The Scottish Bus Industry – just a bunch of profiteering opportunists?

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1. Introduction

The Transport Act 1985 privatised and deregulated the bus industry in Great Britain outside of London with the intention of creating a competitive industry that would compete for patronage through the economic principles of contestability and consumer sovereignty. As a result, the long term decline in bus patronage would be reversed. Over thirty five years and a plethora of Competition Commission inquiries later, such outcomes seem further away than ever. In Scotland (as elsewhere in Britain), this has led to serious consideration of re-establishing some form of regulatory framework that most likely would control market entry through some form of tendering, and hence increase competitive pressures in the form of competition for the market. This of course assumes that the industry is characterised by profiteering monopolists, and thus the solution lies in increasing competitive pressures. The main aim of this paper therefore is to examine how the bus industry in Scotland has evolved over time with regards to producing outcomes that are consistent (or otherwise) with the efficient competitive market.

In order to do this, analysis is undertaken at two different levels. Firstly, a long run analysis of key demand and supply side statistics is carried out at the overall Scottish level, before a firm level assessment of productivity, efficiency and profit margins is completed. For the firm level analysis, performance of the Scottish firms is benchmarked against two comparator markets – the deregulated English market and the regulated London market. This should help in identifying issues that may be Scotland specific as opposed to common factors affecting the whole British bus market, as well as provide a valuable comparative dynamic, particularly with regards to the London market.

The next section will consider in general terms the development of the bus industry in Scotland since privatisation, and draws concise comparisons with the markets in England and London. A very brief and highly selective review of the literature on the subject is then considered, before results are presented. Conclusions are then drawn and policy recommendations made.

2. The Scottish, English and London Bus Markets

The bus industry in Scotland generally reflects that of the wider British context. In many respects, what exists today is what emerged out of the 'bus wars' period of the mid to late 1990s. Prior to privatisation, the Scottish Bus Group was re-organised into 9/10 operating subsidiaries and sold to the private sector in the early 1990s. At the same time, the four local authority owned operators were removed from public administration and established as arm's length private limited companies. All bar one of these were then subsequently sold to the private sector through a combination of private sales and management-employee buyouts. Strathclyde Buses in Glasgow represented the largest public sector subsidiary, while Scottish Highland the smallest. It was suggested at the time that the SBG subsidiaries had been considerably undersold in terms of value, however bus company proceeds were not the only consideration, the creation of a competitive industry was another strong driving factor. This aspect in itself would have reduced sale values, although many were subsequently sold on for large capital gains.

After privatisation, how the industry developed in Scotland was through a process of merger and acquisition, hence while 'competitive' in one sense, not in the sense envisaged by the 1985 Act. The perception was that competitive pressures would be applied either directly by way of on road competition or indirectly through contestability. In Scotland, apart from one notable exception, there was very little evidence of either of these forms of competition, but rather competition emerged through a combination of stealth, survival of the fittest and 'absorption' through a combination of merger and acquisition. What this resulted in was the annexing of territory, which is a key component to successful operation in terms of bus economics and hence the term 'bus wars' well specified. Of particular importance is the location of depots in support of the on road effort, as this ultimately defines the competitive position of the operator – located far from market results in long non-revenue earning drive in and drive out times that

substantially decrease productivity and increases costs. This was no better exemplified than by Firstbus's failed attempt to increase its market share in the Edinburgh market during the period 2001/2, in which many buses were supplied from the company's depot in Larbert, some 20 miles outside of the Scottish capital.

Out of this period what emerged is a bus industry in Scotland that is dominated by the main players in the British market, mainly Stagecoach and First, but also with a presence from National Express. These companies, along with Go Ahead and Arriva, also acquired stock market listings, hence have become public limited companies and partly subject to the demands of the stock market (although Arriva was subsequently acquired by Deutsche Bahn in 2010). Two other companies of significance exist in Scotland, the privately owned McGills buses in Ayrshire and south west Glasgow, and the publicly owned (but strictly commercially operated) Lothian Buses in Edinburgh and the south east. Of the fourteen major operators in existence at the time of privatisation, twelve exist as legal identities today (as opposed to market brands), although not all have been active throughout the whole of the post privatisation period.

In England, to briefly consider, there was more evidence of the 'bus wars' in the direct and contestable senses of the phrase, but again most competition occurred through merger and acquisition, with the above mentioned five main players emerging out of this process. As in Scotland, markets are based upon territories, hence very little direct competition. London in simple terms is a regulated market, where the provisions of the London Regional Transport Act (1984) led to the division (into 10 subsidiaries) and privatisation of London Buses and the introduction of a competitive tendering system, where pricing, ticketing, marketing and scheduling all remain public sector functions. In some senses, this can be viewed as a contestable market imposed through regulation, otherwise known as Demsetz competition (Demsetz, 1968).

To summarise, what emerged in the Scottish and English deregulated markets was an industry dominated by a few large players, with very little direct competition. From a purely theoretical perspective, this would lead to the conclusion that in both cases this results in an inefficient market in terms of prices, costs and profits, and therefore one heavily biased towards firm rewards rather than consumer benefits. As will be seen in the following section, such outcomes are largely reflected in the research undertaken on the British bus market.

3. Selective Literature Review

To consider some of the research literature very briefly, White and Farrington (1998) found that fares had increased in real terms in Scotland since deregulation, but not as much as in England, particularly in the PTE areas, due to the large reductions in subsidies that the 1985 Act brought into force in these areas. Despite this, the authors found the decline in patronage to be considerably higher in Scotland overall than in England outside of London. In a more recent study, Preston and Almutairi (2013) undertook an examination of British bus deregulation comparing the outcomes with a hypothetical counterfactual situation, in other words, what would have happened without bus reforms. What they found is that patronage would have fallen by considerably more, but that in London most of the increase that has occurred would have occurred anyway. Overall, they find that bus reforms have led to economic welfare gains, but primarily as a result of producer gains through cost reductions rather than consumer benefits as a result of price/usage levels.

