Networks and Market Makers in Bank of England Shares: London 1720

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Abstract

We examine the role played by market makers and networks within the 6,844 transfers of Bank of England shares during the South Sea bubble year of 1720. Potential entrants and actual stock owners had broad-based information on prices as well as information on the location of market. There were 2,549 buyers and 2,509 sellers of Bank of England stock. Yet 15 individuals were involved in one-third of all transactions between buyers and sellers. These we denote as market makers. Our analysis shows that while the majority of sellers and buyers (60%) were in the market only once, defined as noise or liquidity traders, through the stock they had purchased they were part of a broader network. Our results show that market makers increased market access for women who wanted to purchase stock and for foreigners who wanted to sell as well as for those who need to lay off large block of stock. We find that the London market already had by 1720 the necessary depth and resilience to operate across barriers of politics, religion, and social class.

<u>Introduction</u>

Developing and developed economies require finance both from financial intermediaries with private customer relationships, and capital markets with arm's length appraisals of public liabilities to operate efficiently over time. In recent years there has been an expansion of activity on stock markets in the developed economies and an increase in the number of such markets in currently developing economies. Despite the fact that we know stock markets are important for promoting economic growth and recovery from unforeseen shocks (*World Economic Outlook*, September 2006, Rajan and Zingales, 2004, Mishkin, 2006), the most effective way for these markets to operate is still under debate. Currently, financial markets operate under many different sets of rules. For example, the London Stock exchange operates on the basis of competitive market makers but more limited price transparency. In contrast, price transparency is almost immediate on the Paris Bourse. The New York Stock Exchange "runs a call market at the morning opening and continuous specialist trading throughout the day, along with a separate upstairs market for block trades." (Flood et al, 1999: 38). Further, these rules prove quite difficult to change in response to new technologies and regulations, rooted as they are in the historical origins of each exchange (Davis and Neal, 1998; 2005).

The coexistence of these quite different microstructures has prompted economists to investigate how different rules affect price discovery, market efficiency, or how agents gain information. Whether the issues are addressed theoretically within a game-theoretic or search model (for example, Dennert, 1993; Jurgen, 1993; Pagano and Roell, 1996; de Frutos and Manzan, 2005; Calcagno and Lovo, 2006) or empirically (Gemmill, 1996; Madhavan et al, 2005) or experimentally (Bloomfield and O'Hara; 1999 and 2000; Flood et al, 1999), these papers must specify how agents acquire information. Even under different specifications, models of search show "that the bid-ask spread is smaller if traders can find other traders more easily" (Miao, p. 71). In this paper, we add another dimension to this discussion. We explore how traders found one another in the early stages of stock market development, before they had formulated explicit rules and regulations or been subjected to government oversight and regulation. In essence, we explore how the market operated in a competitive market-maker situation where price

and quote disclosure was at best semi-opaque. In a transparent market, all quotes and trades are disclosed immediately and all market makers have all information immediately. In opaque markets, no quotes or trades are publicly disclosed. In semi-opaque markets, quotes are disclosed but trades are not.

By the end of the seventeenth century, a secondary market for shares in joint stock corporations was well established in London. By 1720, the wealth derived from the burgeoning commercial activities in the city of London was sufficiently dispersed to allow capital market access to those well down the social hierarchy, not just to those in the nobility or peerage but to merchants and tradesmen, widows and spinsters (Earle, Grassby, Zahadieh). Although most individuals active in the market in 1720 lived in the greater London area, participation was not limited to this region. Individuals living in other parts of England and Europe were also investing in this market (Carlos and Neal, 2006). Yet, for the secondary market to operate those who wished to purchase a share had to be able to find someone who wished to sell a share. How was this accomplished? How did those who wanted to buy a share or sell a share find a counterparty in this developing market in 1720 London?

To make our argument, we focus not on the ways in which people were divided by class interests, urban-rural conflicts, or Whig-Tory political differences as is common in much of the historiography of this formative period in English history (de Krey, 1985; Gauci, 2001). Instead, informed by the extant literature, we consider market participants as belonging one of three groups: liquidity or noise traders (those who have to sell or buy); informed traders; and market makers – and explore how these players functioned in relation to a market where information was semi-opaque. By 1720 potential buyers and sellers had access to price quotes from newspapers and at coffee shops. Based on transfer data we have collected from the stock ledgers of the Bank of England to infer how individual traders found one another during 1720, we find that a network of market makers standing ready to buy and sell already existed in the London stock market. Using social network analysis, we show that while the level of connectivity between all market participants was diffuse and fluid, the central core of brokers mediated at least one third of the connections between buyers and sellers. Econometric analysis shows that these market makers were important as counterparties for those with large market value

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transfers, in this way, perhaps, stabilizing the market. These market makers were also relatively more important for those groups with less access to other market channels. Thus women as a group were more likely to buy from these brokers, while those living outside of England were more likely to sell to a market maker. In turn, this implies that access to the market for the majority of those living in London was open and relatively low cost.

Efficient markets require that information is dispersed among potential participants and a variety of reliable sources of information were available to potential sellers and buyers in 1720. We begin by discussing the nature of the information available to those who wished to participate in the secondary market for Bank of England share. We then describe who was involved in this market. First we use systematic network analysis to enhance our understanding of how our participants, liquidity traders, informed traders and market makers, were embedded in the market. Then we quantify the role of market makers more formally using regression analysis to explore the relative importance of brokers to different segments of the market. Finally we provide some interpretation of these results for the year of the South Sea Bubble. We begin, however, with a short overview of the Bank of England and the South Sea bubble in the year 1720, which forms the backdrop for our study.

The Bank and the Bubble

In the years following the Treaty of Utrecht in 1713, the English government grew increasingly concerned about the size of its outstanding debt. The monied companies – Bank of England (1694), New East India Company (1698) and the South Sea Company (1710) – had already shown that through a debt for equity swap they could reduce the government's debt service. Such a strategy again seemed appropriate when the possibility of renewed war with Spain loomed in 1718.[1] Although the proposal to undertake a new debt for equity swap came from the directors of the South Sea Company, by the end of 1719, the directors of the Bank of England had entered into competition for this business.[2] The impact of such competition was to increase the price that each company offered the government for the privilege of undertaking this swap. Ultimately, at the end of February 1720, Parliament chose the South Sea Company offer. The bare

outlines of the agreement meant that the government would receive a £7.5 million loan from the South Sea Company and that the Company would issue roughly £31 million shares of new capital, with shares being exchanged for existing government debt and the remainder as a new share issue.[3] The main implication of this debt for equity exchange for our purposes is that it brought the holders of government debt in the form of annuities into the already flourishing market for equities.

The bubble, therefore, began in February 1720 with Parliamentary approval of the South Sea Company's plan to redeem outstanding government debt not already held by that company, the Bank of England or the East India Company. Despite losing out to the South Sea Company in the bid for re-financing the government's stock of outstanding debt, the Bank of England found that its stock price rose and then fell in rough synchronicity with the price of South Sea stock which began with the uncertainty in January and February over which company would get to undertake the debt for equity swap. In May, the Bank of England extended loans to share holders on the collateral of their shares; the resulting mortgages removed £1.6 million book value of Bank shares from the market and helped sustain a higher price for the remaining shares.[4] Bank of England shares started the year at 150, rose to 180 in May and 250 in June on a par value of 100. Bank stock ended the year at 147 on the last day of the year, roughly about its market value at the beginning of 1720. (See Figure 1). It was this environment that attracted many participants into the market. They came from the large number of investors who held small denomination annuities and exchanged them for equity in the South Sea Company as well as from those who wanted to purchase shares for the first time. But how could buyers find sellers or sellers find buyers at the desired time and for the desired amount? That depended first on what information in general about the market was available.

Information and the Market

The act of buying a stock on the secondary market requires some level of information. The desire to buy a stock presupposes, to some extent, that the person already has information on what a share purchase might mean and what benefits might accrue. Yet a purchase also requires knowledge on how to do this in terms of where to go, what forms to fill and file, what to ask for, and what price to pay. In a completely

decentralized market, sellers and buyers would have to spend considerable amounts of time trying to find one another and then negotiate over price. As the market becomes more centralized, information about forms, price and potential counterparties, which can be thought of as a public good, needs to be more widely accessible in that one shareholder's knowledge does not impinge on what another shareholder can know. There are three potential and certainly not mutually exclusive sources of such information: print media, centralized locations, and experienced people.

Resulting from the general freedom allowed to printers after the accession of William of Orange to the throne of England in 1688/9, a number of print sources emerged to keep potential investors informed of developments in the emerging securities market in London. Newspapers regularly inserted paragraphs to report on the latest prices for the major forms of government debt available. Perhaps even more useful, a specialized publication, John Castaing's *Course of the Exchange,* began regular appearance at least by 1698. This was followed by competition from John Freke's *The Price of Several Stocks,* the last issue of which appeared June 22, 1722, while Castaing's *Course of the Exchange* continued through to 1810. It appeared twice-weekly, on Tuesdays and Fridays, which also happened to be the days that mail packet boats left from Harwich to the Dutch port at Hook of Holland. Each issue contained the prices of the major securities over the prior three days, as well as the latest exchange rates for bills of exchange on major European cities. It concluded with notes on the days of dividend payment for the major government stocks and the numbers on tallies that currently paid off at the Exchequer. As Neal (1990, p. 33) has documented, the "combination of low price, inexpensive delivery and rapid posting to the countryside and abroad" must have made Castaing the standard for those involved in the market, even though several other competing price lists had appeared by the time of the South Sea Bubble in 1720. After the bubble, although Castaing's *Course of the Exchange* continued as the most authoritative price list, a wider public could now obtain stock prices from *Lloyd's List* (weekly) and *Gentleman's Magazine* (monthly), both of which included regular sections on stock prices in addition to their primary material.

