

## **Financial Innovation**

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**Abstract:** This essay surveys the literature on financial innovation from a wide variety of disciplines: financial economics, history, law, and industrial organization. I define financial innovation, discuss problems with creating taxonomies of financial innovation, and outline the explanations given for the extensive amount of financial innovation we observe both today and in history. I also review work that studies the identity of innovators, the process of diffusion of innovation, the private benefits of innovation and the social welfare implications of innovation.

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## 1. Introduction

In Merton Miller's (1986) view on financial innovation, the period from the mid-1960s to mid-1980s was a unique one in American financial history. Looking backward, he rhetorically asked, "Can any twenty-year period in recorded history have witnessed even a tenth as much (financial innovation)?" Looking forward, he asked the question, "Financial innovation: Is the great wave subsiding?" Answering "No" to the first question and "Yes" to the second, he concluded that the period was an extraordinary one in the history of financial innovation. However, with 20-20 hindsight, we can disagree with his assessment and answer the two questions somewhat differently.

History shows that financial innovation has been a critical and persistent part of the economic landscape over the past few centuries. In the years since Miller's 1986 piece, financial markets have continued to produce a multitude of new products, including many new forms of derivatives, alternative risk transfer products, exchange traded funds, and variants of tax-deductible equity. A longer view suggests that financial innovation—like innovation elsewhere in business—is an *ongoing* process whereby private parties experiment to try to differentiate their products and services, responding to both sudden and gradual changes in the economy. Surely, innovation ebbs and flows with some periods exhibiting bursts of activity and others witnessing a slackening or even backlash.<sup>1</sup> However, when seen from a distance, the Schumpeterian process of

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<sup>1</sup> For example, there have been numerous periods throughout the past centuries in which innovation flourished, failures took place, and public and regulatory sentiment led to temporary anti-innovation feelings. See Chancellor (1999). More recently, the failure of Enron has probably slowed the innovation of new forms of special purpose entities and off-balance sheet financing, although this chilling effect is unlikely to be permanent.

innovation—in this instance, financial innovation—is a regular ongoing part of a profit-maximizing economy.

In this review piece, I summarize the existing research on financial innovation and highlight the many areas where our knowledge is still very incomplete. The existing work, while fairly modest in scope relative to others topics covered in this volume, is spread over a wide range of fields: general equilibrium analyses of the role for financial innovation; thought pieces proposing the reasons for innovation; legal and policy analyses of tax rules, regulation and innovation; studies of financial innovation in the industrial organization literature; clinical studies of individual innovations: and a handful of empirical studies of the process of innovation.<sup>2</sup> A number of comprehensive books on the subject have been written, including Allen and Gale's (1994) comprehensive overview, and entire issues of journals have been devoted to the topic (e.g., *Journal of Economic Theory* (1995, Volume 65.)) The topic of financial innovation has been addressed by a number of AFA presidents, including Merton, Miller, Ross and Van Horne, some in their Presidential Addresses. My goals in this short overview are to cover the breadth of the existing literature briefly, rather than treat one sub-area in detail, and to highlight open issues that researchers may find suitable for future work.

This piece is divided into five sections. The first defines financial innovation and discusses the difficulty of creating a taxonomy of financial innovations. The second section discusses the explanations advanced for financial innovation. The third section discusses the identity of innovators. The fourth section discusses the implications of

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<sup>2</sup> In addition, there are a variety of a large number of articles in the financial press as well as popular business books addressing the topic of financial innovation, typically from the perspective of how businesses can capitalize on them. For examples of popular book-length discussions of financial innovation, see Geanuracos and Millar (1991), Walmsley (1988) and Crawford and Sen (1996).

financial innovation on private and social wealth. The final section concludes with a brief discussion of new means of protecting the intellectual property of innovators and a review of the open issues in this field.

## **2. What is financial innovation?**

Much of the theoretical and empirical work in financial economics considers a highly stylized world in which there are few types of securities (debt and equity, perhaps) and maybe a handful of simple financial institutions (banks or exchanges.) However, in reality there is a vast range of different financial products, many different types of financial institutions and a variety of processes that these institutions employ to do business. The literature on financial innovation attempts to catalog some of this variety, describe the reasons why we observe an ever-increasing diversity of practice, and assess the private and social implications of this activity.

“Innovate” is defined in *Webster’s Collegiate Dictionary* as “to introduce as or as if new,”<sup>3</sup> with the root of the word deriving from the Latin word “novus” or new.

Economists use the word “innovation” in an expansive fashion to describe shocks to the economy (e.g., “monetary policy innovations”) as well as the responses to these shocks (e.g., Eurodeposits). Broadly speaking, financial innovation is the act of creating and then popularizing new financial instruments as well as new financial technologies, institutions and markets. The “innovations” are sometimes divided into *product* or *process* innovation, with product innovations exemplified by new derivative contracts, new corporate securities or new forms of pooled investment products, and process improvements typified by new means of distributing securities, processing transactions,

or pricing transactions. In practice, even this innocuous differentiation is not clear, as process and product innovation is often linked. The *processes* by which one creates a new index linked to college costs or invests to produce returns that replicate this index are hard to separate from a new indexed investment *product* that tries to help parents save to pay for their children's education.

Innovation includes the acts of invention (the ongoing research and development function) and diffusion (or adoption) of new products, services or ideas.<sup>4</sup> Invention is probably an overly generous term, in that most innovations are evolutionary adaptations of prior products. The lexicographer's addition of the phrase "as if" to the definition of innovation reflects one difficulty in any study of this phenomenon—almost nothing is completely "new" and the degree of newness or novelty is inherently subjective.<sup>5</sup> (Patent examiners charged with judging the novelty of inventions face this challenge routinely.)

One sub-branch of the literature on financial innovation has created lists or taxonomies of innovations. Given the breadth of possible innovations, this work tends to specialize in particular areas, such as securities innovations. For example, Finnerty (1988, 1992, 2001) has created a list of over 60 securities innovations, organized by broad type of instrument (debt, preferred stock, convertible securities, and common equities) and by the function served (reallocating risk, increasing liquidity, reducing agency costs, reducing transactions costs, reducing taxes or circumventing regulatory constraints.) One investment bank published a guide to innovative international debt securities in the mid-1980s. This 64-page booklet did not describe individual innovations,

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<sup>3</sup> Webster's Ninth New Collegiate Dictionary (1988).

<sup>4</sup> See Rogers (1983) for a discussion of the adoption of innovations.

but rather categorized the *characteristics* of the innovative securities along five dimensions (coupon, life, redemption proceeds, issue price and warrants.)<sup>6</sup>

Neither innovation nor the impulse to categorize it are new activities: The 1934 edition of the investing classic, Benjamin Graham and David Dodd's *Security Analysis* included an appendix entitled "A Partial List of Securities which Deviate from the Normal Patterns," which they introduced in this way:

In assembling the material presented herewith it has not been our purpose to present a complete list of all types of securities which vary from the customary contractual arrangements between the issuing corporation and the holder. Such a list would extend the size of this volume beyond reasonable limits. We have, however, attempted to give a reasonably complete example of deviations from the standard patterns.

In the following 17 pages, they described 258 securities. Put in modern language, their list included pay-in-kind bonds, step-up bonds, putable bonds, bonds with stock dividends, zero coupon bonds, inflation-indexed bonds, a variety of exotic convertible and exchangeable bonds, 23 different types of warrants, voting bonds, non-voting shares, and a host of other instruments. Graham and Dodd's list is not an anomaly. A small literature on the history of financial innovation demonstrates that the creation of new financial products and processes has been an ongoing part of economies for at least the past four centuries, if not longer.<sup>7</sup> While many of these old innovations sound quite new even today, some have become extinct. For example, the "Million Adventure," described by Allen and Gale (1994, p. 13) raised one million pounds in 1694. The structure of this "lottery loan" innovation was a 16 year bond paying 10% with an added bonus—a lottery

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<sup>5</sup> Scholars in Industrial Organization sometimes differentiate between "drastic" and "incremental" innovations. Drastic innovations bring costs to a level below the corresponding monopoly price. See Tirole (1988, chapter 10).

<sup>6</sup> Other useful lists were drawn up by Tufano (1989, 1995), Matthews (1994) and Silber (1975).

<sup>7</sup> For extended discussions, see Silber (1975), Allen and Gale (1994, Chapter 2) and Tufano (1995, 1997).

ticket which gave the holder a chance to share in an additional £40,000 per year for each of the next 16 years.

