

# Marine Insurance in Britain and America, 1720-1844: A Comparative Institutional Analysis

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## Abstract

By the mid nineteenth century, the British marine insurance market was dominated by Lloyd's of London, a marketplace in which voyages were underwritten by private individuals. In contrast, marine insurance in other countries, including the United States, was carried out mainly by joint-stock corporations. This paper examines the historical evolution of the marine insurance industry in Britain and America during its critical formative period, focusing on the information and agency problems which were inherent to the technology of overseas trade at the time, and on the path-dependent manner in which the institutions which addressed these problems evolved. We argue that the market was characterized by multiple equilibria because of a potential lemons problem. The regulatory environment produced by Britain's Bubble Act, and exogenous shocks including American Independence and the Napoleonic wars, combined to bring about a bifurcation of institutional structure, the effects of which persist to the present day.

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# 1 Introduction

Recent works on institutions in economics have emphasized the importance of understanding institutional change (Aoki 2001; North 2005). This paper explores the nature of institutional change in the marine insurance industry during the eighteenth and early nineteenth centuries. Marine insurance played a vital role in facilitating the expansion of trade during this period, but the industry evolved in different ways in different countries. By the mid nineteenth century, the British marine insurance market was dominated by Lloyd's of London, a marketplace where private individuals risked their personal fortunes by insuring vessels and cargoes with unlimited liability. In contrast, in most other countries, including the United States, private underwriting had virtually disappeared, and marine insurance was predominantly carried out by joint-stock corporations which insured vessels on the surety of their capital stock. To account for the success of private underwriting in Britain and its demise in the United States, we will focus on the information and agency problems which were inherent to the technology of overseas trade at the time, how different kinds of institutions arose to address these problems, and how exogenous and endogenous changes in the political, legal and economic environment affected the evolution of these institutions over time.

Broadly, the argument is as follows. In eighteenth century Britain, the Bubble Act of 1720 temporarily limited the development of marine insurance corporations, thereby enabling Lloyd's coffee house to develop as a center where individual private underwriting could flourish. Lloyd's became a hub for information about ships and their crews, trade routes and political developments, and the many other factors which would affect the riskiness of a voyage, and also for reputational information about trading partners, which helped partially overcome various agency problems inherent to marine insurance at the time. Over time, its role gradually evolved in the shadow of the Bubble Act as a variety of informal and later formal organizations, laws, specialized roles, and mechanisms for sharing information developed and were adapted to a market dominated by private underwriting. In particular, the extended period of heightened risk in international commerce resulting from the Napoleonic wars (1793-1815)<sup>1</sup> led to boom years in marine insurance, and a period of accelerated institutional development at Lloyd's. By the time the Bubble Act was repealed in 1824, enabling joint-stock corporations to enter the market, Lloyd's had gained an institutional sophistication which enabled

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<sup>1</sup>For simplicity, we will refer to the entire series of wars which took place between 1793 and 1815 as the Napoleonic wars.

it to survive the competition, and it remains an important center for marine insurance today.

In contrast, the American marine insurance market was freed from the Bubble Act's restrictions before the start of the Napoleonic wars, and private underwriting was rapidly extinguished as marine insurance corporations developed during the wars.

We argue that the dominance of private underwriting in Britain, and its demise in the US, can be explained by the role of information. Marine insurance transactions were fraught with information asymmetries and agency problems. In the British market, which was dominated by a well-developed market for private underwriting, corporations faced a lemons problem because of their inferior ability to assess risks. In the US, where private underwriting was less well developed, corporations faced no such lemons problem. Thus, the market was characterized by multiple equilibria. We further argue that the timing of exogenous changes including American independence and the Napoleonic wars, together with the endogenous development of Lloyd's and its legal environment, gave rise to a path-dependent evolution of marine insurance institutions and a bifurcation of institutional structure between Britain and the rest of the world.

In the next section, we describe the relevant technological constraints facing marine insurance in the eighteenth century, which successful marine insurance institutions needed to try to overcome. Section 3 discusses the history of the British marine insurance market, and the emergence of Lloyd's as the dominant center, stressing its role as an information hub. Section 4 describes how the American market developed and the process by which corporations came to dominate marine insurance there. In Section 5 we show how a lemons problem can account for many aspects of the observed behavior and institutional development. Section 6 briefly discusses how the market developed in other countries. Section 7 concludes.

## 2 Marine Insurance in the Eighteenth Century

In a marine insurance contract, an insurer (“underwriter”) agrees to assume some portion of the maritime risks on a vessel or cargo, or both, in exchange for a premium. The risks covered may include a variety of risks at sea or in port, for a particular voyage or for a period of time. The hazardous nature of maritime commerce during the Age of Sail made marine insurance a crucial input in the expansion of trade, and this impelled the development of increasingly

complex institutions for sharing marine risks. In the middle ages, contracts such as “loans on bottomry”, which were repayable only if a voyage was successful, had served a marine insurance function. By the seventeenth century, modern, premium-based marine insurance was familiar, and contractual forms were relatively standardized. However, marine insurance corporations had not yet emerged, and underwriting was still carried out entirely by private individuals, frequently themselves merchants, who underwrote specific risks on an individual case-by-case basis (several private underwriters each covering portions of a risk).

Marine insurers in the eighteenth century had to contend with numerous sources of uncertainty, and complex informational asymmetries, which created agency problems for both the insurer and the insured. We can separate these information and agency problems into three main categories.

Firstly, the probability of a ship or its cargo being lost or damaged (and therefore, the appropriate premium) depended on numerous risk factors including the distance, the route, the season, the age and seaworthiness of the ship, and the quality of its crew and armament, as well as, in wartime, the danger of capture by enemy naval vessels and privateers, or of seizure in a foreign port. Some of this information could be taken into account by the underwriter when determining the premium. Often, however, the merchants seeking insurance were more familiar with the ship and had better information about other aspects of the risk.<sup>2</sup> As we will see, this asymmetric information created a potential adverse selection problem.

Second, there were many possibilities for moral hazard on the part of the insured. These ranged from excessive risk-taking, such as sending unseaworthy ships to sea, or attempting to bring goods to a blockaded port, to outright frauds, such as deliberately sinking a ship, mis-representing the value of the goods, insuring the same goods multiple times, or seeking to insure a ship already known to have been lost.<sup>3</sup>

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<sup>2</sup>Merchants could try to convince the underwriters of the quality of the vessel and crew. The problem, of course, was to convey this information credibly. For example, in 1749, New York merchant Gerard Beekman, requesting his London agents to get insurance for a slaving voyage, wrote: “I am Concerned in a fine Brigantine prim[e] Sailors Sailed 2 Days ago for the Coast of Africa with a fair wind the Captain Extreemly well acquainted have bin several Voiages there. hes a Sober honist and Industerous man the vessel mounts 6 Carrage guns 4 pounder . . . The Reason of my being so particular is to Prevent Any Disputes arising In case of Loss Misfortune and at the Same time am in hopes of the Vessell is so good and well found etc. that it may Save me one or two per Cent on the Premium . . . I hope youl git done at the Cheapest rate and Lett the underwriters be good. (White 1956: 73)”

<sup>3</sup>Frauds were common, and could be difficult to detect. In one instance, a shipowner took out several policies with different brokers in London, Hull, Glasgow, and Dundee to

Thirdly, the financial stability of the underwriters was a major concern for those buying insurance. Private underwriters could and sometimes did fail, particularly after a major disaster such as the loss of an entire merchant convoy to the enemy, as occurred on several occasions. Underwriters vulnerability was further increased by the fact that many underwriters were themselves merchants, whose fortunes might rise or fall with the success or failure of a voyage. As a result, merchants made diligent efforts to choose reliable underwriters, and were willing to pay higher premia to underwriters who were perceived as more financially secure.

All of these problems were exacerbated in wartime. Increased uncertainty arising from the risk of capture increased the demand for marine insurance and drove up premia, while the opportunities for profit and incentives for moral hazard on the part of the insured increased. Many underwriters made huge profits from the increased wartime premia, but others failed or dropped out of the market.

In the context of these ubiquitous informational asymmetries and agency problems, information was critical. In order to accurately assess the risk of a voyage, an underwriter had to have access to prompt and accurate intelligence on the movements and condition of particular ships, on political developments at home and abroad, and on the character of the merchant being insured and the captain of the vessel, as well as the experience to weigh this information correctly in order to determine what premium to charge. In the words of one contemporary underwriter,

An insurer ought to be constantly casting about for the earliest, the best, and the most circumstantial intelligence: - he ought to have a quick perception of the circumstances of the risque, and be able to reason well and instantly thereupon, in order to guard against concealments and misrepresentations; ... it is far more material to him to regard the *quality* than the *quantity* of the risques which he undertakes.<sup>4</sup>

Information, however, travelled slowly in the eighteenth century. Even from Scotland, information could take up to 2 weeks to arrive in London, and the latest news from foreign ports was frequently months old. Ships sometimes disappeared without a trace, and when a ship was lost or damaged,

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insure goods worth about £1,000 for £3,745. The ship was then deliberately sunk after some of the cargo had been secretly removed. The fraud was accidentally discovered, and the culprit narrowly escaped a death sentence (Jackson, 1971). For other examples, see, eg., Wright and Fayle (1928:10, 36); Weskett (1781); and Select Committee on Marine Insurance (1810), evidence of Throckmorton.

<sup>4</sup>Weskett (1781: 295); emphasis in original.

it was frequently costly, and sometimes impossible, to verify or disprove events which had occurred in distant ports or at sea.

Despite these difficulties, marine insurance provided crucial support for the expansion of trade throughout the eighteenth and nineteenth centuries. The market was able to function because institutions were created to mitigate the agency and information problems inherent to marine insurance at the time. What were the important characteristics of these institutions, and how did they arise?

### 3 Marine insurance in Britain, 1720-1844

In Britain, at the beginning of the eighteenth century, there were few specialist underwriters; many underwriters were merchants who wrote insurance on the side, but any wealthy individual willing to dabble could underwrite a policy. Although risks were usually shared among several underwriters, underwriters sometimes failed, either because of personal financial difficulties, or due to a more general catastrophe. For example, in 1693 many private underwriters had failed after 100 merchantmen in convoy were captured or destroyed in the Bay of Lagos by the French.<sup>5</sup>

The international character of marine insurance ensured that there was active international competition between underwriters. It was still common in the early eighteenth century for British ships to be insured abroad, especially in Holland, but as the commercial strength of Britain increased, an increasing amount of marine insurance was carried out in London.

