Trading Facts: Arrow's Fundamental Paradox and the Origins of Global News Networks

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Abstract

Since the Renaissance newsbrokers have developed solutions to overcome the main problem of selling news. The 'fundamental paradox in the determination of demand for information', originally identified by Kenneth J. Arrow, implies that buyers cannot assess how much they want to pay for information without knowing its content, but once they know its content, they do not need to pay anymore.

The first part investigates the evolution of newsbrokers' business models since the Renaissance, noting the use of reciprocity by diplomats and merchants, who wrote the latest news at the bottom of their letters, and how the news trade profited from selling numerical values of quantifiable properties of economic qualities, such as prices, exchange rates, ship arrivals, 'credit ratings', and later interest rates and share prices. These properties could all be stated without revealing the actual numerical value. Newsbrokers used various transmission technologies to satisfy the expanding demand for news, from couriers, pigeons, semaphore systems, pneumatic tubes to, eventually, the electric telegraph.

The second part focuses on how, using several of these technologies, international news agencies emerged that partially replaced the earlier newsbrokers during the nineteenth century. The business models they developed to mitigate Arrow's paradox included subscription selling that made news items' marginal price zero, the bundling of news, the lobbying to create and enforce copyrights in news, and, finally, cross-subsidisation of news provision with ancillary revenues from advertising, financial services or from governments. The main agencies—such as Reuters, Wolff-Continental, Havas and Associated Press—overcame further selling difficulties by forming an international news cartel.

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During the nineteenth century, the communications industry grew considerably.[1] Initially, governments and businesses made wide use of messengers on foot or horseback, postal pigeons, and semaphores, while later in the century they started using the electric telegraph. Standardized and universal postal service expanded substantially, with the largest cities getting six or more daily deliveries and collections.[2] The growth in communication speed, capacity, and quality affected the way news was gathered and how it was traded internationally.

This chapter aims to investigate how the nature of information and its use in society has affected the evolution of the gathering and selling of information since the Renaissance. It examines how, during the nineteenth century, this evolution led to the emergence of international news agencies that partially replaced the earlier newsbrokers, as well as the business models they developed. It analyzes how newsbrokers determined the value of information, what difficulties they faced in trading it, and the various strategies they devised to overcome these obstacles. The chapter focuses exclusively on these issues and does not aim to give a complete descriptive history of the news agencies, as these can be found readily elsewhere.[3]

The chapter's perspective is that innovation in communication transmission was strongly affected by the increasing demand for news, instead of being exclusively supply-led by a particular new invention appearing exogenously and then creating demand that had been previously nonexistent. Therefore, the chapter focuses more on the demand for news, than on the particular technology used to deliver it. A large demand for commercial information, for example, existed prior to the commercialization of the electric telegraph and was met by technologies such as couriers, pigeons, and semaphore systems.[4] Long-run factors such as rising incomes, increasing literacy, urbanization, liberalization, market integration, and the proliferation of organizations spanning large territories stimulated the demand for information.[5] This demand constituted a basic human want that could be fulfilled by various alternative technologies.

Two further factors made demand especially important in the case of news. Because news-gathering costs were largely fixed, average costs decreased in the size of the market, and because news formed its own complement, growing news consumption further increased news demand endogenously.[6] Given the importance of demand, this chapter also investigates alternative transmission technologies and news services preceding the electric telegraph.

In the next section the evolution of the trade in news will be discussed, as well as the transmission technology used for it. This is followed by an analysis of the economic aspects of news and how these forces shaped the business models that the news agencies adopted. A subsequent section looks at the wider role of the news trade and communication costs in society. Finally, organizational aspects of news agencies are discussed.

EVOLUTION OF THE INDUSTRY[7]

The users and exchangers of early news messages were mainly governments,[8] banks, insurers, and merchants. Invariably, letters between officials from different cities or countries ended with a brief summary of all the latest news, an expected and reciprocated diplomatic courtesy.[9] Likewise, correspondence between merchants habitually contained detailed data on prices and exchange rates at the end of each letter. In the course of the sixteenth century, these handwritten notes were sometimes replaced by printed lists, as was done, for example, by the Antwerp cloth trader Van der Molen in 1540. Trading exchanges such as those in Antwerp, Amsterdam and Italy also started to issue letters, "price currents," containing lists of commodity prices and exchange

rates.[10] The currents had two functions: They provided local businessmen with a compacting digest of all local information and second, they provided trading information for businessmen elsewhere.[11] Other news that was increasingly sold included the creditworthiness of trading partners and ship arrivals. Later, interest rates and share prices also were sold.[12]

In addition to private correspondence and exchange news letters, specialized newsbrokers corresponded with agents in important trading cities and compiled newsletters that were sent to paying subscribers, mainly merchants and governments.[13] Before the adoption of the printing press, this was a costly process. From 1536, the German lawyer Christoph Scheurl sold his letters to the court of Mainz for wine and meat, and was called the "eye and ear of Germany" by Martin Luther.[14] The bank and trading firm Fugger of Augsburg operated an internal news service that made use of correspondents in the firm's offices throughout Europe.[15] During the sixteenth century other newsbrokers operating from the same city were Jacob Philipp Hainhofer , Jeremias Crasser, and the latter's successor Jeremias Schiffle, who provided a weekly news service.[16] In London in the late sixteenth century commercial newswriters were providing an "aristocratic news service," sometimes to as many as a hundred or more clients. The letters reported events in chronological order, usually in one or two sentences, without commentary or opinion.[17] In the Netherlands during the seventeenth century, Abraham Casteleyn operated a regular news service from Haarlem.[18]

The independent newsbrokers often delivered newsletters on a weekly basis, the news being duplicated by a team of copyists. In the Italian city states during the sixteenth and seventeenth centuries, these newsletters, or *avvisi*, became increasingly important.[19] In major trade cities—such as Venice, Augsburg, Nuremberg, Wittenberg, Frankfurt, Cologne, and Antwerp—correspondents existed that sold all kinds of business information. The postmasters in these cities also made money from the gathering and sale of news.[20] Because of the high costs of running a news service and copying the news, and the resulting high subscription fees, businesses and governments were probably the only customers willing to pay for it. They could assess how the financial benefits they had received from being better informed weighed against the cost of subscription. What was clear was that the selling of business information was profitable: At exchanges in the Low Countries and Italy, entrepreneurs paid substantial sums to obtain the exclusive license to publish the exchanges' prices, as well as annual renewal fees. The possibility of nonrenewal may have kept the newsbrokers accurate.[21]

During the sixteenth and seventeenth centuries, the handwritten newsletters with mainly business and political news survived the adoption of the printing press.[22] The large costs and slowness of printing and

the need to print a large run to be sold over a long time span may have induced newsbrokers to keep using copyists to achieve speed for small circulations because the value of news depreciated quickly as it became old.[23] Rather than appearing exogenously, the printing press was probably adopted because practices changed from trying to gain advantage by keeping information private to increasing profits by making information public. Only after the determination to make information public was the printing press widely used and developed as a technology.[24] This also might explain the simultaneous occurrence of various alternative printing technologies in several European countries. Potential reasons for switching from private to public information exchange could have been, first, the additional business for a particular city that publishing information generated, second, the profitability of publishing in itself, and third the increase in daily efficiency for local businessmen such as merchants, bankers, insurers, notaries, who did not have to be continuously on the city's exchange but could run their business from a coffee house or a front office.[25] The pay-offs to these three factors increased as the general trading volumes grew.

An extensive international network of correspondents was run by coffeehouse owner Edward Lloyd from the late seventeenth century to publish *Lloyd's List*, which contained information of ship arrivals in ports across the world, exchange rates, and commodity prices. Lloyd paid an annual fee to Royal Mail for expedited and secure delivery, free of postage. Besides insurers and government departments, other businesses also were among its customers, especially the trading corporations. By 1693, the Hudson Bay Company, for example, had come to rely so greatly on "Mr Loyd the Coffee Man for his Intelligence of the Comp[an]ies Shipps" that it awarded him a gift of £3. During wartime Lloyd's List became in effect an arm of the Admiralty.[26]

Many news services were of an informal character. In eighteenth-century Paris, for example, Mrs. M.-A. L. Doublet ran a salon for her friends of the Paris elite, where news was gathered, reliability assessed and then copied by hand to be sent out to selected friends who might copy it further. Inhabitants of the provinces were happy to pay six livres a month to subscribe to the newsletter.[27]

Both formal and informal news services were facilitated by rudimentary private and public postal systems that emerged in the late fifteenth and sixteenth centuries and gradually improved. The family Von Thurn und Taxis, for example, whose ancestors had been operating courier services in Italian city-states since 1290, in 1489 secured the right to carry government and private mail throughout the Holy Roman Empire and Spain. Eventually, the private Thurn and Taxis system employed up to 20,000 messengers not only to carry mail but also to deliver newspapers.[28] French and English rudimentary delivery systems, exclusively for

government use, were founded around the same time as Thurn and Taxis, and were only opened for general use in the early seventeenth century, the English system being linked to Thurn and Taxis' in 1620.[29] The latter continued in the Low Countries until 1794 and its last remaining assets were nationalized by the Prussian government in 1867.[30]

During the early nineteenth century, the number and size of news services grew. Governments invested in costly information-transmission systems, mainly using optical telegraph technology. These networks had become feasible because telescopes could now be produced relatively cheaply, expanding the potential reach of semaphore systems.[31] A pioneer in this area was the French revolutionary government. From 1792, adopting technology from Claude Chappe, it started constructing a network of towers on hilltops, used mainly for state purposes.[32] Other countries quickly followed the French example. At the Congress of Vienna in 1815, for example, Prussia insisted on keeping Western Saxony, as this offered the only clear line of sight to Westphalia, needed for the functioning of the optical telegraph that linked East and West Prussia.

Harbor authorities in port towns also installed optical telegraphs to get advance news of arriving ships. The Harbor of Liverpool, for example, established an optical telegraph from Holyhead Mountain to Liverpool in 1826, which remained in operation until 1860.[33] By the mid-1830s, the European optical telegraph network reached from Amsterdam to Cadiz in Spain, and from the French Atlantic coast to Trieste in the east, with further networks in Germany, Britain, Russia, Finland, Sweden, and Denmark. In Britain, for example, Manchester had lines to Hull, London, Southampton, and Plymouth.[34] The total number of telegraph towers was probably well over 1,000.[35] The optical telegraph also spread outside of Europe, with, for example, networks linked to the U.S. northeastern ports, such as the 72-mile line built in 1801 to link the North Atlantic shipping lanes to Boston, a semaphore system on Van Diemen's Land (Tasmania) in Australia, a system in Rio de Janeiro, and a line in the Nile delta in Egypt, starting with the line Alexandria-Cairo, to which later the line Cairo-Suez (1839) was added.[36]

Simple optical signaling systems had been in use since time immemorial, such as the chains of fire beacons along roads in Assyria in the seventh century B.C. and in the Roman Empire,[37] or the system of fire signals along the Chinese wall.[38] The eighteenth-century telegraph offered three key advantages over most previous systems: cheap telescopes that made complex signals possible; the ability to send many messages continuously instead of an irrevocable message once in case of, say, invasion; and, finally that rather than one signal it could send more developed messages with codes or signals for each letter of the alphabet. A disadvantage was that it could hardly be operated successfully at night.

The limited bandwidth of optical networks meant that they were exclusively used for information with the highest value per word transmitted, such as the most essential political and military facts. Because for governments this value was one of the highest, it is not surprising that they were major investors. Although the value per word was probably less for any individual business, the importance of speedy communication must have been immense for all businesses combined. Yet only a wider bandwidth than that offered by the optical telegraph could serve all those businesses.[39] The potential value of the few messages that could be sent needed to be higher than that of alternative messages. Napoleon, for example, ordered that winning national lottery numbers were transmitted weekly through the telegraph, which sharply reduced fraud.[40] This message had an extremely large (social) return related to its size. Another high-value message was sent half a century later, saving the British government about 50,000 pounds sterling; a telegram cancelled a previous order to send Canadian troops to India, because an uprising had been suppressed in the mean time. The next day, the transatlantic cable broke down.[41] The early systems had high costs and therefore high prices, so that the marginal utility (the value of the last message sent) was relatively high compared with the present day.