In preparing this chapter, I asked my research assistant to compile a complete list of security innovations so that I could update an estimate from the mid-80s that showed that 20% of all new security issues used an “innovative” structure.<sup>8</sup> One place to begin this exercise was Thompson Financial Securities Data (former SDC), a data vendor that tracks new public offerings of securities. He provided me with a list of 1,836 unique “security codes” used from the early 1980s through early 2001, each purporting to be a different type of security. Some of the securities listed were nearly-identical products offered by banks trying to differentiate their wares from those of their competitors. Others represented evolutionary improvements on earlier products. Perhaps a few were truly novel. Nevertheless, the length of the list represents a “normal” pattern of financial innovation, where a security is created, but then modified (and improved) slightly by each successive bank that offers it to its clients.

Even this list—if combed to eliminate false innovation—would severely underestimate the amount of financial innovation, as it only includes corporate securities. It excludes the tremendous innovation in exchange-traded derivatives, over-the-counter derivative contracts<sup>9</sup> (such as the credit derivatives, equity swaps, weather derivatives and exotic over-the-counter options), new insurance contracts (such as alternative risk transfer contracts or contingent equity contracts), and new investment management products (such as folioFN or exchange traded funds.)

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<sup>8</sup> The original estimate comes from Tufano (1989).

<sup>9</sup> Duffie and Rahi (1995) cite the Wall Street Journal (June 14, 1994), p. C1 as stating there are over 1200 different types of derivative securities in use, although these journalistic calculations are somewhat suspect.

The many different “lists” of financial innovations—even just security innovations—demonstrate the difficulty in categorizing new products. Lists organized by product name (like SDC’s categorization) tend to be uninformative, because firms use names to differentiate similar products. Lists by “traditional labels” (e.g., legal or regulatory definitions of debt or equity, etc.) tend to be problematic, as innovations often intentionally span across different traditional labels. Lists organized by product feature (e.g., maturity, redemption provisions, etc.) provide a great deal of information and highlight the component parts of each innovation, but do so at creating a classification system that has so many dimensions as to be unmanageable.

The alternative chosen by most academics writing about innovation has been to adopt a functional approach to classifying products.<sup>10</sup> Rather than group products by their names or features, authors categorize them by the functions they serve. Finnerty’s taxonomy mentioned above does this, as does The Bank for International Settlements (BIS, 1986). The BIS discusses the problems with creating taxonomies and concludes that the best scheme is a functional one. While there seems to be some agreement that the best categorization scheme is a functional one, it is less clear how to identify the particular functions.

### **3. Why do financial innovations arise? What function do they serve?**

If the world were free of all “imperfections”—such as taxes, regulation, information asymmetries, transaction costs, and moral hazard—and if markets were complete in the sense that existing securities spanned all states of nature, we could arrive



at an M&M-like corollary regarding financial innovation. Financial innovations would benefit neither private parties nor society and would simply be neutral mutations.<sup>11</sup>

Against this backdrop, a sizeable body of literature attempts to understand how various “imperfections” (and changes in these imperfections) stimulate financial innovation. These *imperfections* prevent participants in the economy from efficiently obtaining the *functions* they need from the financial system. Generally, authors establish how financial innovations are optimal responses to various basic problem or opportunities, such as incomplete markets that prevent risk shifting or asymmetric information. Some of these analyses are “institution-free” in that they do not explicitly consider the role of innovators in the process, while other institutionally-grounded explanations study the parts played by financial institutions using innovation to compete.

What functions do innovations help us perform? Merton’s (1992) functional decomposition identifies six functions delivered by financial systems: (1) moving funds across time and space; (2) the pooling of funds; (3) managing risk; (4) extracting information to support decision-making; (5) addressing moral hazard and asymmetric information problems; and (6) facilitating the sale of purchase of goods and services through a payment system. Different writers use slightly different lists of functions, but there is much overlap in these descriptions. For example, Finnerty (1992) identifies a set of functions, two of which correspond closely to Merton’s functions (reallocating risk and reducing agency costs), and a third (“increasing liquidity”) which is an amalgam of

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<sup>10</sup> While various authors have proposed functional classification schemes, the broader notion of using “function” as the critical unit in understanding financial systems has been advanced strongly by Merton (1992), and is developed in Crane et al. (1995).

<sup>11</sup> While the notion of neutral mutations has been long recognized in evolution, Miller (1977) used the term to describe a variety of financial decisions and financial innovations. While this term is normally used as a derogatory one, Miller is careful to note that the existence of seemingly neutral mutations can “permit the

Merton's movement of funds and pooling functions. The BIS (1986) has a slightly different scheme to identify the functions performed by innovation, focusing on the transfer of risks (both price and credit), the enhancement of liquidity, and the generation of funds to support enterprises (through credit and equity.) Each author strives to describe the functions in a parsimonious fashion, but it is probably fair to say that no commonly accepted and unique taxonomy of functions has been adopted. Even if it were to exist, no functional scheme could avoid the complication that a single innovation is likely to address multiple functions. For example, using Merton's functional scheme, asset securitization invokes at least three functions: it pools various future promises, modifies risk profiles through diversification, and moves funds across time and space.

If functions represent timeless demands put upon financial systems, then why do we observe innovation? Some authors adopt a static framework, where no attempt is made to explain the timing of the innovation. Other authors adopt a dynamic framework, where innovations reflect responses to changes in the environment, and the timing of the innovation mirrors this change. My discussion below summarizes most of the key arguments, and uses a combination of recent and historical examples to illustrate the points.<sup>12</sup>

(1) *Innovation exists to complete inherently incomplete markets.* In an incomplete market, not all states of nature can be spanned, and as a result, parties are not able to move funds freely across time and space, nor to manage risk. Duffie and Rahi (1995), in their introduction to a special issue of the *Journal of Economic Theory* on financial market innovation and security design, review the literature on market incompleteness

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adaptation to new conditions to take place more quickly or surely" in response to real changes in the economy.

and innovation.<sup>13</sup> This literature attempts to establish conditions under which innovation would occur in equilibrium. In summarizing a wide range of the literature they conclude:

At this early stage, while there are several results providing conditions for the existence of equilibrium with innovation, the available theory has relatively few normative or predictive results. From a spanning point of view, we can guess that there are incentives to set up markets for securities for which there are no close substitutes, and which may be used to hedge substantive risks.

This theoretical proposition is consistent with evidence of the pattern of innovation in exchange-traded contracts documented by Black (1986). She shows a relationship between a new contract's viability (measured by its trading volume) and its ability to complete markets (measured by its lack of correlation with large but uninsurable risks.) Grinblatt and Longstaff (2000) study a different innovation (Treasury STRIPS or zero-coupon bonds). They find that investors create new STRIPS primarily to make markets more complete, a conclusion drawn from the observation that STRIPS are created when it would be most difficult to synthesize the discount bonds from existing coupon instruments.

Allen and Gale (1988) consider a particular form of market incompleteness—in the form of short sales restrictions—as motivation for innovation by parties seeking to share risk. They show it may be optimal for firms to offer multiple classes of claims (“breaking the firm into pieces”) generating value from different investor preferences and needs (“selling the pieces to the clientele that values it most.”)

Cloaked in less academic language, the idea that innovation typically address the unmet preferences or needs of particular clienteles is reasonably well discussed in business practice. For example, one popular book describing the derivatives activities at

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<sup>12</sup> Portions of this section are drawn from Tufano (1992).

a major bank (Partnoy (1997)) provides details on relatively uncommon products designed for a small number of institutional investors.

*(2) Innovation persists to address inherent agency concerns and information asymmetries:* Much of contracting theory (or the security design literature) explores how contracts can be written to better align the interests of different parties or to force the revelation of private information by managers. This extensive literature has been surveyed by Harris and Raviv (1989), and is also covered in Allen and Gale (1994, pp. 140-147). Persistent conflicts of interest between outside capital providers and self-interested managers, and asymmetric information between informed insiders and uninformed outsiders, leads to equilibria in which firms issue a multiplicity of securities. Most of this work deals with innovation in a fairly limited sense, explaining the existence of a few contracts like debt or equity, not scores of different types of corporate securities. However, Haugen and Senbett (1981) argue that incorporating embedded options into securities can mitigate moral hazard problems. This motive for innovation can possibly explain the embedded options in some innovative R&D financings (for a case study of these innovations, see Lerner and Tufano (1993)<sup>14</sup> and for an empirical analysis see Beatty, Berger and Magliolo (1995)). In these structures, an R&D financing organization is set up with separate shareholders from the “parent,” which retains all decision rights to the day-to-day activities of this separate organization. Attaching warrants exercisable into the stock of the “parent” of the R&D financing vehicles partially ameliorates the inherent conflicts of interest.

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<sup>13</sup> Duffie and Rahi (1995)’s survey describes a unified modeling framework to study the impact of innovation on risk-sharing and information aggregation.

