

**TURMOIL, TRANSPARENCY, AND TEA:  
EVALUATING THE IMPACT OF IT  
ON LONDON'S STOCK EXCHANGE**

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# Turmoil, Transparency, and Tea: Evaluating the Impact of IT on London's Stock Exchange

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## Abstract

Evaluating strategic investments in information technology can be difficult. Uncertainties exist in customer responses, competitor reactions, and thus in the actual economic benefits to be realized. Valuing interorganizational information systems (IOS) is far more complex, since the valuation is complicated by issues of bargaining power, and distribution of IOS benefits. Although an IOS may create a net benefit or *economic surplus*, valuation by the innovator contemplating the investment must also consider who *retains* these benefits. The distribution is in part determined by the technology's capabilities, but principally by the power and resource endowments of the different IOS participants. Screen-based securities markets represent IOSs that serve many stakeholders including investors, securities firms, and listed companies, as well as the securities exchange or vendor providing the system. The London Stock Exchange's (LSE) £25 million investment in trading technology at the time of its 1986 Big Bang deregulation did not benefit all IOS participants equally. Although the screen-based market produced significant benefits for the Exchange, and for investors, whose transactions costs were reduced, any gains retained by the LSE's member firms, who ultimately paid for the investment, are difficult to demonstrate. The damage done to those parties that paid for technological improvements at the LSE has led to dysfunctional behavior by the member firms, and to some deterioration in the quality of the market. The evidence indicates that an uneven distribution of benefits can potentially subvert the efficient functioning of an important IOS.

## 1. Introduction

Evaluating strategic investments in information technology can be difficult, due to uncertainty in customer response, uncertainty in competitor reactions, and the resulting uncertainty in economic benefits. Long lead times associated with developing and implementing strategic systems, and the possibility of significant shifts in the competitive environment prior to roll-out, compound risks. In addition, strategic systems may themselves radically alter the firm's operating environment, casting doubt on any *ex ante* estimates of costs and benefits. These difficulties in valuing strategic systems have been well documented [5][8][14]. Valuing interorganizational information systems (IOS) is far more complex, since valuation is

compounded by issues of power and the allocation of benefits. Although a system may be capable of creating a net benefit or *economic surplus*, valuation by the innovator contemplating the investment must also consider who retains these benefits. The allocation of benefits is determined in part by the power and resource endowment of the participants [27][43], and in part by the technology investment itself [4][34].

On October 27, 1986, the London Stock Exchange (LSE) was deregulated and restructured by the *Big Bang* reforms. These changes were accomplished by replacing the manual floor-based trading system with an electronic market based on screen displays for price discovery and information dissemination. London's screen-based stock trading mechanism is an inter-organizational system that links three principal classes of organizations: (1) investors, who are either large fund management institutions such as pension funds, or private clients, (2) Exchange member firms, who function as brokers and dealers on behalf of their investor customers, and (3) the Exchange itself, which facilitates trading and supplies services such as market data to participants.

#### LONDON'S MARKET DEREGULATION — Glossary:

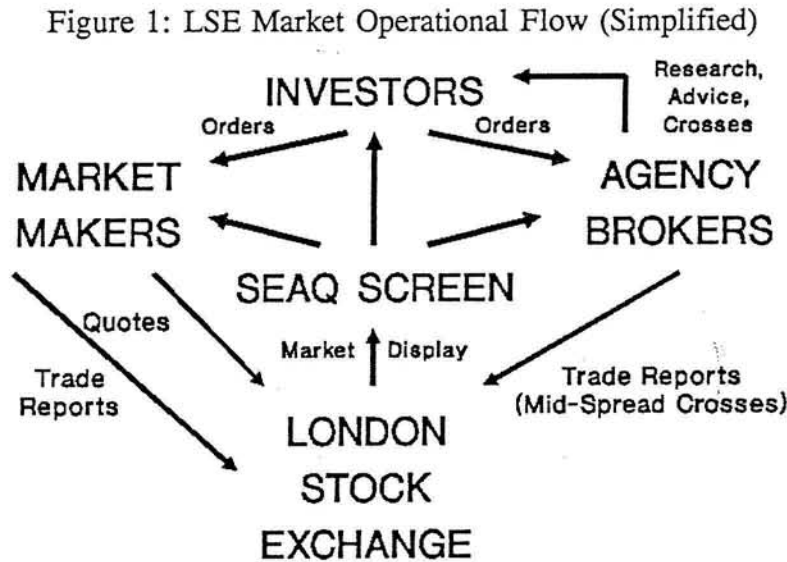
***Big Bang*** occurred on October 27, 1986, and was the result of a 1983 settlement reached with the British Government's Office of Fair Trade to end a lawsuit over restrictive practices and anti-competitive rules by the Exchange. The *Big Bang* changes abolished the fixed commission rate schedule, and permitted firms to operate in *dual capacity* as a broker-agent and as market makers trading for their own account with customers. A 30 percent limit on outside ownership of member firms was removed, and Exchange membership was opened up to overseas firms. Finally, SEAQ, a screen-based market mechanism, was introduced to support the new Exchange operations.

***SEAQ*** is the acronym for Stock Exchange Automated Quotations system, an electronic system displaying market makers' quotations in the 3,000 securities listed on the Exchange. The on-screen market is an IOS used by agency brokers, market makers, and investors.

***Market makers*** are member firms of the London Stock Exchange that operate as dealers, posting quotes, and buying and selling from their own account with customers. At the time of *Big Bang*, market makers replaced single capacity *jobbers* who previously stood on the Exchange floor, and bought and sold shares with floor brokers who represented investors. SEAQ market makers are required to post firm, two-way (bid and offer) quotes for shares in the securities for which they are registered.

The difference between the highest bid quote and the lowest ask or offer quote for a security is called the ***bid-ask spread***. The spread is a transactions cost paid by investors, but it provides a source of profits to dealers in a market. Increased competition and greater visibility of the market led spreads to become narrower on SEAQ than they had been in the pre-*Big Bang* floor market.

Figure 1 depicts the flow of information among the principal participants in the post-Big Bang market.



This case study of events in the London equities markets since the Big Bang introduction of trading technology demonstrates the difficulty of estimating the benefits to be received by participants in an IOS, and the consequences of an eventual distribution of benefits that leaves one class of organizational participant disadvantaged and worse off.

The Big Bang reforms produced important competitive benefits for the Exchange, and are generally viewed as having improved market quality and efficiency [13][36]. First, SEAQ allowed the Exchange to offer a more visible and open market to investors, and to compete for trading volume far more effectively with other exchanges and bourses. The Exchange itself also benefitted, relative to its international competitors — Continental European bourses, and to a lesser extent the New York Stock Exchange, and market data vendors such as Reuters — and through greater trading volumes and Exchange revenues. The number of the TOPIC subscriber terminals — exchange-supplied services to receive and display market data — more than doubled after the reforms, generating an additional £25 million in revenues annually for the Exchange. Investor customers benefitted from lower commissions, and other per trade fees paid to member

s were reduced. In addition, investors were able to participate in a more visible, open, and petitive market.