Nationwide or international networks were hardly used for business news, given their limited capacity and their ownership by government. For a short period, stock market information was sent over the French network, but the government soon stopped this experiment.[42] In Britain, besides the Admiralty's network, other systems were used for business purposes, such as the Merseyside–Liverpool optical telegraph.[43] In the nineteenth-century world, this type of use became widespread across port towns. In Egypt, small boats approached incoming vessels with postal pigeons, who would fly on-shore, where the optical telegraph towers carried the news inland.[44] In the United States, from c. 1820 two commercial telegraphs in Boston and New York City sold information on shipping arrivals for an annual fee to mainly marine insurers, merchants, ship owners, and journalists. The information was sold at an "exchange" in the cities' downtown business districts. Between October 1833 and December 1834, the Boston telegraph, for example, reported the arrival of 2,104 ships.[45] Elsewhere, a group of Philadelphia brokers set up signal stations on high points across New Jersey to link New York, where ships and news from Europe arrived, and Philadelphia, which in 1790 had founded the first U.S. stock exchange. Signalmen watched through telescopes as coded flashes of light brought news of stock prices, lottery numbers, and other information, which could travel from New York to Philadelphia in as little as ten minutes, sharply narrowing the advantage of New York speculators. It remained in use until the arrival of the telegraph in 1846.[46] In 1847, a Wall Street trader set up a system of opti-

cal telegraphs between Halifax, where European steamers first arrived, and Boston, the head of telegraph line to New York.[47]

Newsbrokers using different technologies flourished as well, long before the arrival of the electric telegraph. An early example was the news service of the *Gazette de Leyde*, a paper published in French from the Netherlands to an international subscriber base. By the mid-eighteenth century it relied on a network of paid, mostly part-time news writers in at least eight to ten cities, including Paris, London, Hamburg, Vienna, and St Petersburg. The newspaper of record of its time, the paper sought to give an impartial chronicle of events, relying almost exclusively on subscription revenue.[48] In France, from 1811 the agency Correspondence Garnier ran a daily news service from Paris, charging fifty francs a month. Its major customers were German newspapers.[49] Many "translation bureaus" translated news from several sources in different languages to one news overview in one target language.[50] In 1832, Charles-Louis Havas founded Bureau Havas, which was to become a major international news agency. Havas bought several existing news agencies, including Garnier. He used the French government's extensive optical telegraph network, and in 1840 he started a regular pigeon service between Paris, London, and Brussels. Eventually he began using the electric telegraph.

Newspapers also obtained news by exchanging copies with papers at other locations. Especially in the United States, this source of news took on enormous forms. The 1792 Post Office Act allowed the exchange of copies between newspapers free of postal charges, a deliberate act by Congress to kick-start a national news network. The average newspaper received an astounding 4,300 exchange copies a year.[51]

The Times of London was one of the few newspapers that operated its own news service. It had an international network of correspondents, and in 1837 it started a pigeon service to deliver stock market information from the continent. Julius Reuter supplied *The Times*' competitors, the number of which had boomed after the abolition of the newspaper duty in the 1850s. These newspapers could not afford their own news service. Eventually *The Times* itself became a Reuters customer. Reuters charged 2s6d for twenty words if its name was acknowledged, and 5s if it was not.[52] This underlined the importance of reputation in the news business, as customers often could not verify and check the news they received in a timely way.

The news agencies combined various technologies to gather and distribute news. In the United States, for example, two New York business newspapers, the *Journal of Commerce* and the *Courier and Enquirer*, each ran a pony express between Washington and New York City to get the political news first, and several private horse expresses were running between New York and New Orleans.[53] During the 1830s,

East Coast news services approached incoming vessels in fast "news boats," to get the news from Europe before the ships reached the harbor. The news boats released pigeons to fly the news ashore. The value of having the news first is clear from the premium newspapers were willing to pay. The *New York Herald*, for example, offered five hundred dollars for every hour it received European news in advance of its competitors.[54] To save costs newspapers eventually pooled their news gathering into agencies. In 1846, several New York City newspapers formed a partnership that became known as the Associated Press.[55] European firms used similar methods. Reuters, for example, was the first to report the news of Lincoln's assassination in London in 1865, twelve days after the event, as one of its boats intercepted the mail boat off the Irish coast and telegraphed the news to London.

The pigeon system used by the news agencies was probably one of the oldest alternatives to optical communications. In about 2000 B.C., the Sumer civilization in what is now southern Iraq, discovered that pigeons unerringly returned to their nest and started using them to send messages and breeding them further for postal aptitude. In the twelfth century B.C., Egyptians used pigeons for military communications, and in the seventh century A.D., the Muslim Empire ran a regular airmail system through postal pigeons, the postmasters acting as the eyes and ears of the government. The thirteenth-century Sultanates further perfected this system. Royal pigeons had a distinguishing mark, and the breeding of postal pigeons had become an industry in itself, with well-trained pairs fetching as much as 1,000 gold pieces.[56] In Napoleonic times, Baron von Rothschild reportedly gained a legendary advantage when he received advance knowledge of Wellington's victory at Waterloo by carrier pigeon, which enabled him to adjust his investment portfolio.[57]

Julius Reuter started his business with a pigeon service between Aachen and Brussels, and added pigeon services from several other European cities. After market closure, stock market information was put on lightweight paper, rolled up in a small cylinder, and attached to a pigeon. Three pigeons were sent off each time with identical information, to improve reliability. The route Aachen–Brussels was strategic as it connected two electric telegraph hubs and Berlin to Paris. Reuters initially served many business customers, including local merchants and bankers in Aachen.[58] When the telegraph line Aachen–Brussels was completed, Reuters moved to London, initially mainly serving merchants, grain traders, bankers, brokers, and the London Stock Exchange.[59] In the United States, Daniel C. Craig ran a similar business, using a combination of pigeons and express couriers to be the first to get news from European steamers in Halifax to New York City, first selling his information to speculators, and after that to newspapers.[60]

The electric telegraph, commercially introduced by William F. Cooke and Charles Wheatstone in Britain in 1839, and by Samuel Morse in the United States in 1844, became widely adopted globally from about 1850.[61] Beforehand, it was extremely costly to get information to arrive faster than carriages, ships, or trains.[62] Regular, cheap, reliable, and fast telegraphic information transmission lowered the costs of financial transactions and changed business practices such as inventory management.[63] Morse himself thought merchants engaging in long-distance trade would be the main users of the electric telegraph.[64] Yet the telegraph also enabled the emerging railway systems to use largely single tracks. Given the high cost of double-tracking, the latter use of the telegraph alone had saved the U.S. economy an accumulated $1 billion by 1890, or 6.6 percent of the gross domestic product, perhaps 1.3 percent of total U.S. capital stock.[65]

The electric telegraph also changed the news agency business.[66] News could now be reported in installments, as events unfolded, increasing the quantity of news messages. The low marginal distribution costs integrated previously isolated markets for news. Many smaller news agencies were put out of business or taken over, and in most countries a few large organizations emerged. The international news trade came to be dominated by a handful of agencies.

THE EMERGING BUSINESS MODEL OF NEWS AGENCIES

As these news agencies developed, they devised new ways of organizing and transacting that made the gathering and distribution of news profitable. The major challenge they faced was being able to trade information for money. According to the "fundamental paradox in the determination of demand for information," put forward by the economist and Nobel laureate Kenneth J. Arrow, buyers cannot assess how much they would want to pay for information without knowing its content, but once they know its content, they do not need to pay anymore: "its value for the purchaser is not known until he has the information, but then he has in effect acquired it without cost."[67] This made selling news piece by piece rather problematic.

The diplomats and merchants of the Renaissance, who noted the latest news at the bottom of their letters, and later the exchanging newspapers in the United States and elsewhere used reciprocity as a mechanism to make the marginal price of the news zero, even though the marginal cost to the news supplier might have been higher than zero.[68]

The early modern newsbrokers suffered less from Arrow's paradox when they supplied trade information that consisted of the numerical value of a measurable property of an economic quality. Six main categories of values were traded (Table 1.1). First, a price was a measurable property of the economic quality "scarcity" and was abundantly traded in letters and through price currents. Imported and exported quantities at specific ports, as tabulated in bills of entry, formed another measurable property of scarcity.[69] Second, exchange rates formed a measurable property of the general terms of trade between two areas. A third important category, which was more often dealt with in private correspondence and internal news services, such as that of the Fuggers, was the reputation of clients or trading partners.[70] The quality "reputation" had the measurable property "credit rating," which in theory could be "creditworthy" or "not creditworthy," or some steps on an ordinal scale in between. Money could be asked by simply mentioning the quality (reputation or creditworthiness) and supplying qualitative information from which the buyer could distill a judgment, or, as would happen during the nineteenth century, a numerical value itself (the credit rating) could be sold.[71] Morse would later mention inquiries about creditworthiness as an important potential application of the telegraph.[72]

A fourth category was formed by ship arrivals in harbors, such as that supplied in *Lloyd's List*, a measurable property of the quality "existence of a ship," which was useful for insurers, large trading companies, and navies.[73] Later, share prices and interest rates would become two important new categories, measurable properties of the scarcity of a firm's total (tangible and intangible) assets and of the scarcity of the future, respectively. For each of these six economic qualities, the seller could advertise its measurable property, and only reveal its numerical value after being paid, thus resolving Arrow's paradox. It was still impossible to ask premiums for unexpected changes in numerical values, such as price implosions, exchange rate collapses, or the loss of an entire merchant convoy, such as the capture of the Spanish silver fleet by the Dutch Republic.[74]

Business news could be sold because the seller could inform the buyer what particular economic quality the information would be about, and what measurable property of it was contained in it, without revealing the actual numerical value. In theory, general news also could be sold in this way, but by saying that one had information about a political upheaval in Spain or about events affecting future grain prices one already had revealed important information: that something had happened in Spain, that it was political, and that it was important, or that something had happened that would affect grain prices. Yet one had not revealed enough about the information's reliability and detailed content for the buyer to establish what he was willing to pay.

Table 1.1. Measurable Properties of Economic, Political, and Social Qualities

Quality	Measurable Property	Typical Range of Numerical Values	Typical Sources
Scarcity	Price	<0, → >	Price currents
	Quantity	[0, → >	Imports/exports (Bills of entry)
Terms of trade	Exchange rate	<0, → >	Price currents
Reputation	Credit rating	{0, 1}	Letters, report credit agencies
Existence of a ship	Arrival in a harbour	{0, 1, Ø}	*Lloyd's List*
Scarcity of the future	Interest rate	<0, → >	Price currents
Scarcity of a firm's total assets	Share price	<0, → >	Price currents; newspapers
Change of Executive and/or Legislative	Outcome of the election; Detailed election results	{0, 1}; [0, N]	Newswires/ newspapers
Performance of armies in known military battle	Outcome of the battle; Losses/casualties	{0, 1}; [0, → >	Newswires/ newspapers
Contestants' performance in sports match	Sports match outcome; Contestants' score	{0, 1} ; [0, → >	Newswires/ newspapers
Prevailing opinion in a population	Responses to survey	[0, 100]	Newswires/ newspapers

Note. numerical values are expressed in standard mathematical domain ranges, where, for example, a square bracket includes a value; whereas a diagonal bracket excludes it. For example, <0, → > implies that the numerical values are above zero, {0, 1} that a battle has been lost (0) or won (1) and {0, 1, Ø} implies that a ship can be listed as arrived (1), is not listed (Ø), or can be listed as lost (0). [0, n] refers to a definite range, where n depends on the size of the respective legislature.

Source. See section "Evolution of the industry" of this chapter and its sources.

Some general news did have measurable properties that could be specified in advance without revealing their numerical value. The main such categories were election results, sports results and, to a lesser extent, the outcome of known military battles (Table 1.1). Contrary to the economic categories, these three categories involved irreversible win-or-lose outcomes, although the intermediate election results, losses, or match scores could be reported in installments. As a rule of thumb, any information on which one could place a definite bet, and for which thus in theory a futures market was possible, was at least partially tradable and suffered less from Arrow's paradox: The buyer knew on which economic quality information was needed and the number of measurable properties was a closed set, usually containing just a single property, with each property having a defined range (Table 1.1). Other news was largely unexpected in quality, almost by its nature, as that was its main selling point. The emergence of opinion polls can probably be explained by the desire of polling firms to first create measurable properties to some news events and then sell their numerical values. Polls also resulted in more frequent installment reporting for events such as elections, as each poll could be read as an intermediate election result.

