The Internet and Financial Market Structure

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Introduction

Financial markets provide for trade in information because money is just a means of scorekeeping, a way of tallying the relative purchasing power of individuals and organizations. It can be a physical tally such as a coin made from rare metals or a paper claim on a government or other reputable agent that is difficult to counterfeit. But records of relative purchasing power also can be stored digitally as strings of ones and zeros if the storage medium is secure.

Information generally is costly to produce but not to reproduce. In fact, information is perhaps too easy to reproduce – once it is revealed, it is difficult to exclude others from further use of information. When the value of information mainly is strategic, as often is the case in financial markets, information producers have incentive to protect their investment by holding their cards close to the vest. But doing so obstructs trade and undermines the social interest in informationally efficient markets. Financial intermediaries promote trade in financial markets by balancing the tension between self interest and collective interests in information.

Financial intermediaries endure a similar tension in their dealings with one another. Competition among intermediaries traditionally was fueled by the human capital of key families and individuals – Morgan, Rothschild, Goldman, etc. – whose names still dominate the financial landscape. Primitive information technology led early financial intermediaries to form information networks by scattering human repositories for information as widely as possible.[1] Fair dealing over time within the network led to strong relationships bound by trust through which information moved about more freely than it would have otherwise. Reputations and relationships, the foundations for trust, likewise are composites of

information but information that is not so easily disembodied from its originator – you can't buy a reputation.[2] Innovation flourished in the context of close relationships and powerful intermediaries that tempered competition and thereby protected easily copied ideas and products assuring at least a fair return on investment.[3]

The internet upsets this delicate balance. We may look back on the internet as having punctuated the evolution of financial market, but its effect will most likely be interpreted as different in degree not in kind from the effects of motorized transportation, the telegraph and telephone, low-cost computers, etc. The internet is just another technological advance along a path where human capital is being transformed and in some instances displaced by information technology that codifies what previously was embodied in human intermediaries.[4]

The tension between human capital and information technology, however, has profound consequences for the organization and management of intermediary firms. The small family partnerships that dominated early financial markets provided an environment in which human capital was nurtured and passed from one generation to the next. By contrast, the modern financial firm depends far more on financial capital to support the large-scale but low margin operations that remain when intermediary functions are codified.

The Economic Functions of Financial Intermedairies

Bankers, brokers, market makers, and other financial intermediaries grease the wheels of exchange in financial markets. *How* financial intermediaries do this depends on the

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[1] *The Economist*, October 26, 1996.
[2] Or can you? See Tadelis, 2000, "title"American Economic Review…
[3] A recent paper by Bharat Anand and Alexander Galetovic formalizes the competitive effects of the industry's dependence on human capital. See "Information, Nonexcludability, and Financial Market Structure," Journal of Business 73, 357-402, 2000.
[4] In the words of Michael Polanyi, what previously was tacit knowledge is being converted to explicit knowledge. See "The Tacit Dimension," Doubleday (Garden City, NY), 1966. In his 1973 book, "The Coming

state of technology and regulatory constraints. In the midst of great upheaval in both the technology and regulation of financial markets, it's easy to lose sight of the fact that *what* financial intermediaries do is relatively stable. Robert Merton and Zvi Bodie propose a perspective that draws a sharp distinction between these stable functions of a financial system and their sometimes arbitrary execution that is particularly useful for understanding how financial intermediaries adapt to changes in technology and regulation.[5]

At the core of any financial system must lie a means of clearing and settling payments. In modern economies, this function is already highly mechanized. A second function of any financial system is to provide means for pooling savings. Large-scale industrial production requires investment well beyond the means of most individuals. Banks, mutual funds, pension funds and the like pool the resources of many individuals for investment in large-scale projects. Pooling resources also promotes more efficient risk sharing by providing investors with relatively small savings a level of diversification that would be costly, if not impossible, to achieve otherwise. Once pooled, savings are generally transferred across time and space. A geographical correspondence between savings and investment opportunities would be purely happenstance. Likewise, individuals, organizations, and economies at large are net borrowers at some stages of their life cycle and net savers at others. Finally, a financial system must provide liquidity for financial claims to allow both borrowers and lenders to respond to changes in the economic environment.

