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INTERMEDIARIES IN THE U.S. MARKET FOR TECHNOLOGY, 1870-1920

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ABSTRACT

We argue that the emergence of a well-developed market for patented technologies over the late nineteenth and early twentieth centuries facilitated the emergence of a group of highly specialized and productive inventors by making it possible for them to transfer to others responsibility for developing and commercializing their inventions. The most basic of the institutional supports that made this market possible was, of course, the patent system, which created secure and tradable property rights in invention. But trade was also facilitated by the emergence of intermediaries who economized on the information costs associated with assessing the value of inventions and helped to match sellers and buyers of patent rights. Patent agents and lawyers were particularly well placed to provide these kinds of services, because they were linked to similar attorneys in other parts of the country and because, in the course of their regular business activities, they accumulated information about participants on both sides of the market for technology. Our quantitative analysis of assignment contracts demonstrates that patentees whose assignments were handled by these specialists produced more patents over their careers, assigned a greater fraction of their patents, and also were able to find buyers for their inventions much more quickly than other patentees. In other words, the development of institutions supporting market trade in patented technology seems to have made it possible for creative individuals to specialize more fully in inventive work -- that is, it seems to have set in motion the kind of Smithian processes that have generally been associated with higher rates of productivity growth.

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The critical role played by intermediaries in the operation of financial markets is well known. Because entrepreneurs often lack sufficient savings to finance their ventures on their own and people with savings often do not have projects that will put their funds to profitable use, there are significant benefits to be derived from trades in which savers transfer funds to entrepreneurs in return for income in the form of interest or dividend payments. The problem, however, is that high transactions costs may prevent such mutually advantageous exchanges from occurring. Because it is costly for savers to assess the prospects of each entrepreneurial project, or conversely for entrepreneurs to convince savers individually of the merits of their ventures, many good (if risky) projects may be starved for support, while savings get channeled to more conventional, easier to evaluate, investments. Intermediaries can significantly reduce this problem by mobilizing and pooling resources from savers, and investigating the creditworthiness of alternative investment opportunities on their behalf. By thus economizing on information costs, intermediaries increase the efficiency with which existing savings are employed to support economic development. Moreover, because their activities raise the return to saving in the economy as a whole, they also have a positive effect on the pool of available investment funds.¹

Similar kinds of transaction costs can impede both the generation and exploitation of technological knowledge. In the first place, the individuals who come up with ideas for new products or processes often need capital from outside investors in order to transform their visions into workable inventions. They thus face financing problems analogous to those of traditional entrepreneurs. In addition, because the comparative

¹ Lance Davis and Robert Gallman, "Capital Formation in the United States During the Nineteenth Century," in The Cambridge Economic History of Europe, vol. 7, part II, eds. P. Mathias and M.M. Postan

advantage of inventors typically stems from their creativity or specific knowledge, any time and resources they are compelled to devote to developing and commercializing their inventions may be relatively unproductively spent; indeed, they may, in fact, be poorly suited for these tasks. As a consequence, there are potential advantages to exchanges in which inventors sell or license the rights to the new technologies they have created to others better able to exploit their commercial potential. The problem, however, is that it is extremely costly for would-be buyers or lessors to assess the worth of the many and varied ideas that inventors devise. As in the case of financial markets, therefore, one might reasonably expect specialized intermediaries to emerge to economize on assessment costs and improve allocative efficiency.²

During the early twentieth century, large firms as diverse as General Electric, DuPont, and General Motors began to build in-house R&D laboratories. The apparent success of these investments, and the spread of this model to other important firms throughout the economy, led scholars to posit that vertical integration was a solution to the information problems associated with the market exchange of technological information. Indeed, some went so far as to argue that the development of complex technologies depended on the movement of R&D inside large, managerially coordinated enterprises.³ Recent events, however, have brought this view increasingly into doubt.

(Cambridge, ENG: Cambridge University Press, 1978).

² Although they do not discuss the technology sector, Ariel Rubinstein and Asher Wolinsky and Gary Biglaiser have provided theoretical rationales for the emergence of middlemen in industries with similar types of matching and assessment problems. See Rubinstein and Wolinsky, "Middlemen," *Quarterly Journal of Economics*, 102 (Aug. 1987), pp. 581-94; and Biglaiser, "Middlemen as Experts," *Rand Journal of Economics*, 24 (Summer 1993), pp. 212-23.

³ See David J. Teece, "Technological Change and the Nature of the Firm," in *Technical Change and Economic Theory*, ed. Giovanni Dosi, et al. (London: Pinter, 1988), pp. 256-81; David C. Mowery, "The Relationship between Intrafirm and Contractual Forms of Industrial Research in American Manufacturing, 1900-1940," *Explorations in Economic History*, 20 (October 1983), pp. 351-74; and "The Boundaries of the U.S. firm in R&D," in *Coordination and Information: Historical Perspectives on the Organization of Enterprise*, ed. Naomi R. Lamoreaux and Daniel M. G. Raff (Chicago: University of

Many large firms have reduced or even eliminated their research operations, and venture capital has flowed to smaller enterprises that focus on inventive activity and sell or license the resulting intellectual property—not infrequently to the same firms that earlier had built their own in-house labs.⁴ These developments, which intriguingly have been most prominent in the “high-tech” sectors of the economy, mark a return, we argue, to an earlier pattern that scholars have neglected, perhaps because of their preoccupation with the rise of big business. As we show, over the course of the nineteenth century there was a tremendous expansion of market trade in technology that facilitated a division of labor across (rather than within) organizations between those who generated and those who exploited new technological knowledge. By enabling, indeed encouraging, creative but ambitious inventors to focus on what they did best, this division of labor gave rise to the most technologically fertile period in American history, at least as measured by patents issued on a per capita basis (see Figure 1).

[Figure 1 about here]

In this article we examine some of the mechanisms through which this market for technology operated. We show that the U.S. patent system created a framework that supported trade in technology, and that the patent agents and lawyers who serviced this

Chicago Press, 1995), pp. 147-76; and Richard Zeckhauser, “The Challenge of Contracting for Technological Information,” *Proceedings of the National Academy of Sciences*, 93 (Nov. 1996), pp. 12743-8. Earlier scholars were more likely to attribute the success of these labs to the benefits of putting together teams of researchers to work systematically on technological problems. See, for example, Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy* (New York: Harper, 1942); Alfred P. Sloan, *My Years at General Motors*, eds. John McDonald and Catharine Stevens (Garden City: Doubleday, 1964); and John Kenneth Galbraith, *The New Industrial State* (Boston: Houghton Mifflin, 1975).

⁴ The principal explanations offered thus far for this change have focused on the effects of increases in the security of intellectual property rights and of expanded access to venture capital. For examples, see Josh Lerner and Robert Merges, “The Control of Strategic Alliances: An Empirical Analysis of the Biotechnology Industry,” *Journal of Industrial Economics*, 46 (March 1998), pp. 125-156; and Joshua S. Gans and Scott Stern, “Incumbency and R & D Incentives: Licensing the Gale of Creative Destruction,” *Journal of Economics and Management Strategy*, forthcoming. For a general theoretical

system often took on the functions of intermediaries, matching inventors seeking capital with investors seeking profitable outlets for their funds and also inventors seeking to sell new technological ideas with buyers eager to develop and commercialize them. Through systematic analysis of samples drawn from the Patent Office's manuscript records of patent sales and from other official sources, we explore the effect of these intermediaries on patentees' access to, and use of, the market for technology. Our findings suggest that intermediaries appear to have lowered transactions costs and improved the efficiency of exchange and that, as one might expect, inventors who were most specialized in patenting and most likely to sell off the rights to their intellectual property were the ones who made the most intensive use of intermediaries. We also provide evidence in support of the idea that the increased ability to extract returns from invention by selling off patent rights was in fact associated with a growing division of labor that enabled talented inventors to devote a greater proportion of their time and resources to creative work. In the final section of the article, we draw on a particularly rich set of papers for one patent attorney, Edward Van Winkle, to develop a more complete picture of what services these intermediaries provided to support the market for technology. Although Van Winkle's activities may not have been representative of patent attorneys in general, his papers open a window on a world that hitherto had been largely unknown—a world in which at least some patent attorneys played key informational roles at the center of overlapping groups of businessmen who were in effect operating much like modern-day venture capitalists, investing in new technologies and financing high-tech startups.

treatment, see Philippe Aghion and Jean Tirole, "The Management of Innovation, *Quarterly Journal of Economics*, 109 (Nov. 1994), pp. 1185-1210.

The U.S. Patent System and the Sale of Patent Rights

The patent system provided the institutional framework within which trade in technology evolved over the course of the nineteenth century. Consciously designed with the aim of encouraging inventive activity—and thus technological progress—the U.S. system provided the inventor of a device with an exclusive property right for a fixed term of years. Because patent rights were transferable assets, inventors who did not wish to exploit their inventions themselves could sell (assign) or lease (license) the rights to others.⁵ Moreover, because a patent could be awarded only to the “first and true” inventor of a device, sellers of new technologies could reveal information to potential buyers at an early stage and still be protected against the possibility that someone else would patent their ideas.

Of course, this protection and, more generally, the ability of inventors to find buyers or licensees for their patents depended on the security of these property rights. From the beginning the law left responsibility for enforcing patents to the federal courts, and as Zorina Khan has shown, judges quickly evolved an effective set of principles for protecting the rights of patentees and also of those who purchased or licensed patented technologies. Subsequent legislation in 1836 instituted an examination system under which, before granting patents, technical experts scrutinized applications for novelty and for the appropriateness of claims about invention. This procedure made patent rights more secure by increasing the likelihood that a grant for a specified technology would

⁵ One important feature of the law was the requirement that patentees be individual men or women. Firms could not be awarded patents for ideas developed in their shops but could obtain the rights by assignment.

survive a court challenge, and may also have provided some signal about the significance of the new technology. Thereafter, both patenting and sales of patent rights boomed.⁶

Although the main purpose of the patent system was to stimulate invention by granting creative individuals secure rights to their intellectual property, another important goal was to promote the diffusion of technological knowledge. The law required patentees to provide the Patent Office with detailed specifications for their inventions (including, where appropriate, working models), and the result was a central storehouse of information that was open to all. Anyone could journey to Washington and research others' inventions in the Patent Office files. In addition, more convenient means of tapping this rich source of information soon developed. The Patent Office itself opened branch offices around the country and published on a regular basis lists (some with descriptions of specifications and drawings) of the patents it granted. By the middle of the century, moreover, a number of private journals had emerged to improve upon these official services. One of the most important was *Scientific American*, published by Munn and Company, the largest patent agency of the nineteenth century. Others included the *American Artisan*, published by the patent agency Brown, Coombs & Company; the *American Inventor*, by the American Patent Agency; and the *Patent Right Gazette*, by the United States Patent Right Association (which, despite its name, functioned as a general patent agency). Covering the full spectrum of technologies, these journals featured articles about important new inventions, printed complete lists of patents issued, and offered to provide readers with copies of patent specifications for a small fee. Over time,

⁶ See B. Zorina Khan and Kenneth L. Sokoloff, "Patent Institutions, Industrial Organization, and Early Technological Change: Britain and the United States, 1790-1850," in *Technological Revolutions in Europe: Historical Perspectives*, ed. Maxine Berg and Kristine Bruland (Cheltenham, UK: Edward Elgar,

the scope and number of these periodicals increased, reflecting an expanding and ever more articulated demand for information about new technologies. Moreover, specialized trade journals also appeared to report on developments in particular industries. The *Journal of the Society of Glass Technology*, for example, provided detailed descriptions of all patents taken out in the United States and Britain that were relevant to the manufacture of glass.