In his *Collection for Improvement of Husbandry and Trade (1692-1703)*, John Houghton explained the mechanics of the market for the new investor as well as how s/he

could access the market and learn the prices of the various securities on offer. He explained that securities could be purchased either by going directly to someone who wanted to sell or by using a broker who would help guide the new investors through the process. These 'brokers' provided both expertise and information about the market. Interestingly, brokers were not positively perceived. Some of the antipathy might have come from the threat to the social order and status quo possible from the very anonymity of the market. Houghton was writing in the 1690s during a period of heightened activity in the market in securities (Carlos, Key and Dupree, 1998; A. L. Murphy, 2006) when the high level of activity in conjunction with the monetary crises in the mid decade generated calls for restrictions on the market. These resulted in 8 & 9 Wm III, c. 32, which limited the number of all kinds of brokers to 100, called *Sworn Brokers*, and forbade them from dealing in government securities without the Treasury's permission. The law also prohibited these 100 *Sworn Brokers* from dealing in stock themselves. As we show below, not all Sworn Brokers followed the letter of the law.

From the early 1690s, these various printed sources addressed different and wider audiences and suggest an extended network of individual readers in England, Holland and perhaps even more widely on the continent of Europe. As Anne Laurence has shown, Lady Betty Hastings and her sisters were able to participate in the London stock market despite living in Yorkshire because of the newspapers they received daily from the City (Laurence, 2004). Thus the print media of broadsheets and pamphlets provided an easily accessible base level of information about how to access the market and more particularly about prices. It is in this sense that the market can be thought of as semi-opaque. Potential participants and current participants had information about posted quotations for the various shares available. What was not commonly known were the actual trades.

In addition to these broadsheet sources, there are reports of pre-printed lists of the major stocks with their current prices posted in shops and coffee houses in the City of London. As early as 1692, Houghton noted that an investor could find out "what Prices the Actions bear for most of the Companies trading Joynt-stocks" at Garraways (a coffee house proximate to Exchange Alley). Two years later, in 1694, he noted "brokers as being 'chiefly upon the Exchange, and at Jonathan's Coffee-house, sometimes at

Garaways's and at some other Coffee-Houses'" (Dickson, 1967: 490). Thus starting in the 1690s, coffee houses in and around Lombard Street and Exchange Alley became focal points for dealers in securities. By 1720, an interested buyer or seller could circulate quickly and easily through the entire market place for securities. He or she could confirm readily the price information available from printed sources at such well-known trading places. (See Figure 2.)

The interested buyer or seller could also get information from people they knew. Such links into social networks through liveried companies, churches or political affiliation or informal through location or friends could further reduce the costs of gathering information. The importance of networks is now well established in many different fields. Sociologists have, of course, been particularly interested in how networks operate (Granovetter, 1973, 1983, 2005; Burt, 1987; Mongomery, 1994). Political scientists consider the ways in which networks affect the transmission of political information (Huckfeldt and Sprague, 1995; Wasserman and Galaskiewicz, 1994) and economists have examined how networks determine the propogation of crisis through contagion (Kelly and O'Grada, 2000; Schiller and Pound, 1989; Calomiris and Mason, 1997).

Networks reflect choices, both by individuals and by the social structures in which those individuals operate. While the individual can choose with whom to spend time and share information, individual choices are, in turn, affected by geography, occupation, social customs, religion and mores, each of which tends to generate connections between any given individual and many others. Networks, therefore, can provide the individual with a short cut for acquiring information in that they potentially help agents screen out irrelevant information and help evaluate the information to which they are exposed. Obviously, not all networks are identical or of equal effectiveness. For instance, networks can be of different sizes. Burt (1992:16) has argued that bigger networks are better because "more contacts can mean more exposure to valuable information, more likely early exposure, and more referrals." Granovetter (2005) has examined frequency of interaction – where more frequent interaction means stronger ties - with special focus on the strength of those ties. He argues that networks built on strong ties will quickly exhaust information in the network. He, thus, points out the "weakness

of strong ties" where networks based on weak ties can provide participants more new information which may force them to discard preconceived and possibly erroneous notions about the world around them. Weak networks in this sense expose people to new information because they allow diverse groups to interact. These loose links allow individuals to move beyond mutually reinforcing ideas received from like-minded people within a tightly knit environment or rigid social structures such as liveried companies.[5] Exchange Alley from this perspective served as a central meeting place for individuals from a variety of tighter-knit networks.

During the bubble year of 1720, as new individuals entered the market, perhaps excited by the prospects for capital gains in the speculative bubble under way in South Sea stock or in the various new ventures being offered on the market, these new buyers had to match to sellers who for whatever reason wanted to or had to sell stock. Whatever the motivations of the individuals dealing in Bank of England stock during 1720, there were many more of them from an increased diversity of backgrounds than in any year previously.[6] One approach to the market was to use the network of people who regularly bought and sold stock and were active in the coffee houses of Exchange Alley. These people could provide any of several services. They could put the potential customer into contact with an appropriate counterparty, serving as a broker and taking a commission, or they could operate as market makers standing ready to buy and sell, hoping to make money on the spread.[7] In fact, broker networks provide "an expression of knowledge that influences the capability of individual actors, with more information leading to more relations" (Huggins, ch. 6, p. 104). By 1720, the potential investor could access the securities market equipped with printed information on prices, enter a central meeting place, and contact people who were market makers. Before examining the role of centralized market makers for Bank of England stock, we discuss the data we use for the subsequent analyses.

Transfer Books of the Bank of England 1720

To examine the nature of trader and market-maker relationships in the market for Bank shares, we primarily use the Bank of England Transfer Books 1720 (AC28/1545-1554) with some reference to the Bank of England Stock Ledgers 1720-1725 (AC27/434-

437) and their Alphabets (AC 27/430-433. While all joint stock companies had to keep records of those who owned shares, the Bank's records are exemplary. Ledger accounts were kept for the purpose of dividend payments but also to know who could vote at the annual meeting and who was eligible for election to the Board of Directors.[8] The Transfer Books document all sales and purchases of Bank of England stock. Each entry gives the name of the person who sold; who purchased; address of buyer and seller; social status or occupation for men and social status or marital status for women; the date on which the transfer occurred; and the amount transferred.[9] The Bank of England clerk signed as witness. If the transfer took place due to death, the executor/executrix is named and additional witnesses may be listed. If the transfers took place shortly before the next dividend, a note may be inserted that the transfer does not include the next dividend.

The book value of the Bank of England stock outstanding at the beginning of 1720 was £5,559,995.[10] The actual book value of transfers over the first eleven months of 1720 was £5,965,286. In essence, the capital stock of the Bank turned over completely. Such extremely large volumes of activity were also evident in other companies. The book value of the East India Company (£3.2 million) and Royal African Company (£450,000) each turned over one and half times. In addition, the Royal African Company issued an additional £1.5 million book value of stock, with the South Sea Company bringing at least £11 million book value of new shares into the market.[11]

The turnover in the Bank stock in 1720 is reflected in the number of transactions. According to Dickson, in the three years prior to the Bubble, the number of transactions per year ran about 2,000.[12] During 1720, there were 6,844 transactions with an average book value per transaction of £871.30. Clearly, the South Sea Bubble generated high levels of market activity in Bank of England stock. February, April and August each had between 750-800 transactions, while May and June had roughly 1,100 and 900 respectively. These very large numbers of transactions were generated both by individuals who were in the market only once and other individuals who had multiple transactions. It must also be kept in mind that there were shareholders of Bank stock who never entered the market but held their stock across 1720 (Carlos and Neal, 2006). In other words, the complete turnover of Bank capital was generated by a subset of shareholders and a subset of the existing shares outstanding.

Of those in the market, there were 2,549 individuals selling Bank stock and 2,509 buying it. Overall, we have identified unique 3,720 individuals who were active either as buyers, as sellers, or both. Table 1 shows the pattern of activity; three-fifths of individual sellers and buyers were in the market only once. Of the 3,720 individuals who were active in the market, 1,480 sold only once and 1,454 purchased only once during the whole year. We consider these individuals to be liquidity traders or noise traders in the parlance of the current finance literature. At the same time, there were only 320 transactions in which both the buyer and seller had no other dealings in Bank stock. This means that individuals who only sold once generally sold to someone who bought multiple times; while those who only bought once bought from someone who sold multiple times. Obviously, finding a counterparty for a prospective buyer or seller was facilitated if there were individuals who were willing and capable of making multiple sales or purchases. Although the number of individual sellers or buyers ranked by the number of their transactions declines quite rapidly to three individuals with 14 transactions and six different buyers with 14 purchases, there is a group of 50 individuals with much larger numbers of transactions. Within this group of 50, fifteen had more than 30 transactions as buyer and similarly as seller. We define these top fifteen as market makers, with those ranked below them as informed traders. The boundary between liquidity traders and informed traders is less well defined. For example, dividing up a large estate might require multiple sales within a few days, so that those with two to nine transactions would still be liquidity trades. We consider the issue of demarcation among liquidity and informed traders further when we discuss the econometric specifications below.