Because of the information asymmetries and agency problems inherent to marine insurance at the time, up to date and accurate information was of particular importance for those involved in marine insurance. The most important centers of social and business activity in London at the time were the coffee-houses. In an era when newspapers were rudimentary, and the mail was slow and irregular - especially from distant ports - the coffee houses served as centers of information, primarily because of the news and gossip brought in by the customers themselves.<sup>6</sup> Different coffee-houses tended to

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<sup>5</sup>On the early history of marine insurance, see Barbour (1929) and de Roover (1945). For British insurance generally, see Cockrell and Green (1994), Raynes (1964) and Martin (1876). On Lloyd's, see Gibb (1957) and Wright and Fayle (1928). Supple (1970) and John (1958) discuss the history of the chartered corporations. Weskett (1781) is the most comprehensive contemporary guide. The evidence given to the Select Committee on Marine Insurance (1810) is also invaluable.

<sup>6</sup>See "The Internet in a Cup", *The Economist*, 20 Dec 2003 for a discussion of the role of the coffee houses as centers of business information in the eighteenth century.

specialize in attracting particular types of clientele. Merchants, underwriters, and others concerned with shipping frequented several coffee houses around the Royal Exchange and near the Thames, where relevant news and gossip was exchanged, and marine business including ship auctions and marine insurance was transacted.

### 3.1 The “Bubble Act”, 1720

Prior to 1720, nothing prevented unincorporated companies from selling insurance, and in fact, although there were no companies involved in marine insurance in Britain, several were active in fire and life insurance. However, in 1717, during the stock market boom which culminated in the “South Sea Bubble”, several groups of merchants and speculators began petitioning to obtain charters for joint-stock marine insurance corporations.

The promoters argued that the proposed corporations would provide cheaper and more secure insurance than the existing system of private underwriters. Private underwriters might become bankrupt, die, emigrate or abscond before a claim could be made, and their financial stability was frequently uncertain, especially in wartime. In contrast, corporations were potentially infinitely-lived, and could draw on a large fixed capital fund. Furthermore, because a corporation could sue and be sued in its corporate name, it would be easier for a merchant to recover losses, in the event of a claim, than if he had to recover losses from many individual underwriters separately. Corporations also expanded the pool of available capital by making it possible for those without specialist knowledge of marine risks, or with relatively modest amounts of capital, to act as insurers by entrusting their underwriting decisions to experts.

The proposed charters were opposed by merchants and private underwriters in London and Bristol, who claimed that the existing system was adequate, and that a monopoly would harm trade. Both sides in the debate, however, shared the expectation that if charters were granted, the corporations would drive private underwriters out of the market.

The argument was settled when the two main groups of promoters offered the King a £600,000 bribe (to pay off the debt on the Civil List) in exchange for charters. Two joint stock corporations (the Royal Exchange Assurance and the London Assurance) were subsequently incorporated as part of what later became known as the “Bubble Act” of 1720. The Bubble Act made it illegal for joint-stock companies to operate without a corporate charter. In all industries *except* marine insurance, however, other kinds of unincorporated companies, including partnerships and trusts, were still allowed, and businessmen were

later able to use these devices to create (highly imperfect) substitutes for the joint-stock business corporation (Harris, 2000).

Because of the bribe payment, however, marine insurance received special treatment: *all* firms and partnerships, apart from the two corporations chartered by the Bubble Act, were barred from marine insurance. Only private individuals, acting purely on their own account and with unlimited personal liability for losses, were still allowed to underwrite. The Bubble Act therefore created an artificial corporate duopoly in marine insurance, which had a tremendous impact on the development of marine insurance in Britain until its repeal in 1824.<sup>7</sup>

However, despite the apparent advantages of corporations, and contrary to expectations, private underwriting not only survived, but flourished after 1720. Except perhaps during their first few years of operation, the two chartered corporations probably never wrote more than 10% of all marine insurance business. In 1810, at the height of the Napoleonic wars, it was estimated that together they accounted for less than 4% of total sums insured, and that “both [corporations] added together would not exceed what two of the most considerable individual underwriters would write in one year”<sup>8</sup>. Ultimately, rather than extinguishing private underwriting, the competitive pressure from the corporations appears to have provided an added impetus for private underwriting to become more organized. Some private underwriting occurred in regional ports,<sup>9</sup> but the vast majority of the British marine insurance market became concentrated at Lloyd’s.

Why, contrary to expectations, did the two chartered corporations fail to dominate the British marine insurance market? This paper will argue that

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<sup>7</sup>The Bubble Act was repealed in 1825, but the clauses which governed marine insurance were repealed in 1824 (Harris 2000: 211).

<sup>8</sup>Select Committee on Marine Insurance (1810), evidence of Angerstein. One indirect measure of the proportion of underwriting done by the corporations comes from the revenue generated by Stamp Duty on marine insurance policies. Between 1805-1809, policies underwritten by private underwriters in London generated a total of £1,022,008 in revenue; policies underwritten by the corporations generated £43,848 (based on Martin 1876: 246).

<sup>9</sup>See, eg., Downs (2004), Jackson (1971) and Jackson (1972) on regional underwriters. Regional underwriters had the advantage of proximity and familiarity with local risks. In 1756, when New York merchant Gerard Beekman instructed his correspondents in Bristol to obtain insurance in London, where premia were cheaper, rather than in Bristol, they replied that “Insurance has been done in London at 7 Guineas [per cent] but we generall think the Rissque of having Underwriters we don’t know and difficultly of getting the money in case of a Loss is really worth more than one per Cent”. (White 1956: 608). On the other hand, because ships from regional ports tended to specialize in particular trades, it was harder to spread risk. In 1807, for example, Hull underwriters suffered unusually heavy losses as a result of the “Danish captures” (Jackson 1972: 152)



because of the manner in which private underwriting developed in Britain - in particular, the manner in which the private underwriters managed to overcome the information asymmetries and agency problems described in the previous section - the two chartered corporations faced a lemons problem. In the remainder of this section, we describe how the market developed. We will focus on the resulting lemons problem in section 5.

### 3.2 Development of Lloyd's, 1720-1793

Edward Lloyd's coffee house opened for business in the mid-1680s, and by the turn of the century, had become a center for ships news and other activity connected with shipping (Dawson, 1934). However, it is not known how much marine underwriting was done there prior to 1720. At most, it was only one of several venues in which marine insurance was carried out, and merchants, or brokers acting on their behalf, made their way between the coffee houses, seeking underwriters to subscribe their policies. But after 1720, Lloyd's gradually emerged as a focal meeting place for those involved in marine insurance. Merchants and shipowners, or brokers acting on their behalf, could get a policy underwritten there quickly and conveniently because of the number of underwriters in attendance, while underwriters in turn were lured there by the prospect of plentiful opportunities to underwrite. In this way, decades before it gave rise to any formal association for private underwriting, Lloyd's coffee house had become the center of the marine insurance market in London. By 1727, the London Assurance Corporation was regularly sending a clerk to Lloyd's to collect shipping news.<sup>10</sup> By the 1730s, the majority of British marine underwriting was being done at Lloyd's.

In order to compete with the corporations, the private underwriters had to overcome the three kinds of informational problems discussed in Section 2: collecting and interpreting the information needed to determine the correct premium; overcoming moral hazard problems such as fraud on the part of the insured; and generating confidence in the financial security of the underwriter. Business practices at Lloyd's, which emerged and evolved gradually over an extended period of time, managed to partially overcome each of these difficulties. We will consider each in turn.

First, to meet his customer's needs for shipping news, Lloyd made a deliberate and systematic effort to gather and disseminate the most accurate and up-to-date information on ship movements, political developments, and

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<sup>10</sup>This task was initially assigned to a junior clerk but later became one of the chief duties of the most senior clerk (Guildhall MS 8728 May 10 1727; 14 Sept 1737; 31 July 1751).

all kinds of information relevant to shipping. As early as 1693, the Hudson's Bay company had made a gift to Edward Lloyd in acknowledgement of "his intelligence of the companies ships" (McCusker 1997). Some of the news came from the customers themselves; but Lloyd also employed runners who went along the docks picking up news of arrivals, departures, losses, and other relevant gossip, and relaying this information to the coffee-house. He began to build up a network of correspondents who were paid to send him shipping information from domestic and foreign ports. He also cultivated a special relationship with the post office, the headquarters of which was near the coffee-house. In exchange for a fixed annual fee, letters addressed to Lloyd's were carried free of postage, sorted specially and held for collection by a Lloyd's messenger. The combined effect of these efforts was to give Lloyd's a "practical monopoly of complete and up-to-date shipping intelligence" (Wright and Fayle, 1928, p.75)

As the news was brought in, it was announced publicly from a pulpit built for the purpose. Lloyd had also begun publishing *Lloyd's News*, a news-sheet of shipping news, in 1696, and although the regular publication was short-lived, he continued to print sporadic newsheets detailing ships arrivals and departures, political developments and other news. In 1734, regular publication was resumed as *Lloyd's List*, which has been published ever since. In addition, by the early 1760s at the latest, and possibly much earlier, a committee of Lloyd's underwriters were employing surveyors to assess the condition of ships, and displaying this information in a register of ships which became *Lloyd's Register*.

Not only did Lloyd's have an efficient apparatus for gathering information, it also had an advantage over corporations in its ability to interpret that information effectively. This arose from the presence of a wide variety of groups of underwriters at Lloyd's with specialist knowledge of particular routes. This sort of expertise was particularly important on cross risks (voyages between two foreign ports). As one broker explained:

If I have a cross risk to make, if it is from America, I go to a box where there are Americans to give me information; and so it is from the Baltic or any other part . . . they are the people who can begin the policy for me better than the others, and I can by that means get it done. It is of no use applying to a Baltic merchant [to underwrite] on an American risk; he does not do it, simply because he knows nothing about it . . . There are so many people frequenting the coffee-house, that, even if an underwriter does not himself understand a question, he soon procures

information, and makes me master of the subject at the same time.<sup>11</sup>

Once a policy had been begun by a “lead” underwriter with the appropriate expertise, other underwriters, despite lacking specific knowledge of the risk, would subsequently often be willing to underwrite at the same premium.

In contrast, although the corporations were not excluded from Lloyd’s news service,<sup>12</sup> they did not have access to the same level of expertise in every market and local knowledge that the private underwriters, collectively, had, and this forced them to be conservative in their underwriting. Each of the corporations ultimately had to rely on the expertise of a single individual to make knowledgeable decisions about all proposals for marine insurance (Supple, 1970, p.200). After experiencing some cases of fraud, they became increasingly reluctant to cover cross risks,<sup>13</sup> and the risk of capture in a foreign port. On regular risks, their premia were generally 20-30% higher than at Lloyd’s. In section 5, we show how the superior access to information of Lloyd’s underwriters may have created a lemons problem for the corporations which can help to explain their conservatism in underwriting.

Second, there was the problem of moral hazard on the part of the insured: deliberate sinking of a heavily insured ship, for example. Contemporary accounts suggest that the trust generated through repeated interaction between merchants and brokers, and between brokers and underwriters, helped to reduce (though not eliminate) this kind of fraud. Reputable brokers frequently refused business from merchants and shipowners who they did not know, and had regular accounts with particular underwriters to whom they offered first refusal of their business. They could therefore get policies written more quickly, and at a lower premium, than brokers who were not well known and established.

