

**Technological innovation and financial stagnation
(the growth of international telegraphy 1866 - 1900: a British perspective)**

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Introduction

Communications by means of electric telegraph was one of the most important developments of the Victorian age and as Standage¹ suggests, it probably had an even greater impact than its equivalent today- the internet. We can draw many parallels. A modern inter-network requires terminal hardware, links, protocols and the all important binding element; software, the provision of which is dominated by one company. The situation in the past was somewhat more complicated. The sending and receiving apparatus was relatively simple, as were the protocols. The links, cables were the most significant element and there were three dominating companies, all British and here we can observe another parallel with modern computer developments. Just as Apple, Sun or some other company might have eclipsed Microsoft were it not for several timely business decisions, so British domination in international telegraphy was the outcome of many happen-chances, which if they had been slightly different might have led to a totally different communications evolution.

Electric telegraphs may have been invented in Britain, but other countries were close behind. Certainly, the rate of expansion of the inland network in the United States was much greater. However, unlike most other European countries there was in Britain a free market without government intervention during a critical period of growth and, according to Kieve² when the UK inland telegraphs were nationalised in 1870 the compensation payments liberated a vast amount of capital which was readily available for investment in international communications at a time when there was great confidence in this new technology.

Britain very nearly lost out in one very basic aspect, namely the insulation of copper wire by means of the thermoplastic vegetable product, gutta-percha (cis-polyisoprene). It is true that with major plantations in India and Malaya, they controlled the supply of the raw-material, but the first patents were awarded to the Siemens brothers who at that time were officers in the Prussian army. A Dublin entrepreneur, Henry Bewley devised an alternative technology which did not transgress the existing patent³ and the development was financed by Samuel Gurney⁴, a member of the merchant banking family.

¹ T. Standage *The Victorian Internet* Walker & Co. New York 1998 ISBN 0 8027 1342 4

² J.L. Kieve, *The Electric Telegraph*, David & Charles, 1973

³ D. de Cogan, *The Bewleys and their contribution to trans-Atlantic telegraphy* Proceedings of the IEE History of Technology Weekend ,Trinity College, Dublin, July 198

⁴ D. de Cogan, *East Anglia and the Origins of the Information Revolution* Ziggurat (The magazine of the UEA Society) No 9. Published by the University of East Anglia, Norwich (UK)

Britain was slow to influence trends in communications. It was the French under Napoleon III who took centre stage in the establishment of the International Telegraphic Union, but the outcome of the Franco-Prussian war put French aspirations on hold at precisely the moment when British investment was at its height.

In spite of a faltering start Britain soon came to dominate international communications. The Telegraph Construction and Maintenance Co. was the major producer and layer of cables. The Anglo American Telegraph Co was the major Atlantic carrier and the Eastern Telegraph Co and its associates served most of the Empire.

This paper will look at developments from the vantage-point of the Anglo-American telegraph Co which was established out of the financial ruins of previous attempts to lay an Atlantic cable. In 1866 it opened for business with two cables between Valentia island in Ireland and Hearts Content in Newfoundland. As will be seen, it was heavily overcapitalised. Throughout its operational life it had to contend with this burden which laid it open to competition and with few exceptions tended to limit any foresight on the part of its management. This paper uses financial data to paint a wider picture of the business of international communications in the 19th century and makes comparisons with a contemporary view of the economic state of the industry.

The financing of the trans-Atlantic cable

The British Government had little direct involvement in inland telegraphs before 1870. Their involvement in submarine telegraphy developed somewhat differently. They were well aware of the strategic importance of rapid communication within the Empire and were at first willing to support any reasonable project. The New York merchant, Cyrus Field, having established a line of telegraph between New York and Newfoundland, came to London to publicise his plan for an Atlantic cable link and sought Government involvement. The Atlantic Telegraph Co was formed by Act of Parliament in 1856 and had firm promises of Government support. The first attempt to lay a cable in 1857 was hindered due to mechanical problems. The 1858 expedition was more successful but the cable was destroyed after one month in use. The failure was caused by inherent defects and the use of excessively high voltages⁵. During its life the 1858 cable carried approximately 732 messages, some being of considerable importance. The subsidy of the Atlantic Telegraph Co. had stipulated that British or American government business must take priority over all other traffic. One Government dispatch countermanding troop movement orders is estimated to have saved the British Exchequer £50,000. Nevertheless the reverses of 1857/8 led to a decision on the part of the UK Treasury to avoid all further financial involvement and this policy continued until late in the 19th century when military necessity forced a change^{6,7}.

⁵ D. de Cogan, *Dr. E.O.W. Whitehouse and the 1858 trans-Atlantic Telegraph Cable* History of Technology, 10, 1-15, (1985).

⁶ **Cain**

⁷ **Headrick**

It is well acknowledged that the railway industry played a major part in the development of the private inland telegraph companies in Britain⁸. Cable telegraphy received considerable investment from railway financiers but this was more on a personal rather than an institutional basis. Lord Brassey was a major investor and Daniel Gooch went as far as purchasing the Great Eastern (a vessel of 22,500 tons, conceived by Brunel) so that the 1865 expedition would have a ship large enough to carry all the cable.

There had been some banking involvement in the early ventures but following the collapse of Overend and Gurney in 1866 this was substantially reduced. People with other, more commercial interests predominated. Foremost amongst these was John Pender, sometimes called the 'Cable King'. Pender was remarkable in that he combined an interest in technical matters with a sharp business sense. He was as keen to promote the commercial interests of others as he was to promote his own ventures. His monopolistic approach helped to prevent international telegraphy from fragmenting into a large number of unprofitable units. He provided the Empire with its "Red Line" of communication (a system of cables which circumvented the globe and landed only on British territory) and today Cable and Wireless is a testimony to his efforts. He was born in Scotland in 1815 and when still quite a young was speculating on the Cotton Market, first in Glasgow and later in Manchester, where he founded the firm of John Pender & Co⁹. In 1852 he became a director of the British & Irish Magnetic Telegraph Co, the second largest of the private inland companies. In 1856, seeing the value of an American link for his cotton and telegraph interests, he invested £1,000 in Cyrus Field's Atlantic Telegraph Co. In 1861 he founded the Telegraphic Journal which later became the Electrical Review and is still a valued publication in the field of electrical engineering. He masterminded the amalgamation of the cable manufacturer, Glass Elliott & Co. and the Gutta Percha Co. who supplied the insulating material. The outcome was the Telegraph Construction and Maintenance Co. (Telcon) and he was elected its first Chairman.