Given a well-functioning legal system that protects contracts and individual property rights, a condition often taken for granted, these five functions are largely a matter of record keeping and therefore modern information technology provides for a high degree of

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of Post-Industrial Society," (Basic Books, New York, NY) Daniel Bell identified the growing capacity for codifying theoretical knowledge as an "axial principle" reshaping modern society.

[5] Citation.

mechanization. In other words, functions involving information storage and dissemination, historically carried out by people, are being disembodied. In the process, functions related to securities custody and transaction processing become more nearly commodities that remain profitable only in large-scale production by highly specialized intermediaries.

The final function of financial intermediaries is to promote exchange of information among self-interested parties. The most insidious, and subtle, frictions in financial markets arise from differences in information among trading partners. For example, corporate borrowers often have a clearer understanding of their ability to repay loans than do potential lenders. This places the borrower at an advantage because it only accepts loan terms that are commensurate with or better than its credit quality warrants. From the lender's perspective, borrowers adversely select into transactions that favor them. Although individual borrowers have an interest in protecting this strategic advantage, absent some form of redress, lenders shy away from such transactions because they expect to do no better than break even. In the worst cases, otherwise mutually beneficial trades simply do not occur.

Alternatively, after the loan is made borrowers have incentive to invest in projects that are riskier than the lender envisioned when the loan terms were set. In essence, the borrower’s actions alter the terms of the transaction after the fact. This threat, referred to as moral hazard, arises when parties to a transaction influence events that bear on their ability to carry out their obligations. Moral hazard is particularly common in the provision of guarantees or insurance. The purchaser of a fixed-price auto insurance policy, for example, essentially receives more insurance for his money by driving recklessly. Likewise, the insurer can reduce the insured's level of protection by recklessly investing the proceeds from the sale of the policy and thereby weakening its ability to make payments if the insured is involved in an accident.

Finally, the production of the financial goods and services that diminish these problems likewise is information intensive and therefore subject to similar frictions. Among these are the externality problems that arise because financial products are easy to reverse engineer and generally built on ideas that receive little protection from copyright, trade secret, and patent law. The registration of public securities offerings, for example, virtually guarantees the reverse-engineering of the transaction's innovative features before the typically high costs of innovation to the pioneering bank are covered. In fact, Peter Tufano found that pioneers most frequently complete only one transaction before a new product is replicated by competitors.[6] Worse yet for financial firms, their productive assets often are concentrated in human capital embodied in a notoriously mobile workforce. For example, Deutsche Bank's entire technology banking group (more than 70 bankers) left to join Credit Suisse First Boston in the summer of 1998. Ironically, the departure of the team built by Frank Quattrone, Bill Brady, and George Boutros came only two years after Deutsche bid the three away from Morgan Stanley.

Investment Banking Syndicates

If we focus on the production and distribution of information goods by investment banks, we see that it always has been highly fragmented. From the outset, the industry was characterized by relatively small organizations headed by dominant individuals like J.P. Morgan – content originators, if you will. Organizations were small for two reasons. First, the knowledge underlying the information goods produced by investment bankers mostly was tacit. The scale and scope of its application was then limited in large part by the physical capacity of the individual in which it was embodied. Obviously, some knowledge and responsibility could be shared but technological and theoretical limits to codification were

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[6] Peter Tufano, " Financial Innovation and First-Mover Advantage," *Journal of Financial Economics*, 25 (1989),

substantial. Even where codification was possible, monitoring one's peers in the application of shared intellectual assets was difficult.

At the turn of the 20th century, a primary consequence of the fragmentation of the industry was that individual banks often could not meet the needs of governments and the large-scale industrial concerns spawned by the second industrial revolution. In many functions, content production and distribution were coordinated informally, often through family connections or within well-defined social networks such as the German-Jewish banking community in New York.[7] In the case of securities offerings, a formal syndication platform evolved. Jay Cooke, dubbed the 'modern Midas' for his role in marketing Civil War bonds, is generally credited with introducing the underwriting syndicate to the U.S. markets after having observed its application in France. Prior to 1890, syndicates were most commonly formed in the U.S. to handle massive bond issues for railroading concerns. The syndicate temporarily brought together the resources of many banks to purchase securities from the issuing firm or government and then provided for their distribution through the combined networks of the syndicate members.