Reputation also affected the settlement of accounts following a claim. Because of the uncertain timing of voyages in wind-driven vessels, marine

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<sup>11</sup>Select Committee on Marine Insurance (1810), evidence of Angerstein.

<sup>12</sup>It has been asserted that Lloyd’s began to supply the two chartered corporations with shipping intelligence in 1814 in exchange for an annual payment of £100 (Wright and Fayle, 1928, p.316). But in fact, at least by 1762, the London Assurance Corporation was making regular annual payments to the coffee-house masters for *Lloyd’s List*, and beginning in 1766 it also subscribed to “a register of shipping”, almost certainly *Lloyd’s Register* (Guildhall MS 8728/8, 13 Jan 1762 and 29 Jan 1766). Also, from as early as 1727, clerks of the London Assurance Corporation regularly attended Lloyd’s to gather shipping news (Guildhall MS 8728/2, 10 May 1727, MS 8728/4, 14 Sept 1737).

<sup>13</sup>For example, the London Assurance insured risks worth £23,505 between the West Indies and North America between 19 August 1730 and 27 July 1731, but only £705 on the same routes between 16 November 1768 and 4 September 1770 (John 1958, Table 1).

insurance contracts remained necessarily incomplete, and there were clear advantages to allowing captains some discretion in terms of the return cargo and route. As a result, underwriters often had opportunities to contest claims. Nonetheless, they were generally regarded as very generous in settling claims in cases where there had been an unanticipated change in the voyage, or a mistake which might have rendered the policy technically invalid. Their motivation for this generosity was straightforward: by maintaining a reputation for honest and open dealing with brokers and merchants whom they trusted, they would be offered future business and higher premiums. One of them stated, however, that “the private underwriters will settle the loss for a man of character, where they will not for a man whom they suspect”,<sup>14</sup> and brokers also preferred to confine their business whenever possible to men of “character”, who were prudent in their underwriting and not litigious in case of loss. Thus, all participants - merchants, brokers and underwriters - had an incentive to maintain a reputation for prudence, fair dealing and respectability.

The importance of these personal connections in constraining moral hazard gave Lloyd’s underwriters an important advantage over the chartered corporations. All underwriters had to be constantly on guard against fraud (Westkett, 1781), but the corporations were particularly vulnerable, and this made them especially inflexible and cautious in their underwriting. We will return to this theme in section 5.

Thirdly, there was the problem of the underwriter’s security. The corporations were widely regarded as more financially secure than the private underwriters.<sup>15</sup> However, although private underwriters did sometimes fail, such failures were surprisingly rare, even during the Napoleonic wars when several calamitous events produced large claims. Part of the explanation lay in the terms of credit granted to brokers in the collection of premia. Underwriters were bound to pay losses within a month of notification. However, they generally granted brokers generous terms of credit, often over a year, to pay premia. In turn, the brokers often allowed credit to the merchants, so that in effect, the premium was often not actually paid until after the risk had been run. This meant that at any time underwriters had, in effect, two sources of capital: their own private fortune, with full unlimited liability; and

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<sup>14</sup>Select Committee on Marine Insurance (1810), evidence of Angerstein.

<sup>15</sup>In 1748, for example, one American merchant explained his decision to insure with the London corporations : “I wrote thee lately that divers insurers were become bankrupts, and that more we looked upon as doubtful . . . we think it unsafe at present to apply to any of the policy brokers, but to get our business done either at the Royal Exchange, or London Assurance Office, tho the premiums may sometimes be rather higher, yet the safety in our opinion will more than answer the difference” (Gillingham 1933: 19).

a “premium capital” owed to them by the brokers for policies they had already underwritten. Even if an underwriter became insolvent, there were generally sufficient funds available from the fund of premia owed by the brokers to pay off any claims which might arise on outstanding policies.<sup>16</sup>

The underwriters’ were willing to grant such lenient terms of credit because of the brokers’ customary system of remuneration: brokers got 5% of the premium income, plus 12% of any net profits made by the underwriter on the account at the time accounts were settled. Therefore, it was in the underwriters interest to maintain a credit balance with the broker, so that if any losses should occur, in effect, 12% of the burden would fall on the broker.

Thus, business practices which emerged at Lloyd’s managed to partially overcome each of the three kinds of information and agency problems we described in section 2. Remarkably, these practices emerged despite virtually no conscious collective efforts by the inhabitants of Lloyd’s to design new rules or change old ones. Rather, Lloyd’s was “a striking example of evolution as distinct from creation. Conditions have been made, rules instituted not in preparations for new factors and developments, but to systematize a practice which had already been adopted to meet the requirements of commerce as they arose.” (Wright and Fayle 1928, p. 2).

The evolving legal environment during the mid-eighteenth century both reflected and reinforced the dominance of Lloyd’s. Until the mid eighteenth century, insurance cases had been decided for the most part in an unsystematic, ad-hoc way. However, Lord Mansfield, who was Chief Justice of the Court of King’s Bench from 1756-1788, took major steps towards rationalizing and setting out legal principles of insurance. The principles and precedents which Mansfield established were generally derived from mercantile practice and custom, and included the principle of “utmost good faith”, according to which any misrepresentation or concealment of facts by the insured, or deviations from the planned voyage without reasonable cause, would void a policy. Mansfield also simplified legal procedure, in particular, by eliminating the necessity for an insured party to bring legal actions against each underwriter separately in the event of a disputed claim (the “Consolidation Rule”). This strengthened private underwriting by removing one of the major advantages of insurance corporations over private underwriters - the convenience of having to bring only one lawsuit to recover a claim (Oldham, 1992).

The roles of the participants at Lloyd’s also continued to evolve. In the early 1700s, there were few specialist underwriters; most underwriting was done by merchants or wealthy individuals who underwrote on the side, but

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<sup>16</sup>Observations of the Select Committee on Marine Insurance (1810), p.171-2.

whose main business was elsewhere. Many of those who acted as brokers were also underwriters or merchants. Over time, as the scale and variety of commercial risks grew, these roles became increasingly distinct and specialized.

Thus, by the time of the Napoleonic wars, Lloyds had evolved procedures which collected and made efficient use of shipping information, and offered underwriters some protection against fraud (though instances of fraud were still by no means uncommon), while giving merchants and shipowners some protection against the possibility of underwriters insolvency. Although this system had evolved largely without conscious design, it worked so well that not only British, but also many foreign merchants and shipowners chose to insure at Lloyd's. London became the most important center of marine insurance in Europe, and the vast majority of all business done in London was done at Lloyd's.

The first elements of a formal organization began to emerge at Lloyd's towards the end of the eighteenth century. The process began in 1769, when a group of merchants, brokers and underwriters broke off from Lloyd's to form "New Lloyd's", and formed an ad-hoc committee to find new premises. The rebellion was successful, and within a few years, "Old Lloyd's" had disappeared and "New Lloyd's" again became simply "Lloyd's". But although the committee's purpose had been completed by 1774, and no formal terms of reference for its functioning had been defined, it continued to meet sporadically to discuss various issues which arose from time to time, and eventually formed the basis for the future development of the organization.

### **3.3 Development of Lloyd's, 1793-1844**

The process of formal institutional development accelerated greatly as a result of the Napoleonic wars (1793-1815). The wars substantially increased the risks of international commerce,<sup>17</sup> thereby increasing the demand for marine insurance, raising premia, and creating opportunities for profit for both merchants and underwriters. On average, high premia more than compensated underwriters for the increased losses, and although some failed, many underwriters made a fortune. The number of subscribers to the society of Lloyd's grew from less than 200 in 1775 to more than 2,000 by 1801. The two char-

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<sup>17</sup>The total number of ships on the Register of the British Empire in 1792 was 16,329. During the first nine years of the war (to April 1802), a total of 3,919 British ships were captured by the enemy, of which 799 were recaptured. During the same period, approximately 3,700 more were lost by marine risks (Wright and Fayle 1928: 183, 451). Of course, Lloyd's underwriters also insured many foreign (neutral) vessels. Insurance of enemy vessels, which had been common in earlier wars, was banned in 1793 (John 1958: 136).

tered corporations also prospered as their premium income grew (Figure 1), but they still commanded only a small fraction of the overall marine insurance market, which remained overwhelmingly concentrated at Lloyd's.

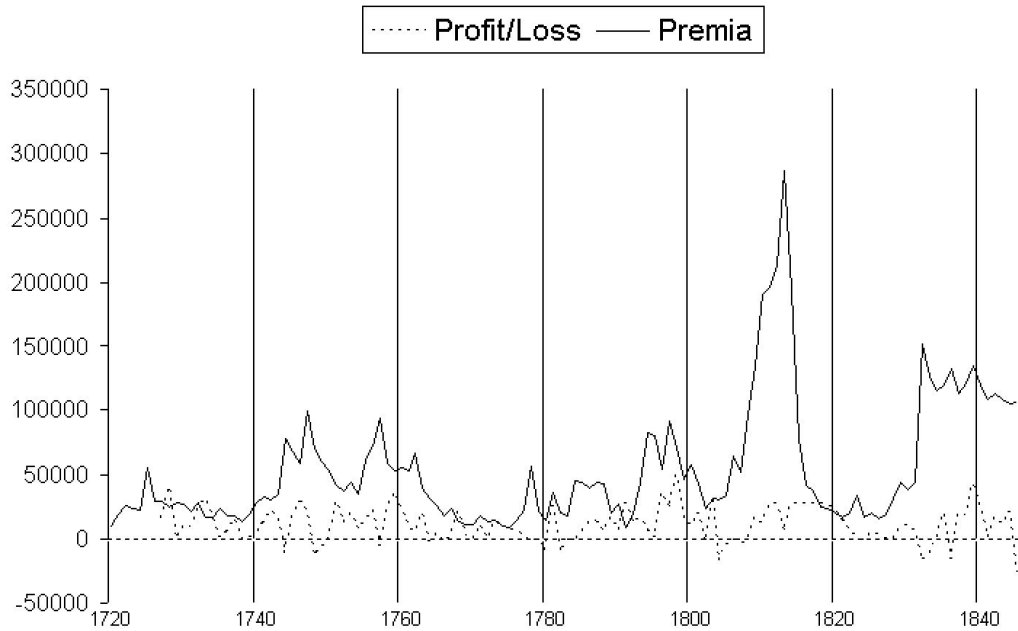


Figure 1: Profits and Premia of the London Assurance Corporation, 1720-1844. Source: Guildhall MS 8749A.

This growth in business provided the impetus for substantial institutional changes at Lloyd's. In 1796, the existing ad-hoc committee began to hold regular meetings and to issue an annual report. In 1800, in response to overcrowding in the subscriber's rooms, the exclusion of non-subscribers from the subscribers rooms was enforced and a rule was introduced requiring candidates to be elected to join Lloyd's.