The economic historian, Stanley Chapman¹⁰ has observed that "Pender's name connects the telegraph with another group of early customers, the entrepreneurs connected with the international commodities markets. In the middle decades of the century the largest of these markets was cotton, which was based on Liverpool and New York. The fastest communication between the two centres was still that of the fastest ship, about 14 days and the whole business was dominated by 'big capital'- big planters, big American factors, established Liverpool brokers and the major European merchant bankers¹¹. But it was easy to discern that this system was reaching the end of its life. The telegraph from New York to the south reached Baltimore in 1846 and New Orleans before the Civil War, and with the extension of railroad lines out from New York, more and more decision making was focussed on the original suppliers or their local agents in the USA. The American Civil War(1861-5)

⁸ J.L. Kieve, *The Electric Telegraph*, David & Charles, 1973

⁹ H. Barty-King, *Girdle round the Earth*, pp. 3-7, Heineman, London 1979.

¹⁰ [private communication]

¹¹ B. Supple, *A Business Elite*, Business Hist. Rev., XXXI, (1957)

served to terminate the old plantation system and alternative sources of supply were developed in Egypt and India. It was not difficult to foresee that a trans-Atlantic telegraph with direct communications to Manchester could instantly bypass the merchants and brokers of Liverpool. Certainly this proved to be the case and within a few years the old Liverpool system withered away."

There had been an attempt to lay a cable using the Great Eastern in 1865 which very nearly succeeded. Following this it was suggested that it should be possible to lay a new cable, raise the broken one, splice onto it and thus land two cables during the following summer. Extra capital was required but strenuous efforts to raise it were unsuccessful in spite of a heavy commitment from the cable manufacturers. It was then decided to attract investors with the issue of 12% preferential shares. This would rank before the original 4% 1857 and 8% 1865 shares. At the last moment however the directors were informed that this course of action was not legal, as the issue of *preferential* shares would require a special Act of Parliament. A solution to the problem was suggested by several of the larger investors. A new company, the Anglo American Telegraph Co. would be formed with a capital of £600,000. It would enter into agreement with the Atlantic Telegraph Co., issue the *preferential* stock and take over responsibility for laying the cable. The initial subscriptions comprised £60,000 from Lord Brassey, £20,000 from Daniel Gooch and £10,000 from Pender. The raising of further capital required a financial commitment from the Telegraph Construction & Maintenance Co., who were to lay the cable. Pender asked his fellow directors to each contribute £10,000. Finding them reluctant to put so much at risk, he forced their hands by a guarantee of £250,000 of his own and his wife's money¹².

The agreement provided for the winding up of the Anglo American Telegraph Co. on condition that a payment of £1.2m was received from the Atlantic Co. on or before 1 Jan 1869. In 1867 an Act of Parliament¹³ was obtained which permitted the Atlantic Co. to raise the capital necessary to buy out the Anglo American Co. However Clause 4 of the Act stipulated that such resolution must be passed with the assent of three quarters of the votes of the Anglo's shareholders. A few of the larger shareholders (including Lord Brassey) were opposed to the dissolution of the Anglo and used this provision to block the resolution. With no further prospects for the Atlantic Telegraph Co. the two Companies were merged under Act of Parliament¹⁴.

The expansion of cable company business

The expedition of 1866 was a complete success and by the end of that summer there were two cables connecting Hearts Content, Newfoundland and Valentia island, Ireland. The lines were immediately opened for business. The inland telegraph practice of a message rate was adopted. A message was calculated on the basis of 20 five-letter words and the first commercial message was from Speyer in London to Speyer in New York and cost £20.

¹² H. Barty-King, *op. cit.* p. 22.

¹³ UK Parliamentary Records (30 Vic. c 28)

¹⁴ UK Parliamentary Records (33 & 34 Vic. c 99)

Speyer Bros. were an enterprising firm of merchant bankers, active in both foreign exchange and issues. Of Frankfurt Jewish origin, they opened in New York in 1837 and London in 1861. Their early financial business consisted largely in acquiring American railroad and other investment bonds for sale in Europe, from which they became very wealthy; in 1866 they were already reckoned to be worth around £1.0m and consequentially they were one of the leading Anglo-American financiers of the day¹⁵.

The tariffs were reduced to £10 on 1 Nov. 1866, 5 guineas (£5.25) in Dec. 1867, £3.7s.6d (£3.37) in Sept. 1868. In order to further stimulate traffic the message rate was reduced to ten words.

Within a short time of the opening of the service its potential was amply demonstrated. The debate on the *Alabama Claims*¹⁶ was printed in The Times. During three days, when not involved in other work, the copy, consisting of approximately 15,000 words, was transmitted to New York. James Graves¹⁷, Superintendent of the Valentia Cable Station from 1866 to 1909 suggests in his writings that this achievement gave considerable impetus to the practice of transmitting press information. The press had been large users of the inland telegraph, but had suffered badly from the monopolistic attitudes of the private companies who had their own intelligence (news) offices¹⁸. The tariff rates depended entirely on distance. Between 7am and 7pm thirty words cost 1 shilling (5p) for a destination up to 100 miles. This rose to 1/6 (7.5p) between 100 and 200 miles and 2 shillings (10p) for over 200 miles. The night rate was the same but the number of words carried at a given rate was increased to forty. Press organisations which attempted to alter the situation were blacked by the telegraph companies.