The underwriting syndicate has changed little since its inception. Modern syndicates have a lead manager or perhaps several co-managers who advise the issuer in structuring the transaction and are responsible for coordinating the sales and distribution effort of other syndicate members – often upwards of twenty banks. Chief among the sales efforts is responsibility for managing the book of indications of interest from institutional investors, essentially price/quantity bids for the securities on offer. The lead bank also is responsible for allocating securities among the selling members of the syndicate and so effectively determines the commissions earned by other syndicate members. Whether the offering is

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successful or not, the codified elements of the underwriting syndicate are formally dissolved upon completion. The price of admission to underwriting syndicates is a proven ability to admit others to one's own deals. As a consequence, banks tend to work repeatedly with one another so that syndicate composition across deals is quite stable with only the lead manager(s) varying.

Although syndication takes its most explicit form in securities underwriting, coordinated effort and repeated dealing through complex networks of relationships are pervasive in the investment banking industry. Foreign exchange markets might be thought of as syndicates comprised of the many dealers in the market bound by a tacit but clear understanding of each other's capacity for analysis of market conditions (content) and putting capital at risk (distribution capacity). Although security design, portfolio management and similar functions are being codified, we think of content origination as remaining more tacit-knowledge, or judgment, intensive. By contrast, while investment banking distribution networks traditionally have been bound by relatively tacit personal relationships, advances in information technology have long provided for greater codification of distribution than for origination.

Even in their corporate advisory role, perhaps the most tacit of functions, investment bankers repeatedly work with one another for a single client or negotiate with one another on behalf of adversarial clients. In doing so, banks make unique contributions to the bundle of content defining a particular 'deal.' Content might involve only advice, but more typically includes the execution of securities transactions necessary for financial restructuring. Distribution capacity might come bundled with advice from one or more

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[7] Supple (1957) Carosso (1970).

banks or just as likely be provided, at least in part, by other banks. But again, *the coordination among intermediaries is more nearly transaction specific.*

On the surface of things, underwriting syndicates appear rather inefficient. Why, for example, are syndicates, virtual firms, if you will, formed around a transaction only to be dissolved and then reformed for the next? Why didn't the highly fragmented banking industry simply collapse into a smaller core of behemoths each capable of independent execution of the largest transactions? Alternatively, why weren't more permanent, formal syndicate arrangements established? Sanford Grossman, Oliver Hart, and John Moore observe that in circumstances where a contract is ambiguous or silent, or otherwise incomplete, careful assignment of property rights over physical assets can help to resolve conflicts that arise in joint production where ownership of productive assets is separated from their control.[8]

To see why, it is useful to recognize that a firm is nothing more than a collection of human and physical assets. Contracting over physical assets is relatively straightforward but not so with human assets. A mind cannot be enslaved. However, if human assets are most productively used in conjunction with certain physical assets, the control that resides with owners of the physical assets can be used to shape behavior in circumstances where contracts are ambiguous – *control over nonhuman assets leads to control over human assets.*[9] Physical assets then are the glue that binds the collection of human assets defining a firm and the assignment of property rights over physical assets determines how effectively the firm's assets are used.

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[8] See O. Hart, "Firms, Contracts and Financial Structure," (Oxford, Oxford University Press, 1995) for a comprehensive review of this 'property rights approach' to the theory of the firm.
[9] Hart, 1995, p.XX.

This example highlights, what is for our purposes, the central insight of the Grossman, Hart, and Moore property rights perspective on the firm: production efficiency is served when control over physical assets is in the hands of those who bring the most valuable human assets to a project. But what if physical assets contribute little to the value of products or services that nevertheless require a team production effort? This is more nearly the setting in which investment banks as well as most other professional services firms operate. Advances in information technology have led to a substantial physical infrastructure in financial markets, but at the turn of the 20^{h} century, the physical infrastructure of financial markets was virtually nonexistent. In such instances, Oliver Hart observes, "it is not clear what keeps the firm together, or what defines authority within the firm."[10] So the Grossman, Hart, and Moore view of the firm suggests one reason why the investment banking industry remained so fragmented for so long – physical assets, the glue that binds human assets to one another, were inconsequential

Form Follows Function[11]

The success of an underwriting syndicate is determined in large part before it is formed. Obviously, the marketing and distribution of a securities offering must be conducted in a professional manner but the capacity for doing so lies in the tacit knowledge and relationships developed independently of the transaction at hand. Likewise, the quality of a banker's advice to a client considering acquiring a competitor or otherwise restructuring

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[10] Hart, 1995, p.58.