In the course of the nineteenth century, the emerging international news agencies introduced their own two "solutions" to Arrow's paradox. First, they used subscriptions, by which customers paid an advance fee for all the news reports. The price was based on the agency's past reputation in delivering reports and the guarantee that the subscriber received all the news the agency gathered, and often also was based on the subscriber's ability to pay, such as circulation, or estimated profitability. In the United States, for example, newspapers generally paid according to a complex formula, and in Britain provincial newspapers paid far lower fees than the London papers.[75] When subscribers had to decide whether it was worth renewing, they only had to think of the value of the few news items that had made a difference in their business, and these items probably differed from subscriber to subscriber. The subscription system made the marginal price of a news item to the customer equal to zero, and thus solved Arrow's paradox.[76]

Second, agencies bundled news in packages containing boring and exciting, relevant and irrelevant news that could differ from customer to customer. This admixture was mainly a characteristic of subscriptions, but sometimes also was achieved in other ways. A specific historical circumstance that allowed bundling, for example, was the arrival of scheduled mail steamers, such as those from Europe in the United States. Entrepreneurs such as Daniel Craig sold the news arriving from Europe first to New York merchants and then to the newspapers.[77] Knowing that they would be first to have the latest European information was enough for buyers to pay. The content did not have to be revealed before pay-

ment was agreed. Also, part of this news consisted of the numerical values of measurable properties of economic qualities that merchants knew they could use whatever its content would turn out to be. Expected new developments of existing stories probably formed a somewhat similar category. Undoubtedly, entirely unexpected news was the most valuable, but could not be sold separately. With the laying of permanent transatlantic cables in the 1860s, European news started to come in piecemeal in small, continuously arriving chunks. The opportunity to sell prime European news in a bundle disappeared.[78] A similar case of "natural" packaging was Reuter's exclusive first-use contract with Austrian Lloyd's for news and market information arriving at Trieste by ship from the East, starting in 1852.[79]

A third, regulatory, solution to Arrow's paradox was the use of copyright to protect news. Reuters campaigned for a copyright in news throughout the British empire, but only found success in South Africa, while the Associated Press lobbied for news copyright in the United States, obtaining a quasi-property right in news in 1918.[80] The degree to which copyright laws could create and protect intellectual property rights in news differed from country to country. A detailed study on copyright in news telegrams in Australia between 1869 and 1912, for example, shows that the balance between the interest in strong property rights and that in the free flow of news weighed more heavily toward the former in Australia and toward the latter in Britain. An important reason for this was that laws in several British colonies specifically protected copyrights in news telegrams.[81] In the United States, courts did not find quasi-property rights in "hot" news before the 1910s and copyright does not appear to have been a major issue before this time.

Fourth, ancillary services or revenue streams that exploited the news agencies' assets, brand name, or reputation could be used to "cross-subsidize" the supply of news. Havas and Reuters, for example, introduced advertising services, whereas Wolff-Continental received financial support from the German government.[82] In the 1890s, Reuters even started to offer a range of business and financial services, such as private telegrams, wire remittances, and eventually a bank.[83] Although meant to cushion fluctuations in news revenue, the bank eventually brought Reuters to the brink of bankruptcy.[84]

Arrow's fundamental paradox also might explain why recipients of postal letters and telegrams often did not pay a price for receiving each individual item. They would only want to pay if they would know what or from whom the message was and if they did know, they often would not need to pay anymore; thus the marginal price of receiving was often, but not always, set at zero.[85]

In addition to the fundamental paradox, the news agencies faced a second, and related challenge—news was a quasi-public good. It was

nondiminishable (nonrivalrous) but excludable. One person getting acquainted with certain news did not diminish the quantity of it available to others. Only the medium was diminishable, but news could spread through many different media.[86] Yet news was not entirely nonexcludable. News gatherers could keep news secret or use distribution technology to vary the time at which various customers obtained access to news. For example, news on a planned merger might be confined to the negotiators, the public being excluded until an announcement was made.[87]

The quasi-public good posed two major business challenges to news agencies, one related to nonexcludability the other to nondiminishability. The nonexcludability problem implied that in theory, a subscriber could resell or share the news with other organizations. Also, nonsubscribers to news agencies could simply take the news from subscribers' newspapers. Several solutions existed. First, contracts could prohibit such redistribution. Second, news could be sold in bulk to associations of customers such as newspapers. A third solution was that, after some time, news would become old and lose its value, and timeliness was thus a news agency's essential selling point. Fourth, on an international level, agencies could make exclusive agreements for entire territories, leaving the contract partner to organize exclusion at the national level. The agencies achieved this by first agreeing on an international cartel, and then making long-term contracts with national monopolies within each agency's exclusive area.

From the 1850s to the 1930s, Reuters, Havas, and Wolff-Continental, with the acquiescence from the New York Associated Press (NYAP) and later the Associated Press as well as several smaller players, operated an international cartel, in which they divided the world into areas where each had exclusivity for news gathering.[88] These areas generally coincided with colonial and cultural spheres of influence, with competition sometimes maintained in areas that did not fall clearly within such a sphere.[89] The agencies saved substantial costs by obtaining the news from each other in these areas rather than building a duplicate organization. The first agreement dated from 1856 and concerned the exchange of stock market and other business data between Havas and Reuters.[90] Often the international agencies had exchange agreements with national counterparts, which made them the sole supplier of news to and from an area. An example of the difficulty of maintaining such arrangements is the history of contracts between Reuters and the Australian newspapers. The "ideal," from Reuters' perspective, was for Australian newspapers to form their own cooperative news-gathering organization that would have a virtual monopoly on news collection for overseas sale. Such an organization would make an exclusive agreement with Reuters, in which it would only sell its news to Reuters, and Reuters would buy Australian

news exclusively from this cooperative. In practice, rivalries within the Australian press made it difficult to maintain this level of cooperation despite the potential cost savings and increased revenue involved.[91]

Although the nonexcludability problem was mainly related to customers, the nondiminishability problem involved competitors. News had high fixed and sunk costs and low marginal costs meaning that the latter kept decreasing continuously, even if a firm's output equaled the entire market demand. In a competitive situation where prices equaled marginal costs, prices would be zero and either no firm would enter and build a news organization, or already existing organizations would go bankrupt, never to recoup their sunk costs. News agencies had considerable fixed costs, including local offices and correspondents, leases of lines. and head office costs.[92] For the Western Associated Press, the cost of telegraph transmission, paid to Western Union, was about 60 percent of all costs in the 1870s and early 1880s, after that shooting up to 70 percent and more.[93] For its successor, the Associated Press, the costs of leasing or using telegraph lines fluctuated between 48 and 68 percent of all costs between 1893 and 1913, the cost being firmly above 60 percent from 1906 onward (Fig. 1.1).

The solution to the nondiminishability problem was twofold. First, there was a market solution because first mover effects existed. The marginal costs of news distribution were so low that adding a subscriber cost hardly anything. An increase in subscribers thus reduced average costs indefinitely, as fixed costs were spread over more subscribers. Once an agency had built a reputable news service and a large subscriber base, it could deter any new entrant by pricing at marginal cost because it had already incurred its sunk outlays, whereas the entrant could still decide not to sink money.[94] This explained why, after the telegraph, relatively few news agencies dominated national and international markets.

A second solution was organizational. Given that the initial large news agencies already existed, already had incurred their sunk costs, and would not exit the market any more, they learned to live with each other and formed a cartel, preventing competition that would bring prices down to marginal costs in each agency's territory.[95] The cartel limited competition between the four and made new entry difficult, because a new entrant needed a global organization from Day 1, since no existing news agency would be willing to offer a contract for part of the world: The big four internationals had bound themselves in a cartel, and national news organizations generally had exclusive contracts with one of the cartel partners.[96] The global news cartel and its exclusive contracts with national counterparts thus mitigated both the excludability and the nondiminishability problem.

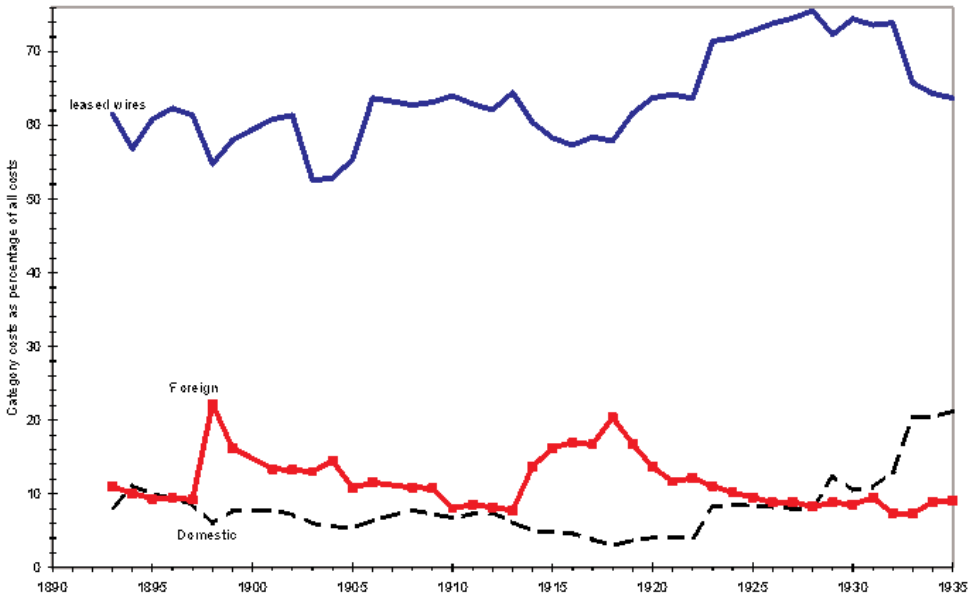

FIG. 1.1. Total costs and disaggregated costs of the Associated Press, 1893–1940.
Note. Leased wire service, the costs related to the distribution of the news report: "operator and messenger salaries, extra operator service, rental of wires, telegraph tolls, auxiliary services, manifold supplies, typewriter exchanges and repairs, and incidentals."
Foreign, foreign news service: "European offices, correspondents, foreign news contracts, and cable tolls (the foreign news-gathering operation)."
Domestic, "Incoming News Service: local agencies, outside correspondents, telegraph tolls, miscellaneous messages, markets, and shipping (the domestic news-gathering operation)."
Source: Schwarzlose, *American Wire Services*, pp. 390–392.

Although here we focus on international exclusion through collusion, at the national level exclusion was sometimes also important. In the United States, for example, the NYAP had exclusive members at the local level that could deny access to other members, allowing NYAP members to capture monopoly revenues. In 1880, for example, it served only 355 of the 971 U.S. daily newspapers.[97] It also required members to supply their news exclusively to the pool and had an advantageous agreement with the major U.S. telegraph company Western Union giving it preferential access and low rates.[98] In Britain, on the contrary, the Press Association, which consisted of mainly provincial newspapers, and had a contract with Reuters, let every newspaper in.[99]

Although marginal news distribution costs were extremely low, the marginal costs of news gathering were not minimal. Correspondents, reporters, and stringers were largely fixed costs, because often, depending on their contract, they needed to be paid whether there were many potential news events or not. On the other hand, eventful years with large quantities of potential news events could increase costs substantially, as more reporters and correspondents would be hired and sent away, and more telegraph line capacity needed to be rented. Reuters used to say that the boring years paid for the exciting years, because in exciting years costs would be higher while the subscriber base would not significantly change. In the British market, Reuters eventually mitigated this problem by levying a 50 percent war surcharge on London newspapers' subscription fee, from 1885. The charge would last from one month after outbreak of war to one month after cessation of hostilities.[100] Yet this was not enough to solve the problem. In 1918, for example, Reuters' profit margin was just 2.1 percent, about one third of what it had been in 1908.[101] The Associated Press' profit margin appears to have been lower most times and was probably not that dissimilar to the margins of its predecessor, the Western Associated Press, between 1867 and 1890 (Fig. 1.2). As both American organizations were cooperatives, low dues for members-cum-customers rather than profit maximization was the objective. Nevertheless, profit margins gave some indication of the viability of the business. The cost of the Associated Press' foreign service shot up in 1898, during the Spanish-American War from 9 percent of all expenditure to 22 percent, reflecting a tripling of the dollar amount spent on foreign news. It happened again at the outbreak of World War I, when foreign service expenditure increased from 8 percent in 1913 to 14 percent in 1914, 16 percent in 1915, reaching 20 percent in 1918, the latter being more than double the 1913 dollar amount in real terms (Fig. 1.1). At the same time, real revenue decreased during the war, with 20 percent in total between 1914 and 1918, and most of it—16 percent—when the United States entered the war (Fig. 1.3).