In wartime, circumstances often changed rapidly, so prompt and accurate shipping, political and military news was more important than ever. At the start of the Napoleonic wars, Lloyd's news-gathering service was already far more efficient than anything the government possessed. Until 1804, Lloyd's correspondence was handled by the coffee-house masters, but as the volume of correspondence grew, this arrangement became unsatisfactory, so a secretary

was appointed to manage it. The secretary further developed and extended Lloyd's' intelligence gathering apparatus, for example, by appointing new correspondents abroad and subscribing to foreign newspapers.

In 1811, a dispute arose over losses in the Baltic, and it became clear that the lack of clear regulations governing the operations of the committee and the use of information were the root cause of the problem. In response, a Trust Deed was drawn up which turned the committee from an ad-hoc into an established body with 12 elected members, gave it control of the subscription funds, and bound subscribers to obey its regulations. The committee was empowered to act on behalf of the underwriters as a group, taking over formal responsibility for the general supervision of the intelligence system, for overseeing the election of subscribers, for appointing agents in ports to provide intelligence and other services. In 1792, Lloyd's had 32 correspondents in 28 ports. By 1820, 269 agents had been appointed.<sup>18</sup>

Thus, in response to temporary needs caused by the increased demand for marine insurance during the Napoleonic wars, Lloyd's had developed a formal structure, and had gained commercial and institutional strength.<sup>19</sup>

In 1810, an attempt to repeal the relevant sections of the Bubble Act failed in parliament by only 26 votes to 25, following a lengthy political battle.<sup>20</sup> A renewed effort to repeal the corporate duopoly finally succeeded in 1824, paving the way for an influx of new joint-stock corporations in the British marine insurance market. As in 1720, it was widely expected that this would mean the end of private underwriting.<sup>21</sup> By the 1820s, however, the boom years were over, premia were low, and the number of subscribers at Lloyd's was in decline. Whereas the Royal Exchange Assurance corporation, for example, had averaged profits of £32,500 per year during the turbulent years from 1793-1813, it made an average annual loss of £20,000 from 1814-34. Its annual premia, which had risen from an average of about £20,000 in the 1770s to over £500,000 at their peak in 1814, fell back to around £20,000 in 1821-5 (Supple, 1970, p.201). The experience of the London Assurance was similar (Figure 1). Several of the new companies managed to survive in this inhospitable environment, but many others failed (Palmer, 1984). After the 1844

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<sup>18</sup>Wright and Fayle (1928: 383).

<sup>19</sup>There were limits to this evolution. In particular there was no formal attempt to ensure the financial security of underwriters, and insurance business continued to be conducted strictly on an individual basis.

<sup>20</sup>Wright and Fayle (1928: 259-60).

<sup>21</sup>One contemporary underwriter, for example, believed that "if companies are sanctioned, individual underwriting must cease, as has been proved by the example of all other countries, more particularly by the recent example of America" (Marryat, 1810, p.265).



Joint Stock Companies Registration and Regulation Act enabled companies to obtain all the privileges of incorporation<sup>22</sup> simply by registering and meeting various legislative requirements, a large influx of new corporations substantially increased the degree of competition. Although growing trade volumes, and later, the American Civil War, made the 1850s and 60s better years for marine insurers, again, many of the new companies failed. Lloyd's, however, although it continued to evolve in significant ways in response to competition from the companies, weathered the competition and remained the major commercial force in the marine insurance market.

## 4 Marine insurance in America, 1720-1844

In the US, as in Britain, the Napoleonic wars had a decisive and lasting effect on the development of the marine insurance industry. However, in contrast to Britain, private underwriting had virtually disappeared in the US by 1815, and instead the business was carried on almost entirely by joint-stock marine insurance corporations.<sup>23</sup>

In colonial America, marine insurance was carried on much as it had been in Britain before 1720: merchants met in coffee-houses and taverns where they shared news and insured each others ventures; some of these merchants also brokered policies for their correspondents in other ports, and specialist brokers had begun to emerge. America had no major marine insurance marketplace that could compare with Lloyd's, but there were several active centers for private underwriting, such as the City Tavern in Philadelphia, which was frequented by about 50 underwriters in the years after the American revolution.<sup>24</sup> As ships brought news from London and elsewhere, this information was posted together with details of arrivals, departures and losses. Similarly in New York in 1759, there were two Coffee houses which functioned as meeting places for marine business (Harrington, 1935, p.154). Local underwriters had the advantage of proximity which enabled quick payment in case of loss, facilitated resolution of disputes, and avoided the necessity for merchants to rely on agents to represent their interests. Despite these advantages, however, colonial merchants frequently obtained insurance in London, because insurance in

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<sup>22</sup>Limited Liability was not a general feature of British corporations until 1855. However, all insurance companies had limited liability clauses in their policies (Shannon 1931: 282).

<sup>23</sup>On the history of marine insurance in America, see Huebner (1922). On the formation of corporations in general, see Davis (1917). On marine insurance corporations see, eg., Ruwell (1993), Fowler (1997), Gillingham (1933), Montgomery (1885).

<sup>24</sup>Before the Revolution, private underwriting in Philadelphia was concentrated at the London Coffee House; after the Revolution, it switched to the City Tavern (Carr 1967: 37).

London was cheaper, and the underwriters were regarded as more financially secure.<sup>25</sup>

The Bubble Act, which prohibited any joint-stock companies or partnerships (other than the two chartered corporations in London) from providing marine insurance, was extended to the American colonies in 1741. On occasion, however, individual underwriters joined together to form ad-hoc unincorporated “companies”. For example, in 1757, Thomas Willing and five other prominent Philadelphia merchants formed a company, each agreeing to underwrite one sixth of risks, but without assuming joint liability (which was prohibited by the Bubble Act). In essence, therefore, the “company” was in reality merely a syndicate designed to reduce the transaction costs of individual underwriting. The arrangement was terminated within a few years (Gillingham 1933: 31-33). Similar companies were later formed in Boston and elsewhere.

American Independence freed underwriters from the Bubble Act’s restrictions on joint-stock companies, and in the late 1780s and early 1790s, the newly-formed American states began to charter corporations for various purposes with increasing frequency.<sup>26</sup>

As in Britain, the Napoleonic wars created enormous risks and opportunities for American merchants.<sup>27</sup> Britain’s maritime superiority effectively closed off direct communications between France and its colonies, so at the outbreak of war, the French opened their colonies, including their West Indian colonies and the entrepôts at Ile de France and Bourbon, to trade with American vessels. Under the “Rule of 1756”, Britain refused to recognize the neutrality of vessels trading directly between France and its colonies, but American vessels were able to carry on the trade indirectly, by importing goods from French, Spanish and Dutch colonies to the United States, where they paid customs duties, thereby conferring neutral status on the goods so that they could be re-exported to France and the continent; while in the reverse

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<sup>25</sup>Insuring in London could be precarious, however. For example, orders for insurance in London were often sent on ships expected to arrive before the ship being insured. If the goods arrived before the ship carrying the order for insurance, then the premium was saved. However, this could backfire, as in the case of a London agent who received an order to insure a consignment of tobacco only an hour before news arrived that the ship had been lost, leaving the tobacco uninsured. See Joshua Johnson’s letterbook, 19 Feb 1774 (Price, 1979). The Beekman’s letters (White, 1956) contain further examples of this practice.

<sup>26</sup>Until 1799, virtually all business incorporation was by special act of state legislatures. The total number of charters to business corporations grew from 33 from 1781-90 to 295 from 1791-1800 (Davis 1917: 17, 22-5)

<sup>27</sup>On the American position during the Napoleonic wars, see Claunder (1932), and Phillips and Reede (1936) .

direction, European goods flowed indirectly to the colonies.

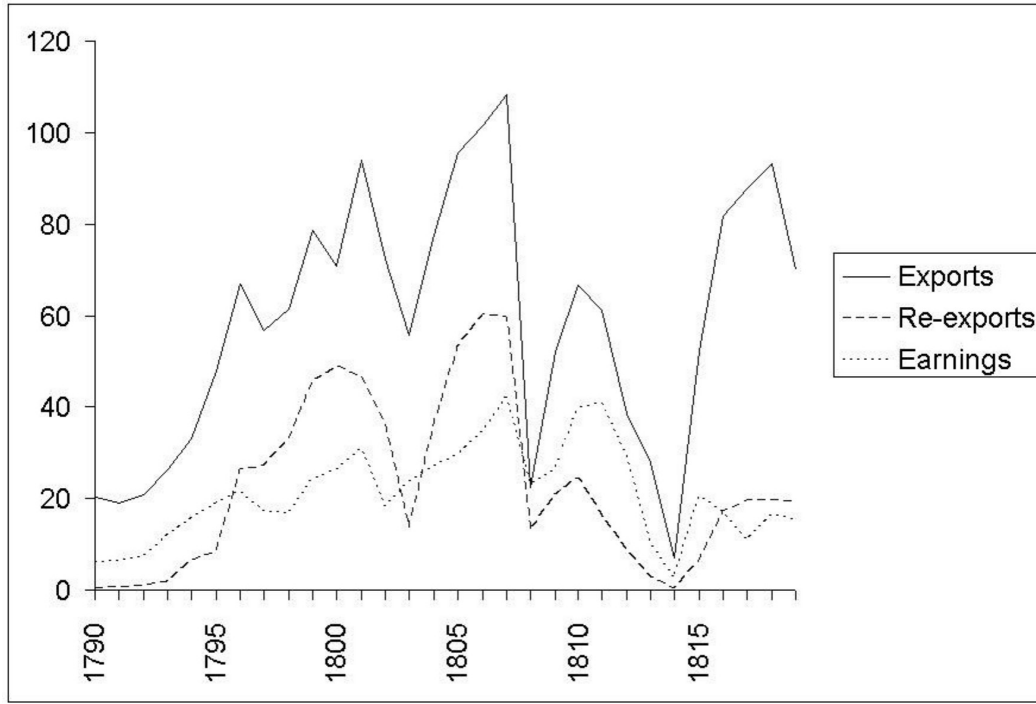


Figure 2: Value of exports and re-exports from the US, and net freight earnings of US shipping, 1790-1819, in millions of dollars. Source: North (1960).

As a result of these new opportunities, and of protective tariffs and regulations which had been introduced by Congress in 1789, American trade volumes and shipping tonnage grew rapidly (Figure 2). In the words of one contemporary American observer,

The affairs of Europe are certainly of less and less consequence to us in a political point of view; in a commercial, they rain riches upon us; and it is as much as we can do to find dishes to catch the golden shower.<sup>28</sup>

At the same time, however, this growing trade was subject to considerable risk as a result of the wars. Although America was neutral, both belligerents employed their navies and commissioned privateers to seize food bound from America for the other, and to seize enemy property carried in American

<sup>28</sup>The *Columbian Centinel*, 5 Nov 1796, quoted by Smith and Cole (1935, p.15).

vessels. Six hundred American vessels bound for the ports of the enemy were seized or detained in British ports between November 6 1793 and March 28 1794 alone (Huebner, 1905, p.436). The decrees regarding neutrality issued by the belligerents changed with sometimes extraordinary frequency,<sup>29</sup> and in any case were not always carefully observed.