[11] The following perspective on the syndicate is developed formally by Pegaret Pichler and William Wilhelm in "A Theory of the Syndicate: Form Follows Function," *Journal of Finance*, forthcoming. Alternative theories of the syndicate's function interpret it as a risk-sharing device – risks that one bank cannot absorb are comfortably spread across a group of banks. But these theories shed little light on theseemingly inefficient practice of dissolving syndicates upon completion of a transaction only to reform similar if not identical teams for future transactions. Moreover, the process of building a book for securities offerings coupled with deals being priced just hours before trading begins substantially diminishes the syndicate's risk of paying more for securities than market conditions will support. Add the fact that risks borne by bulge bracket banks are now spread widely through public ownership and the risk sharing rationale for underwriting syndicates appears quite fragile.

derives more from experience in other transactions than from the shear effort exerted in the moment. In other words, bankers bring human capital to transactions.

In light of the grueling pace of their work, it's perhaps a statement of the obvious to say that the development and preservation of the banker's human capital requires considerable effort. Unfortunately, measuring the quality of this effort on a day-to-day basis is difficult. A combination of measuring the frequency of client contact (call reporting) and cross evaluations among bankers who work closely with one another can shed light on the quantity and quality of a banker's effort.[12] Linking these evaluations to compensation and promotions diminishes incentives for bankers to free ride on one another, but only if the evaluations are meaningful.

The problem is that anything more than a superficial review process consumes an enormous amount of energy in non-hierarchical organizations. For example, when Goldman Sachs went public in 1998, it reported in its S-1 filing with the SEC that its "360-degree" evaluation system involved over 140,000 performance evaluations (in a firm with fewer than 15,000 employees) in 1998 alone. At some point, the balance between evaluation and performance begins to favor a more decentralized form of organization and this tension, we think, essentially determined the limits of formal organization in the investment-banking industry.

But collaborative efforts, like the underwriting syndicate, that cut across formal organizations present their own problems. Syndicate members do not work with one another on a day-to-day basis and therefore have less opportunity for monitoring the current state of a collaborator's human capital. Observable outcomes, like the number of deals carried out and the banker's role, provide some insight. On the other hand, in a business

[12] Eccles and Crane, chapter 7.

where reputation is everything, even modest effort can disguise slow but steady decay in human capital. In other words, potential collaborators must consider the threat that their peer's are resting on the laurels of past success. If there was a physical asset central to the collaborative effort, one party's control over that asset might serve to diminish the problem by threatening potential slackers with exclusion from future use of the asset. But again, the role of physical assets in the traditional banking platform was minimal. Likewise, if reputation attached to the syndicate rather than its members, control over this intangible asset might be assigned to a key member. But the syndicate is short-lived.

Against this background, let's reexamine the structure of underwriting syndicates. First, banks compete aggressively for the lead manager's role because it carries larger fees and enhances the bank's reputation (and therefore future earning power). But the lead manager designation also puts one (or a few) syndicate member's feet to the fire. Responsible or not, the lead manager is usually held accountable for the highly visible outcome of an IPO by the issuing firm and the market generally. Thus banks have an incentive to protect their reputations by putting forth the ongoing effort necessary to make the most of such opportunities.

The incentive for bankers to free ride on one another is further blunted by the relatively exclusive but informal working relationships they maintain. Exclusive working relationships essentially create a barrier to entry for potential upstarts and therefore support fees in excess of competitive levels. If transactions are beyond the capacity of any single bank, there is no way for a single competitor to break into the market by undercutting the existing fee structure. Many would argue that this is the reason that underwriting spreads in the U.S. for medium-sized IPOs have clustered so persistently around 7% of the money raised. But if spreads exceed competitive levels, dominant banks will have a powerful

incentive to preserve access to such opportunities. So while there is no physical asset of the kind imagined by Grossman, Hart and Moore, similar incentives are created if slackers can be excluded from sharing in particularly attractive profit opportunities.

Placing one or a few banks in the spotlight provides a crude means of judging a bank's ongoing efforts that bear so heavily on their contribution to the team. The informality of banking relationships, embodied in the limited formal life of the syndicate, eases the exclusion of apparent slackers from future deals. If, on the other hand, underwriting syndicates were longer-lived legal entities, the threat of exclusion would have less bite. Seen in this light, the form of the underwriting syndicate reflects its function as an organizational structure that reduces the threat of shirking among bankers who do not work closely with one another on a day-to-day basis but depend on one another for success in large-scale transactions.

