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**COMPETITION AND ECONOMIC REGULATION IN
INFRASTRUCTURE INDUSTRIES: LESSONS FROM ECONOMIC
HISTORY AND CURRENT UK DEBATES**

Jon Stern
Centre for Competition and Regulatory Policy (CCRP)
City, University of London

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ABSTRACT

This paper discusses the role of affordability in the economic regulation of the retail markets of network infrastructure industries – railways, electricity, water and telecommunications/ICT. The paper first considers the rise of these industries after 1800 from serving a small number of businesses and richer consumers and their transition to providing ‘necessity’ goods for the whole population. It also describes the evolution of these industries in the UK and USA over the period 1850-1970 from competitive supply to regulated vertically and horizontally integrated monopoly companies. From 1850 onwards, economic regulation developed to provide monopoly oversight and regulation that promoted affordable services with USOs. The paper then turns to more recent UK debates and, in particular, to the analysis and findings of two major recent reports (i) the 2015-16 Ofcom Strategic Review of Digital Communications and (ii) the 2015-16 CMA Energy Investigation. These reviews are discussed in the light of the economic history related in the first part of the paper. The paper concludes that affordability and related considerations has led in the UK to ‘regulation for competition’ replacing reliance solely on ex post competition policy for household and SME retail markets in these industries. General political economy concerns over the affordability of these goods as reflected in the economic history suggest that retail price controls will remain at least a significant threat and often a temporary or long-term actuality for household and SME retail markets for electricity and natural gas, water and sewerage as well as ICT services.

1. Introduction¹

The main infrastructure industries (railways, electricity, water and sewerage, telecommunications and now information communications technology) have transformed our economies and the quality of peoples' lives. Each of them was introduced and each developed widespread coverage and use over a relatively short period, around 30-50 years.

Once in place, these industries became essential parts of economic activity and of everyday life. Hence, for each of them, governments have taken an active interest in their roll-out and conditions of service – particularly on the prices charged to household and small businesses and on general affordability. These issues led to the introduction of economic regulation to protect the customers while promoting the development of infrastructure network industries. This has been the consistent pattern from railways through electricity, gas, water and sewage, telecommunications and ICT.

These issues are as live today as at any time in the past. In the UK, we have recently had the 2014-16 CMA² Energy Market Investigation as well as Ofcom's 2015-16 Decennial Digital Communications Review (which is nearing completion). The protection of consumers and the balance between competition and regulatory policy tools has been a major area of concern in both of these inquiries. Affordability and the ability of low income households and areas to access these 'necessity' goods is not only a major theme in both, but it has given rise to considerable controversy, particularly in the CMA Energy Investigation³.

Of course, efficiency issues, particularly dynamic efficiency, has been an important theme in these studies, but they have given rise to less general controversy than the issues around affordability. Indeed, following the arguments of the 1983 Littlechild Report, some economists have argued that distributional issues, including affordability of the relevant goods and services, should not be addressed at all in utility regulation but rather left to social security and tax policy.

The recent CMA and Ofcom investigations listed above have generated a huge amount of comment: economic, legal, commercial etc and from companies, consumer representative groups, lobbyists, academics, journalists etc. However, one perspective that has not been covered is that of economic history. This paper provides an economic history background to the recent debates, focusing on the role of

¹ I am grateful to Richard Cadman, Martin Cave, Nick Crafts, Amelia Fletcher, Martin Lodge, Geoffrey Myers, Michael Pollitt, Agustin Ros and many others for encouragement and assistance with this paper. However, the views expressed in it are solely my responsibility and should not be ascribed to others or to any organisation with which I am or have been associated.

² The CMA is the UK's competition Agency – in full, it is the Competition and Markets Authority and is the merged successor of the Competition Commission and Office of Fair Trading.

³ See, for instance, Littlechild (2016).

‘affordability’ for economic regulation. This provides another context within which to consider recent experience and debates.

The focus of the paper is on infrastructure industries with unavoidable use physical networks – electricity, natural gas and telecoms/ICT and, to a lesser degree, railways plus water and sewerage. I do not discuss non-network transport industries (airlines, buses, trucking) or infrastructure facilities (ports and airports). A major reason for focusing primarily on electricity, natural gas and telecoms/ICT is that these industries have been at the forefront of pro-competitive infrastructure industry reforms over the last 30 years and are now the main focus of debates on how far ex ante regulation can be replaced by competition policy tools⁴.

The intention of the paper is to provide an economic history which includes an explicit political economy perspective to help provide a lens through which current arguments can be assessed. Economic history repeatedly shows the key role played by political economy concerns regarding affordability and fairness which have affected the concerns and policies of governments of all persuasions – and regulatory agencies - since the introduction of railway regulation in the UK and US after 1850.

The paper contains two main parts. The first part is the economic history exposition (Sections 2 – 5) which covers the historical development of the main network infrastructure industries (railways, electricity, water and telecommunications). These sections cover including the movement from competition to monopoly, the relative roles of private and state ownership and the development of (and rationale for) economic regulation over the period from around 1860 to around 1970.

Within the first (economic history) main part of the paper, Section 2 discusses the degree of competition relative to monopoly in the main infrastructure industries from the mid-19th century, focusing on the UK and US. Section 3 discusses the impact of these industries on productivity and GDP growth and, in particular, how they evolved from providers of luxuries to providers of goods deemed essential for life and health. Section 4 briefly discusses the economic rationale for the development of regulation and in particular to the affordability issues affecting household consumers. Section 5 discusses in some detail the 19th century development of regulation for the railways in the UK and US and this is followed by sub-sections on the demand for and rise of economic (and price) regulation for electricity, telecommunications and the water industry up to around 1970.

The second part of the paper discusses the recent UK experience and debates around the role of regulation and, in particular, of affordability for consumers in the major recent energy and ICT investigations. It suggests that ‘regulation for competition’ (i.e. competition in the market but with ex ante regulatory safeguards) has become the norm for the regulation of retail household markets and small businesses in network infrastructure industries rather than relying solely on competition in the market and ex post competition policy. This part of the paper draws on the earlier economic history sections to analyse UK post-privatisation developments and discussions since the 1980s and, in particular, since 2005-08.

⁴ There might be a case for adding postal services to the industry list but it has many similarities with telecoms/ICT on structure (e.g. the monopoly being at the last mile) but is significantly different in many other ways, including a strong USO specified in primary legislation.

The key elements discussed in the second part of the paper (Section 6) are the development of competitive retail markets and of economic regulation in UK telecoms and electricity following the privatisation of both industries in the 1980s. There is also a discussion of the role of externalities and their impact on the demand for regulation across network infrastructure industries. This is then followed by a discussion of what has happened since 2005 over price caps, USOs (Universal Service Obligations), regulated retail contract requirements for small consumers and similar. Particular focus is given to the evolving debate over the roles of ex ante regulatory tools and competition policy for consumers and regulated companies, drawing on the CMA Energy Investigation and the Ofcom Digital Strategic Review. This section concludes with some game theoretic conjectures which suggest that, at the very least, a credible threat of rapid re-regulation or similar to protect retail household and small business markets is important – and is highly likely to remain so.

The paper's main policy conclusion is that, given the political economy concerns, we should not be surprised to see temporary or even long-term regulated retail prices (e.g. regulated default prices for households and SMEs) in some or all network infrastructure industries in the UK and other OECD countries. Indeed, this has been explicitly suggested by Ofwat in its review of proposals for household retail competition in water in England⁵.

The paper ends in Section 7 with a short, numbered summary of the key points and policy implications.

⁵ See Ofwat September 2016.

Part 1: The Historical Development of Infrastructure Industries and their Economic Regulation 1850-1970

2. Infrastructure Industries: Initial Competition, Natural Monopoly and the Revival of Competition

In the 19th and early 20th centuries, governmental concerns over supply conditions and retail prices in network infrastructure industries led to the development of economic regulation of various types in the UK, the US, and more widely. This occurred first for railways and then for the other network infrastructure industries. Independent regulatory agencies were established progressively from the 1860s for railways in the UK and the US and in other richer countries with substantial private investment in railways and other infrastructure industries. The same happened for electricity and town gas in the US from the early twentieth century and for US telecoms from the 1930s.

In other countries (including the UK and most Continental European and other comparable countries, governments (national, regional or local) from the 1880s to around 1980 provided regulation by government agency. They established, monitored and enforced investment programmes, quality standards and prices – the key economic regulation outputs for network infrastructure industries either directly by government departments or indirectly (e.g. via concession contracts).

Over the period 1930-80, the main infrastructure industries operated almost everywhere as vertically and horizontally integrated monopolies - national, regional or local, often state-owned. However, the development and spread of computerisation from the 1970s allowed, indeed encouraged, vertical and horizontal unbundling with the introduction of competition into potentially competitive areas. The latter applied particularly to non-monopoly network upstream and downstream markets. Among developed OECD countries, the UK was among the countries that took this furthest under the 1980-97 privatisation programme and the associated regulatory reforms which were the responsibility of new or reintroduced independent regulatory agencies. This resulting form of UK economic regulation was heavily embedded within a competition policy framework⁶.

For the strongest UK pro-competition advocates, including Littlechild and economists, one of the ultimate goals of the 1980s infrastructure privatisation reforms was wherever possible to replace economic regulation by a reliance on markets and competition policy – and in particular to eliminate price regulation in non-monopoly market segments. This policy was explicitly advocated for telecommunications in the 1983 Littlechild Report and it was subsequently advanced and developed by Littlechild and others for electricity and natural gas.

Ironically, as will be discussed in Section 6, there has been a significantly greater reliance on markets and ‘pure’ competition policy in UK energy markets than in telecommunications and ICT (information communications technologies). For UK railways and water, there has since 1980 been some development of markets and

⁶ See Stern (2015) and the references cited there.

enhancement of competition although there has not been any significant retreat from economic regulation.

Underlying issues over the functioning of these markets and the degree to which consumers are willing and able to make informed choices has, in recent years, seriously undermined the case just for reliance on ex post 'pure' competition policy for small consumers in these markets. This has arisen at a time when traditional political economy affordability, welfare, income inequality and related concerns have since 2008 become more acute in the UK (and in many other OECD countries) than for many years.

The topics outlined above provide the concerns of what follows. From 1945-80, the main UK infrastructure industries operated as state-owned monopolies. In other countries, they were either state-owned (e.g. France and Italy) or in the private sector but heavily regulated (e.g. the US and some of West Germany). That era was followed after 1980 by unbundling and competition with telecoms, electricity and natural gas as the pathfinder exemplars. However, since 2005, we have seen more activist government policies and regulation both in network energy industries and ICT.

2.1 18th and 19th Century Infrastructure Franchises

Railways were the first modern infrastructure industry and economic regulation as we understand it today began with them. In both the UK and the USA, rail franchises were awarded by legislatures and these franchise contracts specified the terms of operation.

The UK franchises started from the eighteenth century model used for canals which gave a 21-year renewable franchise. These set canal toll rates and imposed a dividend payout ceiling. However, 21 years was not long enough for a rail franchise, particularly as the train company had to provide rolling stock, signalling facilities and make very large investments in the track and associated facilities. Hence, both in the UK and the US, the initial railway franchises became permanent so long as the private operator who owned them was still in business⁷.

2.2 From Competition to Monopoly

The early years of the UK railway industry demonstrated intense competition. During the 1840s UK 'railway mania' period, companies established railways that competed over the most popular routes. In addition, railways competed with canal and road transport, something that became progressively more important after 1900. However, railways always had considerable local monopoly power and after 1850 there was considerable consolidation towards regional monopoly rail companies. This culminated in the 'grand amalgamation' of 1923 of the remaining British railway companies into four major regional monopoly companies.

⁷ For more information on this and other aspects of UK railway history see Stern (2003) and its references. The best single guide is Foster (1992). For nineteenth century US railway history, see Kanazawa and Noll (1994).

US railway experience from 1840 onwards follows a similar pattern with companies gaining legislative approval for franchises and generating intra and inter-State competition. However, this on-rail competition had also largely disappeared by 1900 as less successful companies merged with others or closed.

It is worth noting that this pattern of initial competition in the market followed by consolidation and regional monopoly was to a considerable extent replicated in electricity and town gas. In all of these industries, economies of scale and classic network effects promoted merger and eventual monopoly. Particularly in the UK, vertically integrated monopolies became progressively more important from 1890 onwards – sometimes privately owned (railways and some energy companies) sometimes municipally owned (many energy companies, water supply and sewerage) and sometimes owned by the national government (postal services and telecoms)⁸.

For telephony, before 1912 there were several UK local telephone companies, public and private. However, in 1912, the Post Office took over the privately owned National Telephone Company creating a single state-owned entity, with only the municipally owned Kingston upon Hull telephone company as an exception⁹. The US also had competing phone companies from 1894 until into the 1920s when the Bell Systems monopoly became near complete and a single natural monopoly US telecommunications company was established, a position which lasted until 1982¹⁰.

2.3 Economists and Natural Monopoly

Before 1980, it was common to see discussions of infrastructure industries such as railways, electricity and telecommunications treating them as ‘natural monopolies’. Hence, Alfred Kahn’s classic 1970 two-volume survey of economic regulation had a major chapter on natural monopolies and their role in telecommunications and natural gas transport. Natural monopoly was typically justified by appeals to economies of scale and scope at the whole-industry level.

In fact, Kahn was critical of classing infrastructure industries as natural monopolies, but he was unusual among mid-20th century regulatory specialists of the time. Kahn consistently sought to find ways of bringing in competition where possible, but the natural monopoly perspective was clearly powerful for him and the intellectual perspective against which was writing. Regulated vertically and horizontally integrated infrastructure industries were the policy norm from around 1900 to at least the 1970s leaving little or no scope for any type of competition. State ownership was also common in Europe and elsewhere, particularly after 1945.

The question of natural monopoly did not disappear after 1980. The classic Vickers and Yarrow 1988 book on privatization wrote that regarding fixed line local telephone networks “... typically there is natural monopoly and inevitable market power.” (Mobile telecom services only arrived in the UK in 1985 and take-up was low until

⁸ In the 1950s, there were over a thousand local monopoly water undertakings, a number that fell to 198 by the early 1970s, when there were still over 1,300 sewage disposal authorities. See Vickers and Yarrow (1988) pp 389-90.

⁹ See <http://home.bt.com/news/bt-life/history-of-bt/a-short-history-of-telecommunications-in-the-uk-11363870786446>

¹⁰ See Vickers and Yarrow (1988), pp 202-3 and Wallsten (2005).

the mid-1990s.) Vickers and Yarrow also suggested that major natural monopoly elements remained in both railways and water, giving little if any scope for competition, as well as in the distribution and transmission of energy¹¹.

Since 1980, the use of the natural monopoly concept among economists has primarily – and increasingly - been used to cover unavoidable use monopoly physical networks rather than whole infrastructure industries or companies – at least for electricity, natural gas and telecommunications¹². Moreover, network competition has become a lot more prevalent in telecommunications (particularly with the growth of mobile telecoms and cable networks) and has made some advances in electricity transmission and gas transport. Nevertheless, we still do not see any countries with competing electricity transmission or local distribution networks.

