

GUEST EDITORS' INTRODUCTION

New Technologies, Financial Innovation, and Intermediation

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By most accounts, the Internet and other technological advances are having a significant effect on financial markets and intermediaries. If history can serve as a guide, financial markets will proceed down a path over which advances in information technology challenge existing property rights over information and in doing so shape financial innovation and intermediary functions (Mulherin *et al.*, 1991). From this perspective, we see potential for understanding how intermediaries, their regulators, and the parties they serve might best respond to these technological shocks. It was in this spirit that the *Journal of Financial Intermediation* and Boston College hosted in May 2000 the symposium from which the four articles in this special issue were drawn. The purpose of this article is to place these articles in perspective and outline an agenda for future research.

Traditionally, the production technology of financial intermediaries was human capital and relationship intensive (see, e.g., Wilhelm, 1999). The relative absence of formal protection for these assets influenced both firm and industry structure and their bearing on the process of financial innovation.¹ Broadly speaking, primitive information technology tied otherwise commodity-like distribution functions to intermediary functions that necessarily demanded human judgment, in essence extending the monopoly power of key human capitalists. The presence of rents supported investment in financial innovations and information in spite of there being few formal constraints on those who free ride on pioneering efforts. Advances

¹ On the former point, see Anand and Galetovic (2000). On the latter, see Tufano (1989) and Persons and Warther (1997).

in information technology typically erode barriers to entry by promoting the unbundling of these two broad classes of intermediary functions. Recent attempts among industry participants to preserve control over key assets include unprecedented business-method patenting (Lerner, 2001) and aggressive enforcement of employment contracts aimed at limiting employee mobility.

The recent introduction by the investment banking firm W. R. Hambrecht & Co. of Dutch (or more precisely, Vickrey) auctions conducted over the Internet to price and distribute initial public offerings (IPOs) is a prominent example of how technological advances have begun to challenge human-capital and relationship-intensive practices. In retrospect, it is hardly surprising that the sale of IPOs of equity is one of the earliest areas to be impacted by the internet and the dramatic reductions in information processing costs in recent times. Given that equity is an extremely information sensitive security and that firms making IPOs are immature relative to those making seasoned equity offerings, and often dealing in a new technology, it is reasonable to expect IPOs of equity to be much more affected by asymmetries in information (between firm insiders and outside investors as well as across investors) than seasoned equity offerings or the sales of other kinds of securities. Therefore, any development which reduces the extent of such information asymmetries can be expected to have a bigger impact on IPOs.

The article by Biais and Faugeron-Crouzet in this issue bears directly on the question of whether innovations like IPO share auctions are likely to succeed. Several authors have argued, based on research in multi-unit auctions, for wider application of auctions in the sale of securities (see, e.g., Ausubel and Cramton, 1998). Two questions are pertinent here. First, are nondiscretionary auctions indeed the optimal mechanism for selling shares in IPOs? Second, since a variety of mechanisms are used around the world to auction financial assets, is there an optimal auction rule for selling IPOs? Biais and Faugeron-Crouzet compare fixed-price offerings, market-clearing uniform-price auctions, and the *Mise en Vente* (an auction-like procedure used in France that is now referred to as *Offre à Prix Minimal*) in a setting where outsiders have private information about their demand for the firm's shares and the objective of the firm is to maximize IPO proceeds. Making an argument similar to that of Rock (1986), they conclude that fixed-price offerings suffer from the winner's curse. More importantly, they argue that uniform price auctions may also not be the optimal mechanism for selling shares if auction participants are asked to submit their entire demand function.

In an analysis reminiscent of Back and Zender (1993) and Wilson (1979), they show that bidders in uniform-price auctions can tacitly collude by submitting demand functions such that the market clearing price is very low. No investor has an incentive to bid more aggressively to gain market share since doing so pushes prices up to unattractively high levels. In contrast, the *Mise en Vente* price underreacts to demand and thereby unravels tacit collusion on low prices. Each investor has the ability to gain market share with minimal price impact by bidding more aggressively. They also argue that the *Mise en Vente* has similarities to the

U.S.-book-building methods with regard to its ability to elicit information from privately informed investors.