The changes, however, were less successful from the perspective of Exchange member s. The benefits of moving to a screen-based market do not appear to have been shared by ber firms. In fact, the market improvements destroyed many of the advantages historically ved by securities firms in London [15]. Although trading volume increased and market ty improved, the profit margins of Exchange members were greatly reduced or eliminated.

As an IOS, the screen-based market has been under pressure. Once the Exchange's bers realized that the market had been fundamentally altered in a way that reduced their ability, they responded to the Big Bang improvements with attempts to recreate profit rtunities lost to the more efficient screen-based market. These actions appear to be nctional because members have sought to subvert some of the market quality improvements iced by the Exchange's systems. This has consisted of initiatives by individual firms, e of the market systems, and pressures for a series of changes in the Exchange's operating that represent concessions to market makers and some diminution in the visibility of the st.

The next section examines the improvements that resulted from the move to an openly etitive, screen-based market in London, and provides evidence of the benefits to some s of participants in this IOS. The third section details the damaging activities and private ives undertaken by member firms that threaten to undermine the Big Bang plishments. In the fourth section, we discuss the Exchange's response to the pressures ave faced from the loss-making membership. The responses include revisionist tinkering he market rules, and a roll back of some of the transparency in the screen-based market. fth section is an economic analysis that uses the general principles of Nash bargaining and l resources to explain the events in London. The final section is a summary and a sion.

## 2. The London Stock Exchange: Structure and Practices

Immediately following Big Bang, the London Stock Exchange was regarded as the most progressive and efficient financial marketplace in Europe [22][23]. Profound regulatory and organizational reforms took place, and innovative technological developments were highlighted by the introduction of SEAQ, the screen-based market system that quickly attracted equities trading activity, and led to the abandonment of the centuries-old market floor. The movement of trading activity from the market floor to firms' well-equipped upstairs dealing rooms occurred with unanticipated speed, and having done away with an existing trading floor, London is unique among major world markets [13][42]. SEAQ automation supports price discovery and information dissemination in a quote-driven market, patterned on NASDAQ (for National Association of Securities Dealers Automated Quotations) in the U.S. over-the-counter market. London has between two and twenty market makers that post bid and ask quotes in each stock; the average is about eight. More actively traded stocks tend to have more market makers. In contrast, the New York Stock Exchange (NYSE), assigns a single dealer, known as a *specialist*, to stand on the market floor and supervise and participate in trading in each stock.



**MARKET STRUCTURE — Glossary:**

A range of different *trading mechanisms* are in use in securities markets around the world. There is little agreement on which market structure is best. Stock exchanges are generally either quote-driven or order-driven, and vary in the level of automation and market transparency they provide [6][42].

In a *quote-driven* or dealership market, market-making intermediaries quote prices (usually on screens) at which they agree to buy or sell securities up to a particular size trade. Investors choose the best quote from among the competing market makers, and may be able to negotiate on price and quantity. Examples are NASDAQ in the U.S. and SEAQ in the U.K.

In an *order-driven* or auction market, investors submit buy and sell orders usually through a broker. An order can be a *market order*, an instruction to buy or sell at the best available price in the market at that moment. In order-driven markets, investors can also place *limit orders* by setting a *limit price* as a upper bound on the most they will pay to buy, or a lower bound on what they will sell for. Orders are matched against one another in a central facility. Examples are the Toronto Stock Exchange's Computer-Assisted Trading System (CATS), and the Tokyo Stock Exchange. The NYSE has a hybrid market structure that combines elements of order- and quote-driven systems.

*Liquidity* is the most important determinant of the attractiveness of a market, and reflects the market's ability to convert between securities and cash, rapidly and with minimal impact on the market's price. A representative measure of liquidity is the bid-ask spread.

*Visibility and transparency* are other measures of a market's attractiveness. A transparent market is one in which investors know the sizes and prices of recently completed trades, and the sizes and quotes at which the next trades can be expected to execute. The research literature suggests that transparency is good for investors and enhances market competitiveness and fairness [31]. Stanley Ross, former managing director of Deutsche Bank, describes the opportunities for securities firms in the non-transparent market of the 1960s: "We had the client, who was invisible to the market, which in turn was invisible to him ... we took as big a 'turn' (dealing margin between buy and sell prices) as we thought the market would bear." [30]

The Exchange's membership reforms attracted new entrants and additional capital at a time of buoyant conditions in the securities industry. A loosely regulated international securities market was established to attract the wholesale trading of non-U.K. stocks to the Exchange. These changes gave the Exchange a competitive advantage relative to bourses in Continental Europe. As much as five times more trading in certain blue-chip Swedish, French, and German stocks occurs in London as in the home markets of those shares.

**Big Bang Accomplishments.** The Big Bang reforms have been hailed as a success.<sup>1</sup> Thirty-three market makers were in operation on Big Bang day, up from thirteen jobber firms (only three with significant market share) that handled all trading activity in the pre-Big Bang floor market. Overnight, the amount of capital committed to market making jumped from £60 million to £1 billion. Transactions costs, which consist of commissions and dealing spreads paid by investors, fell by a third. Table 1 details the fall in costs to institutional investors for a *round-trip transaction*, which involves the purchase and eventual sale of a quantity of shares.

Table 1  
Transactions Costs for Institutional Investors in London Market

Transactions Cost Measures	1983	1986	1988	1990
Average commission on all trades	0.58%	0.43%	0.28%	0.26%
Spread (150 most actively traded shares)	1.0%	1.0%	0.80%	0.85%
Average institutional commission	N.A.	0.31%	0.21%	0.16%
Average cost of <i>round-trip</i> transaction of £100,000: 100,000*(spread + 2*commission)	£2,160	£1,620	£1,220	£1,170

Transactions volume nearly doubled from £643 million per day in the first three quarters of 1986 to £1.1 billion per day in the first quarter of 1987.<sup>2</sup> One measure of the value of the SEAQ technology is the savings from lower trading costs. The data in Table 2 suggest that at pre-Big Bang commissions and spreads, investors could have paid an additional £1.4 billion annually in transactions costs in 1990.

<sup>1</sup> For additional detail on the market reforms, the trading technology introduced, and a survey of market participants' reaction to the Big Bang changes see Clemons and Weber (1990).

<sup>2</sup> Data from *Quality of Markets Quarterly*, London Stock Exchange, various issues, 1986-1991.



Table 2  
Implied Savings for Institutional Investors in London Market

Savings to LSE Investors (all figures in millions)	1983	1986	1988	1990
UK Equities: Annual trading volume	£56,100	£162,036	£325,500	£317,459
Transactions costs to investors with 1986 commissions & spreads	£1,212	£3,014	£6,054	£5,905
Estimated actual total spread and commission costs	N.A.	N.A.	£4,427	£4,508
Implied Savings to Investors relative to 1983 Costs	N.A.	N.A.	£1,628	£1,397

The figures in Table 2 for the net savings and surplus from Big Bang naturally are only approximations. Savings in trading costs may be somewhat overstated, since trading volume would not have increased so dramatically without the reduction in commissions and spreads. However, benefits from increased trading resulting from the Big Bang reforms — often called the value of beneficial trade — have been excluded from our analyses.