In addition to disseminating information about new technologies, these periodicals provided a forum for those seeking to sell rights in patents. *The Patent Record and Monthly Review*, for example, featured lists of “Inventions and Patents for Sale” and of “Partners Wanted: Capital Wanted to Develop these Inventions.” The inventions described in these columns ranged from the simple (curtain fastener, clothes line reel, can opener) to the complex (automatic street railway switch, rotary engine, flying machine).⁷ Moreover, the texts of these brief advertisements suggest that inventors felt secure enough in their intellectual property actively to seek buyers for their inventions before they secured the protection of patents. The very titles of these lists (for example, “Inventions *and* Patents for Sale”) provide evidence for this claim, as do the many advertisements that did not include patent numbers.⁸ Because, all other things being equal, having a patent already in hand should have raised the value of the invention in the eyes of prospective buyers, it is reasonable to conclude that most of the inventions listed without patent numbers had not yet been protected in this manner.

1997), pp. 292-313; and Khan, “Property Rights and Patent Litigation in Early Nineteenth-Century America,” *Journal of Economic History*, 55 (Mar. 1995), pp. 58-97.

⁷ This particular journal claimed that its mission was “to bring the capitalist and inventor together for mutual benefit.” It earned revenues from advertisements placed by both buyers and sellers of inventions. See *The Patent Record and Monthly Review*, New Series, 3 (Jan.-Feb. 1902), p. 47.

⁸ See, for example, the lists in *The Patent Record and Monthly Review*, New Series, 3 (May 1902), p. 32.

It is, of course, difficult to know how effective any of these advertisements were, but the advice manuals that targeted audiences of inventors at this time generally agreed that such methods could work if they were coupled with other efforts. The best option “if the inventor [could] afford it” was to have the invention “illustrated and described in one or more of the scientific and mechanical publications of the day,” like *Scientific American* or the *American Artisan*. But if the inventor did not have sufficient resources, it was still effective, the manuals claimed, to put a notice in the “regular advertising columns,” especially if one took care to choose specialized publications that would “meet the eye of the class or classes of persons to whom the invention is of special interest.”⁹ In addition, however, the patentee was advised to prepare a circular describing his invention and its potential market, to procure a list of businesses most likely to be interested in the invention, and to mail the circular to these firms. He should then follow up these circulars with personal solicitations.¹⁰

Marketing a patent in this way was not only expensive but time consuming, and it distracted an inventor from more creative tasks. Not surprisingly, therefore, these publications also contained advertisements from individuals and companies offering to handle the sale of patent rights for inventors. For example, one issue of *The Patent Record* included advertisements from Dr. J. O. White of Philadelphia asserting that he had “excellent facilities for placing a valuable patent, suited to that market, in Europe”; from Messrs. Comere & Co. announcing, “We have several customers wanting to

⁹ William Edgar Simonds, *Practical Suggestions on the Sale of Patents* (Hartford, Conn.: privately printed, 1871), pp. 24-5; F. A. Cresee, *Practical Pointers for Patentees, Containing Valuable Information and Advice on the Sale of Patents* (New York: Munn & Co., 1907), pp. 46-52.

¹⁰ The quotes are from Simonds, *Practical Suggestions on the Sale of Patents*, pp. 19-28; but for additional examples, see W. B. Hutchinson and J. A. E. Criswell, *Patents and How to Make Money Out of Them* (New York: D. Van Nostrand, 1899); An Experienced and Successful Inventor, *Inventor's Manual*:

purchase patented articles suited to the mail-order trade”; from the International Patent Promotion Company of Cleveland claiming, “We have a large number of good patents for sale and would be pleased to have you call your attention to this fact in your paper”; and from the Wouther Patent Promoting Co. of Roswell, Georgia declaring that “We promote patents, and if there are any inventors desiring their inventions promoted, would be glad to hear from them.”¹¹

More important, the patent agencies that published these kinds of journals were themselves in the business of buying and selling patents and, indeed, often saw their publications as means to solicit inventions. Hence the U.S. Patent Right Association used the pages of its *Patent Right Gazette* to tell inventors that it was the best agent to choose “if you wish to dispose of a Patent with the greatest possible certainty, in the shortest time and at its full value.”¹² Similarly, the American Patent Agency heavily advertised the patent selling arm of its business in the *American Inventor*, crowing that it was “the only Agency for the sale of patents in America that has two PRINCIPAL OFFICES and permanent branch offices in all the prominent cities of the Union.”¹³ Although Munn and Company and Brown, Coombs and Company, the publishers respectively of *Scientific American* and the *American Artisan* (the two leading journals in the field), may not have so explicitly advertised such services, they too were functioning as intermediaries. An examination of manuscript assignment records for the years preceding and following the Civil War suggests that Munn and Company alone served as correspondent for roughly

How to Work a Patent To Make It Pay (Rev. ed.; New York: Norman W. Henly & Co., 1901); and Cresee, *Practical Pointers for Patentees*.

¹¹ *The Patent Record and Monthly Review*, New Series, 3 (May 1902), p. 33.

¹² See, for example, the cover pages of *The Patent Right Gazette*, 3 (July 1872)

¹³ See, for example, *American Inventor*, 6 (Jan. 1883), p. 23.

15 percent of all of the contracts for the sale of patents recorded by the Patent Office in 1866, though by the mid 1870s its share had dropped to less than five percent.¹⁴

Beginning around this same time, advice manuals increasingly warned inventors to stay away from intermediaries who advertised in trade publications or mailed out circulars soliciting their business. Such agents, the writers of the manuals claimed, “are unreliable and seek only to get what money they can from the patentee. It is seldom indeed that most of them effect a sale.” Although agents typically advertised that they sold patents on commission, they often charged up-front fees ranging from \$25 to \$250 to cover advertising costs. Patentees, therefore, bore relatively high costs with little assurance of return. Indeed, one writer went so far as to claim, “from long experience and observation,” that he had “never known where a patentee was ever materially benefited by placing his interests in the hands of these concerns.” He went on to assert that “very few of these concerns have any facilities whatever for selling patents,” all of their time being taken up in “working inventors up to the remitting point which usually ends the matter so far as they are concerned.”¹⁵

¹⁴ These figures are based on an examination (for patentees whose surnames began with the letter “B”) of the manuscript digests of assignments kept by the Patent Office. For a more complete description of these records, see below. The share for Munn and Co. appears to have increased from the 1840s and 1850s to the period just after the Civil War, and then dropped off rather substantially.

¹⁵ It is not entirely clear whether or not these advice manuals were including firms such as Munn & Co. among the agencies they were encouraging inventors to avoid. Probably not, given that these last quotes came from a pamphlet published by Munn & Co. It seems likely that, although their overall market share declined, firms like Munn & Co. were able to establish themselves as reputable enterprises, both because the journals they published were so prestigious and because they eschewed such questionable practices. For example, in response to an inquiry from an agent offering a patent for sale, Brown, Coombs & Co, haughtily replied, “We [do] not interest ourselves in patents as a matter of speculation.” Letter of 3 Dec. 1870 to Lemuel Jenks, Box 2, Folder 45, Mss. 867, Lemuel Jenks, 1844-1879, Baker Library, Harvard Graduate School of Business Administration. For the warnings, see Cresee, *Practical Pointers for Patentees*, pp. 42-3; Hutchinson and Criswell, *Patents and How to Make Money Out of Them*, pp. 161-2; An Experienced and Successful Inventor, *Inventor’s Manual*, p. 61; and Simonds, *Practical Suggestions on the Sale of Patents*, pp. 7-9.

Rather than work through these kinds of agencies, inventors who needed help selling their patents were advised to seek the assistance of business people whom they knew they could trust. Some of the men to whom inventors thus turned were local manufacturers or merchants whose enterprises were completely unrelated to the purpose of the invention. Thus when James Edward Smith, a machinist and professional inventor, designed a cigar machine, he approached George E. Molleson, owner of a granite quarry and agent for marble producers, for help in getting “a practical moneyed man who understood the manufacture of cigars to take an interest in Mr. Smith’s cigar machine.”¹⁶ Molleson had previously advanced Smith money to help him develop a patent letter box. How the initial contact was made is unclear, but this previous association encouraged Smith to entrust the marketing of his cigar patent to Molleson. It may be that similar connections account for other cases where businessmen handled the sale of patents unconnected to their main areas of expertise. For example, intermediaries whose businesses were as diverse as textile manufacturing and engineering consulting submitted telephone inventions for sale to AT&T on behalf of inventors.¹⁷

More commonly, however, inventors turned for marketing assistance to the local attorneys and agents who processed their patent applications. After the 1836 law increased the security of patent rights and both patenting activity and trade in patented inventions took off, the numbers of these practitioners began to grow—first in the vicinity of Washington, DC (where, of course, the Patent Office was located) and then in other urban centers, especially in the Northeast (where the overwhelming majority of

¹⁶ “Testimony Taken on Behalf of James Edward Smith,” *Hammerstein v. Smith* (1890), pp. 62-8, Case 13,618, Box 1868, Interference Case Files, 1836-1905, Records of the Patent Office, Record Group 241, National Archives.

patented inventions were generated). By the early 1880s there were about 550 such agents registered to practice before the Patent Office. Slightly more than half of these were located in New England and the Middle Atlantic states, a quarter in the District of Columbia, another fifth in the Midwest, and the rest were scattered through a few southern and western locations.¹⁸

The ostensible function of these specialists was to shepherd inventions through the Patent Office's application process and, in the case of lawyers, to defend their clients' patents in interference and infringement proceedings. In the regular course of their business, however, patent agents and lawyers obtained a great deal of information about participants on both sides of the market for technology. They were used, for example, by buyers of new technology to evaluate the merits of inventions in advance of purchase, and, in this manner, gained knowledge about the kinds of patents buyers were interested in purchasing, as well as personal insight into the character of the people involved. Inventors, of course, used them to file patent applications, in the process providing them with advance information about technologies soon to come on the market. Moreover, inventors frequently developed close relationships with their patent agents that encouraged them to try out new ideas on these specialists. For example, when Joseph Arbes, a fur manufacturer in New York City who also invented sewing machines, came

¹⁷ T. D. Lockwood, Reports of Inventions (Not Approved), 1904-8, Box 1383, AT&T Corporate Archives.

¹⁸ U.S. Patent Office, *Roster of Registered Attorneys Entitled to Practice before the United States Patent Office* (1883). The practice of inventors extracting income from their inventions by selling off or licensing the rights to their patents began early. Among a sample of "great inventors" active during the first half of the nineteenth century, roughly two-thirds derived some income from either the sale of licensing of their patent rights. It is also relevant to note that these great inventors were disproportionately located in those areas where patent agents and lawyers were concentrated. See B. Zorina Khan and Kenneth L. Sokoloff, "'Schemes of Practical Utility': Entrepreneurship and Innovation Among 'Great Inventors' in the United States, 1790-1865," *Journal of Economic History*, 53 (June 1993), pp. 289-307. Around the turn of twentieth century, Cresee estimated that only about one-fifth of inventors wanted to

up with an idea for a blind stitching machine that would use a flat-sided needle, he immediately dispatched a sketch of the needle to his attorney, William E. Knight, for a judgment as to its potential patentability. He had not even experimented with the needle on a sewing machine at that point, and both the casualness with which he made the request and the primitive state of his invention at that time suggest that he had an ongoing relationship with his attorney, who acted in part as a sounding board for his ideas.¹⁹

Patent agents and solicitors were advantageously placed to function as intermediaries in another way as well: they often had links with colleagues in different cities who could be sources of information about new inventions originating elsewhere and about potential buyers for patents developed locally. Some of these links were formal. For example, Boston patent lawyer Frederick Fish took on a partner, Charles Neave, in 1893. Two years later Fish sent Neave to New York City to open a branch office.²⁰ Similarly, after Samuel S. Fisher, U.S. Commissioner of Patents during the Grant administration, returned to private practice in Cincinnati, he took in Samuel A. Duncan as a partner and almost immediately packed him off to New York to open an office for the firm there.²¹ Other links derived from familial connections. For example, the Boston firm of Wright, Brown, Quinby & May had ties with a Chicago firm established by the brother of one of the partners. Still other links were built up through letters of introduction and repeat business. Thus Wright, Brown, Quinby & May

manufacture their devices themselves whereas about four-fifths wanted to sell off the rights to others. See *Practical Pointer for Patentees*, p. 15.