Van de Velde and Wallis (2013) found that deregulation had led to an increase in bus kilometres supplied, but over the years the industry had built up a very negative image due to continued declining passenger numbers, fare increases and the loss of integration with other public transport modes/operators. The authors did highlight however that in a limited number of areas where there was evidence of a pro-active public transport policy that restricted car usage, patronage had significantly increased. Cowie (2014) in an empirical study of consumer sovereignty (i.e. an efficient market) in the English deregulated area, found only very limited evidence of its existence, at just under 30%. 16% of operators were found to have market behaviour consistent with the classic oligopolist, whilst 26% were

labelled as efficient profiteers, hence fully exploiting a strong market position. Of concern however was the 28% of operators that were found to be 'mature marketers', with the general perspective that the sustainability of operations was based more on the revenue generated than the profit or the potential offered, and an overall perception that there was little the operator could do to improve the situation, almost a position of consumer apathy rather than one of sovereignty.

As stated, all do generally confirm the theory of an inefficient market in bus operations, however whilst that is the prevailing overview, clear exceptions are found to exist, with the last cited providing the motivation for the current research topic.

4. Scottish Area Analysis

As noted, deregulation of the bus industry occurred in 1986 with privatisation in Scotland following during the period 1986 to 1993. From 1994 onwards therefore the industry can be considered to have attained a degree of maturity and thus entered into a phase of long term development rather than primarily driven by the short run consequences of privatisation and deregulation. The following section reviews some of the main demand and supply side factors at a national level for staged services from 1994 to 2015, with all statistics compiled from a combination of Scottish Transport Statistics (see for example Transport Scotland 2017) and Scottish Bus and Coach Statistics (see for example Scottish Government 2010 and Scottish Office 1998) . The first of these are shown in Figure 1 and plotted in the form of cumulative indices, and relate to patronage levels and commercial and subsidised bus kilometres.

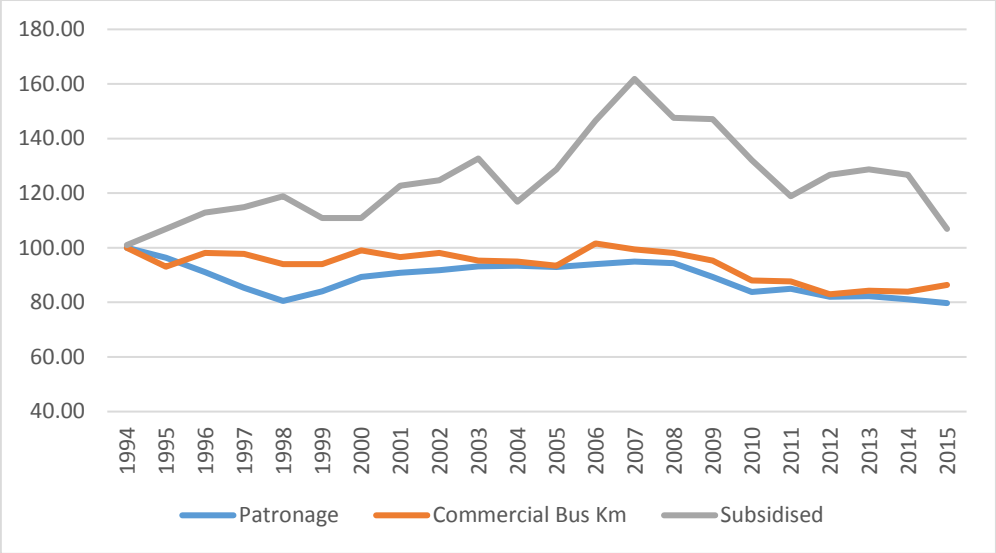


Figure 1: Scottish Bus Patronage, Commercial and Subsidised Bus Kilometres, Changes 1994 to 2015

Source: Compiled from Scottish Bus and Coach Statistics (e.g. Scottish Government 2010, Scottish Office 1998).

As indicated in the literature, with regards patronage Figure 1 outlines what has been a slow decline that has generally continued throughout most of the period. The very notable exception is from the late 1990s to the mid 2000s, due to the effect of enhanced concessionary fare schemes, which was a period when first local and then national entitlements became free. The net effect of this was to return patronage to its 1994 starting point. Nevertheless, since the economic crisis in 2008 all of this gain has been eradicated with the net result that when viewed across the entire period this equates to an overall decline of around 20%.

Commercial bus kilometres remained relatively stable over the first half of the period, but the net effects of the oil price rise in 2004 and the aforementioned economic downturn have contributed to an overall decline of around 14% over the whole period, hence decreases in provision have been less than in usage. The most striking trend shown in figure 1 is for subsidised bus kilometres, although the nature of the figure tends to exaggerate the overall effect. In wider terms, these represents around 15% of all staged bus kilometres run in Scotland, although this did rise as high as 20% in the year 2007/8. There is some evidence of replacement services for commercial operations, but since the peak levels contracted services have almost returned to their 1994 point, primarily as a result of an increasing squeeze on local authority finances and increased contract prices.

Figure 2 plots the changes in passenger receipts, bus fares and the level of local authority subsidy, hence the latter only relates to receipts for the provision of contracted services, thus does not include concessionary travel reimbursement or rebates on fuel duty (i.e. bus operator services grant).