The growth in trade, coupled with its uncertainty, greatly increased American merchants' demand for marine insurance. Many American merchants continued to insure in London despite the considerable inconvenience which resulted. However, crucially, by law, British insurers were not liable for losses on neutral vessels captured by British ships, and at various times during the Napoleonic wars, American ships were at risk of capture by British privateers and the Royal Navy. In addition, from the point of view of London underwriters, voyages from the US to the West Indies were considered cross-risks, and were spurned by the companies, while Lloyd's underwriters demanded a high premium to cover them. American underwriters had a greater experience of these routes, and more recent information, which enabled them to cover these risks at considerably lower premia than Lloyd's. This informational advantage was particularly important in wartime, when premia could change rapidly. For example, when the French began to capture American vessels in the Caribbean in retaliation for Jay's treaty between the US and Britain (the "French spoliations"), the premium on voyages to the West Indies rose from 6% in the fall of 1796 to 15 – 25% by early 1797 and reached over 30% in 1798, before American naval victories in 1799 and 1800 brought rates back down.<sup>30</sup>

All of these factors created the conditions for a rapid expansion of the American marine insurance market, which took the form of an explosive growth in corporate rather than private underwriting. The first American marine insurance corporation, the Insurance Company of North America (ICNA), was formed in Philadelphia in 1792 and chartered in 1794. The President and Directors were all leading underwriters who had previously attended the City Tavern, and most of the board were Philadelphia merchants.

In contrast to Britain, where the two chartered corporations held a monopoly, no monopoly was sought in America. Philadelphia's remaining private underwriters initially opposed the INCA charter, but having observed

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<sup>29</sup>To give an extreme example, on 9<sup>th</sup> May 1793 the French issued a decree authorizing their vessels to arrest any vessels laden with provisions for an enemy port. On 23<sup>rd</sup> May they exempted American vessels from this decree. On May 28<sup>th</sup> they suspended this exemption, but reversed this suspension on July 1<sup>st</sup>. Finally, on 27<sup>th</sup> July they reversed their position again by repealing the decree of May 23<sup>rd</sup>, thereby returning to the original decree of 9<sup>th</sup> May (Clauder 1932: 11).

<sup>30</sup>Carr (1967: 24).

its early success, they founded the rival Insurance Company of the State of Pennsylvania, which was also chartered in 1794.

Boosted by wartime premia, the Philadelphia corporations quickly proved highly profitable. Furthermore, close commercial and social contact between merchants in east coast cities meant that merchants in other American cities would have been familiar with the success of the Philadelphia corporations - indeed, for many years merchants in other cities had often obtained insurance in Philadelphia. As a result, the innovation of the Philadelphia corporations certainly played a role in encouraging the formation of incorporated companies elsewhere. Two corporations were chartered in Maryland in 1795. In New York, two charters were granted in 1798. The first marine insurance corporations appeared in Connecticut in 1797, in Virginia in 1798, and in Maine in 1800. In Massachusetts, where two well-developed unincorporated “companies” of private underwriters had been doing most of the marine insurance in Boston since the early 1780s, the first marine insurance charters were not granted until January 1799. Within 5 years, however, at least 17 additional marine insurance corporations were formed in Massachusetts alone. In Providence, another major port, the first marine insurance corporation was also chartered in January 1799, and more followed soon thereafter in Providence, Newport and other Rhode Island towns.<sup>31</sup> By 1810 private underwriting had virtually disappeared in the US, and it was reported in Britain that “in every part of America the Insurances are done by incorporate companies”,<sup>32</sup> including seven in Boston, eight in Philadelphia, five in Baltimore, and six in New York.

Why did corporations quickly come to dominate marine insurance in the United States but not in Britain? Although the increased demand for marine insurance in the US initially made the corporations highly profitable, as we have seen, this was equally true for the private underwriters at Lloyd’s, so the increase in demand, by itself, cannot explain the demise of private underwriting in the US.

Equally clearly, we cannot look for any explanation based on technology, because the technology of trade was common to both Britain and America at this time, and in any case changed little during the eighteenth century. Nor was there a lack of awareness of the potential for a system of private underwriting; American merchants were very familiar with Lloyd’s.

One might argue that the development of a private underwriting insti-

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<sup>31</sup>See Roelker and Collins (1949) on Rhode Island; Fowler (1997) on Massachusetts; Woodward (1897) on Connecticut; Crothers (forthcoming) on Virginia; Davis (1917) on New York and Maryland.

<sup>32</sup>Select Committee on Marine Insurance (1810), p.11

tution similar to Lloyd's was hindered by the lack of a "London" in America: unlike in Britain, maritime commerce in the US was not dominated by a single major port, but rather there were several major ports and numerous minor ports, so that the American marine insurance market was really a fragmented collection of local markets. However, merchants corresponded freely all along the east coast, engaged in joint ventures, and insured each others voyages. New York merchant Gerard Beekman, for example, frequently brokered policies for Rhode Island merchants in New York in the 1750s, and in turn he sometimes insured his own voyages in Philadelphia, where he found the premia lower than in New York (White, 1956, p.227). So, it is at least possible that the several centers for private underwriting which existed in several cities might have grown into more developed institutions for private underwriting, given time.<sup>33</sup>

The broader political and ideological context clearly played a role; the movement to form marine insurance corporations was part of a broad movement of incorporation in the US which saw several hundred banks, turnpike companies, canals, manufacturing and other companies receive corporate charters during the 1790s. Maier (1993: 84) argues that the corporation was "a child of the American Revolution", reflecting the efforts of a society actively involved in constitution-building to adapt an English institution to American needs by re-creating the corporation "as an agent of opportunity rather than a recipient of privilege". At any rate, the constitutional, legal and ideological changes which made incorporation *possible* at that time can be regarded as exogenous from the point of view of the marine insurance industry. Yet, as we have seen, the repeal of the Bubble Act in Britain, though it enabled the formation of numerous joint-stock marine insurance corporations, failed to extinguish private underwriting, so this still does not explain why private underwriting disappeared in America.

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<sup>33</sup>To lend plausibility to this claim, it is interesting to note the many parallels between the development of Lloyd's and the London Stock exchange. Both had their origins in early eighteenth century coffee houses, and gradually developed mechanisms to deal with the increasing complexity of business as the century progressed. Both businesses relied crucially on timely information, and trust among the market participants. Whereas Lloyd's disseminated this information through *Lloyd's List*, the Stock Exchange had the *Course of the Exchange*. Like Lloyd's, the Stock Exchange received a huge impetus from the Napoleonic Wars (because of the increase in the size and turnover of the National Debt). Thus, "by the end of the Napoleonic Wars in 1815, the Stock Exchange had become an accepted part of financial life displaying many features quite recognizable today" (Hennessy 2001: 32). In America, the New York Stock Exchange developed from informal coffee-house origins into a formal centralized market for stocks and government debt (Banner 1998), but as we have seen, there was no parallel development of an American marine insurance marketplace.

## 5 Hypothesis: A Lemons Problem

In this section, we develop an explanation for the divergence in institutional structure between Britain and the US. First, we argue that the marine insurance market was characterized by multiple equilibria, because of the importance of information in the determination of risk, which created the potential for a lemons problem among uninformed underwriters. Second, we argue that historical events - in particular, the timing of exogenous parameter shifts - led to the selection of different equilibria in Britain and America. An intelligence-gathering apparatus such as that created by Lloyd's, and the institutional structures which enabled private underwriters at Lloyd's to deal with the agency problems inherent in marine insurance, took time to evolve. Yet in the US, the formation of joint-stock corporations became possible at a time when American private underwriting was still at a comparatively early stage of development. Lacking well-developed institutions, private underwriting could not compete with these corporations, and rapidly disappeared.

As described in section 2, asymmetric information was a pervasive feature of marine insurance contracts in the eighteenth century. Merchants had strong incentives to conceal information which, if known, would raise the premium, and to represent other facts so as to reduce the premium. Thus, one underwriter complained that

Intelligence, the most speedy and circumstantial information, is indispensably necessary to an insurer; and yet after all, and with the keenest penetration and judgement, it will rarely happen that he is on an *equal* footing, as he ought to be, with the insured.<sup>34</sup>

This model explores the consequences of the resulting agency problems. The key features of the model, motivated by the historical evidence, are as follows: there are many merchants who can purchase insurance from two kinds of underwriters: private underwriters and corporations. Corporations have an advantage in that they are perceived by merchants as more financially secure. However, if many merchants insure with private underwriters, then (because of network effects) these private underwriters may gain an advantage in assessing risks. This creates a lemons problem for the corporations: the very best risks will be offered favorable rates by private underwriters, leaving the corporations with a disproportionately poor selection of risks, which forces them to raise their premia, which in turn drives more of the better risks to insure with private underwriters. Thus, there may be multiple equilibria: one in which

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<sup>34</sup>Weskett (1781: 297).

all marine insurance is done by corporations, and another in which the better risks are insured by private underwriters at low premia, while the corporations charge high premia and receive business only from the worst risks.

## 5.1 Model

There are three kinds of players in this model: merchants, private underwriters, and corporate underwriters.

*Merchants.* There are many merchants, who undertake voyages which either succeed, yielding income  $I$ , or fail, yielding 0 (for simplicity, we ignore the possibility of partial losses). Merchants have initial wealth  $W$ , and identical continuously differentiable VNM utility functions  $u(\cdot)$  defined over non-negative values of wealth, such that  $u'(\cdot) > 0$  and  $u''(\cdot) < 0$ . The probability of a loss on merchant  $i$ 's voyage is  $\theta_i$ , where  $\theta_i$  is uniformly distributed on the interval  $[\underline{\theta}, \bar{\theta}] \subset (0, 1)$ . The distribution of  $\theta$  is common knowledge, but its realization is observed only by the merchant. Since  $\theta$  is private information, we will refer to  $\theta$  as the merchant's "type".

*Underwriters.* There are a large number of private underwriters, and at least two insurance corporations. All underwriters are risk-neutral and act competitively. A marine insurance contract is one in which an underwriter agrees to indemnify a merchant by paying them  $(1 - p)I$  in case of loss, in exchange for a premium payment  $pI$  in case of success, where  $p$  is the rate of premium charged.