The position is quite different in wholesale and retail supply markets, particularly for electricity and natural gas and throughout the ICT sector.

From Kahn onwards, there has been a reasonably general consensus among economists that *wholesale* electricity and gas markets (e.g. in electricity generation) can and should be established on a competitive basis. Indeed, the US introduced independent power producers (IPPs) during the 1980s following the enactment of PURPA¹³ in 1978, while England & Wales, Australia, Chile, New Zealand and the European Union all introduced competition into generation between 1980 and 2000. Natural gas exploration and production was also generally accepted in OECD countries as a potentially competitive industry segment from the 1970s – at least subject to the constraints of long-term take-or-pay contracts. As with electricity, most developed OECD countries also introduced competitive natural gas retail markets for large industrial customers after around 1985. This was relatively uncontroversial – at least outside Central and Eastern Europe. The move towards unbundling and competition in (rather than for) the market has also become the dominant orthodoxy within ICT across OECD countries.

This new consensus is reflected in recent economic texts on the topic such as Newbery (1999) and Decker (2015). For electricity, climate change concerns and policies have, in practice, led to an emphasis on competition *for* the market in generation rather than competition *in* the market - but this is not least because governments have been unwilling to rely substantially on market-friendly climate change policies such as carbon taxes or tradable quotas. Unbundling and competition in non-network market segments have, though, made much less progress in railways or water and sewerage.

There has been much less consensus on retail supply markets for electricity and gas, particularly for retail sales to households and small businesses. There is general agreement in the UK, the US and other OECD countries that there should be competition in retail supply to all types of customer. However, there has been considerable argument in many countries about how deregulated household and SME (small and medium sized enterprise) retail markets should be. In particular, most

¹¹ See Vickers and Yarrow (1988), p.69, 384, 403. Armstrong, Cowan and Vickers (1994) do not discuss railways but come to very similar conclusions for the other industries.

¹² See Newbery (1998) and Decker (2015)

¹³ The Federal Public Utility Regulatory Policies Act

countries (including the US, apart from Texas, and EU countries) have only allowed retail competition for households and SMEs along with a regulated default price. A tightly drawn regulatory default price leaves little scope for competition so that most US states where retail competition for all electricity customers is allowed have only 10-15% or fewer customers switching to alternative suppliers from their local incumbent utility.

Whether or not household retail competition is allowed for electricity and natural gas and under what regulatory terms has been a major economic debating and policy debate battle-ground in recent years and was the main focus of the 2015-16 UK CMA Energy Investigation. This debate is discussed in Section 6 below.

The natural monopoly case for infrastructure *industries* has not been renewed among economists in recent years – apart from the remaining supporters of state-owned monopolies. However, it is still generally accepted that unavoidable use physical networks (e.g. electricity, natural gas and water pipes and wires) should operate and be regulated as natural monopolies – subject to any specific competitive initiatives. However, the arguments in favour of fully deregulated competition in supply markets have (at least in the UK) become a lot more controversial since 2005-8, particularly as regards electricity and gas supply to households.

3. The Economic Impact of Infrastructure Industries from 1840-1970

This is a classic topic and one much studied by economists and economic historians.

There has long been an interest in quantifying the impact of railways on growth and some major economic history studies, including the classic 1964 Fogel study for the US and Crafts (2004) for the UK. These studies have been followed by lots of subsequent research on the impact on GDP and on productivity growth of electricity and of other technologies, including ICT. Indeed, when in the 1990s economists wanted to project how computers and (what became) ICT would develop and impact on economic growth, they turned to experience with railways and steam and, in particular to the experience of the development and impact of the electricity supply industry.¹⁴

Almost all of this work has focused on the impact of these technologies on productivity and GDP growth. This is also the ostensible main focus of Gordon's recent researches and his major 2016 book. However, one of the most interesting facets of Gordon's recent studies has been his explorations of the impact of these industries on the *lives and welfare of households and people*.

As is well-known, GDP measures output and expenditure – not welfare¹⁵. Gordon has brought together a lot of useful evidence of the impact of railways, electricity as well as water and sewerage on the quality of life of American citizens. The demand for regulation has been driven by the wider benefits from industries that, after an initial

¹⁴ See, for instance, David (1991) and Crafts (2013).

¹⁵ See Coyle (2014) for a full discussion.

competitive surge, operated as monopolistic network-based industries providing ‘necessity’ goods to large numbers of urban and later rural businesses and households.

The resulting direct benefits and externalities from the revolutionary new network industries have always been perceived as very important for peoples’ health and welfare as well as for economic development. Hence the introduction of economic regulation to prevent monopoly abuse and also to ensure ‘affordability’ became an increasingly important political economy driving force in the rich economies when these industries became widespread in their use.

This combination has consistently been the main focus for the introduction of price regulation of infrastructure industries since the first calls for railway regulation in the US and UK in the 1840s.

3.1 Impacts on Productivity and Output

The first and most obvious impact on welfare has been the impact of the infrastructure industries on GDP and productivity growth rates. This has been much studied for the US, the UK and many other countries. The discussion below presents a summary of the current consensus.

Regarding the impact of steam and the railways on productivity and growth, Crafts (2004) suggests that steam (steam engines and steam ships as well as railways) added around 0.2% per year to UK labour productivity growth from 1830-50, 0.4% per year 1850-70 and 0.3% per year from 1870-1910¹⁶.

For electricity supply, Crafts estimates that electricity added 0.4% per year to US labour productivity from 1899-1919 and just under 1% per year from 1919-29. The main boost to productivity growth from electricity in the US appears to have been completed by 1930.

In both railways and electricity, the increase in labour productivity was lagged by several decades from the initial inventions. Over 100 years separated James Watt’s invention of the steam engine to the period when steam had its greatest impact on productivity and growth. For electricity, that period was considerably shorter – about 40 years.

The delay between innovation, widespread incorporation and impacts on growth has been much noticed and has had a major effect on the debates about the productivity impact of ICT, where few economists found any sizeable impact before 2000 – and sometimes after. A lot of this debate is in response to Solow’s 1987 dictum “You can see computers everywhere except in the productivity statistics”. Since we are still far from the end of the digital revolution, it is still extremely difficult to say what the ultimate impact of ICT on productivity and growth will be. Indeed, the problems of incorporating digital products into GDP has proved to be very difficult and has led to many questions about what is actually measured – or should be measured - in GDP statistics¹⁷.

¹⁶ See Crafts (2014) Slide 7

¹⁷ See Coyle (2014), Bean (2015) and many others.

Solow's quote is from 10-15 years before broadband usage developed. However, Crafts (2014) is clear that productivity growth from ICT has already been significantly higher than it was from steam and railways or from electricity over a comparable period.

3.2 Wider Welfare Benefits from the Growth of Infrastructure Industries

The impact of infrastructure industries on GDP and productivity growth is very important, but for the purposes of this paper, I want to focus more on the wider welfare benefits to households and citizens.

Regarding railways, Crafts (2014) notes the wider economic benefits arising from their geographical expansion – in particular, the growth of passenger travel and commuting. Railways allowed the growth of short and long distance rail commuting and the expansion of major urban centres such as London, Manchester, New York, Chicago and Paris. In addition, the modern tourist industry was in very large part the creation of the railways – both short day/weekend excursions and longer duration holidays.

This phenomenon was very important and was well-recognised at the time e.g. in the exchange of poems between Wordsworth and George Heald about the impact of the newly arrived Kendal to Windermere railway in 1847. This railway opened up the Lake District to mass tourism. Only some of the benefits to the urban workers from their excursions will appear in GDP as lower costs. Many of the subjective benefits will not appear in GDP (e.g. the pleasure given to large numbers of urban workers from visiting, seeing and smelling Wordsworth's celebrated Lake District spring daffodils)¹⁸. The same applies to the health and well-being benefits from living in lower pollution areas and commuting to work by train.

Commuter railways also gave rise to major wider non-market consumer benefits from the growth of passenger railways, as well as the output and productivity gains from the growth of (primarily freight) railways discussed above. Commuter railway services began in the 1840s and expanded rapidly with underground services from 1859. This allowed a seven-fold expansion in London population after 1850, which resulted in major output effects from urban agglomeration. To this can be added the welfare benefits, firstly, from those able to move from London slums to rather less polluted inner or outer London suburbs while working in London; as well as, secondly, the increased leisure time from shorter journeys to work. The same phenomenon was happening to a lesser extent in other major UK cities¹⁹.

The changes to economic welfare were even greater from the spread of electricity and also from the development of network-based water and sewerage systems. Gordon's 2016 book describes this for the US with some extremely telling statistics. The same

¹⁸ See https://en.wikipedia.org/wiki/Kendal_and_Windermere_Railway for the fascinating exchange of poems between Wordsworth and George Heald, a contracting engineer.

¹⁹ See Ball and Sutherland (2001). See also Robinson (2011) http://www.bbc.co.uk/history/british/victorians/london_modern_babylon_01.shtml

story would very largely apply in the UK and other OECD countries, albeit some years later than the US.

The story can be largely summarised as the arrival of major new commodities, originally only affordable to (and purchased by) the most prosperous families which then rapidly spread to urban working class families as the necessary networks were rolled out. This happened quite quickly as major and profitable new business opportunities were perceived from expanding supply. There was high demand for these income elastic goods where the costs of supply could fall substantially with mass roll-out. These commodities then increasingly became seen as ‘essential’ for well-being and, with falling prices, urban access became near-universal over a 20-30 year period. Rural areas lagged behind in coverage and it typically required explicit government expenditure or subsidy to extend it to all citizens. This is the story that Gordon (2016) sets out for the USA.

This story started with railways and passenger travel. However, it also applies well to electricity and to water and sewerage and also applies well to telephony (particularly the spread of mobile coverage), and to the roll-out of broadband and other digital services²⁰.

For the US, Gordon’s recent economic history from 1865-2000 sets out in detail the main findings of the take-off of post-1870 impact infrastructure industries – electricity, water supply and sewerage and others – and how these impacted on household and family welfare. A summary of the main findings is as follows:

3.2.1 *Electricity*²¹

- (i) In 1900, 3% of US citizens had electric lighting, but this rose to 79% by 1940;
- (ii) By 1940, electric lighting was ubiquitous in urban areas but 66% of farms and 81% of ‘rural’ farms still relied on kerosene for their lighting;
- (iii) The price of lighting fell by 6% per year over the 1902-29 period (81% over the 27 year period), which greatly assisted rapid take-up as did the quality of electric light as shown by the very large falls in the cost per lumen over this period;
- (iv) Electric lighting resulted in a much lower fire risk than candles, kerosene and town gas. It also greatly improved atmospheric quality – and the incidence of associated health problems;
- (v) The use of standard electrical appliances rose very sharply after 1920. From near-zero in 1920, by 1940, 40% of US households had a refrigerator and/or washing machine and 80%

²⁰ See Gordon (2016) for the US. For UK electricity see Hannah (1979) and Stern (2005) Section 4. For telecoms and ICT see Ofcom Strategic Reviews 2005 and 2015-6.

²¹ Gordon (2016), pp 114-22. He brings together results from earlier studies by Lebergott, Nordhaus and Platt.

had a radio. By 1940, 80% of US households also had an electric iron and a vacuum cleaner;

- (vi) The spread of electricity was also crucial to the growth of central heating. From zero in 1900, 40% of US households had central heating by 1940 and 70% by 1970. (This was followed by the growth of domestic air conditioning in the mid-late 20th century);
- (vii) In Chicago, by 1929, 80% of households had vacuum cleaners and electric irons, 37% had a washing machine and 36% a toaster.

This list demonstrates how the spread of electricity revolutionised domestic work and the home environment. Many of these changes (e.g. refrigeration) had clear and important health consequences. In addition, the spread of reliable, low cost electricity also revolutionised cultural opportunities by enabling the development of radio, gramophones and cinema.

The US led the way on this but other countries were not massively behind. For Britain, Hannah (1979) reports that, by 1939, “almost two-thirds of homes had electric service, but many of these had only a lighting service, some had only one plug socket and only a small minority had the full complement of sockets which was to become standard in a post-war [post-1945] house”. Of the houses with some kind of electric service, 77% had irons, but fewer than 40% had vacuum cleaners. Interestingly, 27% had electric fires (a standard pre-central domestic heating method in Britain for cold days)²².

The pervasive transformation of these changes on family and individual welfare helps explain why the price and quality of electricity has always been a crucial ‘affordability’ issue for governments and regulators, particularly in recessionary times.

3.2.2 *Water and Sewerage*²³

It is well-known how the spread of clean, running water and, even more, effective sewerage have dramatically reduced morbidity and mortality rates, particularly for children under 5.

In the UK, John Snow and Joseph Bazalgette are famous for their role in ridding London of cholera in the 1850s. In 1853-4, over 10,000 Londoners died of cholera. In 1854, Snow, in pioneering epidemiological work, identified the contaminated water source in Soho; he then had the handle of the pump at the infected source removed, following which deaths fell sharply. Snow’s epidemiological studies were crucial for the sewerage developments that followed. Bazalgette was appointed Chief Engineer to London in 1856. Following the ‘great stink’ of 1858, he designed and supervised the building of a complete new London sewer system which was completed in 1875.

²² See Hannah op cit p.208.

²³ See Gordon op cit, pp 122-25.

Unlike other UK cities or Berlin, there were no cholera outbreaks in London after 1875 and a lesser outbreak in 1866 was confined to an area not covered by Bazalgette's new sewers – a system still providing the core part of London's sewage system today²⁴.

For the US, Gordon presents core statistical information on the rapid spread and the huge impact of the rise of network water and sanitation systems.

The key US statistics are as follows²⁵:

- (i) In 1900, only 15% of US households had indoor flush toilets. This rose to 60% by 1940 and 95% by 1960;
- (ii) In 1900, only 33% of US households had running water as opposed to 70% in 1940 and 90% in 1960;
- (iii) In 1870, there were 244 waterworks in the US but, by 1924, the number had risen to 9,850;
- (iv) In 1890, only 1.5% of US houses had filtered, running water. In urban areas, 25% of houses had filtered running water by 1910, 42% by 1925 and 90% by 1940.

The impact of these changes on human welfare was enormous. In 1900, 37% of all US deaths were from infectious diseases; whereas, by 1955, fewer than 5% of US deaths were from these diseases, with most of the fall *before* the development of effective antibiotics. Cutler and Miller (2004) estimate that nearly one-half of the total US 1900-1936 mortality reduction, nearly two-thirds of the fall in child mortality and three-quarters of the fall in infant mortality arose from the spread of clean water filtration and chlorination²⁶.