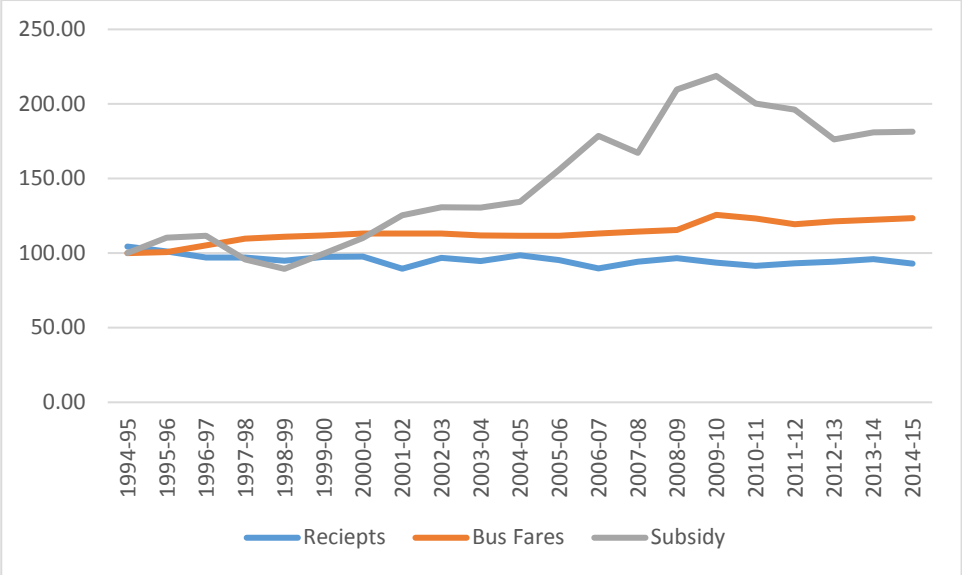


Figure 2: Passenger Receipts, bus fare index and changes in public transport subsidy

Source: Compiled from Scottish Bus and Coach Statistics (e.g. Scottish Government 2010, Scottish Office 1998).

Beginning with bus fares, again consistent with the literature, figure 2 shows rises in real terms throughout the period, with the net cumulative effect leading to a 25% increase over the whole period. This would equate to an annual average increase of just over 1%. Passenger receipts on the other hand have been more stable, although the general trend has been a very slow steady decline, hence leading to a net difference from beginning to end of just over 5%. Taken together, by a very crude regression, the long run price elasticity of demand would calculate to around -0.7, hence slightly under the perceived long run value of -0.8 (Goodwin, 1996). The regression did however also suggest that the market was becoming more inelastic over time, which may account for the difference in the two values.

The last trend reviewed in Figure 2 is changes in local authority payments for contracted services, and as before with subsidised bus kilometres, the effect is exaggerated by the nature of the figure (local authority payments across the whole period represented an average of around 14% of passenger review). Nevertheless, what it does show is a considerable increase in real terms from 2004, but then a significant decline with the onset of austerity measures from 2011 onwards. Nevertheless, when viewed in conjunction with subsidised bus kilometres, it would suggest a very noticeable rise in contract

prices, a rough estimate being in the order of around 30%. Furthermore, whilst these payments represented just under 10% of passenger receipts at the beginning of the period, this had risen to just over 16% by the end.

The final set of area wide figures are presented in Figure 3, which gives the level of passenger revenue and total public finance. The latter is an addition of local authority public transport subsidy, concessionary fare reimbursement and fuel duty rebate in the form of the Bus Operators Services Grant (BSOG). Also shown separately, for reasons that will become apparent, is the level of concessionary fare reimbursement. All figures are shown at constant 2016 values.

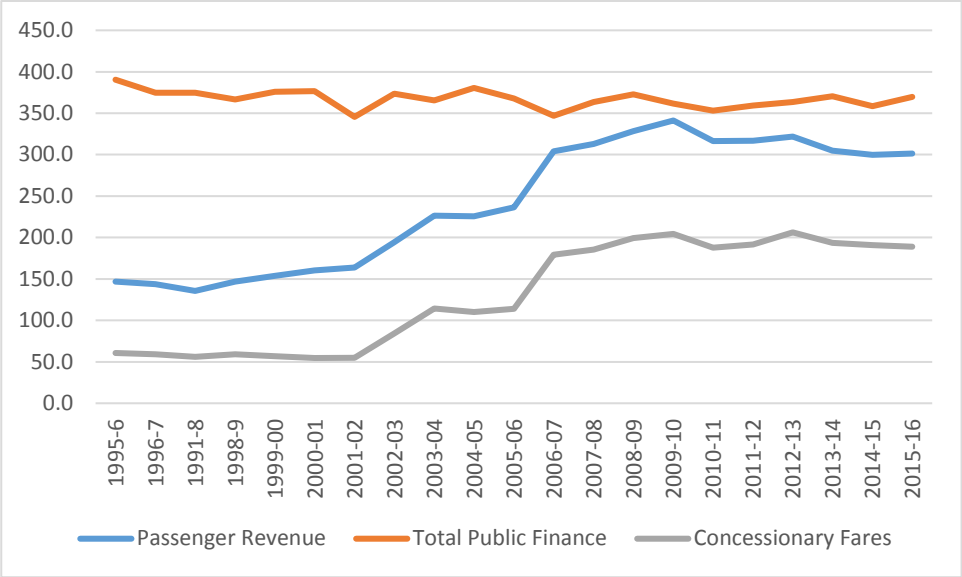


Figure 3: Passenger Revenue, Public Finance and Concessionary Fare Re-imbursement, Constant 2016 prices, 1995/6 to 2014/15.

Source: Compiled from Scottish transport statistics (e.g. Scottish Government 2010, Scottish Office 1998, Transport Scotland 2017).

