

New Evidence on the First Financial Bubble

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Abstract

The first global financial bubbles occurred in 1720 in France, Great-Britain and the Netherlands. Explanations for these linked bubbles primarily focus on the irrationality of investor speculation and the corresponding stock price behavior of two large firms: the South Sea Company in Great Britain and the Mississippi Company in France. In this paper we collect and examine a broad cross-section of security price data to evaluate the causes of the bubbles. Using newly available stock prices for British and Dutch firms in 1720, we find evidence against indiscriminate irrational exuberance and evidence in favor of speculation about fundamental financial and economic innovations in the European economy. These factors include the emergent Atlantic trade, new institutional forms of risk sharing and the innovative potential of the joint-stock company form itself. These factors ultimately had long-lasting transformative economic effects which may have been anticipated by the markets at the time. We use the cross-sectional data to test the hypothesis that the bubble in 1720 was driven by innovation by dividing the London share market into “old” and “new” economy stocks. We find that firms associated with the Atlantic trade and with the new joint-stock insurance form had the highest price increases and had return dynamics consistent with current models of “New Economy” stocks. New, high frequency data allow us to pinpoint the date of the 1720 crash and track its international propagation

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I. Introduction

Asset bubbles are important puzzles in financial economics – important because of their extraordinarily potential for disruption; puzzles because they defy standard notions of rationality. Recent research has highlighted the role of technological innovation in asset bubbles.¹ This approach makes some cross-sectional empirical predictions about security prices during periods of technological change. Nicholas (2008) for example, uses *ex post* patent citations to show that the U.S. stock market boom in the late 1920's was driven by expected returns to firms invested in technological innovation. Macleod (1986) notes the association between stock market investing and the growth in patent filings in the late 17th century in Britain. Pastor and Veronesi (2006) develop a model that shows how imputed growth rates in innovative industries can appear irrationally high *ex post* and that industries in which bubbles occur will be characterized by high return volatility, high uncertainty and rapid adoption of the new technology. They test these predictions on 19th century railroad securities listed on the New York Stock Exchange.

Other research has focused on triggers for the collapse of an asset bubble.² Abreu and Brunnermeier (2003) for example, suggest that rational, sophisticated investors “ride” a bubble until a coordinating mechanism such as a news trigger causes it to burst. Nicholas (2008) finds that the 1930's crash was not driven by the expectations about innovation that caused the price run up in the 1930's. In this sense, the rise and fall that characterize a stock market bubble *ex post* may be due to separate factors.

In this paper we use one of the most famous events in financial history to test hypotheses about the drivers of financial bubbles and causes of a crash. Using new data from the South Sea Bubble and the contemporaneous Dutch Windhandel of 1720 we analyze a broad cross-section of stocks in the London and the Amsterdam markets during the bubble and crash. These include financial firms, banks, insurance companies, international trading companies, manufacturing firms, mining companies, utilities and companies formed simply to pursue emergent business opportunities. Since

¹ C.f. Hobijn and Jovanovic (2001), Nicholas (2008), Pastor & Veronesi (2006, 2009).

² Abreu and Brunnermeier (2003), Brunnermeier and Nagel (2004), Brunnermeier and Sannikov (2011).

some of these firms were engaged in novel ventures with high future prospects, they present an opportunity to test theories about the connection between asset bubbles and periods of innovation and more specifically to shed light on the causes of the first and largest of all international stock market bubbles. We find evidence consistent with recent bubble literature; technological and financial innovation played an important role in the rise of stock prices and news events about financial distress likely coordinated a sudden collapse in an important market sector which propagated to other sectors and internationally. A distinguishing feature of this paper is that, while previous research has focused principally on the effects of innovation in industrial technology, we identify several financial innovations as differentiating factors in the bubble. In other words financial innovations themselves have the potential to dramatically shift investor expectations, particularly if they represent novel forms of risk-sharing, access to capital or offer previously unavailable payoff distributions. 1720 was more than simply a year of spectacular bubbles. It was a year in which several, dramatic innovations in finance took place. While some of these innovations were temporarily curbed either by regulation or by the market distress caused by the crash, in the long run these innovations transformed the modern world economy.

1.1 Innovation

Although 1720 is not generally viewed as a period of technological novelty, we argue in this paper that there were several critical innovations that took place in a very short span of time; four of which were financial innovations, the other was a major potential shift in the configuration of global trade.

The first innovation was financial engineering at a national scale. The Mississippi Company and the South Sea Company issued equity shares in exchange for government debt; in effect converting the national debt into corporate stock. This novelty appeared to be a new vehicle for government finance: a heavily politically-influenced corporation that also had exclusive rights and patents to pursue other ventures. It was clearly perceived at the time as a new and transformative financial technology. Although the 1720 bubbles have often been attributed to the large scale

debt-for-equity conversion that took place in Great-Britain and France³ the logic of this attribution has never been formally tested. Only a few of the many companies trading in London and none of those trading in the Netherlands at the time were public debt conversion vehicles.

Analysis of the data from The Netherlands is an ideal testing ground for seeking alternative causes to the London and Paris bubbles because no widespread conversion of public debt for shares took place in that country. A flurry of IPOs occurred in The Netherlands in late 1720 and these new companies – along with the existing East and West Indies Companies -- experienced a bubble and crash which had nothing to do with debt for equity swaps or government finance. The absence of a government refinancing operation suggests that other factors aside from public finance must have been grounds for Dutch investor enthusiasm. Until now, the lack of Dutch security price data has prevented researchers from examining the Dutch "Windhandel" (as it is known) in any detail. We discovered a previously unidentified source of price data for Dutch companies in 1720. This source covered a large percentage of the Dutch firms launched in 1720, as well as the existing East and West Indies Companies for the entirety of the year 1720. The source also has detailed commentary at a three-times-per week frequency about French, British and Dutch markets which allow us to examine what factors the financial press at the time regarded as relevant drivers of value. Our analysis of Dutch companies, prices and news provides a means to examine alternative factors in the global market bubble and crash of 1720.

The second innovation around 1720 was an incipient shift in global trade. There were several companies in the early 18th century set up to exploit trade in the Americas, however the two largest of such ventures were the Mississippi Company, which effectively owned the Louisiana territory, and the South Sea Company which owned the *Asiento*, the right to export African slaves to Spanish America and the right to establish a number of trading stations in South and Central America. Both France and Britain had ambitions at the time to challenge Spanish domination of the Atlantic trade. Spain's dominant position was weakened as a result of the War of the Spanish Succession

³ Cf. Kindleberger (1978), Neal (1990)

[1701-1714], and the War of the Quadruple Alliance [1718-1720], opening the door to increased competition from Britain, France and the Netherlands. These geopolitical conditions offered economic possibilities and it is logical to posit that they would be reflected in the prices of securities related to New World ventures. Contemporary pictures and plates about the bubble contain many references to the trade across the Atlantic,⁴ however trade with the West has not been part of any quantitative analysis of the bubble thus far.

The third innovation concerned risk. Maritime insurance was a fundamental technology for risk-sharing, particularly for the empires founded on overseas trade such as Great Britain and the Netherlands. Prior to 1720, all maritime trade was insured through a market that matched voyages with individual insurers or private syndicates. In 1720, Great Britain changed the status quo by chartering the first joint-stock insurance corporations. The Royal Exchange Assurance Company and the London Assurance Company immediately presented a novel institutional model of capital formation and risk-sharing as they pooled risk and made possible a larger capital base. Kingston (2007, 2008) argues that this innovation changed the institutional equilibrium for provision of maritime insurance. He notes that the institutional corporate form for insurance quickly took hold outside of Great Britain, most notably in North America. Plans for publicly capitalized insurance companies spread within months to The Netherlands and Germany.

Kingston also observes that, paradoxically, the regulatory limits on corporations in Britain engendered in the Bubble Act of June 9, 1720 (which chartered the two insurance companies but at the same time sharply curtailed the public capital market in share floatations and trade) led to the emergence of Lloyds – a marketplace for insurance contracts rather than a corporation - as a sustained equilibrium. It is thus logical to consider the financial market effects of a shift in a major institutional structure.

The fourth innovation was the short-lived attempt by corporations in Great Britain to pursue opportunities beyond their charter. Leading up to 1720, entrepreneurs sought to

⁴ See, for example *Het Groote Tafereel der Dwaasheid* (1720), and Frehen, Goetzmann and Rouwenhorst (2011).

purchase chartered firms and repurpose them by using their rights to issue stock as a means of financing new enterprise. One such entrepreneur was Case Billingsley who, in 1719, purchased the York Buildings Company, a poorly performing London waterworks. He recapitalized it with the issuance of shares to the public and used the proceeds to purchase confiscated Scottish estates. These properties were intended to serve as income-producing capital to underwrite life annuities and life insurance policies.

The legitimacy of attempts to expand the powers of corporations was examined by the Attorney General and debated by Parliament during the course of 1720, and the fluctuations in share prices of repurposed firms, or firms without clear charter to their lines of business, can be regarded in part as a barometer of public expectation about the future powers of the corporation vs. the state. The actions by the Attorney General, Parliament and the crown taken during 1720, up to and through the debate, passage and enforcement of the Bubble Act ultimately determined the extent to which joint-stock companies would be allowed to freely pursue business opportunities or instead be constrained by Parliament to operate within carefully circumscribed bounds.

The fifth innovation was a dramatic change in the available distributions of payoffs to investors. Murphy (2009) points out the close association between the dramatic growth of lottery schemes and share speculation in the late 17th century British capital markets as evidence that stocks offered investors something that bonds and annuities did not – a chance at outsized returns through large dividends (as in the case of the East Indies Company) or through high capital gains, realizable via the purchase and resale of shares in an active market. The market for a right-skew payoff distribution either through a lottery or by investing in an equity share with the potential for extraordinary economic returns expanded dramatically in the Britain in the period just prior to mid-1720 with the launching of a hundreds of companies in Exchange Alley. Recent studies focusing on the drivers of human decision making show that investors are attracted to positively skewed shares and option-like features. Barberis and Huang (2008) document the asset pricing implications of lottery-like preferences or heavy tails. They point out that positively skewed assets can be overpriced or earn negative excess returns.

Brunnermeier, Gollier and Parker (2007) corroborate the lower average returns for highly skewed stocks in a general equilibrium setting for diversifying investors.

In the Netherlands, the opportunities for right-skew distributions were even more limited prior to 1720. The introduction of publicly financed insurance companies in the Netherlands occurred at a time when small investors had very few opportunities to participate in the success of new business ventures. In addition to large British companies, the only publicly traded companies on the Amsterdam stock exchange were the Dutch East and West India Companies which by that time were mature enterprises and did not need to access capital markets for new financing. Other portfolio holdings consisted of government bonds, real estate and lottery tickets (see Groeneveld (1940)).