Julius de Reuter was one of the first to see the value of telegraph for the dissemination of news material. He set up his news agency office in London in 1851 and in 1859 was contracted by the Electric & International Telegraph Co. for the exclusive rights to supply foreign telegrams to all towns in the UK. He also had the right to supply subscribers with commercial and shipping news within 15 miles of London. Subscribers were prohibited from passing this on to the press or the public. Reuter made his reputation that same year by having news representatives with both the Austrian and French armies and during the 1860s by supplying advance news of the American Civil war.

In spite of various reductions the press still viewed the Atlantic rates as being exorbitant and Reuter made strenuous efforts to have them reduced. Having reputation and money he was able to fare better than his colleagues had with the inland companies. The Anglo American Telegraph Co. was moving only very slowly in this direction. Mainly due to the influence of Reuter they experienced their first taste of competition in 1869 when the Paris-London- New York Telegraph Co. was established. They contracted the Telegraph Construction and Maintenance Co. (who

¹⁵ S.D. Chapman, *Rise of Merchant Banking*, pp 44-46 (1984),

¹⁶ The outcome of an event that nearly brought Britain into conflict with the Federal government during the American Civil war

¹⁷ *36 Years in the Telegraph Service* the technical autobiography of James Graves (unpublished)

¹⁸ J.L. Kieve, op. cit. Chapter 11

were not averse to competition between their customers) to lay a cable between Brest in France and St. Pierre-Miquelon near Newfoundland. This, like the previous successful cables was laid by the Great Eastern. Existing cross-Channel cables were used for the Paris-London link. Initially there was strong competition; the established operator tried to make it difficult for the newcomer by reducing the tariff. In December 1870 it went from £2 to 30 shillings (£1.50) per ten word message. Overall this caused a rise in the traffic level but substantially reduced the Anglo's profitability.

It could be argued that the establishment of the French company (many of whose directors also sat on the Anglo's board) was little more than a ploy to force changes in the latter company. Once these had been achieved, discussions were held and it was agreed that both companies would operate together in what they called the 'Joint Purse Agreement', where the income would be shared out in direct proportion to the relative volume of traffic carried. There were additional advantages to be had from this arrangement. In the event of cable failure one company would carry the other's traffic. This had already been in operation during the winter of 1870-71, when there were breaks in both Anglo cables. In order to limit traffic during this period the tariff was temporarily raised to £3 and was restored to its previous level on 1 July 1871, when the cables were repaired. In 1873 it was agreed that the French Co. should go into liquidation and during December it was totally absorbed by the Anglo, three of its directors, Reuter, Crapelet and d'Erlanger, joining the board of the latter company.

Chapman¹⁹ has also observed that the names of Erlanger and Reuter reintroduce the theme of merchant banking. "The Erlangers were a bold firm of German Jewish bankers from Frankfurt, very much like the Speyers except that they came to London (in 1870) via Paris rather than New York. Reuter is of course best known for his news agency but at this period was trying to establish an imperial bank in Persia^{20,21}. To this end he set up Reuter's Telegraph Co. which in 1866 contracted the Submarine Telegraph Co. to lay a cable between Lowestoft and Norderney as part of the Indo-European Telegraph Company's London-Karachi link²². This line of telegraph which had strong backing from Reuter went overland as far as Persia and from there there was a submarine cable to India. The Lowestoft-Norderney cable provided the first durable direct line of communication between London and Berlin. In 1890 it was taken over by the British Post Office when the Submarine Telegraph Co. was nationalised²³. It is also noted that the senior partner of one of the leading Anglo-American merchant banks, Sir William Brown of Brown, Shipley and Co., was for a time Chairman of a trans-Atlantic cable company²⁴. The merchant bankers were not simply in this business as perceptive investors or firms vitally interested in rapid communication of data about foreign exchanges. The telegraph was simultaneously displacing their traditional business as merchants and opening

¹⁹ S.D. Chapman [private communication]

²⁰ P.H. Emden, *Money Powers of Europe* pp 397-8

²¹ F. Kazemzadek, *Russia and Britain in Persia* (Yale, 1968) Ch. 2 and p.210ff

²² K.R. Haigh, *Cables and Submarine Cables*, p. 202, STC, London (1978)

²³ K.R. Haigh, *op. cit.*, p. 195

²⁴ A. Ellis, *Heir of Adventure: the Story of Brown Shipley & Co., Merchant Bankers* (1960)

up another avenue²⁵. The business of arbitrage, that is, the international purchase and sale of currencies and shares for small margins, was not created by the telegraph, but given an enormous boost by it. Arbitrage began on the Continent and the leading arbitrageurs were very often German Jews. But the principal business was soon between London and New York, as deviations in price between railroad securities(then the principal aim of European foreign investment) between the two financial centres appeared almost daily. In the 1880s one of the sights of the City of London was the telegraph boys racing through its narrow lanes and courts between 3 and 4 pm every day as the New York cables arrived²⁶. There can be little doubt that the opportunities offered by a trans-Atlantic cable were foreseen by many merchant bankers. Thus August Belmont²⁷, Rothchilds' agent in New York wrote to his principals in 1869 that “. . . My conviction is that ere long, the daily arbitrages between London Frankfurt and New York in American securities by telegram will be as regular and large as between the different principal cities of Europe”.

The resumption of the Anglo American Telegraph Co. monopoly after 1871 prompted further competition in an effort to reduce tariffs. This was assisted by the availability of substantial venture capital following the nationalisation of the United Kingdom inland telegraph services. The Direct United States Telegraph Co. was formed with substantial backing from Siemens, who were anxious to establish their own cable making concern and break the monopoly of the Telegraph Construction and Maintenance Co. The new company's route to New York was anything but direct. Siemens tried to land their cable at Newfoundland but were prevented from doing so by legal action on behalf of the Joint Purse companies²⁸. They eventually had to land in Nova Scotia, the increased distance causing a reduction in the speed of the cable.