What is very clear from Figure 3 is the significantly increased level of public support being given to the bus industry in Scotland. At the start of the period reviewed, this accounted for just over 30% of total industry revenue, however by the end had risen to 45%, and even peaked at over 48% in financial year 2009/10. Most, but not all, of this increase is due to the increase in concessionary fare reimbursement. Total revenue to the industry in 2015/16 stood at £671m, an increase of 20% over the whole period, but as stated, most of this was due to concessionary fare re-imbursement. According to the rules of compensation, the operator should be 'left no better or worse off' as a result of this, hence increased subsidy should not equate with profit support, although due to the system used in Scotland to reimburse operators, it has been recognised that this does represent a minor form of indirect government support (e.g. Rye and Carreno, 2008).

To summarise, the bus industry in Scotland has experienced a long slow steady decline in patronage, however due to inelastic demand and increased fares, this has had a far smaller impact on overall revenue levels. Nevertheless, primarily due to increased concessions and to a far lesser degree increased contract prices, the level of public financial support to the industry has risen considerably. Some key issues/questions remain however, notably the impact that all of this has had on company profitability, and more generally on the efficiency, productivity and overall competitiveness of the industry. In order to examine these issues, a company level dynamic is required.

5. Firm Level Analysis

In this section, the performance of Scottish companies is compared to performance elsewhere in Britain in the form of the deregulated areas of the English Metropolitans and Non Metropolitans, as well as the regulated London market. In order to do this, company data was compiled from the annual TAS Bus Monitor, and covers the period 1994 to 2014. What is presented is generally a balanced panel which at the base includes 130 companies/subsidiaries over the full period. This breaks down into 14 Scottish, 109 in the English deregulated area (split 12/97 Met to Non Met), and 7 in London, although over the period reviewed there have been a number of re-organisations, both in terms of ownership and in terms of amendments to operating areas through for example the transfer of depots and associated services from one subsidiary to another. As such, the dataset cannot be entirely considered to be 'closed', but that is the nature of the reality being studied.

At the firm level, firstly productivity/efficiency will be reviewed and analysed – not only is this an important factor in itself, but it also gives an insight into the competitive nature of the industry being examined. Profit levels over the period are then reviewed.

5.1 Productivity and Efficiency Analysis

Various approaches can be taken in the measurement of productivity and efficiency, but in the case of the former, following Fåre et al (1994) the method normally chosen is by data envelopment analysis. This however is not without its problems (see Cowie 2018 for a critical case study), hence the approach taken here is to use an econometric method, i.e. estimation of a production function, with a corrected ordinary least squares (COLS) specification used to estimate efficiencies.

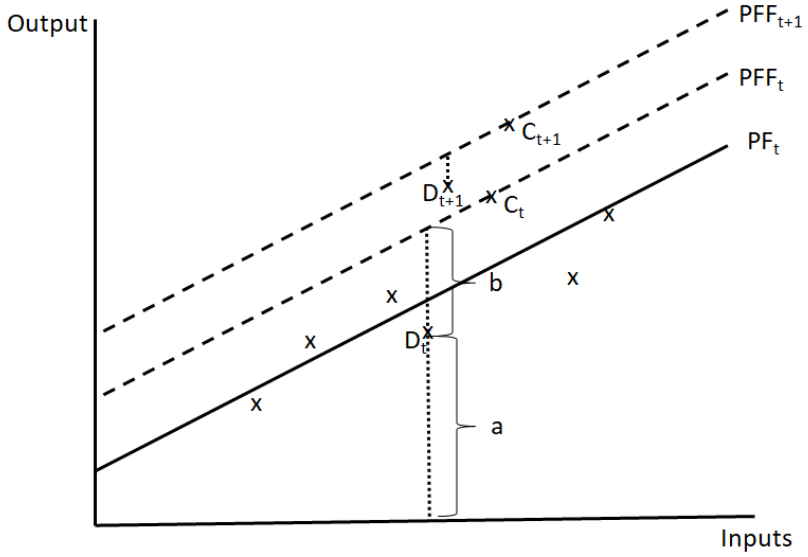
To bring the topic into clear focus and clarify the main concepts, whilst productivity and efficiency are terms that are often used interchangeably, in production economics they represent two distinct, albeit closely related, concepts. Productivity is the change in the output/input ratio over time, and is referred to as total factor productivity, as it should relate to all inputs, not just a single factor such as labour. Efficiency on the other hand is the level of productivity at a particular point in time assessed against 'best practice' at the same point in time. Hence for example a company could improve its productivity but experience a decrease in efficiency if the gains achieved were not of the same order as the change in best practice. Whilst productivity therefore is a standard measure over time, what is deemed to be 'efficient' will change over that period of time.

In economics, production is normally assessed through estimation of a production function where:

$$Q=f(X)$$

Hence the level of output, Q, is a function of the inputs X. For estimation purposes, the functional form, i.e. the relationship, between the output and the inputs needs to be specified, with the two most commonly used being the Cobb Douglas and Translog Production Functions. The latter offers more flexibility with regard to conforming to underlying economic principles, hence is the specification used in this analysis. This is formally specified in Appendix 1, along with the derivation of the measures actually used, but a conceptual overview of the key points in efficiency and productivity assessment is given in Figure 4.

Figure 4: Overview of efficiency assessment using corrected ordinary least squares (COLS)



In Figure 4, ignoring everything else and starting with each x point, this represents the output/input combination for each firm in the sample data set. From these, by applying regression analysis a production function can be estimated, and this is shown by the line labelled PF_t. What this represents therefore is the 'average' level of output expected from a given level of inputs across the sample data set. Hence the firm that in relative terms is found to be the highest above the line, by definition, must be the most efficient; in this example, in year t this would be firm C, shown by the x point labelled C_t. In regression analysis, this would translate into the highest negative residual. Under a corrected ordinary least squares method (COLS), this value is then added to the constant term and hence the production function becomes a production function frontier, shown by PFF_t. What this now shows is the level of output that 'should' be produced by each firm if it was operating at the same productivity level as the most efficient firm. All firms in the data set are therefore compared to the frontier in order to derive an efficiency score. This is shown for the case of firm D in the same time period t, with the level of inefficiency measured by the distance b and the level of efficiency by the distance a, both of which are normally expressed as relative percentages.

