

SHOULD BUSINESS METHOD INVENTIONS BE PATENTABLE?

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“The question in this case turns on whether a patent can be issued for a claimed invention designed for the business world.”

Bilski v. Kappos 561 U.S. ____ (2010).

1. INTRODUCTION

Questioning the patentability of business methods is a lot like trying to close the barn door after the horse has bolted. The United States has awarded business method patents practically since the establishment of the patent system in 1790.¹ In its first fifty years, the U.S. Patent Office granted forty-one financial patents covering arts of bank notes, bills of credit, bills of exchange, check blanks, detecting and preventing counterfeiting, coin counting, interest calculation tables, and lotteries.² The U.S. Patent and Trademark Office (USPTO) has awarded many business method patents in a wide variety of categories, including over 100,000 patents since 1976 in Patent Class 705, “Data Processing: Financial, Business Practice, Management, or Cost/Price Determination.”³ *State Street* strengthened the patentability of business methods by the test that such inventions must produce a “useful, concrete and tangible result.”⁴ In the wake of *State Street*, business method patenting increased in both volume and complexity.⁵ Inventive efforts in the area of business methods grew rapidly and were compared to a “flood,” a “frenzy,” and a “gold rush.”⁶ To undo patent protections for business method inventions would create substantial economic costs and would adversely impact technological change in computer

¹ USPTO (2010, 2) (“The first financial patent was granted on March 19, 1799, to Jacob Perkins of Massachusetts for an invention for ‘Detecting Counterfeit Notes.’”).

² *Id.*, citing Edmund Burke, Commissioner of Patents, List of Patents for Inventions and Designs, Issued by the United States from 1790 to 1847 (1847).

³ A search conducted by author on July 8, 2010, of the USPTO data base for Patent Class 705 yielded 1,143 hits before 1976 and 105,811 hits from 1976 to the present. See <http://patft.uspto.gov/>.

⁴ *State Street Bank & Trust Co v. Signature Financial Group, Inc.*, 149 F. 3d 1368, 1373— (Fed. Cir. Jul. 23, 1998.)

⁵ See USPTO (2010, 22) and Robert Hunt (2010, 322).

⁶ At the height of the dot-com bubble, Kevin Rivette & David Kline (2000, 6) wrote that “Nowhere is the frenzy over patent rights more intense, however, than in the emerging electronic commerce industries of the Internet, where entrepreneurs are rushing to stake their proprietary claims to this booming new frontier of business.” See also Michael Meurer (2002); Arti Rai (2000, 199, 211).

hardware, software, communications, and the Internet. More than avoiding such disruptions, however, the case for patenting business method inventions rests on fundamental economic principles.

Extensive patenting of business method inventions and related legal battles have generated controversy. Some researchers blame the patent system's problems on business method inventions. James Bessen and Michael Meurer (2008) argue that the patent system is a "failure" because patents do not provide the type of clarity and protections that one might expect from physical property rights. They observe that "patents on software, and especially patents on business methods (which are largely software patents), stood out as being particularly problematic."⁷ Dan Burk and Mark Lemley (2009) find that business method inventions are responsible for a "crisis" in the patent system. Burk and Lemley (2009) contend that the courts should solve the problem by varying intellectual property (IP) protections across industries, with particular scrutiny of "bad patents" for software and business methods.⁸

The debate over business method patenting is reflected in the Supreme Court's contentious *Bilski* decision.⁹ How this debate is resolved has crucial implications for public policy towards invention, innovation, and entrepreneurship. I conduct an economic and legal analysis of business method inventions to determine whether such inventions should be patentable. I conclude that *State Street* got it right – the patent system should provide IP protections for business method inventions just as it does for other types of inventions.

I begin by providing an economic definition of business method inventions that serves as a guide to the IP debate. I define a *business method invention* as the discovery of a commercial technique that firms can apply to address market opportunities. This is significant because the initial implementation of a business method invention by firms is a *Schumpeterian innovation*. Business method inventions thus are the commercial discoveries and ideas that drive subsequent

⁷ Bessen and Meurer (2008, 187).

⁸ See Burk and Lemley (2009, 158) ("the solution to the problem of bad patents in the software and business method fields is not the creation of absolute rules against patentability, but the application of existing doctrines designed to weed out bad patents, and if necessary the reform of other doctrines that encourage litigation abuse.")

⁹ *Bernard L. Bilski and Rand A. Warsaw v. David J. Kappos, Undersecretary of Commerce for Intellectual Property and Director, Patent and Trademark Office*, U.S. Supreme Court Slip Opinion No. 08–964 (June 28, 2010), 561 U.S. ____ (2010), hereafter *Bilski*.

commercial innovation, which is the implementation of those discoveries. The economic definition of a business method invention builds on developments in the economic theory of the firm, the economics of transaction costs, the economics of innovation and entrepreneurship, and financial economics. Entrepreneurs and managers implement business method inventions by establishing new types of firms, developing new industries, and improving the productivity and performance of established firms. Patents for business method inventions not only provide incentives to invent *before* the patent award, they facilitate innovation that implements the invention *after* the patent award.

Based on this economic framework, I advance several arguments for the patentability of business method inventions. First, patents for business method inventions are important for entrepreneurship and for the commercialization of many scientific and technological inventions. A major study conducted by Stuart Graham et al. (2009) finds that entrepreneurs tend to benefit from patents, which confer competitive advantage, protect technology from copying by rivals, assist in obtaining financing, and enhance the startup's reputation. The work of Graham et al. illustrates the complex ways that IP protections for business method inventions affect subsequent innovation by entrepreneurs. I argue further that business method inventions provide a major channel for commercialization of scientific and technological discoveries and are important for entrepreneurship. Business method inventions often contain scientific and technological discoveries and help to commercialize scientific and technological discoveries already developed. Business method inventions that commercialize information and communications technology (ICT) often are targeted towards electronic commerce (e-commerce) applications. Restrictions on patenting business methods would cause inventors to present their discoveries under various other categories and could prejudice the awarding of patents for scientific and technological discoveries with commercial applications.

Second, I show that business method inventions should be patentable because IP protections are essential for economic efficiency. I emphasize that business method patents increase dynamic, allocative, and transaction efficiencies in the market for discoveries because they facilitate the commercialization of invention. I address concerns of critics regarding the legal and administrative costs of business method patents. I show how some critics of business method patents offer economically-flawed recommendations for IP rules that would reward

inventors based on the costs of invention. In contrast, maintaining patentability of business method inventions allows markets to reward inventors based on the benefits of invention.

Third, I explain that business method inventions are critical for what I refer to as the “Business Revolution,” which represents a fundamental transformation of the economy and a major source of economic growth. The Business Revolution is changing the office, the store, and the market, just as the Industrial Revolution earlier changed the factory. As a consequence, limiting IP protections for business method inventions would constrain the Business Revolution itself. Scientific and technological advances in ICT have generated changes in commerce on a scale that rivals or surpasses the Industrial Revolution. ICT advances automate practically all business transactions, thereby increasing productivity in retail, wholesale, finance, and many other industries. This explains the large number of business method patent applications and awards. Removing or weakening patent protections for business method inventions potentially jeopardizes advances in e-commerce, ICT, and the Internet. The traditional machine-or-transformation test for patentability is restrictive because it does not address effectively ICT applications to business transactions. The machine-or-transformation test is more suited to the Industrial Revolution than to the Business Revolution. Yet, this is precisely the issue the Supreme Court (hereafter the court) considers in *Bilski*.

The article is organized as follows. Section 2 introduces an economic definition of business method inventions and also examines how such inventions are defined by the USPTO, the Patent Act, and the courts. Section 3 finds that constraining IP protections for business method inventions would adversely impact entrepreneurship and the commercialization of scientific and technological inventions. Section 4 argues for the patentability of business method inventions based on considerations of economic efficiency. Section 5 considers the critical role that business method inventions play in fostering the Business Revolution. Section 6 concludes the discussion.

2. DEFINING BUSINESS METHOD INVENTIONS

The absence of a clear definition of business method inventions poses a problem for

researchers, inventors, judges, and public policy makers.¹⁰ In questioning business method inventions generally and in rejecting the patent for the particular business method at issue in *Bilski*, the court emphasizes the need for a better understanding of this type of discovery. This section presents an economic definition of business method inventions. Then, the section considers the USPTO's definition, the guidance provided by the Patent Act, and the courts' attempts to define business method inventions.

2.1 An Economic Definition of Business Method Inventions

A *business method invention* is the discovery of a commercial technique for firms to address market opportunities, such as a transaction procedure, market microstructure, financial system, operational process, or organizational form.¹¹ Business method inventions contribute to the establishment of new types of firms, development of new industries, and improvement in the productivity and performance of established firms. A business method invention often involves the creation and application of economic and business knowledge. A business method invention can encompass scientific and technological discoveries that implement the commercial technique. Also, a business method invention can commercialize scientific and technological discoveries developed by other inventors.

A business method invention can be transferred to other economic agents in the market for discoveries, embodied in new firms by entrepreneurs, or developed and implemented by

¹⁰ Bronwyn Hall (2009, 445) observes that "There is no precise definition of business method patents:" ("many scholars make little distinction between business method patents, internet patents, and software patents more broadly, at least when making policy recommendations. This is inevitable in the present day, because many business method patents are in fact patents on the transfer of a known business method to a software and/or web-based implementation, so the distinction is hard to maintain.") See Stefan Wagner (2008, 4) ("The concept of business methods is notoriously difficult to define. From an economic perspective, the term "business method" is very broad and comprises various economic activities such as selling and buying items, marketing or finance methods, schemes and techniques. From a legal perspective, it is hard to find an abstract definition of what exactly constitutes a business method and what makes it different from other 'methods'. Currently, neither European nor US (patent) laws contain a legal definition of the term business method while actually using it frequently.") See also Hart et al. (2000).

¹¹ The term market microstructure refers to the rules, procedures and institutions in a market, see Spulber (1999) on the economic theory of market microstructure.

managers of existing firms. Elsewhere, I define a *firm* as a particular type of transaction institution (Spulber, 2009a, b). Firms are distinguished from other types of transaction institutions when their business objectives are separable from the consumption objectives of their owners.¹² By creating markets and organizations and intermediating transactions, firms offer efficiencies in comparison to other types of transaction institutions.

A business method patent formalizes and codifies various aspects of the commercial discovery. Inventors can sell or license business method inventions to market intermediaries, to entrepreneurs or to existing firms. In practice, a business method invention can be expressed as an entrepreneur's business plan for new a new firm or as a manager's strategic plan for an existing business, along with accompanying technical and scientific information. Independent inventors can apply their business method inventions to become entrepreneurs and establish firms that embody the inventions. Existing firms can develop and implement business method inventions. The innovator formulates a new strategy by identifying a market opportunity and the resources needed to achieve that opportunity. The innovator commercializes the strategy by transferring knowledge to others or by establishing a new firm. New or existing firms obtain the resources needed to implement the strategy and to address the market opportunity.

Business method inventions provide the foundations for new industries, enhance the performance of existing industries, and drive economic growth. Business method discoveries draw on the social sciences, including economics and related fields such as finance, marketing, accounting, management strategy, and operations research. Business method inventions are not restricted to manufacturing; they can apply to all of the firm's functional areas, including marketing, sales, procurement, inventory management, R&D, customer service, accounting, and finance. Business method inventions serve to reduce transaction costs, which constitute a major share of the economy.¹³ Transaction costs are an important determinant of the activities of firms, as Ronald Coase (1937) emphasized. Financial innovations increase entrepreneurship and economic growth by increasing the availability of financial capital, see Merton Miller (1986) and Robert Merton (1992). Josh Lerner (2006, 224) points out that "financial innovations enable

¹² Spulber (2009a, b) introduces a definition of the firm based on a "separation criterion" that builds on the Fisher Separation Theorem that is fundamental to finance and neoclassical economics. *See* Irving Fisher (1906, 1907, 1930).

¹³ Spulber (1996).

firms of all industries to raise capital in larger amounts and at a lower cost than they could otherwise.” Lerner finds that in the period from 1990 to 2002, smaller firms accounted for a disproportionate share of financial innovations and financial firms obtained limited patent protections for financial innovations.¹⁴

The initial *implementation* of a business method invention in the market place is a Schumpeterian innovation.¹⁵ The business method invention is the fundamental commercial discovery that forms the basis of a Schumpeterian innovation, which is the realization of that idea in the marketplace. Identifying the underlying commercial discovery extends Schumpeter’s discussion of innovation. The concept of a business method invention benefits from new developments in the theory of the firm, transaction cost economics, the economics of innovation and entrepreneurship, and financial economics. Also, the concept of a business method invention highlights the effect of IP rules on both the market for such inventions and their subsequent implementation by firms. When business method inventions are patented, their application in the marketplace is “practicing the patent.” IP protections for business method inventions enhance incentives for invention and facilitate subsequent innovation.

Schumpeterian innovation is the introductory application of business method inventions by firms. Schumpeter (1989, 59) defines innovation as “‘doing things differently’ in the realm of economic life.” For Schumpeter (1934, p. 66) economic development is “defined by the carrying out of new combinations,” often through the efforts of entrepreneurs. Schumpeter’s (1934, 65-

¹⁴ See Lerner (2006). See also Peter Tufano (2003) and Bronwyn Hall et al.(2009).

¹⁵ The *Oxford English Dictionary (OED)* presents a multipart definition of innovation that recognizes the Schumpeterian description of innovation: “**5. Comm.** The action of introducing a new product into the market; a product newly brought on to the market.” *Oxford English Dictionary*, s.v. “innovation” <http://dictionary.oed.com/> (accessed June 30, 2010). The initial definition is generic: “1. a. The action of innovating; the introduction of novelties; the alteration of what is established by the introduction of new elements or forms,” and “2. a. A change made in the nature or fashion of anything; something newly introduced; a novel practice, method, etc.” The *OED* definition of innovation in commerce also cites John Jewkes et al. (1958, 249) (“It seems impossible to establish scientifically any final conclusion concerning the relation between monopoly and innovation.”); Everett Rogers (1962, 124) (“It matters little whether or not an innovation has a great degree of advantage over the idea it is replacing. What does matter is whether the individual perceives the relative advantage of the innovation.”), and James Allen (1967, 8) (“Innovation is the bringing of an invention into widespread, practical use... Invention may thus be construed as the first stage of the much more extensive and complex total process of innovation.”)

66) “innovations in the economic system” include the “introduction of a new good,” “introduction of a new method of production,” “opening of a new market,” “conquest of a new source of supply of raw materials or half-manufactured goods,” and “carrying out of the new organization of any industry.”¹⁶ Schumpeter (1989, 61) emphasizes that “innovation is the outstanding fact in the economic history of capitalist society.”

Schumpeter distinguishes between an innovation in the commercial sense and an invention in the scientific sense: “Innovation is possible without anything we should identify as invention, and invention does not necessarily induce innovation.”¹⁷ Schumpeter observes that “Although most innovations can be traced to some conquest in the realm of either theoretical or practical knowledge, there are many which cannot.” Schumpeter finds no economic distinction between the two situations because the economic effects of the innovation need not depend on its “scientific novelty.”¹⁸ An innovation can have significant economic impacts even when it lacks scientific novelty. The market value of an innovation depends on the extent to which consumers are willing to pay for the goods and services of firms who “do things differently.”

Schumpeter further distinguishes between the personal features of the inventor and the innovator, pointing out that even when innovation consists of commercializing a particular invention, “the making of the invention and the carrying out of the innovation are completely different things,”¹⁹

“Personal aptitudes—primarily intellectual in the case of the inventor, primarily volitional in the case of the businessman who turns the invention into an innovation—and the methods by which the one and the other work, belong to different spheres.”²⁰

Schumpeter distinguishes between the scientist and the innovator who often is an entrepreneur or a manager of an existing firm. Schumpeter’s distinction between invention and innovation has implications for the question of patentability of business methods.

¹⁶ Among “changes in the methods of supplying commodities,” Schumpeter (1989, 61) lists “Technological change in the production of commodities already in use, the opening up of new markets or of new sources of supply, Taylorization of work, improved handling of material, the setting up of new business organizations, such as department stores.”

¹⁷ OED (1989) citing Schumpeter (1939, 84). *See also* Schumpeter (1964, 1942, 1934).

¹⁸ Schumpeter (1939, 84).

¹⁹ Schumpeter (1939, 60).

²⁰ *Id.*

What is fundamentally at issue is whether the patent system should recognize discoveries that are purely commercial, such as a new transaction procedure. This is distinguished from discoveries that involve advances in chemistry, physics, biology, engineering, and medicine. When there is an accompanying scientific or technological breakthrough, a patent could presumably be awarded for the scientific invention directly. The question of whether commercial discoveries are valuable inventions worthy of IP protections afforded to industrial discoveries stems from a long-standing debate over the relative economic value added by distribution versus production. In *The Wealth of Nations*, Adam Smith argued that both production and distribution are important: “The capital of the merchant exchanges the surplus produce of one place for that of another, and thus encourages the industry and increases the enjoyments of both.”²¹ This debate is reflected in the *Bilski* court’s question about IP protections of business method inventions. Public policies that distinguish transaction technologies from production technologies are likely to generate biases that adversely affect invention and commercialization. The main implication of a more precise understanding of business method inventions is that public policies should treat them in the same way as other types of inventions.

The distinction between commerce and production has little practical basis. Public policy makers, who draw artificial distinctions between commercial and industrial inventions either to support or oppose business methods, will generate economic distortions. Courts seeking to identify differences between transactions and production would face an impossible task. As Coase demonstrated, firms determine whether to carry out a particular task by comparing market transaction costs with internal governance costs.²² Transaction costs affect whether a task is part of a firm’s production process or part of its market transactions, thus determining the boundaries of the firm. As compared with internal governance costs, relatively high market transaction costs favor vertical integration, and relatively low market transaction costs favor outsourcing.

Because firms solve Coase’s “make-or-buy” problem, what might appear to be a production task in one context could appear to be a market transaction in another context. This makes the distinction between manufacturing inventions and business method inventions impractical for the patent office and for the courts. Even knowing how the firm resolves the

²¹ See Smith (1998, II, 5.6 at)

²² See Coase (1937, 1960, 1988).

“make-or-buy” choice, it remains difficult to distinguish in-house production from market purchases because both activities involve market transactions and internal management.²³ As Harold Demsetz (1991) observes the tasks are highly similar,

“Hence, in-house production does not constitute a clear elimination of transaction costs. Similarly, purchasing goods from another firm, rather than producing these in house, involves an implicit purchase of the management services undertaken by the other firm, so management cost is not eliminated by purchasing more nearly complete goods across markets.”²⁴

Demsetz concludes that the correct question is not whether the transaction cost of purchase is less than the management cost of production, but rather whether the sum of management and transaction cost incurred through in-house production is more or less than the sum of management and transaction cost incurred through purchase across markets, since either option entails expenditures on both cost categories.²⁵

In Spulber (2010b, 63), I define the scope of the firm as the combination of its market making and organizational activities, emphasizing that firms create and manage both market and organizational transactions. Therefore, the absence of an operational distinction between commerce and production suggests that business method exceptions to patents cannot be justified by economic analysis. Business method inventions should be accorded the same IP protections as other inventions.

2.2 The USPTO’s Definition of Business Method Inventions

The USPTO recognizes business method inventions and necessarily implements its definition through extensive categorization. The USPTO mainly identifies business method

²³ See Demsetz (1991, 162). [“It is not so easy to distinguish purchase across a market from in-house production because in-house production involves the use of inputs that are *purchased*. Purchasing inputs (across markets) is substituted for purchasing goods that are more nearly complete (across markets).”].

²⁴ See Demsetz (1991, 162). (“It is not so easy to distinguish purchase across a market from in-house production because in-house production involves the use of inputs that are *purchased*. Purchasing inputs (across markets) is substituted for purchasing goods that are more nearly complete (across markets).”).