IPO share auctions remain a puzzle, however. A number of papers have documented that shares sold in IPO auctions in various countries exhibit much lower underpricing than shares sold through fixed-price and related mechanisms. For example, Darrien and Womack (2000) arrive at this conclusion making use of French data to compare the underpricing of IPO shares that are auctioned with those which are not auctioned. Jenkinson and Mayer (1988) make a similar comparison in U.K. privatizations and arrive at similar conclusions. Roughly similar conclusions can also be drawn about IPOs in Japan by comparing the auctioned and fixed-price IPO offering samples in Kaneko and Pettway (1994) and Jenkinson (1990). Yet, IPO auctions are not only not gaining market share (see, e.g., Darrien and Womack, 2000), but are in fact losing market share around the world.² One resolution of this puzzle is provided by Chemmanur and Liu (2001). They argue that firm insiders with private information about their firm's intrinsic value may not be concerned exclusively with maximizing IPO proceeds. Rather, they may also care about the secondary market price of their firm's equity. If so, insiders have an incentive to select a fixed-price mechanism over an auction mechanism even when the former yields heavier underpricing. They show that fixed-price offerings and IPO auctions have different properties when it comes to inducing information production by outsiders: in many situations, fixed-price offerings are optimal, since the firm is able to induce more information production in this case than in IPO auctions, which translates into higher secondary market prices.

Suppose that electronic auctions gain force in the primary equity markets. The article by Benveniste, Busaba, and Wilhelm in this issue suggests a potential cost that has received little attention thus far. In this paper, the IPO is an opportunity for potential issuers to acquire from investors information that might influence investment and production decisions. Information is costly to produce (and therefore acquire) but that the relative transparency of the transaction causes the benefits of information production to spill over among rivals subject to a common valuation factor. Thus, among firms subject to the common valuation factor, individual firms have little incentive to bear the cost of a pioneering IPO and consequently potential issuers fail to carry out projects that are unconditionally negative NPV but positive NPV conditional on feedback from the marketplace.

Benveniste *et al.* show that solving this coordination problem is not trivial even in the presence of a dominant intermediary with a capacity for spreading information production costs across a series of IPOs subject to the common valuation factor. The argument rests on the fact that an issuer's rivals have the option to observe the issuer's IPO while continuing to rely on private finance. In such states, their investment decisions are improved by the information generated by the issuer's IPO

² At one time or another, IPO auctions have been used in Belgium, Brazil, Chile, France, Hong Kong, Israel, Japan, Korea, Portugal, Singapore, Switzerland, Taiwan, and the United Kingdom. They have fallen out of use in many of these countries.

but they lie beyond the "taxing" power of the intermediary. Explicit recognition of this dependence among firms subject to the common valuation factor yields a set of predictions regarding the widely observed boom or bust patterns in primary market volume and initial returns. Evidence in this regard is provided by Lowry and Schwert (2001) and Benveniste, Ljungqvist, *et al.* (2001).

Thus, the optimal mechanism for selling shares in IPOs as well in seasoned equity offerings remains unsettled and will continue to offer rich territory for future exploration. For instance, Biais *et al.* (2000) argue in another recent paper that a uniform price auction may indeed be optimal if the underwriter has private information about the demand for IPO shares, institutional investors have private information about share value, and the underwriter and institutional investors are able to collude. A related interesting topic for future research is the long-term performance of IPOs which have been auctioned relative to those of shares sold through fixed-price offerings. Darrien and Womack (2000) make a beginning in this direction by documenting that the long-term performance of IPO shares that have been auctioned is dramatically better than those sold through fixed-price offerings. However, the fundamental reasons for the long-term underperformance of IPOs, and its relationship to the offering mechanism used to sell these IPO shares, need to be examined further, both theoretically and empirically.

Almazan's article in this issue also draws attention to the interplay between technology and competition. Building on Holmstrom and Tirole (1997), he develops a model of competition between banks that differ in two dimensions: their level of capitalization and their expertise in monitoring different kinds of projects. This model is characterized by two different kinds of moral hazard. On the one hand, the standard moral hazard problem exists between investors and entrepreneurs. Bank monitoring alleviates this form of moral hazard. However, because monitoring is costly, banks themselves face moral hazard in the provision of monitoring services. In this setting, banks operating under limited liability must be guaranteed rents in order to induce diligent monitoring. The main insight here is that since both capital and expertise affect the magnitude of rents, they are substitutes when banks compete to lend. Banks with less expertise must commit more capital to the businesses they monitor. The paper studies the effects of both financial and regulatory shocks on competition in the banking industry. An interesting empirical prediction is that technological advances that uniformly reduce monitoring costs will benefit heavily capitalized banks at the expense of undercapitalized banks.