This is a one-shot game. Play proceeds as follows. First, the corporations announce their premia,  $p_c$ . Because the corporations are unable to learn the merchant's type,  $p_c$  is the same for all merchants. Bertrand competition between corporations is assumed to drive  $p_c$  down to a level (to be determined endogenously) which leads to zero expected profits for the firm. Next, merchants learn their types,  $\theta$ . Then all merchants simultaneously decide whether to apply to corporate or private underwriters. For simplicity, we assume that all merchants inelastically purchase full insurance (this will not affect our qualitative conclusions; see discussion below).

If merchant  $i$  chooses to insure with a corporation he chooses the corporation which has set the lowest premium. If instead he chooses private underwriters, then those underwriters learn his type,  $\theta_i$ , with probability  $\sigma$ , where  $\sigma$  is the proportion of merchants who choose to purchase insurance from private underwriters. The premium charged by private underwriters will depend on the information available to them. If they learn the merchant's type, then competition will lead them to offer insurance at the actuarially fair premium,  $\theta_i$ . Otherwise, they offer a premium  $p_p$ , where  $p_p$  (to be determined endoge-



nously) is driven by competition to a level which yields zero expected profits to the private underwriters. Finally, private underwriters fail with probability  $\phi$ . If a private underwriter fails, any insurance contracts he has made are void, and neither premium nor indemnity is paid.

Let  $u_p(\theta)$  and  $u_c(\theta)$  denote the expected utility obtained by a merchant of type  $\theta$  by choosing private and corporate underwriters, respectively.

**Lemma 5.1.** *For any given values of  $p_p$ ,  $\phi$  and  $\sigma$ ,  $u_p(\theta)$  is strictly decreasing in  $\theta$ ; for any value of  $p_c$ ,  $u_c(\theta)$  is independent of  $\theta$ .*

*Proof.* The expected payoff to insuring with a private underwriter is

$$u_p(\theta) = (1-\phi)[\sigma u(W+(1-\theta)I) + (1-\sigma)u(W+(1-p_p)I)] + \phi[\theta u(W) + (1-\theta)u(W+I)] \quad (1)$$

The term in the first square bracket shows the payoffs obtained in the case where the private underwriter does not fail. The second square bracket shows the expected payoff if the underwriter does fail, leaving the merchant uninsured. Both terms are strictly decreasing in  $\theta$ . The payoff to using a corporate underwriter is

$$u_c(\theta) = u(W + I - p_c I) \quad (2)$$

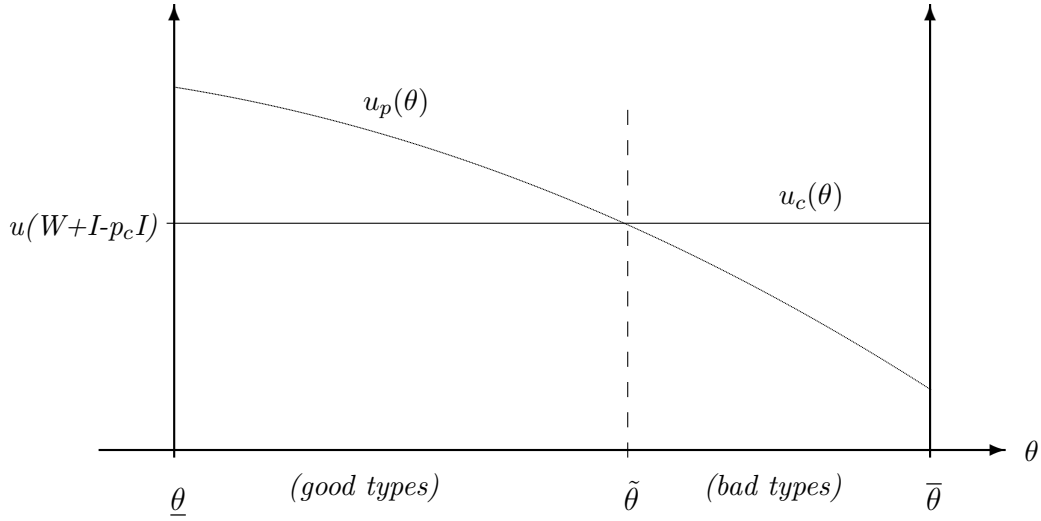
□

Lemma 5.1 ensures that in searching for equilibria of this game, we have only three possible cases to consider: pooling equilibria in which all merchants choose private underwriters and  $u_p(\theta) \geq u_c(\theta) \forall \theta$ ; pooling equilibria in which all merchants choose corporate underwriters and  $u_p(\theta) \leq u_c(\theta) \forall \theta$ ; and equilibria in which there is some critical value of  $\theta$ ,  $\tilde{\theta}$ , such that merchants with types  $\theta < \tilde{\theta}$  choose private underwriters and those with  $\theta > \tilde{\theta}$  choose corporate underwriters (and those with  $\theta = \tilde{\theta}$  are indifferent). The following diagram depicts the choices faced by merchants for some given value of  $p_c$ ,  $p_p$  and  $\sigma$  in the third case. However, in equilibrium,  $p_c$ ,  $p_p$  and  $\sigma$  are determined endogenously. When we take this into account, we find that there are generally two possible equilibria, as Proposition 1 shows.

**Proposition 1.** *(i) There is no pooling perfect Bayesian equilibrium (PBE) in which all types of merchants insure with private underwriters.*

*(ii) There exists a pooling PBE in which all types of merchants insure with corporations.*

*(iii) For sufficiently small values of  $\phi$ , there exists a “lemons” PBE, in which some merchants insure with private underwriters, and some with corporations, and in which the merchants who insure with private underwriters are of better types (lower  $\theta$ ) than those which insure with corporations.*



*Proof.* See Appendix. □

Proposition 1 shows that two kinds of equilibria are possible in this game. If nobody expects any merchants to apply to private underwriters, then the private underwriters will have no informational advantage, and given the insecurity of private underwriting, all merchants would indeed prefer to insure with the corporations. Thus we have an equilibrium in which all merchants choose corporate underwriters. However, if it is expected that some merchants will insure with private underwriters, then low-risk merchants might prefer private underwriters, since if the private underwriters observe their type, they will pay lower premia. But then, the merchants who apply to the corporations tend to be bad types, so the corporations must raise their premia to break even. As they do so, more of the better risks will move to private underwriting; and so on, until the corporations are left with only the very worst risks, who no longer care that by choosing corporate underwriters they reveal their bad type, since the private underwriters would likely discover this anyway.<sup>35</sup>

Our model differs from screening models of insurance such as Rothschild and Stiglitz (1976), which rely crucially on the assumption that customers can buy only one insurance contract, so that firms can induce customers to reveal their type by offering a menu of price-quantity contracts (less risky customers

<sup>35</sup>There are actually two reasons why bad risks prefer to insure with corporations. First, the corporations are unable to observe types; and second, since bad risks are more likely to face a loss, they are more severely affected by the possibility of private insurers' insolvency.

will be willing to buy lower quantities of insurance at lower premia). This is appropriate in many contexts, but not for the marine insurance market during the eighteenth century, when it was quite usual for merchants to insure with multiple underwriters in different ports and even in different countries, and insurers could not limit the total amount of insurance purchased (though, to control moral hazard, a merchant could not legally recover from insurers more than the value lost).<sup>36</sup>

We also assumed for simplicity that all merchants inelastically purchase full insurance. Basic insurance theory reveals that, at a given premium, good risks would wish to purchase a lower quantity of insurance than bad risks (eg., Rothschild and Stiglitz (1976)), and the historical record confirms that merchants frequently underinsured, particularly if they had a relatively small amount of merchandise travelling on a “good” ship.<sup>37</sup> Relaxing this assumption would add another twist to the lemons problem without affecting the qualitative conclusions: not only will the corporations get the worst risks, but within that group, the worse the risks are, the more insurance they will purchase. Indeed, if all types pay the same premium, the lemons problem may drive good risks from the market altogether, but this is not the case we are interested in here: rather, in our model, good types may be driven to insure with (informed) private insurers instead of (uninformed) corporations.

Finally, we treated the interaction between merchant and underwriter as a one-shot game. This may be problematic for both theoretical and empirical reasons. The theory of repeated games has shown that repeated interaction can be an important means of overcoming agency problems, and the historical evidence clearly shows that both private and corporate underwriters strove to build up “a connection” with merchants, so that by engaging in repeated business they could reduce the degree of uncertainty and the danger of opportunism involved in their transactions. At Lloyd’s, and elsewhere where private underwriting was practiced, insurance brokers facilitated this trust by acting as middlemen engaged in repeated transactions with both underwriters and merchants.

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<sup>36</sup>In the event of inadvertent over-insurance (for example, if the value of the cargo had been overestimated), whichever insurance was made first was effective (Weskett, 1781). Deliberate, fraudulent over-insurance was a concern for underwriters. For example, in 1755 the London Assurance discovered a suspected fraud in which the same goods had been insured multiple times in London, Amsterdam and Hamburg (Guildhall MS 8755, 28 February 1755). See also Jackson (1971) (footnote 3).

<sup>37</sup>For example, American merchant Henry Laurens instructed his agents in London that when his goods were shipped “by a good vessel and master” they should not insure values below £100, and only  $\frac{3}{4}$  of the value of larger shipments (Hamer, 2003, 7<sup>th</sup> Jan 1796).

However, repeated interaction would not substantively change our conclusions; on the contrary, it strengthens our argument in the following way. Although we have treated the merchant's "type" as a measure of exogenous risk, we could alternatively interpret a merchant's "type" as their reputation.<sup>38</sup> Because a reputation mechanism based on repeated interaction, such as that which operated at Lloyd's, can help private underwriters to overcome moral hazard, a corporate underwriter, without access to this reputation mechanism, is handicapped because it cannot observe a merchant's reputation, or use the threat of gossip to constrain a merchant's behavior as easily as private underwriters can. The corporations, being excluded from the reputation mechanism, will therefore draw a disproportionately "disreputable" clientele.

The lemons interpretation of events in Britain can explain many otherwise puzzling aspects of the corporations behavior - in particular, their conservatism in underwriting. After experiencing numerous instances of fraud in the early eighteenth century, they ceased to insure cross risks, and refused to cover the risk of seizure in a foreign port: both risks for which a specialist knowledge of local circumstances was of vital importance, and the corporations disadvantage was therefore particularly acute. They also limited the amount they would insure on a single voyage, and placed stringent restrictions on deviations from the planned voyage. Their caution is reflected in the fact that a substantial part of the business done by the companies was done for, or brokered by, their directors and shareholders (John, 1958).

For many merchants, it was this restrictiveness, even more than the high premia, which induced them to insure at Lloyd's instead. One stated that

If I could do all my business at the [corporations] I should undoubtedly prefer doing it with them... I do not think that I can state properly that they are of little service on account of the difference in premiums; I think it is in the amount that they take; they limit themselves in so small an amount that it is impossible to do risks where property is so much enhanced in value; instead of having a sum that they will do on one risk, it is three, four or five times as much as they will take.<sup>39</sup>

Another merchant, having insured with the London Assurance company, warned his correspondent that in case of accident, he should have the documents relating to the claim "well arranged authenticated and sent by two conveyances" because "these Gentlemen or rather this Company are rather

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<sup>38</sup>See Kandori (1992) for a model of community enforcement which stresses the role of reputational information in overcoming opportunism.