Ex post, all but one of these innovations had a transformative effect on the global economy. Only the government debt for equity swaps did not survive the financial crisis when the South Sea Bubble burst. Atlantic trade became important. The triangle trade between Europe, Africa and the Caribbean eventually became the dominant international trade system of the 18th and early 19th centuries. Joint-stock insurance companies became important. The emergence of publicly financed, limited liability insurance companies ultimately transformed risk sharing in economies based on global trade. In fact, the publicly traded insurance companies founded in 1720 survived and flourished and became models for the insurance trade in both the Old and the New Worlds. The public insurance corporation is now the dominant organizational form. Multiple-sector corporations became important. Despite the fact that Parliament re-asserted its control over publicly traded companies by restricting them to their charters, ultimately the unfettered corporation became the dominant institutional structure in global finance. Finally, the offering of investment opportunities with potential for large positive gains has remained one of the consistent motivations for retail investing since the 1720 bubble. Not only have lotteries survived, but "lottery stocks" have as well (c.f. Kumar, 2009).

In this paper we examine the degree to which the confluence of these various innovations in 1720 influenced public expectations about public companies, and if so, which firms were most affected. Cross-sectional and cross-border price data allow us to

test whether any or all of these innovations affected expectations. In a broader context, we also test some recent predictions about the causes of stock market bubbles including Pastor and Veronesi's (2009) model of dynamics in betas, volatilities and Abreu and Brunnermeier's theory about how information triggers a crash.

Our results show that the dynamics of the South Sea Bubble differed by industry. We also provide evidence of international propagation of these effects. Our results suggest that speculation about the Atlantic trade with the Americas was an important factor in investor expectations. We also find evidence that market prices and new issues in Britain and the Netherlands were driven in part by investor expectations about the financial innovations in the insurance trade. On the other hand, we find little evidence that the debt-conversion function of the Mississippi and South Sea companies was an important factor. Most shares rose in the British and Dutch bubbles, but the growth in those not associated with the Atlantic trade or with the insurance trade was significantly less. Finally, we find evidence that Dutch investors at least were motivated not only by the emergence of new insurance companies, but also by the potential of joint-stock firms to pursue multiple lines of business.

Our tests of the Pastor and Veronesi (2009) model find dynamics over the period of the introduction of new financial technologies that are consistent with their predictions about changing factors for security pricing as investor understanding about the prevalence of new technology evolves.

One puzzle we identify is why firms with little exposure to financial or technological innovation also rose during the crisis. We offer some thoughts on this in the discussion at the end of the paper.

1.2 News and the Crash

The cross-sectional data and analytical approach allow us to examine the extent to which the South Sea Bubble and related bubbles burst at the same time, and to ask whether any specific news events sparked the crash. Previous work has mainly focused on the causes of the rise and fall in South Sea Company stock. A broader set of stocks trading in London provides a richer perspective on exactly how the crash occurred.

First, the South Sea Company itself did not drop sharply until two months after reaching its peak. Instead the big crash, during which prices declined by a factor of four or five within a month, was precipitated by the price decline (and illiquidity) of the two marine insurance companies and the York Building Society. This event occurred over a short period of days and led virtually all of the other stocks in the market – even those in unrelated industries – to decline. This coincident drop suggests that some factor other than the prospects of the South Sea Company caused the crash, and that a financial propagation mechanism led to an international asset devaluation and reduction in liquidity.

Second, by focusing on the broader set of securities in the London market, and using press reports in the Netherlands that closely tracked the London capital market, we identify specific news items that appeared exactly in the days around the crash. The existence of such a news trigger is consistent with the Abreu and Brunnermeier (2003) proposition that a coordination mechanism such as a public news announcement is necessary to pop a rational bubble.⁵

The main contribution of this paper is the introduction of a cross-sectional analysis of share prices in 1720 in order to test competing theories about investor expectations in the first great crash of the world's stock markets and the finding that financial as well as technical innovations can dramatically alter investor expectations about the future. While we take no position on whether the bubble of 1720 was an over-optimistic assessment of the potential of New World trade, the potential of new means of risk-sharing and the potential of public companies to fund new technologies, we argue that these factors were important determinants of valuation during the period. Investigators of later bubbles may find that financial as well as technological innovations spark investor enthusiasm.

II. Historical Background

⁵ The hypothesis of the rationality of the bubble in this case has been tested in Temin and Voth's (2004) detailed analysis of Hoare's Bank trading records: the bank, run by a well-placed financier in the City rode the bubble up quite nicely and its clients profited well.

Prior to 1720 all three of the countries in this study; France, England and the Netherlands had privately capitalized and publicly traded corporations. These pre-1720 companies were based upon patents or licenses granted by the government to pursue specific enterprises. In France, public companies with tradable shares date at least to the 14th century and active securities markets date to the 16th century in the Midi.⁶ As early as the mid-17th century the Finance Minister Colbert sought to systematically use the corporate form to develop French industry and financial infrastructure. In the Netherlands, trade in Dutch East and West Indies shares dates to the early 17th century, and sophisticated derivatives use is well-documented from the mid-17th century indicating an active speculative market.⁷ The history of the corporation in Great Britain dates back to the 16th century however an active stock exchange, and most importantly an active IPO market for funding new enterprise emerged in the late 17th century – two decades before the bubble of 1720. London's first share market bubble occurred in the early 1690's with a flurry of speculation around companies launched to pursue a variety of novel enterprises, including manufacturing, salvage, mining and finance, been this activity had become relatively quiescent in the years before 1720.

The roots of the first major innovation discussed in this paper, exchange of equity shares in a corporation for government debt, was a direct result of the massive debts incurred by wars between France and Britain culminating in the War of the Spanish Succession [1701-1714]. For example the Bank of England was chartered in 1694 and granted exclusive rights as the nation's only joint-stock bank and exclusive rights to issue paper money in return for a 1.2 million pound loan to the crown. Similarly, the South Sea Company was founded in 1711 to exchange the debts of soldiers, sailors and other government creditors with shares in the firm that had exclusive rights to trade in Spanish South America. In 1719 the South Sea Company bid aggressively for the lion's share of the government debt, which it financed with the public issuance of shares by subscriptions.⁸ South Sea Company share prices rose dramatically from January to

⁶ Goetzmann and Pouget (2011).

⁷ Gelderblom and Jonker (2005).

⁸ The source of our price data, The Leydse Courant describes a fierce competition between the Million Bank and the South Sea Company to carry out the plan. When the outcome turns out to be favorable for

June, along with the prices of other British companies and remained flat for most of the summer before falling in September. This event has since been termed the South Sea Bubble.

The Scotsman John Law brought the financial innovation of equity for government debt conversion to Paris where, in 1716 he founded a bank to support government finance and a year later purchased a company holding royal patents to colonize the territory of Louisiana. The Mississippi Company acquired several other trading firms and was ultimately, in 1720, merged with the bank to create a monolithic private company controlling most of the fisc of France. Law issued shares and warrants in the company to an eager public, leading to the dramatic rise in the value of the Mississippi Company in 1719 and early 1720. The famous Mississippi Bubble burst when Law set an aggressive exchange ratio between equity shares and bank-notes; effectively converting French money into equity shares.

It is somewhat surprising that the Netherlands did not follow suit in a government debt-conversion scheme in 1719 and 1720 given that it, too, had incurred debts as a result of the War of the Spanish Succession, and had a long tradition of exclusive patent rights extended to select chartered companies. Gelderblom and Jonker (2009) point out that attempts were made to import this financial innovation but these failed; perhaps because trading patents to the Americas and Asia were already held by corporations, and a powerful national bank existed in the Wisselbank of Amsterdam. Never the less, the price of West Indies Company [WIC] shares rose dramatically in 1720, and the directors made an offering of new shares in mid-August, and a second in September. Prices of WIC shares were already falling by the time of the second subscription and had dropped by multiples by the end of October.

More important than the dynamics of the WIC was the attempted launch of a new company – an insurance company – in the Netherlands. The Dutch economy was characterized by heavy competition for business between its cities. As a consequence of this mercantilist tradition, the floatation of the first Dutch limited liability insurance

the South Sea Company, the Courant documents a small price increase (February 1720). In the following months investors speculate heavily on the conversion terms.

company was heavily debated among Amsterdam merchants in the early summer of 1720. While recognizing the benefits, underwriters feared unequal competition and monopolies from the new companies. Hence, Amsterdam decided to reject the proposal to launch a firm to compete with the British insurance companies. Shortly after this rejection, Rotterdam announced the floatation of Stad Rotterdam, the first Dutch limited liability insurance company in July, 1720. The *Leydse Courant*, a news periodical of the time, documented that share prices doubled within the first few trading hours and share trading continued overnight. The Rotterdam success set off a chain reaction. Many surrounding cities (such as Gouda and Schiedam) feared losing underwriting business and floated their own companies. Within weeks after the floatation of Stad Rotterdam, 30 Dutch companies have been proposed and rights offering sold. The prospectuses for these new firms note that insurance was either a primary or secondary line of business, and listed various reasons for floating a company, but one factor was a common theme: attracting business to the city. Some but not all of these new Dutch firms rose in price, although contemporary accounts and images described the sudden burst of speculation as "Windhandel" trade in wind.

Despite some similarities among the bubbles of France, Britain and the Netherlands, there were also some important differences. In France, John Law consolidated many previously independent companies into a monolithic firm. There is little evidence that, in Paris, investor enthusiasm for share speculation led to the funding of other companies. On the other hand, in both Great Britain and The Netherlands, the year 1720 was a high point in the launching of new projects funded by IPO subscriptions. In London, the rate of new equity subscriptions reached as many as 7 per day. In the Netherlands, there were roughly 30 or more new companies subscribed in a three-month period in 1720 from mid-July to mid-October. In addition, there were new firms launched in other countries including Germany and Portugal.⁹

The regulatory reaction to these new equity issues was mostly negative. The British Parliament passed the Bubble Act in June of 1720 to restrict the use of and trade in joint-stock companies, and the Attorney General subsequently actively enforced this

⁹ Cf. Amsinck (1894)

restriction in late August of that year. Trade in Amsterdam in new company shares was restricted on October 6th by city ordinance and on June 26th authorities in Hamburg curtailed the projected public issuance of two maritime insurance companies in their city. By the end of 1720, not only had stock prices in three major European countries risen and then collapsed, but the widespread use of new equity issues to fund enterprise had essentially disappeared in France, Great Britain and in the Netherlands and did not reach the same levels until the 19th century.

In the remainder of this paper we examine this global period of investor enthusiasm in detail using share price data that allow us to test hypotheses about the specific grounds for investor expectations during this first major episode in the emergence of a global capital market. The results shed light on how innovations in trade, finance and corporate rights can rapidly and radically alter public expectations about the future, and how these expectations can change just as rapidly by news about prospects for continued public funding of enterprise and governmental regulatory response to the innovations.

III. Data

We collected prices reported for Dutch and British companies from the *Leydse Courant* (preserved in the National Library of the Netherlands in The Hague) over the period November 1719 to December 1720.¹⁰ These include London transactions of British companies, as well as occasional prices for the same firms on exchanges in The Netherlands. We added these prices to those collected Neal (1990).¹¹ We augmented the Neal data with daily quotation series' from Castaing's *Course of the Exchange* for the two major British insurance companies. Although not employed in the empirical analysis in this paper, we also augmented Francois Velde's (2004) series of Mississippi Company prices with quotes from the *Leydse Courant*. In addition, we collected peak to trough data for 35 British companies from a satirical print from 1721 entitled "The

¹⁰ Our database, including exchange rates as well as equity quotes is available online at: <http://icf.som.yale.edu/south-sea-bubble-1720>. More data including price quotes in different cities is available upon request.

¹¹ <http://www.le.ac.uk/hi/bon/ESFDB/NEAL/neal.html>.