Recent advances in information technology have also affected the organization of financial markets around the world. The final paper in this issue, by Alexander and Peterson, examines how a technology-induced innovation in market architecture interacts with preexisting regulatory constraints. Securities prices, until quite recently, were quoted at discrete intervals that were large relative to the smallest denomination of the local currency. In U.S. stock markets, trading in increments of $\$1/8$ economized on the costs of posting quotes, bargaining, and record keeping. However, differences among stocks almost surely led to excessive transaction costs as market participants were prevented from trading at finer increments. This

argument is borne out by the narrowing of bid-ask spreads in the aftermath of the 1997 switch to quoting prices on the NASDAQ and NYSE in \$1/16 (or "teenies") (see Bollen and Whaley, 1998; Goldstein and Kavajecz, 2000). With the continued sharp decline in the cost of communications technology, the SEC issued an order on January 28, 2000, that directed U.S. exchanges and the NASD to implement decimal pricing by July 3, 2000, and subsequently delayed implementation until April 2001.

Alexander and Peterson assess the likely impact of the move to decimalization of prices on a particular class of existing regulations. The regulation of short selling in the United States aims to prevent manipulation that might result in sharp price declines as short sellers sell into a declining market. The primary tool of regulation is the "uptick rule" which prevents short selling into declining markets while not inhibiting short selling in advancing markets. By examining matched samples of stocks trading before and after the adoption of teenies, they find that the finer quotation system enabled easier execution of short sales in declining markets while inhibiting execution of at-the-quote limit orders in advancing markets. Since these findings run counter to the spirit of the uptick rule, it follows that existing regulation of short selling should be reconsidered in light of the likely consequences of decimalization.

In addition to affecting the architecture of various financial markets, the recent advances in information technology have accelerated the extent of competition and cooperation among exchanges. For example, several new stock markets have opened in Europe in recent years (e.g., the Nouveau Marche in France, the Neuer Market in Germany, and the Europe-wide EASDAQ), driven by the lower barriers to entry brought about by technological advances as well as by increased economic integration. At the same time, the potential for cooperation (and mergers) between exchanges has also increased (witness the recent attempts at tie-ups between the London and Frankfurt exchanges). Partly as a result of these developments, a number of exchanges around the world have announced plans to go public, and thus become profit-maximizing corporations.

This raises a number of interesting questions. How will exchanges compete with each other? Will they dilute their listing standards when they compete (or for that matter, cooperate) in an attempt to attract new listings? What is the appropriate regulatory scheme for competing, profit-maximizing exchanges? Some have argued that there will be a race to the bottom in terms of listing standards, and that the appropriate regulatory scheme is to strip exchanges of much of their regulatory authority, creating instead a single independent regulating body to avoid the temptation to dilute standards (see, e.g., Garten, 1999). In contrast, Chemmanur and Fulghieri (1999) show that, even when exchanges act as self-interested value-maximizing players, there need not be such a race to the bottom. Further, exchanges that lower standards may pay a price, sustaining damage to their reputation and their ability to act as credible certifiers of firm quality, thus lowering long-term profits. Also, they show that listing standards may in fact be raised rather than lowered in many cases of tie-ups between exchanges. Such analyses also suggest

that it may be better to allow exchanges to maintain their self-regulatory authority even after they go public, and in the face of increased competition. Clearly, more research is needed in this direction.

To summarize, the papers collected in this issue have considerably advanced our understanding of the impact of recent technological advances and resulting financial innovations on financial institutions, financial markets, and corporate financing practices. Yet, as we pointed out above, this research has also raised a number of new questions to be answered. Further, the remarkable thing about the effect of the Internet so far on financial institutions and markets is *not* how pervasive it has been; rather, it is how limited this effect has been. We will therefore conclude by raising two additional questions. First, how will financial intermediation and corporate financing practices evolve over the coming years, with further advances in technology and resulting reductions in the costs associated with transmitting and processing information? In particular, will there be a fragmentation in the market for the services of financial intermediaries, with highly rated borrowers and large equity issuers engaging in essentially do-it-yourself financing over the Internet (perhaps with some limited assistance from financial intermediaries), while lower-rated borrowers and smaller equity issuers prone to significant information asymmetries continuing to rely on the relationship-intensive services of conventional financial intermediaries who may serve to dissipate these information asymmetries? Will there be a similar fragmentation of stock and other financial markets, with the largest and best firms around the world choosing to issue securities on a single global financial market, with smaller firms choosing smaller, specialized financial markets where only investors with the information and the skills to value these firms trade? There is clearly ample scope for further research, and more special issues of this kind.

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