There was also a huge impact on the everyday lives of people, especially women. In his 2012 NBER paper Gordon writes as follows:

“But the biggest inconvenience was the lack of running water. Every drop of water for laundry, cooking and indoor chamber pots had to be hauled in by the housewife, and wastewater hauled out. The average North Carolina housewife in 1885 had to walk 148 miles per year while carrying 35 tons of water....*There was no more important event that liberated women than the*

²⁴ Wikipedia and the BBC History website have good short biographies of John Snow and Joseph Bazalgette. For additional information about cholera in London, see <http://www.choleraandthethames.co.uk/>

²⁵ See Gordon op cit pp 120-125 and 217-8.

²⁶ In the early 1980s, I read a book on the health, mortality and development which claimed that water and sewerage engineers had saved more lives than all the doctors who had ever lived. Unfortunately, I have been unable to find the reference....

invention of running water and indoor plumbing, which happened in urban America between 1890 and 1930.” [Gordon’s emphasis]²⁷

In Britain, the development of the water sector before 1914 was predominantly local – and messy. Millward (2005) describes it as largely municipally based with 80% of UK water supply companies being municipally owned, albeit with the support of private and central government finance. However, retail charges were kept low so that British water supply companies consistently operated at a loss, squeezed between progressively tougher public health obligations and an inability to raise prices. Increasing local tax revenues helped fund the investment requirements to meet the public health obligations with total investment in water being the largest component of local infrastructure investment from 1850-80²⁸.

Millward summarises the position on water in 19th century Britain as a semi-commercialised halfway house between wholly publicly provided education and health on the one hand and more commercially oriented electricity, town gas and tramways on the other. This also seems to be the case in the US and in several west European countries²⁹. Keeping water and sewerage prices low to household consumers was a priority throughout.

In view of the role of water and sewerage in modern life, it is not surprising that popular hostility to the commercialisation and privatisation of water has been stronger than for any other infrastructure industry. This is reflected in the much greater hostility to water privatisation in England and Wales in the 1980s, and the refusal of the Scottish authorities to contemplate it - as well as by the recent widespread protests in Ireland against the reintroduction of household water tariffs.

The England and Wales water and sewage industry privatisation was only achieved with an approximately 80% privatisation discount to contain the potential impact on water bills. Given the very long life of most water industry assets, the bulk of this discount still applies even though it is more than 25 years after privatisation. Hence, even in England and Wales, consumers do not cover the bulk of the pre-privatisation capital costs.

Domestic water affordability and disconnections have also been an important regulatory and politically controversial as shown in many countries, including England and Wales, Ireland and many others. It is not so much the *level* of water bills that is an issue – in 2012, water bills accounted for around 1.5% of average household expenditure in Britain as opposed to almost 5% for energy – and similarly in many other OECD countries³⁰. However, *increases* in bill levels do raise protests, often major, particularly in periods of low or negative growth in net incomes for median and lower income families. This reflects the fact that the share of water and energy

²⁷ See Gordon (2012), p.7. The North Carolina material was taken by Gordon from Strasser (1982), p.86, which discussed the results of an 1886 survey by the North Carolina Farmers’ Alliance.

²⁸ See Millward (2005), pp 41-54 for an excellent survey.

²⁹ See Millward op cit p.50 and p.45.

³⁰ See UKRN Report on Affordability January 2015.

expenditure is markedly higher for low income households and regions (viz. Northern Ireland)³¹.

3.3 Wider Economic Benefits and Economic Needs – Evidence from Household Income and Price Elasticities

In the previous section, I discussed how infrastructure products and services – from railways to ICT - started out as luxuries only purchased by the most prosperous households before, over a relatively short period, becoming seen as essential for a reasonable quality of life.

This perspective is reflected in consumer demand theory. For instance, Engel Curves divides goods into ‘luxuries’ whose share in consumption rises as real household incomes rise and ‘necessities’ whose share falls as real incomes rose. The former have income elasticities of demand greater than 1; the latter have income elasticities less than 1.

There has been a great deal of empirical investigation of income and price elasticities for infrastructure industry products, particularly for electricity and energy. Particularly useful are the explorations of how these elasticities have changed over time. In what follows, I discuss the evidence on household demand elasticities in recent years for a range of infrastructure industries as well as on historical trends in income.

3.2.1 Estimates of Current Household Income and Price Elasticities

For electricity, the consensus is that the relevant current household income elasticities are low – significantly less than 1 – and that short-run price elasticities are also low – typically under -0.5. Long-run income and price electricity elasticities have been estimated as significantly larger than short-run elasticities.

For instance, the Espey and Espey meta-regression analysis of mainly US studies estimates the long-run residential income elasticity for as 0.92 at median income and the long-run price elasticity as -0.81. This compares to their estimates of median short-run income and price elasticities of 0.15 and -0.28 respectively³². (The difference between short and long-run is whether or not the stock of electrical appliances used is unchanged or adjusted to the changes in income and price.)

For the UK, Meier et al (2012) report a residential income elasticity for electricity of 0.17 at the sample mean but rising with income from a (2007) income of £7,200 per year. Estimates of electricity own-price price elasticities vary but are almost always less than -1.0 and typically lower (less than -0.5) for samples that exclude households without electric heating³³. For UK water, Waddams and Clayton (2010) suggest a residential income elasticity of 0.3 to 0.4 and an own-price elasticity of -0.4 to 0.5, but point out that there is likely to be substantial variation around these estimates. For

³¹ See UKRN Report op cit p.8. Expenditure shares on energy for the lowest income decile in 2012 were up to three times those of the top decile.

³² See Espey and Espey (2004). They used data from 36 different studies.

³³ See Pollitt (2010), Slide 19.

telecoms/ICT, Cadman and Dineen (2008) estimate (cross-section) income and own-price elasticities for the number of broadband subscribers per 100 inhabitants as 0.78 and -0.43 respectively across 28 countries³⁴.

These residential price and income elasticities show how sharp cost and price increases can significantly reduce consumer welfare, particularly for low income groups, at least for commodities where the share of household expenditure is relatively high. This has been a major issue in electricity and natural gas policy and regulation in the UK since 2008.

3.2.2 *Household Energy Income and Price Elasticities since 1700*

The most useful evidence for the need (and development) of infrastructure industry regulation comes from the history of income elasticities and how they have varied over time. Fouquet (2011) shows clearly how developments in energy service supplies and efficiency have met the growth of successive wants – heating and lighting in particular. The growth of demand and the fall in the cost of providing the specific services has meant that the final commodities supplied have developed from being luxuries consumed by a few into mass consumer goods purchased by almost all households. This is reflected by the trends in income and price elasticities for energy reported by Fouquet for the UK from 1800-2010.

For residential consumption, Fouquet focuses on heating and lighting. He reports that, since 1700, there has been a 220-fold increase in household consumption of energy services for heating and a 295,000-fold increase in lighting consumption. These increases were largely achieved by technical advances which greatly reduced the costs of supplying a unit of heat/light and produced affordable heating and lighting services³⁵.

The pattern of adoption was that first the richest households adopted the new (and relatively expensive technology) such as gas and electricity. These replaced coal, wood or tallow candles. Then middle income families adopted the technologies as their prices fell and then lower income families adopted it as the prices continued to fall and their incomes rose.

The pattern outlined by Fouquet is reflected in the estimates of UK income and price elasticities for energy that he reports for 1800-2010. His estimates are for overlapping 50 year periods. His estimated income elasticities for domestic heating and lighting were around 2.0 in 1800 but rose to peak at around 2.3 for heating and 4.0 for lighting at around 1825 and 1875 respectively. They then declined to reach unity by around 1950. Fouquet suggests that the earlier peak for heating demand reflected that priority was given to heating and cooking over lighting in lower income households³⁶.

³⁴ Cadman has in correspondence written that they were surprised by the relatively low price elasticity, which suggests that broadband access had by 2007 already become a ‘must-have’ for many households in richer countries. In the UK, this is corroborated by DECC statistics which show that electricity consumption for personal electronic devices (including computing) rose from 19% of total domestic electricity consumption to 32% in 2009.

³⁵ See Fouquet (2014), p 9-10.

³⁶ See Fouquet (op cit) p. 19-20.

Fouquet's estimates for UK energy price elasticities show low initial values for each of the energy services (around -0.5) but increasing in absolute terms towards -1.5 for lighting in the 1870s and for domestic heating in the 1920s. However, by 1950, both of these price elasticities were around -0.5, the level at which they have remained since³⁷.

The issues discussed above provide the context for the discussion of the rise and development of economic regulation in the nineteenth century and more recently. That is the topic of the next section. The pressures for regulation (by regulatory agency or by public ownership) have typically emerged once consumption of the relevant service has become widespread and the service has come to be seen as an essential commodity.

4. The Rise of Economic Regulation in Infrastructure Industries after 1850

In this section, we first discuss what is normally covered by the term of 'economic regulation' for infrastructure industries; we then discuss briefly the economic reasons for its introduction and development, including political economy concerns.

4.1 What do we mean by economic regulation

Modern economic infrastructure regulation (for networks or industries) typically includes most of the following features:

- (i) Approval of proposed investment programmes;
- (ii) Price or profit controls;
- (iii) Quality obligations;
- (iv) Efficiency targets;
- (v) Periodic realignment of costs and prices; and
- (vi) Consumer service obligations.

Not all of these are present for all regulated infrastructure industries and several were developed primarily in the mid-late 20th century. The 19th century origins focused primarily on prices, investment and (in the UK) dividend payout limitations.

As set out in Section 2, economic regulation in the UK had its origins in the contractual terms included in the Parliamentary Acts which authorised the construction of canals in the 18th century. Canals and toll roads were constructed following an Act of Parliament which gave a 21 year franchise and set the toll rate that could be charged for users of the canal or road. It also imposed a dividend payout

³⁷ See Fouquet (op cit) p 20-22.

ceiling of 1%. The franchise could be extended by a renewal Act. Hence, investment and price regulation were combined in a simple, if crude, way³⁸.

The model above was insufficient for the railways given, firstly that railway companies owned and operated the trains as well as the track; and, secondly, the much bigger investment outlays and longer life of the investments. Hence, modern economic regulation developed for the railways in the US and the UK from the 1860s.

4.2 Why do we need economic regulation?

The classic statement in recent years of the reasons why we have economic regulation of infrastructure industries comes from Levy and Spiller (1994).

They provide the following three reasons:

- 1) Regulated infrastructure industries are *highly capital intensive*, with long-lived and often *sunk* assets
 - This implies private investors are at risk of losing value of assets by governmental/regulatory open or hidden confiscation.
- 2) The industries typically have *considerable economies of scale* and often *economies of scope*
 - This is most obvious with ‘unavoidable use’ monopoly networks as in railways, electricity and water but may apply to whole industries in small countries.
- 3) The services supplied are (a) *consumed by and necessary to the welfare of all households*; and (b) *provide critically important inputs for all firms and industries*.

Most attention has been given to the first two of these Levy and Spiller criteria. Large numbers of small customers facing a monopoly is always likely to generate a call for regulation – and it has done so in practice since railways in the mid nineteenth century. Preventing large, powerful infrastructure companies from exploiting their consumers remains a classic regulatory objective even where monopoly has been replaced by oligopoly, as in ICT markets and energy supply markets.

The first criterion with its implications for the problematic sustainability of privatised infrastructure industries became a major concern both for privatisation programmes in the UK and other developed OECD countries as well as for World Bank infrastructure activities in middle income and developing countries. Indeed, not only did Levy and Spiller become a key text for anyone involved in infrastructure industry reforms in Central and East European transition countries and across developing countries from the 1990s, but their criteria – particularly this first one – became the standard and obligatory foundation for infrastructure industry policy from the mid-1990s.

Much less attention has been given to the third criterion. However, for developed OECD countries, issues about asset confiscation by government or regulatory

³⁸ See Stern (2003), p 14-15.

‘takings’ have become a relatively minor concern over the last 10-20 years. Governments and regulators have established reputations for fair dealing – and are keen to maintain these reputations as they are closely monitored by debt rating agencies as well as by many other private sector government and international agencies. Hence, the costs of renegeing on countries and consumers (primarily via the cost of capital) are known to be considerable and to occur speedily. This means that the first criterion is for the UK and many other developed OECD countries has in recent years become heavily downgraded as a problem in practice – or at least relegated to a relatively minor ‘insurance-type’ concern.

Conversely, the third criterion – goods sold to all households and essential for welfare plus critically important inputs to all businesses – remains crucial and has, if anything, become more important. In ICT, the range and importance of broadband based products has grown enormously and it is now extremely difficult to run any kind of business without it. Mobile telephony and mobile ‘app’ products have also become hugely important over the last 10 years for consumers and businesses. These factors have undoubtedly increased the demand for activist economic regulation. In response, the US and UK have in recent years mandated a broadband USO.

Similarly, in electricity and natural gas, concerns - and higher costs - from action to reduce carbon emissions and global warming has been a major factor in the demand for more activist economic regulation. This has been reinforced when combined with sharp increases in fossil fuel prices plus static or declining real household incomes for median and lower income households.

In our increasingly digital world, much attention has been given to the vulnerability of the relevant networks and the treats to security e.g. from hackers and terrorists. This again increases the demand for regulation – and for economic regulators to support the necessary investments to minimise the risks from hackers, fraudsters, and other digital intruders – state as well as private and criminal.

At the heart of these concerns is that these commodities (plus water and sewerage supply) are generally seen as essential to life, health and welfare by citizen consumers as well as politicians and governments of all parties. Indeed, this issue transcends political systems. It is as much a concern (if not more so) in Russia and China as in developed OECD democracies. Hence, questions of affordability and the ability of low income and vulnerable households to buy adequate supplies of these goods without going into debt has in recent years become a major – if not the major – focus of regulatory policy, particularly for energy.

It is clear that these issues have since 1840 always been the spur for the introduction of economic regulation of infrastructure industries.

5. The Development of Economic Regulation Across Infrastructure Industries 1860-1970

Economic regulation of public utilities is now over 150 years old. Some of its concerns have remained constant throughout (e.g. prices and fairness for households and small businesses); while others have waxed and waned. In particular, since 1980,

there has been an increasing focus on economic efficiency (productive, allocative and dynamic) and considerable hostility among many regulatory economists against its use for distributional concerns and ‘fairness’. However, in recent years, the pendulum has swung back on the latter as will be discussed in later parts of the paper.

In modern economic texts (e.g. Decker’s 2015 text), maximising efficiency – productive, allocative and dynamic efficiency – is taken as the core objective of the economic regulation of infrastructure industries and utilities. Regulation focuses on this in monopoly industries or industries with monopoly features like infrastructure ‘wires and pipes’. Incorporating externalities (including network externalities) is another classic objective of modern infrastructure economists’ thinking³⁹. Some (more purist) economists argue that economic regulation should not take explicit account of distributional issues – they argue that those issues should be left to tax and social security policy⁴⁰.

As will be discussed below, efficiency aspects of infrastructure regulation have become a much greater concern for governments since the 1970s, but distributional issues in general and ‘fairness’ in particular have always loomed large. Thus, Decker admits that “... many, including economists, would concede that, in practice, regulators, politicians and the courts do consider issues of fairness and distributive equity in applying regulatory policy”⁴¹.