Bubblers Mirror” which makes possible a cross-sectional analysis of the bubble by industry. Information about these firms is obtained by cross-reference to Scott (1912).

No study to date has used regular Dutch price information for the Windhandel period, although scholars had been able to gather occasional references to prices.¹² British stock prices are available for the late 17th and early 18th century in Castaing’s *The Course of the Exchange* and two other sources, but detailed Dutch data has been lacking for this turbulent period. The British insurance company prices in 1720 have been used to construct market indices,¹³ but not studied separately.

Leydse Courant prices were not quoted in currency but as percentages of par value net of paid-in capital. Share issues at the time were offered as subscriptions that required an initial payment that secured the subscription rights. The initial payment was typically a small fraction (1% to 5%) of the par value of the share and came with requests to make future payments to the company over a period of time – sometimes on a monthly basis, but other times at irregular intervals. This convention made comparisons across companies straightforward, since it had the effect of normalizing the prices. We were able to verify this reporting convention by matching share loan transactions in the books of one of the Dutch firms founded in 1720, Maatschappij van Assurantie, Discontering en Belening der Stad Rotterdam [hereafter Stad Rotterdam, its modern name], with share quotes in the *Leydse Courant*. Appendix 3 explains the basis for this interpretation in detail.¹⁴

By similar means we were also able to verify the assertion by Shea (2007) that Dutch subscribers in shares were not obligated to meet future capital calls and held the right to forfeit their shares. The Dutch prospectuses clearly point out that future capital calls are

¹² See Gelderblom and Jonker (2009), concurrent with the first draft of own work, they report Dutch prices for the second half of 1720. Neal (1985) mentions the *Leydse Courant*, but notes that only a few issues are extant for the period. In fact, he implores scholars to search Dutch libraries for a complete run of them.

¹³ Cf. Parsons (1974)

¹⁴ Although the convention is useful for interpretation of the economic scale of the events of 1720 in the Netherlands, it does not significantly affect the estimates of the bubble in share prices, since these are calculated as percentages normalized either to previous prices or previous quotes.

non-binding and subscription share holders held the right to forego their shares.¹⁵ This freedom to walk away from capital calls on the shares is crucial in the interpretation of the bubble. If companies held the right to enforce down payments, subscription share holders were all highly leveraged and the leverage could be a driver behind the bubble. Shea (2007) shows that after the burst of the South Sea bubble, subscription shares were more expensive than their regular counterparts, whereas this relationship was usually reversed. In times of falling prices the option to walk away became valuable and subscription share holders held a valuable right to forego further investments.

Prices in the *Leydse Courant* were often quoted as a daily range. In these cases, we took the average of the range as the daily price. Prices for companies were also quoted in more than one city. In these cases we used the prices for the market with the most liquidity, defined as the market with the largest number of quotes during the period of study. Prices for the major British companies: The Bank of England, the South Sea Company, the East India Company, the Royal Exchange Assurance Company, the London Assurance Company, the York Building Society and a few others were also quoted in the *Leydse Courant*, suggesting that Dutch investors followed – and likely traded in – British shares. This is consistent with the Neal (1990) hypothesis that Dutch capital flowed into Great Britain in 1720, pursuing equity investment opportunities. News of the finances of France was also regularly reported in the paper, and prices for the shares and related financial claims on the Mississippi Company were quoted frequently. This suggests that Dutch investors were interested in the daily fluctuations of the French firm and may have been actively investing, at least in the year 1720. We are lacking the *Leydse Courant* before November 1719, so it is not possible to trace earlier Dutch investor interest through this periodical.

¹⁵ Stad Rotterdam records contain only very few examples of share holders actually forfeiting their shares. Remarkably, Thomas Lombe and Edmund Hoyle, the British founders of the Stad Rotterdam, were the only ones to exercise the option to walk away, together constituting less than 1% of the company's capital.

IV. Analysis

IV.1 Cross-sectional Differences in the South Sea Bubble

Figure 1 shows the stock price growth of the eight major London companies regularly quoted in *The Course of the Exchange* and the other major price list, *Freke's Price of Stocks Etc.* over the period from November, 1719 through December, 1720. The scale is logged to represent percentage changes and indexed to 1 at the beginning of the available quotations for each series.¹⁶ There are three striking features of the graph. First, during the year 1720 all firms experienced, at a minimum, a doubling of their share price. However, for three companies the prices at the end of the year were at or below their beginning of year levels.¹⁷ For these firms the increase in share price during the first part of 1720 was a purely temporary phenomenon, while for the others the run-up had a permanent component. Secondly, there is considerable cross-sectional variation in the degree of price run-up. Although the events of 1720 are historically associated with the South Sea Company, a few firms “bubbled” more dramatically than the South Sea Company, when measured by price growth. In particular, the two marine insurance companies, Royal Exchange Assurance and London Assurance rose to much higher multiples of their beginning of the year prices during 1720. The Royal African Company (which, like the South Sea Company, was engaged in the Atlantic slave trade) rose as high as the South Sea Company in percentage terms as well. By contrast, the two banks, Bank of England and Million Bank, and the East India Company (engaged in the South Asia trade) rose much less than the other four.

¹⁶ Quotes for two companies, Royal Exchange Assurance and London Assurance begin January 1st, 1720 under different names.

¹⁷ Since quotations for the York Building Society only begin in June, we do not know whether it finished up or down for the year, however we know that at its peak, the value of par was a factor of 30 and the increase in the market price from late 1719 was more than 20 times.

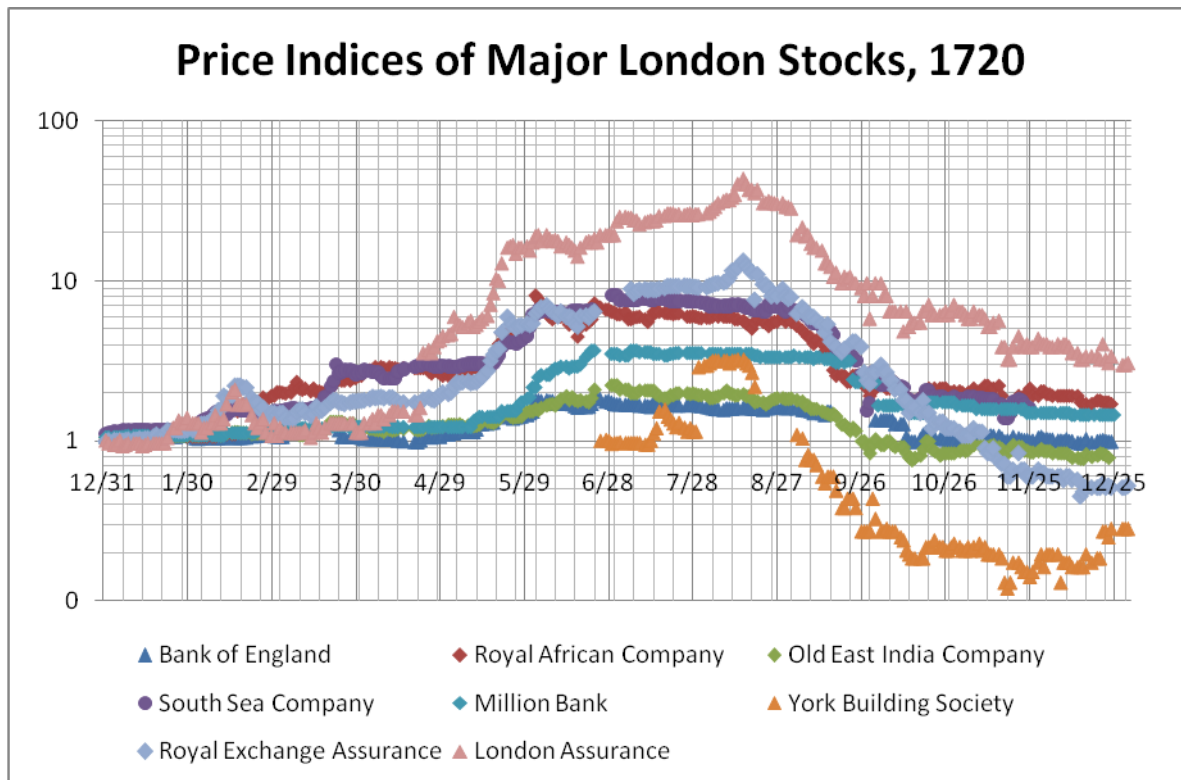


Figure 1: Price Indices of Major London Companies 1720. This figure shows the price indices for the major stocks trading on the London market in the year 1720, i.e. Bank of England, South Sea Company, Royal Exchange Assurance, Royal African Company, Million Bank, London Assurance, Old east India Company and York Building Society. Prices are divided by the January 1st value for all series except the York Building Society, where we used the first available data point (June 28 1720 [JJ]). The price indices are plotted against a logarithmic axis for the year 1720.

The South Sea Company was both an Atlantic trade company and a financial firm. To the extent that these two different businesses were subject to different information shocks and shifts in investor expectations through time it is tempting to interpret figure 1 – in which the South Sea Company shares move more closely with Royal African Company shares – as evidence that the South Sea Bubble was primarily about Atlantic trade. In the next section we examine this question more closely and test it against a separate sample.

IV.2 Atlantic Trade Factor

The difference between the high growth of the South Sea Company and Royal African Company on the one hand, and the modest growth of the East India Company on the other may reflect expectations about the Atlantic trade as opposed to the South Asian trade. The newly discovered Dutch price data give us an opportunity to test this. If there were different causes of the price run-ups in Figure 1, reflecting differential expectations of investors about the relative fortunes of companies trading with the East versus the West, then these differences are likely to show up in the Dutch market as well. On the other hand, if the price run-ups of share prices in London were largely idiosyncratic, or due to a different factor entirely then it is unlikely to find a similar pattern overseas.