How the Internet is Altering the Traditional Syndicate

The traditional syndicate weaves together the fragmented networks of relationships maintained by many different banks. The fragmentation of these networks had much to do with the fact that word of mouth communication dominated information transmission. As a consequence, content development and distribution effectively were bundled and embodied in one or a few key individuals. Advances in information technology have long provided opportunities for codifying, although not fully, what I'm referring to as the distribution function. But intermediaries have a strong interest in content origination and distribution remaining bundled. In essence, key individuals are monopolists in their human capital and by tying the more commodity-like distribution function to content origination, they extend their

monopoly power.[13] The internet provides new capacity for unbundling pure information dissemination and distribution functions from functions that necessarily remain human-capital intensive. But this does not imply that industry structure will change dramatically in the short run.

Recent e-commerce initiatives being pursued by Goldman Sachs provide a useful case in point. If we focus strictly on their fixed income business and further still on primary sales and distribution (the marketing, pricing and initial sale of newly-issued bonds), we see that Goldman is developing both proprietary and joint venture electronic platforms (see figure 1). Although narrowly focused, the pattern revealed is representative of broader initiatives within the firm and the industry. The proprietary platform, *E-Syndicate*, provides for electronic dissemination of proprietary information and online order entry and allocation of claims for Goldman clients. By contrast, *Syndicate.Hub*, a joint venture with Morgan Stanley Dean Witter, Citi/Salomon, J.P. Morgan Chase, Lehman Brothers, and Merrill Lynch, commingles general research from member firms and provides links to each firm's proprietary platform. *Syndicate.Hub* is open to clients of each member and permits, for example, a Goldman client to enter Morgan Stanley's proprietary space. In other words, members of the joint venture can attract other members' clients but they also run they risk of losing the attention of their existing clientele.

[13] For a review of the theory, see Jean Tirole, 1988, "The Theory of Industrial Organization," *The MIT Press*: Cambridge, p. 333.

Figure 1: Goldman Sachs, Fixed Income Division
(May 2000)

	Proprietary	**Joint Venture**
Primary Sales & Distribution	*E-Syndicate:* Electronic - information dissemination - order entry and allocation - secondary trading	*Syndicate.Hub*: - Commingled content - Links to member dealer sites for prospectuses, electronic roadshows, etc. Partners: Morgan Stanley/Dean Witter, Citi/Salomon, JP Morgan Chase, Lehman Bros. Merrill Lynch

At the proprietary level the goal is to use information technology to enable bankers to spend less time in pure information dissemination and more time managing relationships and originating new ideas and analysis. In other words, to focus their energy on the development and marketing of content rather than pure distribution. The joint venture provide for large-scale distribution of information goods and services that are more nearly commodities. The joint venture also serves another purpose. As the costs of information dissemination decline, the primary barrier to being heard is the difficulty of standing out from the gathering crowd. By sweeping together research from six of the most prominent fixed income broker-dealers, *Syndicate.Hub* encompasses a critical mass of research that is more likely to attract the attention of institutional investors than that offered by any single broker-dealer. In other words, *Syndicate.Hub* is being modeled after portals to the broader internet.

But if scale is the order of the day, we might ask why these joint ventures are so exclusive and whether they will remain so. This is where the tension between content and distribution comes into play. On the one hand, there is little marginal cost to posting the prices or research of an additional participant and a bit more competition to stand out from a crowd of content providers is a good thing. On the other hand, the distribution platform

or portal need not be just a pipeline. If it also vets the quality of content or other experience goods, it takes on the role of an intermediary balancing the competing interests of the parties it serves.

Against a noisy background, a reputable portal serves content providers by setting them above the din and thereby increasing the returns to investment in high quality content. Consumers benefit from delegating responsibility for monitoring quality to the portal. But content providers will always have the incentive to either misrepresent the quality of their content to make their way into a reputable portal or once in, curb the investment that made their content quality high enough to gain entry in the first place. Limited membership reduces the dimension of the portal's vetting and monitoring responsibilities and leaves open the door to exclusion of those who do not measure up. Joint ownership of the portal by key content providers serves the function envisioned by Grossman, Hart and Moore of placing control over nonhuman assets in the hands of those contributing key human assets.