As will be discussed below, fairness and distributional issues have historically been at the centre of economic regulation. They may have been a relatively subsidiary objective - particularly for energy - over the 1985-2008 period, but that was because of special factors discussed in Section 6 below. The return of fairness, protection of vulnerable consumers and other distributional issues to the regulation agenda since 2008 reflects not just the post-Great Recession pressures but a return to the pre-1970 historical norm.

In what follows, I will discuss the 1840-1970 historical record, and will (Part B) compare this with events in UK energy and telecoms/ICT regulation since 1970.

5.1 Railways and the Rise of Regulation from 1840-1900

The role of ‘fairness’ and the requirement of governments that modern utilities offer their services as widely as possible is well demonstrated in the way that economic regulation was introduced and developed for the railways after 1840. This is mainly a UK-US story as Continental European countries gave a much larger role to the state and, in some cases like Belgium, to state ownership.

In other European countries, military capability and planning issues were the main focus for railway policy – including state ownership (viz. Germany where the railways were nationalised in 1870s)⁴². In this role, railways became the first modern ‘critical infrastructure’. This factor first became apparent in the American Civil War

³⁹ See, for instance, Decker (2015).

⁴⁰ See Decker op cit, p. 34. This is also an argument made by more free-market oriented economists).

⁴¹ Decker op cit. p.35.

⁴² See Millward (2005), Chapter 4.

of 1861-65. This is often called the first ‘modern’ war and railways played a major role. Their role in the planning and conduct of World War 1 was, if anything, even greater⁴³.

The ‘critical infrastructure’ issue is not discussed further in this paper but is a strong factor in the development of non-economic regulation for infrastructure industries. This is reflected in current concerns and regulatory initiatives over the security of ICT and other networks, including recent concern over the security of electricity transmission networks from digital attack⁴⁴.

5.2.1 UK Railway Regulation 1840-1956

UK policy on railway regulation was first seriously discussed in the early 1840s culminating in the 1844 Railways Act. In the US, some states sought railway regulation from the 1850s. In both cases, the driving force was widespread and (it was claimed) abusive price discrimination over the freight rates charged to businesses and (in the US) to farmers. However, in the UK, the terms and prices offered to passengers were a major feature of concern as early as 1844⁴⁵.

UK railways were built via authorising acts of parliament which operated like franchise contracts. However, the previous 21 year renewable (post-review) franchise arrangements were not suitable for railways and the franchises effectively became unlimited duration. That resulted in very considerable difficulties in finding procedures within the contracts that allowed for rate reviews. Given the continued increases in efficiency of railway technology, this resulted in a progressive divergence between costs and prices – both in general and on specific rates – and very high profits for railway companies and shareholders. In addition, there was an inability to impose common standards e.g. in accounting practices, on health and safety or on consumer standards. On freight tariffs, there was not even an obligation to publish individual rates.

The results of this were:

- a) Increasing difficulties in achieving rate changes;
- b) An inability to stop the padding of the asset base, or to exert any downward pressure on costs;
- c) An inability to handle increased horizontal or vertical integration within railways or between railways and shipping or road transport; and
- d) An inability to investigate or control undue discrimination in pricing.

⁴³ See <http://members.kos.net/sdgagnon/mil.html> for a journalistic introduction. See also Millward, p.72.

⁴⁴ See <https://www.wired.com/2016/01/everything-we-know-about-ukraines-power-plant-hack/> and <https://www.wired.com/2016/03/inside-cunning-unprecedented-hack-ukraines-power-grid/>

⁴⁵ See Stern (2004) and Foster (1992) for UK railways. See Kanazawa and Noll (1994) for US state-level railway regulation. The material below draws heavily on these references.

From the 1844 Railways Act to 1914, various attempts were made to handle these issues with more explicit regulation by agency attempting, ultimately unsuccessfully, to address the gaps left by relying on contract law alone.

The problems grew during the second half of the nineteenth century. There was increasing agitation against the high level of railway rates and, particularly from freight users, about the plethora of rates. By 1887, Great Northern railways had 13 million separate freight rates and North Western had 20 million and there was widespread price discrimination. Rates were particularly high where railways had merged with (or had no competition from) shipping or canals. In addition, there was widespread growth of costs from excessive investment and padding of capital employed – not least because it was for consumers to demonstrate via contract procedures in the courts that rate rises were unjustified. So long as the 10% dividend payout was unbreached, companies were at perfect liberty to raise rates⁴⁶.

After 1850, the only real threat to railway companies' prices and profits was the threat of new entry from competing lines but this threat was low, particularly as the system matured. This was primarily because the incentives for excess track expansion investment meant that, in most cases, new entrants faced the threat of a rates war that they would almost certainly lose – particularly when it was so difficult to obtain price comparisons. Hence revenue sharing, price collusion and merger dominated over competition. Where competition did exist, (e.g. London to Liverpool from steam ships), freight rates were lower, but competition was the exception rather than the rule, particularly when the railway companies vertically integrated through the purchase of canal and dock companies.

Businesses agitated for remedies against the monopoly abuses and in 1873 the Railways and Canal Commission was established. This, however, did little to resolve the problems because the 1873 was quite unable to resolve the regulatory problems because:

- (a) there were still very limited obligations on companies over publishing rates and no common accountancy requirements or other informational obligations;
- (b) the onus of proof remained on consumers to demonstrate why general or specific rate increases should not be allowed; and
- (c) the commission (and its successors) only considered rates on individual lines not averages or indices of rates.

These continued problems for freight users led to further protests and lobbying, the result of which was that, after 1894, the railway companies had to demonstrate to the Commission why they should be able to raise rates. This looks much more like a modern regulatory regime – except that it still applied only to individual rates. Unfortunately, the impact was to ossify rates and to increase the incentives for collusion and merger of rail companies. Rates ossified because:

- (i) it was difficult and expensive to prove the case for rate increases;

⁴⁶ For further details, see Foster op cit chapter 2.

- (ii) as modern road transport developed from 1900 (and particularly after 1920), own and cross-price elasticities of demand for rail rose sharply so that railway companies were worried that revenues would not increase from rate increases, particularly on freight; and
- (iii) temporary reductions in rates were effectively made impossible following a 1907 appeals case in the High Court⁴⁷.

In consequence, the 1894 act made it significantly harder to raise railway rates just at the point where railway operating costs started rising sharply rather than falling as they had done until the 1890s.

Although most of the affordability pressures on nineteenth century railway prices came from freight users, governments were clearly active on behalf of passenger customers over providing affordable fares. Drafts of the 1844 Railways Act were primarily intended to provide economic regulation of freight rates. However, it is now mainly remembered because it is the first modern example of collective action to enforce quality standards and an affordable universal service obligation (USO) to citizens. Under the 1844 Act, railway companies were obliged to run a “Parliamentary train”. This was a regularly running train with an average speed of at least 12 mph and with a ticket price for third class passengers of no more than 1 penny per mile. Operators were obliged to run this train on Sundays as well as weekdays and so the Act provided the basis for Sunday excursion trains.

The provision of passenger trains with mandatory low fares was significantly extended by the Cheap Trains Act of 1883. This law exempted all railway companies from Passenger Duty if they charged less than one penny per mile. This law significantly increased the number of cheap suburban services and inner city commuting in large metropolitan areas. Historians of London have pointed to its role in enabling working class people to move from heavily overcrowded inner city and dockland slums to ‘railway suburbs’ like Walthamstow and West Ham⁴⁸.

The need to reconcile private sector commercial viability of the railways with affordability via regulation ended after 1945 with the nationalisation of the railways. Since then, railway services, particularly passenger railway services, have been kept in existence by continuous government subsidy.

Curiously, the Transport Tribunal, the successor to the Railway Rates Tribunal and the Railways and Canals Commission, continued in existence after railway nationalisation and was only abolished in 1956. As such, the UK regulatory commission for railways must be, in its various guises, one of the longest-lived specialist regulatory agencies. Its final rate hearings in 1955-56 had 44 days of hearings and took over 1,000 pages of evidence⁴⁹.

⁴⁷ See Cain (1978), p.89.

⁴⁸ There is an extensive set of studies of this. For an introduction and set of references, see http://www.bbc.co.uk/history/british/victorians/london_modern_babylon_01.shtml

⁴⁹ See Foster op cit, p. 59.

5.2.2 US Railway Regulation 1850-1970⁵⁰

Price discrimination against shippers was also at the centre of the US development of the economic regulation of railways. From the 1850s, Mid-Western grain farmers complained loudly about the high freight rates that they were charged on short-distance journeys to the nearest major transportation centre. This led, firstly, to the development of State railway regulators in the post-1865 period; and, later, to the Interstate Commerce Act of 1887.

As in the UK, railway companies were, from the 1850s, were operating under unlimited duration franchise agreements. They were very profitable in areas with little or no competition, not least because of technical progress continuing to reduce railway costs coupled with strong demand growth which was increasing capacity utilisation.

Rural communities in the Mid-Western ‘Granger’ states lobbied hard for price controls and anti-discrimination legislation, against which the railroad companies lobbied hard. The main success for the farmers was in Illinois which, in 1870, established the first State regulatory agency. This lasted until 1886 when the Supreme Court decided that Illinois could not regulate prices for any portion of an interstate shipment. After 1886, some states continued to regulate purely intrastate components but only when given Federal authority to do so.

Although the 1887 Interstate Commerce Act abolished most of the powers of the state regulators over railroads, it limited long-haul/short-haul differentials and established the ICC (Interstate Commerce Commission) to regulate rates. It attempted to force publicity about railroad rates and it made illegal rebates and undue discrimination. The ICC was required to ensure that railroad rates be “reasonable and just”.

Initially, the ICC heard complaints against railroad companies and issued ‘cease and desist’ orders against unfair practices but did not initially have price control powers. However, it was given powers to set maximum prices under the 1906 Hepburn Act. This Act also gave the ICC powers to regulate passenger railway services. These powers remained in place until the relaxation of railway price controls developed in the 1970s.

Passenger railway services have been much less important in the US than in Europe, particularly as cars, coaches and airline services have developed. The main area where affordability and fairness issues remain is on commuter rail and subway services which are the responsibility of municipalities and/or states. Some of these, like the New York subway, are municipally owned. The economic (and price) regulation of these within-state commuter services will therefore be a municipal or state responsibility, usually with major political involvement and pressures for ‘fairness’.

⁵⁰ This section draws heavily on Kanazawa and Noll (1994), pp14-18.

5.3 Electricity 1890-1940

Affordability issues emerged for electricity in the US by the late 1920s and there was a growing regulatory response which had begun around 1910.

For the UK and most European countries, as set out in Section 3.2A, the spread of electricity to household consumers was relatively limited pre-1940 with limited mass use other than for lighting. Fouquet's estimates of income elasticities for domestic heating and lighting are only consistently below unity after 1945⁵¹. Further, the development of electricity supply was primarily local with widespread municipal ownership in the UK and Europe. Thus, explicit (let alone independent) economic regulation of electricity (or gas) supply was little used in the UK over this period. Prices were controlled either in franchise contracts or by local government acting as owners.

In this section, we set out the UK electricity retail supply history in some detail and this is followed by a discussion of US experience. In the US, unlike the UK, independent economic regulation was explicitly developed from around 1910, primarily via state regulation including rate-of-return based price caps for consumers. For the UK, the establishment of explicit agency-based economic regulation for electricity (and natural gas) in the 1980s was primarily the end-point of a long process of commercialisation that had started in the late 1960s and culminated in the privatisation of the electricity and natural gas supply industries⁵².

5.3.1 Indirect Electricity Regulation in the UK 1890-1940

Electricity in the UK was first produced and marketed for lighting. It emerged as a (high cost and low reliability) competitor to gas in the 1870s. Indeed, the first parliamentary act was the 1882 Electric *Lighting* Act and many of the early electricity companies were named electricity lighting companies. Electricity was initially used almost entirely for lighting – commercial and public lighting as well as some limited sales to richer households in dense conurbations. This was the position until after 1895 with first traction (mainly urban tramways) and then, after 1900, industrial power uses becoming the main growth areas. Only in 1909 did UK industrial power sales exceed lighting sales.⁵³

Between 1895 and 1913, total annual UK electricity sales grew from 38 GWh in 1895 to 180 GWh in 1900, 645 GWh in 1905 and 1,975 GWh in 1913. Between 1895 and 1913, the sales per head of population rose from 1kWh to 42 kWh. The share of industrial use also rose sharply - from zero in 1895 to 18% in 1905 and 51% in 1913⁵⁴. This growth was very largely based on bottom-up expansion of local,

⁵¹ See Fouquet (2011), pp 25-26. After falling back after 1945, income elasticities for heating rose above unity in the late 1960s and 1970s with the growth in central heating, most of which was gas or electricity powered.

⁵² As this is a paper primarily about retail markets and, in particular, household retail markets, there is little discussion of gas – town gas or natural gas – where for the UK it is very similar to that of electricity, especially before 1980.

⁵³ See Hannah (1979) Chapter 1 and Table A.1. Hannah's statistics and discussion for the period up to 1914 derive primarily from Byatt (1978), which puts into book form an unpublished D. Phil thesis of 1962.

⁵⁴ See Byatt op cit, pp 98.

vertically integrated generation and distribution companies with little or no interconnection between municipalities (unlike Germany and the US where larger regional integrated supply areas developed earlier)⁵⁵.

The UK electricity supply industry was increasingly dominated by municipally owned enterprises. Many of these municipal enterprises also provided (electrically powered) tramways. By 1900, 72% of UK electricity enterprises were municipally owned and these were concentrated in the largest towns – 44 out of the largest 50 towns had a municipal electricity service⁵⁶. These (like their privately owned counterparts) typically combined generation, distribution and retail supply, a vertically integrated local monopoly which, in some cases, was weakly interconnected with other areas.

This pattern of ownership arose out of the 1882 Electricity Lighting Act. This act allowed companies (private and municipal) to establish electricity companies and gave them the powers to break up streets to do so. *However, a major feature of the 1882 Act was that it allowed municipalities the right to buy out privately owned franchises after 21 years at the written-down value of the capital.* The original proposal was for a franchise period of 15 years but the House of Lords amended this to 21 years. (21 years was the standard late eighteenth century franchise length for toll roads and canals as well as that initially proposed by Morrison and Gladstone for railways in 1844.) In 1888, a subsequent Act increased the franchise period to 42 years.

In general, the municipally owned companies were operated on a commercial basis. Electricity prices were set in the original franchises. These were rarely a binding constraint, given subsequent technical progress, cost reductions, improved load factors and rapidly growing demand. The municipal enterprises were generally profitable and both their costs and prices were comparable to those of the private companies⁵⁷.

Municipal companies do not seem to have pursued major cross-subsidisation of local consumers, although, for 1921-22, the average revenue per unit of electricity sold by municipal companies to lighting and domestic customers was around 16% lower than for privately owned companies while the average revenue per unit sold to industrial and other customers was about 20% higher⁵⁸. Some of this difference may, however, be due to compositional effects and regional differences.