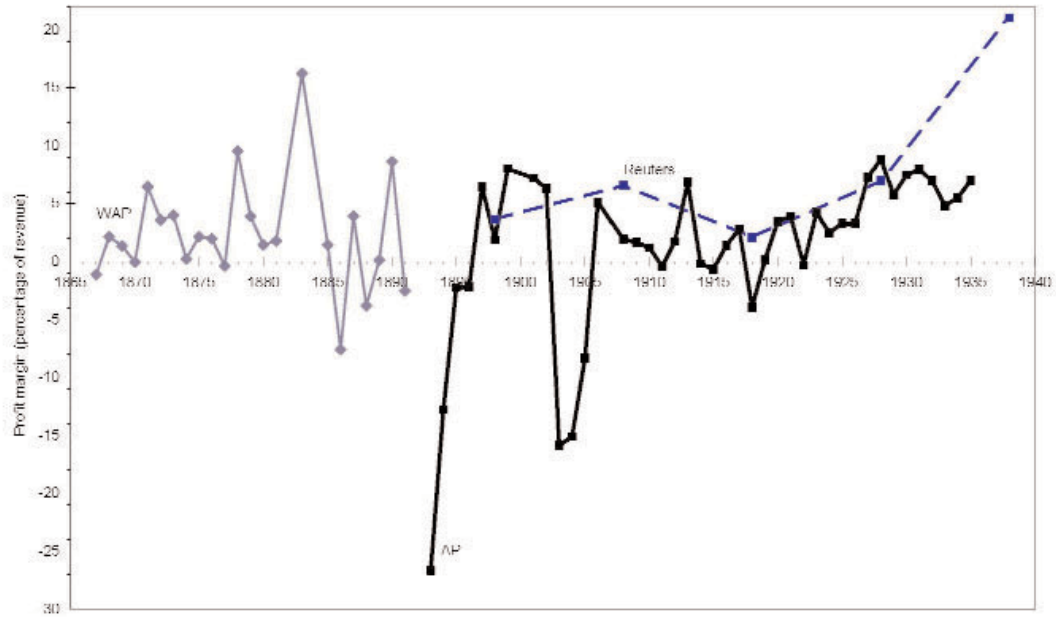

FIG. 1.2. Profit margins of the Western Associated Press, the Associated Press, and Reuters, 1867–1938.
Note. For Reuters, only four benchmark years have been used: 1898, 1908, 1918, and 1938.
Source. Read, Reuters, pp .83, 153; Schwarzlose, *American Wire Services,* pp. 251, 388–389

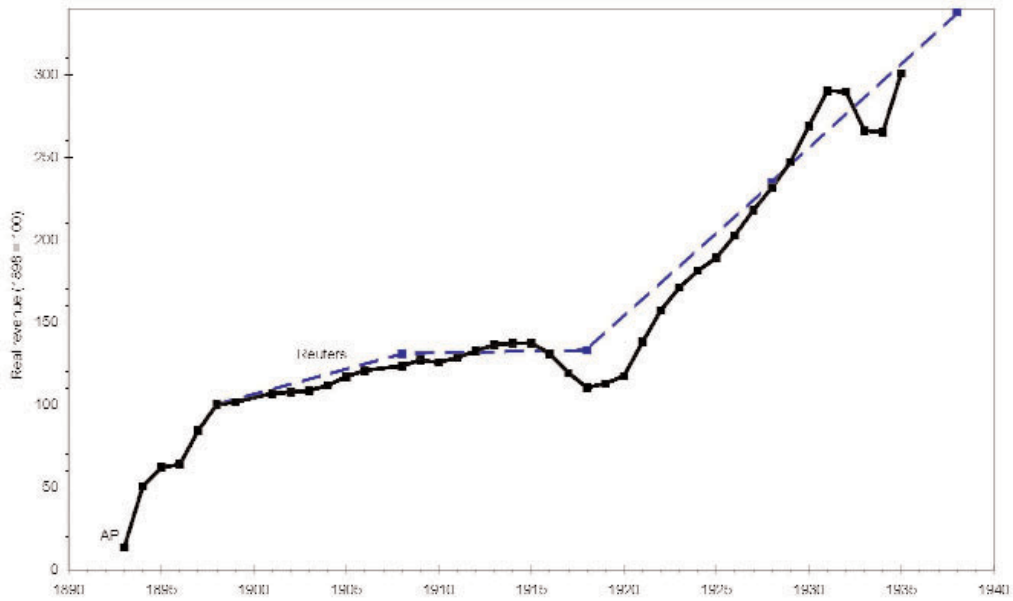

FIG. 1.3. Real revenue growth of Reuters and of the Associated Press, 1893–1940; 1898 = 100.
Note. For Reuters, only four benchmark years have been used: 1898, 1908, 1918, and 1938. Between 1898 and 1918, the Associated Press's revenue was about three times that of Reuters, at exchange rates. Between 1928 and 1938 this had increased to about four to five times that of Reuters. The values at exchange rates differ from growth indexed at 1898=100 mainly because of different national inflation rates.
Source. Read, Reuters; Schwarzlose, *American Wire Services*.

Increasing expenditure on news gathering would not necessarily lead to larger revenues. In the long run it may have added a few subscribers, but once large agencies such as Reuters had subscribed nearly all potential customers, marginal expenditures on news gathering hardly resulted in marginal revenues. First of all, the agencies did not own the papers, so profits from increased circulation because of better news gathering went largely to newspapers. Yet, in the long run, independently owned agencies could extract part of these increased rents by increasing subscription fees, such as Reuters's war surcharge, whereas news cooperatives such as the Associated Press, where newspapers owned the news agency, internalized this incentive problem.[102] It might not be a coincidence that the Associated Press had a lower profit margin than Reuters because it had a bigger incentive to spend more on increasing quality: The Associated Press's owners also were its customers and thus would capture more of the increased marginal revenues driven by the increased quality than Reuters could.[103] The latter's merger with the Press Association may have been a logical step to align the incentives.[104]

Second, increased expenditure on news gathering did not generally lead to more potential news events happening, especially the "hard" events such as murders or wars.[105] At the same time, more potential news events happening, especially the hard events, did lead to more expenditure.[106] Increased expenditure could only increase quality by transforming more of the lesser potential news events into news and by boosting variety through the offering of more human interest reports or by adding new news categories, such as sports, arts, or science. Reuters, for example, set up a supplementary foreign service in 1890 that focused more on human interest, features, and background stories to supplement the hard news. It was jointly funded by Reuters and the Press Association, the latter sharing in the costs and thus reducing Reuter's profit fluctuations.[107]

THE INDUSTRIALIZATION OF INFORMATION TRANSMISSION

The nondiminishability problem was amplified by the enormous productivity growth of communication networks, resulting in ever lower costs. Technological change that made this price decline possible was largely determined by increasing demand for news and communication, not primarily by a new technology that was invented out of the blue.[108] Yet newsbrokers could only service this growing demand if they found ways to remedy the market failure expressed by Arrow's paradox. Each busi-

ness model that mitigated Arrow's paradox, even by a small step, allowed them to tap into a large additional demand.

Several long-run factors caused an increase in the demand for information. These included rising literacy and education levels, urbanization that concentrated demand spatially, a gradual liberalization of news provision, the widening nonsimultaneity of trade exchange, growing and speedier international trade and market integration and, finally, the proliferation of large organizations spanning vast territories such as the trading companies, the emerging nation-states, colonial empires, railways, and multinational enterprises.[109] A basic want for information existed that could be fulfilled by various technologies, each with slightly different characteristics, but always providing an (imperfect) alternative.[110] Characteristics of the basic demand for news included speed, novelty, relevance, reliability, verifiability, price, exclusivity, format, and complementarity with information the recipient already had. Each information transmission technology addressed these needs in a slightly different way. Alternatives always existed. It was not the case that demand for news only emerged when new technologies such as the electric telegraph were introduced. A large demand for business information existed prior to the telegraph's commercialization.[111]

Two additional factors made the role of demand in the development of news provision especially important. First, news itself being a nondiminishable good, a substantial part of costs of news gathering were fixed and independent of the number of subscribers, meaning that a surge in demand would immediately reduce the average costs (per subscriber) of news provision and—if translated into lower prices—further increase demand.[112] Second, it was not unlikely that news consumption endogenously shifted the demand curve outward, for two reasons. First, as merchants received more and better information they could engage in more nonsimultaneous trade, and the increased trade in its turn generated demand for even more information.[113] Second, as recipients received a certain news item, they might be willing to pay more for additional news that would complement this initial information. In other words, in some instances news was its own complement, starting a snowball effect in which the demand curve for information kept ever shifting outward.[114]

For example, once the transatlantic cable made U.S. grain prices available in London in real time, London traders probably wanted to have far more other time-sensitive information on the United States, especially information that might potentially affect grain prices, so that they could make their own assessment on future price movements. If, for example, tax increases were being discussed in Congress, this information would be used by London merchants in their assessment of future prices.

The growth of daily newspapers in the United States started before inventions such as the optical and the electric telegraph, suggesting an

increasing appetite for news was more of a factor in the commercial application of these technologies than vice versa (Fig. 1.4).[115] The emergence and the highest growth took place between 1783 and 1800, shortly before and after the enactment of the Post Office Act of 1792, which facilitated the circulation of newspapers.[116] From 1810 onward, the growth in the number of daily newspapers increased steadily. It accelerated further after 1830, well before the introduction of the electric telegraph. Competition for news scoops between New York dailies and the emerging penny press, depending on fickle single-issue sales in stages throughout the day and weekly subscriptions, increased the demand for timely news and the premiums that were paid for it.[117]

The growth of newspapers was facilitated by sympathetic postal tariffs and the general fall in postal rates. For single letters for distances greater than five-hundred miles they fell from 25 cents in 1774 to 3 cents in 1855, and for distances less than thirty miles they halved from 6 cents in 1792 to 3 cents in 1855, reflecting real annual declines of 2.7 and 0.9 percent, respectively.[118]

The large effect on productivity from the industrialization of messaging also is apparent from the large fall in real telegram prices, because of the adoption of the electric telegraph and its subsequent technical improvement. Between 1866 and 1882, when many international telegraph lines came online, the average price per message decreased 17.4 percent annually in real terms.[119] The real price of transatlantic telegrams also declined substantially, from $258 dollars (in 2009 dollars) per word in 1858, to $5.59 per word in 1888, which amounts to a 12.3 percent average decrease per annum.[120] The real cost of a ten-word telegraph message inside the United States also declined substantially, from $42 (in 2009 dollars) in 1850 to $9.50 by 1890, an average annual decrease of 7.2 percent.[121]

The real price of a three-minute telephone call from New York City to Chicago declined from $136 constant (in 2009 dollars) in 1902 to $57 in 1919, $13 in 1950 and just $6 in 1970, an average annual price decline of 3.4 percent between 1902 and 1970.[122] Despite the rise of telephone, the number of telegraph messages kept growing continuously between 1870 and 1930, from about 10 to 221 million, and reached an all-time peak of 236 million in 1945.[123] By 1970, still 70 million telegrams were still sent annually, seven times as many as a century earlier.[124] Nowadays, e-mail has made the price per written message about two orders of magnitude lower than in the early 1970s.[125]

In the United States, the network increased 250 times in size, whereas the number of messages per mile of wire halved from 147 in 1848 to 69 by 1890.[126] As innovation made costs decrease, it became increasingly possible to add marginal lines to existing networks, as the additional revenue would still make it profitable.

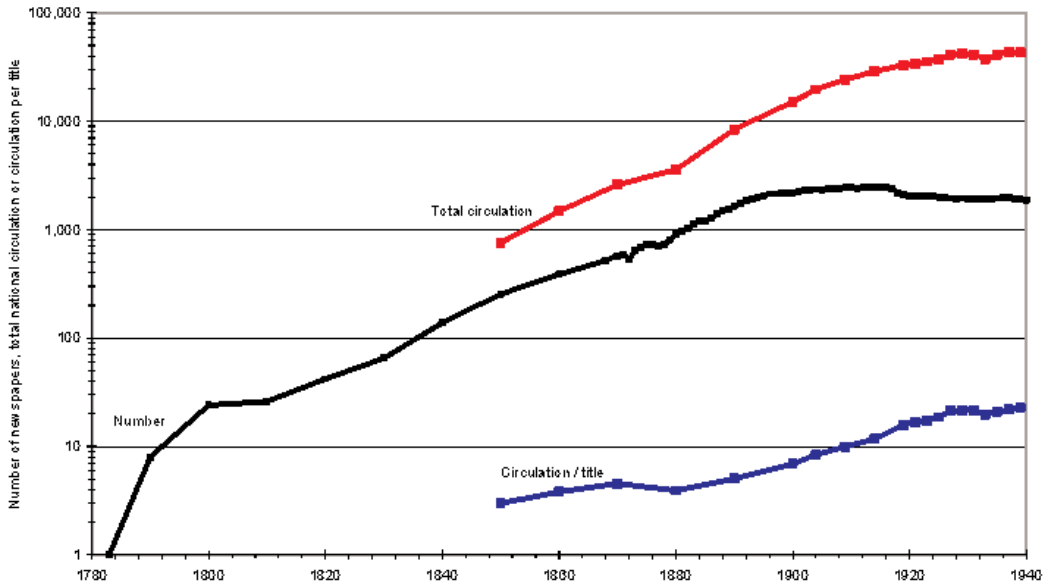

FIG. 1.4. The number of daily newspapers in the United States, 1783–1940: semi-logarithmic scale.