Tables 2a and 2b describe summary statistics for the market activity of the top 15 individuals whom we classify as market makers. Caswall was involved in 214 purchases and 240 sales of Bank of England shares, while Westley had 199 purchases and 254 sales. In the Transfer Ledgers, Caswall is identified by status not occupation, as Sir George Caswall, knight. From 1700, he was in partnership with William Brassey, a goldsmith and, according to Carswell (rev. ed, 1993:28-29), specialized in market business. He subsequently was a partner in the Sword Blade Company and was vilified as a leading "jobber" by Defoe in his *Anatomy of Exchange Alley* (1719). In contrast, the

records list Westley as a tailor or merchant tailor and citizen of London, therefore a member of the Merchant Tailor guild.[13] Following in importance are James Martin, Francis Pereira and Peter Delmé. Martin was an important member of the goldsmith-banker community. Francis Pereira was a merchant and part of the Jewish community in London and Delmé, a merchant and director of the Bank of England. They had 109, 103 and 72 purchases of Bank stock respectively. Martin had 110 sales, while Pereira and Martin had only 50 sales each. The next ten individuals had between 30 to 50 purchases and 2 to 67 sales. [14] The activity of these market makers was not always symmetric with regard to the buying and selling side of the market, which we explore below in the econometric analysis.

The summary statistics show how activity by individual was both similar and different. Across the group the modal size of shares purchased was either £500 or £1000. Anyone with ownership of a £500 block (or five shares) or more was eligible to vote at the general court that elected shareholders to the Court of Assistants. Shareholders, however, had to hold even larger blocks of shares to be eligible to stand for the Court of Assistants, with £4,000 as the minimum necessary for election as Governor.[15] Overall, of the 6,846 transactions, 2,242 were at the £500 book value and 1,938 at £1000 book value. There were, however, 600 transactions with a block size of £100 or less. While £500 and £1000 represent the modal size of transaction, what is evident in the summary statistics for these market makers is the variation in the block size of sales demonstrating their ability to meet a wide variety of customer needs. For example, Samuel Strode had a purchase of £30,000 book value and a sale of £40,000 book value. Yet he also had a purchase of only £53 book value where £100 book value represents the face value of a share. The fact that the minimum book value block purchased and sold could be quite small tells us that the market was flexible and available to those with only limited financial resources. Robert Westley and Thomas Houghton each bought a £5 and a £3 book value amount, while Robert Westley and Anthony da Costa sold a £3 and a £6 book value amount.

In 1720, women comprised about 20% of Bank share holders owning 10% of the capital stock (Carlos and Neal, 2006). During 1720, women accounted for 537 of the buying and 623 of the selling transactions of Bank of England shares, meaning that

women accounted for roughly 10% of the total number of transactions of Bank stock in 1720.[16] In considering market access, women might be one group for whom market makers would be especially attractive. The records show that roughly one-fifth (116 out of 537) of the women who sold Bank shares in 1720 sold to our group of market makers. It would be easiest for women to find and have dealings with the persons most active in the stock.[17] Yet Table 3A reveals that none of the brokers had more than 16% of their activity with women. These brokers had 104 sale transactions with women and 116 purchases of stock (see Table 3). Caswall and Westley had the largest number of transactions with women but women do not appear to be an especially large component of their business.

As we have shown elsewhere (Carlos and Neal, 2006), the market in Bank stock during the South Sea Bubble was largely a London phenomenon. Of those who bought and sold Bank shares, 85% had an address in London. Roughly 5% of buyers and sellers lived outside England, predominantly in Holland, while the other 10% were located throughout England. In a world where information moved only as fast as the fastest horse, carriage or boat, those living away from the center were at a certain informational disadvantage.[18] In Table 3, we also show the location of those dealing with these 15 market makers. Obviously, the bulk of their activity related to the London area, however, only James Martin and Peter Delmé had a purchase structure almost identical to the market distribution by location. Each of the others had some level of geographic specialization. The absolute numbers, however, are not very large because there was not a big foreign presence in the market for Bank of England shares until after the bubble had burst (Neal, 1990, pp. 113-15).

These summary statistics describe the pattern of activity by those involved in the market. We now explore more formally how the various noise traders, informed traders and market makers are related and embedded in the market. We do this first in terms of social network analysis and then through more formal econometric relationships.

Network of Traders

A network, "anything reticulated or decussated at equal distances with interstices between the intersections or sets of intersecting forms." Samuel Johnson, *Dictionary of the English Language.*

Network analysis seeks to explore the ways in which agents are related.[19]   In social network analysis, the basic unit is the pair of relevant agents and the possible tie between them, called a dyad. In our framework, the agents are the individual buyers and sellers with a stock transfer as the tie that binds them. For any two individuals in the market for Bank stock this dyad can take one of four different forms: no connection between two given traders (0,0); trader 1 buys from trader 2 but not the reverse (1,0); trader 1 sells to trader 2 but not reverse (0,1); and trader 1 buys from and sells to trader 2 (1,1). While the relationship between individuals is not necessarily symmetric, it is directed in that someone who wants to buy has to find someone who wants to sell.

Here we explore how individuals are linked as buyers and sellers via a set of network metrics: density, distance and reciprocity. Density refers to the number of actual links in the network compared with the number of possible links. If g defines the number of nodes or actual agents, then g(g-1)/2 represents the maximum number of lines in the network graph. For example if g=5, then the maximum possible number of connections between agents is 10. If L represents the number of actual links between agents, density is measured as 2L/g(g-1). As the number of possible ties increases exponentially with the number of agents, the density measure decreases with the size of the network. Distance measures the shortest path between any two agents, n_i and n_j, such that $d(i,j) = d(j,i)$. Reciprocity, on the other hand, measures how strong is the tendency for any given agent, n_i, to 'choose' n_j, if n_j chooses n_i first. Essentially, these measures give us summary statistics of the how agents are related within the market.

As was noted earlier, there were 328 pairs of traders in Bank of England stock in 1720 for whom this was their only transaction. Each of these 328 pairs only trades within the pair and neither side has any further links with the rest of the market. We have taken these individuals out of the population discussed here as they do not inform us about the network structure of the market. Summary statistics for density, distance and reciprocity are given in Table 4. Density for the complete set of pairs is low at 0.0005, reflecting the size of our network, but with a relatively high standard deviation of 0.0218. Even with the low density coefficient, all pairs of traders are loosely connected through the movement of stock, in that A sells to B who then sells to C. In this market for Bank shares in1720, the average distance between agents was 4.593. One can think of this as

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the degree of separation between traders and implies that on average any two traders in the network were connected through only three to four other traders. At the same time, reciprocity within this network is very low at 0.0211 (2%), demonstrating the large number of noise or liquidity traders in the market.

The market for Bank of England stock described by these statistics indicates a set of loose or weak bonds between individuals. Yet, if market connections are loose, how does the market actually operate as a coordinating device? In open and competitive stock markets, as noted in the finance literature referenced above, market makers play a central role in coordinating activity. They stand ready to buy and sell from both informed and noise traders, but they also act as counterparties for one another in laying off large positions. Here we examine the extent to which the top 15 traders described in Table 2 operated as market makers for Bank stock. Bank ledgers show that this group had transactions with the overall market and with one another. There were 1,114 purchase transactions and 998 sale transactions that included a top 15 trader. Overall, the top 15 traders had 2,112 transactions with 1,259 individuals. This implies that connections spanned by the top 15 traders touched about one-third of the market at a distance of 1.

Network centrality measures allow us to identify more exactly how these market makers operated with respect to all traders and with one another. Our first measure is *reach centrality* (see Table 5), which estimates what percentage of the market sold to each of these large traders at various degrees of separation. We find that at one degree removed 5% of the market sold directly to George Caswall and to Robert Westley but only 1% sold directly to Anthony da Costa. However, at five degrees removed (D5) from the initial transaction, the market penetration for each of the top fifteen had increased to 50% of the market. To stand ready to buy and sell, market makers must be able to find counterparties against whom to lay off large purchases. Important, therefore, for understanding market architecture or microstructure are the ways in which these top 15 operated as a group in relation to one another and not just as focal points for random individuals entering or leaving the market. We begin again by describing the relationships in the same terms as we used for the whole market: density, distance and reciprocity. The results are shown in Table 4b. As expected, density within this group is higher than for the whole market, 0.3381 compared with 0.0005. The distance coefficient

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is 1.7 relative to 4.5, which means that members of this group were, on average, connected through at most one additional trader. The likelihood that a sale between two traders also results in a purchase within the same pair, or reciprocity, is large at 0.3148, or 31%. Obviously, this group of traders was much more tightly connected than was the market as a whole.