<sup>14</sup> This case study and others mentioned here are also in Mason, Merton, Perold and Tufano (1995)

Ross (1989) invokes agency issues to explain some financial innovations. He notes that agency considerations make borrowing costly or limited and, as a result, individuals contract with opaque financial institutions. When a shock (such as a change in taxes or regulation) occurs, financial intermediaries may find it efficient to sell off low-grade assets. Because outside investors cannot easily assess the value of these assets, the institutions turn to investment banks to place these securities with their network of clients. These investment banks innovate, creating new pools of these low-grade assets. Agency considerations interact with marketing costs to produce innovation.

Throughout history, information asymmetries have prompted a number of innovations. Throughout much of the nineteenth and early twentieth century, firms disclosed very little credible financial information. Over time, market forces and governmental action materially increased the quantity and quality—and thus lowered the cost—of information about firms. Early innovations tended to substitute for (or economize on) the use of costly information, while later innovations capitalized on its lower cost. One of the earliest innovations, the nineteenth century practice of issuing assessable stock, provided some mechanisms to squeeze information from firms. An assessable share-holder committed to supply a certain amount of money to the firm, but doled out the cash to the firm in response to regular assessments. (Dewing (1919). Issuers of assessable common stock were forced to return to their investors regularly and make the case for continued commitment, because each investor held the option to fail to make the assessment and forfeit his interest. The nineteenth century firms' almost complete reliance on secured debt for debt financing (see Ripley cited in Baskin (1988, pp.

215-216)) may also be interpreted as a costly contracting choice that substituted for more precise monitoring prevented by inadequate disclosure.

Later nineteenth century innovations took advantage of the presence of cheaper and more reliable information. Later preferred stocks conditioned their holders' voting rights on firms' failure to comply with covenant terms (Johnson (1925) and Wilson (1930), both cited in Dewing (1934)). These covenants, especially after 1900, were more likely to be tied to financial ratios, as were bond covenants keyed to working capital tests or asset maintenance tests (Dewing (1934)). Finally, income bonds, popularized in the late nineteenth century, were completely linked to the availability of accounting information. These unsecured obligations required issuers to pay interest only if the firm earned positive accounting profits in the current period. This early history shows how innovations were a response to information asymmetries. Certain innovations forced the revelation of information and others exploited the low cost information generated through other processes.

(3) *Innovation exists so parties can minimize transaction, search or marketing costs.* Merton (1989) discusses how the presence of transaction costs provides a critical role for financial intermediaries. Financial intermediaries permit households facing transaction costs to achieve their optimal consumption-investment program. Merton uses this argument to explain how equity swaps can be an efficient way to deliver returns to multinational investors. A similar explanation is invoked by McConnell and Schwartz (1992) who provide a clinical study of one particular innovation, LYONS (liquid yield option notes). Lee Cole, the Options Marketing Manager at Merrill Lynch noticed that retail investors tended to place most of their money in low-risk securities and then buy a

series of call options. Merrill Lynch's LYONs allowed investors to replicate this payoff without having to incur the commission costs of rolling over their call option positions at least four times a year.

Many of the process innovations in payment systems technologies are aimed at lowering transaction costs. ATMs, smart cards, ACH technologies, e-401k programs and many other new businesses are legitimate financial innovations that seek to dramatically lower the sheer costs of processing transactions. By some estimates, these innovations have the potential to lower the cost of transacting by a factor of over 100. For example, by one estimate, a teller-assisted transaction costs over \$1.00 and the same transaction executed over the Internet would cost about \$0.01.<sup>15</sup>

New businesses like Instinet, Open-IPO, Enron OnLine, Ebay, or the host of B-to-B exchanges are innovations that aimed at lowering the transaction costs faced by buyers and sellers. These transaction costs are search or marketing costs, which can include a variety of components—the sheer costs of identifying buyers and seller, information costs, and transaction costs of order processing. Ross's (1989) analysis of securitization keys off the expensive process of marketing in conjunction with agency considerations. Madan and Soubra (1991) examine how financial intermediaries attempt to maximize their revenues net of marketing costs, which leads them to design multiple products that appeal to wider sets of investors.

History shows that as marketing costs fall, financial innovations exploit the easier access to buyers and sellers of securities. For example, during World War I, the U.S. government instituted a massive program to fund its war-time efforts through selling

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<sup>15</sup> *The Economist*, "Online Finance Survey," May 20, 2000. Page 20

small-denomination bonds to individual investors. Carosso (1970) describes the Liberty Loan program of 1917 which identified and educated a new clientele of retail investors:

The Treasury immediately decided to mount an intensive nationwide sales effort. Advertisements and thousands of spokesmen emphasized the security, high yield, and probable appreciation of the new Liberty bonds. Established techniques were put aside. Instead of selling substantial amounts of large denominations for holding in relatively few hands, the government issued bonds in small denominations, utilized war saving stamps widely, and permitted installment payments. All the foregoing "new" departures were designed to appeal to individuals not considered potential investors since the Civil War days of Jay Cooke.

These activities by the federal government lowered the costs for the private sector to identify and educate new potential customers. After the war, innovations in the private sector took advantage of the lowered costs of raising funds from households. These innovations, tailored to meet the needs of small savers, included "baby bonds" sold in small denominations and securities sales on installment (Riegel (1920)).

*(4) Innovation is a response to taxes and regulation:* While many authors have pointed out the link between taxes and innovation, Miller (1986) is often cited on this point: "The major impulses to successful innovations over the past twenty years have come, I am saddened to have to say, from regulation and taxes." The list of tax and regulatory induced products would include zero coupon bonds, Eurodollar Eurbonds, various equity-linked structures used to monetize asset holdings without triggering immediate capital gains taxes, and trust preferred structures.<sup>16</sup>

If we think of taxes as a major "imperfection" added to the M&M world, then the search to maximize after-tax returns has arguably stimulated much innovation, and changes in tax law in turn stimulate even more innovation. For example, various equity-linked structures used by firms to monetize their holdings of stock permit these firms to



delay paying capital gains taxes. These innovations decouple economic ownership or exposure from legal ownership (governance and tax implications.) See Tufano (1997b) and Santangelo and Tufano (1997) for a case study of this type of innovation.

A number of legal scholars have written extensively on the relationship between laws and innovation, and have created a flourishing literature on this subject. They discuss how tax laws have both encouraged and discouraged innovation, analyzed the failures of the U.S. tax code for dealing with functionally-similar securities, suggested how to change the tax code to eliminate innovation, and given their opinions of the social welfare costs of tax-induced innovation.<sup>17</sup>

A century ago, taxes were a less visible force in the U.S. economy, yet they still played some role in the process of financial innovation. In the late 1920s, a few states (Delaware, New Jersey, and New York) began to levy incorporation and transfer taxes based on the par value of firms' shares, and to assign par values of \$100 to firms whose stock had zero par value. Corporations almost immediately reissued shares with small, but nonzero (\$1-\$5) par values (Hornberger (1933)). Equipment trust certificates, by which a railroad leased cars from a manufacturer with financing provided by the certificates secured by the equipment, were more popular in states such as Pennsylvania that subjected bonds, but not the certificates, to income taxes (Dewing (1934)).

Changes in regulation are also credited with stimulating innovation. Kane (1986) identified what he calls the “regulatory dialectic” as a major source of innovation.

Innovation responds to regulatory constraints, which in turn are adjusted in reaction to

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<sup>16</sup> For an example of this type of innovation for zero coupon debt, see Fisher, Brick and Ng (1983).

<sup>17</sup> This is a very extensive literature. For representative papers, see Gergen and Schmitz (1997), Kollbrenner (1995), Warren (1993), Knoll (1997, 2001) Strnad (1994), Schenk, D. H., (1995).

these innovations. Bank capital requirements are a good example of regulations that impose costs on the affected parties, who then use innovation to optimize in light of these constraints. Capital notes and certain preferred stocks that qualified as “capital” to bank regulators are examples of regulatory-induced innovation. Similarly, the early Eurobond market was motivated by regulatory concerns. By offering Eurodollar CDs, U.S. banks, led by Citicorp in 1966, sought to circumvent reserve requirements to stem the painful disintermediation they were experiencing.<sup>18</sup> Regulations limiting cross-border flows are sometimes credited with stimulating certain equity swaps, which enable foreign investors to hold an economic interest in equities they would find difficult to own.<sup>19</sup> The academic debate on regulation has taken many different forms: Whether regulation has stimulated or impeded innovation and whether regulation is “sensible” in light of innovation. See White (2000), Hu (1989), Pouncy (1998), and Russo and Vinciguerra (1991) for development of some of these themes. While regulation is considered a key driver of innovation, Jagtaiani, Saunders and Udell (1995) fail to find that changes in capital requirements consistently affected the speed of adoption of certain innovations, like off-balance sheet products.

While ratings agencies are not governmentally-established regulators, they are a form of self-regulatory organization. Their rules have given rise to innovations. In particular, various forms of trust preferred securities that seek to retain tax deductibility while being treated like equity from the perspective of ratings agencies are examples of innovation induced partially by ratings.