The Exchange received benefits from the IOS. The number of TOPIC terminals used to deliver the Exchange's market information service grew from 4,312 in June 1986 to over 10,000 by 1990. Depending on the version used, each terminal generates £3,000 to £5,200 per year in revenues for the Exchange. Thus, market growth in the wake of Big Bang contributed an additional £25 million to the Exchange just from market data services. Reflecting the rise in market volumes and complexities of the new market, the Exchange's staff grew from 1,200 in 1985 to 2,838 in 1989.

The Exchange also succeeded in establishing an active international market for trading of non-U.K. securities away from their home exchanges. London is the most global stock exchange today, listing about 750 non-U.K. stocks, and attracting more than two-third of all equities trading that occurs outside of the stock's country of origin, according to the Bank of England [17]. There were 54 firms operating as market makers on SEAQ-International in

January 1992. Trading volume on SEAQ-International grew from nothing in 1984 to £400 million a day in 1987, and in 1991 exceeded £1.1 billion a day, or about the same volume as recorded in the U.K. domestic equities market. Although daily trading volume of domestic stocks in New York and Tokyo is far greater than in London, trading volume of overseas securities on the New York Stock Exchange averaged just \$441 million (£250 million) a day in 1991, and on the Tokyo Stock Exchange, it was just \$77 million per day in 1991.

Table 3  
Extent of Cross-Border Trading in Major Stock Markets

	Domestic Listings 1991	Average daily trading volume in <u>domestic</u> shares 1991 (\$ million)	Non-Domestic Listings 1991	Average daily trading volume in <u>non-domestic</u> shares 1991 (\$ million)	As a percentage of total market trading volume
London	2,243	2,318	725	1,992	46.2%
New York	1,678	6,278	108	441	6.6%
NASDAQ	3,917	2,938	278	114	3.7%
Tokyo	1,614	3,384	125	77	2.2%
Germany	649	1,620	570	48	2.9%
Paris	449	468	236	18	3.7%

The success of SEAQ-I has come mostly at the expense of less liquid and more costly bourses in Continental Europe. The loss of trading volume in blue-chip Swedish, French, and German shares prompted market authorities in those countries, and led them to modernize their markets and implement reforms aimed at lowering trading costs and repatriating trading volume. Table 4 indicates the volume of SEAQ-I trading in London relative to the home markets.

Table 4  
SEAQ-International Trading Volume in Continental European Stocks

	SEAQ-I Trading Volume: Daily Average in 1991 (millions)	As a percentage of the home market's trading volume
Netherlands	\$165.60	50.3%
France	\$244.80	26.7%
Switzerland	\$125.20	25.8%
Germany	\$500.00	12.2%

**Post-Big Bang Market Practices.** The London Stock Exchange operates as a competing dealer market. In each stock there are a number of dealers, or market makers, that provide bid quotes (the price at which they will buy shares from customers), and ask quotes (the price at which they will sell shares to customers). The SEAQ system has one "page" for each issue that displays all market makers registered in that security with their bid and ask quotes. There is also an indication of the number of shares the market maker is willing to commit to at those prices. By negotiating over the phone, a trader can usually buy and sell in larger quantities than those shown, and market makers will often agree to trade at prices different than those on the screen. Similar to the NASDAQ market in the U.S., dealers are geographically dispersed. Several SEAQ market makers are in fact located in Edinburgh, Scotland, and several SEAQ-I market makers operate out of dealing rooms in Paris and Frankfurt. SEAQ information is displayed on computer screens, and investors, or brokers acting on behalf of investors, contact and make trades with dealers over the telephone. The inside quotes displayed on the SEAQ screen, also called the *touch*, represent the best bid and offer available in London, and are prominently displayed, double sized, in a yellow strip at the top of the SEAQ screen for each stock. The intent when SEAQ was implemented was for the yellow strip to give a rapid and accurate indication of the price at which the next trade in any share could be expected to occur. Once a trade is executed the details of price and number of shares are transmitted to the Exchange, which then publishes the stock's cumulative trading volume and the prices of the most recent transactions on the screen above the yellow strip.

Table 5  
Sample SEAQ Screen for Imperial Chemicals Industries

		Best bid				Best offer							
Stock symbol	SEAQ FT-SE 100 QUOTES	45347								11:36	← Time		
Day's cumulative share volume (000s)	ICI	ICI								1300-1305			
Last trade prices	VOL 880	LT	1303	5	6	3	1298	1301	3	1	4	11:33	← Time of last trade
		<b>RAML BZWE SBRO 1303-8 WARB P&amp;DT MGSB</b>											
		AITK	1300-010	5x5	MOST	1303-013	5x5						
		BZWE	1303-009	50x50	NMRA	1300-010	50x50						
		CNWM	1300-010	50x50	P&DT	1303-008	5x5						
		FLMG	1302-009	50x50	RAML	1303-013	10x10						
		GSCO	999-009	25x25	SALB	1302-012	50x50						
		HOAE	1300-010	50x50	SBRO	1303-010	1Lx1L						
		KGLE	1301-008	50x50	SLAM	1301-011	50x50						
		MERL	1302-012	25x25	WARB	1301-008	1Lx1L						
		MGSB	1300-008	5x5									

Traditions in the London market and the competitive environment since the Big Bang have led to trading practices that would be alien in most securities markets. London's market makers are generally willing to hold in their inventory large principal positions resulting from buying from or selling to an investor customer. Remarkably, this is generally done without assessing whether there is likely to be an interested counterparty to eventually take the other side of the trade. Moreover, shares in large companies will have a bid-ask spread of only a few pence. Since the average share price is about £3, this is often less than 1 percent of the share price, making it extremely difficult to recover losses from bad trades. As a result, market makers' risks are large, even in everyday trading.

On the New York Stock Exchange, the specialist market maker may offer firm quotes in an 1/8th (12.5¢) spread, which is generally less than 1 percent of the share price for NYSE-listed issues, which have an average share price of about \$35. However, these quotes are good for up to only 5,000, and sometimes only 500 shares, rather than for 100,000, or even 500,000

shares, as commonly occurs in London. Although large trades, occasionally for a million or more shares, occur in New York, they generally involve a block trading desk. Block traders will carefully locate counterparties — customers who will take the other side of the trade — before orders are submitted to the floor, matched, and reported on the ticker tape. The London practice of a member firm taking on a large principal position is far less common on the New York Stock Exchange, and generally requires a far more generous spread to be paid than in London.

### 3. Crises in London

The Big Bang reforms created a transparent, screen-based market, and opened the Exchange up to corporate and foreign membership. Buoyant conditions, and visions of developing into global financial services conglomerates, led three of the four large U.K. clearing banks, and a handful of U.S. and European banks, to enter the U.K. securities industry. Acquirers of U.K. brokers and market making firms spent £750 million in 1985 and 1986. In the period after Big Bang, the U.K. market continued to rise. The FTSE-100 index of the 100 largest U.K. stocks rose nearly 50 percent between October 1986 and September 1987. Since member firms tend to hold maintain a net long position in the stocks that they trade, the market's rise contributed to profits.