But joint ownership of the portal presents its own problems in the sense that it is more difficult to break ties with a partner in the venture who fails to tow his share of the load than in the traditional syndicate structure where formal ties were weak. But direct links from the portal into an interface for each partner's proprietary content exposes each member to the risk of losing business to other partners. The best way to retain or attract new clients is to contribute high quality non-proprietary content to *Syndicate.Hub* that might persuade a client to consider the contributor's proprietary offerings. With each partner facing the same incentives, *Syndicate.Hub's* structure promotes high quality non-proprietary content that will serve as a magnet for a larger share of market attention that might then be attracted to proprietary goods and services. The threat of losing one's clients to competitors

can substitute for the frequent recontracting in traditional syndicates that was a costly but perhaps necessary means of assuring commitment from syndicates members.

So this internet-enabled syndicate structure can serve the same function as the traditional syndicate but technological advances have made possible the creation of a physical asset, the portal, that extends the formal boundaries of the firm. Whereas the traditional syndicate might be thought of as a virtual firm that temporarily linked human distribution networks, modern electronic networks lend themselves to large-scale, long-lived business platforms. The scope of these platforms, or their degree of exclusivity, will be tied directly to the difficulty of monitoring the quality of the content for which they provide distribution. Where quality is observable or can be sampled, as in the case of books and other physical goods, expect the likes of Amazon.com to extend their brand or reputation broadly. In financial markets, where content is a true experience good that depends on unobservable investments in relationships or other forms of human capital, scalable distribution platforms will tend toward preserving exclusivity.

The emerging structure thus preserves the received relationships embodied in the traditional syndicate. On the other hand, it appears that the modern equivalent to the syndicate will involve more permanent shared distribution and price discovery platforms through which content providers will compete with one another for the market's attention.[14] The latter will be more like a commodity except to the extent that it provides content quality certification. Where the latter is true, exclusivity will reign and the implicit tying of content development and distribution will persist.[15]

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[14] For a discussion of innovations in the price discovery function see Wilhelm, "Internet Investment Banking: The Impact of Information Technology on Relationship Banking," *Journal of Applied Corporate Finance*, Spring 1999.

[15] The U.S. Department of Justice recently has launched an investigation "looking at the competitive effects of certain joint ventures in the online bond-trading industry and in online foreign exchange." See *The Wall Street Journal*, December 1, 2000 (p.C22). It's noteworthy that neither Goldman nor its peers among the bulge bracket

An Evolutionary Perspective on Financial Innovation[16]

If we step back from the short-term efforts to preserve the status quo, the tension between human capital and information technology suggests an evolutionary path for the structure of financial intermediaries. In this section I'll suggest that this perspective can help shed light on the massive reorganization underway within the financial markets at large.

In financial markets there is a natural attracting barrier for the evolutionary path of intermediaries. Economists define a complete market as one in which it is possible to trade on any potential future state of the world. We might imagine a very simple world in which the future is either good or bad and economic welfare is determined by the efforts of ten industries whose performance differs with the state of the economy. In other words, there are twenty elements of uncertainty or 'states' in the future (ten each for the good and bad economic states). A complete financial market provides for buying or selling a claim on any one of these states. A risk averse investor might hedge his bets by spreading wealth across each of the states, perhaps investing a bit more in industries expected to perform well in the bad economic state. So long as markets are incomplete, opportunities for financial innovation exist because there remain elements of risk that cannot be traded. The primary barriers to market completeness are frictions that outweigh the benefits of new products that lend to market completeness. Intermediaries diminish these frictions.

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banks were pioneers in developing electronic platforms that would heighten fixed-income market transparency. In fact, most of the dominant banks did not roll out significant e-commerce initiatives in this area until InterVest filed a lawsuit against many of the major broker/dealers claiming that they conspired to prevent InterVest's introduction of an electronic trading platform on the Bloomberg network.