²⁵ Demsetz, *id.*

inventions through its class 705 “Data Processing: Financial, Business Practice, Management, or Cost/Price Determination,”

“This is the generic class for apparatus and corresponding methods for performing data processing operations, in which there is a significant change in the data or for performing calculation operations wherein the apparatus or method is uniquely designed for or utilized in the practice, administration, or management of an enterprise, or in the processing of financial data. This class also provides for apparatus and corresponding methods for performing data processing or calculating operations in which a charge for goods or services is determined.”²⁶

The USPTO’s 705 class definition suggests both computer hardware and software (apparatus and method) that are used to “change” data. The class definition emphasizes applications of data processing to business management or financial data. The USPTO “scope of the class” for class 705 identifies the importance of patent claims that relate to business management and transactions involving commodities and finance.²⁷ The USPTO’s definition under this class is by no means exhaustive because the USPTO further references twenty eight other classes of inventions, such as electronic funds transfer.²⁸

²⁶ Emphasis in original, <http://www.uspto.gov/web/patents/classification/uspc705/defs705.htm>, accessed January 25, 2011. The USPTO class 705 also includes the above “in combination with cryptographic apparatus or method.”

²⁷ According to the USPTO “scope of the class: “1. The arrangements in this class are generally used for problems relating to administration of an organization, commodities or financial transactions. 2. Mere designation of an arrangement as a "business machine" or a document as a "business form" or "business chart" without any particular business function will not cause classification in this class or its subclasses. 3. For classification herein, there must be significant claim recitation of the data processing system or calculating computer and only nominal claim recitation of any external art environment. Significantly claimed apparatus external to this class, claimed in combination with apparatus under the class definition, which perform data processing or calculation operations are classified in the class appropriate to the external device unless specifically excluded therefrom. 4. Nominally claimed apparatus external to this class in combination with apparatus under the class definition is classified in this class unless provided for in the appropriate external class. 5. In view of the nature of the subject matter included herein, consideration of the classification schedule for the diverse art or environment is necessary for proper search.” <http://www.uspto.gov/web/patents/classification/uspc705/defs705.htm>, accessed January 25, 2011.

²⁸ *Id.* See also USPTO (2009) (referencing other classes that may apply to business methods). For example, other related sections include 186, Merchandising, various subclasses for customer

The courts have struggled to address business method inventions in part because these discoveries are intertwined with advances in ICT. If the courts or the USPTO were to rule out patenting of business method inventions, the impact would be mitigated because of these ICT connections. As John Allison and Starling Hunter (2006) point out, skilled patent attorneys can draft patents strategically to opt out of, or in to, particular categories, as occurred with software patents. Patents applications for business method inventions would similarly include descriptions of production technologies and applications. This is implicitly recognized by the USPTO's 705 class. Many business method inventions could be patented as ICT inventions but doing so would affect the disclosure function of patents.

Courts seeking to identify software inventions faced related difficulties as patent attorneys wrote in claims of machines and physical devices.²⁹ Julie Cohen and Mark Lemley (2001, 9) point out that the *Diehr* decision and others in its wake created what they call “the doctrine of the magic words;” “During the 1980s and early 1990s, knowledgeable patent attorneys did exactly that, claiming software inventions as hardware devices, pizza ovens, and other ‘machines.’” A “mathematical or ‘mental process’ algorithm” would qualify if the patent application contained “any physical element or step.”³⁰ As Scott Kieff (2003, 112) observes,

service methods and apparatus in a variety of areas including banking, restaurant and stores, 235, Registers (e.g., cash registers, voting machines), 283, Printed Matter, various subclasses for business forms and methods of using such forms. 307, Electrical Transmission or Interconnection Systems, 340, Communications: Electrical, 341, Coded Data Generation or Conversion, 345, Computer Graphics Processing and Selective Visual Display Systems, 359, Optics: Systems and Elements, 360, Dynamic Magnetic Information Storage or Retrieval, 365, Static Information Storage and Retrieval, 369, Dynamic Information Storage or Retrieval, 370, Multiplex Communications, 371, Error Detection/Correction and Fault Detection/Recovery, 375, Pulse or Digital Communications, 377, Electrical Pulse Counters, Pulse Dividers, or Shift Registers: Circuits and Systems, 379, Telephonic Communications, 380, Cryptography, 382, Image Analysis, 434, Education and Demonstration, 463, Amusement Devices: Games, (a method or apparatus for moving or processing information specified as game or contest information), 700, Data Processing: Generic Control Systems, 704, Data Processing: Speech Signal Processing, Linguistics, Language Translation, and Audio Compression/Decompression, 708, Electrical Computers: Arithmetic Processing and Calculating, 709, Electrical Computers and Digital Processing Systems: Multicomputer Data Transferring or Plural Process Synchronization, 713, Electrical Computers and Digital Processing Systems: Support, 714, Error Detection/Correction and Fault Detection/Recovery, 902, Electronic Funds Transfer.

²⁹ Allison and Hunter (2006, 736).

³⁰ Cohen and Lemley (2001, 9).

“patents are legal documents drafted by lawyers for interpretation by judges and lawyers, not technical documents evaluated by peer review.” From a patenting perspective, drawing a distinction between business methods and ICT inventions would be difficult in practice. Business method patents are closely tied to related advances in computer software, computer hardware, and communications technologies. If business method inventions are simply a type of computer hardware or software, then presumably they can be patented as ICT inventions.

2.3 Guidance from the Patent Act in Defining Business Method Inventions

The Constitution grants Congress the power “To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”³¹ The patent system involves all three branches of government: the Congress, the courts, and the executive branch through the USPTO, which is an agency of the Department of Commerce. Although the Patent Act does not address business method inventions specifically, it sheds some light on when such inventions might satisfy the statute.

The Patent Act (35 U.S.C. 101) describes patentable inventions as belonging to four broad categories: “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.” The Patent Act (35 U.S.C. 100a, b) indicates that: “(a) The term “invention” means invention or discovery. (b) The term “process” means process, art, or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material.” An invention is patentable only if it is novel and nonobvious (35 U.S.C. 102 and 103).

The Act’s categories could readily include a variety of business methods as patentable inventions. Newly discovered business methods represent progress in science and the useful arts. There is nothing in the Act that specifically excludes business methods.³² To be patentable, an

³¹ U.S. CONST. art 1 § 8, cl. 8.

³² The *OED* defines a “process” as “[1]b. *gen.* The fact of going on or being carried on, as an action or series of actions; progress, course” and “8. A continuous and regular action or succession of actions occurring or performed in a definite manner, and having a particular result or outcome; a sustained operation or series of operations. (Now the most common use.)”

invention need only satisfy one of the categories of the act – process, machine, manufacture, or composition of matter – not two or more categories. It is sufficient that a business method be a particular type of process. The common definition of a process suggests that a business method defined by a series of actions performed in a definite manner and having a particular result or outcome could be a patentable invention.³³ The *OED* defines a “method” as “a procedure for attaining an object” and “2. a. More generally: a way of doing anything, esp. according to a defined and regular plan; a mode of procedure in any activity, business, etc.” A business method can be a process consisting of a plan of action in business.

Business methods could also be thought of as belonging to the category of a “manufacture.” Business methods are used to produce a product, which can consist of a good or service. Such methods need not be restricted to machines or the physical transformation of inputs into outputs. After World War II, the U.S. economy began to be characterized as a “service economy.” An early study found that “The United States is now pioneering in a new stage of economic development. During the period following World War II this country became the world’s first ‘service economy’ – that is, the first nation in which more than half of the employed population is not involved, in the production of food, clothing, houses, automobiles, or other tangible goods.”³⁴ Almost all the increase in employment between World War II and 1968 took place in services, including health care, finance, retail, and wholesale.³⁵

The economy’s gross domestic product (GDP) provides a useful measure of the contribution of services to the economy. The GDP measures the value added of various economic activities.³⁶ Intermediaries in finance, retail, and wholesale and providers of business services contribute a third of U.S. GDP. The economic activities that are focused on transactions and their value added to the economy include retail trade (8 percent), wholesale trade (6 percent), finance and insurance (7.8 percent), and professional and business services and other services (12.4 percent).³⁷

³³ <http://www.oed.com/> (accessed July 6, 2010).

³⁴ See Victor Fuchs (1968, 1).

³⁵ *Id.*, 1-13.

³⁶ See Donald Kim et al. (2009). An industry’s general product by origin (GPO) or value added equals its gross output (sales or receipts and other operating income plus inventory change) minus its intermediate inputs (consumption of goods and services purchased from other industries or imported); see Robert Yuskavage (1994).

³⁷ Based on U.S. GDP data in Kim et al. (2009).

Taken together, the transaction sector comprises 34 percent of GDP, well over one-third of total value added. Adding services from such industries as education and health care increase the contribution of services to well over half of GDP. The ICT-producing industries consist of “computer and electronic products; publishing industries (includes software); information and data processing services; and computer systems design and related services,” which together contribute 7.3 percent to total GDP. The services component of ICT further increases the estimate of the contribution of services to the economy.

Restricting inventions to manufacturing without including services would exclude more than half of the economy, whether measured on the basis of employment or value added. The machine-or-transformation test would tend to limit inventions to the manufacture of products or to those services that directly rely on equipment. This would tend to exclude business methods that use software and organizational activities to provide services to consumers and businesses. The result of a narrow definition of inventions based on manufacturing of goods other than services would be a view of business based on production methods of the type observed in the Industrial Revolution. This would bias the development of inventions away from those associated with the service sector, which has come to dominate developed economies.

Business method inventions could in some instances be classified using combinations of categories, such as a process and a machine. For example, it might involve a process for providing services using ICT machines. The bundle of inventions need not rely exclusively on the machine or process components, but can include both parts of the bundle. In addressing bundles of discoveries, the Patent Act singles out a particular type of biotechnological process for special treatment.³⁸ For “a biotechnological process using or resulting in a composition of matter,” the Act notes that when they are novel, they shall further be considered non-obvious if

³⁸ The Act (35 U.S.C. 103) defines a “biotechnological process” as “(A) a process of genetically altering or otherwise inducing a single- or multi-celled organism to- (i) express an exogenous nucleotide sequence, (ii) inhibit, eliminate, augment, or alter expression of an endogenous nucleotide sequence, or (iii) express a specific physiological characteristic not naturally associated with said organism; (B) cell fusion procedures yielding a cell line that expresses a specific protein, such as a monoclonal antibody; and (C) a method of using a product produced by a process defined by subparagraph (A) or (B), or a combination of subparagraphs (A) and (B).”

“(A) claims to the process and the composition of matter are contained in either the same application for patent or in separate applications having the same effective filing date; and (B) the composition of matter, and the process at the time it was invented, were owned by the same person or subject to an obligation of assignment to the same person. (2)A patent issued on a process under paragraph (1)-(A) shall also contain the claims to the composition of matter used in or made by that process, or (B) shall, if such composition of matter is claimed in another patent, be set to expire on the same date as such other patent.”³⁹

The specific treatment of biotechnological inventions is interesting because it refers to a bundle of two components: a “process” and a “composition of matter.”

2.4 The Courts’ Movement toward a Definition of Business Method Inventions

Bilski, the last judicial word on the patentability of business method inventions to date, leaves the matter open. There is also uncertainty in Europe over the patentability of business method innovations.⁴⁰ Although the *Bilski* court is unanimous in rejecting the patent at issue in the case, the justices split three ways on the general question of patentability of business method inventions. Anthony Kennedy joined by John Roberts, Clarence Thomas, and Samuel Alito take the position that business methods are patentable inventions. John Paul Stevens joined by Ruth Bader Ginsburg, Stephen Breyer, and Sonia Sotomayor take the opposite position against business methods. Breyer, joined by Antonin Scalia, takes what might be described as a middle position, affirming the usefulness of the “machine-or-transformation” test and expressing doubt about *State Street*’s “useful, concrete, and tangible result” approach.⁴¹ In *Bilski*, the court seeks guidance regarding the nature of business inventions and the function of IP protections for these types of discoveries.

A decade after *State Street*, the U.S. Court of Appeals for the Federal Circuit (CAFC) attempted to close the barn door on business method patents by imposing a restrictive “machine-

³⁹ (35 U.S.C. 103).

⁴⁰ See Stefan Wagner (2008). (“a closer look reveals that business methods are eligible for patentability in Europe and are actually being granted by the European Patent Office despite the apparent exclusion in Article 52 EPC.”)

⁴¹ *Bilski v. Kappos* 561 U.S. ____ (2010).

or-transformation” test.⁴² In *Bilski*, the court reviews that decision and finds that the “machine-or-transformation test” should not be the sole criterion for evaluating the patentability of business methods. Those on the court who favor the patentability of business methods take a prospective approach, emphasizing technological change in industries such as software, biotechnology, and electronics. Those opposed to the patentability of business methods take a retrospective approach, emphasizing production and technology during the Industrial Revolution. Justice Stevens considers the intent of the framers of the Constitution regarding particular types of inventions that would be patentable. Stevens refers to inventions for actual horses (in contrast to my metaphorical characterization of business method inventions as escaping horses):

“Indeed, just days before the Constitutional Convention, one delegate listed examples of American progress in ‘manufactures and the useful arts,’ all of which involved the creation or transformation of physical substances. See T. Coxe, An Address to an Assembly of the Friends of American Manufactures 17–18 (1787) (listing, *inter alia*, meal, ships, liquors, potash, gunpowder, paper, starch, articles of iron, stone work, carriages, and harnesses).”⁴³

Previous decisions provide generic restrictions on patents that also apply to business methods. The laws of nature are not patentable even when they are used to provide customers with a new product. In *Funk Bros.*, Bond obtained US Patent No. 2,200,532 in 1940 for a method of combining compatible strains of bacteria inoculants to be applied to growing legumes.⁴⁴ Bond offered customers the convenience of buying a bundle of compatible inoculants in a single package. Bond charged the Funk Brothers Seed Company with infringement because they offered their customers a different bundle of inoculants.⁴⁵ The court stated that

“The qualities of these bacteria, like the heat of the sun, electricity, or the qualities of metals, are part of the storehouse of knowledge of all men. They are manifestations of laws of nature, free to all men and reserved exclusively to none. He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law

⁴² See *In re Bilski*, [545 F.3d 943](#), [88 U.S.P.Q.2d 1385](#) (Fed. Cir. 2008).

⁴³ *Bilski v. Kappos* 561 U.S. ____ (2010).

⁴⁴ *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127 (1948).

⁴⁵ *Funk Bros.* 333 U.S. 127 (1948).

recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end.”⁴⁶

In *Benson*, the court found that the “method for converting numerical information from binary-coded decimal numbers into pure binary numbers, for use in programming conventional general purpose digital computers, is merely a series of mathematical calculations or mental steps, and does not constitute a patentable ‘process’ within the meaning of the Patent Act.”⁴⁷ The court rejects the argument that “a process patent must either be tied to a particular machine or apparatus or must operate to change articles or materials to a ‘different state or thing’.”⁴⁸ Yet, *Benson* calls for action by Congress to determine whether computer programs are patentable.⁴⁹ Then, in *Flook*, the court extends this approach, finding that post-solution applications of a mathematical formula are not sufficient for patentability.⁵⁰

The court ruling in *Diehr* found “laws of nature, natural phenomena, and abstract ideas” not to be patentable.⁵¹ Mathematical algorithms are not patentable because they are abstract ideas, which would be echoed in *Bilski*. *Diehr* concerns a patent for a process for molding synthetic rubber.⁵² The court cites an earlier decision regarding the patentability of a process:

“If new and useful, it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable; whilst the process itself may be altogether new, and produce an entirely new result.”⁵³

Business method inventions transcend these objections in the landmark *State Street* case. *State Street* was based on U.S. Patent No. 5,193,056 whereby mutual funds could pool their assets in an investment portfolio that was organized as a partnership: “This investment configuration provides the administrator of a mutual fund with the advantageous combination of economies of scale in administering investments coupled with the tax advantages of a

⁴⁶ *Funk Bros.* 333 U.S. 127 (1948) at 130.

⁴⁷ *Gottschalk v. Benson*, 409 U.S. 63 (1972).

⁴⁸ *Gottschalk v. Benson*, 409 U.S. 63 (1972), at 71.

⁴⁹ *Gottschalk v. Benson*, 409 U.S. 63 (1972), at 73.

⁵⁰ *Parker v. Flook*, 437 U.S. 584 (1978).

⁵¹ *Diamond v. Diehr*, 450 U.S. 175 (1981) at 185.

⁵² *Diamond v. Diehr*, 450 U.S. 175 (1981).

⁵³ *Cochrane v. Deener*, [94 U. S. 780](#), [94 U. S. 787](#)-788 (1877). Cited in *Diamond v. Diehr*, 450 U.S. 175 (1981).

partnership.”⁵⁴ The economies of scale derive from transaction efficiencies because an administrator can jointly manage the assets of the mutual funds. The average cost of managing each fund decline with the number of funds being managed.

The patent at issue in *State Street* contains multiple machine claims and multiple business method claims. The CAFC points out that it does not matter whether the patent is for a machine or a process because they fit into the categories of invention.⁵⁵ *State Street* is important because the patent describes the application of computers to business. The patent claim includes “A data processing system for managing a financial services configuration of a portfolio established as a partnership, each partner being one of a plurality of funds.”⁵⁶ The data processing system described would apply to most basic information technology applications, consisting of a personal computer having a central processing unit (CPU) and data storage, and various arithmetic logic circuits.

“Today, we hold that the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces ‘a useful, concrete and tangible result’ – a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades.”⁵⁷

State Street emphasized that “Since the 1952 Patent Act, business methods have been, and should have been, subject to the same legal requirements for patentability as applied to any other

⁵⁴ *State Street*, 149 F. 3d 1368, 1373— ([Fed. Cir. Jul. 23, 1998](#)). “The patented invention relates generally to a system that allows an administrator to monitor and record the financial information flow and make all calculations necessary for maintaining a partner fund financial services configuration.”

⁵⁵ The CAFC observes that “for the purposes of a § 101 analysis, it is of little relevance whether claim 1 is directed to a ‘machine’ or a ‘process,’ as long as it falls within at least one of the four enumerated categories of patentable subject matter, ‘machine’ and ‘process’ being such categories.” *State Street*, 149 F. 3d 1368, at

⁵⁶ The CAFC observes that “for the purposes of a § 101 analysis, it is of little relevance whether claim 1 is directed to a ‘machine’ or a ‘process,’ as long as it falls within at least one of the four enumerated categories of patentable subject matter, ‘machine’ and ‘process’ being such categories.” *State Street*, 149 F. 3d 1368, at

⁵⁷ *State Street*, 149 F. 3d 1368, at

process or method.”⁵⁸ *State Street* endorses the U.S. Patent and Trademark 1996 Examination Guidelines for Computer Related Inventions, which treats business methods as any other type of claim, noting that “Whether the claims are directed to subject matter within §101 should not turn on whether the claimed subject matter does ‘business’ instead of something else.”⁵⁹

In emphasizing the need for a “useful, concrete and tangible result,” *State Street* essentially treats business methods as any other type of invention. Additionally, *AT&T v. Excel Communications* found there to be no basis in subject matter for excluding business method patents.⁶⁰ However, the CAFC in *In re Bilski* applies the “machine-or-transformation test” in an attempt to find a technological middle ground,

“the more challenging process claims of the twenty-first century are seldom so clearly limited in scope as the highly specific, plainly corporeal industrial manufacturing process of *Diehr*; nor are they typically as broadly claimed or purely abstract and mathematical as the algorithm of *Benson*.”⁶¹

In so doing, the CAFC goes against its prior tests, Supreme Court precedent, the Patent Act and congressional intent.⁶²

The *Bilski* court effectively reopens the issue that had been settled in *State Street* because it seeks to distinguish business methods from other inventions. The court emphasizes that it does not endorse *State Street*.⁶³ The court speculates that the *In re Bilski* decision was a way of undoing *State Street*: “The appeals court may have thought it needed to make the machine-or-transformation test exclusive precisely because its case law had not adequately identified less extreme means of restricting business method patents.”⁶⁴ The court signals to the CAFC that it might develop distinctions between business methods and other inventions: “this Court by no

⁵⁸ *State Street*, 149 F. 3d 1368, at

⁵⁹ *State Street*, 149 F. 3d 1368, (citing “Office personnel have had difficulty in properly treating claims directed to methods of doing business. Claims should not be categorized as methods of doing business. Instead such claims should be treated like any other process claims.” Examination Guidelines, 61 Fed. Reg. 7478, 7479 (1996).)