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<sup>18</sup> Eurobond markets were also stimulated by related concerns, although more linked to tax considerations. See Kim and Stulz (1988).

<sup>19</sup> Regulation or lack of certain standard legal forms can also stymie innovation. For example, various laws have apparently slowed the growth of securitization in some European countries.

Court decisions, and the nature of the legal system, gives rise to innovation. Throughout the late nineteenth century, the extreme business cycles experienced by the U.S. economy led to the massive failures of railroads and industrial firms. Security holders turned to the courts to enforce what they believed to be their legal rights, but judges set aside many "inviolable rights" to quickly reorganize the railroads. Specifically, super-senior "debtor-in-possession" financing was given priority above existing senior claimants, certain unsecured creditors were paid before secured creditors, and judges set "judicial" values for the claims of distressed firms. These legal innovations were important stimuli for the adoption of contingent charge securities and voting trusts, which supplanted traditional creditors' rights with more direct means of monitoring and control. See Tufano (1997). Franks and Sussman (1999) argue that the nature of the "innovation regime" (whether driven by lenders and borrowers, or by judges and legislators) affects the nature of subsequent contract evolution and the amount of innovation.

Just as governmental or court rules can give rise to innovation, so too can religious prohibitions. The strong Islamic prohibition against interest has stimulated a number of alternative financing vehicles. Many of these innovations seem to respect the letter, but not the spirit, of the ban on interest, using sale-repurchase contracts to effectively deliver interest to lenders. For a discussion, see Vogel and Hayes (1998).

It may be more than semantics to comment that *legal engineering* has facilitated a range of new forms of contracting innovations. For example, the on-going quest for "tax-deductible equity" has largely been the product of *legal engineers* utilizing new ideas to develop securities whose cash payments are tax-deductible but which are treated like equity in the eyes of potential investors. McLaughlin (2000) discusses the relationship between

legal engineering and financial innovation from the perspective of a practicing member of the legal bar.

(5) *Increasing globalization and risk motivate innovation.* Most essays on financial innovation identify globalization and increasing volatility as drivers of innovation. With greater globalization, firms, investors and governments are exposed to new risks (exchange rates or political risks), and innovations help them manage these risks. For example, a recent press report announced that the Interamerican Development Bank had created the first-ever instrument that incorporated a currency convertibility and transferability guarantee. In addition, globalization enables capital raisers to tap larger and more diverse populations of potential investors. A variety of innovations are attributed to attempts to meet the needs of specific investor clienteles. For example, one popular finance book describes a variety of innovative structures designed to appeal to particular Japanese insurance company investors, a form of cross-national regulatory arbitrage.

Some authors point to increasing volatility as a stimulus to innovation. For example, Smith, Smithson, and Wilford (1990, p. 13) document the increase in the volatility of interest rates, exchange rates, and commodity prices, and draw a link between this increase in riskiness and financial innovation:

Uncertainty in the global financial environment has caused many economic problems and disruptions, but it has also provided the impetus for financial innovation. Through financial innovation, the financial intermediaries were soon able to offer their customers products to manage or even exploit the new risks. Through this same innovation, financial institutions became even better able to evaluate and manage their own asset and liability processes.

They list a variety of innovations spawned by increasing volatility: foreign exchange futures, swaps and options; interest-rate futures, swaps, options, and forwards; and

commodity swaps, futures, and options. As a concrete example, the deregulation of natural gas in the United States suddenly exposed producers and consumers of gas with tremendous volatility. Drawing analogies to financial markets, gas marketers created (or adapted) a variety of new gas contracts, including Volumetric Production Payment contracts, cross-commodity swaps, and a line of branded price protection products. See Mason, Merton, Perold and Tufano (1995).

The volatility of exchange rates and inflation rates prompted earlier innovations. The period of World War I and its aftermath was characterized by high inflation uncertainty. "Stabilized" (inflation-indexed) bonds, which were introduced in 1925 with an issue by Rand-Kardex, linked interest and principal payments to the wholesale price index (Masson and Stratton (1938)). This innovation, although apparently never popularized, was an explicit attempt to solve the problem of volatile prices. The instability of currency values prompted innovations regarding the medium of payment for bonds (currency-choice bonds). "Legal tender" bonds gave "the payer ... the option of paying in any kind of legal tender (gold, silver, or currency); they give to him the benefit of the cheaper form of currency" (Cleveland (1920)). Non-U.S. issuers, facing the problems of "disordered or unstable monetary systems...attempted to allay the fears of investors by various attempts to insure protection against depreciated currencies." These innovations included indexing payments to exchange rates and permitting investors to choose the form of the interest payment (Masson and Stratton (1938)). Stabilized and currency-choice bonds show that volatility motivated innovations in the 1830-1930 period, just as it has spurred more recent innovation.

(6) *Technological shocks stimulate innovation*: Shocks to technology are thought to provide a “supply-side” explanation for the timing of some innovations.<sup>20</sup> Advances in information technology support sophisticated pooling schemes that we observe in securitization. IT and improvements in telecommunications (and more recently the Internet) has facilitated a number of innovations (not all successful), including new methods of underwriting securities (e.g., OpenIPO), new methods of assembling portfolios of stocks (folioFN), new markets for securities and new means of executing security transactions. White (2000) articulates this technological view of financial innovation.

New “intellectual technologies,” i.e., derivative pricing models, are credited with stimulating the growth and popularization of a variety of new contracts. Many new forms of derivatives were made possible because business people could have some confidence in the methods of pricing and hedging the risks of these new contracts. Without the ideas developed by Black, Scholes, Merton and many others, many developments in derivative products would probably never have occurred.

Various forms of innovations such as new risk management systems and measures (such as Value-at-Risk based measures), on-line retirement planning services (like Financial Engines), and new valuation techniques (like real options) clearly were facilitated by both intellectual and information technology innovations. For example, the existence of lifetime portfolio choice models, developments in numerical analyses and simulation, hardware that enables faster processing, and the Internet are all elements that

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<sup>20</sup> Schmookler’s (1967) classic work on innovation articulates a technological-driven view of broad classes of innovations.

support (but may not ensure the success of) new businesses like that seek to provide consumers with advice on their financial decisions.

*A case study: No one explanation works.* Let us consider a quarter century of innovation in one particular part of the investment management world, and how virtually every stimulus mentioned above played a role in a whole family of innovations.

In their 1974 piece, “From Theory to a New Financial Product,” Black and Scholes describe the birth of a new product: “market funds,” or what we call today index funds. Wells Fargo reportedly first offered a privately placed equally-weighted S&P 500 fund in 1971 (which apparently never caught on), and introduced a value-weighted fund in 1973.<sup>21</sup> Black and Scholes describe the challenges in bringing this product to market, which required Wells Fargo to navigate regulatory and tax issues, surmount systems processing requirements, and educate potential investors. What were the stimuli for these innovations? At one level, the introduction of index funds permitted investors to better manage their investment-consumption decisions—they “completed the market.” They also were an economical solution to high transaction costs which would prevent most investors from creating a basket of securities that replicated the entire equity market. We must also acknowledge that the innovation was shaped by new technologies (both intellectual advancements as well as systems capabilities), was a response to tax and regulatory factors, and was driven by the presence of information asymmetries and transaction costs that made trading costly. Thus, this one innovation was the result of virtually every explanation advanced above. Attempts to distinguish which factor was *most* important seems pointless.

Later generations of indexed products (and futures contracts) followed, but moving ahead a later related development was exchange traded funds (ETF). ETFs essentially let investors trade the market index throughout the day.<sup>22</sup> Toronto Index Participations (TIPS) in 1990 , Leland O’Brian Rubinstein’s SuperTrust in 1992, the American Stock Exchange’s SPDRs (Standard and Poor’s Depository Receipts) in 1993, and Merrill Lynch’s HOLDRs in 1999 were steps in the evolutionary innovation process. Arguably, ETFs and HOLDRs were motivated by similar impulses as the index funds, but these innovations enhance the functionality of the original innovation. They permit investors to enjoy even lower transaction costs than many index funds and permit intraday trading, which facilitates speculation, arbitrage and risk management. These innovations are driven by regulation, in that they permit investors to short sell the index, which index funds do not, and avoid the uptick rule, which prescribes when an investor can short-sell a security. These products are also tax-motivated, in that they permit investors to avoid potential tax liabilities resulting from the redemptions of other investors, and to “cherry pick” the timing of recognition of losses and gains on *individual* securities in the basket. The HOLDRS also reduce transaction costs by eliminating rebalancing, whose transaction costs (due to recognition of capital gains) can be material.<sup>23</sup>

The newest “generation” of products pushing this functionality to even greater levels are the “personal funds” that a few web-based firms are offering, such as

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<sup>21</sup> Vanguard’s retail offering, the First Index Investment Trust, was introduced in 1976.