Note. Circulation and circulation/title are in thousands. On a semi-logarithmic scale, the slope of a line reflects the growth rate. The steeper a line, the higher the rate.

Source. Schwarzlose, *American Wire Services*, p. 393; Susan B. Carter et al. eds., *Historical Statistics of the United States: Earliest Times to the Present* (Cambridge: Cambridge University Press, 2006), table Dg253–266.

One characteristic of the telegraph stood out: It sharply reduced variability of delivery times. First, news consumption was closer in time to the news production, and the difference became more uniform and standardized: Generally, it depended on the telegraph transmission time.[127] Second, the moment when most consumers would consume the news became more synchronized. Before the telegraph, news production was unified in time, whereas news reception was highly dispersed over time, depending on customers' geographic position and transmission times. The telegraph made news consumption more equal in time: Consumers in a country would consume important news at approximately the same moment, and—most important for business news—they would know that others would be aware of the news at the same time (or earlier).[128] Before the telegraph, they could roughly calculate and conjecture whether others already had the news.

This increase in uniformity can be quantified. In the United States, for example, in 1830, we can take travel times as a good approximation of how fast messages could reach other areas. Twelve different zones existed that all would receive news at intervals varying from one day to six weeks (Table 1.2). The average time to receive news from New York was as much as fourteen days, while variation was enormous, with the coefficient of variation approaching 1.[129] Absent the telegraph, message transmission times would not have remained static. Therefore, we decompose the 1830–1857 speed gain into two components. First, we calculate the communication speed increase brought about by traditional technologies such as improving transport networks and advances in the administrative coordination of the circulation of information by the Post Office Department.[130] Second, we compare the 1830 transmission times to the speed jump brought about by the telegraph.[131]

The first scenario shows that, because of improving transport, by 1857, the number of reception zones had halved, and reception times varied from one day to one week, the average being three and a half days—only one fourth of what it had been before.[132] The coefficient of variation had halved as well. The second scenario shows an even sharper increase in uniformity, with the reception zones all merging into one zone, the coefficient of variation approaching zero, and the mean only being six hours, the latter being an upper-bound estimate (Table 1.2).[133] It may be misleading to compare the telegraph directly to 1830 messaging times, but subtracting the reductions in transmission times achieved by transport improvements, it is possible to estimate the net contribution of the telegraph in the increase in uniformity of news reception and consumption. This contribution amounted to a decrease in the number of time zones with 6 percent per year, and in average transmission times with 9 percent per year.[134]

Advances in telegraph transmission technologies increased uniformity even further. In the 1860s, Western Union could send news reports with one writing to many different stations, mostly during the night. One writing, for example, reached the entire press along the route from New York via Albany and Buffalo to Cleveland and thence to Chicago, St. Louis, Louisville, Cincinnati, and finally Pittsburgh.[135]

Increasing speed and uniformity of news reception reduced the response times to news events, resulting in more interactions within a given time interval, and thus the likelihood of more news happening in such an interval, which in its turn probably increased the demand for news even further.

The new technologies of the twentieth century, such as radio and television, would increase the uniformity in time even more, as the last leg of the news distribution process—from telegraph line into newspaper into newsstand—which still resulted in variable times at which consumers consumed the news, was also made uniform.

It was the decrease in information costs and the increasing communication speed that stood at the roots of increased market integration, rather than falling transport costs by itself. In order to send goods to another area, merchants needed to know first whether in fact to send off the goods and to what place. Information costs and speed were essential for these decisions.[136] Receiving information first was so valuable that some speculators were willing to cut the telegraph wire after they had sent the news through.[137] When information reception became more uniform, the opportunities to profit from this kind of arbitrage declined and markets became more integrated. The telegraph brought about a sharp decline in price disparities and intermarket arbitrage.[138] The telegraph's role as the great equalizer, delivering information almost simultaneously to all businesses in a country mitigated Arrow's paradox by assuring buyers that the information was the newest, so providing a guarantee against arbitrage by earlier informed entrepreneurs.

Even if transport costs and times had not changed, an increase in the information flow would have fostered market integration. Likewise, before the nineteenth century falling transport costs and times by necessity also constituted falling information transmission costs and time. The latter could have dominated the former, but have not been properly observed by scholars because they were inseparable from transport costs.

This dominance of information over transport costs also is reflected in present-day studies that show a substantial effect of the use of mobile phones on market integration in remote areas. Robert Jensen, for example, examined the introduction of a mobile phone service in Kerala between 1997 and 2001. Kerala is a state in India with a large fishing industry.[139] He showed that the adoption of mobile phones by fishermen

Table 1.2. Transport and Telegraph Transmission Times from New York to U.S. regions, 1830 and 1857.

	Transport		Telegraph	Net contribution
	1830	1857	1857	Telegraph
Reception zone	days	days	days	Days
A	1	1	0.25	–0.75
B	2	2	0.25	–1.75
C	3	3	0.25	–2.75
D	4	4	0.25	–3.75
E	5	5	0.25	–4.75
F	6	6	0.25	–5.75
G	7	6	0.25	–5.75
H	14	6	0.25	–5.75
I	21	6	0.25	–5.75
J	28	6	0.25	–5.75
K	35	6	0.25	–5.75
L	42	6	0.25	–5.75
Time zones (no.)	12	6	1	–5.0
Standard deviation	13.5	1.7	0.0	–1.7
Mean	14	3.5	0.25	–3.3
Coefficient of variation	0.97	0.49	0.0	–0.5
Median	6.5	3.5	0.25	–3.3
		Index 1830=100		
Time zones (no.)	100	50	8	–42
Standard deviation	100	13	0	–13

Mean	100	25	2	–23
Coefficient of variation	100	50	0	–50
Median	100	54	4	–50
		Annual percentage decrease, 1830–1857		
Time zones (no.)	2.5	8.8	6.3	
Standard deviation	7.4			
Mean	5.0	13.9	8.8	
Coeff of variation	2.5			
Median	2.3	11.4	9.1	

Note: The coefficient of variation is the standard deviation over the mean
Source: calculated from Field 2004: 78-79.

and wholesalers led to a dramatic reduction in price dispersion, the complete elimination of waste, and near-perfect adherence to the Law of One Price. Both consumer and producer welfare increased substantially. Undoubtedly, similar welfare gains took place throughout the nineteenth century with each improvement of and addition to the communication network.

ORGANISATIONAL STRUCTURE OF THE INTERNATIONAL NEWS AGENCIES

Although each international news organization that emerged in the second half of the nineteenth century was to some extent unique, they shared several stylized characteristics. A head office coordinated the international gathering and selling of news. National offices sent news to the head office, which retransmitted it to all national offices or external buyers. National offices generally had a two-way function: They gathered local news that was internationally relevant and they sold international news that was locally relevant. Whether national offices were formally managed offices with employees or a single correspondent differed between organizations and between countries.

Sometimes, the international agencies also had agreements with national news organizations, in which the latter paid for the international news and were paid (far less) for national news they provided to the international agency. Reuters, for example, had an exclusive long-standing agreement with a cooperative formed by all Australian newspapers in 1895. Reuters would only sell to this cooperative, the cooperative would only buy international news from Reuters.[140] Such agreements reduced the minimum efficient size of the agencies' national offices.

Within the organizations, effective coordination was essential, as all news was time sensitive by definition. The newsgathering had a somewhat project-oriented nature, in that it was idiosyncratic and only partially predictable. Each news event constituted a project of its own. Nevertheless, many aspects of news gathering were institutionalized to deal with this. Separate tasks existed for reporters, copy editors, and editors; news bulletins came to have a specific structure and format in which the idiosyncratic news was to be reported. Synchronized deadlines structured and made uniform the time frame of news gathering and affected news creation itself when organizations started to take these deadlines into account when announcing news. An early example was the U.S. War Department that from October 1861 adjusted its news releases to the departure schedules of the fastest transatlantic steamers, so as to impact the shaping of policy in Europe.[141]

It may be no coincidence that the four main international agencies—Reuters, Havas, Wolff-Continental, and the Associated Press—all had their headquarters in a different, large country, and that they probably benefited from considerable informal protection and country-specific advantages that helped them enter and stay in the international news business.

In the course of the late nineteenth and early twentieth centuries, agencies providing national news became increasingly organized in cooperative structures in order to solve the quasi-public good problem.[142] In Canada, for example, newspapers had collective arrangements since 1903 and a formal news cooperative, the Canadian Press Agency, since 1917.[143] In Britain, the Press Association acquired Reuters in two transactions in 1925 and 1930. In the Netherlands, three news agencies that had provided most of the national news since the nineteenth century were acquired and merged into a cooperative news service, owned by the newspapers, in 1934.[144] In the Australian case, the fact that nearly all newspapers were member of the cooperative sharply decreased the chance that an organization would free ride on Reuters' news, and for the cooperative guaranteed that some sort of remuneration could be obtained from Reuters for their local news.[145]

Yet the precise organizational solutions varied considerably. Although the NYAP partnership, for example, aimed to be exclusive by barring some newspapers from membership and requiring its members to exclusively supply news to it, the British Press Association was more like a loose federation of which any newspaper could become a member. The ownership structure of transmission infrastructure could affect this result to some extent.[146]

Reuters seems to have fared well under the cartel. Revenues reached about 200,000 pounds sterling at the turn of the century, and more than half a million pounds on the eve of World War II.[147] The profit margin fluctuated between 2 and 7 percent, and exceptionally reached higher than 20 percent in 1938 (Fig. 1.2).[148] In several years this was more than the Associated Press's profit margin, which was not surprising, given that the latter was a cooperative.[149] Reuters' geographical distribution of revenues changed substantially at the start of the twentieth century. Britain and Europe declined in importance, whereas more revenues came from India, the Far East, and the rest of the world (Fig. 1.5). Reuters found it difficult to operate in the British news market. It noted wryly that its annual revenue from British provincial newspapers, through the Press Association, equaled its South African profits.[150] Revenues from the United States were limited, possibly because here Reuters was competing with its cartel partners Havas and Wolff-Continental as well as the Associated Press. U.S. antitrust legislation in the form of the Sherman and Clayton acts, fostering rivalry and making collusion difficult, further reduced Reuters' U.S. revenue potential.[151]

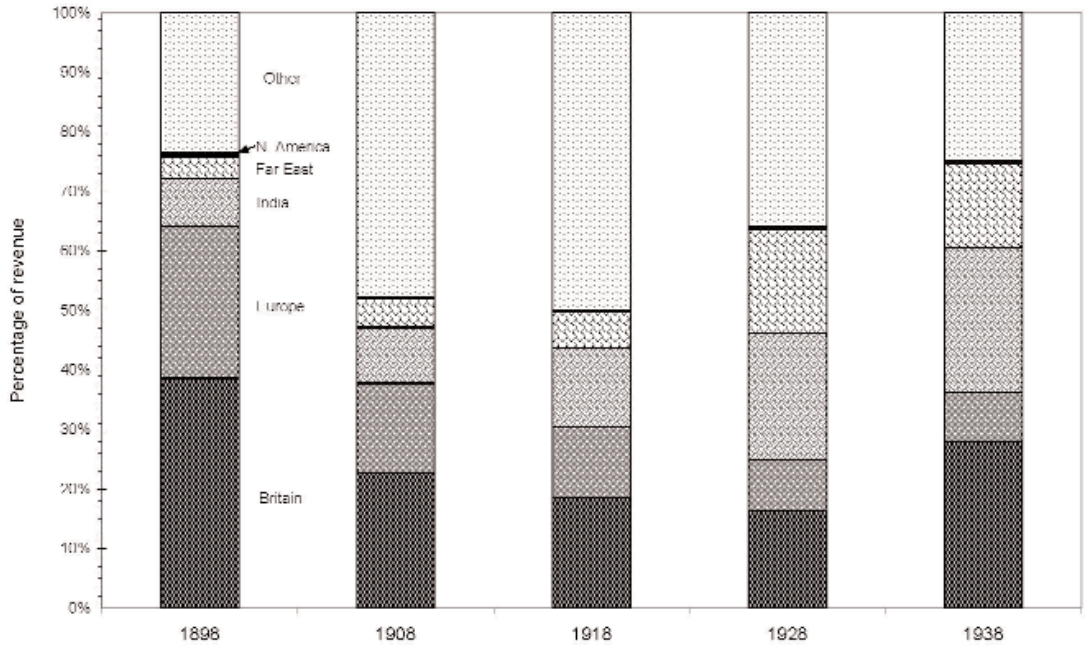

FIG. 1.5. Reuters' revenue by territory, in percentage of revenue, 1898–1938.
Source. Read, Reuters, pp. 83, 153

CONCLUSION

Since the Renaissance, increasing literacy, urbanization, liberalization, market integration, and the proliferation of organizations spanning large territories stimulated the demand for information. Because news-gathering costs were largely fixed, average costs decreased with the size of the market, potentially lowering prices that then further expanded demand that further lowered prices. Because news formed its own complement, growing news consumption further increased news demand endogenously. Because rising speed reduced response times to news events, news events per time interval increased, stimulating both supply and demand.