<sup>39</sup>Select Committee on Marine Insurance (1810), evidence of Alexander Glennie.

particular in respect to vouchers either for an average or loss”.<sup>40</sup> They were too particular, in fact, for an American merchant, resident in London, who explained to his partners in Maryland:

“I have not made it [insurance] in a public office [ie., a corporation]. The reason why I did not was their particularity; they must know who you are and a deal of that; then again you are plagued more than little enough before you can get the money after a loss and everybody prefer making theirs at Lloyds for that reason.”<sup>41</sup>

However, the corporations’ caution can be explained as a rational response to their lemons problem. Recognizing their disadvantage in evaluating risks, they attempted to confine their underwriting as far as possible to relatively predictable voyages.

“The two public offices . . . confine themselves to what are called regular risks . . . It would be absurd to expect any public office to act on any other system; for it is impossible that the acting director or secretary of a public office, should possess the same knowledge, as to the nature and extent of every new description of risk, . . . as 1,500 underwriters, mostly men of commercial habits, and consequently commercial knowledge, daily collected together for the purpose of communicating and receiving intelligence . . . who concentrate the scattered rays of information, as it were, into one focus at Lloyd’s. On this conviction the public offices, very wisely, refuse to take what they do not understand.”<sup>42</sup>

Statements made to a Parliamentary Select Committee in 1810 by the chief clerk in the marine insurance department of the Royal Exchange Assurance Co. confirm that the corporations were well aware of their lemons problem. He explained that, although the company would have liked to expand its business, it often refused to insure merchants who it did not know well because their insurances were not “tendered fairly”. For example, the company’s practice was to underwrite a maximum of £5 – 10,000 on any one ship in the West India or Baltic fleets, because it was usually only offered the opportunity to insure about one tenth of the ships in the fleet. If it could insure *all* the ships in the fleet, he claimed, it would “have no hesitation” in insuring £20 – 25,000 on each ship, “because it would be playing a more equal game”.<sup>43</sup>

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<sup>40</sup>Francis Rotch, 9 October 1786 (Massachusetts Historical Society 1915: 293-4).

<sup>41</sup>Joshua Johnson’s letterbook, 26 July 1771 (Price, 1979, p.8)

<sup>42</sup>Hansard, *Parliamentary Debates*, XV (1810), p. 407-8. Speech by Joseph Marryat.

<sup>43</sup>Select Committee on Marine Insurance (1810), evidence of J. Holland.

## 5.2 Alternative Hypotheses

The lemons problem can explain the failure of the chartered corporations to dominate the British marine insurance market. In this section, we consider some alternative hypotheses.

One alternative possibility is that the two chartered corporations were just not big enough, in terms of their capital stock, to dominate the British marine insurance market. However, this hypothesis does not fit the facts. Firstly, both corporations were able to substantially increase their underwriting activity during wartime, despite the higher risks (Figure 1). Yet, even at the height of their underwriting during the Napoleonic wars, witnesses for both corporations at a parliamentary inquiry in 1810 stated that the corporations would have liked to have done even more business.<sup>44</sup> Furthermore, in 1810, the Royal Exchange had a paid-up capital of only £680,000, although it had the right to call up to £1.5 million from its shareholders.<sup>45</sup> Clearly, a lack of capital was not a binding constraint on the corporations underwriting. Besides, British merchants also had the option of insuring with corporations overseas, yet most British merchants and brokers, and increasing numbers of foreign merchants and shipowners, chose to insure at Lloyd's.

Another possible hypothesis is that the corporations higher prices reflected the exercise of monopoly power. Although this may well have been a goal of those who petitioned for the corporate charters in 1720, the corporations were simply too small a part of the overall market as it actually evolved to make this claim plausible, and later statements make clear that this was not how they were perceived. Besides, although the corporations generally found marine underwriting profitable, their profits do not appear to have been extraordinary, *despite their charging higher premia on apparently similar voyages*.<sup>46</sup> Finally, if the corporations higher premia had reflected their exercise of

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<sup>44</sup>Select Committee on Marine Insurance (1810), evidence of J. Holland and T. Greathead. See also "The Case of the London Assurance Corporation and their objections to the Repeal of the Statute of 6 Geo I", in Guildhall MS 18833.

<sup>45</sup>Select Committee on Marine Insurance (1810), evidence of P. Grenfell. Furthermore, the corporation did not enjoy limited liability: stockholders were personally liable for the corporations debts in excess of the capital stock.

<sup>46</sup>For example, we might compare their premium income and underwriting profits with those of William Braund, described as "a steady but by no means a great underwriter" active in the 1750s-70s (Sutherland, 1933, p.65) who, like many underwriters, had begun his career as a merchant. During 1761-65, Braund made average annual underwriting profits of about £1,700 on premium income of between £4,000 and £9,000 annually (*ibid*, p. 74-77). In comparison, the Royal Exchange Assurance corporation achieved average profits in the same years of about £6,100 on annual premia which averaged £36,600 (Supple, 1970, p.62). The London Assurance averaged profits of £7,300 on average premia of £43,300 (based

monopoly power, one would also expect Lloyd's to be overwhelmed by competition from the influx of competitive marine insurance corporations after 1824, which it was not.

### 5.3 Equilibrium Selection

Proposition 1 reveals the potential for multiple equilibria in the marine insurance market, which can account for both the success of marine insurance corporations in the US after 1792, and the persistence of private underwriting in Britain after 1720. However, to see how these different equilibria came to be observed, we must turn to the historical record.

In Britain, in the period before they obtained their charters (1718-20), the companies which were to become the chartered corporations initially did a large amount of business, and were accused of undercutting the market in order to drive private underwriters out of business (Supple, 1970, p.20). However, the bursting of the South Sea Bubble left the corporations in financial difficulties, primarily because many of their subscribers, who had paid in only a fraction of the nominal value of their stock, were themselves in financial trouble. As a result, the corporations began with little capital, plunging share prices, and low public confidence. They were unable to raise the £600,000 in bribe payments owed to the King's civil list, only half of which was ultimately paid. The value of stock in the Royal Exchange Assurance corporation, which had risen from less than £20 per share in January 1720 to over £200 in August, fell below £10 by the end of the year.<sup>47</sup> The London Assurance suffered heavy losses as a result of a storm which sank twelve Jamaica ships in October 1720,<sup>48</sup> and was forced to borrow money to survive. In the words of Wright and Fayle (1928: 63), "The companies difficulty was the underwriters opportunity", and within a few years the corporations were doing only a small proportion of the total marine insurance business.

The new corporations formed in Philadelphia in 1792-4 arrived at a highly favorable time for marine underwriting, and proved highly profitable. Since many of the most prominent merchants joined the corporations, and they concentrated on insuring local merchants and vessels, they probably suffered little or no informational disadvantage relative to private underwriters, and therefore no lemons problem. Like the British corporations before them, they were accused of undercutting the market in a deliberate attempt to drive pri-

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on Guildhall MS 8749A). (It should be emphasized that this is a very crude comparison, because, as one would expect, there is considerable fluctuation over time).

<sup>47</sup>Supple (1970: 38).

<sup>48</sup>Postlethwayt (1774): article on "Actions"

vate underwriters out of business (Montgomery, 1885, p.40). Whether or not this was their intention, as we have seen, the centers for private underwriting were not well-developed enough to withstand the competition, and the corporations came to dominate the market in the space of little more than a decade. We can only speculate as to whether a well-developed private underwriting market might have been able to survive, once established, in the US. However, private underwriting could not invade a market dominated by corporations,<sup>49</sup> and as a result no such market ever developed in the US.

## 6 France and Holland

In France and Holland, as in Britain and the US, most underwriting was initially done by individual underwriters in the ports, primarily as a means for the merchants to spread risk among themselves. In both, as in the US, individual underwriting ultimately gave way to joint-stock companies.

France, like the US, lacked a single center for marine insurance. Insurance on a single voyage was often effected at several ports, and some insurance was also obtained abroad in Britain and Holland.<sup>50</sup> As the business grew, insurance companies (chambres) were formed, whose members were jointly and severally liable for policies they underwrote (Miquelon, 1978, p.123-5). In the 1750s, two large corporations were chartered in Paris. The Paris corporations, however, were primarily run by non-merchants (Bosher, 1979), and may have suffered from a lemons problem akin to that suffered by the British corporations:

In the seaports a company of merchants gathers together to underwrite insurance. They know their work and inform each other; they know whether the ship they are insuring is good or bad, whether the crew is good or bad, whether the captain is experienced and wise or ignorant and confused, whether the shippers are suspect, of good reputation or likely to be dishonest, whether the voyage is to be long, whether the season is beginning well or not; they know everything because everyone makes it his business to find out. In Paris they know nothing and for the Company to know all that, it would lose as much in the cost of postal charges and correspondence as it would earn in premiums.”<sup>51</sup>

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<sup>49</sup>An effort to create such an institution in New York around 1810 apparently failed (Select Committee, 1810, evidence of John Bennett).

<sup>50</sup>For example, in 1745 Robert Dugard of Rouen obtained insurance for a return voyage from Martinique at Marseilles, Bayonne, La Rochelle, Nantes, St. Malo, Amsterdam, Cadiz, and Pantaleo, Italy (Miquelon, 1978, p.123).

<sup>51</sup>The Bordeaux magistrate Montesquieu in 1750, quoted by Bosher (1979).



For a time, the regional companies and the Paris corporations shared the market with individual underwriters. As late as the 1780s, individual underwriters still did about half the marine insurance in the medium-sized French port of La Rochelle. However, as in the US, the increased risks during wartime tended to drive individual underwriters from the market (Clark 1978; Dawson 1931).

In Holland, too, the long-term trend was towards corporations. A company began writing marine insurance in Rotterdam in 1720, but in Amsterdam, which was the main center for marine insurance in Holland, the first joint-stock corporation was not formed until 1771. Heavy wartime losses in 1780-1, and political instability in 1786, drove many private underwriters from the market, and corporations increasingly began to dominate. In 1851, some private underwriters were still active in Amsterdam, but there were as many as 70 Amsterdam-based companies writing marine insurance, besides which many companies based elsewhere also had agencies in Amsterdam (Spooner 1983, ch. 2).