<sup>22</sup> Index futures also allow investors to buy and sell the market portfolio, although they take a different legal form, have different settling up features, and are not permissible investments for some investors. The Chicago Mercantile Exchange first offered a futures contract on the S&P 500 index in 1982.

<sup>23</sup> For historical background on these products, see Gary Gastineu, “Exchange Traded Funds: An Introduction” *Institutional Investor*, Spring 2001. Also see the case studies of SuperTrust (Mason, Merton, Perold and Tufano (1995) and HOLDRS (Perold and Brown (2000)).



folioFN.<sup>24</sup> These firms permit investors to assemble baskets of stock in relatively small denominations, allowing investors to create and trade positions involving fractional shares. Like ETFs, these products permit investors to assemble and trade baskets as well as enjoy certain tax timing advantages while eliminating the overhang of capital gains triggered by mutual fund redemptions. This innovation takes us back to the days before the first “market portfolio” in that it makes it possible for investors to *directly* create the exposures that index funds and EFTS made possible. What accounts for this new innovation? At a functional level, this product represents another step in the line of products that enable investors to hold broad diversified baskets for consumption smoothing, risk management and speculation. Yet it is technology, embedded in improvements in information technologies, that permit personal funds to be technically feasible. Technology may enable these innovators to market these products via the web as well as execute transactions at low costs. One report noted that “It simply was impossible to consider such a strategy before the advent of the Internet, ‘This firm is a child of the Internet, [the founder] said.’”

Market funds, index funds, ETFs, HOLDRs, personal funds—this family of innovations embody just about every possible motive for innovation. They all deliver a similar basic functionality, but successive innovations build upon each other. Each new generation attempts to lower the costs of transacting, be more tax efficient, and to give investors increasing control over their decisions. This mini-history is a quick reminder of the evolutionary process of innovation. Along the way, some products died out (equal weighted market funds or SuperTrust), some succeeded (index funds and ETFs) and

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<sup>24</sup> Reportedly, the “fn” is apparently an abbreviation for financial innovation. See Eric Winig, “Virginia firm reinvents the stock market” Baltimore Business Journal, 6/2/2000, p. 23.

some are too early to tell (personal funds.) Individual innovations often fail, but even in their failure, they give subsequent innovators new information that can be used to develop the next generation of products.

This evolutionary flavor reminds us that the innovation process is a dynamic one. Understanding these dynamics has been a long-standing topic among students of innovation, with research on patent races being well covered.<sup>25</sup> However, the easily imitated nature of financial innovation may not lend itself easily to these models. Merton (1992) characterizes the dynamics of innovation in the financial service world using a metaphor of “financial innovation spiral” in which one innovation begets the next. We see this in the sequence of innovations discussed above. We also see the spiral when we consider that the trading of standardized exchange-traded products facilitates the creation of custom-designed OTC products, which in turn stimulates even greater trading, lowering transaction costs and making possible even more new products. A variant of this concept would help explain how rival investment banks created a set of increasingly-improved preferred stocks that would maintain a relatively constant principal values (Mason, Merton, Perold and Tufano (1995)), by copying and improving the prior product. Persons and Warther (1997) model the innovation spiral in which adoption of innovations provides other participants with information about the profitability of innovation, creating waves of innovation and an S-curve shape of adoption.

#### **4. Who innovates? The identities of and private returns to innovators**

As Allen (2001) points out, much of financial economics acts as if financial institutions do not exist. While this tendency has also characterized some of the literature

on financial innovation, given the fairly applied nature of the field, writers have more explicitly dealt with the role of private parties and financial intermediaries as innovators. Duffie and Jackson (1990) consider the incentives of exchanges which lead them to offer one new contract rather than another. Ross (1988) explicitly incorporates a role for investment banks that maximize their own profits by coming up with innovative bundles of securities to lower marketing or search costs. Boot and Thakor (1997) model how different institutional structures might lead to different levels of innovation. They find that innovation would be lower in a universal banking system—especially one with substantial market concentration—than in one in which commercial and investment banking were functionally separated. Essentially, greater competition among these private parties leads to increased innovation. Bhattacharyya and Nanda (2000) model the incentives for innovation within the investment banking industry. They find that banks with larger market shares will tend to innovate, as will banks whose clients are more sticky. Heinonen (1992) studies game-theoretic models of innovation, focusing on benefits on the costs of production (economies of scope) or on the costs of distribution (marketing.)

There has been relatively little empirical work on the benefits accruing to financial innovators. Tufano (1989) and Carrow (1999) study the incentives of investment banks to innovate, focusing on the market shares they capture and the underwriting spreads they charge on new types of securities. Both studies find that innovators earn higher market shares than followers, even though imitation is rapid. The studies reach different conclusions about whether innovating investment banks charge higher underwriting spreads than do follower banks. Tufano found that underwriting

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<sup>25</sup> See Reinganum (1989) for a review of this literature.

spreads on the first offerings of innovations were not materially larger than those on later offerings, casting doubt on the notion that the primary profit from innovation comes from increased spreads. Carrow re-examined this question a decade later with a slightly different sample, incorporating additional variables into this analysis (underwriter prestige rankings and 14 dummy variables indicating specific features of the security). With this new specification, he finds that as the number of rivals increases, spreads do indeed decline. Neither of these studies looks at the many ways in which innovative bankers might profit by earning trading profits on aftermarket activities, increasing the likelihood of receiving subsequent business through enhanced reputation, increasing the quality of their own personnel leading to a higher quality staff, or more personally for the individuals involved, increasing their bonuses and career progression. All of these mechanisms for rewarding innovation are open questions for future research.

In some academic models, parties most constrained or inconvenienced by imperfections would be the most likely to innovate, as the shadow costs of releasing these constraints would be greatest for these firms. Silber (1975, 1983) articulates this constraint-based notion of innovation. This might suggest that the smallest, weakest firms, who face the most constraints, would be the most likely to innovate. In the broad field of innovation, this seems to be the case, with smaller firms thought to be more innovative.<sup>26</sup> There is some anecdotal evidence that supports this conclusion in financial services. Two upstart financial service firms—Vanguard and Drexel Burnham Lambert—substantially developed their businesses using a platform of innovative products (index funds and junk bonds), and a variety of e-Businesses attempted to create competitive advantage through innovation. However, this anecdotal observation is not

consistently supported by the empirical data. At least for securities innovations, larger, more financially secure investment banks have consistently been the leading innovators (see Tufano (1989)). Matthews (1994, chapter 13) adapts industrial organization models to show why there might be a self-reinforcing cycle between innovation and market share, with larger firms innovating and thereby increasing their size at the expense of their rivals. It is probably fair to note that cross sectional determinants of the locus of financial innovation is still an eminently researchable question.

Among issuers, it is difficult to argue that the most constrained firms are the most innovative. Rather, a great deal of innovation is directed at larger, well-established firms, as described by one banker:

The only way to reach large investment-grade companies is innovation. Such companies have ready access to every segment of the capital markets on attractive terms; we have to offer the better mousetrap. This inevitably leads to an array of products, often customized for individual issues.<sup>27</sup>

Perhaps, smaller and weaker firms face a great number of constraints, and their efforts are focused on addressing these constraints directly (e.g., communicating their story to potential investors) rather than optimizing the form of capital. Larger firms may have addressed these first-order imperfections and turn their attention to more nuanced capital structuring issues and innovations. Among issuers, the question of which firms innovate—and why—remains an open one.

Innovation includes not only invention, but also the processes of the diffusion or adoption of the adoption. The diffusion of innovations has long been studied in the industrial organization field (Molyneux and Shamroukh (1999) summarize the industrial

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<sup>26</sup> See Scherer and Ross (1990) for a review of the literature on this point.

<sup>27</sup> E. Philip Jones, Head of Equity Linked Origination at Merrill Lynch & Co, quoted in “A market that feeds on persistent innovation,” *Investment Dealers’ Digest*, May 22, 2000.

organizational literature on the adoption of innovations.) Empirical studies of the adoption of financial innovations have focused on the introduction of automated teller machines (Hannan and McDowell (1984, 1987) and Saloner and Shepherd (1995)), small business credit scoring (Akhavain, Frame and White (2001)), patents (Lerner (2002)), off-balance sheet activities of banks (Molyneux and Shamroukh (1996), Obay (2000)), junk bond issuance (Molyneux and Shamroukh (1999)) and corporate security innovations (Tufano (1989)). The central question in much of this literature is to determine which organizations adopt innovations and how quickly they do so. While this literature is rich, much of it plays off of the question of whether larger firms or smaller firms lead innovation, a long-standing debate. There is also a “sociological” aspect to this research, in that it tries to understand the relative importance of external stimuli versus internal factors (organizational characteristics and competitive interactions among potential adopters.) In many of these studies, it has been the larger firms that have innovated more rapidly, for example, with larger banks more quick to adopt credit scoring or larger investment banks are faster to underwrite new securities.