Perhaps the single most important influence on the utilization of international telegraphy was the appointment of Henry Weaver as General Manager of the Anglo American Co. Weaver had been Secretary of the Electric & International Telegraph Co. and following the nationalisation of the UK inland services in 1870 had chosen not to continue as an employee under the new management, the Post Office. In 1872 he introduced the 'word-rate' system which completely changed the scene. From that time onwards messages of any length would be carried and charged at the rate of 4 shillings (20p) per word.

It coincidentally removed Reuter's lucrative scheme of 'message-packing'(selling any spare capacity as individual words within his messages)²⁹. Bright³⁰ cites some examples of the economies afforded by the use of one-word codes: "ELGIN= every article is of good quality that we have shipped to you. PENISTONE= cannot make an offer; name lowest price you can sell at".

²⁵ S.D. Chapman, op. cit., Ch. 8

²⁶ The Statist, XVIII,(1886,2), pp. 179, 719

²⁷ Rothschild Archive, London, T58/3,26 Feb. 1869

²⁸ Information on this can be found in the Centre for Newfoundland Studies in Memorial University, St. Johns, Newfoundland, Canada

²⁹ H. Barty-King, op. cit. p. 56

³⁰ Charles Bright, *Submarine Telegraphs*, pp 171-177, Crosbie Smith, London 1896

The word rate introduced a completely new spectrum of users, but although the number of customers increased the proportion of messages which comprised one or two words was very large and as Bright said "In due course as the use of the telegraph became more widely extended and appreciated, the increased number more than balanced the decreased average length of messages".

In spite of the introduction of the word rate the fortunes of the Anglo American Telegraph Co. were steadily declining. Their value on the stock market drifted downwards and during the early 1870s they were faced with stiff competition from the Direct United States Telegraph Co. (D.U.S.T.) who were offering special rates to the press and other heavy users. John Pender, with interests in cables all over the world was about to come to the rescue (at the expense of the Direct Co.). In an attempt to cushion investors against fluctuations in the value of telegraph stock and the financial effects of frequent interruptions due to cable failure, he had established the Globe Telegraph and Trust Co. in 1873.

This was an early form of unit trust but with a difference. According to Barty-King³¹ its purpose as defined in its articles of association were:

"the acquisition and amalgamation in one Company of the principal lines of submarine telegraph and the land lines used in connection therewith. It is proposed, in the first instance, to acquire the shares and other securities of the companies owning them, issuing the shares of this Company in exchange for them, or to raise funds for the purpose of paying for them, and as opportunity offers, acquiring and absorbing the businesses and properties of the companies themselves".

There were those who labelled the Globe Trust as Pender's attempt to use other peoples' money to further his monopolistic ideals. However, as has been previously stated, he was unique in that he combined a desire for the universal availability of cheap communications (at a reasonable return on investment) with an interest in the commercial well being of his customers. Thus the state of affairs which prevailed on the Atlantic route in 1876 gave him cause for concern. Since commencement of service in 1875 the Direct United States Telegraph Co. had earned £143,610 on capital of £1,300,000 (an 11% return). The Anglo American Telegraph Co. together with its French colleague (The original Paris-London-New York Co.) had earned £480,900 on £7,000,000 capital (a 7% return)³². Pender felt that this was too great a threat to the Anglo, in which the Globe Trust had a heavy investment. He sought to amalgamate the two companies. Against strong opposition, which included a High Court action, he succeeded in obtaining a resolution for the liquidation and reconstruction of the D.U.S.T. in June 1877. On 17 July Pender, Gooch and Sir James Anderson formed a second Direct US Telegraph Co. Its articles of association did not contain the clause prohibiting any agreement with the Anglo, which Pender had found so iniquitous in the original company and it immediately entered the Joint Purse. Nevertheless, the Direct maintained its identity within the Joint Purse even after 1911, when, like the Anglo, it was

³¹ H. Barty-King, *op. cit.* p. 53

³² H. Barty-King, *op. cit.* p. 56

leased by the Western Union Telegraph Co. It went out of existence in 1920, when the British Government purchased its cable as its first direct involvement in trans-Atlantic communications.

In spite of this the competition created by the Direct United States Co. did have one long-term effect. On 1 Jan. 1876 the Anglo introduced a special press rate which was half the normal tariff.

The developments mentioned in the previous paragraph highlight the major weakness of the Anglo American Telegraph Co. Its working capital of £7,000,000 included the investments in the 1857, 1858 and 1865 cable failures, which it inherited from the Atlantic Telegraph Co. As the first in the field it had to pay for the learning experience. The later arrivals were able to set up in business for a much smaller capital outlay and were therefore able to offer a substantially higher dividend. One such arrival was the Commercial Cable Co., which for many years was to be the arch-rival of the Joint Purse Group. It was founded in 1883 by John W. Mackay, an American mining magnate, and Gordon Bennett, proprietor of the New York Herald³³. Its principal objective was to create competition to the Joint Purse monopoly and provide advantageous news rates for the Herald. Being incorporated in New York gave it some protection and helped to ensure that it continued as an independent competitor. For a prolonged period it was able to charge slightly higher rates in exchange for a much faster service. Western Union who had entered the Joint Purse in 1881 had cables running between Nova Scotia and Cornwall. The Anglo and Direct cables, which landed on the south west coast of Ireland and thereby having a shorter length, could for electrical reasons carry more traffic. However messages then had to be relayed along Post Office lines across Ireland and these were notoriously slow and the resulting delays were a continuous source of frustration to customers who demanded a fast service. The Commercial Cable Co. combined the best of the two approaches. Their eastern landfall was Waterville in Ireland, where traffic was then relayed to Britain via a cable to Weston-super-Mare and to Europe via a cable to le-Havre.

In an attempt to stifle competition the Joint Purse Companies dropped their tariff from 2 shillings(10p) to 1/8(8.33p) per word. This had little effect on the Commercial Co. who was now attracting a considerable amount of the traffic. Accordingly the Joint Purse Companies dropped their tariff to 6d(2.5p) per word in 1886. The Commercial Co. being able to offer a faster service retained the 1/8 tariff for some time. The PQ Company, which had operated within the Joint Purse almost since its establishment, did not like the 6d tariff and so withdrew and set up an alliance with the Commercial. It refused to refund its share of the proceeds to its ex-partners as set out under the terms of contract of the joint purse operating agreement. The litigation and appeals were still progressing in 1900.