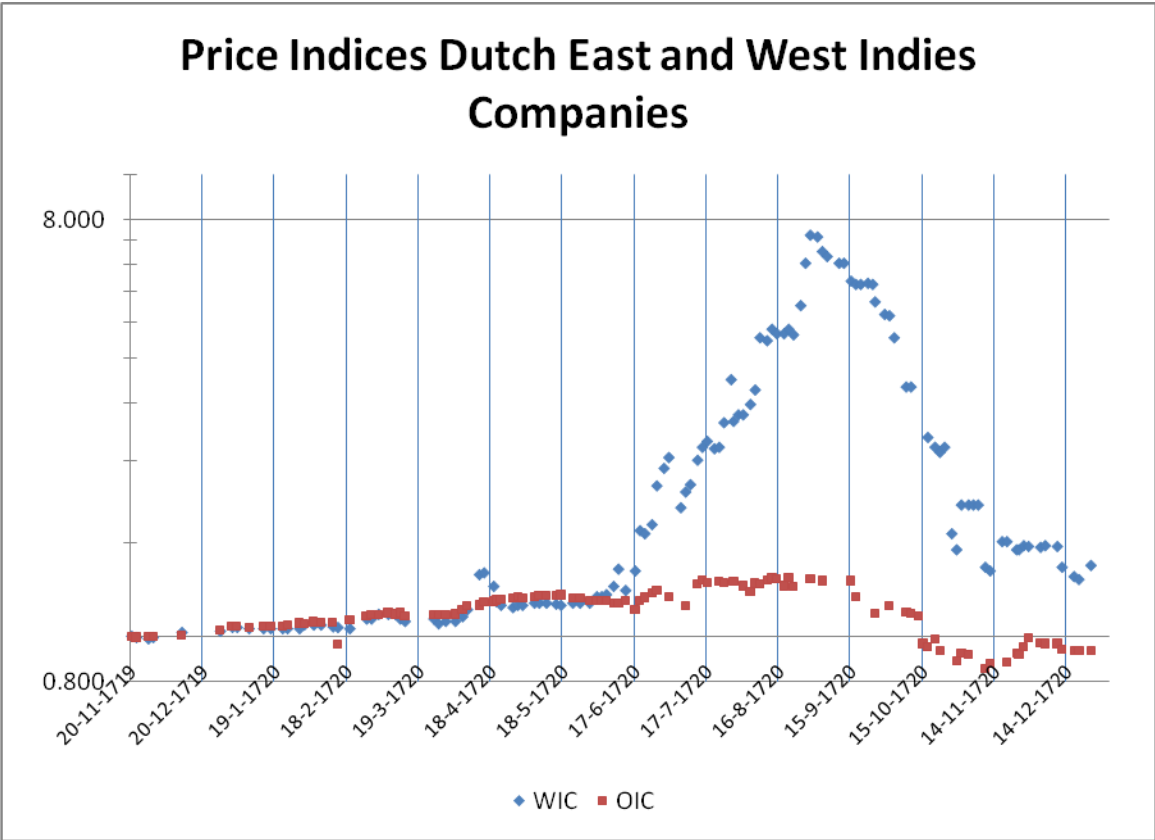


Figure 2: Price Indices of the Dutch East and West Indies Company 1720. This figure shows the price indices for the Dutch East and West Indies Company from November 20 1719 to December 31 1720. Prices are divided by the November 20 1719 value for the respective shares. The price indices are plotted against a logarithmic axis.

Figure 2 shows the rise and fall of investment in the Dutch East Indies Company and the West Indies Company over the period of November, 1719 through December, 1720. The data are reported three times per week. The similarities between the Dutch and London markets are striking. First, the run-up in the Dutch market was much larger for the West Indies Company than the East Indies Company. Second, the relative top-to-bottom variance of prices is strikingly similar in both markets. The Dutch West Indies Company clearly bubbled on the same scale as the South Sea Company and the Royal African Company, rising by a factor of 7 over a very short interval. By comparison, the price of the Dutch East Indies Company did not double and, like its British counterpart it fell below its beginning of year value by the end of 1720.

The four major firms in Northern Europe engaged in Atlantic trade; the Mississippi Company, the Royal African Company, the South Sea Company and the Dutch West Indies Company all rose by factors of 7 to 10 in the global bubble. The two major firms engaged in Asian trade, the Dutch and British East India companies, rose by much less. This is evidence in favor of the hypothesis that investor expectations (or at least sentiment) differed with respect to Atlantic vs. Asian trading companies, supporting the theory that the South Sea Bubble may have been partly a function of expectations about future Atlantic trade.

There is some supporting historical evidence for this hypothesis. The triangle trade that brought manufactured goods to Africa, Africans as slaves to the New World and plantation-produced commodities to Europe was one of the most important international economic institutions in the early modern era. It was just getting underway in 1720 and thus future profits were a long way off at the time of the bubble. Nevertheless, like the modern tech bubble, perhaps this future promise sparked current investor enthusiasm.

Other international events at the time might have also directed investor attention to the Atlantic trade and encouraged broader commercial aspirations in the New World. The short War of the Quadruple Alliance [1718-1720] pitted Spain against Britain, France, Austria and the Netherlands over control of Italy. The New World territories from Texas to Florida were an important secondary theater of the conflict. France fought to extend control over Spanish lands in Texas and New Mexico from her settlement at the mouth

of the Mississippi; the British in Carolina threatened Spanish Florida. While a treaty in February, 1720 concluded the hostilities in favor of the alliance, there was no major realignment of control in the Americas.¹⁸ Never-the-less, Spanish dominance in the New World was explicitly challenged, potentially raising interests and expectations among French, British and Dutch investors about future New World inroads.¹⁹

The commonality in the patterns of price run-ups in Amsterdam and London suggest a high degree of financial integration between these markets.²⁰ However, as noted above, the West Indies Company rose later than the South Sea Company or the Royal African Company. Part of the difference can simply be attributed to time keeping: there was an eleven-day difference between the older Julian calendar used in London and the newer Gregorian calendar used on the continent. But even accounting for this time lag, there remains at least a month difference in the beginning of the bubble trend. This suggests that any spill-over of irrational (or rational) exuberance ran from Britain to the Continent, not vice-versa. It also suggests that propagation of a rise in prices might be less rapid than the propagation of a crash.

IV.3 Events Associated with the International Stock Market Crash

As we have seen, share prices in several companies rose dramatically in 1720, but the timing of their take-off differed. In this section we examine the timing of the crash. Figure 3 shows the Dutch West Indies Company, Stad Rotterdam, the South Sea Company and the two British insurance companies. The trading dates for the British companies have been adjusted to the Gregorian calendar. Hereafter a G will indicate a Gregorian date used on the continent at the time, and J a Julian date used in Great Britain.

¹⁸ In fact the concluded peace likely heightened the prospects for South Sea Company and Royal African Company profitability, as the South Sea company expected to have the Spanish *Asiento* reinstated following the war – the document granting rights to supply African slaves to Spanish America. The South Sea Company had previously sourced slaves from the Royal African Company.

¹⁹ See Weber (1992) p.165 ad ff.

²⁰ See also Neal (1990) for a discussion between the integration of Dutch and British stock markets in the 18th century.

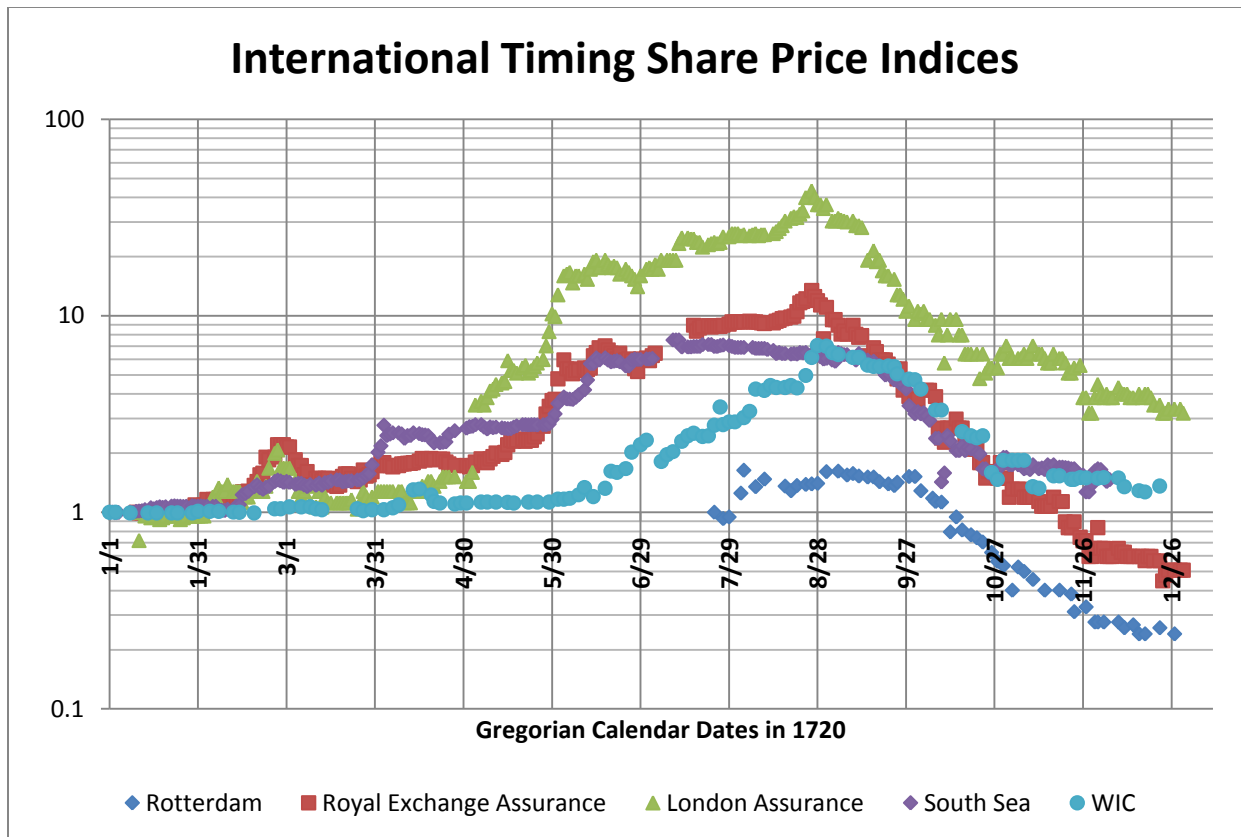


Figure 3: International Timing of Share Price Indices. This figure shows the price indices for the Stad Rotterdam, Royal Exchange Assurance, London Assurance, South Sea Company and Dutch West Indies Company from January 1 1720 to December 31 1720. Prices are divided by the January 1 1720 value for the respective shares. The price indices are plotted against a logarithmic axis.

The prices are indexed to one at the start of each series, and the vertical axis is logarithmic to allow comparison of the scale of the price changes on a percentage basis. The two British insurance companies reached their peak on the same day – August 26th [G], and began their drop on the 27th [G]. They both fell significantly over the following four trading sessions. Clearly their dynamics reflect a factor common to the two firms. The Dutch West Indies Company reached its peak on August 28th [G] and began its drop on the following trading day, August 31st [G]. It, too, continued to fall significantly over the following several trading sessions. Together, these three firms – aside from the Mississippi Company in France – were the first major companies to crash in price in 1720. The crash in Royal African Company shares began three weeks later on September 14th [G] and the crash in South Sea Company shares began on

September 19th [G]. Since late August seems to have been the important turning part in the London and Dutch stock markets, a natural question to ask is what happened around August 27th [G], or August 16th [J]?

The *Leydse Courant* reported news about both the British insurance companies in its edition of August 28th [G] noting that, on the 23rd of August [G] the Royal Assurance Company was planning a new issue of shares for the following week, presumably to raise the 50,000 pounds payment to the Exchequer promised by September 11th [G]. This payment was a condition of their charter granted as a result of the Bubble Act.²¹ The London Assurance Company was also required to deliver the same sum on that date. The news also noted cryptically that the London Assurance Company “kept silent and sought to learn the secrets of the other firm” presumably alluding to some scandal.²² This suggested that there was some asymmetric information of potential importance to investors.

Not reported in the *Courant*, but known from the *London Gazette* of August 23rd [J] is that the Attorney General issued a writ of *scire facias* on August 29th [G] against four firms (including the York Buildings Company) which were seeking to expand their business beyond their charter.²³ This writ represented a serious risk to firms seeking broad latitude. Although the two marine insurance firms were not named in the writ, they both had aspirations to expand into fire and life insurance. Although the writ was ultimately annulled, that reprieve came after the market crash.