Bringing new securities to market requires the voluntary cooperation of both issuers and investors. As a business proposition, innovation surely has the potential to enable businesses to create value. This is the theme in a business book, *The Power of Financial Innovation*, by Geanuracos and Millar (1991), which studies 75 firms around the globe, showing “how the world’s best-managed companies are ...putting the latest instruments to effective use.” While it is surely the case that some businesses will use innovation and profit, there is little systematic evidence on the benefits enjoyed by investors and issuers, and how they share any benefits of innovation. Preliminary

evidence suggest that innovative investors in the 1970s and 1980s apparently endured greater risk than later investors (measured by variability of *ex post* holding period returns) and earned slightly higher returns for bearing these additional risks. However, whether the extra return is appropriate for the level of extra risk borne is difficult to ascertain in a small sample.<sup>28</sup>

There are a series of clinical studies of individual innovations that look at the wealth impacts of innovations. Nanda and Yul (1996) study poison puts in convertible bonds, and conclude that shareholders benefited from this innovation, perhaps at the expense of bondholders. Rogalski and Seward (1991) study foreign exchange currency warrants and find that their issuers apparently benefited from this innovation, although they find that investors substantially overpaid for this innovation. Jarrow and O'Hara (1989) find that purchasers and Primes and Scores apparently overpaid for these products relative to the price of the stocks from which they were constructed. Jarrow and O'Hara note however that these products can serve valuable hedging demands for investors, and in the presence of transaction costs may have benefited all parties.

As a general proposition, we have a great deal more to learn about the pricing of financial innovations and how benefits, if any, are shared among participants. This is a long standing research topic in industrial organization; see Tirole (1988, Chapter 10) for a discussion of the appropriation of the returns to innovation.

## **5. The impact of financial innovation on society**

While most authors acknowledge that innovation has both positive and negative impacts on society, their conclusion regarding the *net* impact of financial innovation

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<sup>28</sup> See Tufano (1996).

reflects a diversity of opinions. Merton (1992) stakes out one side of the argument: “Financial innovation is viewed as the “engine” driving the financial system towards its goal of improving the performance of what economists call the “real economy.” Merton cites the U.S. national mortgage market, the development of international markets for financial derivatives and the growth of the mutual fund and investment industries as examples where innovation has produced enormous social welfare gains.

Others take the opposite viewpoint, sometimes employing literary license (and movie metaphors) to make the argument that innovation’s benefits are less clear:

Nothing is more dangerous than a good idea. That ominous generalization seems inescapable given the development of finance over the past 40 years. Time and again, business has seized upon a new idea—junk bonds, LBOs, derivatives—only to push it far past its sensible application to a seemingly inevitable disaster. If financial innovation is a gift, then the package ticks, and the donor is Alfred Hitchcock.<sup>29</sup>

The phrase “financial engineer” suggests another profession, that of genetic engineer. Indeed, one legal scholar invoked the vision of derivatives inhabiting a financial Jurassic Park with the implication that financial engineers have the potential to create financial products that could end up destroying civilization.<sup>30</sup>

How do we research the question of the net social benefits of innovation? One “methodology” in the literature extrapolates from specific examples, like the mortgage market. For any one innovation, one can attempt to measure the impact of innovation. For example, researchers have attempted to measure the size of the gains from financial innovation in the mortgage market in the form of securitization, and unbundling through the creation of collateralized mortgage obligations or CMOs. These papers conclude that innovation led to materially lower mortgage rates charged to borrowers. See Hendershott

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<sup>29</sup> Terence P. Pare, “Today’s hot concept, tomorrow’s forest fire,” *Fortune*, May 15, 1995, p. 197.

<sup>30</sup> Peter H. Huang, “A normative analysis of new financially engineered derivatives,” *Southern California Law Review*, March 2000 (73 S. Cal. L. Rev 471.) Huang was referring to Hu (1995) who used this term,



and Shilling (1989), Sirmans and Benjamin (1990) and Jameson, Dewan and Sirmans (1992). However, others are quick to identify contrary examples—the legal and policy literature has extended discussions of the “costs” of innovation that defer and evade taxation, giving rise to loss of tax revenues, loss of confidence in government, a sense of inequity, and extensive resources devoted to this activity which does not enhance social welfare. There are other arguments that innovation leads to complexity that in turn leads to bad business decisions and social costs.

One sustained attack on financial innovation is that specific innovations contribute to high levels of market volatility, and in particular, to outcomes like market crashes. For example, supporters of this argument point to examples like the impact of portfolio insurance trading on the stock market crash of 1987. Merton Miller’s (1991) book, *Financial Innovations and Market Volatility*, is a sustained rebuttal to this argument. Miller refutes the contention that innovations have increased market volatility and then argues strongly that attempts to regulate innovation will be counterproductive, like those of King Canute trying to control the tides. The derivatives market has been the site of battles between those who see innovation as a good or bad influence on social welfare. These discussions can quickly turn to very specific questions, such as “Do derivatives exacerbate emerging market crises?”<sup>31</sup>

Despite the best intentions of the authors on either side of these arguments, their studies cannot measure social welfare directly, nor can they benchmark the observed outcomes against those never observed. Furthermore, in light of the innovation spiral (where successful innovations beget others) and the evolutionary process (where many

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but contrasted it with another image—of innovation permitting firms to hedge, producing “soothing, perfect hedges found in formal gardens.”

innovations fail), it is exceedingly difficult to identify the boundaries of a particular innovation, if one wanted to measure its costs.

Looking at the *ex post* impacts of specific financial innovations to judge whether the *ex ante* existence of an innovative financial system is a hopeless task. Seeking another way to approach the *ex ante* question, theorists have weighed into the discussion of the social welfare implications of financial innovation. In order to bring enough structure to the problem so as permit a meaningful discussion, they tend to focus on one particular aspect of innovation. Theorists studying the role of innovation in completing or spanning markets have made the most progress, and the surveys by Allen and Gale (1994) and Duffie and Rahi (1995) summarize the literature. Given that markets are incomplete, one might assume that innovation that gives participants greater freedom of choice (in terms of spanning) would enhance social welfare almost by definition, in the sense of being pareto-optimal. Unfortunately, this is not the case. For example, Elul (1995) studies the welfare effects of financial innovation in incomplete markets. Elul shows that the addition of a new security may have “almost arbitrary effects on agents’ utilities.” The introduction of a new security can “generically make all agents strictly worse off, or all agents strictly better off, or favor any group of agents over another.”

Allen and Gale’s (1994) comprehensive book puts together a set of their papers—but taken together, the results are discomfoting. In a series of papers, they analyze the impact of short sale constraints on social welfare. In their 1988 paper, they show that if short selling is severely limited, innovation may enhance social welfare and is efficient. However, in their 1991 piece, in which they study the environment in which investors are allowed to undertake unlimited short sales, they find that financial innovation is not

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<sup>31</sup> For a discussion of this topic, see the review piece by Garber (1999).

necessarily efficient. (Allen and Gale conclude that with unlimited short sales, even the concept of equilibrium is ill defined.) There are many more papers (see the reviews by Allen and Gale (1994) and Duffie and Rahi (1995)), but it is probably fair to say that the existing theoretical models are sufficiently stylized and sufficiently fragile so as to not permit sweeping generalizations to be made regarding the social welfare implications of financial innovation. This too remains an open issue in the literature. There may be an opportunity to apply advanced techniques from the “new” Industrial Organization literature to estimate supply and demand curves to estimate the social welfare impacts of financial innovation—if the necessary data can be found.

## **6. Issues on the horizon: patenting and intellectual property**

In most businesses, innovators protect their property rights in a variety of ways: They can try to maintain their innovations as trade secrets, as Coca-Cola has done with its famous recipe. They can patent their inventions, and then license them to partners or to litigate to discourage infringement. They can attach proprietary labels (copyrights, trademarks or servicemarks) to them, thereby branding them. They can attempt to capture first mover advantages—in the form of higher prices or greater market shares—by virtue of their innovation.

While financial innovators do put service marks on their products and benefit from some first mover advantages, the extent of financial innovation has been a bit of an intellectual property puzzle, because both trade secrecy and patenting were thought to be impossible means of protection. Secrecy is difficult for innovative securities, as investors and regulators typically demand disclosure of the terms of the offering. Secrecy is

possible to a greater degree to protect process-innovations, such as the pricing algorithms for exotic derivatives or information processing systems that would control the creation of new pooled security vehicles, such as collateralized products or personalized baskets of stocks. Patenting was considered infeasible, because the U.S. Patent Office had historically taken a dim view of the patentability of most financial products. While there had been a few exceptions (e.g., Merrill Lynch's early patent on its process for Cash Management Accounts), financial innovations were considered "business processes" which were hard to patent.