The major sticking point between the competitors was the unwillingness on the part of the Joint Purse Group to release its monopoly on German traffic. For many years the Anglo American

³³ D. de Cogan, *The Commercial Cable Co. and their Waterville station* Proceedings of the IEE History of Technology Weekend, Trinity College, Dublin, July 1987

Co. had been carrying all German trans-Atlantic business and the agreements excluded competitors on the east to west route. The Commercial Co. were already carrying a considerable volume of German traffic in the opposite direction and claimed the the Anglo monopoly was unfair. Both were unaware that the situation was about to change. The records of the Anglo American Telegraph Co. seem to suggest that the German Union Telegraph Co., which had a cable connecting Emden with Valentia, was not particularly well managed. Its fortunes declined and it was happy to sell out to the Imperial German Posts and Telegraphs in 1889. The German Government were planning their own independent lines of telegraph communication³⁴.

A contemporary view of the cable business

Sir James Anderson, was one of the first to comment on the economic effects of the competition between the two cable companies. He had been master of the Great Eastern during 1865 and 1866 and subsequently relinquished his post to run the Eastern Telegraph Co. (now Cable & Wireless) on behalf of John Pender.

In his address to the Royal Statistical Society in 1871³⁵ Anderson used a comparison between inland and international telegraph services when he outlined an economic rule for trans-oceanic telegraphy "a reduction in tariff leads to a diminution in the net product". However his use of this analogue was not strictly valid on account of the different pressures which had brought about the two systems. As already mentioned inland telegraphy had strong links with railways and had attracted much investment from that quarter. On the other hand individual personalities played a more important role in oceanic telegraphy. In addition Anderson's comments of 1871 were made under the shadow of nationalisation of the UK inland service; a time when the trans-Atlantic traffic density was still relatively small and before the introduction of the word-rate (it would have been very valuable if Anderson had had an opportunity of reviewing these comments before his death in 1893).

Anderson's address also gives a broad impression of what he saw as the major customers of both the inland and international telegraph service. During this period press traffic represented 28% of all international telegrams, while it represented 59% of inland traffic. 56% of the international telegrams were commercial as against 34% of the inland service. In each case government and general public messages made up the rest.

Anderson arguing in a traditionalist way, claimed that as commercial affairs constituted the principal object of international traffic "this class of correspondence follows above all, in its movement, the fluctuations of commerce and is only influenced in a secondary degree by the alteration in tariff". From this point in time it is not clear what evidence he had for this statement. Certainly there may have been some basis at the tariff levels then in operation. He

³⁴ D. de Cogan, *Internationale Kabeltelegrafie und die Österreichisch-Ungarische Doppelmonarchie* Blätter für Technikgeschichte, Vienna, 50, 7-44, (1989)

³⁵ Sir J. Anderson, *The Statistics of Telegraphy* Journal of the Royal Statistical Society 35 (1872) 272-236

also claimed that reductions in tariff did little to increase traffic and that the percentage loss was greater than on land, so that an increase in traffic volume did not have a compensating effect.

A retrospective view of the cable business

A variety of sources can be used to derive a modern view of the business of the cable carrier. The effects of many influences are clearly visible in the financial state of the Anglo American Telegraph Co. during this period and they are generally at variance with the views of Anderson. Our analysis is extended on the assumption that the fortunes of one, albeit the biggest company give a reasonable insight into the entire trans-Atlantic telegraph business. We know precisely how many cables were in operation at any time and we know who owned them. We can therefore estimate the Anglo's market share as a proportion of their ownership of the total Atlantic network. This is shown in figure 1. This model is supported by three data-points (marked x) in the figure. These are the Anglo's actual percentage share of traffic taken from the unpublished writings of Graves³⁶, who as Superintendent of their station at Valentia island during the period 1866 - 1909 would have had an intimate understanding of the state of affairs. In all except the first case the agreement is very close. It is suspected that any apparent discrepancy may be due to differences in volume of traffic between Britain and America and France and America as the French traffic went direct from Brest and not through the Valentia island cable station.

Information on the Anglo's traffic receipts can be obtained from several quarters. For the period up to 1876 it has been derived from Company annual reports that form part of the Graves's collection of papers³⁷. Thereafter the Company presented half yearly statements. From 1872 to 1878 the number of points are somewhat limited by the scarcity of available data sources. A periodical called *The Electrician*, which first appeared in that year is the major source of information for the remainder of the period under consideration. In addition to technical articles it also included financial statements of companies involved in business associated with electricity, telegraphy, telephony etc. The financial statements for the Anglo American Telegraph Co give details of total income, which included traffic receipts. In many cases the subsequent issue of *The Electrician* carried the report of the directors to the six monthly meeting of shareholders. These reports are particularly useful as they give a breakdown of income and information about tariff level changes. In general the income for the Jan.-June period was less than that for July-Dec. This could be the result of essentially two components: traffic volume and income from chartering *Minia* their cable repair ship to other operators. Cable repair being critically dependent on weather, the ship would have done most of her work in the summer months. Traffic volume would also be affected by cotton and grain harvests. If these were in fact the only seasonal factors, then the income data can easily be used to give a simple estimate of their magnitude as a proportion of total traffic.

³⁶ Op. cit.

³⁷ in the possession of his family (copies with author, DdeC)

Copies of *The Electrician* which are in the British Library (Periodicals Section) at Collindale (London) are held as individual items in an unbound state. Unlike the bound volumes in locations such as the Institution of Electrical Engineers in London they have retained their outer covers and the advertisements which appeared on these pages provide up-to-the-minute data on tariff rates for each of the cable companies.