Degree and betweenness centrality measures further our understanding of the ways in which this group were connected. *Degree* centrality refers to the number of transfers done by each agent, while *betweenness* centrality shows which of the traders was most central within the flow of transfers, such that they acted as a node for transfers between others. Tables 6a and 6b show the degree centrality and betweenness centrality measures for this group. As we might expect, George Caswall and Robert Westley are the most central traders. However, they do not play the same role within the market. Robert Westley is the most prominent trader in terms of degree centrality – 400 to 367, but George Caswall had a higher degree of betweenness centrality – 1.5 million to 1.1 million geodesic paths relative to Westley. So although Westley was very active in the market as a whole, it was Caswall who more often acted as an intermediary for other traders.

The relative positions of Caswall and Westley show up clearly in Figure 3 where we graph the interactions among the top 15 traders. These trader to trader interactions within the market-maker group comprised 112 dyads with a density of 0.5333. Based on Netdraw (Borgatti et al.), the program automatically positions the most active traders in the center, while the thickness of the arrows indicates the frequency of transactions between traders. The program shows that George Caswall, Francis Pereira, James Martin, Peter Delmé, and Abraham Craiesteyn were the most active; each having multiple transactions with someone else within the group. The graph also illustrates the difference between degree centrality and betweenness centrality, because it places Caswall in the center of the graph and places Westley on the outside of the group, along with Tothill, Strode, Cock, daCosta, and Hart. Thus, this particular graphical representation of the relationships makes visible a core within a core, dealers in the market standing ready to buy and sell with one another, regardless of their differences in status, occupation, religion, or social network.

The interactions displayed in Figure 3 summarize relationships for all of 1720. Yet the Bubble had a time dimension growing and shrinking over the course of the summer months. Figure 4 describes how relationships within the group of top 15 traders developed with the growth in market activity in May, June, and July, that came with the rise in price and volume of transfers. In May, two distinct groups traded actively among themselves and with the other group through Caswall, who served as the "weak link" within an essentially "figure eight" network. In June, two quite separate groups existed, with the Pereiras, Cock, Vandenenden, and Craiesteyn buying and/or selling to one another in sequence, forming a "line" network composed of naturalized Dutch and Sephardic Jews; and then another group of eight that interacted among themselves as a "star" network comprised of diverse occupations. This group included Caswall, Westley, Martin, Delmé, Hart and Bolwerk. In July, the network reverted to a linear structure with Delmé, wealthy Huguenot and a Director of the Bank, acting as the central node through which transactions within the group occurred.

The network analysis used here describes the ways in which the architecture of the market developed along graphical lines. It shows how one trader is related to another trader. Although network analysis illustrates how this central core of market makers was related to one another and to the larger trading population, it nevertheless gives us no measure of relative importance of these market makers for differing agents in the market. This is what we explore in the next section.

Brokers and Market Access

Any individual trader whether buyer or seller must find a counterparty in order to be able to affect his or her transaction. Broadsheets and pamphlets provided some guidance to individual investors in terms of prices and locations of market activity as did correspondence with informed individuals. Not all buyers and sellers had equal access to the market, however, which meant that market makers were more important for those who were unable through distance or by gender to visit the coffee houses around Exchange Alley searching for a counterparty. These market makers might also have been more important for those who desired for whatever reason to sell or buy a large block of shares. Market makers might also have played an asymmetrical role as buyers or as

sellers for those needing to sell or buy. In other words, we explore the likelihood that the characteristics of individual traders affected the likelihood of selling to or buying from the group of top 15 traders seen in Table 2.

Specifically, we use the following specification:

$$B_{15s,b} = \beta_1 Amount_{b,s} + \beta_2\, Gender + Number_{b,s}\gamma_i + Month\delta_t + Location\delta_t + e_t,$$

where $B_{15s,b}$ captures whether a top 15 trader sold to or bought from another trader in the market. In our estimation, we ran separate regressions for sale activity and purchase activity because analysis of the contemporary market suggests an asymmetry in the role of market makers with respect to these two activities (Gemmill, 1996). Amount refers to the market value of purchase or sale by each individual trader.[20] *Gender* is a dummy variable, 0 for men and 1 for women. Number captures the number of transactions by each individual. Experimentation with different specifications showed that the relationship between all participants in the market and the top 15 sellers or buyers is non-linear. To capture this non-linearity we divided individual participants into different groups based on their total number of transactions over the year 1720. This specification also captures possible differences between traders who are noise or liquidity traders, informed traders, or market makers. $Number_1$ refers to those traders who only bought or only sold once, whom we consider to be noise or liquidity traders. The next category, $Number_2$, are those individuals who had two to nine trades. Some liquidity traders may be in this category, as settling an estate could take several transactions among the executors and legatees but it could also include 'informed' individuals who chose to buy or sell at various times based on information concerning the prospects of the Bank or of competing investment alternatives. One such example would be the Shirley sisters discussed in Carlos and Neal (2004). $Number_3$ is comprised of individuals with 10 to 30 purchase or sale transactions. It is our omitted category, which we hope captures 'informed' traders. $Number_4$ contains all individuals with more than 30 purchases or sales over the bubble year, which usually includes our top 15 traders, but some were more active on one side of the market than the other. The coefficients on the *Number* dummies reflect the probability that a trader in that category would be more or less likely to trade with one of the top 15 market makers relative to our omitted group of 'informed' traders, trading 10 through 30 times.

Month is a fixed effect dummy to capture the time dimension of the bubble. The omitted month is March, which was just before the bubble activity began in all the stocks. *Location* captures the proximity of individuals to the primary trading places in Exchange Alley. The majority of participants lived in London (*Location$_2$*), but there were also participants from all English counties other than London (*Location$_3$*) and from abroad (*Location$_1$*). Those whose addresses were unknown to us form the final category (*Location$_4$*). (Most were no doubt from London and the clerks simply omitted the detail in the Bank records.) Given the communication links of the period, participants from outside London would have greater need of a market maker as would foreign (*Location$_1$*) traders. Foreign (*Location$_1$*) is the omitted category. *Gender* is a dummy variable with women=1, men=0.

Tables 7a and 7b present the results of our probit analyses from this specification. In 7a, we examine the probability that participants buy from a top 15 market maker (meaning the market maker is selling to the market). The coefficients give the marginal effects of each variable. Because so many of the variables are categorical, we also test the joint significance of the set of dummies within each category. Tests for joint significance show that the dummies for the categories of traders (*Number$_{1,2,4}$*) are jointly significant at the one percent level.[Prob $>\chi^2$ =0.0025] The month dummies, with March the excluded month, are also jointly significant at the one percent level, with Prob $> \chi^2$ =0.000. The location dummies, however, are neither jointly nor individually significant. The regression shows that the market value of the transfer is significant at the one percent level. The larger the market value of the block of stock, the more likely that it will be purchased from a market maker, reflecting market-making activity by this group, controlling for all other factors in this specification. Gender is significant at the 5% level. Women are 4% more likely than men to buy from a top 15 trader. Thus, even though women did not constitute a large proportion of transactions for this group, the presence of such market makers increased women's ability to buy into the stock market.

As noted, the *Number$_{1,2,4}$* categories measuring the number of transactions by an individual are jointly significant. The dropped category is, *Number$_3$,* or those with 10-30 purchases whom we consider likely to be informed traders. The results are not linear in the number of transactions. Those in the market only once are more likely to use a

market maker relative to the informed group of traders (*Number₃*). Those with the largest number of transactions are statistically 4.5% less likely to use a broker than the informed group. This non-linearity in the role of market makers as sellers was present in each specification that we ran, and is not merely the result of this particular categorization of the numbers of transactions.

The time effect across the Bubble is captured by the month dummies, which as noted above are jointly significant. We omitted March both because the Bank closed its transfer books for the last two weeks in preparation for the semi-annual dividend and because it was the first month that the market knew that the South Sea Company had won Parliament's approval for re-financing the government debt. Market makers were more important for buyers in the first two months of 1720 relative to March. January and February might reflect a more usual pattern of broker activity as representative of a non-bubble environment. September and October are also statistically significant but with opposite signs. The negative sign in September, we suspect, reflects the removal of Sir George Caswall from the market when he was sent to the Tower. The increased tendency to buy from a top 15 trader in October might reflect market-making activity by market makers to soften the landing for the bubble. *Location* is neither jointly [Prob $> \chi^2$ =0.3379] nor individually significant implying that location of participants did not matter in determining whether to buy from a market maker, although the negative signs suggest that all non-foreigners were less likely than foreigners to buy from a market maker.

In Table 7b, we examine the probability that participants sell to a top 15 market maker, meaning the market maker is buying from the market. Again the coefficients give the marginal effects of each variable, as in Table 7a. Again, the higher the market value of the transfer, the more likely were participants to sell to market makers, just as larger market value of transaction made them more likely to buy from a market maker. This is significant at the 1 percent level. On this side of the market, *Gender* is not a significant determinant of the probability of selling to a market maker, whereas, women seeking to buy were statistically more likely to approach a market maker reflecting an asymmetry in the role of market-makers.