Municipal companies also had to obtain permission (originally from the Board of Trade, after 1919 from the Electricity Commissioners) for new loan issues. However, municipal companies could borrow at low interest rates e.g. from the Public Works Loan Board. In general, it seems that the municipally owned companies typically had a significantly lower cost of capital than the private companies before 1945 and that this was frequently reflected in their charging lower prices to consumers in the 1920s

⁵⁵ NESCo (the Newcastle-upon-Tyne Electric Supply Company) was the notable exception and we discuss this below.

⁵⁶ See Millward (2005), table 5.1, p.78.

⁵⁷ See Foreman-Peck and Millward, Chapters 5 and 6.

⁵⁸ See Foreman-Peck and Millward, Table 6.2.

and 30s than privately owned electricity companies – particularly lower prices to domestic consumers, who were also ratepayer-voters.⁵⁹

Affordability issues over residential prices were not a major concern pre-1945. The interest of the supply companies was to keep domestic consumer tariffs low so as to encourage wider and deeper electrification with greater demand than a single lighting circuit. Hence, by the 1930s, domestic demand was already helping smooth the total load curve over the day, particularly in the evenings⁶⁰. In addition, with generation being fuelled virtually entirely by UK coal, there was no risk of external fossil fuel price shocks. Hence, although in some areas, there may have been some risk of monopoly exploitation of domestic consumers, this was rare and the objective need for regulatory retail price protection before 1945 was minor.

Before 1939, low efficiency from weak capital and management incentives in municipal owned companies was perceived as a bigger risk than monopoly abuse of customers and it was much discussed in that period⁶¹. Post-1945, low static and dynamic efficiency became an increasingly important policy concern in the context of monopoly state-owned electricity companies, particularly (and increasingly) from the mid-late 1960s. This was, not least, because final retail prices were set by the government and internal trading prices were neither based on economic allocation criteria nor used for internal transactions within the vertically integrated state-owned incumbents.

5.3.2 Electricity Regulation in the USA 1900-1945

Retail electricity supply in the US began, as in the UK, with franchise contracts issued by municipalities. At an early stage, there had been some competition at municipal level, especially for town gas, but vertically integrated monopolies had become the norm by 1900. The nineteenth century franchises were written as 20-50 year duration long term contracts which included retail price ceilings specified in nominal dollars⁶². As in the UK, these price ceilings increasingly became non-binding because of the rapidly improving technologies.

These municipal franchise contracts were very difficult to modify without explicit regulatory involvement. However, between 1900 and 1910, ten states passed laws that authorised municipal governments to change the contract-specified rates. In general, these laws allowed cities unilaterally to change price rates at the end of the contract period, which was not a long-term viable solution. In other cases (e.g. Tennessee), the state authorised a city (Memphis) to regulate gas rates subject to a legally specified minimum⁶³.

⁵⁹ Hannah (1979) pp. 214-26 has a long discussion of these issues. From it he was able to make some general observations which I have tried to summarise above. However, there was also a great deal of heterogeneity.

⁶⁰ See Hannah op cit, Figure 6.2, p.201.

⁶¹ Hannah op cit provides a good discussion on pp. 225-27.

⁶² See Troesken (2006) pp 260-262 for a good general discussion. Much of the material in this section derives from this paper.

⁶³ See Troesken op cit p.262.

This municipal energy regulation system was relatively chaotic both in legal and commercial terms. Hence, not surprisingly, it was effectively replaced by state level regulation via a public utility commission. By 1910, there were 7 public utility commissions (PUCs) - Massachusetts being the first in 1887 - and another 29 states established such commissions between 1910 and 1920. From this system, the classic US regulatory model evolved under which retail utility prices corresponded to the minimum level needed to cover all reasonably incurred costs, including the achievement of a sufficient rate of return on all relevant activities of the vertically and horizontally integrated utility, including the safeguarding of affordable household retail electricity rates as well as (increasingly in recent years) in promoting efficiency.

In general, the US municipal and state level regulatory system as it developed in the 1920-40 period allowed the co-existence of private ownership with affordable household prices. It also combined this with the ability of the electricity supply companies to invest to increase coverage and quality while earning a reasonable rate of return. The UK only achieved these goals with the 1980s regulatory reforms which accompanied the electricity, telecom and natural gas privatisations⁶⁴.

It is also worth noting that the US electricity regulatory system has also consistently provided explicit support for vulnerable customers. Many of the major process reforms (and the introduction of the Federal Energy Regulatory Commission – FERC) took place in the 1930s i.e. at least in part reflecting affordability pressures from the Great Depression at a time when electricity was becoming more of a necessity. The US has also been the pioneer of ‘lifeline rates’ by which households can purchase a relatively small amount of electricity at a subsidised price.

5.4 Telecommunications 1890-1970

As discussed in Section 2, many countries (including both the UK and the US) originally had competing telecom companies, private and municipal. However, by 1920, national vertically and horizontally integrated companies were the norm.

Telephones were not seen as a household necessity until 1960 or later outside the US. In 1932, the UK had 46 telephones per 1,000 population as against 143 per thousand in the US. Denmark and Sweden had respectively 93 and 98 per thousand population in 1932; however, France only had 30 per 1,000 with Italy and Spain at 12 per thousand⁶⁵.

For the US, the FCC reports historical telephone penetration rates of 35% in 1920, which only exceeded 40% after 1940. In 1960, the penetration rate was 78% but it had risen to 90% by 1970.⁶⁶ For the UK, in 1970, only 35% of households had a landline telephone. This rose to 72% in 1980 and to over 90% by 1990⁶⁷.

The household necessity was not *having* a telephone but *having access* to a telephone. In the UK, this was largely met by the provision of payphones. There were located in the famous red telephone kiosks and supplemented by large numbers of payphones in

⁶⁴ See Newbery (1999), pp 21-23 for a clear exposition of these processes.

⁶⁵ See Millward op cit Table 7.1, p. 100.

⁶⁶ See FCC (2001) ‘Trends in Telephone Service’, Table 17.3.

⁶⁷ See Statista 2016.

hospitals, shops, public houses, railway stations etc. Rural areas had at least one payphone in each village. In the US, telephone access was heavily assisted by the use of party-lines.

Numbers are difficult to find for UK payphone history, but what is clear that the number of such phones has fallen sharply since 2000 with the explosive growth of mobile telephony. In 1999, BT had over 140,000 telephone kiosks; but, by 2013, the number had fallen to 67,000 and to 47,000 by 2016. Of the BT payphone kiosks left in operation, many are email and/or internet kiosks as well as (or instead of being) phone kiosks. The average number of calls per phone box in 2013 was around one call per day with many rural phone boxes being used less than once per month⁶⁸.

In the US, affordability was a major issue for telecom regulation from early on. From 1913, the AT&T monopoly was given the responsibility of developing a country-wide network with “reasonable prices of service”. The 1934 Federal Communications Act explicitly prescribed the need to make an affordable basic telephone service available to all citizens. It established a Universal Service Fund by which long-distance carriers could cross-subsidise low income households and high cost areas “to ensure that all people in the United States have access to rapid, efficient, nationwide communications service with sufficient facilities at realistic charges”⁶⁹. This model continued and evolved and was reiterated in the 1996 Telecommunications Act. Indeed, in April 2016, the universal service obligation was extended to provide a lifeline subsidy to low income Americans to include internet access.

The US telecom affordability support model has survived the unbundling of AT&T in the 1980s and the subsequent growth in telecom competition. Before that break-up, it was the classic example of US retail price setting on the basis of a cost-of-service rate of return regulatory approach. The latter may have changed since the 1980s to a more competition-oriented and forward looking regulatory process, but the affordability support model has not only been retained but has even been expanded with the rise of ICT and broadband.

In the UK, as in most European countries, telecommunications was organised from the early 20th century as part of the General Post Office (GPO), which was itself a department of government headed by a government Minister. There were initially a number of competing private sector and municipal telecom companies but the GPO took over trunk services in 1896 and the rest of the system in 1912. Only the Kingston-upon-Hull municipal service survived into the 1920s – and which still exists as an independent company. The telecoms part of the GPO remained until 1969 when it was established as a nationalised industry. However, telecoms remained along with postal services within the GPO until 1981, when BT was separated out and then privatised in 1984.

Since the UK telecommunications supply industry was part of a government department and then a nationalised industry until the 1980s, there was no need (or desire) for independent economic regulation of its activities. For household service,

⁶⁸ See <http://www.bbc.co.uk/news/business-22861389> and <http://www.bbc.co.uk/news/magazine-35570663>

⁶⁹ Federal Communications Act 1934.

affordability criteria were not only important but were dominant and very important relative to efficiency criteria.

The affordability targets were achieved via a standard pattern of cross-subsidies. In the UK, the US and Western Europe, up to and including the 1980s. The pattern was that call charges subsidised household line rental; international calls subsidised national calls; and trunk calls subsidised local calls. Among different groups, business rentals and call charges subsidised households and urban areas subsidised rural ones⁷⁰. This pattern, which emerged in the US in the 1930s, was gradually unwound in the US and in the UK and many other countries over the 1985-2005 period.

The development and roll-out of moderate and then low-priced pay-as-you-go mobile phones from the late 1990s effectively removed affordability constraints for telephones for almost everyone apart from a small percentage of people with special needs (including some elderly people). However, as discussed in Section 6 below, there are still some mobile and internet coverage and affordability concerns in the UK similar to those discussed above for the US.

5.5 The Water Industry 1840-1970

The UK is unusual among OECD countries in having an independent water industry regulator – although Ireland, Italy and some other countries have in recent years been assigning water regulation to energy regulators. However, that does not mean that the industry has not been subject to economic regulation – it (and particularly retail prices) have typically been subject to setting by governments (sometimes national, more often local governments) either directly or via the terms of concession contracts.

Given public health concerns, the residential retail price has always been a critical concern. In practice, this has historically led to much of water industry capital costs being met from national or local tax revenues, although this may be changing. As the industry becomes more commercialised, there is increasing pressure for consumers to fund new investment – and that leads to the growth of independent water regulators like Ofwat and WICS (the Water Industry Commission for Scotland) or equivalent concession-based systems as in France and Italy⁷¹. However, in all cases, it is the residential price of water (including sewerage) and its affordability that have remained the key political economy metric for regulatory performance in this area.

⁷⁰ See Millward *op cit*, pp 250-251 and Table 13.2.

⁷¹ See Stern (2012) for a discussion of the French system of economic regulation for water.

Part 2: Post-1980 Experience and Debates about Infrastructure Industry Regulation in the UK Since 1980

6. Competition and Economic Regulation in UK Infrastructure Industries since 1980

The late 20th century development of independent economic regulation in the UK was a product of the 1980s privatisation programme. The 1983 Littlechild Report on the regulation of the profitability of privatised British Telecommunications famously recommended a price cap “... to protect domestic and small business subscribers until adequate competition develops⁷²”. In fact, it took almost 20 years for substantial competition to arrive in UK fixed-line telecoms but that development has now been superseded by the growth of a wide-range of digital communication methods of which fixed line telephony is only one.

Ofcom, the UK ICT regulator, has recently published the draft of its second 10-yearly Strategic Review of Digital Communications in which it discusses how it intends to regulate the industry over the next 10 years⁷³. It is a picture of an industry with extensive competition – but competition *with* regulation and considerable amounts of proposed ‘regulation for competition’.

The flagship policy arising from the original 1983 Littlechild Report regulatory approach was the development of wholesale and retail markets in the England and Wales electricity and natural gas markets. Ex ante price regulation was removed for these industries (apart from the physical networks) once the fully-open retail markets were established in 1998. Thereafter, the relevant wholesale and retail markets were intended to be subject only to ex post competition-law based intervention, not economic regulation.

The 1990s energy policy lasted until 2008 after which it was substantially changed so that relatively intrusive regulation returned to wholesale electricity markets and retail markets for both electricity and (domestic) retail gas supplies. The reasons for this post-2008 change were the combination of:

- (a) the introduction of an active climate change policy which active intervention and a substantial return to ‘competition for the market’ in electricity generation;
- (b) widespread popular (and political) dissatisfaction with the operation of retail household markets for electricity and gas along with strong popular protests at the rises in household electricity and gas prices at a time of falling per capita incomes;
- (c) discontent over energy company profits and the apparent problems over the transparency and operation of wholesale and retail electricity and gas markets.

⁷² See Littlechild (1983), Para 14.9, p.39.

⁷³ See Ofcom, February 2016.

Factors (a) – (c) provided the political economy context for a series of investigations and policy actions by Ofgem that were intended to remedy the perceived problems, particularly the problems arising in household retail markets. The continuing complaints and the apparent ineffectiveness of the post-2008 Ofgem solutions led to the commissioning of the 2015-16 CMA Energy Investigation. The results of this were once-in-a-generation substantive analysis of the industry with new proposed remedies⁷⁴.

Note that electricity, natural gas and telecoms/ICT were the only British infrastructure industries where competition policy could replace regulation for non-network market segments since they were the only network infrastructure industries that have had active competition in non-network segments⁷⁵. Water and sewerage has continued to be operated as a set of vertically integrated regional monopolies. Retail competition has been introduced in water for non-household Scottish customers in 2008 and this will be extended to England (but not Wales) in 2017, while Ofwat is consulting about the introduction of competition for residential retail consumers. For railways, there is a small amount of on-rail competition in passenger services (around 1% of passenger miles), but competition is well-entrenched in freight services⁷⁶.

In 2002, I prepared the following table that outlined the need/demand for ex ante economic regulation in the UK for the various network infrastructure industries⁷⁷. This table is shown below.

Infrastructure Industries and Need for Regulation 2002

Industry	Rate of Demand Growth	Rate of Growth of Technical Progress	Potential for Competition (Including competition in products and competition between networks)	Degree to which Assets are Sunk	Externalities (including social benefits and relative costs of achieving them)	Overall Importance of Effective Regulation
Electricity	Low	Low	Medium	High	High	****
Natural Gas	Medium	Low	Medium	High	Medium	***
Telecoms	High	Very High	High	Medium	Low	**
Water & Sewerage	Low	Low	Very Low	Very High	Very High	*****
Railways	Very Low	Low	Low	Very High	Medium	*****

⁷⁴ These issues have been extensively arrayed and dis cussed elsewhere. For further detail, see Gray (2012), Stern (2014), Littlechild (2016), and successive Ofgem and CMA reports.

⁷⁵ I exclude airports from this paper as they have only a ‘virtual’ rather than a physical network.

⁷⁶ See the 2015 CMA Policy Report on the railways.

⁷⁷ See also Stern (2009), p.8.

The table reflects both a pre-ICT world and the pre-2008 energy world with low (and declining) fossil fuel and energy prices. It also implicitly accepts and reflects the network-services separation in electricity, natural gas and railways

Much has changed since 2002. I would now classify demand growth for natural gas as Low and for railways as Medium – High (certainly for passenger railways). Given developments in shale technologies, wires/pipes technologies, solar panels and storage batteries, I would now probably classify Technical Progress for electricity and natural gas as Medium.