After the bull market ended in October 1987, and trading volumes declined, it became clear that member firm profitability would not be easily restored. Observers realized at that time that "banks from around the world which applied their financial muscle to the new U.K. market ended up committing far more capital than could ever earn an adequate return." [23] There followed a period of acrimony among market participants, and the accomplishments of the Exchange and the adoption of new trading practices no longer seemed so praiseworthy. The *transparency* of the screen market and the pressures of overcapacity led to competitive spoiling tactics by market makers, who attempted to force losses on competitors that completed large trades. There has been a deterioration in the information displayed on the SEAQ screen, and dealers have posted quotes on SEAQ that did not represent the prices or volume at which they were prepared to deal.

Persistent losses combined with acrimonious debates about trading practices have led to a belief that elements of the London system of competing market makers and screen-based price discovery are fundamentally flawed [23][35][36]. The Stock Exchange warned in a report that "this dissatisfaction will lead to an initiative to set up an alternative retail market ... (that) would give rise to market fragmentation and the possible disintegration of the overall domestic market." [38] Many came to feel that the level of transparency in the screen-based market prohibited member firms from earning an adequate return on the capital they had committed to the market.

**Losses: October 1987-January 1989.** The problems associated with London's excess capacity and screen-based market appeared just after the price crash in October 1987. Although the SEAQ system operated nearly flawlessly, with only temporary interruptions during the crash and the deluge of orders, the FTSE-100 index fell 22.4% the week of 19 October 1987. London's market makers were net buyers of £250 million in shares on Black Monday, and their fourth quarter trading losses wiped out the £400 million in member firm profits in the first three quarters of 1987. Following the crash, customer turnover fell more than half from its peak of £1.34 billion daily in October 1987 to £664 million in February 1988. Annual turnover in 1988 and 1989 was only slightly greater than the pre-Big Bang levels, and about 40 percent less than the 1987 level. On top of falling business volumes, margins were collapsing. Competition was driving dealing spreads and commissions lower, and market volatility continued to place trading positions at risk. Member firms posted an aggregate loss of over £200 million on their equities trading business in 1988. By late 1988, many market observers grew to believe that the SEAQ trading technology introduced at the time of Big Bang made the market too transparent and too efficient. The *Economist* described the conditions simply: "High tech share trading is theoretically perfect, and practically unbearable." [35]



Table 6  
Events in London Market Since Big Bang

CHRONOLOGY — London Stock Exchange since Big Bang:						
<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	
Oct.86 Big Bang	Oct.87 Price crash: Member firms lose £350 million in 4th Quarter	Aug.88 Price war reduces market maker spreads 33% & cuts size of quotes	Feb.89 Market rule changes end immediate trade publication for large trades & eliminate obligation for inter-market maker trading	Member firms lose £350 million for the year	Jan.91 revisions to rule changes	
	Mar.87 Automatic trade execution systems introduced	Volume 40% below 1987 levels				

As losses and dissatisfaction with the Exchange increased, members began to take actions on their own to improve their financial performance. These actions, which we describe in the next section, while rational from the perspective of individual members, were damaging to the market, and in aggregate precipitated a serious crisis by the summer of 1988. We describe below actions that members took in their attempts to recover what they perceived as an acceptable return due to them, that is, their share of the benefits created by the technological improvements to the market at the time of Big Bang.

**Spoiling tactics.** London's market makers provide immediacy to the market: an investor who wishes to trade can generally execute his transaction rapidly through a market maker rather than waiting for a block trading desk to assemble the other side of the trade as in an NYSE-style auction market. Several market makers that we spoke with in November 1988 described the "illusion of liquidity" in the new market; that is, all but two or three market makers were posting quotes for large size trades only because they knew could lay off any unwanted positions on other market makers. For instance, a market maker without enough investor contacts to be able to "work off" a large position could still post on-screen quotes for 100,000 shares or more, and then rely on the obligation of market makers to trade with one another at their screen prices to get rid of unwanted inventory. With lower trading volumes and fewer opportunities to unwind positions, SEAQ market makers began to fear being "hit" at their screen prices by other market makers. Market makers accused each other of "passing the parcel" by completing a trade with a true customer, such as a pension fund or an insurance company's investment unit,

then quickly laying off the unwanted position and the risk by trading with other market makers. Market makers began to respond immediately to positions taken by their competitors. If it appeared a rival market maker had acquired a large long position in a stock, the other market makers would lower their prices to the point at which the original trade was loss-making. If it appeared a rival market maker had sold a substantial position in a stock, the other market makers would raise their prices. The head trader at a leading British securities house told us, "I get hurt by taking a position now — the other market makers are spoiling my trades."<sup>3</sup>

U.K. EQUITIES MARKET — Terminology:

*Passing the parcel* occurs when a market maker trades with a customer, but rather than holding the position or working it off through trades with other investors, he or she contacts another market maker to lay off the position.

Firms have been accused of *fair weather market making* for using market maker privileges or operating as a market maker without accepting the implicit responsibilities to contribute to market liquidity in both normal and adverse market conditions. Many of the large market makers argue that firms with small market making operations in London avoid trading or quote unattractive prices at times of uncertainty and stress in the market.

From the perspective of financial economists, a market maker quoting the best bid or ask price on SEAQ is *sitting duck*, vulnerable to other traders with better or more timely information. For instance, a trader that is aware of influential news about to be released can trade immediately with a market maker before the price adjusts to reflect the new information.

*Preferencing* occurs when an investor or a broker directs or "preferences" his orders to a market maker that is *not* quoting the best price in the market at that time. The market maker contacted will match the best quotes to do the trade, but this can be detrimental to market quality since it reduces the incentives to make the best prices.

*Parasitic pricing* occurs when market prices that are electronically disseminated are used by other traders as the basis for their own pricing. A firm that offers to trade with its customers (e.g., through an automated order execution system) at prices being quoted by other traders in a market is benefitting from the availability of market prices, but is siphoning trading volume away from the providers of market quotes. This is a form of free-riding in which the beneficiaries of the prices do not contribute to their creation.

<sup>3</sup> Personal interview, November 1988.

It is impossible to ascertain with certainty whether spoiling tactics represented a simple move by the market to a new equilibrium price, reflecting the significant imbalance between supply and demand created by a large trade, or a deliberate spiteful attempt to damage a rival market maker for successfully completing a large trade. Nevertheless the effect on market maker profits was the same, and the largest firms, which were most likely to be contacted by other market makers, began to take defensive actions. Some reduced their quote sizes to the minimum 5,000 shares permitted for the most active category of stocks. Other market makers widened the difference between their bid and ask quotes, but offered to trade 100,000 or 200,000 shares [35]. Although there was no indication of this on the SEAQ screen, the first group was generally willing to trade in far larger size than displayed, but did not want to be obligated to trade with other market makers in more than their posted 5,000 share size. The second group was generally willing to offer real customers a better price than what was displayed, but rival market makers would only be offered the unattractive prices posted on the screen. Although these actions did not restore market maker profits, the effect was to blur and distort the information available on the SEAQ screen, and to force other market participants to decipher what actual prices might be made available to them.