As regards productivity, this occurs across time periods. Hence only concentrating on firms C and D in time period t and the following period t+1, if firm C improves its productivity by moving to the point shown by C_{t+1}, then assuming it is still the most efficient firm, this would move the frontier to PFF_{t+1}. The gap between the two frontiers therefore would represent technical change, as in a productive sense this is breaking new ground. Productivity improvement however can come from another source. If firm D is considered, then in time period t+1 not only has it matched the technical change, but it has also moved considerably nearer to the production frontier. Its productivity improvement is therefore a combination of both technical change (matching the frontier shift) and also efficiency improvement (moving closer to the frontier). The combination of these two effects is known as total factor productivity and formally specified by:

$$TFP_{it} = TC_{it} \times EC_{it}$$

Note that if none of the other firms in Figure 4 changed production positions between year t and year t+1, they would all experience adverse productivity change, and all of this would be as a consequence of moving further away from the production frontier, hence adverse efficiency change. Often completely overlooked in productivity analysis, but technical change therefore creates inefficiency if all firms do not improve production by the same relative proportion. It would be expected however that these firms would improve over subsequent time periods, hence producing positive efficiency change, consequently this is often referred to as the catch up effect.

For a formal specification of the full production function and the measures used to estimate efficiency and productivity, these are outlined in Appendix 1.

5.2 Efficiency Results

In order to estimate the initial production function, the output and inputs need to be specified. In terms of the output, this should reflect the aim of the firm, which consistent with mainstream economic theory is assumed to be profit maximisation. Bus companies are presumed to achieve this through the carriage of passengers (as opposed to, for example, the provision of transport services), however due to commercial sensitivity issues this data is not available at the company level. What is available is annual revenue, however that to a certain extent will reflect market power rather than 'real' output. What has been used therefore is adjusted revenue, with the adjusting factor being the bus price index by area, hence it should give real bus revenue at a constant price over the whole period. As such, it should provide a reliable proxy for passengers carried. The inputs are far more straightforward, and are simply specified as total staff and fleet sizes in each of the years estimated. These represents around 75% of bus company operating costs. As stated, the period 1994 to 2014 is analysed, with all financial and labour data compiled from the TAS Partnership Bus Industry Monitor (e.g. TAS, 2018). Likewise, fleet sizes were similarly compiled up until 2012, since when this has no longer been collected by TAS, hence over time this has been periodically gathered from internet searches and Woolybus fleet lists[1].

Time was also added to the production function as this reflects change in best practice over the sample period, which allows efficiency to be calculated, and also three regional dummies to represent Scotland, London and the English Mets. These were specified both in terms of step dummies (absolute differences) and attached to the time variable (changes in differentials over the period reviewed). The base model therefore represents the English Non Mets. The results from the actual production function estimation are given in Table 1.

Table 1: Bus Industry, Production Function, 1994 to 2014

Variable	Description	Parameter	St Error	T value	Prob
Constant		4.0878	0.0306	133.7280	0.0000
IA	Labour	1.0463	0.0390	26.8210	0.0000
IB	Fleet Size	-0.0463	0.0390	-1.1870	0.2353
T	Time	-0.0119	0.0035	-3.3660	0.0008
IA2	Labour Sq	-0.0710	0.0229	-3.0960	0.0020
IB2	Fleet Sq	-0.0710	0.0229	-3.0960	0.0020
T2	Time Sq	0.0006	0.0003	1.9930	0.0462
IAIB	Labour/Fleet	0.0710	0.0229	3.0960	0.0020
TIA	Time/Labour	0.0026	0.0027	0.9510	0.3414
TIB	Time/Fleet	-0.0026	0.0027	-0.9510	0.3414
DSCOT	Scotland Step	0.0640	0.0219	2.9240	0.0035
DLON	London Step	0.2031	0.0266	7.6270	0.0000
DEMET	Eng Met Step	0.1509	0.0205	7.3710	0.0000
TDSCOT	Scotland Time	-0.0002	0.0021	-0.1050	0.9164
TDLON	London Time	0.0086	0.0025	3.3830	0.0007
TDMET	Eng Met Time	-0.0085	0.0019	-4.3540	0.0000

$R^2 = 0.9768$, n = 1620

[1] Although a commercial site for the bus enthusiast, these fleet lists can be considered to be highly accurate.

In some respects, there is little to say regarding the translog estimation, a high number of the parameters are found to be statistically significant, the calculated marginal products at the mean are found to be in the expected direction, i.e. an increase in either of the inputs leads to an increase in output (despite the negative fleet size singular term), and R^2 indicates that over 97% of the variation in the output is 'explained' by variation in the inputs. As such, it appears to be a robust estimation from which to derive technical efficiencies and total factor productivities.

Of the individual parameters, the singular time variable suggests (for English Non Mets) that 'average' productivity declined by just over 1% per annum, although the squared time term suggests this was at a reducing rate over the period. The regional dummies find that all the included areas had a higher level of output for a given level of inputs than the base model (English Non Mets), with the time slope dummies indicating that this gap remained fairly constant in the case of Scotland, for London it increased but narrowed for the English Mets.

It should be noted that the effect of the inclusion of both the step regional and time slope dummies in the production function is to impose structural barriers between each of the regions specified, and hence an element of 'inefficiency' will be attributed to this factor. What this should do however is better isolate individual company effort, which is particularly important in the productivity analysis which follows. Average efficiency by area for every second year is given in Table 2 below.