By taking the Anglo's traffic receipts for a given period and using their published tariff rates traffic volume can be estimated. Figure 2 shows this as average words/day against time (details of the tariffs are shown above the horizontal axis). Information from figure 1 can then be used to make an overall estimate of traffic volume on the Atlantic route as a function of time. It must be stressed that these are rough estimates, as it is not possible to extract any details about the volume of government and press traffic(both had special tariff rates).

The results in figure 2 show three distinct phases: the initial induction period, the dramatic rise upon the introduction of the word rate and a steady, although less steep upward trend thereafter. The data is perturbed by seasonal and other factors. In spite of the tariff reduction to 1 shilling (5p) around 1876, the traffic went down. There was a drop after 1884, when the tariff was again reduced on the entry of the Commercial Cable Co. There is another sudden rise on the introduction of the 6d (2.5p) tariff, which collapsed the moment it was doubled.

When the results are smoothed using a ten year running average it is possible to identify two distinct upward slopes, the first being steeper than the second. These are surprisingly similar to the results for per capita annual usage of telegraph and telephones in Britain and the USA up to 1970 as given by Atherton³⁸ and are reproduced in figure 3. We feel confident in drawing this parallel because telegraphy remained the dominant communications technology until after the installation of the first trans-Atlantic telephone cable (TAT 1) in 1956. Atherton's curves for UK and US telegraph are composed of the sum of inland and international traffic data. The telephone in America made inroads into the inland telegraph monopoly at an earlier stage than in Britain. This results in a downturn in the American telegraph figures which is not obvious in the British figures until a later date. Telephone traffic, not being affected by the advent of competing technology shows a two stage increase which is identical to the trans-Atlantic telegraph data shown in figure 2. It seems strange that Hazelwood in his paper on British telecommunications statistics³⁹ did not comment on this trend.

We explain some of the fluctuations in the traffic data by assuming that commercial interests and particularly the stock market were the major users of the telegraph. This is supported by Anderson and by Kieve⁴⁰, who states "the cable companies made their greatest impact on the international money markets; funds flowed across Europe and the world". American and German stock markets went through a low in 1877. Britain followed in late 1878⁴¹. This matches up

³⁸ W. A. Atherton, *From Compass to Computer* San Francisco Press, 1984 (see figure 5.11)

³⁹ A. Hazlewood, *Jnl. of the Royal Statistical Society*, A **116** (1953) 191 -202

⁴⁰ J.L. Kieve, *op. cit.* p. 238

⁴¹ O. Morgenstern, *International Financial Transactions and Business Cycles* p. 528. Princeton Press 1959

with the drop in traffic during this period which was not effected by the reduction in tariff. The trade cycles during the period under consideration are identified by Rostow⁴² as peaks during 1882, 1890 and 1900 and troughs during 1886 and 1894, and are in remarkable agreement with the telegraph traffic data. In each case there is almost exact coincidence between the bottom of a trough and a minimum in traffic. The traffic maxima, however, generally seem to lag the peaks by up to a year.

The perturbations due to tariff reductions are interesting when seen in this perspective. From a historical point of view the tariff battles were attempts by the Anglo American Telegraph Co. to stifle competition, which in the way of Anderson's hypothesis "reduced the net product". However it can be seen that these always occurred near economic troughs. Assuming a four year period for commercial cycles during this era, it would appear that competing companies were in general launched at about the time of a peak. In most cases it took six to twelve months before their cable/s were ready for business, so that they invariably entered the market as it was heading for a trough. In these circumstances fierce competition for the available business was inevitable. Nevertheless competition did force a near continuous downward trend in tariff rates and unprofitability was not a great problem so long as the traffic density was sufficiently high. The fact that the 1890 economic peak did not produce another competitor can probably be attributed to the existence of a stable duopoly (Joint Purse Group and Commercial Cable Group) operating within this framework of low tariffs.

Conclusions

The Anglo American Telegraph Co. although the largest operator always had financial problems. They paid the price for being first in the field (and for some apparently strange accounting practices). Their enormous declared capital meant that they could not offer reasonable dividends and this was reflected in the value of their shares.

The introduction of the word rate changed the entire basis for Anderson's hypothesis. There was a general downward trend in tariffs, but lower rates did not necessarily mean unprofitability, since technical improvements and faster cables helped to carry more traffic at lower cost.

It is interesting to note that the same situation still operates with international cables. The first trans-Atlantic telephone cable, TAT-1, was laid at a cost of \$49.6m. It had 48 separate voice channels. Since then there has been a continuous reduction in the cost per channel. TAT-7, laid in 1983 at a cost of \$197m had 4,200 channels and TAT-8, the first optical fibre cable, which will be laid in 1988 doubled this number. TAT-12 and TAT-13 (the first uninterruptible ring circuit) have been laid and the trend continues.

Both Anderson and Bright claimed that international telegraph traffic was largely effected by fluctuations in trade. The results presented here suggest that at least for the case of the Atlantic

⁴² W.W. Rostow, *The World Economy* p.330. University of Texas Press 1978

these were in fact small scale fluctuations on a more general upward trend. However, as has been noted, inland telephone traffic in the US and to a smaller extent in the UK seem to have followed a similar trend. The small scale fluctuations in the estimated traffic rate can be explained in terms of a business which was effected by large scale movements in the major stock markets, but which contained perturbations due to inter-company rivalry during economic troughs.

It is possible to hypothesise about the two stage growth. The telegraph provided a service which was not previously available. The initial rate of uptake was limited by high tariffs. After the introduction of the word rate there was a rapid take-up by those who could foresee immediate gains from the facility. In a regime of constant tariffs with a constant prices index the number of messages per day could have been expected to reach a plateau with growth limited to that of the international economy as a whole or at any rate to the principal users of the telegraph. In fact, the last quarter of the nineteenth century was a period in which prices were generally falling and this decline in the case of the telegraph was more steeply inclined by the growth of vigorous competition. Our graphs suggest that Anglo American's business failed to keep pace with the growth of the international economy in this period and lost its early lead, a significant failure of enterprise in this new science-based industry.