The main – and most significant – changes, however, would be in the Externalities column where climate change concerns and policies (plus worries over health and other impacts from high energy prices) would certainly increase the energy industry Externalities rankings. Another factor in energy is that concerns over the energy needs of low income consumers have been sharply increased as a result of the much slower growth (if any) in the post-tax real incomes of median/average and lower income households. This has given rise since 2008 to concerns, for instance, over hypothermia and the plight of lower income families living in energy inefficient housing.

Table 2 below shows a 2016 revision of the 2002 table, incorporating the changes made above.

Infrastructure Industries and Need for Regulation 2016

Industry	Rate of Demand Growth	Rate of Growth of Technical Progress	Potential for Competition (Including competition in products and competition between networks)	Degree to which Assets are Sunk	Externalities (including social benefits and relative costs of achieving them)	Overall Importance of Effective Regulation
Electricity	Low	Medium	Medium to Low	High	Very High	****(*)
Natural Gas	Low	Low	Medium	High	Medium	****
ICT	High	Very High	High	Medium	Medium to High	****
Water & Sewerage	Low	Low	Very Low	Very High	Very High	*****
Railways	Medium	Low to Medium	Low	Very High	Medium to High	*****

Probably the main change in Table 2 relative to 2002 arises from ICT replacing telecoms. Access to the internet and broadband plus the rapid growth and ownership of mobile electronic communications devices since 2002 has led to these items becoming essential elements both of domestic and business life – not least for small rural businesses. This last has been reflected in government-mandated USOs. Hence,

within the Externalities column, under this criterion I would now not classify any major infrastructure network industry as Low.

The picture described above and illustrated in Table 2 has major economic and political economy implications which greatly undermine the relatively benevolent 2002 picture of the demand for economic regulation and the potential for competition policy as a major if not the main way of safeguarding the position of household consumers of these goods. The growth in the importance of externalities since 2005, particularly for energy and ICT, has become a major factor in the growth of importance of ex ante regulation relative to ex post competition policy in their downstream markets.

The tables above are illustrative and may perhaps be accused as being constructed from casual empiricism. I think that they are more than that and that they represent a reasonably well-founded summary of the past and present position. However, they are certainly far from conclusive.

I set out below a more formally based argument as to why the demand for ex ante regulation has grown for the major British network infrastructure industries and how this has affected the position of non-network wholesale and retail markets. I focus firstly on experience in the telecoms and ICT sector and then on electricity, before turning to some of the underlying reasons why active economic regulation is likely to continue alongside competition policy in the retail markets for household and SME consumers of the products of these industries.

6.1 Competition and Regulation in UK Telecommunications/ICT since 1985

The role of telecom regulation and its form were set out in the 1983 Littlechild Report. The origins and main conclusions of this report are well-known. It is from this document that the classic quotes derive about the role of competition relative to regulation for infrastructure industries, of which the most famous is:

“Competition is indisputably the most effective – perhaps the *only* effective means – of protecting consumers against monopoly power. Regulation is essentially the means of preventing the worst excesses of monopoly; it is not a substitute for competition. It is a means of ‘holding the fort’ until competition comes.⁷⁸”

It was an article of faith that sufficient competition would come to allow ex ante telecom regulation to disappear and be replaced by ex post competition policy. Some 33 years later, price regulation for telecoms and ICT has not disappeared and, as shown by the continuing regulation of mobile termination charges, shows no sign of doing so. Indeed, as set out below, we still have some ICT price regulation and some active Ofcom protection of small consumers. In consequence, we have an Ofcom approach to retail market regulation which takes seriously its USO and affordability obligations within a competitive market framework – regulation for competition.

⁷⁸ See Littlechild (1983), para 4.11.

The origins and messages of Littlechild Report and its consequences were surveyed in Stern (2003) and Littlechild (2003) in papers for a 20th Anniversary Conference. That set of papers also included one by Martin Cave which compared what had happened with the development of competition and regulation of BT relative to what Littlechild had suggested in 1983.

The Littlechild 1983 report was very optimistic about how far and fast competition for BT could develop. However, that did not come about because:

- (i) The government had agreed the duopoly policy with Mercury as sole competitor. This lasted until 1991 (and until 1997 on international calls);
- (ii) The role of cable television as a telecoms competitor for BT was much less than in the US and some other countries; and
- (iii) The development of new radio-based technologies was much slower than Littlechild had hoped⁷⁹.

In consequence, the slow development of competition – and the relative failure of Mercury to become a real competitor to BT – meant that much more weight was placed on regulation. Indeed, competition to BT’s fixed line business voice telephony business only arose significantly with the rise in mobile usage from the late 1990s. This was accompanied by the leasing of BT’s lines by competitors and local loop unbundling - but only after 2000.

6.1.1 Price Regulation in UK Telecoms and ICT 1984-2016

The scope of price regulation was much wider than in the 1983 Littlechild report and remained so for many years. Littlechild had recommended confining RPI-X price cap regulation to BT local calls and line rentals only, but from the start it covered national calls and, from 1991, international calls. Cave (2003) shows that the coverage of retail price controls rose from its initial coverage of 49% in 1984-89 to 67% in 1991-93 before falling back to 22% after 1997⁸⁰.

Another important factor in slow reduction in the scope of retail price regulation was the relatively slow speed of price rebalancing via the abolition of cross-subsidies. The main retail regulation policy outcome after 1984 was a single RPI-X “tariff basket” formula for all BT services but a system within which the rate and speed of rebalancing between services (and between domestic call charges and line rentals) was heavily constrained. Mandatory restrictions on BT household line rentals were important for over ten years and continued indirectly for some years after. Affordability concerns for household customers played a major role in this process. Hence, not surprisingly, when Oftel began removing retail price controls in 1997, it began with deregulating prices for businesses and high-spending household consumers.

⁷⁹ See Littlechild (1983) para 14.8 and Littlechild (2003) p.28

⁸⁰ See Cave (2003), p. 52

Littlechild (1983) had only discussed retail price regulation. Interconnection prices and their regulation became a live issue from soon after privatisation. From the start, Oftel developed a set of network prices in price cap form. These have developed over the years into a set of price controls on the Openreach network elements. These currently cover Wholesale Line Rental (WLR), Local Loop Unbundling (LLU) and termination charges from the main mobile operators. These elements are the main ones that remain from the post-2005 switch from retail price regulation to wholesale price regulation of elements where BT was deemed to have significant market power. However, there are in addition various obligations on BT regarding non-discrimination, cost transparency and similar issues.

Retail price regulation for ICT on the grounds of affordability has not entirely disappeared. Under its USO obligation which has existed since 2003, BT (and KCO) offer a BT Basic service which currently provides a limited amount of low cost telephony at £5.10 per month including line rental and £4.50 worth of UK calls (or telephony with 10GB broadband usage per month for £9.95 per month) to recipients of the main social security benefits. In addition, there are reported discussions between Ofcom and BT for an update to this to provide continued 'basic' protection for consumers when BT migrates from the old copper-based network into the 2020s⁸¹.

The UK government also announced in November 2015 that it will introduce a broadband USO for all households and businesses. Ofcom has been commissioned to design this. The criteria for this USO include 'affordability'. In response, Ofcom are inviting comments as to whether broadband tariffs should include a (regulated) social tariff to cover benefit receiving low income households or for those with special needs.

6.1.2 The Rise of Mobile ICT as a Fixed Line Competitor

Mobile telephony began in the UK in 1985 with an analogue service. Digital mobile services began in late 1993. Analogue mobile in the UK peaked in 1996 and had disappeared by end-1997. Digital services began growing rapidly from 1995.

In terms of total UK mobile subscriptions, there were 1.3 million subscriptions by 1993 (almost all analogue), there were 5.5 million by 1995 (around one-half analogue), there were 10 million by 1998 (all digital) and by mid-2000 there were 30 million. This continued so that by 2010, 91% of households owned a mobile phone as compared to 36% in 2000. This was explosive growth with major implications⁸².

The impact of mobile telephony was even greater from 2010. 2010 was the last year in which fixed line voice call minutes exceeded mobile voice minutes. By 2014, mobile voice minutes were over 70% higher than those for fixed lines. By 2015 Q1, 93% of adults had (or regularly used) a mobile phone, 66% had a smartphone and 15% of adults lived in a mobile-only home.

The changes in internet use and access have been even more dramatic. Before 2009, virtually all internet access was fixed line. However, mobile internet access has

⁸¹ See Daily Telegraph 16 July 2016.

⁸² Data in this section all taken from successive Ofcom Communications Market Reports. See also Cave and Valletti (1998), pp 113-15.

increased from 20% of adults in 2009 to 61% of adults in 2015. Tablet ownership has also increased dramatically, up from 11% of households in 2012 to 54% in 2015. Of course by no means all of this involves purely mobile networks, but it clearly represents a set of major challenges to BT fixed line services.

These developments have greatly reduced BT's market power other than for fixed line network monopoly elements, but they have also created some new retail consumer regulatory issues for Ofcom. These became a major theme in the 2015-16 Decennial Strategic Review.

Economic regulation is not entirely absent from mobile services. Firstly, Ofcom sets various conditions on mobile contracts and their operation; and, secondly, Ofcom regulates the price of the radio spectrum that was allocated administratively before 2000. In the UK, radio spectrum has been auctioned since the 3G auction in 2000. However, for non-auctioned spectrum allocated before 2000, the user price is set by Ofcom based on government direction⁸³. This price was increased sharply in 2015-16 as the government directed in 2010 that spectrum licence fees reflect full economic value⁸⁴. Finally, conditions have been put in the licences of mobile operators e.g. over indoor coverage levels and geographic coverage.

6.1.3 *From Regulation to Regulation for Competition*

In the 2005 Strategic Review of Telecommunications, Ofcom recommended a strategy of withdrawing retail regulation where possible, subject to access to clear and reliable information and straightforward switching procedures. Transparency and access to clear and reliable information plus universal service obligations were seen as the heart of this approach⁸⁵. It largely involved using competition policy tools but as part of ex ante regulation.

This approach has been taken a lot further and made more explicit in the 2015-16 Strategic Review. Ofcom's February 2016 Initial Conclusions has a key section in its Initial Conclusions on 'Empowering and protecting consumers'. This mentions:

- Publishing more detailed information on prices, service quality etc in a readily comparable form;
- Introducing standard cost comparison measures;
- Simplifying switching procedures, particularly on 2,3 or 4 part retail bundled offers;

⁸³ Spectrum from non-auctioned licences is price regulated. This applies to the 900 MHz and 1800MHz bands allocated administratively in 1985 and 1993. Auctioned spectrum licences are of indefinite duration and have an initial term (e.g. of 20 years as in the 2013 4G spectrum auction) during which the spectrum fees are set by the auction settlement. After the end of the initial term, Ofcom has the authority to reset spectrum fees.

⁸⁴ See <http://media.ofcom.org.uk/news/2015/annual-licence-fees-mobile-spectrum/>

⁸⁵ See Ofcom (2016) *Strategic Review of Telecommunications Phase 2 Consultation Document* pp17-21.

- Identifying measures “ to support consumers who may not respond to new or better information, or to easier switching”⁸⁶;
- Potential implementation of “direct and targeted protection for people, especially the most vulnerable, who cannot protect themselves through informed choice”⁸⁷;
- Further USO definition and enforcement for broadband and mobile coverage; and
- Further work to identify and address causes of harm to consumers (e.g. nuisance calls).

The Ofcom principle in this area is spelt out as regulation only when necessary - “We do not believe regulation is an aim in its own right; rather it is a tool to deliver benefits to people and businesses where markets alone cannot”⁸⁸. The list above identifies areas where regulation is expected to continue – or even be extended; but, there is also a list of items where deregulation is proposed (e.g. the deregulation of all central London communications services) or identified as a clear future possibility.

The view of regulation as currently taken by Ofcom is one that actively fosters the use of competition and markets for their general welfare and dynamic efficiency benefits but retains regulation when there is clear consumer detriment from unregulated retail markets. This is a classic exposition of ‘regulation for competition’. The regulator is using standard competition tools but in an ex ante regulatory mode.

Ofcom’s approach described above changes the 1980s era infrastructure industry regulation question ‘*Do we have regulation or competition?*’ to the post-2010 question ‘*How do we best combine regulation and competition to make markets work effectively for all consumers?*’ The UK is in a good position to develop the latter model as its regulatory agencies have competition powers under the concurrency regime and UK regulation has been established and developed under a strongly competition-oriented approach⁸⁹.

It is worth noting that the main areas of regulatory concern identified by Ofcom relate to retail consumers and, in particular, to the protection of vulnerable consumers. As discussed in Sections 2-5 above, this has been and remains the virtually universal rationale for the economic regulation of network infrastructure industries going back to nineteenth century railway regulation.

Ofcom’s proposed approach is well-illustrated by its proposals on quality and by its response to consumer problems e.g. those related to ‘multi-play’ retail contracts. Retail quality issues are discussed in detail in Section 5 of Ofcom’s 2016 Digital Communications Review. That leads to proposed remedies on provision of an annual Service Quality Report, mandating more demanding minimum standards for

⁸⁶ See Ofcom (2016) op cit Para 1.53 p.10.

⁸⁷ See Ofcom (2016) op cit Para 1.54 p.10.

⁸⁸ See Ofcom (2016) op cit Para 1.61 p.11.

⁸⁹ See Stern (2015).

Openreach (BT's network arm) in licences, investment incentives to improve service quality and automatic compensation for consumers and small businesses adversely affected by poor service quality⁹⁰.

Ofcom's discussion of the problems around multi-play contracts is in Section 7 of its 2016 Digital Communications Review. The issues of contract comparability and transparency on prices, terms of service and contract duration particularly arise for these contracts. Ofcom has made it clear that it intends to intervene in this area on behalf of the consumer.

The discussion of contract comparison arose within the context of a discussion of what Ofcom termed 'inactive' or 'passive' consumers, as classified in the regular Ofcom switching survey. These categories are contrasted with 'interested' and 'engaged' consumers. (Inactive consumers are defined as 'may have had some past involvement but have low interest in and do not keep up to date with the market. Passive consumers are defined as reasonably likely to have some past market involvement and indicating some current market interest. In 2015, around 35% of fixed line consumers were classified as 'inactive' and 14% as 'passive.'⁹¹)

Section 7 of the Ofcom 2016 Review points out how inactive and passive consumers pay more for their services than 'interested' or 'engaged' consumers. That leads to a discussion of how to make inactive and passive consumers more engaged and, if that is not possible (e.g. because of age and/or other factors), how best to protect vulnerable consumers who seem to be losing out significantly. This discussion has obvious parallels with the way that retail market problems were discussed in the CMA Energy Investigation, as will be discussed below.

