

The Pricing Revolution in Marine Insurance

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Abstract.

The widespread adoption of marine insurance by merchants in international trade was the result of a revolution in the pricing of marine insurance in the seventeenth century. In London, marine insurance prices dropped by more than half, and in some cases 75%. The city soon became the leading insurance centre in the world, as a progressive increase in the number of trade voyages allowed the transformation of 'uncertainty' into 'risk', which allowed more accurate risk-based pricing. This paper is in three parts. The first discusses the theoretical transformation of uncertainty into risk. The second explores the reasons behind the fall in marine insurance prices, and London's resulting success in this important sector of the international transportation business. The final, quantitative section examines the fall in prices from the sixteenth century to the eighteenth, drawing on a new, unique database.

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For the time to come I resolve to ensure all I send out, which, in times of peace is not above 2 and ½ p Ct., which I think you nor noe other person can thinke much to allow.

*Joseph Cruttenden, apothecary of London,
to Thomas Barton in America, 28 September 1716²*

Marine insurance allowed, in the words of England's 1601 *Act Conc'ninge matters of Assurances, amongste Merchantes*, 'the losse [to] lightethe rather easilie upon many, then heavilie upon fewe'.³ However, this comfort it came at a price, and in the early days of marine insurance many English merchants chose to venture uninsured or only partially covered for all but the most risky voyages. That changed over the course of the seventeenth century, when a revolution in the pricing of marine insurance made the product much more affordable. By the opening of the eighteenth, insurance had been widely adopted, and London had become the leading global centre of underwriting. This paper illustrates and analyses these developments from both qualitative and quantitative perspectives, by focussing on pricing and the factors that drove it down.

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² Bodleian Library, *Letter book of Joseph Cruttenden*, MS Rawl Lett 66, 242.

³ Anno 43 Elizabethæ Cap. 12, *An Act Conc'ninge matters of Assurances, amongste Merchantes*. HeinOnline, 4 Statutes of the Realm, 1547-1624, pp. 978-9.

As England's trade expanded during the seventeenth century, the cost of obtaining the contingent-capital-guarantee offered under premium-based marine insurance policies fell significantly. This phenomenon was particularly pronounced in London, as the city began increasingly to dominate the international re-export trade. Between 1550 and 1640, English merchants assumed control of most of their own country's foreign trade, and launched a fundamentally commercial overseas expansion. English penetration of south European markets and the later seventeenth-century rise of her colonial re-exports, especially of tobacco, sugar, and calicoes, combined to create what Davis described as 'a revolution in trade'. According to his estimates, between 1663 and 1701 imports increased by a third, and exports, including re-exports, by 'rather more than half'.⁴

By this time London already possessed a relatively mature marine insurance market. Italian merchants had brought the practice to England by the fifteenth century, and introduced a set of conventions developed in the northern Italy at least a century earlier.⁵ The ledgers of the bank Filippo Borromei & Co. show insurance underwriting taking place in London centuries before the trade boom. For example, in January 1438 the bank's London branch insured a shipment of Essex broadcloth for transit to Bruges, at a rate of 5.86%.⁶ Later ledger entries show that the marine insurance market operated on a subscription basis, with multiple underwriters sharing individual risks, and that marine insurance was mutual: Borromei & Co. operated as a seller, as well as a buyer of marine cover, following the practice developed in Italy. A century and a half after this earliest concrete evidence of insurance underwriting in London, formal infrastructure – albeit limited – was established at the direction of the Privy Council to reduce and manage marine insurance disputes in the city, and in 1601 a marine insurance law, with the same goals, was enacted.⁷

⁴ Davis, R.: *English overseas trade, 1500-1700*. London: Macmillan, 1973, p. 7; Davis, R.: 'English Foreign Trade, 1660-1700'. *Economic History Review*, New Series, vol. 7, No. 2 (1954), pp. 153, 161.

⁵ Bensa, Enrico: *Il contratto di assicurazione nel medio evo*, 1884, translated to French, Valéry, Jules, as *Histoire du contrat d'assurance au moyen age*, Paris: Ancienne Librairie Thorin et Fis, 1897, p. 20.

⁶ 'Rates' are always given as a percentage of the sum insured (the policy value). Translation and tabulation of data drawn from the Borromei ledgers by Bolton and Bruscoli is at www.queenmaryhistoricalresearch.org/roundhouse/default.aspx

⁷ Leonard, A. B.: 'Contingent commitment: the development of English marine insurance in the context of New Institutional Economics, 1577-1720', in Coffman, D., Leonard, A.B., and Neal, L.(editors): *Questioning Credible Commitment: Re-thinking the Glorious Revolution and the Rise of Financial Capitalism*. Cambridge: University Press (2013).