The *Number* category dummies continue to be jointly significant, with Prob $> \chi^2$ = 0.0015. Again, the dropped category is *Number₃*, the group of informed traders. As we

found when considering the probability of buying from a market maker, the results on this side of the market are also nonlinear in the number of transactions. Those in the market only once were more likely to use a market maker relative to the informed group of traders (*Number₃*). Those with the largest number of transactions are 4.0% less likely to use a broker than the informed group but now only at a 5% level of statistical significance. When considering a selling transaction, our group of mixed noise and possibly informed traders, *Number₂*, is positive and more likely than the informed group to use a market maker.

The month dummies are jointly significant Prob $> \chi^2 = 0.000$. but nearly all the signs reverse relative to their values in Table 7a. For the sellers coming to the market, June and November are statistically significant at the 1% level and in both cases negative, meaning that sellers were less likely to buy from an established market maker in those months, compared to their probability of buying from a top 15 trader in March. We suspect this reflects more the dominating presence on this side of the market for market markers in March than their unimportance in June and November. March was the time transfer books would close for payment of semi-annual dividends; most holders of Bank stock were concerned to collect their dividends before bringing their stock to market. These market makers, by contrast, typically inserted a note in the transfer form that the next dividend was excluded from the transfer of the stock. The *Location* dummies are again jointly significant [Prob $> \chi^2 = 0.000$] as in Table 7a, but now each of the locations is individually statistically significant at the 1% level. All non-foreign sellers were less likely to use a market maker relative to foreigners, with Londoners least likely to sell to a top 15 trader relative to those living outside the country. [21] Again we see this asymmetry in the role of market makers with respect to sale or purchase activity.

Conclusion

The asymmetry in buying activity versus selling activity in securities markets with regard to the role of market makers arises in modern markets. Examining the impact of block trades on the London Stock Exchange under different publication rules, Gemmill found, as did US studies, "a much larger price impact of a block purchase than of a block sale [by a market maker]." (1996: 1787) Gemmill argued that this is not because market makers are unwilling to go short, but rather that buyers are likely to be better informed

than sellers, who need compensation for the risks they run in meeting unfamiliar demands. In the case of the market for Bank stock during the course of the South Sea bubble, new participants such as women and foreigners had more limited physical access to the market and they were also less familiar with the market relative to the bulk of informed traders based predominantly among the London mercantile and professional community. Women desiring to diversify their assets into the relatively more secure Bank stock or foreigners wishing to gain voting privileges within the Bank's General Assembly would therefore be more likely to find a willing seller from our select group of market makers. If newcomers were on the selling side, the cash they desired for liquidity would most likely be available from the most active traders whose cash flows were predominantly committed to their securities dealings.

While our probit regression results refer to the overall role of the market makers for meeting the demands of the rest of the market participants over the course of the South Sea bubble, they do not tease out the changed relationships among the most active traders over the course of the year. That is where the network analysis presented in the previous section is most enlightening. In April, May, and June, when the South Sea Company was amassing the cash necessary to insure their success in the massive conversion of government debt, the Bank of England took one-third of its capital stock out of the market and the East India Company and Royal African Company took similar actions with their capital stock. The result was that overall liquidity within the market diminished sharply; meaning that the importance of the market makers for Bank stock rose sharply. To meet the surge in demand for their services, they responded by tightening their connections with each other as shown in Figure 3. The wealthiest among them, Peter Delmé and Francis Pereira, provided cash while increasing their already large stock of Bank shares. Several of the least well-to-do market makers – Cock, Vandenenden, and Westley – mortgaged some of their own Bank stock to acquire the necessary working capital. The network connections among these most active, and most knowledgeable, traders expanded and strengthened as the liquidity crunch took hold in June, when Delmé with his wealth, power as a senior Bank director, and extensive connections with the Huguenot community in Holland, played the central role.

With the collapse of the bubble, Caswall dropped out of the market entirely, a necessary consequence of being sent to the Tower while a Parliamentary investigation was launched into his role in perhaps causing the bubble and its collapse. In addition, Cock was forced into bankruptcy in November 1720 and Vandenenden in April 1721. In contrast there was the rise to prominence of Robert Westley as the preeminent dealer in Bank stock. In the resiliency of this network of major market makers lies the key to the eventual resurgence of the market for Bank stock as described in Carlos and Neal (2006). Nowadays, we expect stock markets to recover from the collapse of the occasional bubbles in technology stocks (2000), utility stocks (1929), or Latin American mines (1825). But the collapse of the South Sea bubble followed hard on the collapse of the Mississippi bubble, and the dissipation of smaller bubbles in the Netherlands. Further, the depth and extent of the collapse was truly unprecedented. Only the London market recovered. Perhaps this was due in part to banks of issue that could not (Paris) or would not (Amsterdam) respond by increasing their own capital stock, which the Bank of England did in 1723. Perhaps, however, it was due in part to the absence of a similar network of market makers in the securities markets in Paris or Amsterdam.

Tables

Table 1. Number of Unique Sellers and Buyers by Number of Transactions

# of Transactions	# of Unique Sellers	# of Unique Buyers
1	1,480	1,454
2	492	482
3	212	216
4	105	113
5	65	62
6	42	34
7	30	20
8	14	16
9	20	16
10	11	10
11	10	12
12	6	10
13	8	9
14	3	6
15+	51	49
Total	2,549	2,509

Source: Bank of England Transfer Books 1720AC 28/1545-1554

Table 2. Summary Statistics of Transfers by Top 15 Market Makers

A. Book Value of Buys

First Name	Surname	Book Value	Mean	Median	Mode	Max	Min	Count
George	Caswall	366197	1711.2	1000	1000	18050	100	214
Robert	Westley	105556	530.4	350	200	2600	5	199
James	Martin	135250	1240.8	1000	1000	5000	90	107
Francis	Pereira	90550	879.1	1000	500	3000	100	103
Peter	Delme	93225	1294.8	1000	1000	6000	200	72
Abraham	Craiesteyn	40350	791.2	1000	1000	2000	200	51
Samuel	Strode	79999	1666.6	1000	1000	30000	53	48
Solomon	Pereira	34379	716.2	500	500	3000	379	48
Thomas	Houghton	38099	846.6	1000	1000	3000	3	45
Gerard	Bolwerk	43600	1038.1	500	500	7000	500	42
Moses	Hart	40337	983.8	500	500	3500	412	41
Robert	Tothill	24390	641.8	500	500	3000	40	38
Anthony	da Costa	25612	692.2	500	500	2000	12	37
Johanna	Cock	33000	891.9	1000	1000	2000	400	37
Philip	Vanendenden	22640	686.1	500	500	2000	500	32

B. Book Value of Sales

First Name	Surname	Book Value	Mean	Median	Mode	Max	Min	Count
George	Caswall	396765	1653.2	1000	1000	30000	200	240
Robert	Westley	106213	418.2	200	100	4800	3	254
James	Martin	130650	1187.7	1000	1000	9800	100	111
Francis	Pereira	33450	669.0	500	500	2000	150	50
Peter	Delme	73453	1562.8	1000	1000	16000	200	47
Abraham	Craiesteyn	59100	882.1	1000	1000	2500	200	67
Samuel	Strode	60000	30000.0	30000	N/A	40000	20000	2
Solomon	Pereira	12800	673.7	500	500	1000	300	19
Thomas	Houghton	14300	794.4	600	1000	3000	100	18
Gerard	Bolwerk	47700	1192.5	1000	500	7000	100	40
Moses	Hart	40829	1317.1	1000	500	4000	100	31
Robert	Tothill	25800	806.3	1000	1000	4000	45	32
Anthony	da Costa	26488	1018.8	500	500	8000	6	26
Johanna	Cock	36230	1249.3	1000	500	8000	30	29
Philip	Vanendenden	20500	640.6	500	500	2000	500	32

Source: See Table 1

Table 3

		Purchases and Sales to Women (%)		Purchases and Sales by Location (%)					
		Buying from	Selling to	Buying from			Selling to		
		female	female	London	England	Foreign	London	England	Foreign
George	Caswall	12	13	83	16	1	89	9	2
Robert	Westley	16	15	78	20	2	85	15	0
James	Martin	8	7	85	10	5	83	12	5
Francis	Pereira	10	12	74	4	22	86	2	12
Peter	Delme	14	0	88	8	4	92	4	4
Abraham	Craiesteyn	2	10	94	2	4	86	7	7
Samuel	Strode	13	0	83	17	0	100	0	0
Solomon	Pereira	0	11	88	2	10	74	5	21
Thomas	Houghton	16	0	65	24	11	72	17	11
Gerard	Bolwerk	5	8	78	7	15	55	5	40
Moses	Hart	15	3	78	0	22	81	13	6
Robert	Tothill	8	13	84	16	0	90	3	7
Anthony	da Costa	3	8	88	0	12	76	8	16
Johanna	Cock	8	0	84	5	11	93	0	7
Philip	Vandenenden	3	6	97	3	0	84	3	13

Source: See Table 1

Table 4a. Network Statistics for the Complete Network

Structural Properties	Complete Network
Density	0.0005 (Std. Dev. 0.0218)
Distance	4.593
Reciprocity	0.0211

Table 4b. Network Statistics for the Top-15

Structural Properties	Top 15
Density	0.3381 (Std. Dev. 0.4731)
Distance	1.738
Reciprocity	0.3148