Non-legal factors may also have come into play around this time. The *Leydse Courant* of September 4 [G] reported news from London dated August 30th [G] that a fleet of twelve ships from Jamaica had been lost and they were insured by the London Assurance Company for 72,000 pounds.²⁴ It noted the burglary of the home of one of the directors of the company. The insurance claim from the fleet and possibly the

²¹ Supple (1970), p. 37.

²² *Leydse Courant*, vol. 121, p. 2, July 28th, 1720.

²³ Scott (1912) p. 427 identifies the writ as a major factor in the fall of share prices.

²⁴ The date of this event is incorrectly reported in Postlethwayt (1757) as occurring in October.

burglary would have raised concerns about the capability of the firm to meet its September payment deadline.

Thus, over the course of four days in late August, 1720, adverse financial and regulatory news about the York Buildings Company and the two major insurance companies hit the market and the likely factors that triggered their rapid decline in price. Over the course of a week, all three British firms declined roughly 30%. This decline is large enough to have caused financial distress to speculators on margin. In this way it may have led to a broader financial crisis caused by borrowers liquidating securities to cover obligations.

Because they are reported in the *Leydse Courant*, we can track the dates on which these same news items reached the Netherlands. The lag of three to four days between the crash in London insurance companies and the Dutch West Indies Company is not surprising. Koudijs (2009) calculates that the average 18th century travel time of packet boats between London and Amsterdam was about three or four days. Likewise, the lag of three to four days is confirmed by the *Leydse Courant's* dated bylines vs. publishing dates for London news. We might expect, however, that some reports reached the Dutch capital markets through other channels.

Thus, through public information sources, Dutch investors in the British bubble companies as well as the Dutch West Indies Company would have known by August 29th about the financial plans and troubles of the British insurance firms. They may also have known through private information sources that the Jamaica fleet was wrecked.²⁵

It is not clear whether these reports were good news or bad for Dutch investors. The West Indies Company was not engaged in the insurance trade, and the only value-relevant news about the New World (apart from the shipwrecks) might have been the August 30 [G] report in London of the discovery of gold in Jamaica, reported in the September 2 [G] *Leydse Courant*. The only source of propagation of the crash is through the channel of financial distress. Investors in the West Indies Company who

²⁵ The Amsterdam insurance market would have had the same capabilities of learning about Caribbean shipwrecks in a timely manner as the London market, since these affected underwriting decisions regardless of who insured the ships.

held British insurance shares on margin might have had to raise cash by selling their Dutch assets. The *Leydse Courant* reported the prices of Royal Exchange Assurance and the London Assurance intermittently for the trading days July 6 [G] to August 24th [G], and for the York Buildings Company from July 19th [G] to August 17th [G]. It seems reasonable to interpret this demand for news about these firms as evidence of speculative interest in these securities among Dutch investors. Interestingly enough, shares in Stad Rotterdam jumped by 15% from August 28th to August 31st. Since the firm was created to compete with the British insurance companies, the problems of a rival might have been viewed as an opportunity. Stad Rotterdam did not crash until the end of September.

The coincidence of the price peaks for three British firms and the West Indies Company seems best explained by the onset of a liquidity crisis in the international stock markets – a crisis that overwhelmed the capital markets in the following two months. The coincidence of the *scire facias* writ limiting British companies to their charters seems to be the leading culprit in the events that sparked the crash, although negative news about one of the British insurance firms also likely played a role.

Beyond the micro-question about what sparked the global financial crash, the one thing we can determine from the time-series of various stock prices is that, while British and Dutch firms rose at different times over the course of the first eight months of 1720, September and October were terrible months for all stocks. The crash overwhelmed all stocks regardless of whether investor expectations were based on prospects of Atlantic trade, insurance or banking. Indeed one potential measure of the scale of the bubble is the extent to which non-speculative stocks fell. Under the assumption that firms such as the British East Indies Company and the Bank of England were not driven by speculative factors, then their rise itself represents a puzzle. One possible explanation for the rise of stocks unrelated to innovations is the possible demand for diversification by investors profiting during the run-up in speculative shares. Figure 1 provides some support for this hypothesis. Shares in the East Indies Company, Million Bank and Bank of England did not begin to rise until after large increases in shares in the South Sea Company and the two insurance firms.

An additional conclusion supported by an examination of the rise in Dutch share prices is that government re-funding could not have been the sole basis for the British bubble. No Dutch firm was launched to imitate the financial operations of the Mississippi Company or the South Sea Company. The fact that other types of firms bubbled – including the West Indies Company – suggests that the Mississippi and South Sea bubbles were not primarily due to speculation about the debt-equity swap as a financial innovation.

IV.4 Cross-sectional Evidence from New Company Issues

The price bubbles in 1720 were accompanied in Britain and the Netherlands by a wave of new company issues. The *Leydse Courant* provides price information for many of the new firms launched in the Netherlands, however regular price quotations for the new companies in London have not survived. Never the less, some information remains to allow an analysis of the cross-sectional differences in the magnitude of the run up in individual share prices. A satirical British print, *The Bubbler's Mirror*, appeared in 1721. It lists a number of the well-known London issues along with the price at issue of the shares and the maximum percentage price increase achieved during the bubble.²⁶ This information is sufficient for us to further quantify the cross-sectional differences noted for the larger firms and to determine the extent to which differences observed across industries – i.e. Atlantic trade, insurance and banking carry through more generally. The data from *The Bubbler's Mirror* is reported in Appendix 1.

Table 1 shows the average growth by industry. The first column includes the large traded firms previously studied. In the second column, to alleviate the potential data-snooping issue, we removed the Bank of England, the Million Bank, the South Sea Company, the Royal African Company, the Royal Exchange Assurance Company, York Buildings Company and the London Assurance Company from the calculations. The one exception is the inclusion in both columns of the East India Company as a basis for comparison.

²⁶ Reported in Scott (1912) vol. 1 p.410.

<i>Table 1: Maximum Percentage Price Increase of British Firms over Issue Price by Industry, 1720</i>			
Industry	Total	Total (less large firms)	Number
Insurance	2117%	1717%	9
Commodity	1208%	1208%	12
Manufacture	1166%	1166%	6
Atlantic	895%	948%	4
Marine	875%	875%	6
Service/Utility	567%	567%	3
Pacific	349%	349%	1
Bank/Finance	335%	333%	3
Property	300%	300%	1
Total	868%	829%	45

Table 1: Maximum Percentage Price Increase of British Firms over Issue Price by Industry, 1720. This table reports the maximum percentage price increase in the year 1720 of British firms over the par value of the share. The second column reports the maximum percentage price increase in the year 1720 for each share except the Royal Exchange Assurance, London Assurance, York Buildings Company, Million Bank, South Sea Company and Royal African Company. The third column reports the number of firms in each industry, without exclusion of the largest companies.

In order to test the hypothesis that the British firms associated with the Atlantic trade reached higher premia over par values, we performed a t-test on the log growth rates of the Atlantic trade firms and tested the null that the growth rate for the East India Company was drawn from the same distribution. Despite the few degrees of freedom, we were able to reject the null with greater than 85% confidence for both specifications.²⁷ When the South Sea and Royal African Companies were removed, the t-test returned a probability value of 10.6%. This is not surprising since the test in this specification has the minimum feasible degrees of freedom.

Table 1 shows that insurance was the highest growth industry. Five of the top seven firms ranked by growth were insurance companies. Column 2 shows that excluding the three top marine insurance companies, Royal Exchange, York Buildings and London Assurance, reduces the scale of the bubble in insurance firms, but does not change its top rank. This is due to the fact that two firms (General Insurance and British Insurance) bubbled on a comparable scale to their more widely traded cousins.

This cross-sectional industry-level evidence suggests that the exuberance of London investors was driven by certain industries. While the Atlantic trade is the obvious candidate given the fame of the South Sea Company, the data suggest that there was a major bubble – perhaps even a larger bubble – in insurance. The prominent position of the insurance companies in the bubble was noted by contemporary observers; most famously, John Aislable, Chancellor of the Exchequer who took a bribe of 20,000 pounds of South Sea stock in return for his political support of the firm. In his unsuccessful defense before the House of Lords, Aislable exclaimed of the two

²⁷ The test was performed for two specifications: simple growth rates and logged growth rates. In growth rates, the t-value was 4.25 on 3 df. For log growth the t-value was 6.15 on 3 df. The important caveat is that the small sample and its unknown distributional properties potentially limits the interpretation of parametric tests.

insurance firms: “these two projects were founded in greater iniquity and contributed more to the public calamity than anything else.”²⁸

An interesting feature of the Bubble Act of June 9, 1720 [J] which asserted governmental control over chartering companies for limited purposes is that it did not directly concern the South Sea Company. Rather, it chartered the London Assurance and the Royal Exchange Assurance companies and explicitly limited the chartering of competitors.²⁹ It also restricted the trade in companies not chartered by Parliament. The passage of the act did not immediately affect “repurposed” firms such as York Buildings Company, since share quotes appear in the press in June and continue from them onwards – with an exception of a few days’ hiatus after the writ of *scire facis* and the August crash. It thus makes sense to look at the bubble in 1720 through the lens of financial innovation in the insurance sector as much as from the perspective of an event driven by massive government debt conversion, or indiscriminate speculation in company shares.³⁰ The dynamics of the York Buildings Company is particularly instructive because, unlike the two chartered insurance firms, its growth prospects depended crucially on a lax interpretation or enforcement of the Bubble Act. The fact that it plunged so dramatically suggests that the prospects for unconstrained corporate enterprise were dramatically reduced by the writ.

²⁸ Mr. Aislabie’s second speech on his defense in the House of Lords, London (1721) p. 14 quoted in Scott (1912) p. 405.

²⁹ This may account for some of the spread observed within the insurance industry.

³⁰ For a view of the effect of the Bubble Act on business organization, see Harris (1994) and Harris (2000).

IV.5 The IPO Wave in the Netherlands

In the Netherlands, a number of new firms were capitalized in 1720, beginning in July with the creation of Stad Rotterdam and extending through October of that year. We collected data from the *Leydse Courant* for many of these new firms.