## 7 Conclusion

In Britain, the provision of marine insurance by partnerships or companies, other than the two chartered corporations, was prohibited by the Bubble Act, allowing Lloyd's to develop as a center where private underwriters gathered and shared information. The superior access to information enjoyed by Lloyd's underwriters created a lemons problem which prevented the chartered corporations from coming to dominate the market. The Napoleonic Wars gave rise to challenges and opportunities which strengthened the system of private underwriting at Lloyd's, enabling it to survive competition from corporations even after the Bubble Act was subsequently repealed. In the US, in contrast, where the protection provided by the Bubble Act had been removed by American independence prior to the wars, private underwriting was quickly extinguished by competition from joint-stock corporations. Thus, although the two countries were in close commercial contact, and shared essentially the same technology and knowledge, temporary historical differences in the institutional environment led to the selection of different equilibria.

Theories of institutional change have viewed it as sometimes an unintentional, evolutionary process, and at other times as a process characterized by discrete, intentional changes driven by institutional entrepreneurs via the political process.<sup>52</sup> Aoki (2001: 243) offers a partial synthesis of these views,

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<sup>52</sup>Caballero and Kingston (2005) compare recent theories of institutional change.

arguing that institutional change frequently involves short, turbulent periods of deliberate institutional change and experimentation, interspersed with longer periods during which these experiments are weeded out through a gradual, evolutionary process. The development of the marine insurance business in the eighteenth century appears to fit this pattern.

Exogenous events, including the South Sea Bubble, American Independence, and the Napoleonic wars, created the conditions for deliberate institutional innovation at particular points in time, carried out primarily through the political process. For example, the efforts to obtain charters for the British corporations in 1719-20 and the Philadelphia corporations in 1792-4, the narrowly failed attempt to repeal the British duopoly in 1810, and the successful effort in 1824, were primarily political struggles. The development of a formal structure at Lloyd's during the Napoleonic wars also involved deliberate collective action to create rules through an essentially political process. Some of these deliberate innovations had unintended consequences, notably the creation of the corporate duopoly in Britain in 1720, which failed to drive out private underwriting.

In the periods between these turbulent periods of deliberate innovation, and constrained by the previous political choices, evolutionary processes, including competition between alternative institutional forms, gradually altered the rules of the game. For example, prior to the Napoleonic wars, business practices at Lloyd's, and insurance law in Britain, evolved as merchants, underwriters, and coffee-sellers carried out their business in a gradually changing environment, and this evolutionary process generated relatively effective institutions despite a lack of centralized direction or deliberate institution-building. In the US, the pioneering "mutation" of the ICNA in Philadelphia sowed the seed that led to a rapid spread of corporate underwriting throughout the US.

Since Britain and America evolved quite different marine insurance institutions, one might conjecture that an inefficient arrangement arose in one or the other of the two countries. This would be all the more surprising since both countries were in close commercial contact and had a long history of "institutional transplants". It is not clear, however, whether either arrangement was more efficient in any meaningful sense. Both had drawbacks: under the Lloyd's system, even careful underwriters might be unable to meet their obligations if they suffered a run of bad luck. The corporate system in the US, however, lacked Lloyd's ability to gather and efficiently use underwriters' idiosyncratic information about risks.

Over time, both systems attempted to resolve these defects. In the 1860s, Lloyd's began to accept deposits from underwriters as a guarantee of security to the assured, and in 1871, it was incorporated, not as a joint-stock corpo-

ration, but as a Society with the power to make by-laws to regulate itself as a marine insurance marketplace. Lloyd's marine intelligence service continued to be of great importance for both private underwriters and British joint-stock corporations, and following the American Civil War, British firms invaded the American market so successfully that they achieved a "virtual monopoly" of the American hull insurance market which lasted until World War I (Mitchell 1970: 22, 27).

Individual American corporations employed their own foreign correspondents, but had nothing like the advanced information-gathering apparatus of Lloyd's. However, in response to the invasion of their market, they belatedly addressed their need for effective shipping intelligence in 1881, by forming the Association of Marine Underwriters to unify their practices and maintain a single network of correspondents worldwide (Mitchell 1970: 28).

## Appendix: Proof of Proposition 1.

(i) First suppose all merchants expected others to insure with private underwriters. We will show that this cannot occur in equilibrium. Because all insure with private underwriters,  $\sigma = 1$ , so, from (1) the expected payoff to a merchant of type  $\bar{\theta}$  from insuring with a private underwriter is

$$\begin{aligned} u_p(\bar{\theta}) &= (1 - \phi)[u(W + (1 - \bar{\theta})I)] + \phi[\bar{\theta}u(W) + (1 - \bar{\theta})u(W + I)] \\ &< (1 - \phi)[u(W + (1 - \bar{\theta})I)] + \phi[u(W + (1 - \bar{\theta})I)] \quad (\text{by risk aversion}) \\ &= u(W + (1 - \bar{\theta})I) \end{aligned}$$

Therefore, by offering a premium of  $\bar{\theta}$ , a corporation can profitably attract some of the worst risks (those with types close to  $\bar{\theta}$ ). Offering this premium is rational for the corporation no matter what its beliefs are about the distribution of the types of merchants who would accept the offer. Therefore there is no PBE in which all merchants insure with private underwriters.

(ii) Suppose instead that merchants expect all other merchants to insure with corporations. Then competition between corporations will ensure that  $p_c = (\bar{\theta} + \underline{\theta})/2$ , and the private underwriters will have no information advantage ( $\sigma = 0$ ), so

$$u_p(\theta) = (1 - \phi)[u(W + (1 - p_p)I)] + \phi[\theta u(W) + (1 - \theta)u(W + I)]$$

whereas

$$u_c(\theta) = u(W + I - (\bar{\theta} + \underline{\theta})I/2)$$

By insuring with private underwriters, merchants run the risk ( $\phi$ ) of being uninsured. Nevertheless, if the premium that private underwriters would charge without any information,  $p_p$ , were sufficiently low, some merchants might be willing to take this

risk. It all depends on  $p_p$ , which depends on the private underwriters beliefs off the path of play. We can construct a PBE by specifying that private underwriters believe that merchants who apply to them for insurance have types randomly drawn from the population. Then,  $p_p = p_c = (\bar{\theta} + \underline{\theta})/2$ , so, all merchants strictly prefer corporate underwriters.

(iii) In any equilibrium, merchants take  $\sigma$ ,  $p_c$  and  $p_p$  as given. However, in equilibrium, if  $u_p(\tilde{\theta}) = u_c(\tilde{\theta})$  for some  $\tilde{\theta} \in (\underline{\theta}, \bar{\theta})$ , then the following must hold:

$$p_p = \frac{\tilde{\theta} + \underline{\theta}}{2} \quad (3)$$

$$p_c = \frac{\tilde{\theta} + \bar{\theta}}{2} \quad (4)$$

$$\sigma = \frac{\tilde{\theta} - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \quad (5)$$

(3) and (4) hold because competition must drive the premium charged by either kind of underwriter towards the expected value of  $\theta$  for those merchants who choose private or corporate underwriting respectively. Define

$$\begin{aligned} \tilde{u}_p(\theta) &= (1-\phi) \left[ \left( \frac{\theta - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \right) u(W+I-\theta I) + \left( \frac{\bar{\theta} - \theta}{\bar{\theta} - \underline{\theta}} \right) u(W+I-(\theta + \underline{\theta})I/2) \right] \\ &\quad + \phi [\theta u(W) + (1 - \theta)u(W + I)] \end{aligned}$$

$$\text{and } \tilde{u}_c(\theta) = u(W + I - (\theta + \bar{\theta})I/2)$$

(these are the payoffs to a merchant of type  $\theta$ , assuming that he is the critical type, and that  $p_p$ ,  $p_c$  and  $\sigma$  reflect this).

Since  $u(\cdot)$  is continuous and differentiable, so are  $\tilde{u}_p(\cdot)$  and  $\tilde{u}_c(\cdot)$ . Therefore we can establish the existence of a crossing point  $\tilde{\theta}$  such that  $\tilde{u}_p(\tilde{\theta}) = \tilde{u}_c(\tilde{\theta})$  by showing that  $\tilde{u}_p(\theta) < \tilde{u}_c(\theta)$  as  $\theta \rightarrow \bar{\theta}$  and  $\tilde{u}_p(\theta) > \tilde{u}_c(\theta)$  as  $\theta \rightarrow \underline{\theta}$ . The first inequality always holds since

$$\begin{aligned} (1 - \phi) &\left[ \left( \frac{\bar{\theta} - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \right) u(W + (1 - \bar{\theta})I) + \left( \frac{\bar{\theta} - \bar{\theta}}{\bar{\theta} - \underline{\theta}} \right) u(W + (1 - (\frac{\bar{\theta} + \underline{\theta}}{2}))I) \right] \\ &\quad + \phi [\bar{\theta}u(W) + (1 - \bar{\theta})u(W + I)] \\ &= (1 - \phi)u(W + (1 - \bar{\theta})I) + \phi [\bar{\theta}u(W) + (1 - \bar{\theta})u(W + I)] \\ &< (1 - \phi)u(W + (1 - \bar{\theta})I) + \phi [u(W + (1 - \bar{\theta})I)] \\ &= u(W + (1 - \bar{\theta})I) \end{aligned}$$

(the worst type of merchant would prefer safe insurance with a corporation at an actuarially fair rate of premium than insecure insurance with well-informed private underwriters at the same rate). The second inequality holds if

$$(1 - \phi) \left[ \left( \frac{\underline{\theta} - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \right) u(W + (1 - \underline{\theta})I) + \left( \frac{\bar{\theta} - \underline{\theta}}{\bar{\theta} - \underline{\theta}} \right) u\left(W + \left(1 - \left(\frac{\underline{\theta} + \bar{\theta}}{2}\right)\right)I\right) \right] \\ + \phi [\underline{\theta}u(W) + (1 - \underline{\theta})u(W + I)] > u\left(W - \left(\frac{\underline{\theta} + \bar{\theta}}{2}\right)I\right)$$

or

$$(1 - \phi) [u(W + (1 - \underline{\theta})I)] + \phi [\underline{\theta}u(W) + (1 - \underline{\theta})u(W + I)] > u(W + (1 - (\underline{\theta} + \bar{\theta}))I/2) \quad (6)$$

which holds for sufficiently small  $\phi$ . Intuitively, (6) shows that unless private underwriters are so financially insecure that even the best type of merchant (type  $\underline{\theta}$ ) prefers safe insurance at a premium of  $(\underline{\theta} + \bar{\theta})/2$  (the actuarially fair premium rate for the overall population) to unsafe insurance at a fair rate of premium ( $\underline{\theta}$ ), there exists a  $\tilde{\theta}$  such that  $\tilde{u}_p(\tilde{\theta}) = \tilde{u}_c(\tilde{\theta})$ . If such a  $\tilde{\theta}$  exists, then we have multiple equilibria: one in which all merchants choose corporate underwriters, and one in which some choose private underwriters and the corporations face a “lemons” problem: merchants with types  $\theta < \tilde{\theta}$  choose private underwriters and those with types  $\theta > \tilde{\theta}$  choose corporate underwriters.  $\square$

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