Table 5

Reach Centrality: Percentage of Market Reached at Each Step Removed

Name	D1	D2	D3	D4	D5	D6
George Caswall	0.051	0.236	0.422	0.500	0.521	0.525
Robert Westley	0.050	0.192	0.386	0.491	0.522	0.525
James Martin	0.027	0.198	0.412	0.499	0.521	0.525
Francis Pereira	0.022	0.188	0.336	0.480	0.517	0.524
Anthony da Costa	0.010	0.085	0.336	0.480	0.517	0.524

Table 6a. Degree of Centrality Measures

Trader	# of individuals dealt with
Robert Westley	400
George Caswall	367
James Martin	190
Francis Pereira	115
Abraham Craiesteyn	98
Peter Delmé	87
Gerard Bolwerk	74
Robert Tothill	64
Moses Hart	62
Anthony Da Costa	59
Johanna Cock	57
Thomas Houghton	56
William Bance	54
Philip Vandenenden	54
Salomon Pereira	54

Table 6b. Betweenness Centrality Measures

Trader	# of geodesic paths
George Caswall	1,469,658
Robert Westley	1,114,666
James Martin	621,908
Francis Pereira	332,700
Abraham Craiesteyn	276,665
Peter Delmé	249,632
Moses Hart	154,184
Robert Tothill	147,750
Johanna Cock	140,910
Gerard Bolwerk	140,642
William Bance	135,314
Anthony Da Costa	131,194
Philip Vandenenden	129,546
Salomon Pereira	115,875
John Mead	102,220

Table 7a: Individual Buyer Side of the Market, 1720: Top 15 Sellers

$lnAmountBankStock$	0.016
	(3.37)**
$No.Transactions_1$	0.001
	(0.05)
$No.Transactions_2$	−0.004
	(0.34)
$No.Transactions_4$	−0.045
	(3.25)**
$Month_1$	0.079
	(2.55)*
$Month_2$	0.051
	(2.01)*
$Month_4$	−0.043
	(1.91)
$Month_5$	−0.015
	(0.68)
$Month_6$	0.017
	(0.70)
$Month_7$	0.040
	(1.47)
$Month_8$	−0.042
	(1.83)
$Month_9$	−0.062
	(2.54)*
$Month_{10}$	0.106
	(3.45)**
$Month_{11}$	0.042
	(1.52)
$GenderBuyer$	0.047
	(2.85)**
$Location_2$	−0.021
	(1.01)
$Location_3$	−0.034
	(1.57)
$Location_4$	−0.008
	(0.21)
Observations	6844
Absolute value of z statistics in parentheses	
* significant at 5%; ** significant at 1%	

Table 7b: Individual Seller Side of the Market, 1720: Top 15 Buyers

	Top15_Buyers
lnAmountBankStock	0.038
	(7.52)**
No.Transactions$_1$	0.022
	(1.45)
No.Transactions$_2$	0.010
	(0.76)
No.Transactions$_4$	−0.036
	(2.40)*
Month$_1$	0.003
	(0.09)
Month$_2$	−0.020
	(0.85)
Month$_4$	0.044
	(1.72)
Month$_5$	0.005
	(0.20)
Month$_6$	−0.058
	(2.65)**
Month$_7$	−0.022
	(0.86)
Month$_8$	0.029
	(1.12)
Month$_9$	−0.038
	(1.50)
Month$_{10}$	−0.044
	(1.69)
Month$_{11}$	−0.083
	(3.54)**
GenderSeller	0.004
	(0.23)
Location$_2$	−0.107
	(4.32)**
Location$_3$	−0.075
	(3.52)**
Location$_4$	−0.068
	(2.15)*
Observations	6846
Absolute value of z statistics in parentheses	
* significant at 5%; ** significant at 1%	

Figures

Figure 1. Bank of England Stock, 1720
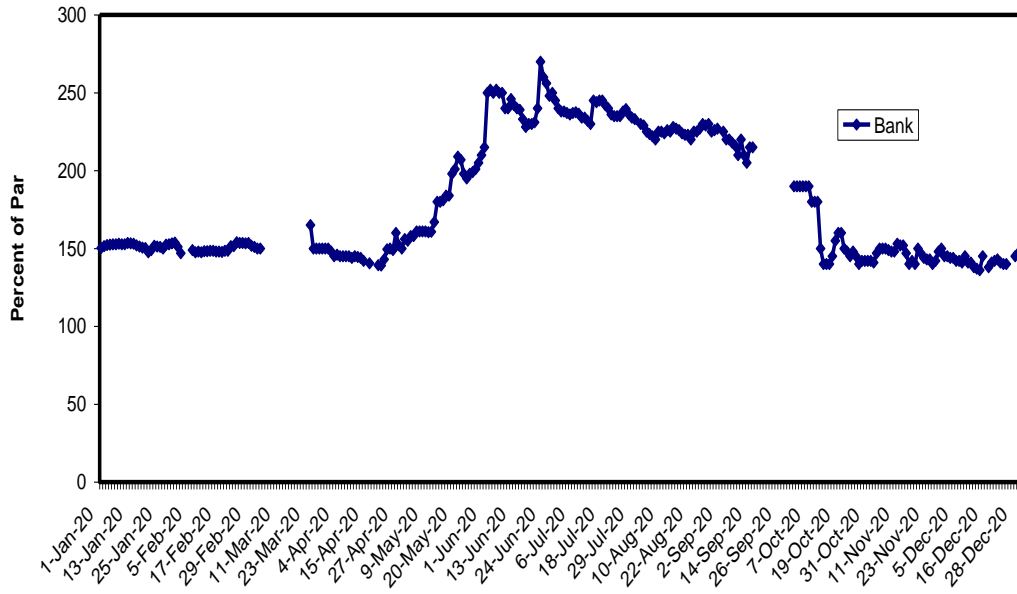
Source: Neal, Rise of FC.