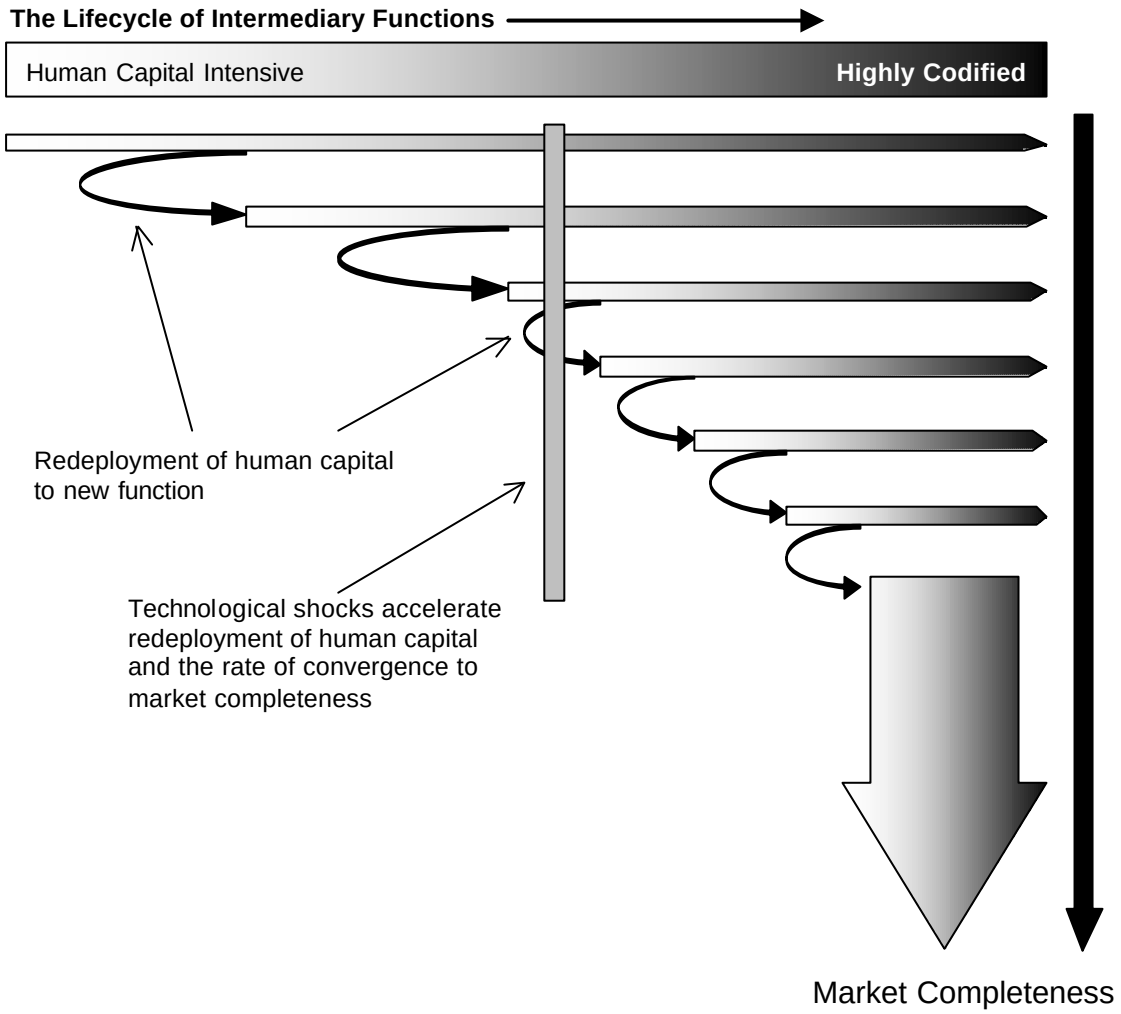
[16] The development of theories explaining the path of financial innovation is a growth industry in the recent academic literature. Key contributions that inform the following discussion include "Financial Innovation and Risk Sharing" by Franklin Allen and Douglas Gale (MIT Press: Cambridge, 1994), "On the Applications of the Continuous-Time Theory of Finance to Financial Intermediation and Insurance," by Robert C. Merton, 1989, *Geneva Papers on Risk and Insurance* 14:225-261, and "Institutional Markets, Financial Marketing, and Financial Innovation," By Stephen Ross, 1989, *The Journal of Finance* 44, 541-556. A recent paper by Bharat Anand and Alexander Galetovic formalizes the competitive effects of the industry's dependence on human capital. See "Information, Nonexcludability, and Financial Market Structure," Journal of Business 73, 357-402, 2000.