This rapid market expansion first triggered process innovations in transmission technologies such as pigeons, optical signaling, and national postal systems, the latter speeding up information flows through organizational capabilities rather than through novel technological contrivances per se.[152] When these innovations reached decreasing returns, product innovations were adopted, such as the electric telegraph or city messaging through pneumatic tubes.[153] Likewise, the organizations that came to dominate the national and international news trade emerged not primarily as a consequence of new technology, but because of the rising demand for information that also drove infrastructure development.

To transform demand into consumption, and therefore profits, newsbrokers needed to solve the market failure expressed by Arrow's fundamental paradox, the problem that buyers did not want to pay until they knew what the news was, and then they did not need to pay anymore. Merchants and diplomats in the Renaissance got around it by reciprocally adding information at the bottom of letters, as a gift. Later, businessmen were willing to pay for information that could be described but not revealed ex-ante, consisting of the numerical values of the measurable properties of economic qualities, such as prices, exchange rates, credit ratings, ship arrivals, and later interest rates and share prices. The emerging news agencies mitigated the paradox by making the marginal price of news zero through subscription selling and by selling the news in bundles. Sometimes they could also use laws creating rights in news telegrams, or cross-subsidize their news service with revenues from ancillary businesses.[154] Another factor mitigating Arrow's paradox was the increasing uniformity of news reception times within countries, increasing buyers' willingness to pay for news by guaranteeing that they could not be taken advantage of by entrepreneurs having received the news earlier.

Another problem for the news agencies was that news was a quasi-public good. It was nondiminishable (non-rivalrous) but not fully excludable, since customers could easily resell news they received. Nationally, the excludability problem was mitigated by contracts and by news' per-

ishability, as well as by national news cooperatives that sometimes facilitated a monopsonistic cartel of their customer-owners. Internationally, the excludability problem was solved by the international news cartel that provided exclusive distribution areas.

The nondiminishability problem, implying a continuously declining average cost curve as the number of subscribers increased, was solved initially by the first movers deterring subsequent entrants, and then by collusion between the first movers in the international news cartel or by integration of customers and owners in cooperatively owned national news agencies. In coping with both limited excludability and nondiminishability, the news industry devised a private solution to a quasi-public good problem.[155]

The nondiminishability problem was amplified by the phenomenal productivity growth in communication networks, resulting in ever-lower costs. The price per standard message fell sharply, suggesting an enormous growth in productivity, a fall in profit margins, or both. Productivity estimates for news gathering are difficult, since the news agencies started to offer news at greater speed, from new locations and on more specialized topics. A business newspaper of the late nineteenth century, therefore, was of a far higher quality than a century earlier, and yet its price was far lower. This low price and the everyday, inauspicious character of a product containing information from virtually everywhere in the world made few people realize the enormous productivity increase that had made this possible. The productivity impact on virtually every other industry that existed is even harder to quantify. It suffices to say that the twentieth century as we knew it, for better or for worse, would not have been possible without the global news networks. They formed the nervous system of an emerging world economy.

NOTES

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alone, of course, is responsible for the final text and any errors of fact or interpretation that may remain.

2. In France in 1881, for example, 4 cities received six deliveries a day, 24 cities five daily deliveries, 277 cities four, 1,066 three, 3,665 two, and 615 cities one daily delivery. Sébastien Richez, "From the transport to the delivery of mail: The transformation of the French postal network in the nineteenth century," *Business and Economic History*, vol. 2 (2004), pp. 1–14; 7.
3. See, for example, Oliver Boyd-Barrett and Terhi Rantanen eds., *The Globalization of News* (London: Sage, 1998); Donald Read, *The Power of News: The History of Reuters, 1849–1989* (Oxford: Oxford University Press, 1992); Richard Allen Schwarzlose, *The American Wire Services: A Study of Their Development as a Social Institution* (Urbana: University of Illinois PhD, 1965, reprinted by Arno Press, New York, 1979), and much of the literature quoted in the next section.
4. See the next section, "Evolution of the industry", below.
5. H.J. Perkin, "The Origins of the Popular Press," *History Today*, vol. 7 (1967), pp. 425–35, for example, concludes that rising real incomes for the lower middle and working classes were an important factor in the emergence of the popular press in Britain.
6. See the section "The industrialization of information transmission" below.
7. The purpose of this section is to sketch the evolution of news agencies in broad lines, with particular attention to the aspects that are relevant for the subsequent sections on business models, productivity, and organizational structure. It does not aim to give an exhaustive history of news agencies and communication technologies, for which many other works can be consulted. See, for example, Mitchell Stephens, *History of news: from the drum to the satellite* (London: Viking Penguin, 1988); Boyd-Barrett and Rantanen, *The globalization of news*; Hans-Jürgen Teuteberg and Cornelius Neutsch eds., *Vom Flugeltelegraphen zum Internet. Geschichte der modernen Telekommunikation* (Stuttgart: Franz Steiner Verlag, 1998), as well as the other works quoted below.
8. For a detailed history of the early business press in Europe and the United States, since c. 1500, see John McCusker, "The Demise of Distance: The Business Press and the Origins of the Information Revolution in the Early Modern Atlantic World," *American Historical Review*, vol. 110 (2005), pp. 295–321.
9. Oliver Volckart, "The Influence of Information Costs on the Integration of Financial Markets: Northern Europe: 1350–1560," in: Mueller and Ojala, *Information Flows*, pp. 31–62.
10. McCusker, "Demise of Distance."
11. Ibid. The increasing brokerage in price information was an effect of the European economy growing out of the Middle Ages. Oliver Volckart and Antje Mangels, "Are the roots of the modern Lex Mercatoria really medieval?," *Southern Economic Journal* vol. 65 (1999), pp. 427–50; p. 436, note how in the Dark Middle Ages a substantial part of exchange existed of reciprocal gifts of goods and services, so that often price information simply did not exist and thus could not be traded.
12. See the next section.

13. See also Donald J. Harreld, "An Education in Commerce: Transmitting Business Information in Early Modern Europe," in: Leos Mueller and Jari Ojala eds., *Information Flows: New Approaches in the Historical Study of Business Information* (Helsinki: Finnish Literature Society, 2007), pp. 63–83.
14. Scheurl had other regular customers besides the court, but it is unclear if or what they paid. Stephens, *History of news*, 89.
15. Stephens, *History of news*, pp. 87–91. Stephens notes that historians have debated whether or not Fugger sold its letters to outside buyers. The evidence for this appears sparse.
16. Juergen Wilke, "The Struggle for Control of Domestic News Markets (2)," in: Boyd-Barrett and Rantanen, *The Globalization of New*s, pp. 49–60; Stephens, History of News, p. 89 note 80.
17. C. John Sommerville, *The news revolution in England: Cultural dynamics of daily information* (New York: Oxford University Press, 1996), pp. 19–20, as quoted in Paul Starr, *The Creation of the Media: Political Origins of Modern Communications* (New York: Basic Books, 2004), p. 31.
18. J. A. Baggerman and J. M. H. Hemels, *Verzorgd door het ANP: Vijftig jaar nieuwsvoorziening* (Utrecht and Antwerpen: Veen Uitgevers, 1985), p. 16.
19. Ibid., p. 15; see also John J. McCusker, "The Italian Business Press in Early Modern Europe," in *Essays in the Economic History of the Atlantic World* (London: Routledge, 1997), pp. 117–44.
20. Baggermans and Hemels, ANP, p. 17.
21. McCusker, "Italian business press," pp. 136–7.
22. Starr, *Creation*, p. 30.
23. Also, because part of the copyists were automated away by the printing press, the wages of copyists should come down, and thus the costs of hand-written newsletters.
24. This point is made by McCusker, "Demise of Distance," 299, in contrast to, for example, Elizabeth Eisenstein, *The printing press as an agent of change: communications and cultural transformation in early modern Europe* (Cambridge: Cambridge University Press, 1979), which argues that the printing press was the root cause of change. It was only in the late eighteenth century that the British Parliament allowed newspapers to report parliamentary debates. Starr, *Creation*, p. 36.
25. McCusker, "Demise of Distance."
26. John J. McCusker, "The Business Press in England Before 1775," in *Essays in the Economic History of the Atlantic World* (London: Routledge, 1997), pp. 162–7.
27. Robert Darnton, "An Early Information Society: News and the Media in Eighteenth-Century Paris," *American Historical Review*, vol. 105 (2000), pp. 1–35.
28. Encyclopaedia Britannica, entry "Thurn and Taxis postal system," Starr, *Creation*, pp. 30–31. The coiled horn, Thurn und Taxis' coat of arms, remains a symbol of many postal services. The Turn und Taxis postal delivery system also features prominently in Thomas Pynchon's novel *The Crying of Lot 49* (New York: J B. Lippincott, 1965), which deals with a (fictional) secret rival mail system, run by the Tristero family and called We Await Silent Tristeros' Empire or W.A.S.T.E.

29. Starr, *Creation*, p. 31; see also George L. Priest, "The History of the Postal Monopoly in the United States," *Journal of Law and Economics*, vol. 18 (1975), pp. 33–80: 34–35.
30. See note 26.
31. Alexander Field, "French Optical Telegraphy, 1793–1855: Hardware, Software, Administration," *Technology and Culture*, vol. 35 (1994), pp. 315–47.
32. See, for example, Ibid.
33. A series of more primitive communication systems had been in use or tried since at least the 1760s, and the Admiralty had been operating its own communication system in the area since at least Napoleonic times. Michael Wobring, *Die Globalisierung der Telekommunikation im 19. Jahrhundert : Pläne, Projekte und Kapazitätsausbauten zwischen Wirtschaft und Politik* (Frankfurt am Main, Peter Lang, 2005), pp. 66–79.
34. Ibid., p. 32.
35. Tom Standage, *The Victorian Internet: The remarkable story of the telegraph and the nineteenth century's online pioneers* (London: Weidenfeld & Nicholson, 1998), p. 18, mentions a number of "almost thousand," but from Wobring's documentation of all major networks it appears that the number must have been higher, possibly at least several thousand. On the German optical telegraph network see Klaus Beyrer, "Die optische Telegraphie als Beginn der modernen Telekommunikation," in: Teuteberg and Neutsch, *Flugeltelegraphen zum Internet*, pp. 14–26. The line Berlin-Koblenz, taken into use in 1833, counted sixty-one stations (and from 1842 sixty-three because of the large distance between stations number 24 and 25; p. 23). To keep a clear line of sight, trees had to be cut, and sometimes whole lines had to be hacked through forests. Also, areas with a lot of mist had to be evaded. In 1852, the last optical line was taken out of service and replaced by the electric telegraph.
36. Wobring, *Globalisierung*, pp. 79, 83; Richard R. John, *Network nation: Inventing American telecommunications* (Cambridge, MA: Belknap, 2010), p. 16.
37. Gerard J. Holzmann and Björn Pehrson, *The early history of data networks* (Los Alamitos, CA: IEEE Computer Society Press, 1995), pp. 2–6. Views on the precision of the Roman signaling system differ. Although long-range communications probably only involved a single signal—smoke by day and fire by night—the system described by Polybius that transmitted individual letters of the alphabet with torches may only have been used for tactical communications, given the resource intensity. See G. H. Donaldson, "Signalling communications and the Roman imperial army," *Britannia*, vol. 19 (1988), pp. 349–56.
38. M. Aurel Stein, *Ruins of desert Cathay: personal narratives of explorations in central Asia and Westernmost China* (London: MacMillan, 1912).
39. But note that one speculator who could get information before all others could make a fortune, although it is doubtful whether this also was socially beneficial. Speculators used both false information and the speedy transmission of correct information to make their profits. Menahem Blondheim, *News over the Wires: The Telegraph and the Flow of Public Information in*

America (Cambridge, MA: Harvard University Press, 1994), p. 79, for example, notes how Daniel Craig made his fortune by getting European news first and then sell it to speculators, and also how gold speculators tried to make profits by releasing a bogus proclamation by President Lincoln in 1864 [Menahem Blondheim, '"Public sentiment is everything": The Union's public communications strategy and the bogus proclamation of 1864," *Journal of American History*, December 2002, pp. 869–99]. For equivalent cases in Britain see Paul Johnson, *Making the Market: Victorian Origins of Corporate Capitalism* (Cambridge: Cambridge University Press, 2010).