Table 2: Average Efficiency, British Bus Industry by area, 1994 to 2014.

	1994	1996	1998	2000	2002	2004
All	61.1%	62.3%	62.0%	61.7%	63.6%	63.7%
Scotland	57.6%	62.0%	63.0%	62.9%	67.8%	61.3%
London	58.9%	59.6%	61.1%	55.9%	66.2%	62.8%
English Met	60.1%	63.2%	58.5%	62.9%	63.4%	65.9%
English Non Met	62.1%	62.1%	62.6%	62.4%	62.9%	63.6%
	2006	2008	2010	2012	2014	
All	58.9%	58.6%	65.0%	62.9%	62.6%	
Scotland	53.5%	56.4%	64.2%	63.2%	62.9%	
London	60.3%	55.8%	66.3%	63.2%	63.8%	
English Met	62.6%	57.4%	61.4%	64.2%	62.1%	
English Non Met	58.7%	59.7%	63.2%	62.6%	63.8%	

What the figures show is that in most instances, there has been little change over the period reviewed – all areas outside of London show a level of just over 60% in most years, although the general trend has been one of improvement. As an average value this may seem relatively low, however efficiency in this case is assessed on the basis of constant returns to scale, therefore some of this 'inefficiency' will be due to that constraint. The one exception to the general status quo is London, which has seen around a 5% increase over the period, even at one point achieving a net 8% gain.

As noted, a further dynamic to the measure of efficiency is that it can be interpreted as a measure of the level of competition in an industry; in industries that are highly competitive then inefficient operators are generally subsumed by the competition, a view consistent with the idea of Downie competition (Downie, 1958). It may be argued therefore that this factor is partly in evidence in the franchised London market, however there is no or very little evidence of it in any of the other areas studied. This would suggest that either all efficiency gains had been achieved by the start of the period or that general inefficiency prevailed throughout the whole period. Further insights into this aspect should be gained from the productivity estimates.

5.3 Productivity Analysis

Results of the productivity analysis are presented in Table 3. These are given for the whole sample along with each of the areas examined, with the first figures relating to the whole time period, and then this is split at 2004 to give first and second halves of the period under review.

Table 3: GB Bus Industry Productivity 1994 to 2014, yearly averages

	TC	EC	TFP
Sample			
Whole period	0.9834	0.9998	0.9832
95 to 2004	0.9884	1.0046	0.9929
04 to 2014	0.9793	0.9952	0.9746
Scotland			
Whole period	0.9985	1.0014	0.9999
95 to 2004	0.9937	1.0140	1.0076
04 to 2014	1.0029	0.9914	0.9942
London			
Whole period	1.0414	1.0053	1.0469
95 to 2004	1.0187	1.0319	1.0512
04 to 2014	1.0647	0.9827	1.0463
English Mets			
Whole period	0.9268	1.0039	0.9305
95 to 2004	0.9571	1.0087	0.9654
04 to 2014	0.8911	0.9956	0.8871
English Non Mets			
Whole period	0.9939	0.9983	0.9922
95 to 2004	0.9916	0.9960	0.9877
04 to 2014	0.9953	1.0002	0.9956

From the figures presented in Table 3, the one area that clearly stands out is the London regulated market. This has experienced annual productivity gains of around 4/5% per annum, which in productivity terms represent massive improvement, particularly given these have been sustained over a relatively long time period. Undoubtedly a large aspect of this will be accounted for by considerably improved utilisation rates. This gain is split relatively evenly across the first and second halves, but what stands out are the levels generated by TC and EC. In the first half, most gains came from improvement in EC, and thus can be considered to be as a consequence of increasing competitive pressures in an evolving market. The second half is a more mature market situation, and thus productivity is solely driven by development of the wider market, i.e. technical change, even to the point that this is creating inefficiency. Consequently, the London market would appear to be one that can be considered in the economic sense to be highly competitive.

This difference is also present in the English Mets and Scottish deregulated markets, but efficiency gains in the first half are at far more conservative levels. To some extent this may reflect the effects of industry consolidation and the earlier introduction of competition, but does still suggest that at the margins some increase in competitive or internal pressures may have existed. The second half however is heavily characterised by TC declines, with efficiency change remaining relatively constant across all three deregulated areas.

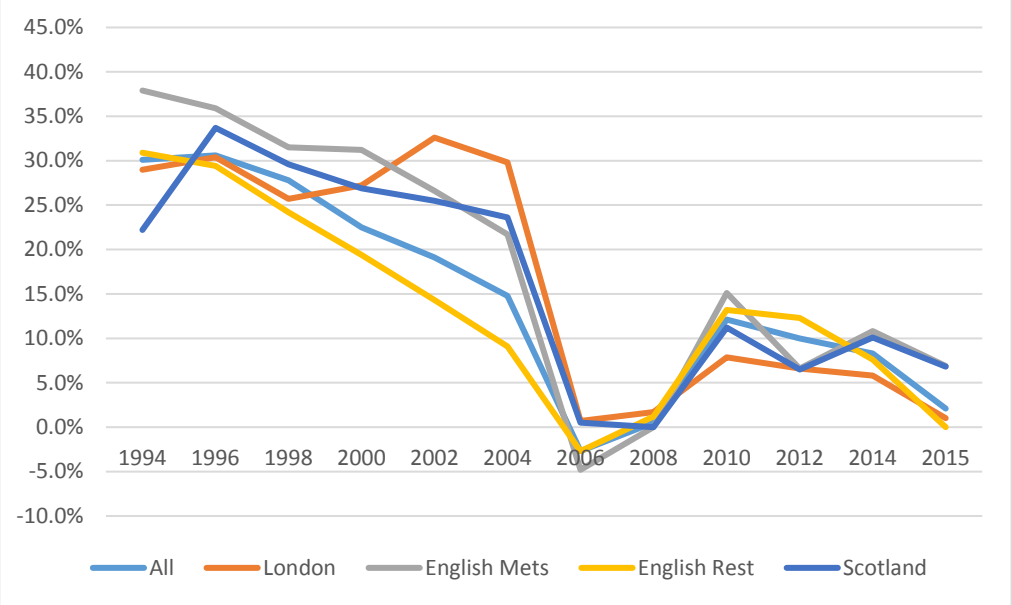
For the whole sample, TFP has fallen on average by over 1½% a year, hence declining productivity. Most transport industries on the other hand tend to show increasing productivity. Cowie (2018) for