A series of a dozen policies issued to Bartholomew Corsini in the 1580s illustrates the work of the Office of Assurances, established as a centre for policy registration. The initiative was part of the Privy Council's programme. The policies show that by this time insurance was no longer the preserve of the Italian merchant community: many underwriters' names are distinctly English.⁸ The Corsini policies also show that practical conventions, such as the policy wording, the perils specified, and the acknowledgement that custom under the law merchant was to govern the contract, were already in place, just as extant policies from the middle of the sixteenth century show that arbitration, rather than the courts, was the generally preferred route for dispute resolution.⁹

It is not possible to know what share of merchants trading from London and Britain's rising outports purchased insurance for their vessels or cargoes. Nor is it possible to know how much cover they bought when they did insure: a merchant may ship £100 worth of goods, but buy insurance to cover only £50. Equally, he may insure the full £100, as well as the his share of the victuals and armaments on the vessel, and even the insurance premiums, as Bristol merchant Richard Long 'thelder' did in 1646.¹⁰ However, it is clear that the market was well developed – far from the 'unorganised' institution described by Kepler.¹¹ Given this level of development, those merchants who did not buy insurance, or who underinsured, must have chosen to forgo cover for one of two reasons. Marine insurance provides contingent capital, allowing merchants to trade with less resource than is demanded by certain risks of shipping. Some merchants may have felt wealthy enough that insurance was not required. The East India Company, for much of its active trading existence (although not all of it, as is commonly asserted), did not purchase insurance, preferring to retain risk.

Alternately, merchants may have forgone insurance because they perceived the cost of cover to be too high, relative to the perceived likelihood of loss, or to the profitability of the

⁸ LMA CLC/B/062/MS22281, CLC/B/062/MS22282, the Corsini papers.

⁹ TNA HCA 24/29 f. 45, policy underwritten for Anthony de Salizar, 05.08.1555. The policy states: 'yf godes will be that the said shippe shall not well procede, we promys to remyt yt to honist m'chaunts and not to go to the lawe'.

¹⁰ Manuals of merchant practice showed how to calculate sums insured to include premiums paid. Nott, H.E. (editor): *The deposition books of Bristol, Vol. I, 1643-1647*, Bristol: Records Society, 1935, p. 141-2; for merchant manuals, see, for example, Postlethwayt, M.: *The universal dictionary of trade and commerce, vol. I., fourth edition*. London: Printed for W. Strahan and 24 others, 1774 (first published 1755), entry on 'Assurance'.

¹¹ Kepler, J.S. 1975: 'The operating potential of the London insurance market in the 1570s'. *Business History* 17, p. 44.

venture. In competitive import/export markets with resulting tight margins, an additional expenditure equal to five, ten, or even twenty percent of the value of trade goods – especially one with no certain return – may have seemed too costly. Rather than engaging in risk *transfer* through insurance, merchants could instead practice risk *mitigation*, for example by dividing cargoes between multiple vessels, owning only fractional shares in ships, or travelling in convoy to fend-off belligerents. However, these mitigation measures had obvious and significant attendant transaction costs.¹² If risk transfer through insurance was cheaper, it would be more attractive. Relative cost restriction is perhaps best illustrated by the practice, which appears to have been common in the seventeenth century, of purchasing only partial cover. Such buyers clearly saw the value of insurance, but purchased the minimum to ensure their solvency in the case of catastrophic loss. To buy more must have seemed too expensive. ‘It’s my general custom to insure when adventures are anything considerable, whether at peace or war’, the London merchant William Freeman wrote to his agent in Montserrat in 1680. ‘When the danger is least, premium is low, and so I look upon it as a safe way.’¹³

It *is* possible, however, to show that the price of marine insurance fell dramatically between its earliest appearances in England in the fifteenth century, and London’s accession to pole position in international markets in the early eighteenth. Section III of this article does so very concretely, through a long series showing the development of marine insurance prices for voyages to and from London from the earliest for which rates can be established, until the close of the long eighteenth century. Section II discusses some of the possible reasons for the decline in prices – and also for several spiky price rises. The latter, it is argued, occurred when uncertainty, rather than risk, characterised the likelihood of the manifestation of insured perils (named, with only insignificant variation, in English insurance policies for 400 years between 1580 and 1980 as ‘the seas, men of war, fire, enemies, pirates, rovers, thieves, jettizons, letters of mart and counter-mart, surprisals and takings at sea, arrests, restraints, and detainments of all kings, princes, and people, of what nation, condition, and quality whatsoever; barratry of the master and mariners, and of all other perils, losses, and misfortunes, that have or shall come to the hurt, detriment, or damage of the said goods and

¹² Price, Jacob: ‘Transaction Costs: A note on Merchant Credit and the Organisation of Private Trade’, in Tracy, James (editor): *The Political Economy of Merchant Empires*. CUP, 1991, pp. 288-90.