40. Standage, *Victorian Internet*, p. 16.
41. Ibid., p. 144; see also Cornelius Neutsch, '"Erste Nervenstränge des Erdballs": Interkontinentale Seekabelverbindungen vor dem Ersten WeltKrieg," in: Teuteberg and Neutsch eds., *Vom Flugeltelegraphen zum Internet*, pp. 470–66.
42. Ibid.
43. Standage, *Victorian Internet*.
44. Holzmann and Pehrson, *Data networks*, pp. 2–6.
45. John, *Network Nation*, p. 17.
46. Historical Society of Pennsylvania, *Philadelphia Stock Exchange Papers* (Philadelphia: 2006), p. 1. Cf. John, *Network Nation*, p. 54, who notes a transmission time of 30 minutes.
47. Blondheim, *News*, p. 91.
48. Starr, *Creation*, p. 44.
49. Baggerman and Hemels, *ANP*, p. 15.
50. Julius Reuter worked for such a service before starting his own company. Read, *Reuters*; Standage, *Victorian Internet*, p. 141.
51. Two national networks of loosely affiliated Federalist and Republican papers emerged. Starr, *Creation*, pp. 90, 92; Richard R. John, *Spreading the News: The American postal system from Franklin to Morse* (Cambridge, MA: Harvard University Press, 1995), p. 37.
52. Reuters' selling policy differed from that of the NYAP partnership, which only supplied to members, and derived part of the value to its members by the exclusion of non-members. See, for example, Blondheim, *News*.
53. Ibid., pp. 138–39; John, *Network Nation*, p. 54. In 1807, when the possibility of war with Britain or France loomed large, the House of Representatives voted in favour of a bill to build a 1,200-mile optical telegraph between New York City and New Orleans. In the end the project was shelved and the line remained unbuilt. Ibid, p. 16.
54. Standage, *Victorian Internet*. Similar techniques were also used in the other direction, see the section "Organisational structure of the international news agencies", below.
55. This organization eventually folded in 1893 and was supplanted by Western Associated Press from Chicago that eventually transferred to New York and is known today as the Associated Press.
56. Peter James and Nick Thorpe, *Ancient Inventions* (New York: Ballantine, 1994), p. 526; The Dead Media Project, *Working notes* 4.1, www.deadmedia.org, accessed March 2009.

57. Jonathan Barron Baskin and Paul J. Miranti Jr., *A History of Corporate Finance* (Cambridge: Cambridge University Press, 1997), p. 308 cf. Johnson, *Making the Market*¸ p. 220.
58. Standage, *Victorian Internet*, p. 142; Read, *Reuters*, pp. 11, 13.
59. Ibid., p. 16.
60. Blondheim, *News,* p. 79.
61. Several different telegraph systems were developed from about the 1820s. The first working commercial telegraph was patented by William Fothergill Cooke and Charles Wheatstone as an alarm system. It was demonstrated successfully between Euston and Camden Town in London and entered commercial use in April 1839 on the 21-km railway line from Paddington to West-Drayton. Before 1850 the British electric telegraph was used primarily by the railroad, whereas the U.S. one was used primarily by the press and merchants trading in agricultural staples. Only slowly would the British shift to news, and the U.S. to railroads. John, *Network Nation*, pp. 26–29, notes that Morse was inspired in part by the French optical telegraph when designing the electric one, and also that the single-line electric telegraph was not necessarily faster than the optical telegraph in good weather conditions during daytime.
62. Standage, *Victorian Internet*, p. 145.
63. The electric telegraph was more reliable than its optical mother system in its all-weather and twenty-four-hour operation, but less reliable in its sensitivity to sabotage, as wires could be, and were, easily cut. John, *Network Nation*, Blondheim, *News*.
64. John, *Network Nation*, p. 52. John also notes that by 1825, the mandate of the U.S. Post Office also included the circulation of information on market trends. Newspapers were conveyed as rapidly as letters to ensure that farmers obtained up-to-date information about the value of their crops. Ibid., p. 21.
65. See Alexander J. Field, "Modern Business Enterprise as a Capital-Saving Innovation," *Journal of Economic History*, vol. 57 (1987); —, "The magnetic telegraph, price and quantity data, and the new management of capital," *Journal of Economic History*, vol. 52 (1992); Richard B. DuBoff, "The Telegraph and the Structure of Markets in the United States, 1845–1890," *Research in Economic History*, vol. 8 (1983).
66. An alternative technology was pneumatic transmission. From the mid-nineteenth century, starting with London in 1853, many large cities started to operate fast postal systems through pneumatic tubes. In 2000, Czech Telecom was still running a pneumatic service in Prague, which had been in operation since 1899. J. C. Hertz, Working Note 43.8, The Dead Media Project, HYPERLINK "http://www.deadmedia.org" www.deadmedia.org, accessed March 2009.
67. Kenneth J. Arrow, "Economic Welfare and the Allocation of Resources for Invention," in: Richard Nelson ed., *The Rate and Direction of Inventive Activity* (Princeton, NJ: NBER / Princeton University Press, 1962), p. 615.
68. See the previous section.
69. See, for example, McCusker, "England," pp. 149–55.

70. On the importance of reputation, see for example, Paul R. Milgrom, Douglass C. North and Barry R. Weingast, "The role of institutions in the revival of trade: The law merchant, private judges and the Champagne fairs," *Economics and Politics*, vol. 2 (1990), pp. 1–23.
71. Information on a trading partner's reputation (such as for payment, respect of deadlines, and fidelity to the terms and objects of the contract) remained important business information throughout history. Alessandro Stanziani, "Economic information on international markets: French strategies in the Italian mirror," *Enterprise & Society*, vol. 11 (2010), pp. 26–64, for example, shows the importance of this information for French and Italian merchants between 1870 and 1914, and how Italian wine exporters had an advantage over their French competitors as the Italian government provided them with detailed information on the reputation of foreign trading partners. On credit rating agencies in the United States in the second half of the nineteenth century see Martin Ruef and Kelly Patterson, "Credit and Classification: The impact of industry boundaries in nineteenth-century America," *Administrative Science Quarterly*, vol. 54 (2009), pp. 486–520.
72. Blondheim, *News*.
73. For credit rating and ship arrivals, the information was binary (creditworthy or not creditworthy, ships on information buyer's list have arrived or not).
74. See the discussion of early news services in the preceding section. Nevertheless, the early newspapers of the sixteenth and seventeenth centuries were typically sold by subscription payable in advance, suggesting Arrow's paradox may have been an issue in selling them. Subscriptions and lower printing costs made the capital outlays needed for early newspapers smaller than for books. Starr, *Creation*, p. 32.
75. This price discrimination was important because of the high fixed costs. Some users had a high willingness to pay, others not. With one (intermediate) price, total revenue might not be enough to cover fixed costs and the service would not be provided, even though aggregate willingness to pay (the consumer surplus) could be enough for the firm to cover fixed costs. By charging different subscription fees to different users the firm was able to transform more of the consumer surplus into revenue and so could incur the high fixed costs. This standard industrial economics finding is discussed with respect to media industries in Gerben Bakker, "Sunk Costs, Dynamic Efficiency and the Structure of Creative Industries: A Very Long-Run Perspective" in Candace Jones, Mark Lorenzen and Jonathan Sapsed eds., *Oxford Handbook of Creative Industries* (Oxford University Press, in press).
76. It may, however, not be optimal in efficiency terms, as the price signal can not be used to reach the most efficient allocation, and because of this absence of the price signal for individual news items users have to "overconsume" information to find the information that is most valuable for them. The present-day "information overload" may be illustrative of this suboptimal allocation mechanism. Another solution to Arrow's fundamental paradox is to make the marginal price zero by bundling it with sponsored messages, which is often used in end (consumer) markets (e.g., television advertising).

77. For a detailed account of the races to get this information first and how and to whom it was sold see Blondheim, *News*.
78. On a more general level the heading 'foreign news' could be used to sell news in a bundle, as the term made a promise about a bundle of news items without revealing their content. It may be no coincidence that in many early European newspapers foreign news predominated. See, for example, Starr, *Creation*, p. 32. Where the foreign news entered by ship at distinctive intervals, such as the post ships between Amsterdam and London and the steamers between Europe and the United States, it arrived already bundled, and newsbrokers could more easily control its supply.
79. Read, *Reuters*, p. 14.
80. Silberstein-Loeb, "News Market." The Supreme Court ruled that information contained in news was not was not copyrightable but that the Associated Press had a quasi-property right in "hot" news. See, for example, Richard Epstein, "International News Service v Associated Press Custom and Law as Sources of Property Rights in News," *Virginia Law Review*, vol. 87 (1992), pp. 85–128.
81. Peter Putnis, "The Struggle over Copyright in News Telegrams in Australia, 1869–1912," in: Sybil Nolan ed., *When Journalism Meets History* (Melbourne, RMIT Publishing, 2003).
82. The author is grateful to an anonymous referee for pointing this out.
83. Jonathan Silberstein-Loeb, "The Structure of the News Market in Britain, 1870–1914," *Business History Review* 83 (Winter 2009), pp. 759–88; 777.
84. Ibid.
85. Exceptions are "collect calls" in which the receiver agrees to pay on hearing who is calling. Historically, several postal systems also had a model by which the recipient of the letter would pay, such as the U.S. Post Office Department before 1855, when customers collected their letters at the post office. "…frequent correspondents often found themselves paying large sums for letters that they would never have bothered with had they known their contents in advance." John, *Spreading the News*, pp. 160–1.
86. Arrow, "Economic Welfare," also notes that information is indivisible: Just a small piece of it does not have a proportionate value; it often has no value at all.
87. A detailed historical case study examining how the Associated Press, a nonprofit cooperative owned by U.S. newspapers, developed a business model solving the quasi-public good characteristics of news is Stephen Shmanske, "News as a Public Good: Cooperative Ownership, Price Commitments, and the Success of the Associated Press," *Business History Review*, vol. 60 (1986).
88. Jacques Wolff, "Structure, Fonctionnement et Evolution du Marché International des Nouvelles: Les Agences de Presse de 1835 à 1934," *Revue-Economique*, vol. 42 (1991); Terhi Rantanen, "Foreign dependence and domestic monopoly: The European news cartel and U.S. associated presses, 1861–1932," *Media History*, vol. 13 (2006). In the nineteenth century Wolff-Continental was less fully developed and relied more on individual foreign correspondents than the other agencies.

89. The agreements did not stop the agencies competing in areas outside the agreement. From the 1860s to the 1890s, for example, Reuters was still providing a competing service to Wolff-Continental in some German cities, using an alternative cable and telegraph line. Terhi Rantanen, *When News was New* (Chichester: Wiley-Blackwell, 2009), pp. 97–99.
90. Read, *Reuters*.
91. For a detailed historical discussion see Terhi Rantanen, "The Struggle for Control of Domestic News Markets (1)," in: Boyd-Barrett and Rantanen, *The Globalization of News*; Peter Putnis, "Reuters in Australia: The Supply and Exchange of News, 1859–1877," Media History, vol. 10 (2004), pp. 67–88; —, "How the international news agency business model failed: Reuters in Australia, 1877–1895," *Media History*, vol. 12 (2006), pp. 1–17. Shmanske, "News as a Public Good," discusses how the cooperative structure of the Associated Press in the United States lowered the cost of exclusion. He also argues that cooperative rules where a commitment mechanism that prevented the Associated Press from matching discounts that any rival might offer; in the short run this might mean foregoing profits, in the long run this meant that members would not haggle about the price because they knew the Associated Press could not lower the price.
92. Fixed costs are costs associated with inputs that cannot be varied. The organization must pay these costs regardless of the output level, even if output would be zero. The extent to which this is the case depends on the length of the period studied. Short-run fixed costs are costs that can be avoided in the longer run (such as salary costs for employment contracts with three months notice), long-run fixed costs can not be avoided in the longer-run (say a five-year lease contract for a telegraph line). Naturally, a fixed-cost category such as "leased wires" may consist of a bundle of contracts with varying length and of "spot" rentals, explaining the fluctuations in Fig. 1.1. Even so, this category as a whole fluctuated far less than the other categories and is consistently monotonically increasing in real dollar terms (not percentage of costs), except for the war years.
93. Schwarzlose, *Wire Services*, p. 251.
94. On sunk costs see John Sutton, *Technology and Market Structure: Theory and History* (Cambridge MA: MIT Press, 1998); for a discussion of the relevance of sunk costs for the history of media industries see Gerben Bakker, "The Decline and Fall of the European film industry: Sunk costs, market size and market structure, 1890–1927," *Economic History Review*, vol. 58 (2005), pp. 310–51; 317–22.
95. The absence of strong international antitrust laws, making collusion go unpunished, and probably governments' reluctance to let their news agencies merge, prevented merger or acquisition as a mechanism that would allow coordination inside one firm. Yet Reuters and Havas did form a joint service to South America, and Reuters, Havas and Wolff formed a joint venture to provide a news photo service. Silberstein-Loeb, "News markets."
96. But note that cartel partners remained in competition in areas outside of an agreement. See, for example, Reuters business in Germany until 1898, in Rantanen, *News*, pp. 97–99.