example found annual long term productivity gains of around 1% a year for the British passenger rail industry, whilst Chen Chang (2014) annual gains of 2% over a six year period for the Taiwanese intercity bus sector. All of the decrease in productivity however has been as a result of declining TC, which at the general level is normally associated with adverse structural change. Industries in decline will almost always experience decreasing technical change, in much the same way that growing industries will almost always experience increasing technical change as the market evolves. Furthermore, the downsizing of inputs will always lag behind the decrease in output, hence resulting in negative TC. It is also important to consider the difference between what bus companies seek to do, in other words how they seek to maximise profits, and how that aim is actually achieved. In a deregulated market the former is realised through the carriage of passengers, however how this is achieved is by the production of bus services. As a consequence, with the output measure a proxy for patronage, declining productivity may also in part represent lower utilisation rates, which in turn would suggest bus companies are operating services closer to the margin. As such, this would represent greater market efficiency. From a statistical perspective, there is some evidence of this; as highlighted earlier, in Scotland patronage levels have fallen by 6% more than bus kilometres over the period, consequently this is having some effect but still suggests a significant level of decreasing productivity. In the most basic terms, declining productivity represents a higher level of resources going into the production of the output, and hence in this case that could be as a result of greater focus on the market rather than inefficiency per se. Admittedly, in such analysis such a view can on only be speculation, but certainly with reference to the latest set of consumer satisfaction statistics (Transport Scotland, 2017), these do show significant improvements over the years 2007 to 2016 in most of the measures assessed. The point being that decreasing productivity does not always automatically equate with production 'bads', particularly if a higher quality output is being produced.

5.4 Company Profitability

The last issue reviewed is profit margins, which are calculated as profit expressed as a percentage of revenue, with the overall trends shown in Figure 5. The source is as above, however as more financial information was available the period reviewed is 1994 to 2015.

Figure 5: Profit Margins, Scotland, London and England



Source: Compiled from the TAS Bus Industry Monitor

Apart from the obvious decline in profit levels, the most notable characteristic from Figure 5 is that it outlines two distinct periods, with a clear division occurring between 2006 and 2008. Prior to that, profit margins were considerably higher, although notably for the whole sample these were falling almost from the outset. 2006 represents the low point, with several areas even showing that on average companies made losses. Since then, profit margins have recovered to some extent and appear to stabilise at around 6 to 12%, although the latest figures for 2015 could suggest another significant downturn. What is also clear and unexpected is that the London margins follow the same general pattern as the deregulated areas in Great Britain, which given the general perception of monopoly markets in these areas would not have been predicted beforehand. Furthermore, as discussed above, if the London market is considered to represent the outcomes of the efficient competitive market (albeit through Demsetz competition), then by the end of the period the 'normal' profit margin for bus operations may be considered to be in the order of 5 to 8% (the 2010 to 2014 London average). Both the English Mets and English Non Mets were found to be higher, at around 10/11%, and the Scottish market slightly lower at 9%. There are however important differences between the London and deregulated markets which may account for these differences. Firstly, contracts in London are full cost, hence the revenue risk lies with the authority, not the operator, and as highlighted, the authority has full responsibility for marketing, ticketing and route planning. A second consideration is the size of contracts, as cumulatively in London this results in revenue flows to the operator that are on average considerably larger than elsewhere in Britain (by around a factor of 4). When these aspects are taken into consideration, this would suggest that profit margins outside of London can probably be considered to represent normal economic profits, i.e. a fair return for the business risk undertaken.

6. Discussion and Conclusions

The issue of the economic re-regulation of the bus industry is currently fairly high on the Scottish political agenda, and in some senses, this is seen as a major tool in addressing some of the issues with bus usage. In particular, this would enable public authorities to control bus fares, routes, frequencies and entrants. Such an approach however assumes there exists a considerable degree of 'slack' in the bus industry, or more generally, wide spread x-inefficiency. It also assumes that bus franchising will introduce competition for the market in the absence of competition in the market. In many areas in Scotland however, there may be very little scope for such competition to exist, as this would represent a considerable business risk to any potential new entrant in the form of investment in the facilities that would be required to support the on road effort.

Analysis from the paper would also suggest that over time, any 'slack' that may have existed in the industry has long been eradicated. Based on a comparison of profit margins from London and Scotland, this would indicate that somewhere close to normal economic profits are being made from deregulated bus operations. Given that in such situations the ultimate power lies in the market and not with the regulatory body, re- regulation is likely to result in franchise bidding that would produce similar outcomes to that which exist today in terms of fare levels, frequencies and routes operated.

This would suggest that in order to reverse the continued long term decline in bus patronage, policy needs to focus on areas outside of the sector, and from past research, this would appear to lie in the direction of proactive public transport initiatives and car use limiting measures. Introduced on their own however, the danger would be that this would result in a return to the early post privatisation period of high profitability and strong operator market positions. What is required therefore is a package of measures that would bring about a change in the overall approach taken in which the wider public interest has a far greater role to play in the provision of bus services, along with some form of economic regulation. This would not have to be in the form of competition for the market, although such an approach may be the most practical way of re-introducing economic regulation into the sector.