¹⁹ Knight apparently thought that the invention was not promising, so Arbes experimented with it for a few months before approaching Knight again. See "Testimony on Behalf of Joseph Arbes," pp. 10, 22-3, 26, *Arbes v. Lewis* (1900), Case 20,049, Box 2,715, Interference Case Files, 1836-1905.

²⁰ John E. Nathan, *Fish & Neave: Leaders in the Law of Ideas* (New York: Newcomen Society, 1997), pp. 13, 19.

funneled their Philadelphia business through a firm with which the partners had no apparent personal connection but with which they had long done business. Virtually all patent agents, moreover, had regular dealings with at least one attorney in Washington, who assumed responsibility for conducting searches of patent records and also represented them in preliminary interviews with examiners in the Patent Office.²² That these links to agents in other parts of the country could be used to market patents is suggested by a letter from one intermediary to “friend Jenks” (Lemuel Jenks, a patent lawyer), asking for Jenks’s assistance in marketing the device: “We have offered said Patent so far to the B & O and N C R R Comps. . . . We intend to sell it to one person for the six New England States and I therefore wish you would give me your opinion in that matter: to viz what price you think we should ask; what would we have to pay you for your assistance [sic] in carrying and effecting a sale.”²³

Just as advice manuals cautioned inventors not to trust intermediaries who advertised in trade publications, there were warnings to be wary of unscrupulous patent agents and attorneys. Indeed, some practitioners themselves took the extreme position that it was improper for members of their profession to function as intermediaries. Thus H. W. Boardman & Company announced in a pamphlet promoting the firm’s services that it was “a rule rigidly adhered to in this establishment, never to take contingent interests in applications for Patents, nor to negotiate sales of Patent rights, or become the owners in whole or in part of them.” As the pamphlet explained, such activity potentially

²¹ *In Memoriam: Samuel S. Fisher* (Cincinnati: Robert Clarke & Co., 1874), pp. 23-4. It was common for individuals who worked in the patent office, even as simple examiners, to move on to become private patent agents later in their career.

²² For insight into such correspondent relations, see Wright, Brown, Quinby & May Correspondence Files, Waltham Watch Company, 1854-1929, Mss. 598, Case 2, Baker Library, Harvard Graduate School of Business Administration.

put the interests of the patentee in conflict with those of his attorney: “If an attorney become a dabbler in Patents (as many do), how is it possible for an Investor to be assured that he is not disclosing his secret to the very party who will be the most interested in defeating his application?”²⁴

Certainly, when patent solicitors functioned as intermediaries, all kinds of conflicts of interest were possible. Although some patentees may have hesitated to reveal information about their inventions to agents who “dabbled” in patents in this way, the more likely problem was that agents interested in seeing transactions concluded may have put their own interests before those of either the patentee or the assignee. In this respect the market for technology can be thought of as much like the real estate market, where agents’ primary goal is a sale, and where buyers and sellers alike face a great deal of uncertainty about whose interest the agent is truly representing. Although these kinds of conflicts of interest have been mitigated in the case of real estate by a combination of regulation and self-policing, during the late nineteenth and early twentieth centuries the market for technology was largely unregulated and professional organizations like the bar association were extremely weak. In such a context, one would expect to see reputational mechanisms playing an increasingly important role and to observe that successful patent

²³Letter of 30 April 1870 from Aug. H. Fick [last name not completely legible] to Jenks, Box 3, Folder 59, MSS 867, Lemuel Jenks, 1844-1879, Baker Library.

²⁴H. W. Boardman & Co., Solicitors of American & European Patents for Inventions, *Hints to Inventors and Others Interested in Patent Matters* (Boston: privately printed, 1869), p. 13. Practitioners in this wing of the profession also warned inventors that if they entrusted their inventions to agents who were primarily intermediaries rather than legal specialists, they risked obtaining patents that would not withstand scrutiny by the courts. “The result is, that out of the numerous patents which have been litigated since the foundation of our Patent System, not one in ten has been sustained by the courts without being reissued to cure defects.” See the brochure of A. H. Evans & Co., Solicitors of American and Foreign Patents (Rev. ed.; Washington, DC: privately printed, n. d.), p. 1.

agents and lawyers were those who made substantial investments in cultivating reputations for fair, as well as insightful, dealing.²⁵

As we will show in the next two sections of this article, there is evidence that successful intermediaries did indeed make such investments and that, as a result, they were able to improve the efficiency of the market for patented technology. Before proceeding to this analysis, however, it is important to note that the willingness of patent agents and lawyers to function as intermediaries sometimes made it possible for inventors without funds to gain access to patent protection in the first place. Although the cost of filing a patent application in the United States was modest by British standards, the \$35 filing fee was still a substantial barrier for many wage earners. Moreover, even in routine cases, the additional charges associated with securing drawings, models, searches of patent office records, and legal assistance might add another \$50 to \$100 to total costs. Patent agents and lawyers who functioned as intermediaries might reduce or even waive many of these charges in the case of patents they thought were valuable, or they might find purchasers for the inventions who would bear the costs of applying for the patents. For example, Lansing Onderdonk, an inventor of sewing machines, testified that he did not have the funds to patent his lock-stitch invention. When he secured employment with the Union Special Sewing Machine Company, he tried to interest his new employers in the invention without success (the firm specialized in a different type of stitch). He was only able finally to patent the invention when lawyer Charles L. Sturtevant took an

²⁵ For a more formal analysis of an analogous case, see Asher Wolinsky, "Competition in a Market for Informed Experts' Services," *Rand Journal of Economics*, 24 (Autumn 1993), pp. 380-98.

interest in the invention and “said he would take the case and that I could pay him as I could.”²⁶

Quantitative Evidence on the Role of Intermediaries

It seems likely that, when patent agents and lawyers functioned as intermediaries in the market for technology, they improved the efficiency with which patents were traded. The sheer number of patents offered for sale by the late nineteenth century suggests that the knowledge these specialists were well positioned to acquire, both about inventions still on the drawing boards and also about the needs of potential purchasers of new technologies, would have helped them match sellers with appropriate buyers in an expeditious way.²⁷ It also seems likely that such intermediation would have had positive effects on the pace of technological change in general. By facilitating a division of labor that enabled inventors to spin off the distracting and time-consuming work of commercialization to others, intermediaries should have made it possible for creative

²⁶ See “Deposition of witnesses examined on behalf of Lansing Onderdonk,” pp. 36-8, 47-8, *Onderdonk v. Mack* (1897), Case 18,194, Box 2,521, Interference Case Files, 1836-1905. The interference records are filled with statements by patentees that lack of funds had prevented them from patenting inventions or from filing applications in a timely fashion.

²⁷ Moreover, the personal knowledge that they were also able to acquire about parties on both sides of the market helped them solve information problems that were unique to these kinds of transactions. To give one example, suppose that a firm bought a patent from an independent inventor and the patent was subsequently challenged in an infringement or interference proceeding. Although an assignee could seek redress against an assignor who conveyed a patent later declared invalid, there were many instances in which the assignee’s position vis à vis competitors depended on the successful defense of the patent—which in turn often depended on the cooperation of the patentee. For example, in an interference case (a proceeding set in motion when two inventors applied for or received patents for the same device), the outcome usually hinged on the inventors’ relative ability to demonstrate priority by documenting the dates on which they conceived of the invention and reduced it to practice. Hence when a firm bought an invention, it needed to know more than technical details. It needed personal knowledge of the patentee—the assurance that, if necessary, the patentee would assist in a patent office or court proceeding and, further, that the patentee would be an articulate witness who would be able to document the priority and substance of his claim.

people to focus their attention more exclusively on coming up with new technological ideas.

In this section, we explore these possibilities systematically, using the rich trove of data that the Patent Office has left to historians. These sources include published lists of patent grants that contain the names and places of residence of the patentees and of any assignees to whom the patentees transferred rights in advance of issue.²⁸ More important for the purposes of this paper are the manuscript copies of contracts for the assignment of patent rights now stored in the National Archives. In order to be legally valid, a complete copy of any contract selling or transferring the right to a patent had to be deposited with the Patent Office within three months. Patent Office clerks maintained a chronological registry of these documents and, in addition, summarized their basic details into a separate digest that was organized chronologically but also divided into volumes according to the first letter of the patentee's surname.²⁹

Our first step was to document the changes that occurred over the course of the nineteenth century in the way that rights to patents were most commonly sold. Although intermediaries potentially increased the efficiency with which patents could be marketed, their role was shaped in turn by the kinds of rights that purchasers most wanted to buy and patentees to sell. Inspection of the Patent Office's assignment records for the 1840s and 1850s—that is, for the period when the sale of patent rights first exploded after passage of the 1836 patent law—reveals that most of the contracts entailed geographically specific assignments to producers in different parts of the country. Such assignments, which constituted the vast majority of the total until well into the 1850s and

²⁸ See the *Annual Reports of the Commissioner of Patents*, published by the Government Printing Office in Washington.

as much as 90 percent during the 1840s, made a great deal of sense in a context where high transportation costs led to geographically segmented markets protected against competition from other regions. Even inventors engaged in exploiting their ideas themselves could increase their returns by selling geographically limited rights to their inventions in other parts of the country.³⁰ Once, however, the expansion of railroads and other improvements in transportation and distribution made it possible for manufacturers in a single location to market their products nationally, producers increasingly wanted to purchase full national rights to technologies important in their businesses. Not surprisingly, the proportion of assignments that involved geographically limited rights began to rapidly decline. Table 1 reports descriptive statistics for all of the approximately 4,600 contracts filed with the Patent Office during the months of January 1871, January 1891, and January 1911. Already by 1871 geographic assignments accounted for less than a quarter of the total for the nation as a whole, though they retained greater importance in the Middle West, particularly in the West North Central states. By 1911, they had almost completely disappeared in all regions of the country.³¹

[Table 1 about here]

Table 1 also provides suggestive indications that the efficiency of the market for technology was increasing at the same time as the nature of the rights being sold was changing. In the first place, there was a drop in the proportion of secondary assignments

²⁹ [need information on the Record Group, etc. here]

³⁰ For an excellent example, see Carolyn Cooper's account of the assiduousness with which Thomas Blanchard, inventor of the gunstocking lathe and other wood-shaping inventions, assigned geographically limited patent rights to producers in distant areas. See *Shaping Invention: Thomas Blanchard's Machinery and Patent Management in Nineteenth-Century America* (New York: Columbia University Press, 1991).