Intermediaries also follow an evolutionary path over the lifecycle of most financial products and services. Initially, intermediaries serve as catalysts for a previously nonexistent market. At this stage of market development, the intermediary is active in promoting trust and balancing interests in privacy and openness. In this capacity, intermediaries can be thought of as deploying human capital in the creation of new content. As community standards evolve, members develop their own reputations and relationships and best practices become apparent. Consequently, human-capital intensive intermediary functions diminish in importance. The remaining intermediary functions are predominantly aimed at sustaining trade. These include maintaining distribution and communications networks and the like. Since these functions are more nearly commodities, profits diminish. In effect, content originated by the intermediary enters the public domain. On the one hand, this diminishes the intermediary's control over the content it originated. But on the other hand, the transformation enables unbundling of human capital from the now mundane functions freeing human capital to serve as a catalyst for higher margin products that lend to further market completion. And the process goes on. Figure 2 is an attempt to bring together these ideas in a graphic fashion.

Think of each horizontal bar as representing a distinct product or practice with the uppermost bars representing earlier introductions. The product lifecycle evolves horizontally from human-capital intensive, catalytic functions to commodity-like, low-margin, maintenance functions. Technological advances compress the product lifecycle for two reasons. First, advances in technology or theory promote codification and widespread application of what once was tacit knowledge. This, in turn, heightens competition. At this point, the game is one of scale and scope economies that pose a threat to intermediaries that lag in re-deploying human capital. Where application of human capital persists, we might

think of lags in technology or theory as delaying the redeployment of human capital. In some instances, as in pure advisory services, the lag might for all practical purposes be indefinite. Technological advances and product-lifecycle compression occur both continuously and more abruptly in the face of 'shocks' like the introduction of the telegraph or the internet.

Figure 7.5: The Evolution of Intermediary Functions



The proliferation of new products along the vertical axis reflects convergence toward market completeness. Codification of human capital provides for its redeployment and thereby stretches the vertical axis. By forcing more rapid redeployment of human capital, technological shocks also takes us down the vertical axis toward market completeness at a more rapid pace. *But as long as markets are incomplete and so there is room for financial innovation, there will be demand for the catalytic role of human capital.*

Prior to the many advances in information technology over the last half century, intermediaries 'got stuck' at intermediate points along the horizontal axis. Standards developed to be sure, but many mundane functions still required human beings for execution. This meant that production in investment banks, as in the traditional underwriting syndicate, remained human-capital intensive. As information technology further enables unbundling of codifiable or mundane functions, we'll see a shift to larger-scale and longer-lived platforms for carrying out these functions. Organizational emphasis then begins to shift from human capital to the financial capital necessary for building permanent physical infrastructure. The modern analog to the syndicate begins to look something more like the e-commerce platforms taking shape in the fixed-income markets. This does not portend the decline of the human side of intermediation. Rather, freeing human capital from mundane functions and coupling it with large-scale physical infrastructure vastly amplifies its power.

Implications for Financial Market Structure

Recent decades have witnessed financial markets in the midst of continuous theory-driven technological advance supported by rapidly declining costs of computer processing. This has driven firms to seek greater scale as profit margins narrow along the horizontal scale in figure 2. The internet represents perhaps a more profound shock whose impact has only begun to surface. It has the potential for converting many traditionally human-capital

intensive functions into pure commodities. As this is taking place, investment banks are re-deploying human capital in a number of novel directions including larger commitments to private equity and venture capital and the development of markets for trading energy, internet bandwidth and other non-financial goods. Connected with the former, bank balance sheets are growing not only from investments in new technology but also as they take equity stakes in firms they previously only provided with advice.

The nature of dealings between functions that remain human-capital intensive and those that depend more on physical and financial capital also is changing. In many instances, we've seen LBO groups, for example, being spun out of large, full-service banks. Even when these human-capital intensive functions are not formally spun out, the increasing mobility of entire teams of bankers suggests widening informal divisions. As these human-capitalists use technology to extend their reach, we expect to see more key individuals or small teams whose stature more nearly approaches that of J.P. Morgan's at the turn of the 20th century. There may be fewer bankers than we've seen through the course of the twentieth century, but the rewards to these key individuals will remain substantial. It is less clear that the rewards to the industry at large will be so great.