⁶⁰ *AT&T v. Excel Communications, Inc* 172 F.3d 1352 (Fed. Cir. 1999).

⁶¹ See *In re Bilski*, [545 F.3d 943](#), [88 U.S.P.Q.2d 1385](#) (Fed. Cir. 2008).

⁶² See Andrew Patrick (2009, 211).

⁶³ “Nothing in today’s opinion should be read as endorsing the Federal Circuit’s past interpretations of §101. See, e.g., *State Street*, 49 F. 3d, at 1373,” *Bilski v. Kappos* 561 U.S. ____ (2010), at .

⁶⁴ *Bilski v. Kappos* 561 U.S. ____ (2010), at .

means desires to preclude the Federal Circuit’s development of other limiting criteria that further the Patent Act’s purposes and are not inconsistent with its text.”⁶⁵ *Bilski*’s rejection of *State Street* not only creates uncertainty for future business method inventors, it calls into question business method patents issued since *State Street*.

Although patenting business methods is the fundamental issue, the bone of contention in *Bilski* is the machine-or-transformation test for patentability. This test may be well suited for the Industrial Revolution but not for the current Business Revolution.⁶⁶ Arguing against business method patents, Alan Durham (1999, 1455) states that to the framers of the U.S. Constitution, “useful arts” referred only to industry: “There is no corresponding evidence that the Framers intended to encourage developments in business methods, political strategies, pedagogical techniques, or similar undertakings.” Also, John Thomas (1999, 1143) asserts that

“By restricting patentable advances to the repeatable production or transformation of material objects and excluding subject matter founded upon the aesthetic, social observation or personal skill, the industrial application requirement would restore a sense of patentable subject matter that matches our sensibilities.”

Echoing the arguments of legal scholars who oppose patenting business methods, Stevens finds that for the framers of the Constitution, “the term ‘useful arts’ was widely understood to encompass the fields that we would now describe as relating to technology or ‘technological arts’” and the “industrial, mechanical and manual arts of the late eighteenth century.”⁶⁷ Stevens argues in *Bilski* that the court’s opinion “can only cause mischief” and that business methods should not be patentable: “a claim that merely describes a method of doing business does not qualify as a “process” under §101.”⁶⁸ Stevens turns to earlier patenting: “there is no basis in the text of the Statute of Monopolies, nor in pre-1790 English precedent, to infer that business methods could qualify.” However, Kennedy cautions that relying only on the machine-or-

⁶⁵ *Bilski v. Kappos* 561 U.S. ____ (2010), at .

⁶⁶ “The machine-or-transformation test may well provide a sufficient basis for evaluating processes similar to those in the Industrial Age—for example, inventions grounded in a physical or other tangible form. But there are reasons to doubt whether the test should be the sole criterion for determining the patentability of inventions in the Information Age,” *Bilski v. Kappos* 561 U.S. ____ (2010), at .

⁶⁷ *Bilski v. Kappos* 561 U.S. ____ (2010), at . Stevens cites Thomas (1999, 1164).

⁶⁸ *Bilski v. Kappos* 561 U.S. ____ (2010). For Stevens a business method invention often is a mere “series of steps.”

transformation test “would create uncertainty as to the patentability of software, advanced diagnostic medicine techniques, and inventions based on linear programming, data compression, and the manipulation of digital signals.”⁶⁹

The argument that industrial processes should be patentable while business methods should not recalls unfortunate but long-standing social biases. Contempt for professional merchants dates back at least to ancient Greece and Rome, reflecting the fear of the newly rich on the part of those who inherited their wealth.⁷⁰ Schumpeter (1934) observes that social resentment of entrepreneurs occurs because some are successful despite the rarity and temporary nature of their success.⁷¹ Paul Veyne (1987) also finds that resentment of success explains why commerce was “almost universally devalued until the industrial revolution.”⁷² The notion that manufacturing is somehow superior to commerce and entrepreneurship also resembles Marxian criticisms of merchants, intermediaries, and business in general.⁷³ Countering this bias, Deirdre McCloskey (2006) provides an extended defense of “bourgeois virtues;” arguing that commerce helps to promote ethical behavior: “But the assaults on the alleged vices of the bourgeoisie after 1848 made an impossible Best into the enemy of the actual Good.”⁷⁴ Thomas Sowell (2009, 62) observes that “The organizations, large and small, which produce and distribute most of the goods and services that make up a modern standard of living –businesses— have long been targets of the intelligentsia.”

⁶⁹ *Bilski v. Kappos* 561 U.S. ____ (2010), at .

⁷⁰ See Veyne (1987, 129).

⁷¹ Schumpeter (1934, 165) (“Because there are always entrepreneurs and relatives and heirs of entrepreneurs, public opinion and also the phraseology of the social struggle readily overlook these facts.”)

⁷² See Veyne (1987, 129) (“The key to the mystery lies in the fact that commercial wealth belonged to the newly rich, while the old wealth was based on land. Inherited wealth defended itself against upstart merchants by imputing to them every conceivable vice: merchants are rootless, greedy, the source of all evil; they promote luxury and weakness; they distort nature by travelling to far-off lands, violating the natural barrier of the seas and bringing back what nature will not permit to grow at home.”)

⁷³ This is typical of Marxist writings. See for example Jan van Zanden (1993, 7). (“merchant capitalism often employed the systems of exploitation that already existed in the pre-capitalist modes of production.”)

⁷⁴ McCloskey (2006, 2). In the year 1848, a major revolutionary wave swept across Europe, see Mike Rapport (2009).

3. LIMITING THE PATENTABILITY OF BUSINESS METHOD INVENTIONS WOULD CONSTRAIN THE COMMERCIALIZATION OF INVENTIONS AND ENTREPRENEURSHIP

Narrow reliance on such criteria as the machine-or-transformation test not only would exclude many useful commercial discoveries but would potentially exclude scientific and technological advances. Constraining patenting of business method inventions also might adversely impact entrepreneurship. Recall the economic definition of business method inventions as new commercial techniques that firms can apply to realize market opportunities. Some business method inventions are purely commercial discoveries without any associated scientific and technological inventions. However, other business method inventions commercialize scientific and technological inventions that might not otherwise leave the laboratory or the university. By identifying market opportunities and the technologies needed to address them, business method inventions provide applications for some types of scientific and technological inventions. Constraining IP protections for business methods would reduce the economic returns to commercial discoveries – affecting not only business method inventions but also the scientific and technological inventions that they commercialize. Inventors of business methods might present some types of discoveries as ICT inventions or perhaps limit the commercial claims of ICT inventions.

3.1 Business Method Inventions and the Commercialization of Scientific and Technological Discoveries

A package of Wrigley's chewing gum crossed a bar code scanner at Marsh's Supermarket in Troy, Ohio in June of 1974 beginning a major transformation of retail and wholesale transactions. The Universal Product Code (UPC) and bar code scanners are important business method inventions because they automate transactions. They replace workers' efforts with capital equipment in the supply of commercial transactions. In only two years after the first product carrying the UPC symbol, over three-quarters of supermarket products carried the

symbol.⁷⁵ The use of UPC codes spread quickly to other consumer goods industries such as clothing, household products, and toys and to commercial and industrial products.

Joseph Woodland and Bernard Silver obtained the first patent for a bar code on October 7, 1952. Their early conception of a bar code was a drawing of a bulls-eye pattern with the thickness of the rings conveying product information.⁷⁶ The patent is for a “classifying apparatus and method,” so it involved both a machine and a business method.⁷⁷ The bar code patent states that “it is the object of the invention to provide an automatic apparatus that will execute with precision and dispatch classifying orders which are given to it and will yield up the results of the classifying process in an intelligible manner.”⁷⁸ The patent specifically mentions super-markets although it is not limited to that application. The patent also includes a description of equipment to read the bar code, allowing the processing and utilization of the information it conveys.

The combination of bar coding and scanner technology provides a useful illustration of a business method invention. The invention is much more than a combination of an information storage process (the bar code itself) and a reader (the scanner). In itself, the storage-reader technology would constitute an ICT invention. However, the discovery is a business method invention because it changes the way business is conducted. The invention identifies a market opportunity and provides a commercial technique that greatly improves economic efficiency for practically any retail or wholesale transaction.

Bar codes speed customers through the checkout counter, providing convenience for consumers and increasing the productivity of cashiers. Customers receive detailed receipts that identify the products that are purchased. Product data from bar codes is used to provide marketing promotions and targeted discounts. Bar codes also reduce the cost to merchants of generating information used to track sales patterns and to update inventories. Better inventory control reduces the costs of carrying inventory and improves the match between inventories and customer demands, thus enhancing immediacy. Bar codes also lower the costs of price adjustment for retailers and wholesalers, because prices can be posted on store shelves and adjusted on the firm’s cashiers and databases. Moreover, the information generated at the

⁷⁵ See John T. Dunlop & Jan W. Rivkin (1997, 5).

⁷⁶ US Patent 2,612,994.

⁷⁷ US Patent 2,612,994.

⁷⁸ US Patent 2,612,994.

checkout counter changes the relationship with wholesalers and manufacturers, allowing them to exchange sales data electronically. Bar coding underlies automated ordering and billing systems that are used in Internet transactions.

By the end of the 1990s, over eighty countries had organizations that issued product codes.⁷⁹ UPC codes and scanner technology, together with related advances in information technology, are used at small retailers, supermarket chains, and large discount retailers, such as Walmart, Costco, and Target. UPC codes and scanner technology are used by shipping firms for packages, such as UPS and Federal Express, and by manufacturing companies for identifying parts, components, and materials. UPC codes and scanners also facilitate information exchange between companies.

The bar code patent illustrates how some business method inventions commercialize scientific or technological discoveries. The bar code invention includes both a business process discovery and an ICT discovery. The business process discovery is a way to utilize digital codes to identify objects. The ICT discovery is a way to represent information that can be read by a machine and the design of a machine that can read the digital code. The bar code invention is much more than either a way to index objects or an ICT discovery of a process for information storage and retrieval. It is the combination of indexing of objects and the information storage and retrieval process that makes this particular business method invention so significant. Taken together, these ideas revolutionize all manner of transactions because they allow the automation of handling of almost any type of object, whether it is a retail or wholesale product being exchanged, a product being inventoried, a product being shipped, or an input or an output produced or used in a factory.

The commercial technique is vital to the bar code invention; without it the ICT discovery might not be useful or interesting. Presenting the bar code invention as an ICT discovery would limit disclosure and reduce the breadth of the patent. The *Bilski* court's question about whether business methods should be patentable perhaps reflects the relatively early state of the art of those business method inventions that involve applications of ICT discoveries. Such controversies are to be expected with new categories of technology; consider earlier debates over

⁷⁹ See Dunlop & Rivkin (1997, 9).

the patentability of computer software. In 1999, *State Street* removed the business method exception in the course of addressing controversies in software patentability.⁸⁰

The Business Revolution, as will be shown in a later section, is driven in large part by business methods inventions that involve applications of ICT discoveries. In e-commerce, there is a wide range of hardware and software technologies that are specific to business methods.⁸¹ An e-commerce website requires a logical design that specifies the flow of information and a physical design that identifies the software, computer hardware, and communications requirements.⁸² Many large traditional retailers built their own sites that made use of their in-house IT personnel, databases, and telecommunications systems.⁸³ Identifying the extensive set of packaged software tools and pre-built website templates, Kenneth Laudon and Carol Traver caution that building your own e-commerce website is difficult and costly and risks duplicating what has already been invented by other firms.⁸⁴

Some types of business method inventions involve applications of previous scientific inventions to the development of new products, services, transactions, market design, production, components, materials, and organizations. Many scientific and technological inventions will not reach the market unless they are commercialized; they will remain in the laboratory or the university. Inventors and adopters will not reap the benefits of scientific and technological discoveries without the efforts of entrepreneurs and intermediaries. New business methods need not require delivering scientific and technological inventions to the market place. However, the commercialization of scientific and technological inventions often requires delivery by new business methods. Therefore, constraining the development of new business methods likely would impact the commercialization of scientific and technological discoveries.

The close interconnection between business method inventions and ICT discoveries is evident from a review of the top patentees in category 705. Table 1 shows patentees with twenty or more patents in this category. The dominance of computer software and electronics companies provides an indication of the technological aspects of business method patents. The legal debate

⁸⁰ For an overview of the judicial treatment of software, *see* Chad King (2000).

⁸¹ *See* Laudon & Traver (2010).

⁸² *Id.*, 210.

⁸³ *Id.*, 211.

⁸⁴ *Id.*

over business methods depends on how the USPTO and the courts treat business applications of ICT discoveries. Determining whether or not business method inventions are patentable will in turn affect the commercialization of many underlying ICT discoveries.

<i>First-named assignees and counts of their associated patents, as distributed by the year of patent grant.</i>						
First-Named Assignee	2005	2006	2007	2008	2009	Total
INDIVIDUALLY OWNED PATENT	114	191	146	196	242	889
INTERNATIONAL BUSINESS MACHINES CORPORATION	50	90	76	112	126	454
MICROSOFT CORPORATION	6	20	23	31	43	123
SONY CORPORATION	11	20	21	35	26	113
PITNEY-BOWES, INC.	41	22	13	23	13	112
FUJITSU LIMITED	11	26	21	33	10	101
TRADING TECHNOLOGIES INTERNATIONAL,	1	4	3	14	73	95

First-named assignees and counts of their associated patents, as distributed by the year of patent grant.

First-Named Assignee	2005	2006	2007	2008	2009	Total
INC.						
HEWLETT- PACKARD DEVELOPMENT COMPANY, L.P.	15	22	16	14	20	87
JP MORGAN CHASE BANK, N.A.	0	5	17	20	32	74
FIRST DATA CORPORATION	3	22	9	16	21	71
AMERICAN EXPRESS TRAVEL RELATED SERVICES COMPANY, INC.	1	3	10	18	32	64
I2 TECHNOLOGIES US, INC.	8	13	10	17	15	63
NCR CORPORATION	16	9	13	15	8	61
HITACHI, LTD	14	11	14	12	8	59
SAP	0	1	4	18	31	54

First-named assignees and counts of their associated patents, as distributed by the year of patent grant.

First-Named Assignee	2005	2006	2007	2008	2009	Total
AKTIENGESELLSC HAFT						
WALKER DIGITAL, LLC	9	7	13	10	14	53
DIEBOLD INCORPORATED	9	7	7	9	17	49
CONTENTGUARD HOLDINGS, INC.	18	12	10	5	3	48
GOLDMAN, SACHS & CO.	2	4	13	18	8	45
ACCENTURE LLP	5	12	5	16	3	41
AMAZON.COM, INC.	7	9	9	11	5	41
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.	8	9	8	12	0	37
ORACLE INTERNATIONAL CORPORATION	5	6	9	9	7	36

First-named assignees and counts of their associated patents, as distributed by the year of patent grant.

First-Named Assignee	2005	2006	2007	2008	2009	Total
CANON KABUSHIKI KAISHA	6	10	4	6	7	33
ACCENTURE GLOBAL SERVICES GMBH	0	5	2	17	8	32
NOKIA CORPORATION	6	8	5	7	6	32
RICOH COMPANY, LTD.	1	3	5	14	9	32
GENERAL ELECTRIC COMPANY	3	3	8	8	9	31
AMAZON TECHNOLOGIES, INC.	0	0	0	5	24	29
GENERAL ELECTRIC CAPITAL CORPORATION	4	8	6	7	4	29

First-named assignees and counts of their associated patents, as distributed by the year of patent grant.

First-Named Assignee	2005	2006	2007	2008	2009	Total
EBAY INC.	2	4	3	9	10	28
AT& T INTELLECTUAL PROPERTY I, L.P.	0	0	0	7	20	27
AT&T CORP.	2	1	2	16	5	26
EASTMAN KODAK COMPANY	7	6	9	2	1	25
STAMPS.COM INC.	2	3	11	4	5	25
TOSHIBA CORPORATION	3	4	3	6	9	25
FORD MOTOR COMPANY	8	3	4	2	7	24
ARIBA, INC.	1	3	6	5	8	23
CHECKFREE CORPORATION	1	2	6	6	6	21
INTEL CORPORATION	7	1	2	8	3	21
NEC CORPORATION	2	6	4	8	1	21

<i>First-named assignees and counts of their associated patents, as distributed by the year of patent grant.</i>						
First-Named Assignee	2005	2006	2007	2008	2009	Total
SIEMENS AKTIENGESELLSC HAFT	4	4	3	4	5	20
UNITED PARCEL SERVICE OF AMERICA, INC.	1	1	5	6	7	20

Table 1 “Patenting In technology classes, breakout by Organization Count of 2005 - 2009 Utility Patent Grants, By Calendar Year of Grant With Patent Counts Based on Primary Patent Classification, Rank Ordered Listing of Organizations Receiving 20 or More Utility Patents During the Period Having Primary Classification In Class 705, DP: Financial, Business Practice, Management, or Cost/Price Determination (Data Processing) (technology class is determined by the primary classification assigned to the patent- see 'Explanation of Data') (patent ownership is determined by the first-named assignee listed on a patent).” Source: U.S. Patent and Trademark Office, Patent Technology Monitoring Team (PTMT) http://www.uspto.gov/web/offices/ac/ido/oeip/taf/tecasg/705_tor.htm (accessed July 12, 2010).

3.2 Business Method Inventions and Entrepreneurship

Entrepreneurs implement business method inventions by establishing new firms that use the inventions. Entrepreneurship provides an important market outlet for independent inventors who can either transfer their inventions to specialized entrepreneurs or become entrepreneurs themselves and embody their inventions in new firms. Entrepreneurship thus gives independent inventors an alternative to transferring technology to existing firms. This helps to explain Schumpeter's identification of entrepreneurs as important agents of innovation.

In Spulber (2009b), I present a dynamic theory of the entrepreneur. During the period of entrepreneurship, the entrepreneur's consumption and savings decisions are difficult to separate from the business decisions of the startup. This interconnection is due to financing constraints that result from asymmetric information and capital market imperfections. Separation occurs only with the end of entrepreneurship when the startup's growth, technological development, and financing allow the launch of the new firm. I refer to this milestone as the "foundational shift." Because of the interconnections between the entrepreneur and the startup, it is difficult in practice to distinguish the entrepreneur's IP from that of the startup.

In evaluating the interactions between IP and entrepreneurship, a major study conducted by Graham et al. (2009) provides valuable guidance. They analyze the results of the Berkeley Patent Survey of 2008 that examines 1,332 early-stage technology companies founded since 1998. To focus on innovation, they target their survey to chief executive officers (CEOs), presidents, and chief technology officers (CTOs). They discover a highly interesting connection between invention and entrepreneurship: "it is common for startups' patents to originate with founders prior to the company's founding date. Such patents may first issue to founders (as individuals, with no initial corporate assignee) and only later be assigned to the company."⁸⁵ Graham et al. find that patents ownership is more widespread among new firms that previously reports although many startups do not hold patents. When startups patent, "they are often seeking competitive advantage, and the associated goals of preventing technology copying, securing financing, and enhancing reputation."⁸⁶ The main factors explaining patenting by startups include:

⁸⁵ Graham et al. (2009, 1275).

⁸⁶ Graham et al. (2009, 1297).