³¹ Because of this shift away from multiple geographic assignments, the reported ratio of assignments in our sample to the total number of patents should not be interpreted as a measure of the

(sales of patents where the assignor was neither the patentee nor a relative of the patentee). That there was less reselling of patents as time went on may be an indication that the market was doing a better job of matching patentees who wanted to sell patents with buyers who were well placed to exploit them. In any event, an increasingly large proportion of sales were being made directly by patentees to assignees who would hold on to the property rights for the duration of the grants.³² Second, the table records a dramatic fall in the proportion of assignments that occurred after the date the patent was issued—from 72.3 percent of the total in 1870-71 to 36.5 percent in 1910-11. That patentees were able to sell their inventions earlier and earlier—increasingly before their patents were actually issued—may also be an important indication that the efficiency of trade in patents was improving.³³

Whether these changes signaled real advances in the operation of the market for technology and, if so, whether intermediaries were responsible for a significant proportion of the gains are issues that remain to be explored. We tackle these questions by exploiting an intriguing feature of the Patent Office's digests of assignment contracts—their inclusion of the names and addresses of the persons to whom all correspondence concerning assignments was to be addressed. Although some of these correspondents may simply have handled the paperwork associated with drawing up and

proportion of patents that were ever assigned. Nor should trends in this ratio be taken to indicate trends in the proportion of patents assigned.

³² The assignor might, however, license the right to use the invention to others. Although assignment contracts had to be filed with the Patent Office in order to be legally binding, there was no similar legal requirement to file licensing agreements. Our sample of assignment contracts does contain some licensing agreements, but they are very few in number, and anecdotal evidence suggests that those recorded in this manner were a declining proportion of the total of such agreements over time.

³³ At least part of the rise in the fraction of assignments that occurred before issue resulted from an increase in the length of time consumed by the application process. In order to get a rough idea of the extent of the increase, we compared two samples of 125 patents each drawn from the October 1874 and October 1911 issues of the *Official Gazette of the United States Patent Office*. In 1874 the median time

recording contracts for the sale of patent rights, others likely functioned as deal makers. We investigate this possibility by testing whether change in the identity of these correspondents was systematically related to other developments in the market for technology—for example, increases in the speed with which patent rights were sold.

Examination of the digests of the assignment contracts for the 1840s and 1850s, when the great majority of assignments entailed geographically limited rights, suggests that there was wide variety in the identity of the correspondents. Many, of course, were principals in the transactions. Some of these were assignors who previously had received shares of the patents and who may have been taken on as partners with responsibility for marketing the rights. Many others were located near assignees who purchased rights limited to the geographic areas in which they resided. These correspondents may simply have been local attorneys with diverse practices. Assignees may have learned about the patents through other channels and have come to them to process the paperwork.³⁴

Over time, however, the identity of the correspondents changed in important ways. As already mentioned, for a brief period around the Civil War, a substantial fraction of assignments was handled by the large patent agencies (such as Munn & Company) that published respected periodicals on technological developments. By the 1870s, however, the market share of these firms had begun to decline as patentees increasingly turned to specialized patent agents and lawyers to handle their assignments. In order to gauge the role that this new category of correspondents played in the market for technology, we collected information from the assignment digests on all of the

between application and issue was 4 months and the mean 5.8 months. In 1911 the median was 12 months and the mean 18.2 months.

³⁴ This interpretation is supported by the observation that it was not uncommon for multiple geographically limited assignments of the same patent to be handled by different correspondents. That

contracts filed with the Patent Office during the first three months of 1871, 1891, and 1911 for patents whose inventors had surnames beginning with the letter “B.”³⁵ We then classified each assignment contract (and the patents it included) by the identity of the correspondent. Working with lists of patent agents and lawyers from 1883 and 1905, we distinguished correspondents who were formally registered with the Patent Office in at least one of these two years as a separate class of intermediaries. Correspondents who were principals to the contract (either the patentee, the assignor, or the assignee of one of the patents involved) were grouped together in a second category of intermediaries. A third category consisted of third parties who did not appear on either of the two lists of registered agents. It seems likely, however, that we would have been able to identify some of these correspondents as registered agents if we had rosters for additional years. Finally, we include in an “unknown” category cases where no correspondent was reported in the digest. Because some of these contracts in the sample covered more than one patent, we present the data with the unit of analysis defined in two different ways: the individual patent assigned and the complete assignment contract (with the descriptive statistics calculated on the basis of the first patent described in the contract).

[Table 2 about here]

In Table 2 we report descriptive statistics (across both patents and contracts) for each of the correspondent classes for 1871, 1891, and 1911. As is immediately evident, the relative prominence of registered patent agents in this trade increased over time.

Registered agents served as correspondents for 26.1 (29.7) percent of the patents (contracts)

some of the correspondents during this period were merely processing paperwork is also implied by the identification of quite a few of them as congressmen.

assigned in 1871, with their shares increasing to 42.7 (51.8) percent in 1891, and 55.7 (58.1) percent in 1911. The rise in importance of these registered agents was paralleled by a decline in the proportion of patent assignments handled by one of the principals (patentees, assignors, or assignees)—from 33.0 (33.9) percent of patents (contracts) in 1871 to 11.2 (9.5) percent in 1911. There was also a drop in the fraction handled by third parties, indicating that not only was there a shift over time toward the use of intermediaries, but there was a shift toward more specialized ones as well. That registered agents were indeed relatively more specialized in this activity is indicated by the higher average numbers of contracts they handled, compared to correspondents in the other categories. For example, in 1871 the average registered agent served as correspondent for 2.36 contracts, whereas the averages for principals and unregistered third parties were 1.05 and 1.26 respectively. These figures, moreover, undoubtedly underestimate the total number of contracts handled by specialized intermediaries, as they are based on only a small subset of all assignment contracts (3 months of assignments for patents whose patentees had surnames beginning with the letter “B”).

The use of specialized intermediaries seems to have been particularly important for the types of assignments that, as we saw from Table 1, were growing in relative importance by the end of the century—that is, primary assignments that were geographically unrestricted. Although all types of correspondents handled roughly similar proportions of secondary assignments in 1871, by 1911 only 9 percent of the contracts mediated by registered agents (15 percent of patents) involved secondary assignments, as opposed to 24 (28) percent for principals and 21 (31) percent for unregistered third parties. As early as

³⁵ We chose “B” because more surnames began with this letter than with any other. The sample included 286 contracts (involving 437 patents) from 1871, 423 contracts (858 patents) from 1891, and 614

1871, moreover, assignments handled by intermediaries (especially registered agents) were much more likely to be national in scope than those handled by principals. Fully 89 percent of the contracts for which the correspondent was a registered patent agent were national, as opposed to 70 percent for unregistered third parties and 51 percent for principals. Despite the general shift toward national assignments, the differences were still evident in 1911, when 97 percent of the contracts mediated by specialized agents were for national assignments but only 69 percent of the contracts handled by principals.

Although skeptics might object that the increased use of patent agents might simply reflect a growing tendency for employees to transfer patent rights to their employers, rather than a true professionalization of intermediation in arms-length trading of technology, the evidence in the table suggests otherwise. The reported percentages of patent assignments going to companies (as opposed to individuals), show that the trend over time toward assigning patents to companies accounts for very little of the change in the composition of correspondents. If we look at patents, for example, the proportion of the assignments handled by registered agents that went to companies (28, 39, and 61 percent in 1871, 1891, and 1911 respectively) was in general only slightly greater than the fraction in the category handled by principals (24, 28, and 55 percent in the respective years) and that handled by unregistered third parties (20, 48, and 46 percent). It seems, therefore, that the growth of trade in patented technologies over the late nineteenth and early twentieth centuries was indeed accompanied by the emergence and increased importance of agents who were specialized at working in that market.

If patent agents offered efficiency advantages in trading patents, we would expect to find that patentees who employed them were able to dispose of their rights more quickly

contracts (880 patents) from 1911.

than those who used less specialized intermediaries and than those who handled the sale of their patents themselves. Table 2 shows that this expectation is borne out by the data. In 1871, for example, 47 percent of the patent assignments (61 percent of the assignment contracts) handled by registered patent agents occurred before issue, as opposed to only 18 (23 percent) for those handled by unregistered third parties and 9 (8) percent of those handled by principals. At this time, the average interval between application for and grant of a patent was very short—less than half a year. The high proportion of assignments handled by registered agents that nonetheless occurred before issue suggests that these specialists were indeed performing an important matching function—that, perhaps by cultivating long-term relationships with inventors, they were able to obtain advance information about new technologies coming on the market, and that they also had a sufficient range of contacts within the business community to enable them sell patents very quickly.

[Table 3 about here]

Table 3 provides additional evidence that the use of registered agents enabled inventors to dispose of their property rights more quickly than they could on their own. The table reports for different classes of correspondents the distributions of both primary and secondary assignments, broken down by the speed of assignment (measured relative to the date the patent in question was granted by the Patent Office). Once again, assignments handled by registered agents were much more likely to occur before the patent was actually issued than those handled by others. Conversely, registered agents were less likely to handle assignments that occurred more than five-years after issue. These patterns, moreover, held in general for secondary as well as for primary assignments.

We can get a better sense of the importance of the role played by these specialized intermediaries by comparing the characteristics of patentees whose assignments were handled by registered agents to patentees who either negotiated their assignments themselves or relied on other principals (assignors or assignees) to do so. If intermediaries did indeed offer some advantage in trading patent rights, such as lower transactions costs, one would expect that the inventors who sought out relationships with them would be those who were both more specialized at inventive activity and more inclined to extract the returns to their efforts by selling off the rights to their inventions. In order to test this proposition, we retrieved, for each of the assigned patents in our sample, a five-year history of all patents received and assigned at issue by the respective patentees, using the year the assigned patent was granted as the mid-year (thus, we looked two years back and two years forward from the base year). The results, which are reported in Table 2, indicate that the predicted pattern did develop over time.

In 1871 the average five-year total of patents awarded to patentees whose contracts were handled by registered agents was roughly similar to the numbers for patentees whose assignments were handled by the other categories of correspondents (although patentees whose contracts were handled by registered agents were somewhat more likely to assign their patents at issue). By 1891, however, a clear difference had emerged between patentees whose assignments were mediated by third parties and those who used principals as correspondents—both in terms of the average number of patents obtained over the five-year period and the proportion of those patents assigned at issue. As time went on, moreover, the use of the two types of intermediaries grew even more differentiated, such that by 1911 the tendency for patentees who were both most productive and most involved

in the market to turn to registered agents to handle their contracts was even more pronounced. In that year, patentees who used registered agents averaged five-year totals of 6.92 patents weighting over patents (4.99 over contracts), compared to 3.76 (4.04) patents for those who used unregistered third parties and 2.28 (2.45) patents for those who used principals. Patentees who used registered agents also, on average, assigned markedly higher proportions of their patents at issue: 5.97 (4.21) of the patents they received during the five-year period, as opposed to 2.66 (3.11) for those who used unregistered third parties and 0.69 (0.84) for those who relied on principals.

[Table 4 about here]

The increased association between specialized inventors and specialized intermediaries is explored in another way in Table 4. Here the total number of contracts (appearing in our sample) that were handled by each correspondent is employed as an indicator, albeit perhaps a weak one, of his degree of specialization in this function. Although the choices of productive (or specialized) inventors appear to have been little different from those of other patentees in 1871, over time a stronger relationship between specialized inventors and specialized intermediaries emerged. For example, in 1911, 67 percent of the contracts involving the least productive patentees (those with only one patent over five years) were handled by correspondents with only one contract, and a mere 4 percent by correspondents with six or more contracts to their credit. By contrast, patentees with four or more patents over the five-year period were relatively more likely to have turned to correspondents with six or more contracts in our sample (who handled 16 percent of their contracts), and relatively less likely to use correspondents with only one (who handled 35 percent of their contracts). Although not strong evidence, this pattern is

remarkably striking, given that our measure of a correspondent's degree of specialization includes only three months of assignments for patentees with surnames beginning with the letter "B" and, therefore provides only a crude means of distinguishing between specialized and unspecialized correspondents.