Figure 2. London Coffee Shops
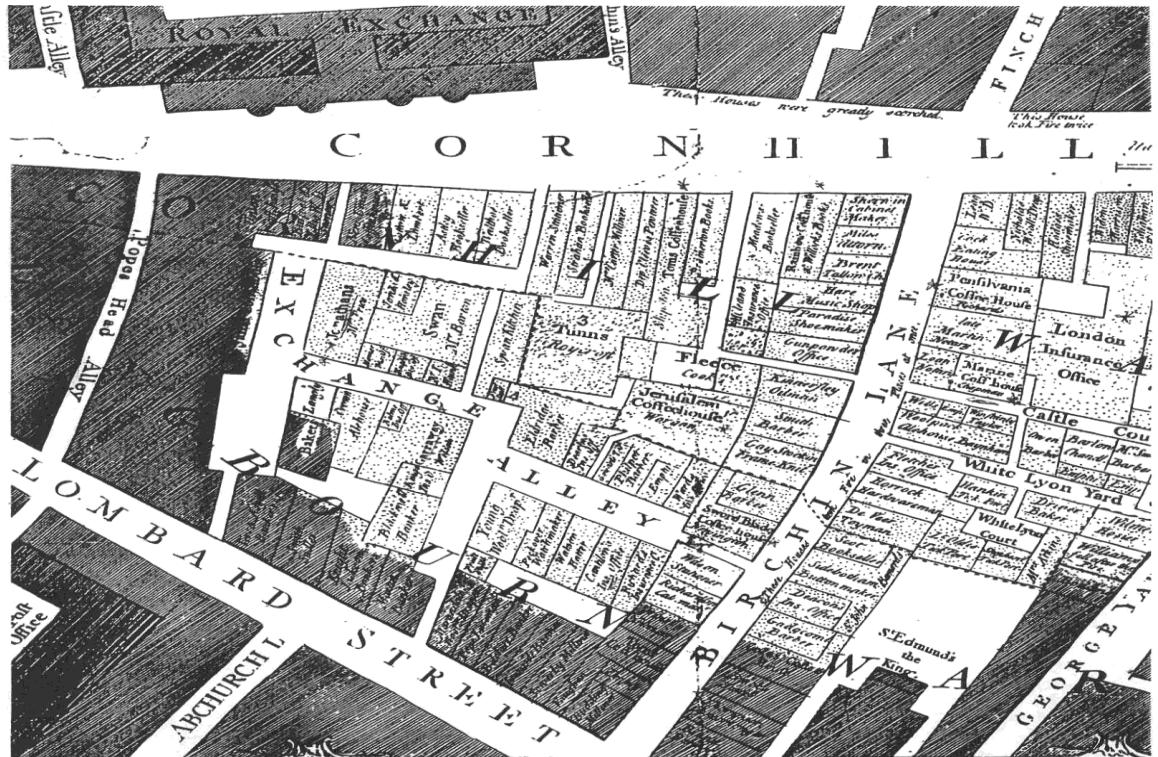
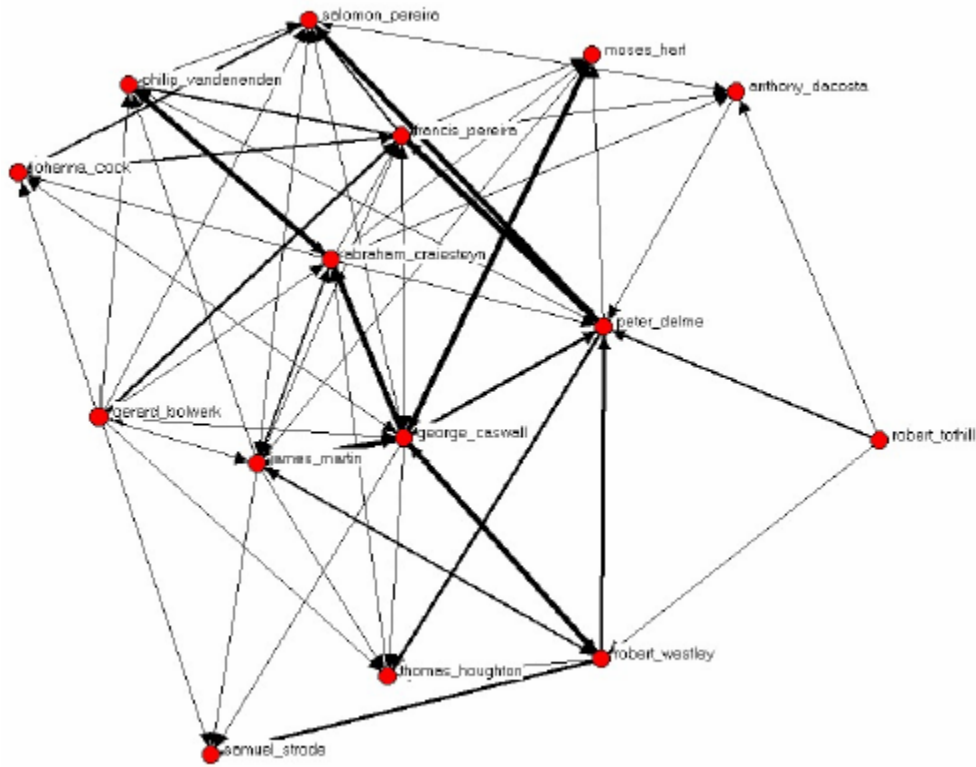**Figure 3. Network Relations Among the Top 15 Traders**
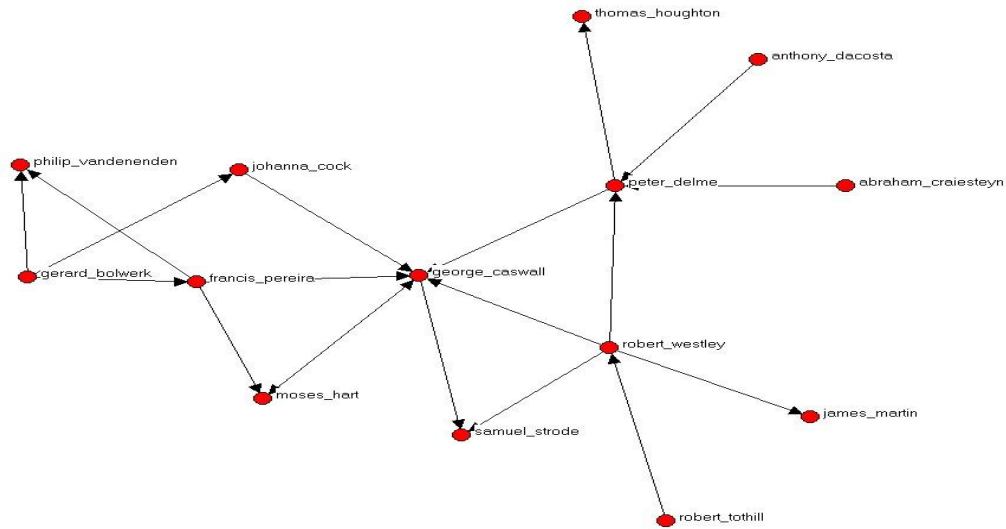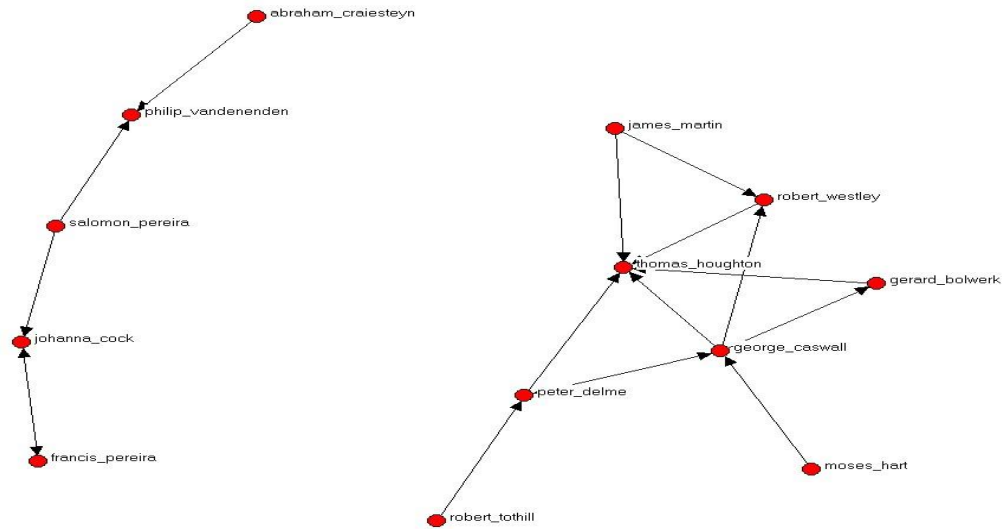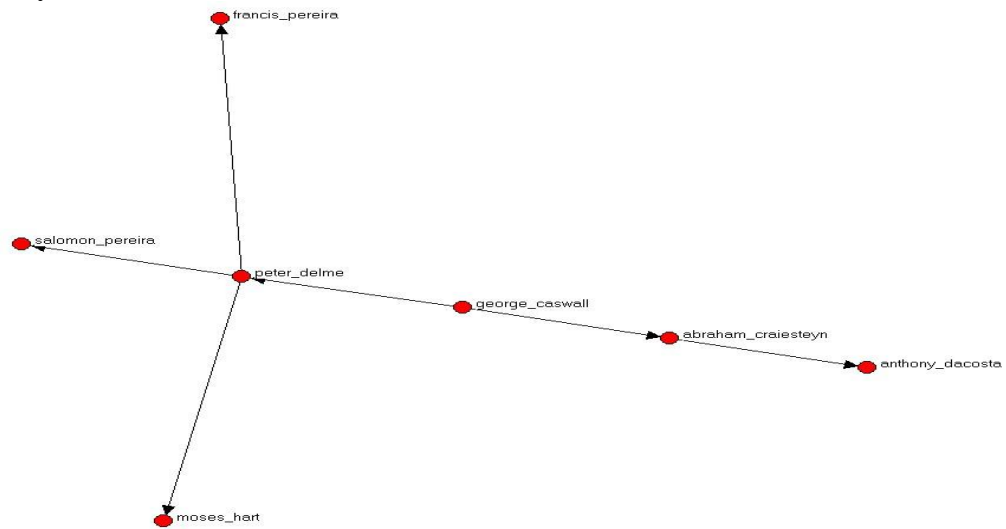**(weighted by frequency of interaction)**

Figure 4. Network Relations Among Top 15 Traders in Bank Stock

May

June

July

References

Bank of England, Transfer Books 1720 (AC28/1545-1554)

       Stock Ledgers (AC27/434-437)

       Alphabets to the Stock Ledgers (AC27/430-433)

Bloomfield, Robert, Maureen O'Hara, "Market Transparency: Who Wins and Who Loses?" *The Review of Financial Studies,* 12:1 (Spring, 1999), pp. 5-35.

Bloomfield, Robert, Maureen O'Hara, "Can Transparent Markets Survive," Journal of Financial Economics, 55 (2000),pp. 425-459.

Burt, Ronald S. "Social Contagion and Innovation: Cohesion Versus Structural Equivalence"*, The American Journal of Sociology*, Vol 92, No. 4 (May 1987), pp. 1287-1335.

Carlos Ann M., Jennifer Key and Jill Dupree, "Learning and the creation of stock-market institutions: Evidence from the Hudson's Bay and Royal African Companies, 1670-1700," *Journal of Economic History,* 58 (1998), pp. 318-344.

Carlos Ann M. and Larry Neal, "The Micro-foundations of the early London capital market; Bank of England shareholders during and after the South Sea Bubble, 1720-1725," *Economic History Review,* 59:3 (August 2006), pp. 498-538.

Carlos Ann M. and Larry Neal, "Women Investors in Early Capital Markets, 1720-1725", *Financial History Review*, 11:2 (October 2004), pp. 197-224.

Carswell, John, *The South Sea Bubble,* rev. ed., London: Alan Sutton, 1993.

Clapham, Sir John, *The Bank of England: A History,* vol. 1, "1694-1797", Cambridge: at the University Press, 1945.

Davis, Lance E. and Larry Neal, "Micro Rules and Macro Outcomes: The Impact of Micro Structures on the Efficiency of Security Exchanges: London, New York, and Paris, 1800-1914," *American Economic Review*, 88:2 (May 1998), pp. 40–45.