“preventing others from copying products or services; improving the chances of securing investment; obtaining licensing revenues; improving the chances/quality of liquidity (e.g., acquisition/IPO); preventing patent infringement actions against the company; improving the company’s negotiating position with other companies (e.g., cross-licensing); and enhancing the company’s reputation/product image.”⁸⁷

Graham et al. find substantial differences in the effects of patents across the economy with patents more common in health-related sector (biotechnology and medical devices) and less common in the software and Internet. However, startups with venture capital financing tend to hold more patents than startups with other types of funding. Startups primarily forego patenting due to the legal costs of obtaining and defending patents, suggesting that improvements in the effectiveness of the patent system would be beneficial to entrepreneurs. Graham et al. also find that startups license technology from others to gain knowledge and settle IP disputes, highlighting the role of entrepreneurs in the commercialization and implementation of inventions.

In creating startups and establishing firms, entrepreneurs commercialize both business method inventions and other types of scientific and technological inventions. Timothy Simcoe et al. (2009, 776) find that “Entrepreneurs often develop innovations that are only valuable as part of a larger platform, such as the Internet, the personal computer or the cellular phone network.” Their study shows that entrepreneurial entrants’ IP strategies differ from those of large established firms. Entrepreneurs may have an interest in protecting platform standards to earn rents while larger existing firms may prefer more open standards that yield returns to their complementary assets. Their empirical results suggest that patents are important to entrepreneurs and to the division of innovation labor in markets.⁸⁸

An inventor can become an entrepreneur and innovate by embodying inventions in new firms. Alternatively, an inventor can enter the market for ideas by transferring his invention to an intermediary, a prospective entrepreneur, or an existing firm. IP rules affect entrepreneurship in fundamental ways because they impact the inventor’s choice between technology transfer and entrepreneurship. IP rules that penalize or reward one of these options will bias market outcomes

⁸⁷ Graham et al. (2009, 1297).

⁸⁸ Simcoe et al. (2009, 807).

and lead to economic inefficiency. The result may be too much or too little entrepreneurship, with too much entrepreneurship resulting in costly creative destruction and too little entrepreneurship reducing competition and favoring incumbent firms.

Own use of inventions through entrepreneurship may provide the inventor with greater IP protections because there is no need to disclose the invention to potential buyers and the inventor can protect the discovery from business rivals through secrecy. The inventor encounters costs of keeping the secret and faces the risk of independent invention but benefits from avoiding copying and expropriation.⁸⁹ The alternative of entrepreneurship also raises the inventor's bargaining power in dealing with existing firms. Because the inventor can use the invention by starting a firm and competing with the existing firm, entrepreneurship provides a threat point in bargaining with the existing firm. Even if entrepreneurship does not occur at the market equilibrium, the possibility of entrepreneurship affects the incentives to invent for both the independent inventor and the existing firm, see Joshua Gans and Scott Stern (2000).⁹⁰ When entrepreneurial entrants offer differentiated products, competition between the entrant and existing firms are mitigated, which can inventors to choose entrepreneurship over technology transfer (Spulber, 2011b).

Strategic interactions between inventors and existing firms result in cooperation or competition. When an inventor and an existing firm cooperate, the inventor transfers the invention and accompanying technology to the existing firm. Alternatively, the inventor becomes an entrepreneur and establishes a firm that competes with existing firms. Entrepreneurship in existing industries entails creative destruction as the new firm competes with incumbent firms. Competition from new firms often causes existing firms to decline or to exit entirely, although some incumbent firms are stimulated by the competition. Creative destruction is socially

⁸⁹ See Ignatious Horstmann et al. (1985) on the choice between patenting and secrecy when there is asymmetric information. See also Nancy Gallini (1992) and Franco Cugno & Elisabetta Ottoz (2006).

⁹⁰ Gans & Stern (2000) consider the tradeoff between the threat of product market entry and the threat of expropriation of the technology by the incumbent, and obtain technology licensing in equilibrium. They suggest that entry by a startup is “something of an economic puzzle” in the absence of non-contractible information asymmetries between the incumbent and the entrant. *See also* Gans & Stern (2003), who find that the issue is the development of a market for ideas: “the main problem is not so much invention but *commercialization*,” at 333 (emphasis in original).

efficient if there are net benefits from the entry and growth of new firms and the concurrent displacement of existing firms.

The relationship between IP and entrepreneurship is complex. Improvements in legal protections for IP in the market for technology transfer can reduce entrepreneurship that would occur as a means of realizing the value of IP. Without adequate IP, the risk of imitation or expropriation reduces the expected returns that the innovator could obtain by attempting to transfer the technology to the existing firm. Better IP protections increase the expected returns to contracting, making technology transfer relatively more attractive in comparison with entrepreneurship, which reduces the supply of entrepreneurs. However, IP protections reduce the need for existing firms to rely on corporate R&D, allowing them to outsource innovation to new firms. By decreasing the transaction costs of cooperation between existing firms and new firms, IP protections increase incentives for entrepreneurs to establish firms that develop, sell, and license technology. This increases opportunities for entrepreneurs who establish new firms that help to commercialize and implement business method inventions. In this way, IP protections increase the likelihood of innovative entrepreneurship. IP protections for business method inventions promote efficiency in the transfer of these discoveries and in the establishment of firms by entrepreneurs.

4. EFFICIENCY ARGUMENTS IN FAVOR OF PATENTING BUSINESS METHOD INVENTIONS AND RESPONSE TO THE CRITICS

Patenting business method inventions serves to promote dynamic, allocative and transaction efficiency. Concerns regarding legal and administrative costs should not prevent patenting of business method inventions. Many of the arguments made against business method patents are generic; they are the same as those made against patents generally. This section presents efficiency arguments in favor of patenting business method inventions and responds to the academic critics of business method patenting.

4.1 Patenting of Business Method Inventions Promotes Dynamic Efficiency in the Market for Discoveries

A system of IP rights promotes *dynamic efficiency* when it generates valuable discoveries in a cost-effective manner. By providing rights to exclude others, IP rights provide incentives to inventors to engage in discovery.⁹¹ When inventors obtain returns to invention, they have incentives to develop better inventions and supply them to the marketplace. Society benefits from valuable scientific and technological discoveries so that a system of IP rights generates social benefits.⁹² The returns to inventions provide incentives to inventors to direct their talents and creative capabilities towards promising areas for discoveries and to invest costly resources in R&D, so as to generate useful inventions.

Property rights in general generate dynamic efficiencies because they provide incentives to invest in productive activities to supply the market place. The benefits of property right are encouragement of production not investment in itself – *incentives from property rights should reward outputs not inputs*. It is well known that property rights, whether in land or technology, create incentives to make investments that may produce useful output. For example, property rights to mineral resources once produced generate investments in exploration and drilling. However, the property rights should encourage the production of mineral resources; investment in the production of resources is not an end in itself. Not all investment in drilling produces resources; dry holes are a common phenomenon. Simply investing in drilling at any random location is costly but not necessarily beneficial.

Similarly, IP rights generate dynamic efficiencies by providing incentives to produce better inventions in an efficient manner. Investment in R&D should never be the goal; it is at best the means to the end. High levels of investment in R&D projects that will not generate useful inventions are not desirable; intellectual dry holes are never valuable no matter how much it costs to drill them. Conversely, it is desirable to obtain valuable inventions even if it costs

⁹¹ See William Landes & Richard Posner (2003). For a general discussion of incentives for R&D see Nancy Gallini and Suzanne Scotchmer (2002).

⁹² The effectiveness of the system of IP rights also depends on associated legal and transaction costs. For example, Stanley Besen & Leo Raskind (1991, 5) state that “The objective of intellectual property protection is to create incentives that maximize the difference between the value of the intellectual property that is created and used and the social cost of its creation, including the cost of administering the system.”

practically nothing to develop them. It is better to explore where resources are located, intellectually rich areas are valuable even when costs of production are low. Never mind that high levels of investment may fail to generate interesting or useful inventions while inexpensive creative efforts may generate inventions of great value.

The dynamic efficiencies created by IP rights have been misunderstood or mischaracterized by some commentators. These commentators assert that the IP rights exist to promote investment in R&D, not useful inventions. Confusion between inputs and outputs is evident in the IP literature and yields precisely the wrong policy conclusions. Alan Devlin & Neel Sukhatme (2009, 902) argue that

“Optimally, property rights should be awarded in a parsimonious manner, awarding deserving inventors just enough proprietary control over their discoveries to compensate them for the risk, capital, and opportunity cost expended ex ante.”

Some emphasize dynamic efficiencies of patents at the expense of allocative efficiencies. Burk and Lemly (2009, 41) suggest that courts should distinguish among industries in providing on the basis of the costs of invention,

“The systematic variation in R&D expenditures across industries naturally affects the need for patent protection. Industries that must spend more time and money in R&D generally have a greater need for patent protection in order to recoup that investment. That doesn’t mean that the patent system has no place for cheaper inventions; they may still facilitate market transactions in new innovations. But it means that certain industries have a stronger claim than others to need the incentives patents provide.”

Burk & Lemly (2009, 39) argue that because of the public goods nature of invention, “patent protection will be more important in industries that require a large investment in R&D than in industries that don’t need such an investment.” They also argue that “Industries that must spend more time and money in R&D generally have a greater need for patent protection in order to recoup that investment.”⁹³ Burk & Lemly (2009, p. 156) conclude on the basis of R&D costs that patent protections should be lower in information technology (IT) than in other industries: “the appropriate policy levers for the IT industry differ rather dramatically from those that were appropriate in the biotechnology or pharmaceutical industries.”

⁹³ Burk and Lemley (2009, 41).

The notion that patents should be based on recouping investment is a public utilities view of invention. Somehow, inventors produce inventions like an electric utility produces power, and should receive compensation from regulated rates reflecting the risk and capital. Even if the process of investment were a mechanical process similar to electric power generation, it is well known that paying for investment leads to inefficient production, high costs, and gold-plated facilities. The same is true for invention: paying for investment inevitably will lead to inefficient R&D, high costs and gold-plated laboratories. The result is “big science” sponsored by large corporations and the government. An example of such big science is the ill-fated particle accelerator known as the Superconducting Super Collider that was to have been built in Texas. Offering debatable scientific returns, the accelerator would have had a ring circumference of over 50 miles and costs that were projected at over \$12 billion with the possibility of substantial cost overruns.

But R&D is the result of creative effort not a mechanical process with results based on the size of inputs. How would policymakers determine who are “deserving inventors”? This approach to public policy quickly leads to public procurement of R&D with government officials determining who the deserving inventors are, that is, bureaucrats picking winners. The result is industrial policy with government agencies choosing the direction of R&D, the level of investment, and awarding contracts on the basis of grant proposals. The inevitable criteria for government funding will be the costs of projects not their benefits. This contrasts with market-based rewards for R&D that are based on the benefits of projects not their costs.

Devlin & Sukhatme (2009) not only suggest rewarding investment in R&D rather than outcomes, they recommend disqualifying from patent protections those “inventions that are consumed by the inventors themselves.” They assert that “Most ‘self-consumed’ inventions would be crafted regardless of whether the patent system existed. That is because the innate utility of these inventions drives inventors to create them in the first place.”⁹⁴ Devlin & Sukhatme recommend that the “Supreme Court, which granted certiorari and recently heard oral argument in *Bilski*, should reconcile the patentable subject matter inquiry with patent law’s utilitarian roots by denying patentability to internal business methods.”⁹⁵ This misguided policy

⁹⁴ Devlin & Sukhatme (2009, 910)

⁹⁵ Id,

recommendation would not only discourage in-house R&D by existing firms, it would discourage inventors from engaging in entrepreneurship, which would in turn discourage many inventors from inventing for the purpose of entrepreneurship. In-house R&D by firms and invention by prospective entrepreneurs certainly covers a substantial share of inventive activity.

Based on the same conceptual error – rewarding R&D investment rather than inventions—these commentators would penalize creativity and inspiration. Devlin & Sukhatme (2009, 904) would disqualify “‘eureka’ inventions—those that are discovered in a flash of brilliance rather than preceded by capital-intensive endeavors. There is some reason to believe that such ad hoc discoveries, immensely valuable to society as they might be, would be invented anyway even if they did not receive patent protection.” Similarly, Burk & Lemley (2009, 38-39) characterize penicillin and Post-it notes as accidental inventions that should not be patented “since there is no need to encourage investment in serendipity.” Devlin & Sukhatme (2009, 904) admit that denying IP rights based on creativity would be impractical. Imagine inventors seeking patents by demonstrating that they were not inspired when making their inventions. Such policy recommendations would rule out IP protections for the many inventions that are the result of chance discoveries by well-prepared scientists.

Devlin & Sukhatme would further disqualify, if it were feasible, “discoveries that are spurred primarily by social, rather than pecuniary, incentives. Such inventions are often discovered in academic circles, where the lure of reputational gain might obviate the need for patent protection.”⁹⁶ Such IP policies would rule out the extensive patenting by academic scientists and university Technology Transfer Offices. Such restrictions on patents would eliminate incentives to invent for academics. The success of the Bayh-Dole Act (35 U.S.C. 200-212) in encouraging academic technology transfer illustrates why ruling out patents for academics would be misguided.

The notion that “eureka” inventions and academic inventions should not be patentable again confuses the cost of invention with the benefits of invention. The example of graphene fits two of the categories of invention for which Devlin & Sukhatme (2009) would wish to deny patents. Andre Geim and Konstantin Novoselov won the Nobel Prize for Physics in 2010 for the discovery of how to produce graphene, a sheet of carbon the thickness of one atom. The Nobel

⁹⁶ Devlin & Sukhatme (2009, 904)

Prize was based on the amazing physical properties of graphene, that is, on the benefits of the invention.⁹⁷ Not only is graphene one of the strongest materials ever discovered, it has important properties that promise to be highly useful in superconductors and semi-conductors with applications in computer chips, video screens and many other areas. The benefits of graphene bear no relation to the costs of invention. Graphene was a “eureka” invention: Geim and Novoselov’s method of producing graphene was startlingly simple; the inventors applied scotch tape to graphite and pulled off a thin layer. Also, Geim and Novoselov were at the University of Manchester, U.K. when they made their discovery. Although Geim and Novoselov were discouraged from patenting their invention due to legal costs and the stage of development of the technology, many other scientists and firms are likely to patent inventions based on graphene.⁹⁸

Arguments against various forms of patents – for self-consumption, for serendipitous inventions, for academics – reflect the view of some that patents are unnecessary because creative people would invent anyway so that dynamic efficiency is achieved without IP. The typical evidence for such an argument is that inventions have occurred in the past without the benefit of IP protections. Noting innovation and entrepreneurship in the eighteenth century, Malla Pollack (2002) finds that “The absence of business method patents cannot be explained by an absence of entrepreneurial creativity in Great Britain during the century before the American Revolution. On the contrary, 1720 is widely hailed as the beginning of a new era in English

⁹⁷ Royal Swedish Academy of Sciences (2010).

⁹⁸ Geoff Brumfiel (2010) interviewed Andre Geim who explained why he did not file for a patent:

“We considered patenting; we prepared a patent and it was nearly filed. Then I had an interaction with a big, multinational electronics company. I approached a guy at a conference and said, “We’ve got this patent coming up, would you be interested in sponsoring it over the years?” It’s quite expensive to keep a patent alive for 20 years. The guy told me, “We are looking at graphene, and it might have a future in the long term. If after ten years we find it’s really as good as it promises, we will put a hundred patent lawyers on it to write a hundred patents a day, and you will spend the rest of your life, and the gross domestic product of your little island, suing us.” That’s a direct quote.

I considered this arrogant comment, and I realized how useful it was. There was no point in patenting graphene at that stage. You need to be specific: you need to have a specific application and an industrial partner. Unfortunately, in many countries, including this one, people think that applying for a patent is an achievement. In my case it would have been a waste of taxpayers’ money.”

public finance and the beginning of major innovations in business organization.”⁹⁹ Sharing this view, Justice Stevens writes in *Bilski*:

“Also noteworthy is what was *not* patented under the English system. During the 17th and 18th centuries, Great Britain saw innovation in business organization, business models, and management techniques, and novel solutions to the challenges of operating global firms in which subordinate managers could be reached only by a long sea voyage. Few if any of these methods of conducting business were patented.”¹⁰⁰

Of course, many scientific and technological inventions occurred in the past without the benefit of patents, but this would not suggest abandonment of the patent system as a whole. The reasoning should be no different for business method inventions.

Occurrence of a class of inventions without patents does not mean that inventions in that class cannot be patented in the future. Various inventions involving the wheel occurred without patents; this does not imply that inventions of machines with wheels in them are not patentable. Conversely, past awards of patents for certain types of inventions need not indicate the need to continue awarding those types of patents. Past patents for James Watt’s steam engines need not require future patents for steam-powered machines. Inventions that are novel and nonobvious in one era need not be so in another. In *Bilski*, Stevens asks: “Why start patenting business methods now when we did not patent them before?”¹⁰¹ Kennedy cautions: “But times change. Technology and other innovations progress in unexpected ways.”¹⁰²

Some argue that business method patents are not necessary for dynamic efficiency because markets already reward such inventions. Lemley & Burk (2003, 1575-1589) assert that “[C]ompanies have ample incentives to develop business methods even without patent protection, because the competitive marketplace rewards companies that use more efficient business methods.”¹⁰³ However, this argument could be applied generically to any type of invention; applying this argument to business methods however defined is highly selective and misleading. Companies have profited from inventions in science, engineering, and

⁹⁹ Cited by Judge Dyk, *In re Bilski*, [545 F.3d 943](#), [88 U.S.P.Q.2d 1385](#) (Fed. Cir. 2008), *en banc* decision of the United States Court of Appeals for the Federal Circuit.

¹⁰⁰ *Bilski v. Kappos* 561 U.S. ____ (2010).

¹⁰¹ *Bilski v. Kappos* 561 U.S. ____ (2010).

¹⁰² *Bilski v. Kappos* 561 U.S. ____ (2010).

¹⁰³ This is cited by Stevens in *Bilski v. Kappos* 561 U.S. ____ (2010).

manufacturing techniques, including those that satisfy the machine or transformation test, without the benefit of patents.

Another generic objection to business method patents is that they reduce competition by increasing the market power of patent owners.¹⁰⁴ This objection is not specific to business method inventions, but potentially applies to scientific or technological inventions. The limits on patent length are meant to reduce the exercise of market power by patent owners of all categories. Patents generate incentives to invent by providing economic rents to their owners; market power is inherent in the generation of rents. Without exclusivity, copying the invention would dissipate economic rents. Patents also generate incentives to invent because expropriating the inventions of others is not an option. The economic rents that go to existing patent owners generate incentives to inventors to generate substitute inventions that will improve upon and possibly replace existing inventions.

4.2 Patenting of Business Method Inventions Promotes Allocative Efficiency in the Market for Discoveries

To examine whether business method inventions should be patented it is useful to consider the purpose of patents. Administrative patent awards clearly differ from property rights for physical property such as land. Patent awards require a government agency, the USPTO to examine the scientific and technical details of the invention. Inventors must apply for the patent and satisfy a complex administrative process. Before awarding a patent, examiners must determine whether the invention is useful, novel, and non-obvious. Patents are of limited duration, in contrast to tangible property. Patents convey a right to exclude others but that exclusion and application of the patented technology is subject to various legal challenges from other inventors. The patent owner must successfully defend against possible charges of infringement and obtain redress should infringement arise. Patent litigation can involve difficult scientific and technical issues.

IP rights serve to provide *allocative efficiencies* in the market for inventions. Despite their differences from physical property, patents once awarded fulfill many of general the

¹⁰⁴ Stevens observes that the marketplace already rewards business methods (“Innovators often capture advantages from new business methods notwithstanding the risk of others copying their innovation.”) *Bilski v. Kappos* 561 U.S. ____ (2010).

functions of property rights. Discussions of IP often emphasize some aspects of property rights at the expense of others, generating great variety in public policy recommendations. It is worthwhile reviewing the efficiencies associated with IP to evaluate whether business method inventions should be patented.