In a dramatic, if somewhat self-destructive, one day protest in November 1988 aimed at trading practices and trading rules on the Exchange, Bernard Leaver, head of market making at Lehman Brothers International, posted equal bid and ask quotes (*zero* spread) that were firm for trades of up to 10,000 shares in British Aerospace. Later in the day, market pressures forced him to retreat.

**Deterioration of SEAQ prices and market fragmentation.** Investors began to realize that SEAQ quotes were less than a clear signal of the true trading prices available, and they increasingly sought to improve upon market makers' screen quotes. Aware that the screen prices were not necessarily representative of market sentiment, the Exchange itself noted in its Fall 1988 *Quality of Market Review* that "institutional investors have found it necessary to negotiate for the best deal" [28]. We sampled LSE transactions data in nine stocks in July 1989, and showed that 44.5 percent of all trading volume was being done at prices *better* than the SEAQ *touch* quotes displayed at the time of the trade (data reported in [22]). This meant that

there could be multiple prices for what was ostensibly the same trade, depending on the negotiating ability of the trader. Brokers have a fiduciary obligation to provide 'best execution' for their clients, which ordinarily means demonstrating that no better quoted prices were available than those obtained for clients. Assessing best execution is difficult when nearly half of trading volume is negotiated inside the best, screen-displayed quotes. Questions arose as to whether small investors and overseas institutions with less influence were getting quality prices in the market. In the absence of a trading floor, it is not clear what the concept of a central market with a single best quote means. Rather than appearing to be a consolidated central market in which all participants are on equal footing, data from the SEAQ market has exhibited signs of market fragmentation, in which several prices might exist for trades completed in a single stock at any one time.

Market fragmentation is damaging because as the degree of integration drops and the market begins to behave as a collection of smaller, less liquid markets, most measures of market quality begin to drop as well. Orders execute less quickly, or do so at inferior prices. Fairness deteriorates as some customers perceive that they are receiving inferior prices. Confidence in the market may drop. Ultimately trading volume may be lost if alternative markets, such as the New York Stock Exchange — which lists about 55 British equities in American Depository Receipt (ADR) form — are perceived as offering more consistent and fair pricing.

The SEAQ display is widely available to institutions and brokerage firms, and there are no off-exchange trading prohibitions such as Rule 390 in the U.S. (which dictates that NYSE member firms to route their orders to an exchange floor) to require orders to be brought to a SEAQ market maker. Thus, in London, a broker can choose not to bring customer orders to the market, and to serve as a market maker if conditions make this advantageous. As a result, market makers have accused brokers of "*fair-weather market making*", that is, functioning like a market maker when it suits them, and standing out of the way and relying on the obligations of regular market makers when difficult, high-risk situations arise. Brokers often search out counterparties for investors in hopes of finding a "cross" or a "put-through" at a price between the best bid and ask quotes displayed on SEAQ. For instance, if a stock that has a SEAQ bid of £3.00 and an ask quote of £3.03, a broker with a customer that wanted to sell could try to

find another investor that wanted to buy at £3.01 or £3.02. The broker and the two customers would be better off, but the central market has been bypassed and those that risk their capital as dealers suffer. This may initially appear beneficial, and brokers who negotiate these internal crosses argue that they are indeed good for both parties to the trade. Exchanges argue that these crosses have two problems:

- They do not show the orders to market makers, and thus deny customers the possibility that the market maker may in fact offer a better price than the broker.
- They deny the market makers the reward for their obligation to participate in *all* trades, including risky, difficult ones where the counterparty is not readily identified, and reduce their incentive to make the best quote, causing market quality to deteriorate.

Because trades often occur with the benefit of a screen price, but without the participation of market makers, the incentives for market makers to participate in price discovery on the SEAQ screen are potentially weakened.

**Preferencing.** Since market makers are obligated to honor their SEAQ quotes to other market participants, posting the best bid or ask quote carries a large associated risk. The market maker becomes what Amihud and Mendelson refer to as a "*sitting duck*", vulnerable to traders who can exploit any information advantage that they have by trading with the market maker before the price adjusts to reflect the new information [1]. Fundamental to the functioning of SEAQ's competing market maker system is the principle that the market maker who accepts the risk of quoting the best buy or sell price, and doing so the earliest and in the largest size, should be rewarded with order flow. The intent was for traders to direct their orders to market makers in the yellow strip, providing a strong competitive incentive to supply attractive quotes, while those members making inferior quotes would see little or none of the business. However, in an analysis of trading records from July 1989, we found that the market maker(s) quoting the best, or inside price for a stock received only 41.3 percent of the incoming trading orders, with the



rest going to market makers quoting less attractive prices, but who were willing to match the best prices posted by their rivals.<sup>4</sup> The explanation often given for such preferencing of order flow is that established relationships between brokers and market makers, or investors and market makers, leads many orders to be directed not to the market maker quoting the best price, but to firms that have good reputations for trading in large size or matching or improving upon the best available quote.

At the time of Big Bang, preferencing was viewed as a potentially very serious problem, for the following reasons:

- Unlike order-driven markets such as the New York Stock Exchange, where prices are generally determined by customers submitting limit orders for specific quantities of stock at specified prices, in quote-driven markets it is only the quality of the market makers' quotes that determines the quality of price discovery.
- The higher the proportion of trades that are directed to the market maker providing the best quotes, the stronger the economic incentives supporting tight and accurate pricing. This is also essential for rewarding the market maker for the risk of making firm quotes for the entire market to see, and that can be picked off by a better informed trader.

If preferencing becomes widespread, and if this is widely known by market makers, their incentive to participate actively in price discovery through competitive SEAQ quotations is greatly reduced, and market quality suffers greatly. Many market observers, and the Exchange, are concerned that the current level of preferencing will in time harm the efficient functioning of the market.

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<sup>4</sup> Data reported in Franks and Schaefer (1990).



**Automatic execution and parasitic pricing.** The introduction of proprietary automated small order execution systems is another controversial step that member firms have taken to regain lost profitability. Unfortunately, it also threatens the efficient functioning of the SEAQ market. In March 1987, Kleinwort Benson rolled out the BEST system, and in mid-1988 Barclays de Zoete Wedd introduced its TRADE system [12]. Both of these systems allow brokers anywhere in the U.K. to key orders into a terminal for their clients. The order is electronically routed to the firm offering the system, and the trade is executed at the best available quote in the stock on the SEAQ screen and confirmed on-line in a matter of seconds. The shares are deducted from or added to the market maker's inventory in the stock, and details of the trade are passed on to the Exchange for reporting and settlement.