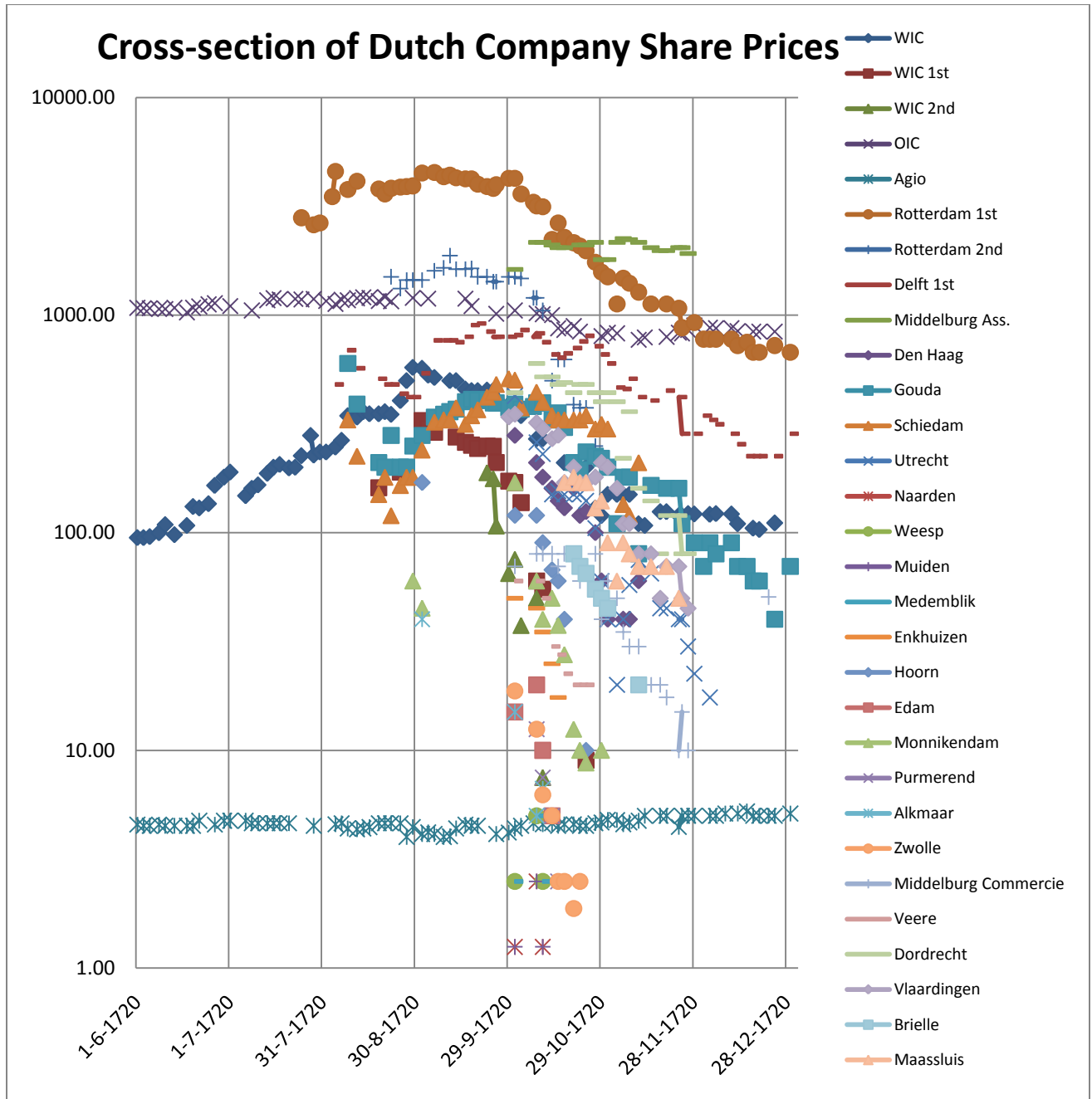


Figure 4: Cross-section of Dutch Company Share Prices. This figure shows the time series of prices for Dutch companies from June 1 1720 to December 28 1720. The graph contains all shares for which prices are quoted in the *Leydse Courant*. The price indices are plotted against a logarithmic axis.

Figure 4 shows the major Dutch price series' as well as a number of the additional issues over the last six months of 1720. As noted previously, the East India Company [OIC] rose only a little through the year and then dropped below its June level by the end of 1720. The West Indies Company rose quite dramatically and raised additional capital in two subscriptions in 1720 as its stock price rose.³¹ The most striking feature of the figure is that, with the exception of Middelburg, which floated both an insurance company and a commercial company, all the Dutch projects were singularly associated with its own city. Gelderblom and Jonker (2009) point out that this reflects the history of Dutch corporate development. The East Indies Company resulted from a consolidation of trading companies in different cities. Gelderblom and Jonker (2009) hypothesize that Dutch cities may have anticipated a similar consolidation of the insurance trade, and thus the first move of Rotterdam might have stimulated a rush to create similar projects that would result in a share of the consolidated firm. If this were so, it would suggest that the Dutch viewed the publicly traded corporate insurance company as an important and potentially transformative financial innovation that had the power to become a dominant organization. No city wished to be left out of the potential future gains to the consolidation of marine insurance enterprises into a huge national company. This is consistent with our hypothesis that speculation about the new insurance company form was a major driver of the international bubble in share prices in 1720.

If the expectation of consolidation motivated the flurry of Dutch public offerings, despite several attempts, such a consolidation never materialized. The shares of Stad Rotterdam began trading in mid-July, after the peak of the South Sea Company, but a month before the peak of the London and Royal Exchange Assurance companies. The

³¹ The East India Company and West Indies Company are easy to recognize in Figure 4, since they are among the few companies for which price quotes are available throughout the entire year.

firm made a secondary offering a month later, and by that time many other companies had been launched. Gouda, Delft and Schiedam were next, and their share prices followed a similar trajectory in August and September. After a drop following their initial offerings their shares rose sharply – increasing from the pre-September lows by as much as 100% to 300%. These brief spikes may not have been comparable in scale and duration to the bubble in West India Company shares, but they were evidently perceived by some market participants as such.

Following the entry of Gouda, Delft and Schiedam, came a flood of new issues at the end of September and the beginning of October; just as the global crisis hit London and the Netherlands. Note the density of initial public offerings and transactions in the Netherlands in September in this brief interval. The Dutch new issues market lasted a brief two months. All shares traded down in November and towards the close of the month trading dried up. Share quotations are virtually lacking in December. The *Leydse Courant* stopped quoting share prices in January, 1721.

The financial bubble in Holland began later than the bubbles in France or Britain, and it came to a conclusion with the fall in company shares. Appendix 2 reports the maximum trough to peak percentage gain for the full sample of Dutch firms. The average was 127%; much lower than the average maximum percentage gain in the London bubble. This is consistent with the claim of Gelderblom and Jonker (2009) that the Dutch bubble was smaller in scale than the British and French bubbles.

Assessing the economic significance of the bubble in the Netherlands based upon the peak to trough range of prices may be misleading, however. Coming in September and October at the tail end of the global bubble sequence, many of the new firms were launched even as the British companies were falling. The new Dutch data do, however, support the relative importance of speculation about insurance, and also about potential the expansion of the rights of the corporation. In Appendix 2 we report the stated intent of the new Dutch firms launched in 1720, gathered from their founding documents. The majority of the Dutch companies were launched as insurance firms, but they typically claimed other lines of potential business. It is telling that the charter of Stad Rotterdam mentions the competitive challenge of the new British insurance companies in

motivating the need to launch the firm.³² This suggests that the Dutch were worried about the power of the new publicly issued insurance company, but also excited about its potential.

There was clearly more to the Dutch IPO bubble than the insurance trade, however. Unlike earlier corporations which focused on a single enterprise, these new Dutch firms were established to conduct a variety of commercial activities and trade. This included financial operations, manufacturing, fishery, shipping and infrastructure development.

IV.6 Consequences of the Crash

The crash in the equity markets was a significant setback for financing of enterprise. The success of the public insurance corporation depended on the external demand for shares and the availability of public investment capital. These dried up with the global contraction of securities markets following the crash in Great Britain. Had the global crash not occurred, public investment in marine insurance underwriting at least in The Netherlands might have continued. After 1720, many of the new Dutch firms closed and returned shareholder capital (or issued financial substitutes such as life annuities). A few firms survived and prospered. The Middelburg commerce company became a major player in the Atlantic economy – including the slave trade – in the late 18th century. Stad Rotterdam also fulfilled the promise of the potential of a publicly capitalized insurance corporation. It survived and prospered to become one of the largest insurance companies in continental Europe, eventually merging with the financial giant Fortis.

The survival of Stad Rotterdam, London Assurance and Royal Exchange Assurance into the modern era proved the long-term viability of incorporated insurance companies. Given that the average peak to trough price increase for most of the Dutch companies was comparatively modest, it is difficult to view investors of the time as wild speculators. The underlying rationale for investing at the time – i.e. an innovation in the financing of marine insurance underwriting, does not appear to have been unreasonable.

³² Anonymous, 1720, *Het Groote Tafereel de Dwaasheid*, p. 25.

One result of the crash in all three countries was a decrease in the opportunity set for many investors. While lotteries continued through the 18th century to meet the demand for right skew distributions, these rarely channeled speculative capital into growth-related enterprise. Macleod (2008) points out that the earlier IPO boom in Britain was followed by an increase in public-sponsored lotteries; in effect crowding out the demand for stocks.

V. Technology and Stock Market Bubbles

Pastor and Veronesi (2009) build a theoretical model for share price development during times of technological revolutions. In essence, their model posits that when an innovation takes place, it is optimal for companies to invest a small amount in the new technology. They learn about possible productivity gains from the innovation. If the gain is sufficiently large the new technology is gradually adopted across firms. This strategy of gradual adoption has important implications for both risk and share prices during the set up phase of financial discoveries. Pastor and Veronesi (2009) explain that the cash flow effect dominates in the early stage. The expected productivity gain drives share prices up through increased expected future cash flows and firm betas consequently decrease. However, in the second stage, the discount rate effect dominates the cash flow effect. The broad adoption of the new technology increases systematic risk and drives up discount rates and betas of the new economy companies. As the character of risk changes from idiosyncratic to systematic, share prices also begin to fall. An essential feature of the model is uncertainty at the outset, and resolution that leads to revaluation.

The evolution of risk is also reflected in the relative volatility of the new and old shares in the economy. Pastor and Veronesi (2009) predict that the volatilities of the new and old economy both bubble, but that the bubble in share price volatility of new technology stocks is much larger than the old stock price volatility. They test their model empirically on the Nasdaq bubble in the nineties and the railroad mania halfway the nineteenth century and find that the empirical patterns in share prices, betas and volatilities closely follow the predictions of the model.

In this section we study the role of innovation in the 1720 bubble. We examine the patterns in betas and volatilities through the year 1720 in the British stock market. To construct market factors and compute betas and volatilities for the different sections (new and old) of the economy, we first remove outliers and interpolate missing observations in the return series³³. We classify the new insurance companies (London and Royal Exchange Assurance) and the South Sea Company as new companies and the remaining (Old East India, Million Bank, Bank of England and Royal African Company) companies as old. We compute market betas and volatilities for both sections over a rolling window of 45 daily returns.