¹³ William Freeman to John Bramley, 16.07.1680. Hancock, David (editor): *The letters of William Freeman, London Merchant, 1678-1685*. London: Record Society, 2002, p. 162

merchandizes, or any part thereof’). Over the longer term, this transformation from uncertainty to risk was one of the key developments which allowed prices to fall. As the perils of the ergodic future became understood well enough to be assessed, underwriters were able to find the ‘right price’. This made insurance affordable, and allowed the underwriters to achieve a long-term profit from underwriting risk, rather than gambling on uncertainties.

The concrete distinction between risk and uncertainty was set out by Frank Knight in 1921, and yields striking practical implications for marine insurance. In principle, to render insurable an outcome – the manifestation of one of the perils specified (named) in an insurance policy – the characteristics of the uncertainties surrounding such an event must be known with sufficient confidence to transform them into risks. In other words, in principle, calculable risk can be transferred economically through conventional premium-based insurance, while uncertainty cannot. Knight stated that, in the case of risk,

the distribution of the outcome in a group of instances is known (either through calculation *a priori* or from statistics of past experience), while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique ... The application of the insurance principle, converting a large contingent loss into a smaller fixed charge, depends upon the measurement of probability upon the basis of a fairly accurate grouping into classes.¹⁴

Writing at almost exactly the same time, and without adopting the nomenclature of risk and uncertainty, J. M. Keynes, in his *A treatise on probability*, made the same distinction in a slightly different way. It is not possible, Keynes showed, to assign a numerical value to every instance of probability.

Whether or not such a thing is theoretically conceivable, no exercise of the practical judgement is possible, by which a numerical value can actually be given to the probability of every argument. So far from our being able to measure them, it is not even clear that we are always able to place them in order of magnitude. Nor has any theoretical rule for their evaluation ever been suggested.¹⁵

Keynes used legal and insurance-market examples to illustrate this point, and given the current topic, the latter is worth repeating. The ‘arbitrary element’ in some underwriting

¹⁴ Knight, Frank: *Risk, uncertainty and profit*, Boston: Houghton Mifflin, 1921, pp. 233-5.

¹⁵ Keynes, J. M.: *The collected writings of John Maynard Keynes, Vol. VIII: A treatise on probability*. Cambridge: Royal Economic Society, 1973 (1921), p. 29.

scenarios is great, he states, citing reinsurance¹⁶ rates offered in the Lloyd's market on the missing vessel *Waratah*.

The lapse of time made rates rise; the departure of ships in search of her made them fall; some nameless wreckage is found and they rise; it is remembered that in similar circumstances thirty years ago a vessel floated, helpless but not seriously damaged, for two months, and they fall. Can it be pretended that the figures which were quoted from day to day – 75 per cent, 83 per cent, 78 per cent – were rationally determinate, or that the actual figure was not within wide limits arbitrary and due to the caprice of individuals? In fact underwriters themselves distinguish between risks which are properly insurable, either because their probability can be estimated between comparatively narrow numerical limits or because it is possible to make a 'book' which covers all possibilities, and other risks which cannot be dealt with in this way and which cannot form the basis of a regular business of insurance, – although the occasional gamble may be indulged in.¹⁷

The rigorous Keynes rather lets his analysis slip near the end of this illustration. While underwriters do indeed distinguish between risks which are properly insurable and those which are not, his description of the difference is flawed. Knightian risks, which can be probabilistically determined, are insurable. For uncertainties (such as the missing vessel) where this is not possible, at best a wager can be made. If it is possible to collect sufficient wagers to make a 'book' (a bit of terminology borrowed by Keynes directly from the jargon of gambling), the underlying act remains one of wager, not of insurance. The nature of the uncertainty has not changed. Further, it seems only a remote possibility that a 'book' covering all possibilities could ever be made in the practical world of insurance. Keynes offers the example of underwriters' offers on an election outcome in 1912:

60 per cent was quoted at Lloyd's to pay a total loss should Dr Woodrow Wilson be elected, 30 per cent should Mr Taft be elected, and 20 per cent should Mr Roosevelt be elected. A broker, who could effect insurances in equal amounts against the election of each candidate, would be certain at these rates of a profit of 10 per cent. Subsequent modifications of these terms would largely depend upon the number of applicants for each kind of policy.¹⁸

¹⁶ The insurance of insurers, an instrument to further spread exposure to underwriting losses.