These automatic execution systems employ "*parasitic pricing*". Orders input to TRADE and BEST are routed to the Kleinwort Benson or BZW market makers, who execute the trades at the inside price in the market regardless of the price they were quoting on SEAQ at the time. In other words, the firms with automated execution systems make preferencing automatic. These systems are only possible because of the electronic dissemination of SEAQ prices, and the ability of any market maker to match the best quotes in the market. Some observers have argued that this is unfair to the provider of those quotes, who is putting capital at risk, but is not being compensated or enabled to participate in the trades that their quotes have helped to attract to the market. The brokers gain because their transactions costs are reduced while clients still get best execution of their orders. The two market making firms with automated systems gain because they receive a flow of orders even if they are not making the best quotes in the market. Unfortunately, the Exchange market may be harmed because the market maker displaying the best prices does not receive subsequent orders, reducing the incentive to make the best price and to participate in on-screen price discovery.

Automatic order execution systems have grown to account for about 5,000 trades out of the 30,000 trades that are done daily in U.K. stocks. As a result, Exchange officials and other observers are concerned about the quality of SEAQ price discovery if proprietary automated execution systems continue to grow.

**Withdrawals from Market Making.** Not surprisingly, the erosion of profits in the London market has led to a reduction in the capital committed by member firms and a retreat from some business activities that proved unprofitable [28][30]. Total member firm capital committed to equities and fixed income trading fell from a peak of £3.5 billion in 1988 to £3.1 billion in late 1990. The number of market makers has decreased from 36 in 1987 to 24 in 1991 [28].

#### **4. Redressing the Balance of Benefits in SEAQ: Market Makers' Efforts to Restore Their Profitability**

In addition to its rule-setting and supervisory roles, a stock exchange functions as a trade association for its member firms. Not surprisingly, the Exchange began in 1988 to set up several committees to look into concerns about the market and ways to stem the further erosion of member firms' profits. In addition to actions taken individually by member firms to recover benefits lost to SEAQ, the members acting collectively through Exchange committees sought to effect a return to what they believe to be fair profitability. In particular, since members rightly saw that much of their difficulty after Big Bang could be directly attributed to improvements in market transparency resulting from screen-based trading, and since they believed that they were receiving little benefit from these innovations, their actions were directed at reversing the impacts of many Big Bang reforms and systems.

The market systems innovations at the time of Big Bang appear to have produced a considerable surplus or societal gain when aggregated over all affected parties. The Exchange and its institutional trading customers were the principal beneficiaries. We identified £1.4 billion in annual savings to investors, and £25 million in added market data revenue to the Exchange. Member firms of the Exchange — market making and brokerage firms — have seen their performance decline and any direct value from Exchange membership evaporate. Their efforts to recapture profitability have involved subverting many of the market quality enhancements that made the efficient screen-based SEAQ market a successful IOS in 1986. Members' willingness to subvert the system's intended functioning — through distortions of screen quotes, preferencing, etc. — indicates that valuation efforts failed to determine that the IOS impact on

this critical group of participants would be decidedly and significantly negative. In addition, the LSE has taken steps to reduce market transparency.

**The Elwes Committee.** In late 1988, the Domestic Equities Markets Committee was established, and chaired by Nigel Elwes, finance director of Warburg Securities, one of the largest U.K.-based securities houses. The Committee was composed of market practitioners, and was charged with reviewing the choice of market structure made in preparation for Big Bang, and recommending refinements or fundamental changes to it. Joseph Hardiman, President of the NASD in the U.S., has commented that "any market must allow the participants putting up capital to make an adequate return" [23, p.104]. In response to such sentiment and pressure from its members, the LSE made several striking rule changes in February 1989.

**February 1989 Rule Changes.** The Elwes Committee proposed two substantial rule changes. The first rule change eliminated the obligation of market makers to honor their quotes to one another. Previously, quoted prices and sizes were firm for all traders. Beginning in February 1989, market makers were allowed to decline to trade when contacted by a rival market maker. Since the volume of trading among market makers made up about 40 percent of total Exchange turnover in 1988, the removal of inter-market maker trading obligations was significant. The consequence of the rule change was to force small market makers, with fewer contacts with retail and institutional investors, to hold trading positions longer, and to reduce their reliance on larger market makers for laying off positions.

The second change delayed the publication of trade prices until the following day for trades that have a value greater than £100,000. Such trades accounted for about 78 percent of the trading value on the Exchange in 1988. Previously trade details were published immediately. After February, the screen continued to register the day's cumulative volume for each stock, but the prices of large trades no longer appeared in the last trade display on the SEAQ screen. The effect of the change was to reduce the transparency of the market, and to add to the risk of trading for all but the largest market makers. Because small market makers see less order flow, they are far less informed about prices for institutional-sized trades. The loss of transparency also meant that investors contemplating a transaction face the risk that a large trade has taken

place without their knowledge. However, the relative position of large market makers was improved because they see a greater proportion of the order flow and depend less on trade publication for this information.

**Impact of Rule Changes and Reaction.** Both changes have considerable impact, and numerous observers have noted that the changes may be harmful to the Exchange in the long run. Richard Grasso, President of the New York Stock Exchange, called the changes "a giant step backwards".<sup>5</sup> The U.K. Office of Fair Trading (OFT) objected to the publication delays, but did not block them. David Walker, head of the Securities and Investments Board (SIB), the U.K. counterpart to the Securities and Exchanges Commission, expressed a hope that the changes would be rolled back as soon as possible. The *Financial Times* in a February 1989 editorial criticized the changes as "excessive generosity to the old club", meaning that the changes favored those U.K. firms that had dominated the market prior to Big Bang.

Reactions in the U.K. varied. The major U.K.-based market making firms applauded the rule changes, and those that had lowered their SEAQ sizes to the minimum 5,000 shares raised them after the rule change. Overseas firms that had become member firms of the LSE at the time of Big Bang were the most outraged by the changes. Bernard Leaver of Lehman Brothers International worried that London may "reduce the size of the game we're playing and instead of being a high-profile international market, we'll be a domestic playground."<sup>6</sup> John Heimann of Merrill Lynch was more direct, saying the changes were "an attempt to re-establish the old oligopoly", and that the Exchange was "in danger of eliminating or downgrading the very principle of transparency on which the new, supposedly level playing field was created." [7] Customers of the Exchange, the institutional investors that pay commissions and trade with SEAQ market makers, had mixed opinions [30][37]. Some felt that without the burden of immediate exposure of large trades market makers would be willing to trade more readily and on better terms. Most institutions did acknowledge they would be denied information. An

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<sup>5</sup> During Advisory Board Meeting, U.S. Congressional Office of Technology Assessment, Washington, D.C., April 1989.