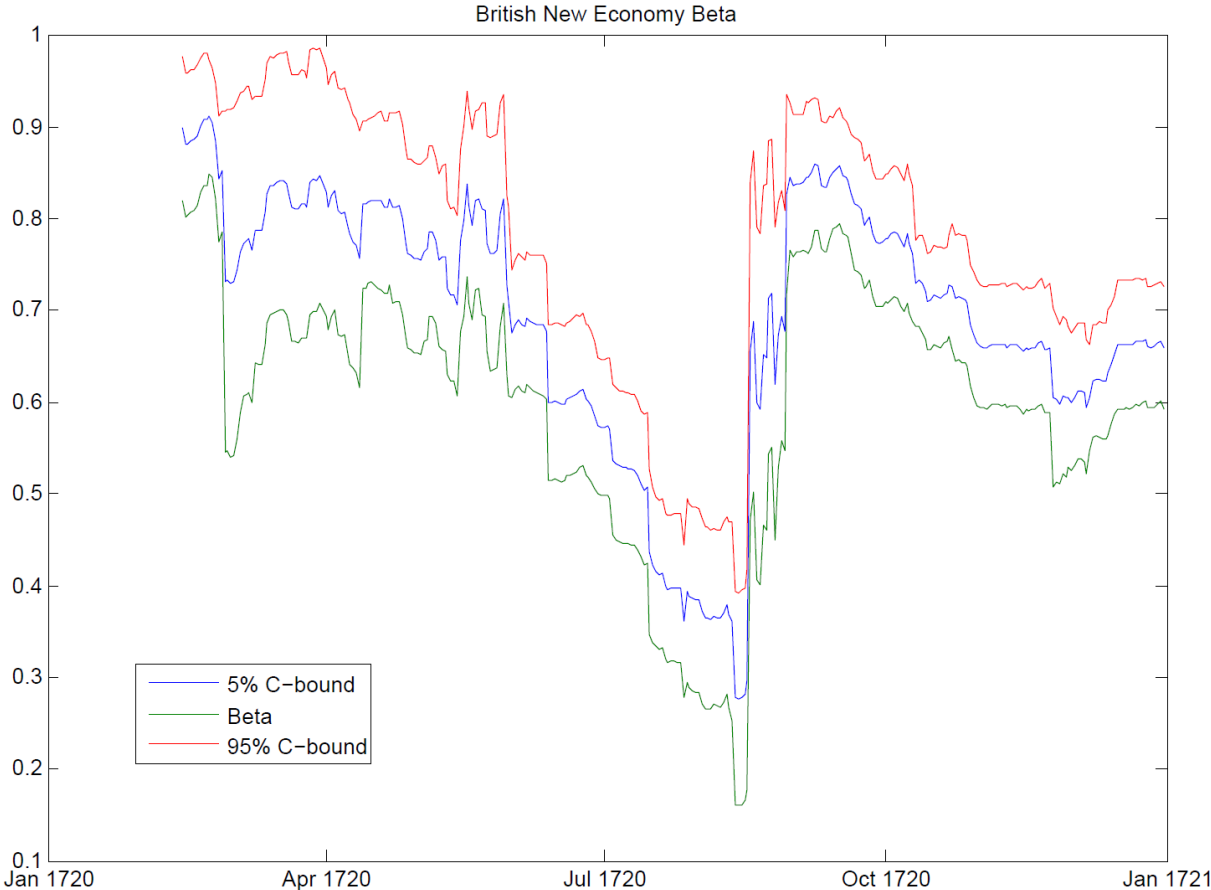


Figure 5: British New Economy Beta. This figure shows the time series of a rolling window beta for British 'New Economy' stocks from January 1 1720 to December 31 1720. Betas are estimated over a 45 day

³³ We remove returns larger than 90% or smaller than -90% and maximally interpolate over a period of three weeks.

period. All shares for which price data is available are classified as either 'New Economy' or 'Old Economy'. The 'New Economy' consists of the South Sea Company, London Assurance and Royal Exchange Assurance, whereas The Bank of England, Royal African Company, Old East India Company and Million Bank are classified as 'Old Economy' shares. Betas are measured against an equally weighted market factor of all shares for which price data is available.

Figure 5 displays the beta of the new economy stocks over the year 1720 with corresponding confidence bounds. The development in beta over the year 1720 is strikingly similar to the theoretical prediction by Pastor and Veronesi (2009) in their Figure 4A. As the cash flow effect dominates, the betas gradually drop. Thereafter the discount rate effect takes over and an increase in betas is documented. After the full-scale adoption of the new technology, betas decrease again.

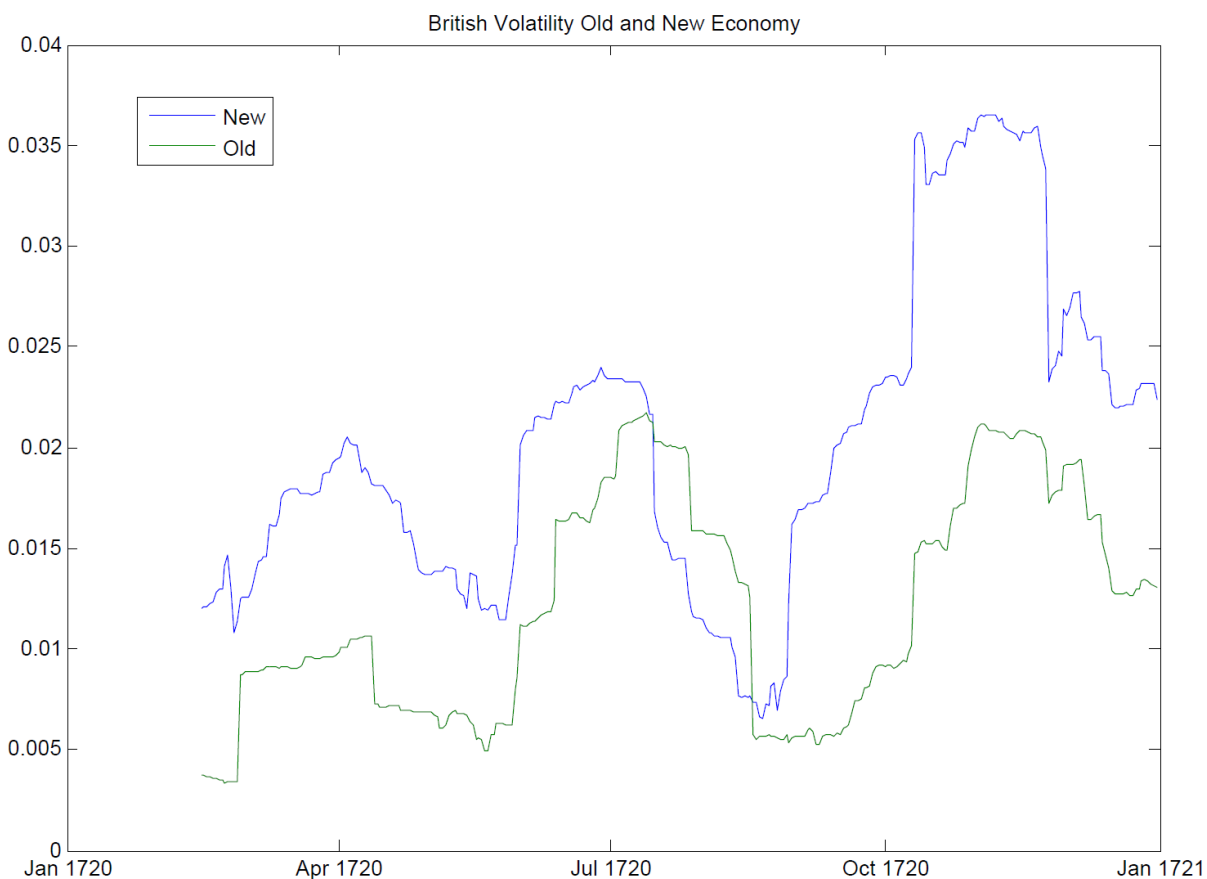


Figure 6: British Volatility Old and New Economy. This figure shows the time series of share price volatility for British ‘New’ and ‘Old Economy’ stocks from January 1 1720 to December 31 1720. All shares for which price data is available are classified as either ‘New Economy’ or ‘Old Economy’. The ‘New Economy’ consists of the South Sea Company, London Assurance and Royal Exchange Assurance, whereas The Bank of England, Royal African Company, Old East India Company and Million Bank are classified as ‘Old Economy’ shares. Volatilities are computed over a 45 day interval.

Figure 6 also shows evidence consistent with the predictions of the theoretical model. As expectations of future cash flows are most important in the early stages, volatilities are expected to drop, as documented in Figure 6. Thereafter the new technology is gradually taken on and the risk of the new technology transforms from idiosyncratic to systematic, increasing stock return volatilities of both old and new stocks. More specifically, the increase in volatility of the new shares is larger than the increase in volatility of the other shares. Finally, the full adoption of the new technology leads to a

drop in share price volatilities, where the drop in new shares exceeds the drop in old shares. Schwert (1990) studies volatility during the 1987 stock market crash and shows that after the crash volatilities returned to pre-crisis levels unusually quickly. Figure 6 shows that this is not the case for the South Sea Bubble.

Also from a perspective of timing, figures 5 and 6 show trajectories similar to Pastor and Veronesi (2009), beginning with try-outs in early June and ending in full-scale adoption by the end of November. The findings are robust to the length of the estimation window, subsampling, interpolation periods, outlier removal, classifications of old and new and weighting of the market factors³⁴.

V.2 Information and Price Triggers

Given our findings that the bubbles in equity shares in 1720 had more than a single, driving factor and evolved at different rates throughout the course of the year, it is puzzling that all stocks should crash at about the same time. Abreu and Brunnermeier (2003) attribute bubble-like patterns in share prices to a lack of synchronization among informed investors to attack the bubble. As pointed out previously, the catalyst for the crash was likely to have been the revelation of financial distress of the leading bubble companies in Great Britain. This is inconsistent with the uncertainty resolution hypothesis. By contrast, in The Netherlands, the immediate, rapid, universal adoption of joint stock financed insurance underwriting does seem to match the Pastor and Veronesi (2009) scenario.

VI. Conclusion

The cross-sectional evidence from British and Dutch firms in 1720 does not directly allow a test of whether investment in shares at the time was economically rational. Instead, it provides more information about the nature and timing of investor expectations.

³⁴ The results of the robustness tests are not reported but available on request.

The data for major British companies suggests that expectations (rational or not) about the Atlantic trade may have been an important factor. The differential between the South Sea Company and the East India Company in the British market is matched by the differential between the Dutch East and West Indies Companies. This hypothesis is supported by a test of the size of the bubble using another data set of “bubbles.” The bubble in other Atlantic-trade firms, excluding the Royal African Company and the South Sea Company, also exceeded the maximum growth in East Indies Company shares in 1720.

We have price records for nine major firms over the year 1720; two from the Netherlands and seven from Britain. Of these, the share prices for the three firms engaged in the Atlantic trade: the South Sea Company, the Royal African Company and the Dutch West Indies Company were higher at the end of 1720 than at the beginning.³⁵ Although their prices increased by multiples in the middle of the year and then dropped considerably from their highs in 1720, as a group, they experienced a permanent price improvement. Firms engaged in other industries had mixed results. This cross-sectional evidence suggests that the “bubble” may have been based upon some fundamental common factor that justified a value increase. While investor irrationality may have carried prices to many multiples of their post-crash value, the bubble speculation may have anticipated some long-term permanent effect.

The cross-sectional data also show that speculation in insurance companies was another important factor in the bubble. The chartering and incorporation of insurance companies in the early 18th century was a financial innovation. It extended the potentially valuable feature of limited liability to firms that dealt in risk. Before this transition, insurance was provided by underwriters operating alone or in syndicates that pooled capital. With the transition to corporations came broader access to public capital. The new, liquid stock markets gave the public insurance firms the capacity to increase their capital base and to diversify their risks. These may have been perceived as valuable financial innovations at the time. Our data provide an opportunity to test recent theory about the evolution of security prices during periods of technological change.

³⁵ South Sea = 45% gain, Royal Africa = 91% gain and West Indies Company 51% gain.

Within the limits of our data we test the implications of Pastor and Veronesi (2009)'s theory and find support for them. However, our findings are also in line with Temin and Voth's (2004) theory of rational investors riding a bubble in asset prices or Abreu and Brunnermeier's (2003) lack of coordinating mechanism among rational investors. The stylized facts of the South Sea Bubble can therefore not be used to test rationality of bubble investors.