Commercialization of invention is essential for the development of economic incentives for inventors. Economic historians have examined the effects of market demand on inventive activity and find that market demand often drives technological change.¹⁰⁵ Commercialization based on industrialization played an essential role in stimulating inventive activity. Kenneth Sokoloff's analysis of patents demonstrates that the growth of markets induced and accelerated inventive activity during the early industrialization of America (1790-1846).¹⁰⁶ Market demand in the U.S. helped to stimulate the commercialization of British technology.¹⁰⁷

As with other forms of property rights, exclusive access allows markets to form. When markets efficiently allocate scarce resources, these go to the highest-value users, that is, users with the greatest willingness to pay. Consider for example a market with an invention that has two potential buyers who value the invention at V_1 and V_2 , where $V_1 > V_2$. The inventor can restrict access to the first buyer, generating a higher benefit than if the invention were sold to the second buyer. Such allocation may take place through bargaining, auctions, intermediated exchange, and other market mechanisms. With patents, the inventor will wish to assign the patent to the first buyer. This will generate the greatest social benefits as well because the first buyer obtains the greatest benefit from the invention.

Because of the nature of inventions, it may be feasible to license the invention to both buyers. If the buyers do not compete in activities that apply the invention, then the seller will generate the greatest value by licensing to both buyers, $V_1 + V_2$. If in contrast, the buyers compete when they apply the invention, for example, they compete in a downstream product market, their values from licensing the invention will diminish, equaling $v_1 < V_1$ and $v_2 < V_2$. Then, the efficient outcome will be either to sell the invention to the first buyer or to license the invention to both buyers, depending on whether V_1 is greater than or less than $v_1 + v_2$. Kenneth

¹⁰⁵ On the importance of market demand as a driver of inventive activity, *see* Jacob Schmookler (1966); Landes (1969).

¹⁰⁶ *See* Sokoloff (1988).

¹⁰⁷ *See* Nathan Rosenberg (1963, 1972a, 1972b).

Arrow (1962) showed that a monopoly inventor obtains greater rents from selling to firms that compete with each other than from selling to a downstream monopolist. This is because competitive markets generate greater rents and these can be appropriated by the inventor. Additionally, by affecting total demand, the greater the extent of the market, the greater will be the quality of inventions. Elsewhere, I show that extending patent protections internationally increases the extent of the market and thus improves the quality of inventions and their diffusion, Spulber (2010a).

The supply side of the market for inventions also matters. The cost of invention will affect the entry of inventors, ultimately affecting the supply of inventions. The success rate of inventors in producing different but competing inventions will also affect the supply side. Elsewhere, I show how competing inventors dissipate rents to invention and affect the equilibrium in the market for inventions, Spulber (2011a). The market value of inventions, as with most other goods and services, thus depends on both demand and supply.

There is a tendency to neglect the demand side in some policy discussions of inventions, so as to focus on the supply side alone.¹⁰⁸ It bears emphasis that allocative efficiencies are important regardless whether the R&D process involves a flash of insight or prolonged and difficult effort. Also, the value of inventions to buyers, the demand side of the market, does not is independent of the cost to suppliers of producing those inventions. An inventor may accidentally stumble upon an invention that changes the world, such as penicillin, while others may toil long and hard to produce useless inventions.

4.3 Patenting of Business Method Inventions Promotes Transaction Efficiency in the Market for Discoveries

Patents also provide transaction efficiencies by lowering the costs of transactions in markets for discoveries. IP provides a standardized form of property that serves as a foundation for markets in knowledge, inventions, and related intellectual outputs. IP rights increase commercialization by facilitating coordination among market participants, reducing the costs of

¹⁰⁸ This is a familiar problem in economics with echoes of the Marxian labor theory of value and even Adam Smith's (1776) famous observation that "The real price of everything, what everything really costs to the man who wants to acquire it, is the toil and trouble of acquiring it." See also Mark Blaug (1962).

market transactions, and increasing specialization through market exchange.¹⁰⁹ IP rights are based on more standard common law property rights rather than specialized knowledge institutions such as legal liability rules, open source projects, and government procurement.¹¹⁰

IP rights affect the market for discoveries because of the risk of imitation or expropriation by potential buyers. Kenneth Arrow (1962) points out that selling inventions requires revealing information to potential buyers.¹¹¹ Without adequate IP protections, revealing the invention increases the likelihood that the buyer can copy or expropriate the technology.¹¹² Arrow observes that without property rights “the only effective monopoly would be the use of the information by the original possessor.”¹¹³ When IP protections are limited, inventors are less likely to sell or license their inventions and correspondingly are more likely to seek alternative ways to apply their inventions.

IP protections play a critical role in the commercialization of invention. This includes both the transfer of the invention itself and complementary resources. Legal protections for knowledge include licensing contracts, patents, copyrights, trademarks, and trade secrets. Knowledge can be transferred in various forms such as prototypes, technical specifications, blueprints, chemical formulas, industrial designs, business plans, software, training, and consulting. Trademarks, copyrights, and secrecy are not sufficient to protect discoveries.¹¹⁴ Although patents and trade secrets are often viewed as substitutes they are often complementary. Karl Jorda (2007) recommends that firms use a combination of patents and trade secrets to protect particular inventions. Jorda (2007, 1056) further observes that a combination of patents and trade secrets are useful for technology transfer: “Hybrid patent/trade-secret agreements are also prevalent, since patent disclosures generally cover only embryonic or early stage R&D

¹⁰⁹ See Becker & Kevin Murphy (1995); F. Scott Kieff (2006).

¹¹⁰ See Ian Ayres & Paul Klemperer (1999).

¹¹¹ See Arrow (1962).

¹¹² See James Anton & Dennis Yao (1994, 1995, 2002, 2003, 2004).

¹¹³ See Arrow (1962, 151).

¹¹⁴ Stevens suggests that businesses can obtain rents from their inventions through trade secrecy and first mover advantages (branding, technology lock-in, and networking effects). First-mover advantages are far from reliable forms of protections for IP; entrants often fare better than first movers, through improvement, imitation, and strategic capabilities. The notion that technology lock and networking effects provide returns to IP is unsubstantiated and inconsistent with economic analysis, see Spulber (2008b, 2008a).

results, which are insufficient for commercializing the patented technology, absent access to collateral proprietary know-how.” In considering trade secrets, copyrights, trademarks, and sui generis protections, King (2000) observes that “while some of them complement patent law in protecting software-related inventions, none of them can effectively replace the vital role patent law plays in protecting software.” Patents are designed to encourage disclosure and exchange of technology, so suggesting that companies rely on trade secrecy is precisely the opposite of the functions of an IP system.

IP rights facilitate the purchase and sale of knowledge. IP rules help to address information costs in markets for discoveries, see Merges (1994) and Henry Smith (2003, 2007). Patents provide some standardization of IP rights in terms of registration, disclosure, descriptions of inventions, and legal protections. IP rights can favor outsourcing to specialized technology suppliers, see Ashish Arora & Robert Merges (2004). Patents also provide transaction efficiencies by reducing contracting costs in transferring technology.¹¹⁵ Paul Heald (2005) points out that patents function as titles to property protecting firms that acquire technology from challenges by third parties.

Accordingly, the patent system provides the basis for markets for the sale and licensing of patented technologies. Without patent protections, inventors will seek other means of obtaining returns including copyrights, trademarks, and trade secrets that may not perform as well as patents in protecting inventions. If inventors seek these other forms of IP protections because their inventions are denied patent protections, it is likely that they involve higher transactions costs than patents.

Business method inventions are important features of the market for ideas. By reducing transaction costs, IP rights facilitate the decisions of firms regarding the mix of markets and organizations. Firms establish both markets and organizations as means of coordinating transactions.¹¹⁶ With well-defined rights for IP, firms need not favor market transactions or organizational transactions as means of overcoming imperfections in intellectual property. International business strategies provide a useful illustration of the effects of imperfect IP protections. The risk of expropriation of IP in host countries has tended to favor internal

¹¹⁵ See Jay Kesan and Marc Banik (2000), Kesan (2002), and Vincenzo Denicolò & Luigi Franzoni (2004).

¹¹⁶ See Spulber (2009b).

allocation of IP by international businesses. Because of weak IP protections in many countries, multinational corporations tend to establish foreign divisions for production and distribution as a means of keeping IP within the company. Most international technology transfers occur within multinational corporations. As foreign protections for IP increase through greater host country legal protections and international treaties governing IP, there is a growing international market for arms-length technology transfers and technology licensing.¹¹⁷ IP protections also facilitate the growth of outsourcing of business services, manufacturing, and supply chain coordination, as businesses face less risk of technology expropriation from their business partners.

Some critics of patents have expressed concerns that IP increases the costs of coordination. Inventors incur costs of searching across patents to avoid infringement of existing patents. Companies seeking to develop new technologies or to apply existing technologies may have to obtain the consent of many patent holders, which can involve substantial transaction costs. Finally, there are substantial litigation costs involved in seeking redress from infringement and in defending against charges of infringement. However, Kieff (2007) notes that “The typical laptop computer represents a bundle of thousands of patent and other IP permissions, yet the negotiation to buy one takes only a few clicks of a mouse and costs as little as \$1,000, if not less.” In biotech, for example, IP rights do not appear to impede the process of invention and discovery.¹¹⁸ There is evidence that the patent system works very well in many industries including chemistry and biotechnology.¹¹⁹

Just as with products and financial assets, IP intermediaries reduce transaction costs in the market for IP through market-making and matchmaking activities. Patent dealers and other intermediaries invest in transaction costs needed to buy and sell IP. Additionally, patent dealers bring together inventors and potential users of technology through matchmaking. Patent dealers provide liquidity and immediacy in IP markets, thus increasing the returns to invention. Perhaps most significantly, patent dealers help to enforce property rights by investing in legal action that is not available to financially-constrained inventors and entrepreneurs. James McDonough points out that even though patent dealers significantly improve market efficiency, they are inaccurately vilified as “patent trolls” by policy makers and some established firms. The complaint that patent

¹¹⁷ See Spulber (2010).

¹¹⁸ See Timothy Caulfield, Robert Cook-Deegan, Kieff, & John Walsh (2006).

¹¹⁹ See Bessen and Meurer (2008) and Burk and Lemley (2009).

dealers do not produce or employ inventions ignores the contributions of specialized intermediaries to market efficiency.¹²⁰

Specialized intermediaries began to create a market for patented technologies in the late nineteenth and early twentieth centuries.¹²¹ This important development “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.”¹²² Patent agents and lawyers matched buyers and sellers of patent rights, reduced transaction costs, and increased the effectiveness and speed of commercialization, allowing inventors to obtain the returns from specialization in inventive activity.¹²³ This development helps to explain why many large firms scaled down their R&D operations and relied on licensing and contracts with inventors and smaller firms.¹²⁴

Another objection to patents in general, and business method patents in particular, is that inventions have properties of what economists call “public goods.” In particular, inventions are non-rivalrous in the sense that there can be multiple users of the same invention. Unlike eating a cake, consumption of the invention does not deplete it. Of course, if multiple firms copy an invention they will dissipate the rents to the inventor. Competition among firms applying the same invention is of course rivalrous. The non-rivalrous nature of IP does not imply that such goods should be provided for free; there is no free lunch, dynamic efficiency requires providing incentives to invent. To the contrary, the economics of public goods suggests instead that the supply of a public good should reflect the benefits obtained by multiple users. Private firms are capable of earning such rents by charging users for access, consider for example cable television. Similarly, by licensing inventions patent owners can reap the benefits from supplying the invention to multiple users. Therefore, the public good nature of inventions suggests the use of patents to reward inventors.

¹²⁰ See McDonough (2006). Market dealers are also referred to as “nonpracticing entities.”

¹²¹ See Naomi Lamoreaux & Sokoloff (2002).

¹²² *Id.*

¹²³ *Id.*

¹²⁴ *Id.*

4.4 Addressing Legal and Administrative Efficiency: Business Method Patents Are Not Intrinsically Vague or Abstract

Business methods inventions are not intrinsically vague. The economic definition of business methods inventions given in the previous section should help to formalize the description of such inventions. Application of economic analysis to characterizing business method inventions is useful in clarifying claims.

Opponents of business method patenting suggest that the subject matter itself generates bad patents. A common argument against business method patents and related ICT patents is that they are intrinsically vague, see for example Rochelle Dreyfuss (2000) and Hunt (2010). Bessen & Meurer (2008) suggest that most business method inventions are software and present evidence that software is involved in a large share of patent lawsuits. Their empirical analysis suggests that “poor patent notice has reduced the incentives to invent.”¹²⁵ Vincent Chiappetta (2004) opposes business method patenting, arguing that business methods or commercial arts are abstract although the technologies that implement those processes are not. In *Bilski*, Stevens worries that: “Anything that constitutes a series of steps would be patentable so long as it is novel, nonobvious, and described with specificity.”¹²⁶ For Stevens, “Business methods are similarly often closer to “big ideas,” as they are the basic tools of *commercial* work.”¹²⁷

Concerns over vagueness or abstraction are generic objections that are not sufficient to reject business method inventions. Such concerns would apply to many scientific discoveries that involve abstract concepts in physics, mathematics, chemistry, and biology. Those business methods that are so general and basic are ruled out the same rules that restrict patenting of abstract ideas. Abstract ideas continue to be ineligible for patenting, so inventions that do not offer useful results and practical applications are already excluded. The claim that business methods are mere series of steps could apply to many descriptions of scientific or technological processes. There is little evidence that business methods are more or less abstract than other

¹²⁵ Bessen & Meurer (2008, 219).

¹²⁶ Stevens points out that “The Court, in sum, never provides a satisfying account of what constitutes an unpatentable abstract idea.” *Bilski v. Kappos* 561 U.S. ____ (2010).

¹²⁷ *Bilski v. Kappos* 561 U.S. ____ (2010). Stevens also expresses concerns about the “‘potential vagueness’ of business method patents, *eBay Inc.*, 547 U. S., at 397.”

types of inventions. Allison & Emerson Tiller's statistical analysis of patent quality finds any presumed inferiority of business method patents to be a "myth."¹²⁸

Bessen & Meurer (2008) emphasize that the abstract nature of such inventions interferes with the notice function of patents and increases costly litigation. They argue that the property rights function of patents fail because of the high costs of search of prior patent awards. When patent claims are vague, inventors cannot determine *ex ante* whether they are infringing a particular patent, or even spot the patents they might be infringing, that the risk of patent litigation becomes a significant cost for innovators.¹²⁹ Their proposed solution to the patent notice problem is not elimination or restriction of business method patents, but rather the improvement of the system of patent claims to enhance the notice function of patents.

Another standard criticism of business method patents is that they are either obvious or not novel. A standard example is Amazon.com's one-click patent.¹³⁰ Another standard example is Priceline.com's patenting of a Dutch auction for airline tickets.¹³¹ Dreyfuss (2000, 279) suggests that the transfer of business models to the Internet should only be patentable when they involve "the creation of nonobvious implementing technology." Quinn (2002, 124) concludes that "there is very little prior art being considered when the examiners assess patentability of new software and business method patent applications." Jay Dratler (2005, 302-303), commenting on *State Street*, characterizes the "alleged invention" as a "pedestrian computer program" with overly broad claims: "The claims, however, were not limited to any particular programming methods; they were broad enough to cover *any* computer program used in *any* manner to control that type of business."¹³²

¹²⁸ See Allison & Tiller (2003) (stating that "Overall, our data show that Internet business method patents were no worse than patents in general in the late 1990s. Indeed, our empirical evidence suggests that they may have been better than average.")

¹²⁹ Bessen & Robert Hunt (2007) find that the significant growth in software patenting is due to relaxed patent standards rather than increased productivity of software patents. ("Eliminating the subject matter exclusion and reducing the nonobviousness and enablement requirements may have made software patents much easier (less costly) to obtain. Patents with more abstract claims may have had broader scope, increasing the appropriability each patent delivered. Both served to decrease the cost of appropriability." Bessen and Hunt (2007, 181).

¹³⁰ U.S. Patent No. 5,960,411 (September 12, 1997).

¹³¹ U.S. Patent No. 5,797,127 (Dec. 31, 1999). See Eugene Quinn (2002).

¹³² See Jay Dratler (2005, 302-303): "The alleged "inventor" there had written a pedestrian computer program to manage a certain type of investment vehicle, a "hub and spoke" investment

The arguments that business methods are obvious or not novel is could apply generically to any category of invention. These arguments are easily addressed; those inventions that are obvious or not novel are not patentable in general. The question of whether the responsibility for evaluating the patentability of inventions rests with either the USPTO or with the courts is generic as well.¹³³ Bessen and Meurer (2008, Chapter 11) recommend greater deference by the Federal Circuit to the USPTO and trial courts, public access to information on patent boundaries, and limits on software claims. Merges (1999) suggests restructuring procedures for awarding patents to improve patent quality. Less scrutiny by the patent office may be efficient because litigation only occurs for patents that matter, see Merges (1999) and Lemley (2001). Kieff (2003) argues that less scrutiny by the USPTO under a hypothetical system of registering patents would improve incentives to provide information for inventors and competitors.¹³⁴

When the commercial discovery is stand alone or accompanied by a scientific invention, standard patenting procedures evaluate the usefulness, novelty and non-obviousness of the invention. IP standards can be applied to business methods just as to more traditional scientific discoveries. Business method inventions certainly can be evaluated on whether they are useful; economic impacts implicitly enter into consideration because the claims identify applications in the marketplace. It is feasible to determine whether or not business methods are obvious or just recitations of mathematical algorithms and laws of nature. The novelty of business methods can also be evaluated in comparison to previous inventions. Business methods are not new phenomena; retailing, wholesaling, banking, financial hedging, or lotteries have long existed.

5. BUSINESS METHOD INVENTIONS AND THE BUSINESS REVOLUTION

partnership. The program made pedestrian arithmetic calculations, mostly as required by rules of the SEC and other accounting and tax authorities. Nothing in the claims at issue addressed any particular algorithm, programming technique or method of programming. For all those claims revealed, the alleged “inventor” had done nothing more than write a pedestrian computer program for performing routine arithmetic calculations dictated by legal authority, using programming languages, techniques and computers invented—if at all—by someone else.”) *See also* Dratler (2003).

¹³³ Adam Jaffe & Lerner (2006).

¹³⁴ See also Kieff (2009).

The rapid growth of business method inventions reflects a major new technological area that underlies that I refer to as the Business Revolution. What distinguishes the current era from any other is that the Business Revolution involves the application of science and technology to organizations and markets rather than to production alone. The Industrial Revolution augmented and replaced human effort by machines in manufacturing, farming, and transportation. The Business Revolution, in contrast, augments and replaces physical and mental effort devoted to repetitive commercial interactions in offices, stores, and markets. While the Industrial Revolution greatly increased labor productivity in manufacturing, the Business Revolution is dramatically increasing labor productivity in transactions.

5.1 The Industrial Revolution: Machines and Transformation

Great technological advances improve the human condition when they increase labor productivity. With a given effort level, individuals can produce more products, better products, and a greater variety of products. Individuals can obtain the same goods and services with less effort, avoiding stress, strain, and drudgery. Increased productivity relaxes the tradeoff between effort and output so that individuals in an economy can be made better off by simultaneously obtaining greater output while expending less effort.

In economic terms, technical advances increase labor productivity by changing the relationship between output and productive inputs, referred to as the production function. These changes can be quantitative, with given levels of capital and labor generating greater output. Technological change often is qualitative in nature; the type of capital equipment put into use changes, with the power loom replacing the hand loom. Such changes in capital equipment can increase the productivity of labor. Capital equipment acts as a substitute for labor.¹³⁵ Technological changes such as mechanization and automation require different types of labor services. The effort and skills needed to operate and maintain equipment such as power looms differ from those used in traditional weaving. Investments in human capital, through education, training, and migration, increase labor productivity.¹³⁶ Different inputs that enter into the

¹³⁵ See David Hounshell (1985).