Davis, Lance E. and Larry Neal, "The Evolution of the Rules and Regulations of the First Emerging Markets: The London, New York and Paris Stock Exchanges, 1792-1914" *The Quarterly Review of Economics and Finance*, 45 (2005), pp. 296-311

Defoe, Daniel, *Anatomy of Exchange-Alley: or, A System of Stock-Jobbing,* London: B. Smith, 1719.

De Krey, G. S., *A Fractured Society: The Politics of London in the First Age of Party, 1688-1715,* Oxford: Oxford University Press, 1985.

De Frutos, M. ≃ngeles, Carolina, "Trade Disclosure and Price Dispersion," *Journal of Financial Markets*, 2 (May 2005), pp. 182-216.

Dennert, Jurgen, "Price Competition between Market Makers," *Review of Economic Studies,* 60, (Jul, 1993), pp. 735-751.

Dickson, P. G. M., *The Financial Revolution in England: a Study in the Development of Public Credit, 1688-1756,* London: Macmillan, 1967.

Earle, Peter, *A City Full of People: Men and Women of London, 1650-1750.* London: Methuen, 1994.

Earle, Peter, *The Making of the English Middle Class: Business, Society and Family Life in London, 1660-1730.* London: Methuen, 1989.

Flood, Mark D., Ronald Huisman, Kees G. Koedijk, Ronald J. Mahieu, "Quote Disclosure and Price Discovery in Multiple-Dealer Financial Markets," *Review of Financial Studies*, 12,(Spring 1999), pp 37-59.

Gauci, Perry, *The Politics of Trade: The Overseas Merchant in State and Society, 1660-1720*, Oxford: Oxford University Press, 2001

Gemmill, Gordon, "Transparency and Liquidity: A Study of Block Trades on the London Stock Exchange under Different Publication Rules," *The Journal of Finance,* 51:5 (December 1996), pp. 1765-1790.

Granovetter, Mark, "The Strength of Weak Ties," *American Journal of Sociology,* 78:6 (1973), pp. 1360-380.

Granovetter, Mark, "The Strength of Weak Ties: A Network Theory Revisited," *Sociological Theory,* 1 (1983), pp. 201-33.

Granovetter, Mark, "The Impact of Social Structure on Economic Outcomes," *Journal of Economic Perspectives,* 19:1 (Winter 2005), pp. 33-50.

Grassby, Richard, *Kinship and Capitalism: Marriage, Family and Business in the English Speaking World, 1580-1720*, Cambridge: University Press, 2001.

Huckfeldt, Robert, and Sprague, John. "Networks in Context; The Social Flow of Political Information," *The American Political Science Review,* Vol. 81, No. 4 (December, 1987), pp. 1197-1216.

Huggins, Robert, "Competitiveness and the Global Region: The Role of Networking" in *Innovation, Networks and Learning Regions?* ed. James Simmie, Regional Policy Development Series, London, 1997.

Kelly, Morgan and Ó Gráda, Cormac, "Market Contagion: Evidence from the Panics of 1854 and 1857," *The American Economic Review,* Vol. 90, No. 5 (Dec 2000), pp. 1110-1124.

Laurence, Anne, "'That Nasty South Sea Affair': The Hastings Sisters, Mrs. Bonnell and the Rage to Speculate", Open University working paper, 2004.

Levine, Ross, "Stock markets, growth and tax policy," *Journal of Finance,* 46 (1991), pp. 1445-1465.

Levine, Ross, "More on Finance and Growth: More Finance, More Growth", in *Historical Perspectives on Financial Development and Economic Growth*, Federal Reserve Bank of St. Louis, July/August, vol 84, No. 4, 2003.

Madhavan, Ananth, "Trading Mechanisms in Securities Markets," *The Journal of Finance*, 47:2 (June, 1992), pp. 607-641.

Miao, Jianjun, "A Search Model of Centralized and Decentralized Trade," *Review of Economic Dynamics*, 9 (2006), pp 68-92.

Mishkin, Frederic, *The Next Great Globalization: How Disadvantaged Nations Can Harness Their Financial Systems to Get Rich,* Princeton, N. J.: Princeton University Press, 2006.

Mortimer, Thomas, *Every Man His Own Broker: or, a guide to the Stock-Exchange,* 11th ed., London: G. G. J. and J. Robinson, 1791.

Murphy, A. L., "Investors in London's first stock market boom", paper at Economic History Society meetings, University of Reading, 2006.

Neal, Larry, "The "Money" Pitt: Lord Londonderry and the South Sea Bubble, or, How to Manage Risk in an Emerging Market," *Enterprise and Society*, 1 (December 2000), 659-74.

Neal, Larry, *The Rise of Financial Capitalism: International Capital Markets in the Age of Reason,* New York: Cambridge University Press, 1990.

Pagano, Marco and Ailsa Roell, "Transparency and Liquidity: A Comparison of Auction and Dealer Markets with Informed Trading," *Journal of Finance*, 51:2 (June, 1996), pp. 579-611.

Rajan, Raghuram G. and Luigi Zingales, *Saving Capitalism from the Capitalists,* New York: Random House, 2003.

Scott, W. R., *The Constitution and Finance of the English, Scottish and Irish Joint-Stock Companies to 1720,* 3 vols., Cambridge: at the University Press, 1910-12.

Zahedieh, Nuala, "London and the Colonial Consumer in the late Seventeenth Century," *Economic History Review,* 47:2 (May 1994), pp. 239-61.

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[1]. See Neal, *Rise of Financial Capitalism*, ch. 4 for a more complete discussion of the nature of the debt for equity swaps.

[2]. Dickson, *Financial Revolution*, ch. 5.

[3]. The so-called 'money subscriptions" offered by the South Sea Company were a separate financial innovation that spawned great controversy at the time, controversy recently renewed in Dale, Tang, and Wu, "Financial markets can go Mad," (2005) and Shea, "Financial analysis can go mad," (2006).

[4]. These transfers are recorded in separate mortgage ledgers.

[5] Much of the work conducted to date on interconnection in the seventeenth and early eighteenth century has focused on the interconnections between commerce, merchants and government. In Merchants and Revolution, Brenner documents the role of the overseas trader in the process of commercial and political change. The politics of trade is highlighted by de Krey's analysis of party affiliation, while Gauci examines the dynamic role of the merchant in the formation of national

policies. In his important and influential work, de Krey identified a sample of 1,339 'merchants' active in the 1690s but as a result of his focus on political association, he ultimately focused on less than half of the sample. Gauci constructed a different sample of 850 merchants from the City assessment for the poll taxes levied in the 1690s. His focus was on those who were delineated as "merchants" in the poll tax and thus involved in overseas trade. Both samples allowed the authors to explore relationships among a mercantile élite from political to geographical to family connections. de Krey, *Fractured Society*; Gauci, *Politics of Trade*, pp. 17-19.

[6] There were roughly 2000 transactions in Bank of England stock in each of the three years prior to the Bubble year and three times that number in 1720

[7] Brokerage on Exchequer orders was limited by 8 & 9, Wm. III, c. 20 to 1/8%, which, according to Dickson, became the standard. (Dickson, 493, fn 1. Accounts of Lord Londonderry, one of the more active speculators in the London market before and during 1720 show that he typically paid 1/8 percent commission. (Neal, 2000).

[8]. Eligibility to vote and to stand for the board of directors was based on the number of shares owned. A shareholder had to hold a certain number of shares to vote and more to be eligible for election.

[9]. The date in the transfer book is the date when the transfer is recorded and not necessarily when the sale took place but the date recorded is in effect the date of

official transfer. We also have no reason to believe that much time existed between sale and transfer.

[10].   See, Scott, *Constitution and Finance*, vol. 3.

[11].   Carlos, Moyen and Hill, "Royal African company share prices", p. 67.

[12].   Dickson, *Financial Revolution*, Appendix D. These numbers slightly overestimate the number of transactions because they are based on an average number of entries per page by the number of pages.

[13]   Dickson (p. 499), however, lists him as a known jobber in stock, but tells us nothing more.

[14].   One of these ten was a woman, Johanna Cock. For a more complete description of Johanna Cock's activities, see Carlos and Neal, "Women Investors in Early Capital Markets."

[15].   Clapham, *The Bank of England*, p. 274.

[16].   See Carlos and Neal, "Women Investors"

[17].   The range of newspapers and broadsheets, circulars and pamphlets available was very large. Getting information on the market, especially over the course of the Bubble period would not be difficult. Even those living outside London could have a newspaper each day if so desired. See Anne Laurence, "'That Nasty South Sea Affair'".

[18]. People could use a London agent. This, however, put them at a different kind of disadvantage.

[19] The discussion that follows is based on Wasserman and Faust, *Social Network Analysis: Methods and Applications*.

[20] We had also tried using book value of transfer and market price entered separately, but this specification is more robust.

[21] Given the number of foreign buyers purchasing £500 blocks of Bank shares after the collapse of the South Sea bubble, they would find it easiest to make a purchase from one of the remaining market makers, who in turn would be eager to replete their case reserves with Dutch specie or bullion. The motivation of the foreigners, presumably, was to acquire voting rights for selecting the new group of Bank directors who would determine the actions of the Bank to help relieve, or not, the plight of South Sea stockholders. (Neal, 1990, ch. 4)