<sup>6</sup> Personal interview, London, 8 March 1989.

executive of a major U.K. pension fund stated that "the market is an information mechanism, and if the information is muddled, people will be more wary of using it and the market."<sup>7</sup>

**Effect of Rule Changes.** Two years after the Elwes Committee's rule changes, adequate profitability failed to return, and despite cost-cutting efforts, member firms had their worst year on record in 1990. Changes in the Stock Exchange's rules have not returned its member firms to. The erosion of member firm profits led to staff layoffs, to persistent losses, and in extreme cases to withdrawal from Exchange membership. Member firms lost £350 million in 1990, and about 10,000 net job losses are estimated to have occurred since 1987. There has been a decline from a peak of 36 market making firms in 1987 to 22 in mid-1991. Capital employed by member firms fell from its 1989 peak of £3.5 billion to £3.1 billion in late 1990 [28]. The losses suffered by exchange members in 1988 and 1990 — £200 million and £350 million — would have wiped out the capital of all of the firms operating in the City several years earlier. Annual return on capital averaged *negative* 2 percent between 1987 and 1990. For comparison, member firms of the New York Stock Exchange were affected by the post-Crash downturn in trading volumes, but only showed a small collective loss in 1990 and had an average annual return on capital of about 6 percent in 1987-1990. One of the hoped-for effects of the rule changes, greater trading volumes, did not occur, and trading volumes in U.K. equities continued to fall between 1988 and 1990, with only a slight increase in 1991.

**January 1991 Rule Revisions.** The rule changes implemented in the wake of the Elwes Committee recommendations were intended to be temporary, and to have a beneficial effect on market problems and member firms' profitability. The rules were changed again in January 1991, moderating some of the changes made earlier. The first revision restored the obligation of market makers to trade at their quoted price with rival market makers. Immediate trade publication was not reinstated, but 90 minute delayed trade publication was introduced for trades with a value larger than three times normal market size (NMS). The NMS is determined for each stock individually, and averages about £40,000. Thus, a greater proportion of trades prices were published after the January 1991 rule revisions.

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<sup>7</sup> Personal interview, London, 25 May 1989.



Some market makers continue to argue for next day publication of trade prices, saying 90 minutes is an inadequate amount of time to unwind their position before it becomes exposed to the marketplace. Advocates of delayed trade publication point out that the SEAQ market provides a high degree of *pre-trade* visibility (i.e., firm, competing quotes for large trade size), which substantially reduces the need for *post-trade* publication. Since a considerable volume of trading occurs at prices different than SEAQ screen quotes, pre-trade information is fallible, and investors appear likely to benefit from broader trade publication in London [22]. One fund manager finds heightened transparency and the shrinking number of players has made it difficult to find adequate liquidity for large trades: "by the time it's done you've stuffed your own position." [19]

In spite of the January 1991 rule changes, there is still less market transparency than at the time of Big Bang. A blueprint for substantial refinements to the market's structure and trading practices is currently under consideration [40].

## 5. Economic Analysis

**Applicable Techniques.** Developments in the London equities market between 1986-1991 indicate that although substantial benefits were created by Big Bang and investments in technology at the London Stock Exchange, little of this economic surplus was retained by the member firms that made the investment. Some of this can be explained through analyses that are unique to securities markets. The relationship between transparency and *member firm profitability*, for example, is best described by John Phelan, former Chairman of the New York Stock Exchange: "Technology and communications bring efficiency. Money is made in inefficiency. The dealer will always go for the dark. It's the investor that will always pull it back to the light." [23] Technology, by increasing the flow of information, reduces or eliminates inefficiencies, and thus cuts profit opportunities for member firms. Market makers cannot buy low and sell high, earning a large "turn", when customers are equally well informed. Brokers cannot charge high commissions for locating the market maker with the best quote and directing the order to the floor; there now is no floor, and institutional investors can scan a SEAQ screen and call market makers by phone as easily as can their brokers.



More general techniques for examining the valuation and distribution of benefits from investments in interorganizational systems are available, and we show how the experience of the London financial markets can be explained in a more general IOS context. The analytical techniques that we will consider here are Nash bargaining and critical resources.

- *Nash bargaining* can be used to assess distribution of benefits in interorganizational systems [9].
- Examining the *critical resource endowments* of IOS participants will shed light on the eventual distribution of benefits in interorganizational systems [10].

Nash bargaining is one of several recognized techniques for examining how the benefits of complex cooperative arrangements are divided among participants [26][29]. It starts by examining the total net economic surplus created by the cooperative relationship; that is, it examines the total benefits of players with cooperation and the total benefits of players without cooperation. There is, however, no guarantee that a player will actually realize the benefits implicit in the cooperative solution; other players may feel disadvantaged or resentful, and may defect or threaten to sabotage the cooperative relationship if they are not compensated. Thus, it is essential to examine the bargaining power of all players in the cooperative relationship. Nash bargaining then examines the next best solution for each player if he leaves the cooperative relationship. Most importantly, for each player the Nash bargaining approach calculates the difference between the benefit implicit in cooperation, and the benefit if this single player were to defect. Each player's relative bargaining power will be determined by the difference between his solution under cooperation and his solution if he defects. A player whose benefits are not radically altered will have considerably more bargaining power than a player who would be seriously damaged by unilateral defection. Finally, it is necessary to divide the total surplus created by cooperation among the parties cooperating on the basis of their relative bargaining power. This usually involves transfer payments from weaker-positioned players to ones in a stronger bargaining position. Nash bargaining suggests dividing the surplus so that a player who

will not be badly hurt if the cooperation ends will receive far more of the surplus created by cooperation than a player who is more dependent upon continued participation.

Analysis based on endowment of critical resources suggests that players who possess critical resources not readily duplicated will receive a greater share of benefits than will players without such advantages [34]. Using Teece's terminology, a *weak appropriability regime* on an innovation — due to the absence of barriers to competitive duplication — implies that the innovator will be unable to retain benefits, while *tight appropriability* and the presence of barriers suggest retention of benefits. If the innovation requires inputs (i.e., factors of production) and these are obtained in a competitive factor markets, essentially as commodities, the suppliers will not be able to charge a premium for participation. Alternatively, if the innovation requires access to resources controlled by a limited number of suppliers, these suppliers will be able to retain a significant portion of the benefits created by innovation.

**Application to London's Big Bang.** The London Stock Exchange acts as a vendor of services to its investor customers and to its market makers:

- It consolidates and distributes market maker quotes through SEAQ and TOPIC.
- It publishes information on trading activity and reports market indexes.
- It provides services after the trade is completed, especially settlement and clearing.

Member firms are suppliers to the Exchange and to its customers. Brokers provide customer's with access to the Exchange market, while market makers provide quotes and the risk capital needed to offer customers immediate trade execution. The Exchange sets the rules under which members operate; members do not have a choice about making firm quotes, honoring their quotes, or reporting their trades within the allotted three minutes. If they find the rules

onerous, their only alternative is to leave the Exchange, or to pressure the Exchange to have the rules changed.