[Table 5 about here]

The tendency for patentees with the greatest market involvement to turn to professional intermediaries is also evident in Table 5, which shows that as early as 1871, 80 percent of the patentees who assigned at issue more than 60 percent of their five-year total of patents (not including the patent involved in the assignment originally sampled from the Digest) made use of an intermediary (that is, a correspondent that was not a principal to the contract) for the recorded transaction, and that fully 50 percent employed a registered agent. Over time, moreover, the table reveals a general shift both toward higher rates of assignment and toward the use of registered agents. Indeed, by 1911 the modal cell in the entire distribution was patentees who assigned more than 60 percent of their five-year total of patents and who also used a registered agent. Two-thirds of the patentees who assigned more than 60 percent of their patents employed registered agents for the transaction sampled. These results provide intriguing support for the idea that because registered agents were more efficient at intermediation in the market for technology than other types of correspondents, inventors who wanted to make extensive use of the market sought them out.

The literature on financial markets, to which we alluded in our introduction, makes the case that intermediaries not only improved the efficiency with which funds were transferred from savers to investors, but also raised the level of savings in the economy.

One might expect that the appearance of intermediaries between buyers and sellers of patented technology might have had a similar effect on the pace of technological change by encouraging creative people to specialize in invention. Unfortunately, we cannot test this proposition directly, but the evidence that we can present is highly suggestive. For example, the effect of the growth of the market for patented technology on the assignment behavior of inventors can be traced in Table 6, which reports descriptive statistics for three random cross-sectional samples of patents drawn from the *Annual Reports of the Commissioner of Patents* for the years 1870-71, 1890-91, and 1910-11. It is important to note that the table only includes assignments that were arranged in advance of the grant of the patent. Nonetheless, we can see from the table that there was a sharp increase over time in the proportion of patents thus assigned—from 18.4 to 31.1 percent. There was also a pronounced shift toward assignments in which patentees transferred all rights to their intellectual property to buyers with whom they had no formal connection. In 1870-71, for example, more than half of the assignments (52.1 percent) went to groups that included the patentee. By 1910-11 this proportion had fallen to 25.4 percent. At the same time, the share of assignments going to companies increased sharply from 23.6 percent in 1870-71 to 64.2 percent in 1910-11. Although some of these transfers involved companies in which the patentee had an ownership interest (for example, the proportion made to companies bearing the patentee's name increased from 5.6 percent in 1870-71 to 9.2 percent in 1910-11), the vast majority were arms-length sales. As we have shown in other work, assignments by employees to the firms that employed them were not a major determinant of the increased frequency of assignments at issue or the trend toward assignments to companies.³⁶

³⁶ See Naomi R. Lamoreaux and Kenneth L. Sokoloff, "Inventors, Firms, and the Market for

[Table 6 about here]

That this increased ability to sell off patent rights did indeed make it possible for creative individuals to specialize in inventive activity is supported by the evidence in Table 7, which we constructed first by selecting from our three random cross-sectional samples patentees whose surnames began with the letter “B” and then by collecting data on all the patents awarded to these individuals over the twenty-five years before and after they appeared in one of our samples. We analyze the patenting and assignment behavior of these individuals in two ways: by including in our calculations each patent they obtained and by selecting for analysis only one patent per patentee (the patent included in the original cross-sectional sample). The table reports descriptive statistics for four categories of patentees: those who did not assign their patent before issue; those who assigned the patent but also maintained an ownership interest in it; those who assigned away all of their rights to the patent to an individual; and those who assigned full rights to a company.

[Table 7 about here]

As Table 7 shows, in each of the three time periods patentees who assigned all their rights to companies by the time of issue had very different careers of inventive activity than other groups of patentees. They received many more patents over time, were active at inventive activity for a longer period, and assigned away a much higher proportion of the patents they were awarded. The contrasts are evident as early as the 1870-71 cohort, but they are much starker by 1910-11. For example, the means computed over patentees (patents) drawn in the 1910-11 cross-section indicate that those who assigned their patents at issue to companies received 32.6 (135.6) patents over their careers on average, whereas

Technology in the Late Nineteenth and Early Twentieth Centuries,” in *Learning by Doing in Firms, Markets, and Countries*, Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin, eds. (Chicago:

those who did not assign, those who made only partial assignments, and those who made full assignments to individuals were granted 6.4 (38.2), 2.6 (24.4), and 3.0 (39.2).

In general, Table 7 highlights the emergence over time of two rather sharply differentiated classes of inventors. The first was composed primarily of individuals who tended to retain control of the relatively few patents they received over rather short careers at invention. These occasional inventors had little involvement with the market for technology. The other class of inventors, by contrast, had careers that were largely shaped by the market. They assigned away a high proportion of their inventions (especially to companies) and were quite focused on generating patented inventions, receiving many patents over careers that extended over several decades. Most prolific patentees fell into this second category, and it would seem reasonable to conclude on the basis of the evidence we have collected that the market for technology played a central role in enabling them to specialize in this creative activity.

The Case of Edward Van Winkle

The quantitative evidence thus supports the contention that the use of specialized intermediaries like patent agents and lawyers improved the efficiency of the market for patented technology. Ideally we would like to collect data on the activities of a broad sample of these specialists so that we can document the ways in which they facilitated the sale of patent rights, but most patent agents and lawyers have left only fragmentary traces in the historical record. The fortuitous preservation of one set of business diaries, however, has enabled us to track the activities of one such solicitor, Edward Van Winkle, in unusually close detail. Van Winkle resided in Jersey City, New Jersey, but worked in

New York City. In January 1905, he moved into a new office in the Flatiron Building in lower Manhattan, and for the rest of that year we are able to analyze the relationships he cultivated with men on both sides of the market for technology and to observe the various ways in which he performed the function of intermediary.³⁷

Like many patent agents of the time, Van Winkle's formal training was in engineering rather than law. He was a graduate of Columbia University, and his diary records the pride with which he displayed his certificate of membership in the American Society of Mechanical Engineers, as well as the eagerness with which he sought positions in other engineering societies.³⁸ By contrast, Van Winkle's legal education was quite casual. In 1905, he enrolled in Sprague's Correspondence School, signed up for courses in contracts, agency, partnerships, corporations, and real property, studied the assigned texts during his spare time, took written examinations in these subjects, and received a Certificate of Law—all in the space of five months.³⁹

As befitted his training, Van Winkle earned part of his living as an engineering consultant. For example, in 1905 he was employed by various parties to determine the horsepower needed for a hydraulic pump, design the hub of an automobile wheel, and calculate specifications for a twelve-story apartment house project.⁴⁰ By contrast, he did no legal work outside the area of patents and, indeed, hired other lawyers to represent his interests in lawsuits or to process incorporation papers.⁴¹ Even in the area of patents, his

³⁷ Our main source for the following discussion is Van Winkle's 1905 Diary, but other relevant papers include "Accounts: Personal and Business 1904-1916" and "Reports on Patents, 1905-1907." See Edward Van Winkle Papers, Ac. 669, Rutgers University Libraries Special Collections.

³⁸ For example, his entry for 22 Jun. 1905 proudly recorded that the council of the Canadian Society of Civil Engineers "had passed upon my application for associate grade."

³⁹ See entries for 4 Mar., 6 Mar., 9 Mar., 11 Mar., 3 Apr., 13 Apr., 17 Apr., 10 May, 15 May, 19 May, 10 Jul., 11 Jul., and 24 Jul. 1905, Van Winkle Diary.

⁴⁰ 6 Jan., 10 Jan., 18 Jan., 19 Jan., 27 Feb., 15 May, 16 May, and 22 May 1905, Van Winkle Diary.

⁴¹ See, for example, 24 Jun., 26 Jun., and 30 Jun. 1905, Van Winkle Diary.

legal knowledge seems to have been limited. For example, he asked around and got the name of someone “who is very capable in foreign patent application work” and thereafter subcontracted much of this kind of business to him.⁴² He also did relatively little of the more complex side of patent law, such as defending inventors’ rights in infringement proceedings. Like other patent lawyers, however, he had long-standing relationships with solicitors in other parts of the country. For example, he routinely used the Washington firm of Evans & Company to conduct searches of patent office records and preliminary interviews with patent examiners.⁴³ As we will see, he also had extensive dealings with an agent in another city named Zappert.⁴⁴

Van Winkle’s engineering expertise enabled him to provide technical assistance to businessmen interested in purchasing patents. For example, Frank P. Parker and Frederick J. Bosse brought him a “non-refillable bottle” and several other devices invented by John L. Adams, and requested that he test the inventions and assess their patentability. When Van Winkle reported positively, the men engaged him to process Adams’s patent applications and also papers assigning the patents to themselves.⁴⁵ Parker and Bosse seem to have invested in these patents with the aim of reselling them, for Van Winkle’s diary includes a couple of entries noting visits by potential purchasers, including one businessman who indicated that, though his company did not want to take up the invention, he himself “would be interested to look at it.”⁴⁶ It is unclear, however,

⁴² 1 May 1905, Van Winkle Diary.

⁴³ See, for example, 23 Mar. and 1 Jun. 1905, Van Winkle Diary.

⁴⁴ Zappert’s city of residence is unclear, but was certainly not New York because the only contacts between the two men recorded in the diary occurred by letter. See 11 Mar., 27 Mar., 20 Apr., 28 Apr., 1 Jun., 2 Jun., and 12 Jun. 1905, Van Winkle Diary.

⁴⁵ See the diary entries for 12 Jan., 2, Feb. 22 Mar., 23 Mar., 29 Mar., 6 Apr., 20 Apr., 28 Apr., and 16 Aug. 1905. On 29 Dec. 1905, the same two men brought in a soap shaving machine invented by a Mr. Luis for Van Winkle to examine and evaluate.

⁴⁶ 29 Mar. 1905, Van Winkle Diary. See also 21 Jul. 1905

whether Van Winkle had lined up these potential customers—that is, whether he was functioning as an intermediary in these instances—or whether he was simply providing information to prospective buyers contacted by Parker and Bosse.

On other occasions, however, Van Winkle clearly played the role of intermediary—sometimes on behalf of inventors and sometimes on behalf of purchasers of patents. He noted in his diary, for example, that inventor S. A. Davis “placed in my hands a matter of adjusting royalties + disposing of his drophead patent and said he would give me half of what I collected.”⁴⁷ A businessman named Kendall dropped by Van Winkle’s office to discuss letting him “have the foreign patents in melting furnaces.” Later Kendall called again, and “we started the ball a rolling for sale of foreign pats of the Rockwell furnace.” Among the first steps Van Winkle took in marketing these patents was to forward information about them to Zappert, an agent in another city with whom he had ongoing contact.⁴⁸ Van Winkle also worked from time to time as an intermediary on behalf of parties in other cities. For example, after Zappert wrote and sent him “specimens + literature” about a dry adhesive photographic mounting process, he “took it around to Chas Walsh + he thought it would be a valuable thing to control, he is going to get ideas on the matter and see what he can do towards making some money out of the scheme [sic].”⁴⁹

In some cases Van Winkle himself took a position in a patent as part of the deal. Thus an inventor named Pratt “agreed to let me have that patent [for a differential valve motion] on a shop right royalty of 10¢ and all over that sum I would have if I sold.”⁵⁰

⁴⁷ 5 Jun. 1905, Van Winkle Diary.