97. John, *Network Nation*, p. 146. The American Press Association was a newsbroker formed by newspapers excluded from the NYAP. Ibid., p. 147.
98. Western Union probably hoped that this helped keep Congress from regulation the telegraph. Contracts stipulated that NYAP and its newspapers could not write unfavourably about Western Union. See John, *Network Nation*.
99. Silberstein-Loeb, "News market in Britain."
100. Ibid., p. 778.
101. Reuters was restructured and reorganised during the war, with government support, among other things abandoning its disastrous foray into banking. Read, *Reuters*, pp. 83, 153, 111–31; Silberstein-Loeb, "Market for News." Using additional data to Read, Silberstein-Loeb also shows that gross margins had roughly halved between the 1860s and the 1880s, after which they fluctuated in a relatively stable band until World War I. Ibid., p. 777.
102. The NYAP (c. 1846–1893), was organized as a partnership. The present-day Associated Press is the successor of the Western Associated Press, a rival to NYAP. On transaction costs and vertical integration see Oliver E. Williamson, *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting* (New York: Free Press, 1985).
103. Obviously, many other factors were likely to have contributed to the difference in profit margins. The importance of the ability to capture marginal revenues for media organizations is further explored in Gerben Bakker, "The Making of A Music Multinational: Polygram's International Businesses, 1945–1998" *Business History Review*, vol. 80 (2006), pp. 81–123. Williamson, *Economic Institutions*, and John Roberts, T*he Modern Firm: Organizational Design for Performance and Growth* (Oxford: Oxford University Press, 2004) provide theories to explain why activities are done within or without an organization.
104. See "Organisational structure of the international news agencies."
105. One could argue that a potential news event became news once it was reported. If it went unreported and unrecorded, obviously it was not transformed into news. For a general discussion of the nature of news see Robert E. Park, "News as a form of knowledge: a chapter in the sociology of knowledge," *American Journal of Sociology*, vol. 45 No. 5 (March 1940), pp. 669–86.
106. We abstract here from the secular acceleration in news events per time interval through increasing uniformity and decreasing response times brought about by the telegraph. See the next section.
107. Silberstein-Loeb, "News market in Britain," p. 779.
108. This is not inconsistent with the general industrialization pattern of service industries with high sunk costs, as discussed in Gerben Bakker, *Entertainment Industrialised. The Emergence of the International Film Industry, 1890–1940* (Cambridge: Cambridge University Press, 2008), pp. 388–403; see also Richard B. DuBoff, "Business Demand and the Development of the Telegraph in the United States, 1844–1860," *Business History Review*, vol. 54 (Winter 1980).
109. The importance of the increase in nonsimultaneous trade on the demand for information is noted in Volckart and Mangels, "Lex Mercatoria."

110. This approach follows Timothy F. Bresnahan and Robert J. Gordon, "Introduction," in their *The Economics of New Goods* (Chicago: University of Chicago Press, 1997), pp. 1–26; 5–7.
111. See the section "Evolution of the industry", above.
112. The continuously declining average cost was of course a public good characteristic. Jacob Schmookler, *Invention and Economic Growth* (Cambridge, MA: Harvard University Press, 1966) and Sutton, *Technology and Market Structure*, emphasize the importance of market size for the appearance of innovations.
113. This point partially emerges from Milgrom, North and Weingast, "Institutions," p. 3. See also Volckart and Mangels, "Lex Mercatoria" who show that the Milgrom-North-Weingast model is less useful to understand trade in the Middle Ages.
114. Both the continuously decreasing average costs and the endogenous shifting of the demand curve suggest that the price elasticity of demand for news might have been huge.
115. Although correlation does not prove causation, of course. On the emergence and the growth of U.S. newspapers since 1783 see also McCusker, "Demise of Distance." The importance of pre-1840 information flows has been emphasized by Thomas C. Cochran, *Frontiers of Change: Early Industrialism in America* (Oxford: Oxford University Press, 1981), especially pp. 48–49, 105, 116–19, and by Alan R. Pred, *Urban Growth and the Circulation of Information: the United States System of Cities, 1790–1840* (Cambridge, MA: Harvard University Press, 1973).
116. John, *Spreading the News*; Starr, *Creation*, p. 86. In 1790, eight daily newspapers existed, by 1800 this had increased threefold to twenty-four [figure 4].
117. Menahem Blondheim, "The click: telegraphic technology, journalism and the transformations of the New York Associated Press," American Journalism, vol. 17 (Fall 2000), pp. 27–52.
118. See Fig. 1.4. On the sympathetic tariffs see John, *Spreading the News*.
119. Peter J. Hugill, *Global Communications since 1844: Geopolitics and Technology* (Baltimore, MD: Johns Hopkins University Press, 1999), p. 35.
120. Ibid.
121. Tomas Nonnenmacher, "History of the U.S. Telegraph Industry," in Robert Whaples ed., *EH.Net Encyclopaedia*, August 15, 2001. http://eh.net/encyclopedia/?article=nonnenmacher.industry. telegraphic.us.
122. Nonnenmacher, "History of the U.S. Telegraph Industry."
123. Ibid.
124. Ibid.
125. If one writes ninety messages of fifty words a month and pays $20 for Internet connection, and $20.83 for equipment depreciation ($1,500/3/2/12), then the average price per ten words message would be $0.09, or 9.1 cents. See also JoAnne Yates and Robert I. Benjamin, "The past and the present as a window on the future," in: Michael S. Scott Morton ed., *The Corporation of the 1990s: Information Technology and Organizational Performance* (Oxford: Oxford University Press, 1991).

126. Gary Fields, *Territories of Profit. Communications, Capitalist Development, and the Innovative Enterprises of G. F. Swift and Dell Computer* (Stanford: Stanford University Press, 2004), p. 65.
127. In the United States, from 1851, for example, the Associated Press would send news bulletins from New York using a technology that transmitted a single bulletin as it was keyed directly to all receiving stations at the same time. Blondheim, "The Click," pp. 41–44.
128. The increased synchronicity was of course relative. Paul Starr, for example, argues that as early as the seventeenth century the proliferation of newspapers likewise increased synchronicity and made readers aware that others would read the news at *roughly* the same time. See *Creation*, p. 24.
129. The coefficient of variation is the standard deviation over the mean. See table 1.1 in Gerben Bakker, "Trading Facts: Arrow's Fundamental Paradox and the Emergence of Global News Networks, 1750–1900," *LSE Working Papers on the Nature of Evidence* 17 (June 2007), based on data from Fields, *Territories of Profits*, pp. 78–79. For a detailed overview of information transmission times in the pre-1840 United States see also Pred, *Urban Growth*.
130. The latter technology was independent of the former. The roads in the United States were terrible by European standards, but the Post Office Department did an excellent job in coordinating the flow of information, subsidizing stage coaches but not the roads they travelled on. John, *Spreading the News*, pp. 64–111.
131. See Ibid.
132. Before 1830, transport times also fell considerably. Blondheim, *News*, p. 17 notes a fall in the public information time lag between New York and four other cities between 1794 and 1817 that ranges from 57 to 64 percent, a decrease of about 4 percent per annum, on average.
133. Bakker, "Trading Facts," table 1.
134. Ibid.
135. Blondheim, *News*, p. 171.
136. A point also made by Volckart, "Information Costs." Volckart concludes that in periods and places were information costs were low, markets were more integrated.
137. Blondheim, *News*, p. 73.
138. Ibid., p. 172.
139. Robert Jensen, "The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector," *Quarterly Journal of Economics*, vol. 122 (2007), pp. 879–924.
140. Rantanen, "Foreign Dependence"; see above. In Australia co-operatives came and went and were rarely all-encompassing. The cooperative formed in 1895 was fairly comprehensive but new competition came in from 1910. A re-newed comprehensive cooperative would come in 1935 when Australian Associated Press (AAP) was formed.
141. In some cases news yachts from the NYAP would intercept London-bound mail steamers off New Foundland and provide the latest news that had been telegraphed to NYAP at St John's, the U.S. easternmost telegraph post. In cases where news was not ready, the U.S. War Department also

could ask ship owners to delay departure, as it asked Samuel Cunard in May 1864. Not only did the War Department cooperate closely with NYAP, it also had an understanding with Reuters arranging effective transmission of war news in England and on the Continent. The substantial political dimension of and interference in the international news flow is important for understanding of the history of the news agencies but lies outside the scope of this article. Blondheim, "Bogus Proclamation," pp. 880, 885.

142. See the preceding section, "The Emerging Business Model of News Agencies" and Shmanske, "News as a Public Good."
143. Gene Allen, "News Across the Border: Associated Press in Canada, 1894–1917," *Journalism History*, vol. 31 no. 4 (January 2006), pp. 206–16.
144. Baggerman and Hemels, *Verzorgd door het ANP*, 33–89. One of the reasons put forward by the Dutch association of newspaper publishers was that a single national news cooperative would enable exclusive agreements with foreign agencies on an equal footing, whereas the fragmented and competitive nature of the existing Dutch news agencies made such agreements difficult.
145. In the case of competition, Reuters probably would have had to pay far less.
146. See Silberstein-Loeb, "Market for News."
147. This was between one third (until the 1920s) and one fifth of the Associated Press's revenue, at exchange rates.
148. All data based on Read, *Reuters*.
149. See the comment earlier on the organizational form and incentives to increase quality.
150. The Press Association subscription at that time, 1915, had been £8,000 annually for more than forty years. The combined London papers paid nearly three times as much. Read, *Reuters*, p. 121. See also Silberstein-Loeb, "Market for News."
151. John, *Network Nation*, traces the antimonopoly tradition in the United States back to the 1840s and shows how it shaped the history of the news brokerage business in the 1870s and 1880s; it would have been difficult for the Western Associated Press to beat out the NYAP in the absence of the National Telegraph Act of 1866 and the Butler Amendment of 1879 (both antimonopoly laws). The courts, at times, also were favorable to antimonopoly appeals.
152. As, for example, is documented for the United States in John, *Spreading the News*, pp. 64–111. On the development of the French postal system see, for example, Richez, "French postal network."
153. As late as the 1990s, remote regions in India still used pigeon services for important news. In 1998, for example, pigeons were used to report the election results from the province of Orissa. The birds were officers of the Orissa Police Pigeon Service, which was launched in 1946, with birds taken from the army. *Reuters News Media*, 23 February 1998; Working Note 31.3, The Dead Media Project, HYPERLINK "http://www.deadmedia.org" www.deadmedia.org, accessed March 2009.
154. This is still the way subscription systems work today. Subscription channels on cable TV, for example, do not aim to maximise audience size by focus-

ing on the lowest common denominator (the usual technique to maximise advertising revenue), but by having a variety of programs, each of which may be highly valued by a small group of customers. When those customers renew, they will remember the few programs that they like intensely, not mainstream programs that they watch occasionally.

155. See also Ronald H. Coase, "The Lighthouse in Economics," *Journal of Law and Economics*, vol. 17 (1974), pp. 357–76, who shows how in Britain the public good problem of providing light houses for ships, the archetypical textbook public good, was also solved by a private solution. British light houses have never been owned by the government, but are part of a private organization, Trinity House, which is not entirely unlike the national cooperative news agencies that monopolized news provision in some countries.

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