However, in 1998, Federal Circuit Court of Appeals decision in the case of *State Street Bank v. Signature Financial* 47 U.S.P.Q.2d (BNA) 1596 (Fed. Cir. 1998) seemed to open the door for patents on financial products. Signature had developed a system for asset management that it called the Hub-and-Spokes system, in which a centrally-managed master fund (the hub) was distributed in a variety of institutionally-distinct forms (the spokes). Signature patented this system, and then sued State Street for using it. The Court of Appeals upheld Signature's patent, which was considered by some to be a watershed event in financial innovation, providing innovators with new means to protect their intellectual property. For a discussion, see Heaton (2000).

It is unclear whether the State Street decision will be construed narrowly or broadly, or whether it will have a substantial impact on business activity. However, as with any new development, this one is likely to invite additional research. Lerner (2002) has given us a first glimpse of the new phenomenon of financial patents, demonstrating the substantial increase in patenting activity, the failure of finance patents to give proper attribution to prior art, and the failure of many firms, individuals and universities to seek

protection for their ideas. The interested reader can browse the current set of applications and grants at [www.uspto.gov/patft/index.html](http://www.uspto.gov/patft/index.html). Finance-related patents are being filed for a wide range of new products and processes, ranging from patents on Monte Carlo valuation methods to “prepayment wristbands and computer debit systems.” There is understandably some factual and legal disagreement over the validity of individual patents, in particular over the novelty of some of the patents in light of the substantial amount of prior (non-patented) prior art.

Academic research could help to understand whether patenting will encourage or discourage innovation, change the nature of financial innovation, encourage more innovation by smaller players, or change the competitive/cooperative interactions among financial service firms. In part, this yet-to-be completed work will simply build upon the extensive body of work in the industrial organization field on patenting. However, trying to understand what—if anything—is different about the financial services industry, and the implications for protection of intellectual property and the nature of competition, is likely to be a fertile area for future work.

## **7. Summary**

The activity of financial innovation is large, but the literature on the topic is relatively small and spread out broadly among a number of fields. Unlike some other areas represented in this volume, where our profession had made a great deal of progress, the subject of financial innovation remains one in which our intellectual maps show vast uncharted—and potentially interesting—lands to be explored.

## Sources

- Akhavein, J., W. S. Frame and L. J. White (2001), "The diffusion of financial innovations: An examination of the adoption of small business credit scoring by large banking organizations", unpublished manuscript, Federal Reserve Bank of Atlanta, April 2001.
- Allen, F. (2001), "Presidential Address: Do financial institutions matter?", *Journal of Finance* 56(4): 1165-1175.
- Allen, F. and D. Gale (1988), "Optimal security design", *Review of Financial Studies* 1(3): 229-263.
- Allen, F. and D. Gale (1991), "Arbitrage, short sales and financial innovation", *Econometrica* 59(4):1041-1068.
- Allen, F. and D. Gale (1994), *Financial Innovation and Risk Sharing* (MIT Press, Cambridge, MA).
- Bank for International Settlements (1986), "Recent innovations in international banking", Bank for International Settlements Report dated April 1986.
- Baskin, J. B. (1988), "The development of corporate financial markets in Britain and the United States, 1600-1914", *Business History Review* 62:199-237.
- Beatty, A., P. G. Berger and J. Magliolo (1995), "Motives for forming research & development financing organizations", *Journal of Accounting and Economics* 19(2-3): 411-42.
- Bhattacharyya, S. and V. Nanda (2000), "Client discretion, switching costs, and financial innovation." *Review of Financial Studies* 13(4):1101-1127.
- Black, D. G. (1986), "Success and failure of futures contracts: Theory and empirical evidence", *Salomon Brothers Center for the Study of Financial Institutions Monograph Series in Finance and Economics* 1986:1
- Black, F. and M. Scholes (1974), "From theory to a new financial product", *Journal of Finance* 29(2):399-412.
- Boot, A. and A. Thakor (1997), "Banking scope and financial innovation", *Review of Financial Studies* 10(4):1099-1131.
- Carosso, V. (1970), *Investment Banking in America: A History* (Harvard University Press, Cambridge, MA)
- Carrow, K.A. (1999), "Evidence of early-mover advantages in underwriting spreads", *Journal of Financial Services Research* 15(1):37-55.

- Cleveland, F. A. and F. W. Powell (1920), *Railroad Finance* (D. Appleton and Co, New York).
- Crane, D. et al. (1995), *Global Financial Systems: A Functional Perspective* (Harvard Business School Press, Cambridge, MA)
- Crawford, G. and B. Sen (1996), *Derivatives for Decision Makers* (John Wiley, New York).
- Dewing, A.S. (1919), *The Financial Policy of Corporations* (Ronald Press, New York)
- Dewing, A.S. (1934), *Study of Corporate Securities* (Ronald Press, New York). This book quotes a number of unpublished and now-unavailable studies.
- Duffie D. and M.O. Jackson (1989), "Optimal innovation of futures contracts", *Review of Financial Studies* 2: 275-296.
- Duffie, D. and R. Rahi (1995), "Financial market innovation and security design: An introduction", *Journal of Economic Theory* 65:1-42.
- Elul, R. (1995), "Welfare effects of financial innovation in incomplete markets economies with several consumption goods", *Journal of Economic Theory* 65:43-78.
- F. Allen and D. Gale (1988), "Optimal security design," *Review of Financial Studies* 3(3):229-263.
- Finnerty, J. D. (1992), "An overview of corporate securities innovation", *Journal of Applied Corporate Finance* 4(4):23-39.
- Finnerty, J.D. (1988), "Financial engineering in corporate finance: An overview", *Financial Management*, 17:14-33.
- Finnerty, J.D. (2001), *Debt Management* (Harvard Business School Press, Cambridge, MA)
- Fisher L, I. Brick and F, Ng (1983), "Tax incentives and financial innovation: The case of zero-coupon bonds and other deep discount corporate bonds." *The Financial Review*, 292-305.
- Franks, J. and O. Sussman (1999), "Financial innovations and corporate insolvency," unpublished manuscript, London Business School.
- Garber, P. (1999), "Derivatives in International Capital Flows," in M. Feldstein, ed., *International Capital Flows* (University of Chicago Press, Chicago).
- Gastineau, G. (2001), "Exchange traded funds: An introduction," *Institutional Investor*

- Geanuracos, J. and B. Millar (1991), *The Power of Financial Innovation* (Harper Business, New York).
- Gergen, M. P. and P. Schmitz (1997), "The influence of tax law on securities innovation in the U.S.: 1981-1997", *Tax Law Review* 52:119-.
- Graham B. and D. Dodd (1934) *Security Analysis* (Whittlesey House, New York)
- Hannan, T. and J. McDowell (1984), "The determinants of technology adoption: The case of the banking firm." *Rand Journal of Economics* 15 (Autumn):328-335.
- Hannan, T. and J. McDowell (1987), Rival precedence and the dynamics of technology adoption: An empirical analysis. *Economica* 54(May):155-171.
- Harris, M. and A. Raviv (1989), "The design of securities", *Journal of Financial Economics* 24:255-287.
- Harris, M. and A. Raviv (1991), "The theory of capital structure", *Journal of Finance* 46(1):297-355.
- Haugen, R.A. and L.W. Senbet (1991), "Resolving the agency problems of external capital through options", *Journal of Finance* 36(3):629-647.
- Heaton, J.B. (2000), "Patent law and financial engineering", *Derivatives Quarterly* 7(2):7-15
- Heinonen, T. (1992), *Financial Innovation*, Ph. D. dissertation, Helsinki School of Economics.
- Hendershott, P. H., and J. D. Shilling (1989), "The impact of agencies on conventional fixed-rate mortgage yields," *Journal of Real Estate Finance and Economics* 2:101-115.
- Hornberger, D. J. (1933), "Accounting for no-par stocks during the depression," *Accounting Review* (March)
- Hu, H. T. C. (1989), "Swaps, the modern process of financial innovation and the vulnerability of a regulatory paradigm", *University of Pennsylvania Law Review* 138:333+
- Hu, H. T. C. (1995), "Hedging expectations: 'Derivative reality' and the law and finance of the corporate objective", *Texas Law Review* 73:985.
- Huang, P. (2000), "A normative analysis of new financially engineered derivatives", *Southern California Law Review* 75:471-.