⁴⁸ 28 Apr., 9 May, 1 Jun., and 2 Jun. 1905, Van Winkle Diary.

⁴⁹ 27 Mar. 1905, Van Winkle Diary.

⁵⁰ 9 Jun. 1905, Van Winkle Diary.

Indeed, there is evidence that Van Winkle actively sought such participations. For example, he told one of the officers of the Davis, Redpath Company, that “I would sell him the Canadian patent for 5000^{xx} + if he would assine [sic] me” and do certain other things not specified in the diary entry, “[I] would be willing to go in with him.”⁵¹ On still other occasions, he displayed an interest in investing in a new technology long before it got to the patent stage. After “Sol Katz called with a kite proposition,” he began to study kites and flying machines and visit the shops of people who were experimenting with the devices. A month later he and Katz agreed jointly to put up money for the development of a promising invention.⁵²

As one might expect, Van Winkle’s work as intermediary sometimes put him in situations where there was a clear conflict of interest. For example, W. N. Richardson, one of the businessmen with whom he regularly dealt, wanted an option to buy out inventor Edward A. Howe’s interest in some patents. Van Winkle recorded Richardson’s offer as follows: “He will give \$3000 to 4000 for the last two patents and give me a commission of 10%. If I can get the patents for less, will receive a larger fee.”⁵³ Van Winkle called on Howe and “had a hard fight to get Howe to accept terms.” Ultimately, however, after a session that lasted two and a half hours, Howe agreed to accept Richardson’s terms “provided R will give him a free hand in all future patents.”⁵⁴ Somehow, throughout all of these negotiations, Van Winkle managed to be completely above board with the inventor about his interest in the deal. He maintained excellent relations with Howe, who continued to do business with him for the rest of the period of

⁵¹ 25 May 1905, Van Winkle Diary.

⁵² To Van Winkle’s disappointment, the inventor later backed out of the deal. See 7 Jun., 16 Jun., 17 Jun., 18 Jun., 9 Jul., 17 Jul., 23 Jul., 3 Aug., 4 Aug., 19 Sept., 24 Sept., 12 Nov., 13 Nov., 21 Nov., 4 Dec., 18 Dec., 1905, Van Winkle Diary.

the diary. Indeed, after Richardson later decided not to take up the patents, Howe confided to Van Winkle that he had “only signed option so that I [Van Winkle] could collect my fee.” Although this statement should probably not be taken at face value, it is an indication of the strength of the relationship that Van Winkle had been able to build with this inventor.

That Van Winkle was able to cultivate relations of trust with a number of inventors is evinced by their willingness to come back to him again with new ideas. For example, the Adams who invented the non-refillable bottle subsequently approached him seeking “money on a tooth pick scheme. Saturated wooden toothpicks with spice flavors that are antiseptic auromatic [sic], etc.”⁵⁵ Previous work for Pratt involving elevator and escalator devices was what had led Pratt to return and suggest the deal for the differential motion valve.⁵⁶ Similarly, Katz had earlier used Van Winkle to file a patent for a shoe heel.⁵⁷

Not surprisingly, Van Winkle devoted a great deal of his time to cultivating these kinds of personal relationships—not just with inventors but also with businessmen interested in investing in patents. Van Winkle’s diary shows that he spent the bulk of each day receiving visitors, calling on people, and talking business over lunch and dinner at the Columbia Club or other similar places. This constant round of face-to-face meetings helped Van Winkle build relationships of trust with parties on both sides of the market. In addition, these meetings became an important source of tips about potential buyers for inventions, new technologies for Van Winkle to explore, and clients he might

⁵³ 16 May 1905, Van Winkle Diary.

⁵⁴ 16 May and 17 May 1905, Van Winkle Diary.

⁵⁵ 28 Sept. 1905, Van Winkle Diary.

⁵⁶ 7 Feb., 17 Feb., 2 Mar., 23 Mar., and 27 Apr. 1905, VanWinkle Diary.

attract to his practice. Thus when Van Winkle was handling an elevator safety invention for Pratt, he received information from a friend with whom he often dined “that C. L. C. Howe of the N.Y. Life Co was looking for a safety for Elevators.” Van Winkle called on Howe that very afternoon, noting in his diary that “There might be something doing later.”⁵⁸ On another occasion, he lunched with Charlie Halsey, who “said he had some cigarette machine patents + papers which he would bring to my office and let me look over.”⁵⁹ A similar lunch with Robert E. Booream, an inventor whose work embraced electric bridge hoists, washers for gold mining, and methods of roadway construction, yielded the notation that the two men had “lightly touched on business. We will no doubt be associated.”⁶⁰ Van Winkle’s use of the word “associated” suggests that he envisioned his work with Booream to encompass more than simply filing patent applications,” and the diary entries show him later putting Booream in contact with a mining engineer.⁶¹

A few businessmen appeared over and over again in the pages of the diary as purchasers of, or investors in, patents. One of the most striking things about these men is the wide variety of technologies in which they displayed an interest. Richardson, for example, was involved in patents for hat-frame formers, rails for high-speed railroads, electric railroad systems, and pliers.⁶² Another businessman, Arthur DeYoung, was in frequent contact to discuss technologies as diverse as coin counters, arc lamps, and dry mounting processes for photographs.⁶³ The most intriguing case is a man who is identified in the records only as Mr. Oliver, although he was closely associated with Van

⁵⁷ 4 Feb., 5 Apr., and 22 May, Van Winkle Diary.

⁵⁸ 31 Mar. 1905, Van Winkle Diary.

⁵⁹ 8 Aug. 1905, Van Winkle Diary.

⁶⁰ 24 Jan. 1905, Van Winkle Diary. See also 5 Mar., 7 Jun., and 12 Jun. 1905.,

⁶¹ 7 Jun. And 8 Jun. 1905, Van Winkle Diary.

⁶² See, for examples, 30 Jan., 16 Mar., 17 Mar., 1 Apr., 1 May, and 7 May 1905, Van Winkle Diary.

Winkle in a number of important deals. Oliver's investments spanned the full gamut of technologies, from envelopes to drills to arc lamps to sewing machines to signaling systems for railroads.⁶⁴

The wide variety of technologies in which these men were interested suggests that they were not primarily manufacturers seeking to purchase new inventions to improve the efficiency of their enterprises or expand their product lines. Instead, they seem to have been functioning essentially as venture capitalists eager to profit from cutting-edge technologies by getting in on the ground floor. Sometimes getting in on the ground floor simply meant purchasing the rights to promising new technologies. Richardson, for example, typically operated this way. Similarly, Oliver offered an inventor named Peters a note for \$100,000 in exchange for the assignment of a patent for a wireless receiver—after Oliver and Van Winkle had thoroughly discussed possible complications from the Deforrest Company, the value of foreign patents, and the likelihood of marketing the device to the U.S. government.⁶⁵

Sometimes, however, getting in on the ground floor meant much more—meant actually organizing companies to develop and exploit an invention's potential. Van Winkle was involved in at least two such promotions during the period of the diary: the Simplex Machine Company and the Automatic Security Signal Company.⁶⁶ Both efforts

⁶³ See, for examples, 6 Jan., 28 Jan., and 13 Jun. 1905, Van Winkle Diary.

⁶⁴ See, for examples, 1 Jan., 4 Feb., 16 Feb., 23 Feb., 7 Apr., 11 May, 20 May, and 6 Sept. 1905, Van Winkle Diary. Oliver also financed the invention of a cloth guide for sewing machines by Van Winkle himself. See entries for 24 Aug. and 29 Aug. 1905.

⁶⁵ See diary entry for 20 May 1905. Oliver and Peters subsequently had some disagreement about the terms of the arrangement, and it is not clear from the diary whether the deal actually went through. See also 21 Jan., 24 Jan., 25 Feb., 28 Feb., 2 Mar., 13 May, 22 May, and 27 May 1905, Van Winkle Diary.

⁶⁶ Van Winkle was also involved with DeYoung in a coincounting venture, but the two men appear to have been shut out of the resulting company and had to negotiate to have their interests in the patents bought out. See 6 Jan., 28 Jan., 23 Feb., 4 Mar., 9 Aug., 16 Aug., 18 Aug., and 14 Sept., 1905, Van Winkle Diaries.

concerned inventions patented by William M. Murphy, and in each case Van Winkle worked closely with Oliver. These promotions suggest that the roles of patent agents as intermediaries could extend far beyond simply matching inventors with potential buyers of their patents. Although Van Winkle did not handle the formal legal work associated with incorporation, he did everything else: he brokered agreements between the inventor and the main investors, arranged for the inventor to assign his patents to the company, arranged for the application and sale of foreign patents, worked to find buyers for the companies' securities and customers for the companies' products, and even helped the inventor work out knotty technical details.⁶⁷ In exchange, he received payment in the form of shares in the new company's stock. In the case of Simplex, for example, he received 25 out of 500 shares; Murphy received 175.⁶⁸

Although we have no basis for assuming that Van Winkle was representative of the general population of patent lawyers, his diary nonetheless offers an intriguing window on the market for patented technology, allowing us to observe in close detail some of the ways in which patent attorneys might improve the efficiency of this kind of trade. The diary provides concrete evidence of the extensive investments that intermediaries had to make in cultivating the trust of participants on both sides of the market—the time and resources that had to be devoted to building personal relations with inventors and also with businessmen who were potential buyers of patented technology. The diary also highlights the very personal nature of many of the channels through which information about inventions flowed during this period. Despite the existence of

⁶⁷ See 27 Feb., 22 Mar., 14 Apr., 20 Apr., 11 May, 12 May, 5 Jun., 15 Jun., 21 Jun., 26 Jun., 17 Jul., 8 Aug., and 14 Aug., 1905, Van Winkle Diary.

⁶⁸ See page inserted by the entry of 27 Jul. 1905, Van Winkle Diary. Neither of these companies appear to have been successful, but that is a subject for another paper.

publications that specialized in reporting new technological developments, the operation of the market for technology depended to a large extent on the circulation by word of mouth of details about new inventions that had not yet been fully worked out—details patent agents and lawyers were uniquely well placed both to obtain and assess. More interesting still, the diary opens a window on a world hitherto largely unknown—a world in which businessmen who were operating in effect as venture capitalists eagerly purchased interests in patents, and where attorneys like Van Winkle not only helped them by assessing the investment potential of new inventions, but also played a vital role in bringing businessmen and inventors together in companies formed to exploit these promising new technologies.

Although much work needs to be done to assess the extent and importance of such activities during the late nineteenth and early twentieth centuries, evidence from interference records and other sources suggests that Van Winkle and his associates were by no means alone. For example, Lansing Onderdonk, a sewing machine inventor, testified that he and patent attorney Henry P. Wells had been part of a group that had organized a business, in the early 1880s, to exploit a combination plaiting and ruffling attachment for sewing machines.⁶⁹ The president of the Bonsack Machine Company, Demetrius B. Strouse, was none other than the patent attorney who had filed James A. Bonsack's original cigarette machine patents.⁷⁰ To give a final, but very suggestive example, patent lawyer Grosvenor Porter Lowrey played an important role in putting together financing for Thomas Edison's work in electric lighting. Lowrey was a partner

⁶⁹ See "Deposition of witnesses examined on behalf of Lansing Onderdonk," pp. 32-4, *Onderdonk v. Mack* (1897), Case 18,194, Box 2,521, Interference Case Files, 1836-1905.