Figure captions

- 1 Anglo American Telegraph Co. share of the total cable installation, shown as a percentage over the period 1866 - 1900. FR = La Societe du Cable Transatlantique Francaise, DU = Direct United States Telegraph Co., PQ = La Compagnie Francaise du Telegraph de Paris a New York, (founded by Mr Pouyer-Quertier.), WU = Western Union Telegraph Co., CCC = Commercial Cable Co.
2. Traffic volume (words per day) over the period 1866 - 1900. In old currency £1 sterling was divided into 20 shillings. One shilling (1/=), equivalent to 5p in decimal currency was divided into 12 pence (12d).
3. Per capita telegrams and telephone calls for UK and USA from 1860 - 1980 derived from figure 5.11 in W. A. Atherton, *From Compass to Computer* San Francisco Press, 1984. Note
(i) unified records were not maintained in Britain until after nationalisation.
(ii) The sudden jump in UK telephone calls (ca 1912) is due to the inclusion of local calls from that time

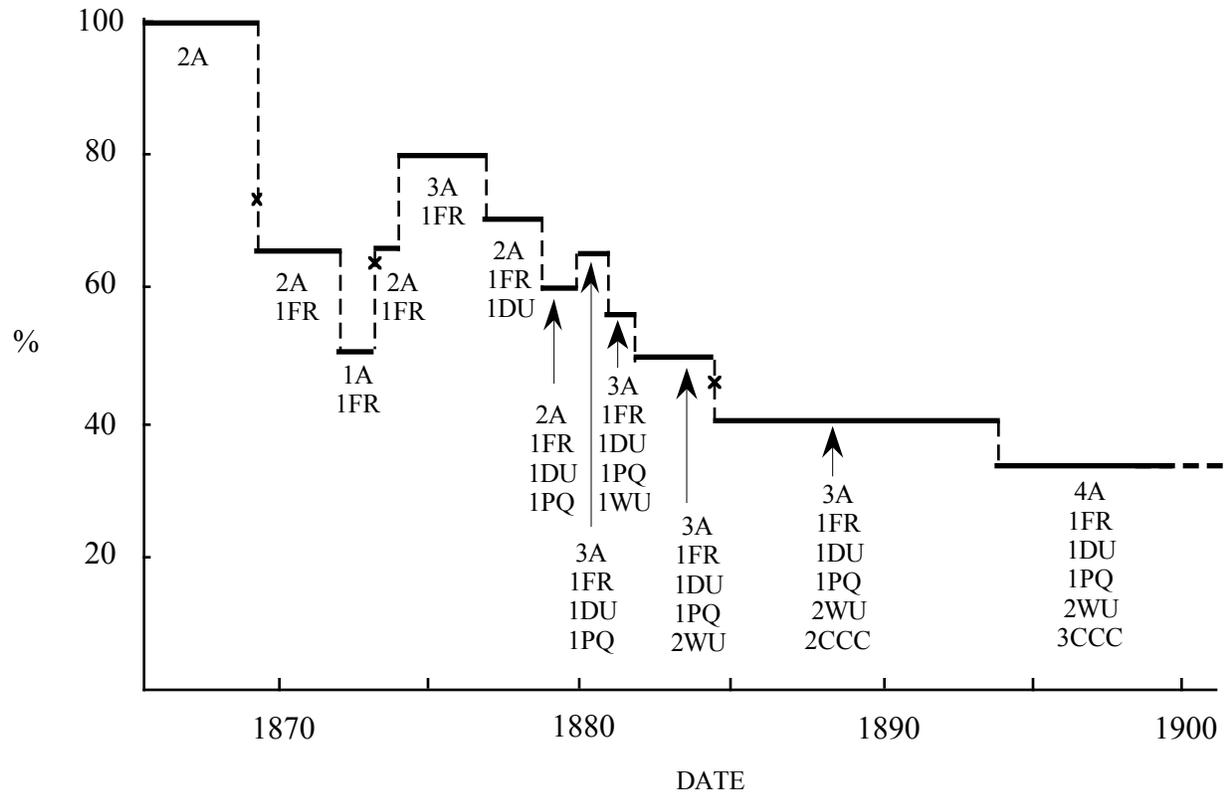


Figure 1

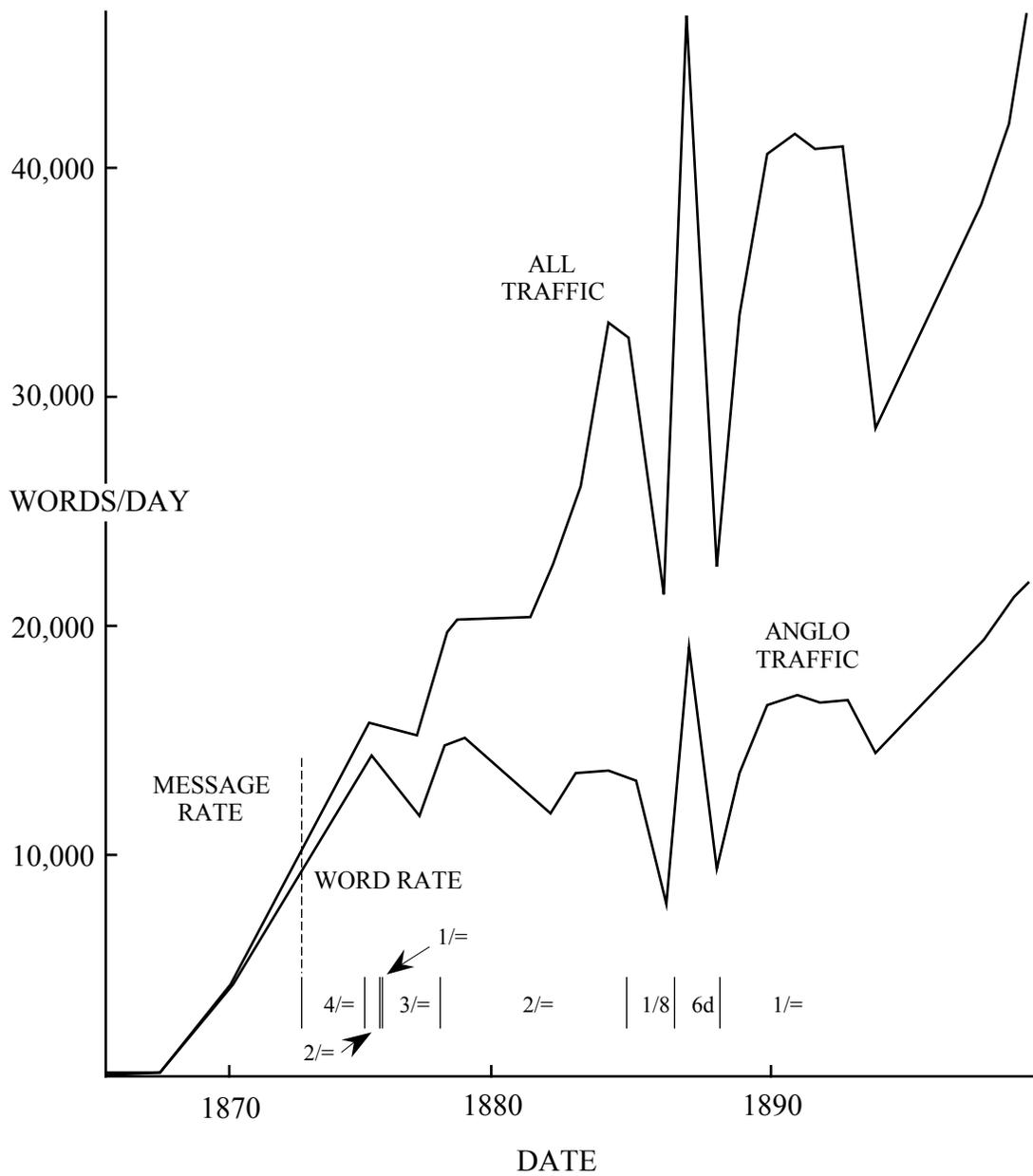


Figure 2

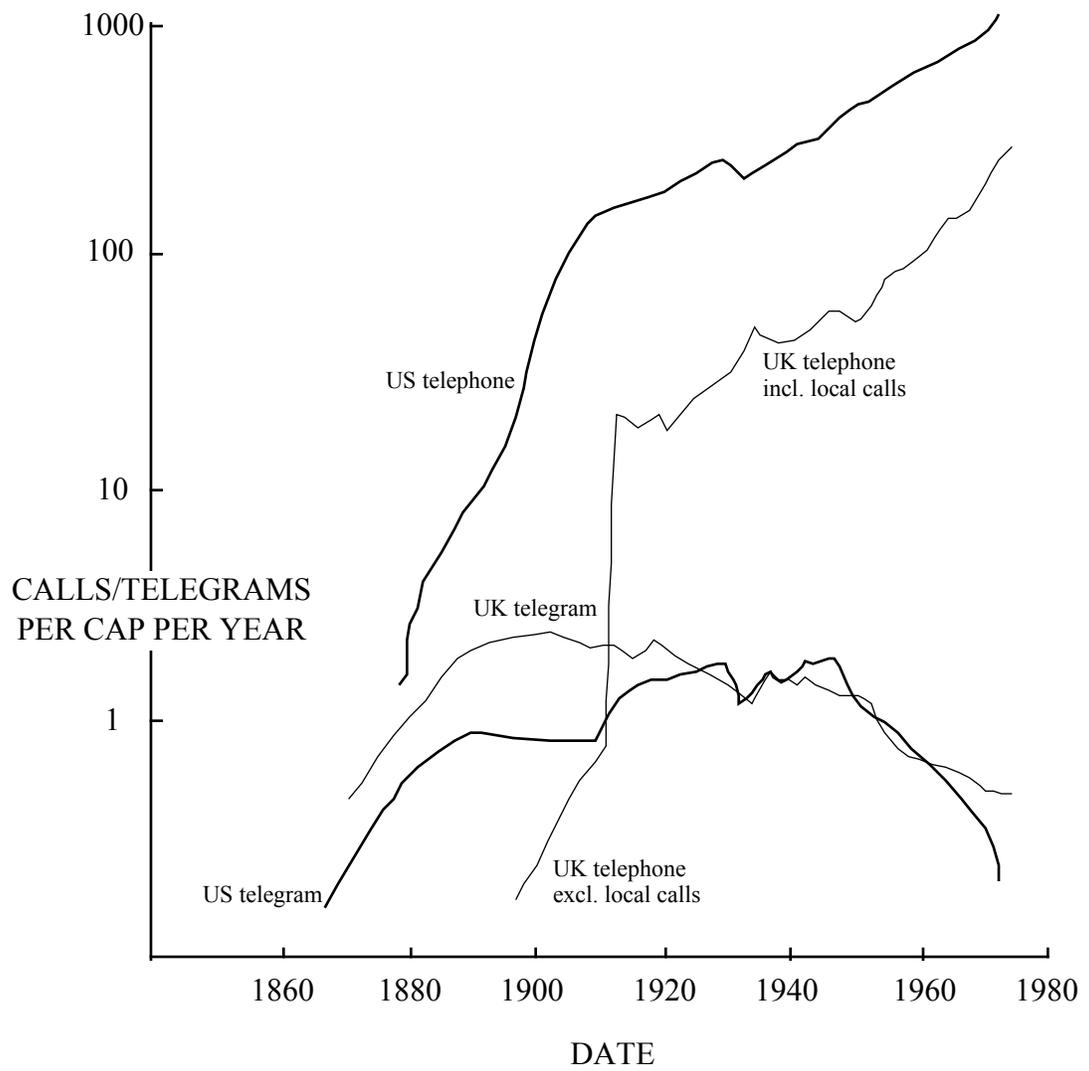


Figure 3