Nash bargaining suggests that member firms will have extremely limited bargaining power when acting individually. If a single market maker leaves the Exchange, no harm is done to the Exchange. Several market making members have indeed left, with no adverse effect on market quality or trading volume. In contrast, since there is virtually all equities trading in the U.K. passes through the Exchange, if a market maker leaves the Exchange, it has withdrawn from equities dealing. This disparity suggests that a single market maker acting alone is likely to get badly hurt, and that the advantage in bargaining power lies with the LSE. There is some concern in London that if enough market makers were to leave the market, market quality might suffer and investors might pay significantly higher dealing costs. There is no evidence that this is occurring. While the weakest market makers have withdrawn, most of the remaining players are resisting leaving; each hopes to be a survivor, and each hopes that the final survivors will enjoy significant profit opportunities. As long as members' expectations are that they will ultimately profit from their Exchange participation, they will remain. As long as most members remain, they will be in a weak bargaining position relative to the Exchange. However, members also make rules. Acting jointly in their capacity as rule makers they may be able to develop a new cooperative solution, less damaging to themselves. Thus, problems in the market, and greater bargaining power of the LSE relative to individual members, are reflected in the members' ongoing efforts to alter the Exchange rules in a manner that will allow them to recover some of the benefits from technology.

Examination of the endowments of critical resources similarly suggests that member firms will have limited economic power. The Exchange controls the following resources:

- **Liquidity.** The Exchange is the highest quality, most liquid market in Europe. This is probably the most important asset an Exchange can enjoy. As we have shown in previous work [16], this is extremely difficult for a competitor to attack; thus, the Exchange's strength exhibits tight appropriability.

- **Price Information.** The London Stock Exchange is the source of accurate bid and offer quotes, rapidly and accurately disseminated. Once all market participants employ SEAQ, there is great risk associated with any market maker leaving it due to participation externalities. This creates a strong barrier to competitors' launching competing screen based systems and again exhibits tight appropriability.
- **Settlement and Clearing.** The Exchange provides settlement and clearing services after trades are completed. No single member can develop competing infrastructure.
- **Oversight of Market Activities.** The Exchange provides surveillance and regulatory oversight, and thus enjoys a significant reputation effect that causes trades to be directed to it. Again, this would be difficult for a competitor to assault, and exhibits tight appropriability.

Thus, the Exchange enjoys tight appropriability on its Big Bang innovations, and can expect to retain most of the benefits.

In contrast, individual market makers control resources that are *less* critical, and it is less difficult to replace any single market making firm:

- **Quotes.** They control their own quotes, including information not on the SEAQ screen. Unfortunately, this has become a commodity; quotes from competing market makers have become largely interchangeable as each will generally match competitors' bids and offers. As providers of a commodity factor in SEAQ's success, market makers are poorly positioned to retain benefits; rather, their share of benefits is competed away to customers.

- **Risk Capital.** Market makers provide capital for immediacy, allowing customers to execute even extremely large trades without delay assembling counter-parties. However, this, too has become a commodity. The opening of the Exchange led to too many market makers and too much capital chasing too few customers and too few trades; once again, the market makers' share of benefits created by Big Bang are competed away to customers.

This suggests that market maker members cannot defend their share of benefits, and that those benefits not retained by the Exchange will be competed away to end customers. This indeed is what we have observed.

## 6. Conclusions

**Summary of Member Response to Big Bang.** There has been a considerable degree of confusion and discord in the London equities market since Big Bang, resulting in large measure from the improvements instituted as part of the Big Bang reforms. The systems investments associated with Big Bang have been profitable for the Exchange:

- Trading volume has increased, resulting in greater fee and market data revenue.
- Trading volume in non-U.K. securities has been captured from foreign bourses, principally Stockholm, Paris, Frankfurt, and Amsterdam; this too has resulted in greater fees for the Exchange.
- The Exchange's technology, especially the SEAQ screen, is essential for all market participants, and market data has become significant revenue source as well.

The Big Bang investments in technology likewise have been beneficial for the Exchange's institutional customers:

- Increased transparency has led to lower search costs, allowing customers to monitor the market more closely.
- Increased transparency has led to heightened competition among market makers, reducing spreads and lowering customers' dealing costs.

The systems investments made by the Exchange have been shown to have produced a significant economic surplus far in excess of the £25 million IOS investment. And yet, the distribution of these benefits has been uneven, with little or no benefits accruing to the Exchange's member firms. There are senior industry participants who believe that this lack of benefit for the members should have been foreseen at the time that Big Bang was planned, but clearly it was not. That is, the economic surplus created by interorganizational trading systems was correctly envisioned, but the division of this surplus, and the negative impacts on the member firms that actually paid for the investments, were not foreseen. This is confirmed by the following:

- The members voted overwhelmingly to support the reforms and the introduction of a screen-based market. Seventy-five percent of the Exchange's 4,495 individual members voted for the Big Bang changes in 1985.
- Losses are being sustained by the membership. Average annual return on capital for 1987-1990 was negative. Margins as reflected by spreads and commissions were lower, and staffing levels have been reduced. Some members have closed down lines of business in an effort to stem losses.
- As the impact of SEAQ and of Big Bang's transparency improvements became clear to members, they have acted individually to subvert, or at



least reduce, these improvements. Actions include lowering the quality of their SEAQ quotations and relying on negotiated prices inside the touch, or negotiated deals for large trades. By increasing customer search costs and lowering market transparency, they hope to restore profitability. They also acted collectively, through Exchange committees, to weaken Big Bang reforms. Probably the most controversial changes involved reducing the publication of large trades.

Members have continued to act in ways designed to limit the damage caused them by the Exchange's technological improvements. Several proposals were put forward by the Elwes Committee to make the market structure more flexible for investors. Many of these, including a proposed limit order matching facility, were stalled by the Exchange market maker and eventually rejected. [37]

**Competitive Implications for the Stock Exchange.** In our earlier study of the London Stock Exchange [13] we argued that Big Bang reforms had given the Exchange competitive advantage relative to European bourses. We suggested that for a variety of reasons, including the significant liquidity already present in London, this advantage might be sustainable. This appears to have been correct. Despite major reforms undertaken by most European exchanges, London's share of cross border trading, and its attractiveness for large trades, continue to increase. However, the improvements in trading technology in other markets and the threat of trading activity moving to another venue would have eventually forced the London Stock Exchange to make many of the changes that were introduced in 1986. That is, an efficient transparent trading mechanism may have become a strategic necessity — an essential aspect of operating a securities market [8]. Thus, while Exchange members are extremely dissatisfied when they compare the status of their operations in 1987 through 1991 with their operations prior to Big Bang, this may be a misleading comparison. A more reasonable comparison might be to compare the status of their operations today with an estimate of the status of their operations if they had failed to modernize and introduce market transparency. We call such use of inappropriate comparisons "the trap of the vanishing status quo." [14]

The unanticipated effects of Big Bang, and the damage done to those parties that paid for technological improvements at the LSE, have led to damaging market practices by the member firms, revisionist tinkering with trading rules, and some deterioration in the quality of the market. While the systems investments were shown to have produced a net surplus when summed over all market stakeholders — investor customers, the Exchange, and member firms — the Exchange's members retained no benefits and are probably worse off than they had been prior to 1986. We find an uneven distribution of benefits can potentially subvert the efficient functioning of a major IOS.

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