⁷⁰ See "Testimony on Behalf of Bonsack," pp. 45-46, *Bohls v. Bonsack* (1893), Case 15,678, Box 2,159, Interference Case Files, 1836-1905.

in the firm of Porter, Lowrey, Soren & Stone and also general counsel for Western Union. In this latter capacity, he had handled a number of patents for Edison and had developed a close relationship with the inventor. Edison was thinking of working on electric lighting, but had put the idea aside because he could not see how to come up with the funding he needed for the project. Lowrey came to his aid by putting together “a syndicate of his friends and closest business associates,” including some of his legal partners, colleagues from Western Union, and personal friends such as the Fabbri brothers, partners in Drexel, Morgan & Company. Financing from this group enabled Edison to create the primitive research lab at Menlo Park where he conducted his experiments with incandescent lighting. When the experiments proved successful, Lowrey convinced essentially same people to organize the Edison Electric Light Company in 1878.⁷¹

Conclusion

This essay has investigated the institutions that helped to make the late nineteenth and early twentieth century such a fertile period in U.S. technological history. As we have argued, the creation of a well-developed market for patented technology facilitated the emergence of a group of highly specialized and productive inventors by making it possible for them to transfer to others responsibility for developing and commercializing their inventions. The most basic of the institutional supports that made this market possible was, of course, the patent system, which created secure and tradable property rights in invention. But, as we have argued, trade was also facilitated by the emergence of intermediaries who

⁷¹ See especially Jocelyn Pierson Taylor, *Mr. Edison's Lawyer: Launching the Electric Light* (New York: Topp-Litho, 1978), pp. 32-4.

economized on the information costs associated with assessing the value of inventions and helped to match sellers and buyers of patent rights. Patent agents and lawyers were particularly well placed to provide these kinds of services, because they were linked to similar attorneys in other parts of the country and because, in the course of their regular business activities, they accumulated information about participants on both sides of the market for technology. As our quantitative analysis of assignment contracts demonstrated, patentees whose assignments were handled by these specialists assigned a greater fraction of their patents and also were able to find buyers for their inventions much more quickly than other patentees.

In the case of financial markets, scholars have argued that the emergence of banks and other similar kinds of formal intermediaries not only improved the efficiency with which capital was transferred from savers to investors, but also had a more profound effect on the economy by raising the general level of savings and investment. Although we do not have the evidence we need to test formally whether levels of inventive activity were similarly spurred by the appearance of specialized intermediaries in the market for patents, our results provide at least circumstantial support for such a view. Thus we have shown that inventors who were most specialized in patenting (that is, had the greatest numbers of patents over a five-year period) and who were most involved in the market (that is, had assigned a higher fraction of these patents at issue) made the most extensive use of registered intermediaries. Moreover, our analysis of the longitudinal “B” sample indicates that inventors who were most involved in the market both had the longest patenting careers and received the highest numbers of patent grants over their careers. In other words, the development of institutions supporting market trade in patented technology seems to have

made it possible for creative individuals to specialize more fully in inventive work—that is, it seems to have set in motion the kind of Smithian process that generally has been associated with higher rates of productivity, in this case in the generation of new technological knowledge.

TABLE 1

DESCRIPTIVE STATISTICS ON ASSIGNMENTS MADE BEFORE
AND AFTER ISSUE OF PATENTS

	1870-71	1890-91	1910-11
New England			
Assignment to Patenting Index	115.1	109.5	132.4
% Assigned After Issue	70.4	31.2	30.1
% Secondary Assignments	26.6	14.8	12.0
% Geographic Assignments	17.1	0.8	0.0
Middle Atlantic			
Assignment to Patenting Index	100.7	94.8	116.3
% Assigned After Issue	70.9	44.4	37.9
% Secondary Assignments	33.3	16.4	11.0
% Geographic Assignments	19.1	1.9	0.7
East North Central			
Assignment to Patenting Index	96.3	118.1	104.9
% Assigned After Issue	77.7	48.5	32.8
% Secondary Assignments	18.1	18.4	11.8
% Geographic Assignments	34.3	5.7	1.8
West North Central			
Assignment to Patenting Index	90.7	110.1	73.5
% Assigned After Issue	77.4	48.6	42.6
% Secondary Assignments	32.3	19.2	11.0
% Geographic Assignments	41.9	13.0	2.6
South			
Assignment to Patenting Index	60.0	68.9	68.0
% Assigned After Issue	74.4	42.3	48.2
% Secondary Assignments	27.9	11.3	19.1
% Geographic Assignments	20.9	6.2	2.5
West			
Assignment to Patenting Index	150.0	67.2	81.5
% Assigned After Issue	59.1	57.4	36.0
% Secondary Assignments	22.7	11.4	10.4
% Geographic Assignments	18.2	7.4	1.2
Total Domestic			
Assignment to Patenting Index	100.0	100.0	100.0

% Assigned After Issue	72.3	44.1	36.5
% Secondary Assignments	27.8	16.4	12.0
% Geographic Assignments	22.8	4.6	1.2
Assignments to Patents Ratio	0.83	0.71	0.71
Number of Contracts	794	1,373	1,869

Sources and Notes: Our sample consists of all assignment contracts filed with the Patent Office during the months of January 1871, January 1891, and January 1911. These contracts are recorded in “Liber” volumes stored at the National Archives. There are a total of about 4,600 contracts in our sample. Only those involving assignors that resided in the United States are included in this table. The assignment to patenting index is based on the ratio of assignments originating in the respective regions (given by the residence of the assignor) to the number of patents filed from that region in 1870, 1890, and 1910 respectively. In each year the index has been set so that the national average equals 100. The percentage of secondary assignments refers to the proportion of assignments where the assignor was neither the patentee nor a relative of the patentee. The percentage of geographic patent assignments refers to the proportion of assignments where the right transferred was for a geographic unit smaller than the nation.

TABLE 2

DESCRIPTIVE STATISTICS ON PATENT ASSIGNMENT,
BY CORRESPONDENT TYPE, 1871-1911

		Registered Patent Agent	Patentee, Assignor, or Assignee	Third Party but not Registered	Unknown
1871					
Number	Patents	114	144	126	53
	Contracts	85	98	82	21
% of Total Number	Patents	26.1	33.0	28.8	12.1
	Contracts	29.7	33.9	29.4	7.0
Proportion Assigned Before Issue	Patents	0.47	0.09	0.18	—
	Contracts	0.61	0.08	0.23	—
Proportion Secondary Assignments	Patents	0.35	0.33	0.32	0.85
	Contracts	0.20	0.31	0.30	0.80
Proportion National Assignments	Patents	0.89	0.53	0.71	—
	Contracts	0.89	0.51	0.70	—
Proportion Assigned to Company	Patents	0.28	0.24	0.20	0.66
	Contracts	0.25	0.16	0.20	0.48
Prop. Where Patentee in County With City of >100,000	Patents	0.46	0.28	0.40	0.32
	Contracts	0.39	0.31	0.35	0.38
Patentees' Ave. 5-Yr. Total of Patents	Patents	3.90	3.73	3.35	4.69
	Contracts	2.45	3.10	3.27	3.05
Patentees' Ave. 5-Yr. Total of Patents Assigned at Issue	Patents	1.47	0.88	0.80	0.88
	Contracts	1.08	0.64	0.88	0.70
Ave. No. of Contracts Assigned by Correspondent	Contracts	2.36	1.05	1.26	—

1891					
Number	Patents	336	188	235	69
	Contracts	219	89	88	27
% of Total Number	Patents	42.7	21.9	27.4	8.0
	Contracts	51.8	21.0	20.8	6.4
Proportion Assigned Before Issue	Patents	0.44	0.15	0.32	0.24
	Contracts	0.52	0.18	0.40	0.37
Proportion Secondary Assignments	Patents	0.20	0.31	0.37	0.81
	Contracts	0.13	0.25	0.23	0.78
Proportion National Assignments	Patents	0.91	0.78	0.86	–
	Contracts	0.94	0.72	0.78	–
Proportion Assigned to Company	Patents	0.39	0.28	0.48	0.68
	Contracts	0.41	0.27	0.45	0.52
Prop. Where Patentee in County With City of >100,000	Patents	0.51	0.45	0.55	0.58
	Contracts	0.46	0.45	0.48	0.52
Patentees' Ave. 5-Yr. Total of Patents	Patents	6.61	3.65	5.80	5.45
	Contracts	4.90	3.43	5.17	3.00
Patentees' Ave. 5-Yr. Total of Patents Assigned at Issue	Patents	4.29	1.10	3.50	3.65
	Contracts	3.39	1.27	3.43	1.74
Ave. No. of Contracts Assigned by Correspondent	Contracts	1.77	1.07	1.24	–

1911					
Number	Patents	467	94	189	89
	Contracts	337	55	112	77
% of Total Number	Patents	55.7	11.2	22.5	10.6
	Contracts	58.1	9.5	19.2	13.2
Proportion Assigned Before Issue	Patents	0.70	0.15	0.31	–
	Contracts	0.72	0.18	0.41	–
Proportion Secondary Assignments	Patents	0.15	0.28	0.31	–
	Contracts	0.09	0.24	0.21	–

Proportion National Assignments	Patents	0.97	0.69	0.89	—
	Contracts	0.97	0.69	0.92	—
Proportion Assigned to Company	Patents	0.61	0.55	0.46	—
	Contracts	0.57	0.47	0.51	—
Prop. Where Patentee in County With City of >100,000	Patents	0.51	0.32	0.49	0.37
	Contracts	0.50	0.40	0.43	0.39
Patentees' Ave. 5-Yr. Total of Patents	Patents	6.92	2.28	3.76	2.96
	Contracts	4.99	2.45	4.04	3.13
Patentees' Ave. 5-Yr. Total of Patents Assigned at Issue	Patents	5.97	0.69	2.66	2.49
	Contracts	4.21	0.84	3.11	2.64
Ave. No. of Contracts Assigned by Correspondent	Contracts	1.72	1.04	1.24	—

Sources and Notes: The data were collected from the manuscript Digests of assignment contracts for patentees whose family names began with the letter “B.” Our data set includes information on all such patent assignments filed with the Patent Office during the months of January through March for 1871, 1891, and 1911. Because some contracts involved the sale or transfer of more than one patent, and some encompassed multiple transfers of the same patent (such as the sale of a patent from A to B, and then another transfer of the patent from B to C), we report one set of figures computed over all patents assigned and another set computed over all contracts. For every patent in our sample of assignments, we compiled a five-year record of all of the patents received by the patentee, using the year of the assigned patent as the central year. From this record, we computed the total number of patents the patentee received over the five years and the total number of these patents that he assigned at issue. We categorized each assignment contract (and the patents it included) by the identity of the person to whom all correspondence about the assignments was to be addressed. Working with lists of patent agents and lawyers from 1883 and 1905, we distinguished correspondents who were formally registered with the Patent Office in at least one of these two years as a separate class of intermediaries. Correspondents who were principals to the contract (either the patentee, the assignor, or the assignee of one of the patents involved) were grouped together in a second category of intermediaries. A third category consisted of third parties who did not appear on either of the two lists of registered agents that we relied upon. It seems likely, however, that we would have been able to identify some of these correspondents as registered agents if we had rosters for additional years. Finally, we include an “unknown” category that is primarily composed of cases where multiple patents were assigned together and where the details of the contract were summarized in

the record of another patentee whose family name began with a letter other than “B”—
and was thus in another Digest volume.