- Jagtiani, J., A. Saunders and G. Udell (1995), "The effect of bank capital requirements on bank off-balance sheet financial innovation", *Journal of Banking and Finance* 19:647-658.
- Jameson, M., S. Dewan, and C. F. Sirmans (1992), "Measuring welfare effects of "unbundling" financial innovations: The case of Collateralized Mortgage Obligations," *Journal of Urban Economics* 31:1-13.
- Jarrow, R. and M. O'Hara (1989), "Primes and Scores: An essay on market imperfection", *Journal of Finance* 44:1263-1287.
- Kane, E. J. (1986), "Technology and the regulation of financial markets," in *Technology and the Regulation of Financial Markets: Securities, Futures and Banking*. A. Saunders and L.J. White, eds. (Lexington Books: Lesington, MA) 187-193.
- Kim, Y. and R. Stulz (1988), "The Eurobond market and corporate financial policy: A test of the clientele hypothesis", *Journal of Financial Economics* 22 (2), 189-205.
- Knoll, M. S. (1997), "Financial innovation, tax arbitrage and retrospective taxation: The problem with passive government lending", *Tax Law Review* 52(4), 199-224.
- Knoll, M. S. (2001), "Put-call parity and the law," unpublished manuscript, U. Penn. Law School and The Wharton School.
- Kollbrenner, S. M. (1995), "Derivatives design and taxation", *Virginia Tax Review* 15:211-.
- Lerner, J. and P. Tufano (1993), *ALZA and Bio-Electrical Systems (A) Technological and Financial Innovation*, Harvard Business School Case number 293-124.
- Lerner, J. (2002), "Where does State Street lead? A first look at finance patents, 1971-2000", *Journal of Finance* 57(2), 901-930.
- M. Grinblatt and F. A. Longstaff (2000), "Financial innovation and the role of derivative securities: An empirical analysis of the Treasury STRIPS program", *Journal of Finance* 55 (3): 1415-1436.
- Madan, D. and B. Soubra, B. (1991)," Design and marketing of financial products", *Review of Financial Studies* 4(2):361-384.
- Mason, S., R. Merton, A. Perold and P. Tufano (1995), *Cases in Financial Engineering: Applied Studies of Financial Innovation* (Prentice Hall, Englewood Cliffs, NJ)
- Masson, R. L. and S.S. Stratton (1938), *Financial Instruments and Institutions: A Case Book* (McGraw Hill Book Co., New York).
- Matthews, J.O. (1994), *Struggle and Survival on Wall Street* (Oxford University Press, New York)

- McConnell, J.J. and E. S. Schwartz (1992), "The origin of LYONS: A case study in financial innovation," *Journal of Applied Corporate Finance* 4(4):40-47.
- McLaughlin, R. (1999), *Over-the-counter Derivative Products*, (McGraw Hill, New York)
- Merton, R.C. (1989), "On the application of the continuous time theory of finance to financial intermediation and insurance," *Geneva Papers on Risk and Insurance* 14(July):225-262.
- Merton, R.C. (1992), "Financial innovation and economic performance", *Journal of Applied Corporate Finance* 4(4):12-22.
- Merton, R.C. (1995), "A functional perspective of financial intermediation," *Financial Management* 24(2):23-41
- Merton, R.C. (1993), "Operation and regulation in financial intermediation: A functional perspective," in P. Englund , Ed, *Operation and Regulation of Financial Markets* (The Economic Council, Stockholm)
- Miller, M. H. (1986), "Financial innovation: The last twenty years and the next", *Journal of Financial and Quantitative Analysis* 21(4):459-471.
- Miller, M.H. (1991), *Financial innovation and market volatility*, (Blackwell, Cambridge, MA).
- Miller, M.H. (1992), "Financial innovation: Achievements and prospects", *Journal of Applied Corporate Finance* 4:4-11.
- Miller, Merton H. (1977). "Debt and taxes." *Journal of Finance* 32, 261-275.
- Molyneux, P. and N. Shamroukh (1996), "Diffusion of financial innovations: The case of junk bonds and note issuance facilities", *Journal of Money, Credit and Banking* (August) 502-526.
- Molyneux, P. and N. Shamroukh (1999), *Financial Innovation* (John Wiley, Chichester, England).
- Nanda V. and Y. Yun (1996), "Financial innovation and investor wealth: A study of the poison put convertible bonds", *Journal of Corporate Finance* (3)1: 1-22.
- Obay, L. (2000), *Financial Innovation in the Banking Industry: The Case of Asset Securitization* (Garland Publishing, New York)
- Partnoy, F. (1997), *F.I.A.S.C.O.* (W.W. Norton, New York)
- Perold, A. and S. Brown (2001), *Merrill Lynch HOLDERS*, Harvard Business School case 201-059

- Persons, J.C. and V. A. Warther (1997), "Boom and bust patterns in the adoption of financial innovations", *Review of Financial Studies* 10(4):939-967.
- Pouncy, C. R. P. (1998), "Contemporary financial innovation: Orthodoxy and Alternatives", *Southern Methodist University Law Review* 51:505+
- Reinganum, J. (1989), "The timing of innovation: Research, development and diffusion" in R. Willig and R. Schmalensee, eds., *The Handbook of Industrial Organization* (North Holland).
- Riegel, R. (1920), "The installment plan and the baby bond," *Annals of the American Academy of Political and Social Sciences* 88 (March):169-176.
- Rogalski, R. J. and J. K. Seward (1991), "Corporate issues of foreign currency exchange warrants", *Journal of Financial Economics* 30:347-366.
- Rogers, E.M. (1983), *The Diffusion of Innovations* (Free Press, New York).
- Ross, S.A. (1989), "Presidential address: Institutional markets, financial marketing and financial innovation", *Journal of Finance* 44(3):541-556.
- Russo, T. A. and M. Vinciguerra (1991), "Financial innovation and uncertain regulation: Selected issues regarding new product development", *Texas Law Review* 69:1431+
- Saloner, G. and A. Shepard (1995), "Adoption of technologies with network effects: An empirical examination of the adoption of automated teller machines", *Rand Journal of Economics* 26(Autumn):479-501.
- Santangelo, R. and P. Tufano, (1997), "Financial engineering and tax risk: The case of Times Mirror PEPS," *HBS Note* 297-056.
- Schenk, D. H., (1995) "Colloquium on financial instruments: Foreward", *New York University Tax Review* 50:487-.
- Scherer, F. M. and D. Ross, (1990), *Industrial Market Structure and Economic Performance*. (Houghton-Mifflin)
- Schmookler, J, (1967), *Invention and Economic Growth* (Harvard University Press, Cambridge, MA).
- Schumpeter, J. A. (1950), *Capitalism, Socialism and Democracy* (Harper and Brothers, New York)
- Silber, W. (1975), *Financial Innovation* (Lexington Books, Lexington, MA)
- Silber, W. (1983), "The process of financial innovation", *American Economic Review* 73:89-95.

- Sirmans, C. F. and J. D. Benjamin (1990), "Pricing fixed rate mortgages: Some empirical evidence," *Journal of Financial Services Research* 4:191-202.
- Smith, C., C. Smithson and D. Wilford (1990), *Managing Financial Risk* (Harper Business, New York).
- Strnad, J. (1994), "Taxing new financial products: A conceptual framework", *Stanford Law Review* 43:569, 587-593.
- Thompson Financial Securities Data, online service. ([www.tfsd.com](http://www.tfsd.com))
- Tirole, J (1988), *The Theory of Industrial Organization* (MIT Press, Cambridge, MA).
- Tufano, P and B. Kyrillos (1994), "Leland O'Brien Rubinstein Associates, Inc.: SuperTrust", Harvard Business School case 294-050.
- Tufano, P. (1989), "Financial innovation and first mover advantages", *Journal of Financial Economics* 25:213-240.
- Tufano, P. (1995), "Securities innovations: A historical and functional perspective," *Journal of Applied Corporate Finance* 7(4):90-113.
- Tufano, P. (1996), "Do fools rush in?: Rewards to buying and selling the newest financial products," unpublished manuscript.
- Tufano, P. (1996b), "Times Mirror Company PEPs Proposal Review," Harvard Business School case 296-089.
- Tufano, P. (1997), "Business failure, judicial intervention, and financial innovation: Restructuring U.S. railroads in the nineteenth century," *Business History Review* (Spring);1-40.
- Van Horne, J.C. (1985) "Of financial innovations and excesses", *Journal of Finance* 15:621-631.
- Vogel F. E. and S. L. Hayes III (1998), *Islamic Law And Finance: Religion, Risk and Return* (Kluwer Law International, The Hague, Netherlands).
- Walmsley, J. (1988), *The New Financial Instruments* (John Wiley, New York).
- Warren, A.C., (1993), "Financial contract innovation and income tax policy", *Harvard Law Review* 107:460-.
- White, L. J. (2000), "Technological change, financial innovation, and financial regulation in the U.S.: The challenge for public policy" in *Performance of Financial Institutions*, ed. P. Harker and S. Zenios (Cambridge University Press, Cambridge, UK). 388-415.