¹³⁶ See Gary Becker (1975).

production function, including new materials and new sources of energy, also increase the productivity of labor.

Increases in the productivity of individuals generally increase firms' demand for labor, which in a competitive market is based on the marginal revenue produced by labor. Workers in competitive markets tend to receive wages that are at least the market value of their marginal product. Increased demand for labor increases wages and employment in a market equilibrium, which translates into greater material wealth in an economy. Higher incomes, in turn, are associated with improvements in housing, education, health, lifespan, and leisure.¹³⁷

Technological change also affects the types of effort and skill that firms demand. Increases in the productivity of individuals potentially improve working conditions by reducing the need for physical effort in manufacturing or farming. Depending on how business is organized, new forms of production can create new difficulties. For some workers in the Industrial Revolution, the drudgery of factory work replaced the effort and difficulty of weaving cloth and spinning thread. However, the shift of employment to industry from agriculture and small-scale traditional handicrafts occurred gradually.¹³⁸ Although industrialization initially brought new work habits and longer working hours, evidence suggests that holidays and shorter hours were introduced as more workers entered industry.¹³⁹

The Industrial Revolution refers to a broad historical period in which an important set of innovations and productivity improvements occurred, particularly in manufacturing and transportation. There is considerable debate among historians about its origins, duration, and economic implications.¹⁴⁰ However, the technological changes set in motion during the Industrial Revolution would result in substantial increases in economic growth.¹⁴¹ Evidence suggests that

¹³⁷ Technological change also can affect employment levels and the distribution of income; *see* Daron Acemoglu (1999, 2002).

¹³⁸ *See* Eric Hopkins (1982).

¹³⁹ "It follows that to suggest that during the classic years of the Industrial Revolution the majority of workers in this region (and perhaps elsewhere) were forced to assume new work habits and become the slaves of a new time discipline is really a very doubtful proposition, and its unthinking repetition can serve only to perpetuate a historical myth." *Id.*, 66.

¹⁴⁰ *See* Steven King & Geoffrey Timmins (2001, 68-100).

¹⁴¹ Ronald Hartwell observes that "On any historical accounting, the industrial revolution in England began one of the great discontinuities of history marking 'the great divide' between a world of slow economic growth, in which population and real incomes were increasing slowly or

these technological changes increased workers' standards of living.¹⁴² The Industrial Revolution saw the replacement of human power by machinery and mechanical power, both relieving physical labor and boosting worker productivity.¹⁴³ The application of science and technology to manufacturing during the Industrial Revolution generated increases in prosperity and economic growth.¹⁴⁴ Whether or not living standards rose during the period of the Industrial Revolution itself, it is apparent that significant and unprecedented economic growth subsequently occurred during the nineteenth and twentieth centuries.¹⁴⁵

Mechanization and the application of centralized power changed the manufactory to the factory.¹⁴⁶ Beginning in the late eighteenth century, the mechanization of spinning and weaving in the textile industry yielded significant increases in labor productivity and inspired productivity increases in many other industries. Just as windmills and water wheels had earlier relieved the drudgery of grinding grains, so the use of water power in textile mills allowed mechanization that reduced the drudgery of spinning and weaving. In the nineteenth century, the Industrial Revolution entered another phase with the development of steam-powered railroads and ships, the introduction of the internal-combustion engine, and electric power. These developments not only improved transportation, but allowed for further mechanization of production that increased industrial productivity. These important developments in manufacturing and transportation, while sweeping in nature, addressed very specific types of human effort.

5.2 The Business Revolution and Transactions

A major category of human activity that remained largely unaffected by technological change until the late twentieth century might be termed “transaction effort.” The mental and

not at all, and a world of much faster economic growth, in which population has increased at an almost frightening rate and in which there have been sustained increases in real income per head.” *See* Hartwell (1967).

¹⁴² For the period 1781-1851 of the Industrial Revolution, workers experienced “impressive net gains in the standard of life.” *See* Peter Lindert & Jeffrey Williamson (1983). For a standard pessimistic view, *see for example* Charles Feinstein (1998).

¹⁴³ *See* David Landes (1998, 186).

¹⁴⁴ *See* Landes (1998) for an overview.

¹⁴⁵ Data for the period 1870-1979 exhibits “historically unprecedented growth in productivity, gross domestic product per capita and exports and the remarkable convergence of productivities of industrialized market economies.” *See* William Baumol (1986).

¹⁴⁶ *See* Landes (1998).

physical effort associated with conducting business transactions differs substantially from the physical effort required in traditional manufacturing. Beginning in the late twentieth century and continuing into the twenty-first century, technological change addressing transaction efforts began the Business Revolution.

Advances in information and communication technologies (ICT) including the Internet have driven major changes in economic activity. Increased productivity in business is achieved through the substitution of capital equipment in the form of computers and communications for the transaction effort of individuals. Technological change in the generation of transactions changes the types of capital equipment involved in transactions and also changes the type of effort required by workers to complete transactions. The result is an increase in the productivity of workers in generating transactions and a change in the types of effort and skills needed to carry out transactions. For example, the effort required to mind the store is replaced by web design and operation.

Innovations in ICT change the demand for labor and alter the types of labor skills that firms demand. David Autor et al. find that computer capital substitutes for labor in cognitive tasks that involve explicit rules.¹⁴⁷ They also find that computer capital complements labor in tasks that involve nonroutine problem solving and complex communications.”¹⁴⁸ Their analysis shows that beginning in the 1970s, “within industries, occupations, and education groups, computerization is associated with reduced labor input of routine manual and routine cognitive tasks and increased labor input of nonroutine cognitive tasks.”¹⁴⁹ Evidence suggests that investment in ICT has generated value added for firms.¹⁵⁰ Also, investment in ICT has generated significant growth in labor productivity in service industries.¹⁵¹

¹⁴⁷ Autor et al. (2003) consider data from the period 1960 to 1998. *See also* Autor, et al. (2008).

¹⁴⁸ *See* Autor, et al. (2003). On complementarity between computers and skilled labor, *see also* Zvi Griliches (1969); Claudia Goldin & Katz (1998); Erik Brynjolfsson & Lorin Hitt (2000); Levy & Murnane (1996).

¹⁴⁹ *See* Autor et al. (2003, 1279). (“Translating task shifts into education demand, the model can explain 60 percent of the estimated relative demand shift favoring college labor during 1970 to 1998.”)

¹⁵⁰ *See* the survey and discussion in Brynjolfsson & Hitt (2000).

¹⁵¹ *See* Barry Bosworth & Jack Triplett (2007b, 2007a) and Triplett & Bosworth (2006, 2004). *See also* Dirk Pilat (2004).

Increases in transaction efficiency are analogous to the increases in productive efficiencies in the Industrial Revolution. While the Industrial Revolution would change manufacturing and distribution, the Business Revolution is changing economic interaction among individuals, among firms, and between firms and individuals. The fundamental economic developments that spring from the Business Revolution are only beginning to be realized. These technological changes extend into every area of the economy.

Because transactions have traditionally been labor intensive, transaction effort constituted a large share of transaction costs. Coase introduced the concept of transaction costs, which he defined as the “costs of using the market.”¹⁵² Individuals devote transaction effort to such activities as communicating, negotiating, searching for trading partners, gathering information, selecting prices, and monitoring contractual performance. Transaction costs reflected the time, skills, and disutility of effort of individuals engaged in transactions. Coase wrote his initial article introducing transaction costs in 1937; the production of transactions would remain labor intensive for most of the twentieth century.

“Transaction effort” occurs in routine distribution and management activities. There are numerous examples associated with the distribution of goods and services. (a) Retail and wholesale clerks expend transaction effort, including the monotony of “minding the store” when there are no customers and the routine aspects of retail transactions such as record keeping and collecting payments. (b) Purchasing agents within companies expend transaction effort in executing orders for parts, components, equipment, and services. (c) Clerical personnel within companies expend transaction effort in managing information associated with routine sales, billing, production, inventories, and accounting. (d) Clerical personnel within companies also expend transaction effort in meetings, correspondence, business forms, and basic contracts.

Advances in computers and networks connected by the Internet set in motion the Business Revolution. E-commerce over the Internet connects consumers with firms and makes connections among firms. By standardizing and automating the exchange of business information, the Internet replaces human effort devoted to mundane tasks in the exchange and distribution of goods and services. The Internet offers new forms of transactions and economic institutions and promises increases in prosperity and economic growth.

¹⁵² See Coase (1937; 1988; 1994, 3-14).

The net income generated by an activity provides an indication of its economic value added. The revenues generated by an activity do not provide a useful measure of its economic value added because it is necessary to net out costs. Thus, the revenues generated by e-commerce would not provide a useful estimate because they necessarily exceed the incremental value of inventions applied to e-commerce. For example, the annual revenue generated by e-commerce alone exceeds \$1.35 trillion.¹⁵³

The economic value of an invention is determined by considering its contributions to the present value of a stream of net benefits over time. Such contributions must be measured incrementally against the estimated value of the next best technological alternative. The value added by the invention is the present value of a stream of net benefits with the invention minus the present value of a stream of net benefits without the invention. The value added by an invention provides an estimate of its economic contribution because the market returns to the new technology are necessarily limited by technological alternatives. Users' willingness to pay for an invention cannot exceed the incremental returns they obtain in substituting the new technology for the old technology.

By isolating the value added associated with the Internet, it is possible to obtain an indication of the economic value of business method inventions. Gross domestic product (GDP) for the U.S. economy measures total value added by economic activity and is built up from the value added of each industry.¹⁵⁴ The economic value added by the Internet provides an indication of the incremental value of ICT inventions. A study of the economic value of the Internet

¹⁵³ See Hamilton Consultants, Inc., John Deighton, & John Quelch (2009).

¹⁵⁴ The measurement of GDP by industry prepared by the Bureau of Economic Analysis (BEA) is based on the National Income and Product Accounts (NIPAs). According to the BEA: "Current-dollar value added in the annual industry accounts is measured as the sum of industry distributions of compensation of employees, gross operating surplus, and "taxes on production and imports less subsidies." The BEA prepares current-dollar statistics on value added by industry "by extrapolating industry statistics on compensation of employees, gross operating surplus, and 'taxes on production and imports less subsidies' with published and unpublished industry data from the NIPAs." According to the BEA, "Compensation of employees by industry is extrapolated using the sum of industry wage and salary accruals and supplements to wages and salaries. Gross operating surplus by industry is extrapolated using the sum of industry corporate profits, proprietors' income, capital consumption allowances, net interest, and net business current transfer payments." Additionally, the BEA obtains value added for farms and government from the NIPAs. See Lindberg & Monaldo (2008).

estimates the Internet's contribution to GDP at approximately \$120 billion per year.¹⁵⁵ This estimate is based on consideration of Internet service providers (ISPs) and transport, hardware providers, information technology (IT) consulting and solutions companies, software companies, web hosting and content management companies, search engines and portals, content sites, software as a service provider, advertising agencies and support services, advertising networks, e-mail marketing and support, enterprise staffs and subcontractors responsible for Internet advertising, marketing and web design, e-commerce companies including physical delivery, and B2B e-commerce.¹⁵⁶

Estimating the annual contributions of the Internet to GDP at over \$120 billion per year suggests that a rough estimate of the net present value of the Internet's economic contributions would exceed \$1 trillion. This is the present value of the stream of value added contributions over time. With greater annual contributions to GDP, the present value of the stream of contributions will increase accordingly.

Microeconomic studies of ICT usage and productivity effects are limited because of the evolving nature of this phenomenon. There is some evidence that computer networks increase the efficiency of businesses processes such as order taking, inventory management, accounting, and product distribution.¹⁵⁷ A study of the impact of computer networks in three OECD countries, Denmark, Japan and the United States, finds that usage of computer networks increase firm-level productivity.¹⁵⁸ A study in the United Kingdom of computer networks in e-commerce shows increases in productivity.¹⁵⁹ However, the study finds that e-buying has positive impacts on output growth and e-selling has negative impacts. The problem is to separate price effects from transaction cost effects because when electronic markets increase competition and lower prices, buyers will benefit from lower expenditures and sellers will have reduced earnings.¹⁶⁰

Firms are transaction institutions, often acting as intermediaries between buyers and sellers.¹⁶¹ Firms handle transactions by creating and managing markets and organizations.¹⁶² The

¹⁵⁵ See Hamilton Consultants, Deighton, & Quelch (2009).

¹⁵⁶ *Id.*, 5.

¹⁵⁷ See Atrostic et al. (2004). See also Atrostic et al. (2000).

¹⁵⁸ See Atrostic et al. (2004).

¹⁵⁹ See Clayton et al. (2004).

¹⁶⁰ *Id.*

¹⁶¹ See Spulber (2009b, 1999, 2009a).

intermediation role that firms play in the contemporary economy implies that they possess substantial transaction cost advantages over direct exchange.¹⁶³

The role of the firm in improving transactional efficiency suggests an “intermediation hypothesis,” which states that increases in consumer transaction costs relative to those of the firm lead to growth of the scope of the firm. The “intermediation hypothesis” is complementary with the “internalization hypothesis,” otherwise known as the “make-or-buy” choice, which suggests that firms address some types of transaction costs by vertical integration. This determines how the firm divides its scope between its market-making activities and organizational activities. The “intermediation hypothesis” suggests that, as a result of transaction costs, the extent of the market explains the establishment of firms to replace consumer organizations and direct exchange. The general theory of the firm yields useful insights that can be tested empirically using contemporary and historical data. The diversity of firms in the contemporary economy provides substantial information for studying the activities of firms.¹⁶⁴

Transactions contribute a significant proportion of the economy’s total value added. By improving the efficiency of these transactions, business method inventions generate the Business Revolution. Some parts of the economy are almost entirely devoted to economic transactions and provide insights into the costs of transactions. The economic activities that are focused on transactions and their value added to the economy include retail trade (8 percent), wholesale trade (6 percent), finance and insurance (7.8 percent), and professional and business services and other services (12.4 percent).¹⁶⁵ Taken together, industries focused on transactions comprise 34 percent of GDP, well over one-third of total value added.¹⁶⁶

¹⁶² See Spulber (2009b).

¹⁶³ See Spulber (1999, 1998) on the role of firms in establishing and operating markets and in the design of market microstructure. Spulber points out that firms provide markets with mechanisms of spontaneous order in addition to prices, including marketing, sales, media and other types of mass communication.

¹⁶⁴ See Spulber (2009b).

¹⁶⁵ Based on U.S. GDP data in Kim, Lindberg, & Monaldo (2009).

¹⁶⁶ See Kim, Lindberg, & Monaldo (2009). An industry's general product by origin (GPO) or value added equals its gross output (sales or receipts and other operating income plus inventory change) minus its intermediate inputs (consumption of goods and services purchased from other industries or imported); see Yuskavage (1994).

Standard approaches to telecommunications and the Internet focus directly on the information-communications-technology producing industries. This consists of “computer and electronic products; publishing industries (includes software); information and data processing services; and computer systems design and related services, which contribute 7.3 percent to total GDP. Adding this group of activities would bring transactions to over 40 percent of GDP. This surprising figure excludes the contribution of transaction activities in such industries as: manufacturing; agriculture; mining; construction; transportation and warehousing; utilities, educational services, health care, and social assistance; and arts, entertainment, recreation, accommodation, and food services.

Retailers include supermarkets, discount stores, department stores, general merchandise stores, specialty apparel stores, warehouse clubs, drug stores, convenience stores, and variety stores. Some sell durable goods, some sell nondurables, and some sell both. The retail sector performs a wide variety of intermediation functions including pricing, marketing, inventory holding, selection of suppliers, setting bid prices offered to suppliers, quality certification, and management of transactions. Retailers have enhanced their market-making activities through traditional Electronic Data Interchange (EDI) with their suppliers, which lowers costs and increases speed in exchanging data on sales, inventory and marketing, as well as expediting billing and invoicing. Retailers have improved data collection and exchange through bar coding of merchandise, point-of-sale scanners, and computerized inventory tracking and reordering. Increases in information about sales allow a rapid response to changing market conditions.

Wholesalers act as intermediaries for transactions between businesses. Like retailers, they distribute goods, manage inventories, communicate price and product information, certify quality, and provide credit. Wholesalers market to retailers, search for suppliers, and handle inter-business transactions. In addition, they increasingly provide value-added services such as packaging, labeling, bar coding, electronic data interchange, product lot tracking, inventory controls, and faster delivery.¹⁶⁷

¹⁶⁷ See U.S. Dept. of Commerce (1994).

About 90 percent of firms in the wholesale sector, holding 60 percent of the market, are merchant wholesalers.¹⁶⁸ Their business is split about 50-50 between durable and nondurable goods. The other 40 percent of the wholesale sector is split among other intermediation arrangements. The most important of these alternative distribution arrangements include direct manufacturer-retailer transactions (retail chain stores, warehouse clubs, discount stores, and home center stores), mail order, catalog sales, manufacturer-industrial user transactions, and retail sales to industrial users.¹⁶⁹ Wholesalers also include manufacturer's sales branches, and agents, brokers, and commission merchants.

Financial intermediaries perform a wide array of services including pricing of some financial assets, providing liquidity, risk allocation, allocation of financial assets over time, combining assets to reduce the transaction costs of diversification, supplying information, and managing transactions. Depository institutions intermediate between borrowers and lenders, setting rates of interest for loans and deposits, screening borrowers for creditworthiness, and monitoring their repayment performance. Securities and commodity brokers provide a range of intermediation services, including managing complex financial transactions, carrying out trades on the organized exchanges, and supplying investors with information. Insurance companies manage transactions, allocate risk, and intermediate between investors and buyers of insurance contracts.

Business and professional services include: professional, scientific, and technical services; management of companies and enterprises, and administrative and support services. Many types

^{168.} *Id.*, 38-1. While many people can name retailers, the largest wholesalers are less well-known. The ten largest wholesalers in 1994 were Supervalu, Fleming, McKesson, Sysco, Alco Standard, Bergen Brunswig, Cardinal Health, Foxmeyer Health, Merisel and Genuine Parts (*Fortune*, May 15, 1995). (Dan, I could not find this *Fortune* reference, so I just left it here and didn't add it to the bibliography.)

^{169.} *See* U.S. Dept. of Commerce (1994, 38-2). Measuring the wholesale trade industry can be difficult. As noted (*id.*, 38-2), retail sales to industry are no longer included in the Census Bureau's sales totals for wholesale establishments. However, manufacturer's sales branches, and agents, brokers and commission merchants, continue to be included in the GDP. It quotes an industry survey for 1992 in which total wholesale was divided as follows: 45 percent through merchant wholesalers, 7 percent through agents, brokers and commission merchants, 26 percent through alternative channels, and manufacturer's sales branches distributed 23 percent. Clearly, some of the wholesaler's traditional activities are being carried out by retailers, and are reflected in value-added of the retail trade. Also, some of the strategic alliances between retailers and manufacturers appear to reflect increased wholesaling responsibilities for manufacturers, which show as a contribution to manufacturing value added.

of business services are directly or indirectly involved in managing transactions including advertising, credit agencies, direct mail, advertising services, personnel supply services, and computer rental and leasing.¹⁷⁰

Some activities in the retail and wholesale sector may be closer to production than to intermediation. Conversely, intermediation activities are present that can be difficult to discern in aggregate data on the manufacturing, agriculture, mining, construction, transportation, or public utilities sectors. Manufacturers do expend a substantial effort on marketing and sales, purchasing, personnel recruitment, financing, and technology procurement, and surely such activities account for some share of the value added by the manufacturing sector. However, the aggregate manufacturing data are focused on units of output, employees, total costs, inventories, and receipts, and do not separate out the value added by the retail, wholesale, marketing, and sales activities carried out internally by manufacturers.