TABLE 3

DISTRIBUTION OF ASSIGNMENTS BY DATE AND TYPE OF ASSIGNMENT
AND BY CORRESPONDENT CLASS

		Assignment Before Issue of Patent		After Issue, but Within 5 Years		Assignment More Than 5 Years After Issue		Total	
		No.	%	No.	%	No.	%	No.	%
		1871							
Registered Patent Agent	Prim.	40	69.0	17	29.3	1	1.7	58	24.3
	Sec.	5	13.2	26	68.4	7	18.4	38	23.3
Principal	Prim.	12	12.8	77	81.9	5	5.3	94	39.3
	Sec.	0	—	39	86.7	6	13.3	45	27.6
Unregistered Third Party	Prim.	21	26.6	53	67.1	5	6.3	79	33.1
	Sec.	0	—	31	81.6	7	18.4	38	23.3
Unknown	Prim.	0	—	6	75.0	2	25.0	8	3.4
	Sec.	1	2.4	38	90.5	3	7.1	42	25.8
Total	Prim.	73	30.5	153	64.0	13	5.4	239	
	Sec.	6	3.7	134	82.2	23	14.1	163	
1891									
Registered Patent Agent	Prim.	141	48.3	127	43.5	24	8.2	292	50.3
	Sec.	20	27.0	40	54.1	14	18.9	74	27.1
Principal	Prim.	25	19.4	82	63.6	22	17.1	129	22.2
	Sec.	4	6.8	27	45.8	28	47.5	59	21.6
Unregistered Third Party	Prim.	60	40.8	59	40.1	28	19.1	147	25.3
	Sec.	14	16.1	47	54.0	26	29.9	87	31.9
Unknown	Prim.	7	53.9	2	15.4	4	30.8	13	2.2
	Sec.	9	17.0	28	52.8	16	30.2	53	19.4
Total	Prim.	233	40.1	270	46.5	78	13.4	581	
	Sec.	47	17.2	142	52.0	84	30.8	273	

1911

Registered Patent Agent	Prim.	231	76.5	57	18.9	14	4.6	303	63.7
	Sec.	19	33.9	25	44.6	12	21.4	56	43.4
Principal	Prim.	12	18.8	40	62.5	12	18.8	64	13.5
	Sec.	1	4.6	17	77.3	4	18.2	22	17.1
Unregistered Third Party	Prim.	46	42.6	45	41.7	17	15.7	108	22.8
	Sec.	4	7.8	36	70.6	11	21.6	51	39.5
Total	Prim.	289	61.0	142	30.0	43	9.1	474	
	Sec.	24	18.6	78	60.5	27	20.9	129	

Sources: See Table 2.

Notes: The unit of analysis in this table is the patent. For 1911, we omit the unknown category because we have no information on the assignments as well as on the correspondents for those cases.

TABLE 4

DISTRIBUTION OF CONTRACTS BY THE FIVE-YEAR TOTAL OF PATENTS
RECEIVED BY THE INVENTOR AND BY THE NUMBER OF
CONTRACTS HANDLED BY THE CORRESPONDENT

		Number of Contracts Handled by Correspondent				
		1	2-3	4-5	6+	Total
1871 Patentees with						
1 Patent	Number	64	18	5	12	99
	Row %	65	18	5	12	
	Col. %	36	37	29	52	37
2-3 Patents	Number	73	17	6	10	106
	Row %	69	16	6	9	
	Col. %	41	35	35	43	39
4+ Patents	Number	43	14	6	1	64
	Row %	67	22	9	2	
	Col. %	24	29	35	4	24
Total	Number	180	49	17	23	269
	Row %	67	18	6	9	
1891 Patentees with						
1 Patent	Number	79	24	3	10	116
	Row %	68	21	3	9	
	Col. %	35	23	10	26	29
2-3 Patents	Number	66	31	14	19	130
	Row %	51	24	11	15	
	Col. %	30	30	48	50	33
4+ Patents	Number	78	50	12	9	149
	Row %	52	34	8	6	
	Col. %	35	48	41	24	38
Total	Number	223	105	29	38	395
	Row %	56	27	7	10	
1911 Patentees with						
1 Patent	Number	137	35	23	9	204

	Row %	67	17	11	4	
	Col. %	48	27	37	21	39
2-3 Patents	Number	83	32	13	3	131
	Row %	63	24	10	2	
	Col. %	29	25	21	7	25
4+ Patents	Number	64	61	27	30	182
	Row %	35	34	15	16	
	Col. %	23	48	43	71	35
Total	Number	284	128	63	42	517
	Row %	55	25	12	8	

Notes and Sources: See Table 2.

TABLE 5

DISTRIBUTION OF ASSIGNED PATENTS BY CORRESPONDENT TYPE AND BY
PROPORTION OF PATENTEE'S FIVE-YEAR PATENTS
THAT WERE ASSIGNED AT ISSUE

Proportion of Five-Year Patents Assigned at Issue	Registered Patent Agent		Inventor, Assignor, or Assignee		Unregistered Third Party		Unknown		Total	
	No.	Row %	No.	Row %	No.	Row %	No.	Row %	No.	Col. %
1871										
0	10	13.7	17	23.3	20	27.4	26	35.6	73	46.5
0+ to 0.2	0	—	3	30.0	4	40.0	3	30.0	10	6.4
0.2+ to 0.4	11	29.7	19	51.4	6	16.2	1	2.7	37	23.6
0.4+ to 0.6	5	29.4	5	29.4	7	41.2	0	—	17	10.8
> 0.6	10	50.0	4	20.0	6	30.0	0	—	20	12.7
Total	36	22.9	48	30.6	43	27.4	30	19.1	157	
1891										
0	40	28.4	57	40.4	33	23.4	11	7.8	141	27.6
0+ to 0.2	9	25.7	4	11.4	16	45.7	6	17.1	35	6.9
0.2+ to 0.4	14	28.6	12	24.5	19	38.8	4	8.2	49	9.6
0.4+ to 0.6	20	37.7	8	15.1	15	28.3	10	18.9	53	10.4
> 0.6	134	57.5	21	9.0	56	24.0	22	9.4	233	45.6
Total	217	42.5	102	20.0	139	27.2	53	10.4	511	
1911										
0	26	44.8	10	17.2	20	34.5	2	3.5	58	9.3
0+ to 0.2	4	33.3	4	33.3	4	33.3	0	—	12	1.9
0.2+ to 0.4	8	57.1	0	—	4	28.6	2	14.3	14	2.2
0.4+ to 0.6	17	73.9	2	8.7	3	13.0	1	4.4	23	3.7
> 0.6	275	66.6	19	4.6	66	16.0	53	12.8	520	82.9
Total	330	52.6	35	5.6	97	15.5	58	9.3	627	

Sources: See Table 2.

Notes: The unit of analysis in this table is the patent. For each patent, the proportion of five-year patents assigned at issue was calculated by subtracting from the patentees' five-

year total the patent originally sampled from the digest of assignment contracts and then computing for the remaining patents the proportion assigned at issue.

TABLE 6

ASSIGNMENT OF PATENTS AT ISSUE, 1870-1911

	1870-71	1890-91	1910-11
Number of Patents	1,563	2,031	2,512
% of Patents Assigned	18.4	29.3	31.1
% of Assignments to Group Including Patentee	52.1	41.5	25.4
% of Assignments in Which Patentee Assigned Away All Rights to Unrelated Individuals	24.7	11.1	10.4
% of Assignments in Which Patentee Assigned Away All Rights to a Company	23.6	47.1	64.2
% of Assignments in Which Patentee Assigned Away All Rights to a Company with the Same Name as the Patentee	5.6	11.8	9.2

Sources and Notes: The table is based on three random cross-sectional samples of patents drawn from the *Annual Report of the Commissioner of Patents* for the years 1870-71, 1890-91, 1910-11. The three samples total slightly under 6,600 patents, including those granted to foreigners. The table includes only patents awarded to residents of the United States. The category “% of Assignments to Group Including Patentee” consists of patents assigned to one or more individuals including the patentee, an individual with the same family name as the patentee, or an individual specifically designated as an agent for the patentee. Patents assigned to companies with the same last name as the patentee were included in the general category of patents assigned to companies, as well as in the particular category of companies with the same name as the patentee. It is, of course, also possible that patentees had an ownership stake in companies that did not bear their name.

TABLE 7

DESCRIPTIVE STATISTICS ON THE CAREERS OF PATENTEES
IN THE "B" SAMPLE

	1870-71	1890-91	1910-11	Total
	<u>Means Computed Over Patentees</u>			
Not Assigned at Issue				
Ave. No. of Patents	8.0	10.0	6.4	7.9
Length of Career (Yrs.)	13.2	14.7	11.1	12.7
Career Assign. Rate (%)	8.3	11.5	9.2	9.6
Number of Patentees	121	117	178	416
Percent of All Patentees	84.6	63.9	75.7	74.2
Share Assignment				
Ave. No. of Patents	5.4	11.1	2.6	6.9
Length of Career (Yrs.)	10.6	13.5	8.1	11.0
Career Assign. Rate (%)	67.1	75.3	87.5	76.7
Number of Patentees	13	19	14	46
Percent of All Patentees	9.1	10.4	6.0	8.2
Full Assign. to Individual				
Ave. No. of Patents	5.3	29.0	3.0	12.1
Length of Career (Yrs.)	12.0	18.3	5.3	11.9
Career Assign. Rate (%)	52.1	74.1	76.4	66.7
Number of Patentees	7	6	6	19
Percent of All Patentees	4.9	3.3	2.6	3.4
Full Assign. to Company				
Ave. No. of Patents	30.0	23.7	32.6	28.0
Length of Career (Yrs.)	25.5	21.7	23.5	22.6
Career Assign. Rate (%)	62.1	70.7	80.9	75.2
Number of Patentees	2	41	37	80
Percent of All Patentees	1.4	22.4	15.7	14.3
	<u>Means Computed Over Patents</u>			
Not Assigned at Issue				
Ave. No. of Patents	20.0	39.7	38.2	33.7
Length of Career (Yrs.)	21.5	28.2	26.0	25.6
Career Assign. Rate (%)	14.2	23.5	22.0	20.4
Number of Patents	900	1264	1053	3217
Percent of All Patents	80.0	50.1	43.8	53.1
Share Assignment				

Ave. No. of Patents	19.3	40.5	24.4	30.7
Length of Career (Yrs.)	20.7	27.5	25.6	25.4
Career Assign. Rate (%)	39.9	66.5	62.8	59.4
Number of Patents	75	156	108	339
Percent of All Patents	6.6	6.2	4.5	5.6
Full Assign. to Individual				
Ave. No. of Patents	27.3	76.5	39.2	58.6
Length of Career (Yrs.)	26.1	30.6	28.3	29.2
Career Assign. Rate (%)	40.3	77.0	70.9	67.9
Number of Patents	82	224	74	381
Percent of All Patents	7.3	8.9	3.1	6.2
Full Assign. to Company				
Ave. No. of Patents	35.9	62.5	135.6	101.8
Length of Career (Yrs.)	26.6	32.9	35.1	33.9
Career Assign. Rate (%)	53.3	78.0	85.5	81.3
Number of Patents	73	880	1168	2121
Percent of All Patents	6.5	34.9	48.6	35.0

Sources and Notes: The table is based on a longitudinal data set constructed by selecting all of the patentees in the cross-sectional samples (see Table 6 for a description) whose family names began with the letter “B” and collecting information from the *Annual Reports of the Commissioner of Patents* on the patents they received during the twenty-five years before and after they appeared in the samples. This data set contains information on 6,057 patents granted to 561 “B” inventors. The top panel treats each patentee as a single case, based on the patent that appeared in the cross-section. The bottom panel analyzes each patent obtained by the patentee separately. Patentees are divided into categories depending on whether the patent in the original cross-section was assigned at issue or not and how that assignment was made. The career assignment rate includes only assignments at issue.