6.2 Competition and Regulation in UK Retail Electricity Markets Since 1990

Retail supply competition in electricity was introduced into Britain in 1990 when all consumers with maximum demand of at least 1 MW were given the right to choose their supplier⁹². This covered large industrial consumers. From 1990-1998, the threshold for competition was progressively reduced, to 100kW in 1994 and to all consumers in 1998. From 1998-2002, the retail electricity price charged to household consumers had a regulated default price ceiling. The level of that default price was raised until, in 2002, retail supply competition took place without a regulated default price for any consumers. However, as discussed below, this only lasted until 2008 when the retail energy supply market for households was reregulated (for natural gas as well as for electricity).

The UK opening of energy retail supply competition to industrial and commercial consumers has never been controversial, apart from some concerns about SMEs particularly since 2008. However, introducing competition in retail supply to households has always been more disputed and, although there were many supporters of the policy in the 1990s, a number of leading energy economists argued that the costs of deregulated retail supply competition were likely substantially to exceed the

⁹⁰ See Ofcom (2016) op cit Paras 5.31-5.41, pp. 54-55.

⁹¹ See Ofcom Switching Tracker 2015.

⁹² As in Section 5, the discussion in this section only includes natural gas peripherally as most of the argument follows through from electricity.

benefits⁹³. In a highly prescient prediction, Newbery wrote in 1999 “If about one-half to two-thirds of customers are reluctant to switch, then incumbent RECs [regional electricity companies] and Centrica (British Gas) may be left in a comfortable quasi-monopoly position”⁹⁴.

Attitudes to retail competition for household consumers changed sharply after 2005. The 1985 -2005 period was special as that energy prices were low and falling while climate change and responses to it were not yet a serious concern. In consequence, this period was marked by a steady decline in fossil fuel prices and energy industry efficiency so that the share of UK household expenditure on fuel, light and heating fell from over 6% in 1983 to under 3% in 2003. Household electricity prices fell in real terms by 36% between 1980 and 2003 but then rose by 56% over the 2003-10 period⁹⁵. After 2003, fossil fuel and energy prices started to rise sharply so that the share of household expenditure on fuel, light and heating rose from 3% in 2003 to 4.5% by 2012. In 2016, the CMA Energy Investigation reported that energy costs were almost 10% of overall expenditure for the poorest households.

According to the CMA Energy Investigation, between 2004 and 2014, average domestic electricity prices rose by about 75% in real terms and gas prices by around 125%. The price increases have not continued since. Increases in fossil fuel prices (particularly of gas) were most important up to around 2009-10, but most of the increased expenditure on electricity, particularly after 2009, was from increases in social and environmental obligations. After 2009-10, retail prices continued to rise even though wholesale prices were flat. This was one of the main reasons behind consumer group, popular and political agitation, with recorded complaints increasing six fold between 2008 and 2014 before falling back in 2015. Following a sharp fall in EBIT margins, in 2009, the profits of the Big 6 UK energy companies rose steadily between 2010 and 2014, with higher retail profit margins on gas than electricity and higher margins on sales to SMEs than to households⁹⁶.

Other conditions necessary for keeping retail electricity and natural gas retail markets outside economic regulation were also progressively weakened after 2005. The post-2008 recession led to a major squeeze on household incomes, particularly for low income households of working age.

Per capita real household disposable incomes were rising steadily until 2005-07 but they fell by almost 5% in 2009. but fell by 2.1% between 2009 and 2011. In 2016, the level was still almost 2% below that of 2007. These reductions in real household income are unprecedented over the last 50 years.

The impact of stagnant and falling living standards has been a major factor in attitudes towards the prices of regulated utilities, particularly those where there are significant health or other externalities. This particularly applied to the regulated energy industries. In addition, climate change and the operation of wholesale electricity

⁹³ See Joskow, Mackerron, Thomas and others cited in Barale (2003)

⁹⁴ Newbery op cit p.229.

⁹⁵ See Pearson and Watson (2012), Figure 3, p.16.

⁹⁶ See CMA Energy Investigation Summary Report pp4-5, paras 21-24.

markets became a major government policy concern after 2008. The extra costs of these are estimated by DECC to add 37% to retail bills by 2020⁹⁷.

The analysis and proposed remedies in the CMA are interestingly similar to those of Ofcom. As with Ofcom, much of the analysis focuses on the comparison of ‘engaged’ and ‘disengaged’ consumers. Among the headline findings in the CMA Overview Document are:

- (i) 34% of CMA surveyed domestic customers had never considered switching energy supplier;
- (ii) Many of those who had not considered switching reported that they had not done so because they thought it would be ‘too much hassle’ (a term also much reported in the equivalent Ofcom reviews, particularly for multi-play bundles);
- (iii) Switching consumers had significantly higher incomes, more education, were more likely to be in owner-occupied accommodation and to be aged over-65. These differences were amplified for pre-payment consumers;
- (iv) Weak competition for - as well as high payments by - households on pre-payment meters who don’t have access to lower cost tariffs. This group included a high proportion of low income and otherwise disadvantaged households;
- (v) A very high proportion - 70% of household customers and 45% of micro-business customers - of the Six Large Energy firms were on the Standard Variable Tariff, the (unregulated) default tariff. The CMA estimated that the household customers could have made savings of up to around £330 per year had they switched to an alternative supplier;

The analysis, diagnosis and suggested remedies of the CMA Energy Investigation share a lot in common with those for Ofcom in the digital communications market.

- They share a view that these commodities are ‘necessity goods’.
- They share a view that the presence or absence of active ‘engagement’ in the market is crucial for the effective working of these retail markets;
- They share a view that engagement problems are not an issue for large or medium-sized firms but can be a significant issue for households, especially low income, less educated and older household customers, and – to a lesser extent – for micro-businesses and SMEs;
- They share a view that complexity and lack of transparency of information inhibit robust consumer responses to relative price differences, but that such remedies must take account of engagement issues;

⁹⁷ See CMA Energy Market Investigation Final Report, Para 320.

- They share a concern that the time and ‘hassle’ costs are important for explaining low consumer engagement and responses to potentially large price differences with little or no expected quality difference.
- They both show a particular concern with the usage costs for low income and disadvantaged customers.

To remedy the problems identified in the retail electricity market, the CMA initially proposed in July 2015 that there should be strong measures to promote engagement with the market by disengaged consumers. In the July 2015, they also argued that there should, in addition, be a *regulated transitional safeguard tariff* of the kind used in New South Wales for all households on the standard unregulated default tariff. There was no statement about how long this regulated transitional tariff should stay in place. It was also agreed that the post-2008 Ofgem ‘4-core-tariff’ RMR restrictions should be ended as they had not provided effective protection for consumers; rather, it was concluded that they had *reduced* competitive pressures in the retail household market.

Following great hostility from the major energy companies and others, the CMA revised its proposed remedies in its Final Report. The final set, confirmed in June 2016, re-emphasised the role of engagement-promoting initiatives and included a variety of suggestions of methods to be trialled to enhance customer engagement. However, it also proposed restricting the transitional safeguard tariff to customers with pre-payment meters only – and for them only temporarily, for a period of three years (2017-20)⁹⁸. But, in a note of dissent, Martin Cave, maintained the provisional report view of a regulated transitional safeguard tariff for two years to apply to all customers on the current unregulated default (standard variable) tariff.

Although there are many similarities between the Ofcom and CMA Energy Investigation approaches, there are also some significant differences:

- (a) Ofcom expects there to be regulated retail prices for many years to come for fixed line retail telephone contracts and broadband contracts for low income and disadvantaged household consumers. The CMA (and Ofgem) are only referring to temporary – three year – restrictions;
- (b) The CMA and Ofgem seem to be taking a much more pro-active approach to fostering active engagement by retail consumers. It remains to be seen how effective this will be;
- (c) The CMA energy analysis placed much more emphasis on the profit margins of the Big Six energy companies than did the Ofcom analysis of telecommunications companies; and

⁹⁸ The policy of universal household smart energy meters by 2020 was argued as the basis for a need only for temporary protection. It remains to be seen about how universal this policy will be (households can opt out), whether it will be on-time or delayed as well as how many households refuse to have a smart meter.

- (d) In general, the CMA expressed more concern over adverse supply-side effects of codes, rules and regulation in energy than did Ofcom for ICT.

The effectiveness of the CMA Energy Investigation remedies in retail energy markets will in large part depend on how effective are the measures to improve consumer engagement. Ofgem have made it clear that these will be carefully trialled and only the most successful taken up.

In spite of CMA and Ofgem assurances, a note of scepticism is in order. In 2012, Which (the UK Consumers' Association) and 38 Degrees organised a large-scale collective switching exercise with around 110,000 participants. The data from this have been carefully studied by Deller, Giulietti, Waddams et al (2013). This sample was a well-educated, above average income group of owner-occupiers. Nevertheless, despite median potential gains of around 10% of energy bills, only around one-third of participants switched – even with several reminders from Which.

However, whether or not the proposed CMA remedies will significantly solve the identified problems, the issues will not be going away. The letter of 3 August 2016 from Dermot Nolan, Ofgem CEO, Ofgem to the CMA on implementing the proposed Energy Investigation Remedies concludes as follows:

“We will closely monitor how the energy market develops as these reforms are implemented, and will do so with a particular focus on consumer outcomes. We are committed to assessing competition and consumer outcomes in the GB energy market, and we will not hesitate to take action if we feel that outcomes for consumers are not as good as they could be.”

Hence, if greater consumer engagement, information transparency and similar methods do not achieve good outcomes for consumers, including low income and vulnerable consumers, we should expect more directed regulatory interventions. That is very similar to the position with regard to the balance between regulation and competition over the last decade. It is clearly not a position that renounces interventionist regulatory policies in favour of relying solely on competition policy in regulated infrastructure industries.

6.3 The Economics of Regulation for Competition

The CMA Energy Investigation has come under strong criticism from Littlechild and others⁹⁹ as well as from critics who would advocate significantly more interventionist and directly regulated infrastructure industries with a much lesser role for competition. The reasons for the latter primarily represent social and political aspirations which would argue for even more emphasis on affordability and equity issues¹⁰⁰.

A number of the more free-market oriented economists argue that distributional issues should be handled elsewhere (e.g. via social security policy) and not via economic

⁹⁹ See Littlechild et al (2016).

¹⁰⁰ This has been a major theme of post-2013 Labour Party and Green Party energy sector proposals

regulation¹⁰¹. In the UK energy debate, this has led to strong arguments in favour of leaving household retail energy markets to competition policy. Indeed, Littlechild and his ex-energy regulator colleagues have strongly argued that the CMA and Ofgem should refrain from re-introducing any ex ante regulation of prices. (Curiously, these arguments do not seem to have been anything like as prominent in the recent Ofcom publications, which are very similar to those of the CMA Energy Investigation both in analysis and in their policy recommendations.)

The free-market view (which goes back to the 1983 Littlechild Report) is that competition policy should replace ex ante regulation in infrastructure industries like telecoms/ICT and the network energy industries apart from monopoly network elements, particularly on price regulation. But, these infrastructure industries are very different from other industries, and that is why they are regulated. Going back to the Levy and Spiller criteria, these industries (plus financial services) underpin production throughout the economy and produce ‘necessity goods’. That is not only why they are regulated but also why the underpinning regulatory legislation in the UK and other OECD countries includes ‘affordability’ as a primary criterion.

Nevertheless, the free-market view does raise important questions. The key question posed is whether the problems with the consumer market in energy and ICT will be remedied sufficiently without regulatory intervention of the kind that the CMA, Ofgem and Ofcom are promoting. If there is sufficient competition, including potential for new entry, is it not the case that these problems would be resolved better and sooner without regulatory intervention; and is it not the case that new regulation is likely to hinder rather than help alleviate the problems?

6.3.1 Regulation for Competition

This is the point at which ‘regulation for competition’ becomes relevant. The key point about regulated markets in energy, telecoms and other sophisticated service industries (e.g. financial markets) is that there seem to be sufficient impediments to effective competition on the demand side so that markets do not function well even where there are no fundamental anti-competitive features on the supply side (e.g. monopoly, cartel, collusionary behaviour).

Fletcher (2013 and 2014) argues that in many sophisticated service markets, there are a number of impediments both on the demand side and the supply side which give incumbent companies considerable market power. In addition, she points out how these impediments are often not handled at all well by standard ex post competition policy. Hence, she argues that competition policy in network infrastructure industries needs to be supplemented by regulation if the markets for these products are going to work well for small consumers.

On the demand side, Fletcher lists information access and comprehension problems arising from aggressive or misleading selling and unfair contract terms and WYSIWIG (What You See is What You Get) rules. According to Fletcher, these manifest themselves in:

¹⁰¹ In doing so, they follow the approach advocated in Decker op cit, p.34.

- High search costs;
- Poor information transparency;
- Divergence of incentives;
- Significant switching costs and ex post hold-up problems; and
- Behavioural biases¹⁰².

The important point to note is that this list includes the main items cited as causing problems and justifying regulatory remedies both by Ofcom in its recent Strategic Review and the CMA in its Energy Investigation. Fletcher (2014) also cites a number of other Ofgem, Ofcom and FCA/FSA regulatory interventions which refer to these problems as a reason for ex ante intervention.

Fletcher (2014) also cites some issues that regularly arise in these industries on the supply side – structural issues, tacit collusion, collective exclusion and market manipulation. The first two of these have again been common concerns in regulated energy markets and telecoms/ICT. Indeed, at the time of writing, Ofcom have proposed a significantly greater degree of network-service separation for BT. This has become a very hotly debated issue for the effective operation of UK digital communications markets.

The point about the Fletcher analysis is that it suggests that there are demand and supply side features that typically give the incumbent regulated companies a considerable degree of de facto market power vis-à-vis small consumers. This may or may not be sufficient to justify action under competition law; but it seems much better handled by regulatory interventions which directly address the information problems faced by those consumers. Hence, regulation in these areas is needed to make markets work effectively for consumers, especially low income household consumers and those who are less effective at information processing.

Affordability remains a key concern in this area – and for governments. Governments have regularly intervened in these areas. Besides the examples cited earlier, there is the case of payday lending where the government legislated for a mandatory price cap on these loans via the 2014 Banking Reform Act. This was in response to a raft of widespread and outspoken representations from across the country – including the Archbishop of Canterbury¹⁰³. A price cap was not a standard competition policy remedy, but this is a classic example of political economy concerns on affordability proving dominant over narrower competition concerns¹⁰⁴.

One final point in this section. As Fletcher states clearly, finding good solutions to these problems is far from easy and poorly designed remedies can worsen outcomes. Ofgem’s RMR 4-retail-tariff-only regulations were not an effective solution to the problems in retail energy supply markets after 2010 – indeed they may have worsened them. That is one reason why the CMA and Ofgem have made it clear that they will carefully trial their proposed new remedies.

¹⁰² See Fletcher (2014) Slide 13. See also Slides 15, 16 and 18.

¹⁰³ See <http://www.archbishopofcanterbury.org/articles.php/5083/payday-loans-archbishops-speech-in-the-house-of-lords>

¹⁰⁴ See <https://www.gov.uk/government/news/government-to-cap-payday-loan-costs>

6.3.2 *A Little Light Game Theory*

Unless they operate only in retail supply, network infrastructure companies are always large and capital intensive. There may be a single dominant company and some smaller ones (e.g. as in UK fixed line telecoms 1984-95) or a small number of large oligopolistic players. The latter is commonly found in electricity and natural gas, with varying degrees of transmission/transport network separation – relatively high in the UK. This gives the companies significant potential market power, particularly where there are major network externalities.