Many of the companies in manufacturing, mining, construction, transportation, and public utilities sectors are vertically integrated. These companies carry out many intermediation functions that are difficult to identify from company data, including pricing, marketing, inventory management, and ordering from suppliers. This shortcoming in the manufacturing data reflects the traditional economics perspective that the firm is a manufacturer and that market allocation decisions are handled by an exogenous price system. In addition, manufacturers have significant finance and personnel requirements. They devote effort to raising capital on financial markets, communicating with investors, and issuing debt and equity. Manufacturers also invest in hiring personnel, learning about the labor market, and managing the employment relationship. Such labor market activities are explicitly recognized contributions to GDP as part of business services when they are outsourced to temporary help firms.

Similar considerations apply to companies in the mining, construction, transportation, and public utilities sector. For example, major oil companies not only carry out mining and refining, but make complex decisions about purchases, supplies, inventories, and pricing. Transportation and logistics companies, such as UPS, manage a vast transportation market, intermediating between

¹⁷⁰. In an earlier study (*see* Spulber 1996), I choose to exclude business services that did not represent intermediation. The current focus is on transactions generally so that it includes such activities as accounting and legal services.

customers mailing packages and transportation suppliers. Intermodal trucking companies, such as J. B. Hunt Transport, perform intermediation services by coordinating transfers of shipments with rail and shipping companies. Manufacturing companies also engage in merchant activities, operating markets for goods and services and factors of production. The distinction between merchants and manufacturers is not clear cut. In combination with managing transactions, intermediaries often transform products to add value: transporting, storing, repackaging, assembling, preparing for final use, and adding information and guaranties. Manufacturers carry out many market-making activities, intermediating between sellers of raw materials or product components and buyers of manufactured goods.

One indicator of the scope of firms' market-related activities is that about 30 percent of manufacturing employees are not classified as production workers. These employees include supervisors and sales personnel, as well as "advertising, credit, collection, installation and servicing of own products, clerical and routine office functions, executive, purchasing, financing, legal, personnel (including cafeteria, medical, etc.), professional, and technical employees."¹⁷¹ For example, manufacturing includes "apparel jobbing (assigning of materials to contract factories or shops for fabrication or other contract operations); as well as contracting on materials owned by others."¹⁷² Over 40 percent of total manufacturing payroll goes to nonproduction employees.¹⁷³

5.3 Business Method Inventions and New Transaction Techniques

With transactions accounting for at least one-third of economic activities, greater efficiency will have great effects on economic performance and growth. The gains from the Business Revolution result from automation of transactions, more effective intermediaries, and more efficient markets. Market transactions can be classified in three categories: business to business, business to consumer, and consumer to consumer.¹⁷⁴ In addition, business method inventions improve the efficiency of transactions within organizations, by producing more transactions for a

¹⁷¹ See U.S. Census Bureau (2006).

¹⁷² *Id.*

¹⁷³ *Id.*

¹⁷⁴ See Microsoft Corporation (1997); Microsoft Corporation; Javed Sikander & Vinod Sarma (2010).

given cost and by improving the accuracy of transactions. This section illustrates some important examples of business method inventions.

Business method and apparatus patents date back to those obtained by Herman Hollerith in 1889 for data processing based on punch cards.¹⁷⁵ Hollerith was both an inventor and an entrepreneur, and his Tabulating Machine Company would later be renamed the International Business Machine Corporation (IBM).¹⁷⁶ With the development of the computer and the growth of the Internet, business methods patents have been closely associated with hardware and software used in electronic commerce.

Many of the examples given below are e-commerce applications, but firms are increasingly engaged in marketing through multiple channels, operating both Internet stores and bricks-and-mortar facilities. These activities can be substitutes because customers choose between online and local outlets. However, some aspects of multi-channel marketing and sales are complements. For example, customers who purchase online can receive delivery through a local store. Conversely, customers who visit a local store may place online orders there and receive delivery at home.

Business method innovations automate the store. This means that the application of ICT replaces human efforts and skill in managing retail and wholesale transactions. Computers “mind the store” for Internet websites: displaying products and prices, informing customers about product features, determining product availability, taking orders, billing and receiving payments, issuing order confirmations and receipts, keeping records of the transactions, and arranging deliveries. For example, Amazon.com, Overstock.com, and practically all other Internet retailers offer automated transactions. Amazon.com took the automation process further by offering sellers the services of “storefronts” located in a virtual marketplace.

The shopping activity itself is automated, reducing buyers’ costs of locating sellers and sellers’ costs of locating buyers. Shopbots offer automated comparison shopping that finds products for shoppers. Search engine firms, such as Google, Bing, and Yahoo!, automate the information gathering process. Search services gather information from websites, images, audio, video, government documents, books, and scholarly articles. Information provision by online

¹⁷⁵ See USPTO (2010).

¹⁷⁶ *Id.*

search engines replaces some of the routine information gathering and dissemination functions of teachers, doctors, pharmacists, attorneys, and reference librarians. Google further automated the process of using search services with a service that guesses the user's query from a few or even one key stroke, estimating that saving a few seconds of search "will add up to 350 million hours in time savings for its users over the next year."¹⁷⁷

The automation of Internet advertising sales contributed to the growth of search and e-commerce generally. GoTo system for auctions of keywords, renamed Overture, ranked an advertiser's messages based on their bids.¹⁷⁸ Overture provided their advertising system to many other search engines.¹⁷⁹ Overture obtained a patent for "A system and method for enabling information providers using a computer network such as the Internet to influence a position for a search listing on a search result list generated by an Internet search engine."¹⁸⁰ Yahoo! initially partnered with Overture to offer search services and paid advertising and acquired Overture in 2003.¹⁸¹ Yahoo!'s service, renamed Yahoo! Search Marketing, initially ranked advertisements based on bids, and then adjusted rankings using click-through rates and quality measures with the introduction of its Panama software. Microsoft initially partnered with Overture and later established AdCenter in 2006, which featured demographic targeting and an algorithm that used cost per click and ad click-through rate.¹⁸²

Google offered its AdWords program to sell search advertising in 2000 and in 2003 introduced AdSense, which automated the placement of advertisements.¹⁸³ Overture filed a patent infringement lawsuit against Google in 1999. In 2004, Overture, which by this time was owned by Yahoo!, settled for 2.7 million shares of Google stock.¹⁸⁴ Google obtained

¹⁷⁷ See James Temple (2010).

¹⁷⁸ US Patent 6,269,361 (Davis et al., July, 31, 2001). See also <http://www.searchenginehistory.com/>.

¹⁷⁹ These included AllTheWeb, Altavista, AskJeeves, Hotbot, IWon, Lycos, Teoma, MSN and Yahoo!. See Andrew Ellam (2003).

¹⁸⁰ US Patent 6,269,361 (Inventors: Davis et al., July, 31, 2001, Assignee: GoTo.com, Pasadena, CA).

¹⁸¹ See <http://www.searchenginehistory.com/>.

¹⁸² *Id.*

¹⁸³ *Id.*

¹⁸⁴ See Stefanie Olsen (2004).

approximately three-quarters of the market for Internet advertising, followed by Yahoo! and Microsoft.¹⁸⁵

Business method innovations also automate search and matching functions in business-to-business applications. For example, ChemConnect serves companies in the chemical industry with automation of transactions for materials and finished products, and transmission of information about demand, inventories and orders. Serving 9,000 companies from over 150 countries, ChemConnect helps “customers manage and optimize complex supply chains throughout the sourcing, fulfillment, and ultimately the sales processes” (www.chemconnect.com).

Business method innovations automate specialized services that often involved highly skilled personnel. For example, travel agents provided expert help to individuals in making reservations and travel plans. This required knowledge of travel schedules, pricing, and alternative transportation providers. Internet websites such as Expedia, Orbitz, and Travelocity provide full access to airlines, hotels, rental cars, and other travel-related services. Automated travel websites handle all of the transactions associated with displaying schedules and prices, making travel reservations, and purchasing travel services.

Business method innovations apply to many other types of specialized financial agents. Most banks offer fully automated online banking, and some banks operate exclusively online, handling many types of banking services, including loans. Automated agents sell home, auto, and life insurance. Automated payment intermediaries such as PayPal handle transactions online, and most banks offer bill payment services, including automatic bill payments and transfers. Automated intermediary services replace specialized personnel in securities brokerage (Scottrade, Charles Schwab, Etrade, OptionsHouse, TDAmeritrade, TradeKing).

Business method innovations have succeeded in automating the services provided by a particularly skilled intermediary, the auctioneer. For example, eBay offers automated auctions in which a virtual auctioneer receives buyer bids, automatically places bids for buyers who provide maximum bids, and determines the winning buyer. MercExchange filed an infringement suit

¹⁸⁵ In 2008, Google search and content had about 75% of Internet advertising expenditures, Yahoo! search and content had 20%, and Microsoft had less than 5%. *See* Efficient Frontier (2009).

against eBay and Half.com.¹⁸⁶ MercExchange holds a business method patent for an electronic marketplace for used and collectible goods (U. S. Patent No. 5,845,265). The Supreme Court in *eBay* affirmed a set of general rules for injunctive relief, finding that the patent holder did not need to practice to obtain an injunction. Search engines Google, Bing, and Yahoo! hold automated “position auctions” for sellers that place advertisements with search results.

Business method innovations were instrumental to the automation of markets. Traditional financial exchanges relied on floor trading with professional traders engaged in “open outcry,” often shouting, exchanging hand signals, and pushing and shoving each other in trading pits. Advances in ICT have replaced the congestion costs of floor trading with the nearly unlimited capacity, increased speed, and greater accuracy of electronic trading.¹⁸⁷ Traditional exchanges that were organized as mutual associations reorganized as corporations to implement the business method innovations and to raise investment capital for the new systems.¹⁸⁸ The traditional exchanges were associations of brokers and dealers, and the reorganized exchanges operate as joint ventures of large market-making firms and broker-dealers.¹⁸⁹

Business method innovations automate the firm’s organization, including its inventory management, production, financial and accounting systems, sales operations, and human resources. These processes include the traditional data management and information processing functions within companies, as well as new support systems for online commerce for both Internet retailers and traditional retailers with online marketing channels.¹⁹⁰ Sikander and Sarma identify software applications in various areas of e-commerce: “authentication, authorization, caching, communication (browser-based user access, communication between applications

¹⁸⁶ *eBay Inc., et al., Petitioners v. Mercexchange, L. L. C.*, 547 U. S. 388 (2006).

¹⁸⁷ See Benn Steil (2002).

¹⁸⁸ *Id.*

¹⁸⁹ See Hans Stoll (2002).

¹⁹⁰ Sikander and Sarma consider business method inventions in relation to Microsoft’s e-commerce strategies: “Over time, the e-commerce function has evolved from a component of the retail strategy to a core strategic enabler for businesses. For most retailers, e-commerce represents their fastest growing revenue channel and a key asset from which they can build and maintain relationships with their customers. Retailers today are focused on delivering consistent experiences for customers across channels to enable revenue growth, brand loyalty, and innovation.” See Sikander & Sarma (2010).

layers, communication with back-end systems such as ERP [enterprise resource planning], payment integration, analytics systems, search engines), data access, and security.”¹⁹¹

6. CONCLUSION

The debate over the patentability of business method inventions among academics and public policy makers reflects the growing economic importance of such discoveries. The surge of business method invention and patenting attests to their substantial economic benefits. Just as patenting and IP law adjusted to the Industrial Revolution, so the IP system must adjust to significant developments associated with the emerging Business Revolution.

Business method patents extend IP protections to commercial discoveries, which are the foundation of Schumpeterian innovation. Business method patents are helpful to entrepreneurs who often transfer their IP to the startups and new firms that they establish. Business method patents not only are useful to innovative entrepreneurs, they also assist in the commercialization of scientific and technological discoveries developed in conjunction with business methods. Additionally, business method inventions increase the market value of preciously-developed scientific and technological discoveries. Business method inventions are a new class of discoveries because they often involve advances in ICT technologies.

The question of whether business method inventions should be patentable raised by *Bilski* poses a challenge to the patent system. IP protections for business method inventions are important for dynamic, allocative, and transaction efficiencies in the market for discoveries. Problems with patent quality and litigation are by no means intrinsic to business method discoveries. Standard requirements that inventions should be useful, novel and non-obvious are sufficient to evaluate business method inventions. Restricting IP protections for business method inventions would weaken the patent system because in practice, it is difficult, if not impossible, to distinguish commercial inventions from manufacturing methods. Commercial discoveries augment and replace human effort in business transactions, increasing the efficiency of transactions and improving the performance of firms. The patent system should provide IP protections to business method inventions just as they do other types of discoveries.

¹⁹¹ *Id.*

REFERENCES

- Acemoglu, Daron. 1999. Changes in Unemployment and Wage Inequality: An Alternative Theory and Some Evidence. 89 (5) *American Economic Review* 1259-1278.
- Acemoglu, Daron. 2002. Technical Change, Inequality and the Labor Market. 40 (1) *Journal of Economic Literature* 7-72.
- Allen, James A., 1967, *Scientific Innovation and Industrial Prosperity*, Amsterdam: Elsevier.
- Allison, John R., & Starling D. Hunter. 2006. On the Feasibility of Improving Patent Quality One Technology at a Time: The Case of Business Methods. 21 (2) *Berkeley Tech. L.J.* 729-794.
- Allison, John R., & Emerson H. Tiller. 2003. The Business Method Patent Myth. 18 (4) *Berkeley Tech. L.J.* 987-1084.
- Anton, James J., & Dennis A. Yao. 1994. Expropriation and Inventions: Appropriable Rents in the Absence of Property Rights. 84 (1) *American Economic Review* 190-209.
- Anton, James J., & Dennis A. Yao. 1995. Starts-Ups, Spin-Offs, and Internal Projects. 11 (2) *J.L. Econ. & Org.* 362-378.
- Anton, James J., & Dennis A. Yao. 2002. The Sale of Ideas: Strategic Disclosure, Property Rights, and Contracting. 69 (3) *Review of Economic Studies* 513-531.
- Anton, James J., & Dennis A. Yao. 2003. Patents, Invalidity, and the Strategic Transmission of Enabling Information. 12 (2) *Journal of Economics & Management Strategy* 151-178.
- Anton, James J., & Dennis A. Yao. 2004. Little Patents and Big Secrets: Managing Intellectual Property. 35 (1) *Rand Journal of Economics* 1-22.
- Arora, Ashish & Robert P. Merges. 2004. Specialized Supply Firms, Property Rights and Firm Boundaries, 13 *Industrial and Corporate Change* 451-475.
- Arrow, Kenneth J. 1962. Economic Welfare and the Allocation of Resources for Invention. In National Bureau of Economic Research, *The Rate and Direction of Inventive Activity*. 609-626. Princeton, NJ: Princeton University Press.
- Atrostic, B.K., Peter Boegh-Nielsen, Kazuyuki Motohashi, & Sang Nguyen. 2004. IT, Productivity and Growth in Enterprises: New Results from International Micro Data. In OECD, *The Economic Impact of ICT – Measurement, Evidence and Implications*. 279-300. Paris: OECD.

- Atrostic, B.K., John Gates, & Ron Jarmin. 2000. Measuring the Electronic Economy: Current Status and Next Steps. Center for Economic Studies, U.S. Bureau of the Census, Working Paper No. CES-WP-00-10. Available at: <http://www.census.gov/econ/estats/papers/3.pdf>.
- Autor, David H., Lawrence F. Katz, & Melissa S. Kearney. 2008. Trends in U.S. Wage Inequality: Revising the Revisionists. 90 (2) *Review of Economics and Statistics* 300-323.
- Autor, David H., Frank Levy, & Richard J. Murnane. 2003. The Skill Content of Recent Technological Change: An Empirical Exploration. 118 (4) *Quarterly Journal of Economics* 1279-1333.
- Ayres, Ian, & Paul Klemperer. 1999. Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-Injunctive Remedies. 97 *Mich. L. Rev.* 985-1033.
- Baumol, William J. 1986. Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show. 76 (5) *American Economic Review* 1072-1085.
- Becker, Gary S. 1975. *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, 2nd ed. New York: National Bureau of Economic Research.
- Becker, Gary S., & Kevin M. Murphy. 1995. The Division of Labor, Coordination Costs, and Knowledge. In Ramon Febero & Pedro S. Schwartz, eds., *The Essence of Becker*. 608-632. Stanford: Hoover Institution Press.
- Besen, Stanley M. & Leo J. Raskind. 1991. An Introduction to the Law and Economics of Intellectual Property. 5 *Journal of Economic Perspectives*. No. 1. Winter. 3-27
- Bessen, James & Robert M. Hunt. 2007. An Empirical Look at Software Patents, 16 *Journal of Economics & Management Strategy*, Spring. 157-189.
- Bessen, James & Michael J. Meurer. 2008. *Patent Failure: How Judges, Bureaucrats and Lawyers put Innovations at Risk*. Princeton, NJ: Princeton University Press.
- Blaug, Mark. 1962. *Economic Theory in Retrospect*. Cambridge: Cambridge University Press.
- Bosworth, Barry P. & Jack E. Triplett. 2007a. The Early 21st Century U.S. Productivity Expansion is Still in Services. 14 *International Productivity Monitor* 3-19.
- Bosworth, Barry P. & Jack E. Triplett. 2007b. Services Productivity in the United States: Griliches' Services Volume Revisited. In Ernst R. Berndt & Charles M. Hulten, eds.,

- Hard-to-Measure Goods and Services: Essays in Memory of Zvi Griliches*. 413-448. Chicago: University of Chicago Press.
- Brumfiel, Geoff. 2010, Andre Geim: in Praise of Graphene, *Nature*, October 7, doi:10.1038/news.2010.525, <http://www.nature.com/news/2010/101007/full/news.2010.525.html>
- Brynjolfsson, Erik & Lorin M. Hitt. 2000. Beyond Computation: Information Technology, Organizational Transformation and Business Performance. 14 (4) *Journal of Economic Perspectives* 23-48.
- Burk, Dan L. and Mark A. Lemley. 2009. *Patent Crisis and How the Courts Can Solve It*. Chicago: University of Chicago Press.
- Caulfield, Timothy, Robert M. Cook-Deegan, F. Scott Kieff, & John P. Walsh. 2006. Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies. 24 (9) *Nature Biotech* 1091-1094.
- Clayton, Tony, Chiara Criscuolo, Peter Goodridge, & Kathryn Waldron. 2004. Enterprise E-Commerce: Measurement and Impact. In OECD, *The Economic Impact of ICT – Measurement, Evidence and Implications*. 241-260. Paris: OECD.
- Chiappetta, Vincent, 2000-2001. Defining the Proper Scope of Internet Patents: If We Don't Know Where We Want to Go, We're Unlikely to Get There. 7 *Michigan Telecommunications & Technology Review*.
- Chiappetta, Vincent, 2004. TRIP-ping Over Business Method Patents. 37 *Vanderbilt Journal of Transnational Law*. 181-202.
- Coase, Ronald H. 1937. The Nature of the Firm. 4 (16) *Economica* 386-405.
- Coase, Ronald H. 1960. The Problem of Social Cost. 3 *J.L. & Econ.* 1-44.
- Coase, Ronald H. 1988. The Nature of the Firm: Origin, Meaning, Influence. 4 (1) *J.L. Econ. & Org.* 3-47. (Reprinted 1991. In Oliver E. Williamson & Sidney G. Winter, eds., 1991, *The Nature of the Firm: Origin, Meaning, Influence*. 34-74. Oxford: Oxford University Press.)
- Coase, Ronald H. 1994. *Essays on Economics and Economists*. Chicago: University of Chicago Press.

