitivity checks on BTC's cost base considered for the analysis, which confirm the main preliminary results.

[53] URCA notes that BTC's current wholesale charges, set out in its published RAIO, do not contain any efficiency adjustments.

assessed. Common targets include, amongst others, the median or upper quartile performance within the relevant adjusted benchmarking sample.

To ensure that any efficiency adjustments applied to BTC represent a conservative measure of its relative inefficiency, URCA is of the preliminary view to apply a 'median performer' efficiency target within this analysis (i.e., measuring BTC's performance relative to the median performer in each benchmarking sample, as indicated by the 'sample median' line in Figures 3 to 8 above).[54]

When determining the required efficiency adjustments to BTC's RAIO charges which are based on its A/S unit cost results, URCA will further need to form a view on whether a single adjustment should be applied (i.e., based on a one-off adjustment to the A/S unit costs) or whether an adjustment should be applied over a period of time (i.e., based on a multi-year glide path).

Regardless of URCA's final determination or decision on this efficiency study, it also notes that the current RAIO charges should be amended to reflect the latest cost information available from BTC, namely its 2010 separated accounting statements, the audited results for which have recently become available. In line with the cost orientation requirements, BTC will now be required to update the RAIO rates based on the latest set of A/S results. Given the underlying reductions in unit costs, URCA expects this to lead to lower RAIO charges going forward.

In addition to the update above, BTC may be required to adjust its revised RAIO charges based on the outcome of this efficiency study. This is to ensure that the interconnection rates are not only cost-oriented, but further reflect only efficiently incurred costs. Based on the preliminary results presented above, URCA is of the preliminary view that further efficiency adjustment to BTC's revised regulated wholesale charges based on the 2010 A/S results may be required. Given the magnitude of the potential adjustments, URCA is minded not to apply these as a one-off adjustment in a single year.

6.2 Further Considerations

In addition to ensuring that interconnection rates are reflective of only the efficiently incurred costs of providing these services, efficiency considerations may also become important in forward looking (retail) price controls.

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[54] For example, Ofcom in the UK applied a "top decile" efficiency target in its decision on leased line charges in 2007. Applying an upper decile efficiency target within these benchmarking analyses would result in significantly higher adjustment factors for BTC.

Consultation Question 4:

Do you agree with potential policy conclusions URCA has drawn from the preliminary efficiency study results? Please detail your response in full.