In summary, a view of the stock prices of more than thirty traded companies, and the price gains in 1720 of another forty additional firms provides a useful perspective on the bubbles in South Sea Company and Mississippi Company shares. While the actions and price dynamics of these two major companies have dominated the historical study of the period because of their major scale, a cross-sectional perspective suggests that the basis for speculative enthusiasm at the time may have been connected to long-term prospects for Atlantic commerce, and the recent innovation in the organizational form of insurance companies. Our test of theory suggests that the price dynamics interpreted as a bubble may reflect the rapidly changing understanding of the economic effects of innovation.

***Appendix I: Maximum Growth for London Companies, 1720
Highest price paid and nominal value of share***

<i>Company</i>	<i>Industry</i>	<i>Nom. Value or Lowest Mkt Value</i>	<i>High Price</i>	<i>Growth</i>
Manuring of Land	Service/Utility	1/8	1 1/2	1100%
Furnishing of Funerals	Service/Utility	2 1/2	15	500%
Liverpool Water Supply	Service/Utility	10	20	100%
Improvement of Land	Real Estate	5	20	300%
East India Company	Pacific	100	449	349%

Building or Buying ships for Freight	Marine	1	15	1400%
Navigation of the River Douglas	Marine	5	70	1300%
Grand Fishery	Marine	1/2	5	900%
Orkney Fishery	Marine	25	250	900%
Whaling Co.	Marine	1/2	3 1/2	600%
Royal Fishery	Marine	10	25	150%
Temple Brass Mills	Manufacture	10	250	2400%
Royal Lustering Co.	Manufacture	5 1/8	105	1949%
Water Engine	Manufacture	4	50	1150%
Stockings Frame-work Knitters Co.	Manufacture	2 1/2	30	1100%
Irish Sail Cloth	Manufacture	1/4	1	300%
Puckle's Machine Gun	Manufacture	4	8	100%
General Insurance	Insurance	1/8	8	6300%
London Assurance Co.	Insurance	5	175	3400%
York Buildings Co.	Insurance	10	305	2950%
Royal Exchange Assurance	Insurance	10	250	2400%
British Insurance	Insurance	1/8	3	2300%
Rose Insurance	Insurance	1/2	4	700%
Life Insurance	Insurance	1/2	4	700%
Marine Insurance	Insurance	1	3	200%
Sun Fire Office	Insurance	10	20	100%
Gold Mining Co.	Commodity	1/2	16	3100%
Welsh Copper Co.	Commodity	4 1/8	90	2082%
English Copper Co.	Commodity	5	105	2000%

Rock Salt	Commodity	1 1/4	15	1100%
Hemp and Flax	Commodity	1/8	1 1/2	1100%
Melioration of Oil	Commodity	5	60	1100%
Saltpetre	Commodity	1/8	1 1/2	1100%
Flax and Hemp Growing in Pennsylvania	Commodity	2 1/2	28	1020%
Trading with Hamburg	Commodity	15	120	700%
Drying Malt by Air	Commodity	1/8	1	700%
Supplying Coals from Newcastle	Commodity	1/4	1	300%
Holy Island Salt	Commodity	5	15	200%
Westley's Actions	Bank/Finance	2	12	500%
Million Bank	Bank/Finance	100	440	340%
Bank of England	Bank/Finance	100	265	165%
Bahama Islands	Atlantic	3	40	1233%
South Sea Company	Atlantic	100	1050	950%
Royal African Company	Atlantic	24	200	733%
Pennsylvania	Atlantic	5 1/4	40	662%
Based on the Bubbler's Mirror print	Means:	13 1/4	102	1172%
from Scott vol.1 page 420	Mean (par-weighted)			670%

Appendix I: Maximum Growth for London Companies, 1720. This table reports the maximum growth for each British share in the year 1720. The growth rate is based on the minimum of the par value or the lowest reported market value of the share (column 3) and the maximum of the market price (column 4). In column 2 we report the industry for every individual firm.

Appendix II: Maximum Growth for Dutch Companies, 1720

<i>Date</i>	<i>increase</i>	<i>Primary</i>	<i>Mention Insurance</i>
WIC	647%	Intl. Trade	
Middelburg Commercie	406%	Commerce	
Schiedam	325%	Commerce	Insurance
Edam	300%	Commerce	
Monnikendam	278%	Commerce	Insurance
Utrecht	275%	Commerce	Insurance
Delft 1st Subscription	118%	Insurance	Insurance
Gouda	106%	Insurance	Insurance
WIC 1st Subscription	103%	Intl. Trade	
Naarden	100%	Manufactur e	
Weesp	100%	Commerce	Insurance
Muiden	100%	Commerce	Insurance
Medemblik	100%	Commerce	Insurance
Rotterdam 1st Subscription	76%	Insurance	Insurance
Dordrecht	64%	Commerce	Insurance
Den Haag	50%	Finance	Insurance
Maassluis	50%	Commerce	Insurance
Rotterdam 2nd Subscription	42%	Insurance	Insurance
Vlaardingen	40%	Marine	Insurance
OIC	39%	Intl. Trade	

Middelburg Assurantie	39%	Insurance	Insurance
WIC 2nd Subscription	33%	Intl. Trade	
Alkmaar	33%	Commerce	Insurance
Zwolle	33%	Marine	Insurance
Hoorn	0%	Commerce	
Veere	0%	Commerce	
Brielle	-7%	Commerce	
Enkhuizen	-10%	Commerce	Insurance
Purmerend	-17%	Commerce	Insurance
Mean	127%		

Appendix II: Maximum Growth for Dutch Companies, 1720. This table reports the maximum growth for each Dutch share in the year 1720, as reported in the Leydse Courant. The growth rate is based on the the par value and the maximum of the market price (column 4), and therefore possibly negative. In column 3 we report the primary industry for every individual firm, based on the company prospectus and in column 4 we indicate if the firm mentions insurance as a possible line of business in its prospectus.

Appendix III

The interpretation of price quotes

One of the problems in the analysis of the price data from Holland in 1720 is the question of how the price quotations should be interpreted. Share or subscription prices were not quoted in currency, but in a percentage in excess of some value. Scholars to date have disagreed on the interpretation of this value. We address this basic question through examination of the language used in the price lists in 1720, and by matching share loan transactions in the books of one company to the documented market quotations. The benefit of matching price quotes to company transactions in their shares is that the books were kept in units of currency.

Price quotes in the *Leydse Courant* typically were given in sentences such as: "Rotterdam: Today the shares of our company were traded for prices ranging from 52 to 56 percent *avans*". Intervals like this are not uncommon due to the high daily volatility; especially in the rise of the bubble the morning prices differed substantially from evening quotes. A key question posed by these quotes is of course, what is meant by "*avans*"? What amount is the quotation in excess of? This question is more challenging than it appears. Shares were issued through subscriptions that required capital calls. Thus, the relevant multiplicand might be interpreted as the capital paid in to the company up to that date [the paid in capital] or it might be interpreted as the face value of the share after all the shareholder installments are paid -- something we now often refer to as the par value or nominal share value.

It is therefore not surprising that previous authors have debated the interpretation of these quotes. For example:

van Rijn (1899) presumed that the *avans* referred to the nominal (or fully paid in) value of the share, and that additional paid-in capital represented a fraction that incremented the quoted price.³⁶

There is logical because newspaper percentages could not practically be based on the amounts paid-in. The paid-in capital increased over time and the exact amount paid-in was therefore uncertain until the books were closed and the paid-in amounts computed. If newspaper percentages were based on the amount paid-in, the newspaper percentages would have to drop after the payment of an installment; if the market share price does not change and more capital is paid-in, the percentage decreases by construction. Also, share holders often had two or three weeks to pay their next contribution. If the quoted share price were a percentage of the amount paid in, during the weeks of the payments newspapers would have to differentiate between shares for which the payment had been made and shares on which the payment was still required. Obviously, no such difference is documented in the newspapers.

Smith (1919) concurs with this interpretation: "The share price was recorded in percentages "avans", i.e. it indicated the percentages to be paid in excess of par value, calculated based on the amount which, with respect to the nominal amount traded by the company as installment was demanded."³⁷ Likewise, Slechte (1982): "In the first two months the prices fluctuated between 100 and 80%, but dropped in September and

³⁶ "The furnishment up till 80% of the shares of the first subscription is also foolish and absurd, since the amount furnished in these shares exceeds the market value of the original shares, i.e. 15% has been paid in on the subscription shares, to demand an additional 65% would be highly unfair ... The shares of the first subscription have already been traded at 38%, together with the paid-in amount of 15% this makes 53 percent, if an additional 65% were to be paid in then these shares would be worth 118%, this would be unreasonable ... If ... on the old shares 75% had been paid in, these would now be worth 3750 guilders, so a share of 1000 guilders would be worth 750 guilders."

³⁷ Original Dutch text: "De koers werd genoteerd in procenten "avans", dus men gaf aan hoeveel procenten boven pari betaald moest worden, te berekenen over de geldsom, die, met betrekking tot het verhandelde nominaal bedrag, door de compagnie als storting was geëischt."

October to 60%. The Rotterdam shares ... were therefore on average priced at 4000 guilders in this period.”³⁸

Despite their general agreement, none of the earlier authors offered empirical evidence supporting their interpretations. Thus, we sought to reject or verify their calculations of monetary share prices by matching transactions in the *Leydse Courant* with company records.

After the burst of the bubble at the end of September 1720, the directors of Stad Rotterdam made non-recourse loans to directors using their shares as collateral. If share prices fell during the maturity of the loan, the company incurred the loss. This arrangement could be interpreted as beneficial to shareholders because it was a means to reduce the “float” of shares by keeping directors from dumping into a falling market. It could also be interpreted as pure self-dealing by directors. In either case, these transactions allow us to link the market quotes to currency-valued transactions.

On pages 37 and 142 of the general ledger of Stad Rotterdam, some of these share loans are recorded in prices that match quotations reported in the *Leydse Courant* for the same day.³⁹ Since the ledger accounts are recorded in guilders, we can ascertain that the newspaper prices are reported in percentages of the nominal share value (5,000 guilders for the Rotterdam company). The losses incurred in these loan transactions also appear on the profit and loss account of the Rotterdam company (page 9 of the general ledger account).

A simple example of our interpretation is useful. Suppose that Rotterdam shares [with 5,000 guilders nominal value] are trading for 2,500 guilders on a certain date and that up until that date 1% had been paid in. Then the *Leydse Courant* quote of 49% *avans* would imply the following: ‘Rotterdam is trading today at 50% ($2,500/5,000 * 100\%$) or

³⁸ This quote is in line with our interpretation as the nominal value of a share of the Rotterdam company was 5,000 guilders. The quotes are hardly affected by paid in capital since typically very little was paid in.

³⁹ Gemeentearchief Rotterdam, archive no. 199 inventory no. 451, pages 37 and 142.

49% of the par value of the share above the paid-in capital $((2,500 - 1\% * 5,000) / 5,000) * 100\% = 49\%$.

This convention was convenient during weeks of installment payments. It allowed investors to distinguish between shares on which the installment has been paid and shares on which the installment still needed to be paid.

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