The relationship between companies in this setting is that of a repeated non-zero sum game. However, the relationship between regulated infrastructure companies and their economic regulator is also a repeated non-zero sum game. As is well known, such games do not have a unique solution and game outcomes depend heavily on reputation.

Cave and Valletti (1998) discuss the evolution of the UK mobile telephony market from analogue to digital and from two to four operators in game theoretic terms. Cave and Valletti argue that, in a dynamic setting where oligopolists confront one another repeatedly, implicit threats can be used to sustain high prices. Tacit collusion can be an equilibrium outcome “when the present value of lost future profit is greater than the present value of short-run gains in cheating”¹⁰⁵.

Cave and Valletti find evidence of tacit collusion in the initial period of the mobile market roll-out with only two operators but not when there were four. However, the underlying issues have not gone away in mobile or other ICT markets. Hence, Ofcom has imposed roll-out and other regulatory obligations on mobile licensees and BT for broadband, not least to minimise the potential for tacit collusion by the relatively small number of firms. The arguments in favour of acting this way are, of course, strengthened to the extent that the demand side information problems discussed by Fletcher help enhance firms’ market power.

Note that, as Cave and Valletti suggest, such collusion can fall somewhat short of tacit co-ordination. The latter is typically a breach of competition law and most oligopolistic behaviour and tacit collusion falls far short of that. However, tacit collusion can arise in a variety of ways and with more, less or minimal damaging consequences to consumers – indeed, in some dynamic contexts, it can be beneficial to consumers. That suggests the use of a variety of potential tools to remedy serious anti-consumer adverse effects. For regulated infrastructure industries, that again points to the use of the kind of ‘regulation for competition’ interventions that Ofcom and other UK regulators have put in place. Note that these have not been successfully challenged via appeals to the CAT or elsewhere.

In the CMA Energy Investigation, the Big Six energy companies were not found to have been involved in tacit co-ordination over the 2010-14 period. Nevertheless, the CMA Energy Investigation’s consideration of profit margins and rates of return for the Big Six Energy after 2010, suggests that margins were high and that these high margins were sustained, at least in part, because of the high percentage of ‘inactive’

¹⁰⁵ See Cave and Valletti (1998), p. 116.

consumers on (unregulated) default tariffs¹⁰⁶. If correct, this would be a classic case where the repeated game between among a small number of oligopolistic companies, was insufficiently constrained by the fringe of (small) retail competitors facing consumers with significant information collection and assessment problems. In consequence, the oligopoly member companies have been able to sustain a high return market outcome over a number of periods.

Littlechild and his colleagues have argued that such a conjecture is false. They claim that market impediments are insufficient to sustain such a market outcome over many periods, particularly given potential dynamic responses. They argue that the concluded household consumption decisions are just showing their revealed preferences. However, if that were the case, why was there such an outpouring of consumer protests to the companies, Ofgem and politicians after 2011 when wholesale gas and electricity prices were falling a lot more sharply than retail prices?

An obvious question to ask is whether retail competition in electricity in retail markets has ever long been sustained without regulated default prices for household consumers and SMEs. The answer seems to be not. As discussed in previous sections, retail competition without regulated default prices is very unusual. Littlechild and colleagues point to the fact that it was possible to lift default price controls in 2002 after 4 years over which the default price ceiling had been gradually lifted. From 2002-2008, competitive retail markets seemed to work without obvious problems; this happened without regulated default prices for household consumers and SMEs.

There are, though, serious problems with this argument. The first problem is that, as discussed in Section 6.2, the period 1998-2005 was a period when fossil fuel prices were still falling and the major efficiency gains from privatisation and restructuring of wholesale competition and distribution were still being achieved. After 2005, neither of these effects was still in place and retail prices began to rise sharply – and, post-2008, at a time when household real incomes were falling. The 1980s reforms meant that the commercial pressures to raise household and SME retail energy prices after 2005 was considerably greater than it would have been pre-privatisation with lots of cross-subsidies and ‘averaging’.

The second and major problem with this argument, though, is why the post-2011 period showed the gap between retail and wholesale energy prices widening. The companies have claimed the need to recoup low profits in earlier years (particularly the under 1% average return in 2010). The CMA has decided otherwise, citing the combination of inactive consumers, serious information problems and relatively little effective competition to the major energy companies.

There is also a game theory conjecture that is worth considering. Between 1998 and 2002, the energy oligopolists had a strong incentive not to exploit their market power for high profits. Firstly, it was unclear whether any attempt to do so would carry all of the major companies (see the short-term/long term profitability argument above). Secondly – and more importantly – the companies had a powerful interest in containing profits while retail price controls were still in place. Once the controls,

¹⁰⁶ See CMA Energy Investigation (June 2016), Section 8.

had been removed, the incentives against using market power to raise prices were much weaker. It would require major investigations over a long period by regulatory and/or competition agencies – or new primary legislation – to bring them back. That was much more demanding than a downward adjustment on regulated prices.

It can well be argued that the full deregulation of retail energy prices after 2002 gave the major energy companies a potentially strong incentive to ‘try their luck’ at raising profit margins. They could then, subject to short-term demand and supply considerations, establish a retail market with expectations of higher prices and profits in the medium-to-long term once price regulation had been abolished maybe via a modicum of tacit collusion. This may not have required a conscious decision. Game theory suggests that it could well arise from standard oligopolistic and regulatory strategy concerns¹⁰⁷.

The conjecture above may or may not have great merit. Even if it is true, it would certainly only be part of the answer as to why the Big Six energy companies acted in retail energy markets after 2005 in the way that they did. However, the thought-experiment does reveal an important underlying policy point.

Large players in regulated infrastructure industries do have potential or actual market power for Fletcher-like or more traditional competition reasons, particularly in dynamic settings. If so, for each case, there is the question of whether or not to regulate – in particular whether or not to have some regulated retail price caps for household customers on affordability grounds. In some cases, an economic appraisal will suggest that they are needed, in spite of likely efficiency costs. In other cases, no action may be necessary or dynamic efficiency considerations may dominate. However, recent UK experience in both energy and ICT suggests that in a high proportion of cases, there may be some significant problem(s) related to information provision and transparency and consumer responses for which the best solution is a ‘regulation for competition’ remedy. That is where UK infrastructure (and finance) regulators seem to have converged.

Thinking in game theory terms, there does seem to be a case that temporary or permanent retail price caps (e.g. a regulated default household price) should not be ruled out for these ‘necessity goods’ infrastructure industries. Indeed, we note that Ofwat’s 2016 suggestions they be included should England adopt retail household competition. However, it would be very unwise to rule them out even for infrastructure industries like energy and ICT with relatively long-established retail markets including competition – and the regulators have not done so.

It also seems important at least to retain the possibility of early activation of a *convincing threat* of significant early regulatory intervention by regulators, including temporary or permanent price caps if necessary. That threat should be of considerable

¹⁰⁷ A similar problem has confronted the EU authorities over the accession of the Central and East European countries. Before accession, the EU authorities had considerable power to enforce formal and informal requirements – from civil society and anti-corruption activities to competition law and regulatory policy. After accession in 2004, the countries had considerably more power relative to the EU authorities. This has given rise to a considerable number of increasingly serious problems (viz. the positions taken since 2010 by the Hungarian, Polish and other governments).

assistance in constraining the behaviour of companies against a medium-to-long term high profitability strategy. That view is also born out by the historical experience discussed in earlier sections of this paper.

UK experience with economic regulation since 2000 points to the major – and growing - role of ‘regulation for competition’ in small consumer retail supply markets - as well as the threat of an early (re-)introduction of safeguard price controls. It is not a question of competition *or* regulation; rather it is a question of competition *and* regulation.

7. Summary and Conclusions

The key points of this paper are summarised below:

- 1) Network infrastructure industries, from railways to ICT, have had revolutionary impacts. They have had major positive impacts on industrial growth and productivity and, even more important, they transformed peoples’ lives. This typically took 30-50 years.
- 2) Apart from water and sewerage, 19th and early 20th century network infrastructure industries almost always began as competitive in the relevant market. However, from railways to telephony, they became national or regional/municipal monopolies within about 20-30 years.
- 3) Network infrastructure industry products were originally all luxuries with high income and price elasticities, but as they became widespread in use, they increasingly became ‘necessity’ products with low income and price elasticities.
- 4) Pre-1900, the standard UK method of procuring network industry investment and service was by franchise contract. For water and energy outside the US, these were typically municipal or concession franchise contracts. For railways in the UK, US and some other countries, there were private franchise contracts; elsewhere they were state-owned companies.
- 5) Independent economic regulation began in the UK and the US from 1860 as a way of monitoring and modifying railway franchise contracts in an orderly and legally sound way. 20th century energy sector and telephone regulation in the US also followed this model, but in the UK and elsewhere, state and municipal ownership (without independent regulation) dominated until around 1980.
- 6) Economic regulation has always had affordability as a major (if not its main) priority. The word ‘affordable’ occurs in most regulatory legislation. The origins of railway regulation after 1850 were primarily to protect industry and agricultural freight users from exploitation by the railway companies and later to protect commuters and others.
- 7) USOs to ensure lower income households could benefit from the new industries began with the UK 1844 legislation ‘Sunday excursion’ train with

mandatory, regulated fares of less than 1d per mile (and with minimum speed and quality provisions). This was extended in 1883 to provide regulated low fares on 'workmen's' daily commuting trains.

- 8) Affordability issues were most important in the water and waste water industry where competition never took hold for retail markets. The industry had a huge impact on mortality rates from London in the 1850s onwards and also in the US with the growth of treated water and sewerage. The mortality improvements (particularly of infants and children) were crucial. However, the industry was run in both those countries on a semi-commercial, semi public service basis and regulated with a close watch on affordability.
- 9) The standard pre-1980 regulatory model was developed in the US between 1910 and 1940 at state and Federal level. For telecoms, there was state and Federal regulation – the FCC was established in 1934 and the Federal Power Commission (the predecessor of FERC) in 1935. The telecom market and regulatory model included a natural monopoly telephone company (AT&T), USOs, regulation of final prices, lifeline tariffs and pervasive cross-subsidies. US regulation of electricity and gas followed a similar pattern, albeit with lags.
- 10) Affordability considerations (and natural monopoly arguments) largely dominated infrastructure regulation from 1930-70 for network infrastructure industries in almost all countries. From 1970, efficiency concerns (static and dynamic) investment cost and resource allocation questions became increasingly more important in the US, the UK and many other OECD countries.
- 11) Post-1970, technical progress (and computerisation in particular) allowed the unbundling of telecom and energy industries with competition in wholesale and retail markets away from the core networks. Starting with telecoms, this model became increasingly dominant after 1980 not just in the US but in the UK, Australia, and in many EU and OECD countries.
- 12) Led by telecoms, competition in production and for supply to large industrial consumers took off, largely without explicit price or similar regulation from the 1980s across OECD countries. Electricity and natural gas followed this model. However, retail competition to households and SMEs has rarely been fully deregulated. In many countries (including the US and some EU countries), USOs and lifeline or tightly regulated default tariffs remain in place for low income and/or other disadvantaged household consumers.
- 13) Unbundling and a growing role for markets has led to the creation of independent regulatory agencies across the OECD (and more widely) in both telecoms and the network energy industries. The UK is a particularly competition-based regulatory model. The 1983 Littlechild Report was a major landmark in this process.
- 14) The UK has been the exception on retail supply competition. The 1983 Littlechild Report advocated it as a relatively early goal for telecoms. In fact, effective competition in retail fixed line services developed only after 1995

and the arrival of mass mobile telecoms has been the dominant pro-competition force, particularly since 2010 and the arrival of smart phones..

- 15) The most far-reaching attempt to allow retail competition without default retail supply tariffs has been in UK electricity and gas. It was allowed (and encouraged) from 1998-2008. After 2008, regulated retail tariffs returned to the UK to meet the affordability problems thrown up by (a) climate change concerns and associated policies; (b) the sharp rise in wholesale and retail fossil fuel, wholesale and retail prices; and (c) the post-2008 recession reduction in household incomes.
- 16) Since 2005, both Ofcom (the UK digital services regulator) and Ofgem (the British electricity and natural gas regulator) have become increasingly concerned about information problems and responses by household and consumer responses to the choices offered by supply companies.
- 17) Both Ofcom (in its 2005 and 2015-15 Decennial Strategic Reviews) and Ofgem have become more vocal about problems with information transparency, search and switching costs, and related problems. This has given rise to growing concerns about the degree to which retail supply markets genuinely meet the needs of household and SME consumers via a focus on 'inactive' consumers and the higher prices that they pay.
- 18) The energy market concerns led to a major 2015-16 CMA Energy Investigation. This again focused heavily on the position and impact of the sizeable percentage of 'inactive' consumers.
- 19) The proposed Ofcom and CMA remedies to the affordability problems focus heavily on methods to increase consumer awareness and persuade inactive consumers to be more active in the market. However, Ofcom retains some price controls not least on affordability grounds (and the right to extend them if necessary). In energy, the CMA has proposed a temporary price control on households with pre-payment electricity and gas meters but has drawn back from other retail price controls.
- 20) Discussion among economists about appropriate roles of economic regulation and competition for network infrastructure finance (and financial services) reflects many of the practical concerns listed above. Littlechild and colleagues retain the position that there should be no regulated default prices in retail markets for households and SMEs (particularly in energy). However, the main developing argument is that, in these markets, we should have 'regulation for competition', a case argued strongly by Fletcher.
- 21) The 'regulation for competition model' seems to have become the dominant intellectual position for Ofcom, Ofgem, the CMA and the FCA (the UK financial regulator). This means that, instead of arguing whether to have competition *or* regulation in household and SME retail supply markets, regulators, we ask how best to combine competition *and* regulation.

22) As regards regulated default retail price controls, oligopolistic and game theory arguments suggest at least retaining the *threat* of their early use to constrain leading companies from trying to move to a high price, high profitability long run market position. In some instances, there is a good case for their use (temporarily or for a reasonably long period) not least to ensure the affordability of necessity goods.

Most of the points above focus on the recent economic debate around infrastructure industry regulation. However, looking at the economic history from 1850 to today makes it clear that the issues involved are as much about political economy as pure economics. Looking back, the revealed preference of governments as well as infrastructure industry regulatory agencies is that affordability issues remain crucial and that they justify intervention in retail markets to ensure that household consumers are able to meet their consumption needs for these goods at reasonable prices. Whatever the supposed revealed preferences of household and SME consumers, the revealed preferences of consumer advocates and politicians of all parties typically place a lot of weight on affordability and associated political economy issues.

The position set out above is far from new. It has been the position since the mass expansion of the railways in the mid nineteenth century and it remains so now, over 150 years later.

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