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Appendix 1

As noted in the text, in economics production is normally assessed through the estimation of a production function where:

$$Q = f(X) \quad [1]$$

The two most common specifications of the production function being the Cobb Douglas and Translog Production Functions. In this paper, the latter is used, and the general form given i firms and N inputs, is specified by:

$$LnQ_i = a + \sum_{j=1}^{n} b_j LnX_j + \sum c_j \, {}^1\!/_2 \, (lnX_j^2) + \sum_{k,l=1}^{n} d_{kl} ln\, X_k lnX_l; k \neq l \quad [2]$$

The output specified should reflect the aim of the firm, which in this case is assumed to be profit maximisation. Bus companies are assumed to achieve this through the carriage of passengers (as opposed, for example, through the provision of transport services), however unfortunately this data, for commercial sensitivity reasons, is not available at the company level. What is available is annual revenue, however that to a certain extent will reflect market power rather than 'real' output. What has been used therefore is adjusted revenue, with the adjusting factor being the bus price index by area, hence it should give real bus revenue at a constant price over the whole period. As such, it is assumed to be a reliable proxy for passengers carried. The inputs are far more straightforward, and are simply specified as total staff and fleet sizes in each of the years estimated. As above, the period 1994 to 2012 is analysed, with all financial and labour data compiled from the TAS Partnership Bus Industry Monitor (TAS, 2017). Likewise, fleet sizes were similarly compiled up until 2012, since when this has no longer been collected by TAS, hence over time this has been periodically gathered from internet searches and Woolybus.

In the following formulation, time is added as this reflects change is best practice over time, and three regional dummies included, these are specified in terms of both step dummies (absolute differences) and attached to the time variable (changes in differentials over the period reviewed). The full function to be estimated therefore is given by:

$$LnAR_i = a + b_L lnL_i + b_F lnF_i + c_L \, {}^1\!/_2 \, (lnL_i)^2 + c_F \, {}^1\!/_2 \, (lnF_i)^2 + d_{LF} lnL_i lnF_i + g_t t +$$

$$g_{tt} \, {}^1\!/_2 \, t^2 + g_{tl} lnL_t + g_{tf} lnF_t + \sum_{k=1}^{3} h_D \, D_k + \sum_{k=1}^{3} h_D \, tD_k + e_i \quad [3a]$$

The three area dummies refer to the Scottish, London and English Metropolitan markets, hence all deviations from the base model relate to deviations from the Rest of England. In order to assess productivity, then any productive gains achieved from returns to scale need to be eradicated, hence the following constraints need to be applied:

$$b_L + b_F = 1 \quad [3b]$$

$$b_L + c_L + d_{LF} = 0 \quad [3c]$$

$$b_F + c_F + d_{LF} = 0 \quad [3d]$$

What is estimated therefore is a constant returns to scale function, and hence efficiency measures relate to CRS efficiency. On the one hand, given the length of time period under review (18 years), over such a period firms should aspire to achieve the minimum efficiency scale, and thus from that perspective this seems appropriate, but on the other hand in some cases the size of the local market may limit the extent to which this can be achieved, hence a degree of 'inefficiency' may be inevitable. An overall view of the literature on the MES point for bus operation however tends to suggest that the MES point is

relatively low[2], certainly with regard to the production of bus services, and hence can be attained in most markets.

Under a COLS assessment, technical (productive) efficiency is found by adding the largest positive residual to the constant so that the function becomes a production frontier and bounds all the data from above. Each production point is then compared to the relative position on the frontier in order to derive efficiency. Given the logarithmic form of the equation this is done by the calculation of:

$$TE_{it} = exp(e_{it} - e^{MAX}) \qquad [4]$$

Note that inclusion of the time trend means that 'best practice' changes across the time period, hence to some extent this is converting the measure of productivity into one of efficiency.

Total factor productivity is made up of two elements, technical change and efficiency change. Technical change relates to technical progress, and essentially raises the bar against which individual company performance is assessed (i.e. efficiency). Efficiency change on the other hand is the extent to which the firm has moved towards or away from industry best practice. Technical progress therefore 'creates' inefficiency, as essentially best practice improves, and firms that fail to keep pace with these developments now become inefficient. In subsequent time periods, these will be (or should be) captured by most firms, hence initially whilst positive TC leads to negative EC, following time periods will have positive EC. Consequently, for a mature industry all TFP gains will come through TC, with EC 'balancing' out over the same period. This is an often misunderstood/completely overlooked aspect of TFP assessment.

Technical change is derived from the time trend in function 1a, whilst efficiency change is a simple comparison of efficiency in year t-1 and efficiency in year t. Thus technical progress is defined by:

$$TC = GEOMEAN\left(\frac{\partial LnAR_{it}}{\partial t}, \frac{\partial LnAR_{it-1}}{\partial t}\right) \qquad [5a]$$

Thus technical progress for the individual firm i is defined as the average (the geometric mean) of the rate of change of the output with respect to time in time period t and the previous year t – 1.

Efficiency change is defined by:

$$EC = \frac{TE_t}{TE_{t-1}} \qquad [5b]$$

Hence efficiency change is measured by the position of the firm to the efficiency frontier in year t compared to the position in the previous year.

In both the case of TC and EC, gains in productivity are where the value is greater than 1, and deteriorations where the value is less than one. To complete, total factor productivity (change, TFP), which is the main overall measure of productivity, is given by the combination of the two:

$$TFP_{it} = TC_{it} \times EC_{it} \qquad [6c]$$

Hence productivity improvement arises through a combination of technical change and efficiency improvement.

[2] Note this refers to returns to scale, not economies of scale, hence only refers to scale gains in the production process, it does not therefore include issues such as cost savings through bulk buying.