- Cohen, Julie E. and Mark A. Lemley. 2001. Patent Scope and Innovation in the Software Industry. *California Law Review*, 89, 1, pp. 1–57.
- Cugno Franco & Elisabetta Ottoz 2006. Trade Secret vs. Broad Patent: The Role Of Licensing. 2(2) *Review of Law And Economics* 209-221.
- Demsetz, Harold. 1991. The Theory of the Firm Revisited. In Oliver E. Williamson & Sidney G. Winter, eds., *The Nature of the Firm*. 159-178. Oxford: Oxford University Press.
- Devlin, Alan & Neel Sukhatme. 2009. Self-Realizing Inventions and the Utilitarian Foundation of Patent Law, 51 *William & Mary Law Review* 897-955.
- Denicolò, Vincenzo and Luigi A. Franzoni. 2004. The Contract Theory of Patents. 23 *International Review of Law and Economics* 365–380.
- Dratler, Jr., Jay. 2003. Does Lord Darcy Yet Live? The Case against Software and Business-Method Patents, 43 *Santa Clara Law Review* 823-
- Dratler, Jr., Jay. 2005. Alice In Wonderland Meets The U.S. Patent System. 38 *Akron Law Review* 299-336.
- Dreyfuss, Rochelle C. 2000. Are Business Method Patents Bad for Business? 16 (2) *Santa Clara Computer & High Technology Law Journal* 263-280.
- Dunlop, John T., & Jan W. Rivkin. 1997. Introduction. In Stephen A. Brown, *Revolution at the Checkout Counter: The Explosion of the Bar Code*. 5-9. Cambridge, MA.: Harvard University Press.
- Durham, Alan L. 1999. “Useful Arts” in the Information Age. 1999 (4) *BYU L. Rev.* 1419-1528.
- Efficient Frontier. 2009. U.S. Search Engine Performance Report: Q4 2008, January, White Paper.
- Ellam, Andrew. 2003. Overture and Google: Internet Pay-Per-Click (PPC) Advertising Auctions. London Business School Case Study CS-03-022.
- Feinstein, Charles H. 1998. Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution. 58 (3) *Journal of Economic History* 625-658.
- Fisher, Irving. 1906. *The Nature of Capital and Income*, New York: Macmillan.
- Fisher, Irving. 1907. *Rate of Interest: Its Nature, Determination and Relation to Economic Phenomena*. New York: Macmillan.

- Fisher, Irving. *The Theory of Interest: As Determined by Impatience to Spend Income and Opportunity to Invest It*. New York: Macmillan.
- Fuchs, Victor R. 1968. *The Service Economy*. Cambridge, MA: National Bureau of Economic Research.
- Gallini, Nancy T. 1992. Patent Policy and Costly Imitation, 23 *RAND Journal of Economics* 52–63.
- Gallini, Nancy T. and Suzanne Scotchmer. 2002, Intellectual Property: When Is It the Best Incentive System? *Innovation Policy and the Economy*, Vol. 2, 51-77.
- Gans, Joshua S., & Scott Stern. 2000. Incumbency and R&D Incentives: Licensing the Gale of Creative Destruction. 9 (4) *Journal of Economics & Management Strategy* 485-511.
- Gans, Joshua S., & Scott Stern. 2003. The Product Market and the Market for ‘Ideas’: Commercialization Strategies for Technology Entrepreneurs. 32 (2) *Research Policy* 333-350.
- Goldin, Claudia, & Lawrence F. Katz. 1998. The Origins of Technology-Skill Complementarity. 113 (3) *Quarterly Journal of Economics* 693-732.
- Graham, Stuart J.H., Robert P. Merges, Pam Samuelson & Ted Sichelman. 2009. High Technology Entrepreneurs and The Patent System: Results of the 2008 Berkeley Patent Survey 24 (4) *Berkeley Technology Law Journal*. Fall. 1255-1328.
- Griliches, Zvi. 1969. Capital-Skill Complementarity. 51 (4) *Review of Economics and Statistics* 465-468.
- Hall, Bronwyn H. 2009. Business and Financial Method Patents, Innovation, and Policy. 56 (s1) *Scottish Journal of Political Economy* 443-473.
- Hall, Bronwyn H., Grid Thoma, & Salvatore Torrisi. 2009. Financial Patenting in Europe. 6 (1) *European Management Review* 45-63.
- Hamilton Consultants, Inc., John Deighton, & John Quelch. 2009. Economic Value of the Advertising-Supported Internet Ecosystem. Cambridge, MA: The Interactive Advertising Bureau. Available at: <http://www.iab.net/media/file/Economic-Value-Report.pdf>.
- Hart, R., P. Holmes & J. Reid, 2000. *The Economic Impact of Patentability of Computer Programs, Report to the European Commission*, OECD.

- Hartwell, Ronald M. 1967. Editor's Introduction. In *The Causes of the Industrial Revolution in England*. Ronald M. Hartwell, ed. London: Methuen & Co. 1-30.
- Heald, Paul J. 2005. A Transaction Costs Theory Of Patent Law. 66 (3) *Ohio State Law Journal* 473-509.
- Hopkins, Eric. 1982. Working Hours and Conditions during the Industrial Revolution: A Re-Appraisal. 35 (1) *Economic History Review* 52-66.
- Horstmann, Ignatious, Glenn M. MacDonald, & Al Slivinski. 1985. Patent as Information Transfer Mechanisms: To Patent or (Maybe) Not to Patent, 93 *Journal of Political Economy* 837-858.
- Hounshell, David A. 1985. *From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States*. Baltimore, MD: Johns Hopkins University Press.
- Hunt, Robert M. 2010. Business Method Patents and U.S. Financial Services. 28 (3) *Contemporary Economic Policy*. July. 322-352.
- Jaffe, Adam B. & Josh Lerner. 2006. Innovation and Its Discontents. 1 (3) *Capitalism and Society*. 1-36. Available at: <http://www.bepress.com/cas/vol1/iss3/art3>
- Jewkes, John, David Sawers & Richard Stillerman, 1958, *The Sources of Invention*, New York: St. Martin's Press.
- Jorda, Karl F. 2007. Trade Secrets and Trade-Secret Licensing. In *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices*. Anatole Krattiger, Richard T. Mahoney, Lita Nelson et al. eds. Davis, CA: PIPRA. Available online at <http://www.ipmall.info/ipHandbook-Ch%2011%2005%20Jorda%20Trade%20Secret%20Licensing.pdf> (Accessed January 30, 2011). 1043-1057.
- Kesan, Jay P. 2002. Carrots and Sticks to Create a Better Patent System. 17 (2) *Berkeley Technology Law Journal*. Spring. 763-797.
- Kesan, Jay P. & Marc Banik. 2000. Patents as Incomplete Contracts: Aligning Incentives for R&D Investment with Incentives to Disclose Prior Art. 2 *Washington University Journal of Law and Policy* 23-54.

- Kieff, F. Scott. 2003. The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules, 45 *Boston College Law Review*. 55-123, <http://lawdigitalcommons.bc.edu/bclr/vol45/iss1/2>
- Kieff, F. Scott. 2006. Coordination, Property, and Intellectual Property: An Unconventional Approach to Anticompetitive Effects and Downstream Access. 56 (2) *Emory L.J.* 327-438.
- Kieff, F. Scott. 2007. On Coordinating Transactions in Intellectual Property: A Response to Smith's Delineating Entitlements in Information. 117 *Yale L.J. Pocket Part* 101-109.
- Kieff, F. Scott. 2009. The Case for Preferring Patent-Validity Litigation Over Second-Window Review and Gold-Plated Patents: When One Size Doesn't Fit All, How Could Two Do The Trick? 157 *University of Pennsylvania Law Review*. 1937-1963.
- Kim, Donald D., Brian M. Lindberg, & Justin M. Monaldo. 2009. Annual Industry Accounts: Advance Statistics on GDP by Industry for 2008. 89 (5) *Survey of Current Business* 22-37.
- King, Chad. 2000. Abort, Retry, Fail: Protection for Software-Related Inventions in the Wake of State Street Bank & Trust Co. v. Signature Financial Group, Inc. 85 (4) *Cornell L. Rev.* 1118-1180.
- King, Steven, & Geoffrey Timmins. 2001. *Making Sense of the Industrial Revolution: English Economy and Society, 1700-1850*. Manchester: Manchester University Press.
- Lamoreaux, Naomi R., & Kenneth L. Sokoloff. 2002. Intermediaries in the U.S. Market for Technology, 1870-1920. NBER Working Paper No. 9017. Available at: <http://www.nber.org/papers/w9017>.
- Landes, David S. 1969. *The Unbound Prometheus: Technological Change and Industrial Development in Western Europe From 1750 to the Present*. Cambridge: Cambridge University Press.
- Landes, David S. 1998. *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor*. New York: Norton.
- Landes, William M., & Richard A. Posner. 2003. *The Economic Structure of Intellectual Property Law*. Cambridge, MA: Harvard University Press.

- Laudon, Kenneth C., & Carol G. Traver. 2010. *E-Commerce: Business, Technology, Society*, 6th ed. Boston: Prentice Hall.
- Lemley, Mark A. 2001. Rational Ignorance at the Patent Office. 95 *Northwestern University Law Review*. 1495, 1495 n.1.
- Lemley, Mark A., & Dan L. Burk. 2003. Policy Levers in Patent Law. 89 (7) *Virginia. Law Review*. 1575-1696.
- Lerner, Josh. 2006. The New New Financial Thing: The Origins of Financial Innovations. 79 (2) *Journal of Financial Economics* 223-255.
- Levy, Frank & Richard J. Murnane. 1996. With What Skills Are Computers a Complement? 86 (2) *American Economic Review Papers and Proceedings* 258-262.
- Lindberg, Brian M. & Justin M. Monaldo. 2008. Annual Industry Accounts: Advance Statistics on GDP by Industry for 2007. 88 (5) *Survey of Current Business* 38-50.
- Lindert, Peter H., & Jeffrey G. Williamson. 1983. English Workers' Living Standards during the Industrial Revolution: A New Look. 36 (1) *Economic History Review* 1-25.
- McClosky, Deirdre N., 2006, *The Bourgeois Virtues: Ethics for an Age of Commerce*, Chicago: University of Chicago Press.
- McDonough, James F. 2006. The Myth of the Patent Troll: An Alternative View of the Function of Patent Dealers in an Idea Economy. 56 *Emory L.J.* 189-228.
- Merges, Robert P. 1994. Of Property Rules, Coase, and Intellectual Property, 94 *Columbia Law Review*, 2655-.
- Merges, Robert P. 1999. As Many as 6 Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform. 14 (2) *Berkeley Tech. L.J.* 577-615.
- Meurer, Michael J. 2002. Business Method Patents and Patent Floods. 8 *Wash. U. J.L. & Pol'y* 309-339.
- Microsoft Corporation. Taking Business Web Sites to the Next Level. Available at: <http://msdn.microsoft.com/en-us/library/ms953581.aspx>.
- Microsoft Corporation. 1997. Microsoft Internet Commerce Strategy: A Foundation for Doing Business on the Internet. Available at: <http://msdn.microsoft.com/en-us/library/ms953599.aspx>.

- Merton, Robert C., 1992. Financial Innovation and Economic Performance. *Journal of Applied Corporate Finance* 4, 12–22.
- Miller, Merton H., 1986. Financial Innovation: The Last Twenty Years and the Next. *Journal of Financial and Quantitative Analysis* 21, 459–471.
- Olsen, Stefanie. 2004. Google, Yahoo Bury the Legal Hatchet, *CNET News*, August 9, 2004, Available at: http://news.cnet.com/Google,-Yahoo-bury-the-legal-hatchet/2100-1024_3-5302421.html
- Oxford English Dictionary. 1989. Oxford: Oxford University Press. 2nd ed. Available at: <http://www.oed.com/>.
- Patrick, Andrew. 2009. Patent Eligibility and Computer-Related Processes: A Critique of In re Bilski and the Machine-or-Transformation Test. 14 (3) *Va. J.L. & Tech.* 181-211.
- Pilat, Dirk. 2004. The ICT Productivity Paradox: Insights from Micro Data. 2004 (1) *OECD Economic Studies* 37-64.
- Pollack, Malla. 2002. The Multiple Unconstitutionality of Business Method Patents. 28 (1) *Rutgers Computer & Technology Law Journal* 61, 96.
- Quinn, Eugene R. 2002. The Proliferation of Electronic Commerce Patents: Don't Blame the PTO. 28 (1) *Rutgers Computer & Tech. L.J.* 121-154.
- Rai, Arti K. 2000. Addressing the Patent Gold Rush: The Role of Deference to PTO Patent Denials. 2 *Wash. U. J.L. & Pol'y* 199-227.
- Rapport, Mike, 2009, *1848: Year of Revolution*, New York: Basic Books.
- Rivette, Kevin G. & David Kline. 2000. *Rembrandts in the Attic: Unlocking the Hidden Value of Patents*. Cambridge, MA: Harvard Business School Press.
- Rogers, Everett, 1962, *Diffusion of Innovations*, New York: Free Press.
- Rosenberg, Nathan. 1963. Technological Change in the Machine Tool Industry, 1840-1910. 23 (4) *Journal of Economic History*, 414-443.
- Rosenberg, Nathan. 1972a. Factors Affecting the Diffusion of Technology. 10 (1) *Explorations in Economic History* 3-33.
- Rosenberg, Nathan. 1972b. *Technology and American Economic Growth*. New York: Harper & Row.

- Royal Swedish Academy of Sciences. 2010. *Scientific Background on the Nobel Prize in Physics 2010: Graphene*, October 5, Stockholm, Sweden.
- Schmookler, Jacob. 1966. *Invention and Economic Growth*. Cambridge, MA: Harvard University Press.
- Schumpeter, Joseph A. 1934. *The Theory of Economic Development*. New Brunswick, NJ: Transaction Publishers. (Reprinted 1997.)
- Schumpeter, Joseph A. 1942. *Capitalism, Socialism, and Democracy*. New York: Harper & Row.
- Schumpeter, Joseph A. 1964. *Business Cycles: A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. Philadelphia: Porcupine Press. (Reprinted 1989, abridged version of first edition 1939.)
- Search Engine History. Available at: <http://www.searchenginehistory.com/>.
- Sikander, Javed & Vinod Sarma. 2010. A Prescriptive Architecture for Electronic Commerce and Digital Marketing. Microsoft Corporation White Paper. Available at: <http://www.microsoft.com/commerceserver/en/us/white-papers.aspx> (accessed July 17, 2010).
- Simcoe, Timothy S., Stuart J. Graham, & Maryann P. Feldman. 2009. Competing on Standards? Entrepreneurship, Intellectual Property and Platform Technologies. 18 (3) *Journal of Economics & Management Strategy*. Fall. 775-816.
- Smith, Adam. 1998. *An Inquiry Into the Nature and Causes of the Wealth of Nations*. Washington, D.C.: Regnery Publishing. (Orig. pub. 1776.)
- Smith, Henry E. 2003. The Language of Property: Form, Context, and Audience, 55 *Stanford Law Review*. 1005-.
- Smith, Henry E. 2007. "Intellectual Property as Property: Delineating Entitlements in Information," 116 *Yale Law Journal*. 1742-.
- Sokoloff, Kenneth L. 1988. Inventive Activity in Early Industrial America: Evidence From Patent Records, 1790-1846. 48 (4) *Journal of Economic History* 813-850.
- Sowell, Thomas. 2009, *Intellectuals and Society*, New York: Basic Books.
- Spulber, Daniel F. 1996. Market Microstructure and Intermediation. 10 (3) *Journal of Economic Perspectives* 135-152.

- Spulber, Daniel F. 1998. *The Market Makers: How Leading Companies Create and Win Markets*. New York: McGraw Hill/ Business Week Books.
- Spulber, Daniel F. 1999. *Market Microstructure: Intermediaries and the Theory of the Firm*. Cambridge: Cambridge University Press.
- Spulber, Daniel F. 2008a. Consumer Coordination in the Small and in the Large: Implications for Antitrust in Markets with Network Effects. 4 (2) *Journal of Competition Law and Economics* 207-262.
- Spulber, Daniel F. 2008b. Unlocking Technology: Innovation and Antitrust. 4 (4) *Journal of Competition Law and Economics* 915-966.
- Spulber, Daniel F. 2009a. Discovering the Role of the Firm: The Separation Criterion and Corporate Law. 6 (2) *Berkeley Bus. L.J.* 298-347.
- Spulber, Daniel F. 2009b. *The Theory of the Firm: Microeconomics with Endogenous Entrepreneurs, Firms, Organizations, and Markets*. Cambridge: Cambridge University Press.
- Spulber, Daniel F. 2010. The Quality of Innovation and the Extent of the Market. 80 (2) *Journal of International Economics* 260-270.
- Spulber, Daniel F. 2011a. Competing Inventors and the Incentive to Invent, Northwestern University Working Paper.
- Spulber, Daniel F. 2011b. How Entrepreneurs Affect the Rate and Direction of Inventive Activity, in Josh Lerner and Scott Stern, eds., Fiftieth Anniversary of the Rate and Direction of Inventive Activity, NBER Conference volume, forthcoming.
- Spulber, Daniel F. 2011c. Intellectual Property and the Theory of the Firm, in F. Scott Kieff and Troy Paredes, eds., Perspectives on Commercializing Innovation, Cambridge University Press, 2011, forthcoming.
- Steil, Benn. 2002. Changes in the Ownership and Governance of Securities Exchanges: Causes and Consequences. In Richard Herring & Robert E. Litan, eds., *Brookings-Wharton Papers on Financial Services: 2002*. 61-91. Washington, D.C.: Brookings Institution Press.

- Stoll, Hans R. 2002. Comment and Discussion. In Richard Herring & Robert E. Litan, eds., *Brookings-Wharton Papers on Financial Services: 2002*. 83-90. Washington, D.C.: Brookings Institution Press.
- Temple, James. 2010. Google Instant Predicts What Users are Searching For, *San Francisco Chronicle*, September 8.
- Thomas, John R. 1999. The Patenting of the Liberal Professions. 40 (5) *B.C. L. Rev.* 1139-1186.
- Triplett, Jack E. & Barry P. Bosworth. 2004. *Services Productivity in the United States: New Sources of Economic Growth*. Washington, D.C.: Brookings Institution Press.
- Triplett, Jack E. & Barry P. Bosworth. 2006. 'Baumol's Disease' Has Been Cured: IT and Multifactor Productivity in U.S. Services Industries. In Dennis W. Jansen, ed., *The New Economy and Beyond: Past, Present, and Future*. 34-71. Cheltenham, U.K.: Edgar Elgar.
- Tufano, Peter. 2003. Financial Innovation. In George Constantinides, Milton Harris, & Rene Stulz, eds., *Handbook of the Economics of Finance vol. 1A*. 307-336. Amsterdam: North-Holland.
- United States Census Bureau. 2006. *Annual Survey of Manufactures, Statistics for Industry Groups and Industries: 2005*. Washington, D.C.: U.S. Government Printing Office.
- United States Department of Commerce. 1994. *U.S. Industrial Outlook 1994*. U.S. Government Printing Office.
- United States Patent and Trademark Office. Patent Full-Text Databases. Available at: <http://patft.uspto.gov/>.
- United States Patent and Trademark Office. Patent Technology Monitoring Team. Patenting In Technology Classes. Available at: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/tecasg/705_tor.htm (accessed July 12, 2010).
- United States Patent and Trademark Office. 2009. Data Processing: Financial, Business Practice, Management, or Cost/Price Determination. USPTO Patent Class 705, Section II, 705-1-705-3.
- United States Patent and Trademark Office. 2010. Automated Financial or Management Data Processing Methods. USPTO White Paper. Available at: <http://www.uspto.gov/web/menu/busmethp/index.html#origins> (accessed June 3, 2010).

- Van Zanden, Jan L. 1993. *The Rise and Decline of Holland's Economy: Merchant Capitalism and the Labour Market*. Manchester: Manchester University Press.
- Veyne, Paul. 1987. *The Roman Empire*, Cambridge, MA: Harvard University Press.
- Wagner, Stefan. 2008. Business Method Patents in Europe and Their Strategic Use – Evidence From Franking Device Manufacturers. 17 (3) *Economics of Innovation and New Technology* 173-194.
- Yuskavage, Robert E. 1994. Gross Product by Industry, 1991-92. 74 (10) *Survey of Current Business* 30-34.