¹⁷ Keynes, *Probability*, p. 25.

¹⁸ Keynes, *Probability*, p. 24.

Even if a broker could balance his portfolio of contracts as Keynes describes, such an activity is ‘in principle one of bookmaking’, he concedes.¹⁹ It is market-making in wagers, rather than genuine insurance – although when the Bristol underwriter Abraham Clibborn accepted the ‘risk’ of ‘Peace till 14th May 1772’, he did not have an offsetting policy to pay out if war were declared.²⁰ It may be that the contract was called an insurance policy, the bookmaker an underwriter, and the market Lloyd’s of London, but that does not make such wagers into insurance. English law specifies that such contracts are not insurance, because the beneficiaries possess no insurable interest in the outcome of the poll. Section 4 of the *Marine Insurance Act* 1906 specifies that: ‘Every contract of marine insurance by way of gaming or wagering is void’.²¹ This follows controversial legislation of 1746, which prohibited certain speculative insurances by requiring that buyers of policies possessed an ‘insurable interest’ in the object of the insurance.²² In other words, it was no longer possible to insure an outcome in which had nothing beyond the policy itself to do with the buyer of the insurance.

The distinction between risk and uncertainty, and thus the insurability of a given outcome, was understood long before Knight’s formal distinction was expressed. According to this analysis, insurance can operate only in the areas of uncertainty that have been translated into risk through quantification and statistical or probabilistic analysis, and where a sufficient number of homogeneous individual risks can be assumed by an individual risk-bearing entity – the underwriter – to ensure that pricing reflects actual likelihood of loss. In London’s marine insurance market this was possible in the seventeenth and eighteenth centuries – leading to a revolution in marine insurance pricing. The greater number of voyages undertaken and insured in the period allowed underwriters to undertake probabilistic assessments of the likelihood of loss (albeit in a crude, frequentist way), instead of relying on pure judgement alone. This resulted in more accurate, risk-based pricing, and thus a more affordable product. Second, the larger risk pool allowed underwriters to offer lower rates due to the simple advantages of risk diversification. Cheaper insurance attracted a larger, increasingly diverse group of customers, which in turn further increased the size of the risk

¹⁹ Ibid.

²⁰ TNA C107/12, Risk books of Abraham Clibborn & Co, II. 10.

²¹ 1906 c. 41, Reg 6 Edw 7.

²² 19 Geo. II c. 37.

pool. It was these pricing factors which were responsible for the increased uptake of marine insurance, and for its institutional evolution during the period.²³

II

Insurance prices in London fell for many reasons. Chief among them was the increase in the amount of insurance that was underwritten in the city, especially at Lloyd's, a market where information – and risk – were shared amongst members of the merchant-insurer community.²⁴ Alas, no credible and comprehensive reckoning can be made of total the value of insurance underwritten over most of the period under review, since no broad government or corporate records were kept. Marine insurance underwriting in England was a business carried out almost exclusively by sole traders operating at the Coffee-house, very few of whose underwriting records survive. This domination of private insurers was certainly the case between 1720 and 1824, when marine underwriting by corporations and partnerships was limited to the a duopoly of the Royal Exchange Assurance and the London Assurance – companies which were only minor players alongside individuals in the Lloyd's market.²⁵ However, a crude estimation can be made. An early nineteenth century witness – unreliable at best – calculated that the two companies together insured ships and merchandise to a value of £2.11 million, and that they had roughly ten per cent of the insurance market, which thus would have granted cover of about £20 million.²⁶ (The actual figure may be somewhere near this, or some distance away.) A more reliable figure (although still questionable) for 1810 was estimated by a parliamentary committee, based on policy stamp duty. It put the total sum insured by underwriters in Britain in 1809 under marine insurance policies at £162,538,905,²⁷ an eight-fold increase from the estimate for 1720.

²³ And not exclusively, or even particularly, the growth of transatlantic trade, as has recently been asserted by Christopher Ebert, who argues, erroneously in my view, that the rise of transatlantic trade drove institutional developments in the insurance industry. Instead it was the expansion of trade in general which spurred the need to modify marine insurance institutions, because increasing numbers of 'individualist' players joined the game. Ebert, Christopher 2011: 'Early Modern Atlantic trade and the development of maritime insurance to 1630', *Past & Present*, no 213, 87-213.

²⁴ The moniker 'merchant-insurer' was used by contemporaries, as in, for example, England's 1693 *Bill to enable divers Merchants-Insurers, that have sustained great Losses by the present War with France, the better to satisfy their several Creditors*.

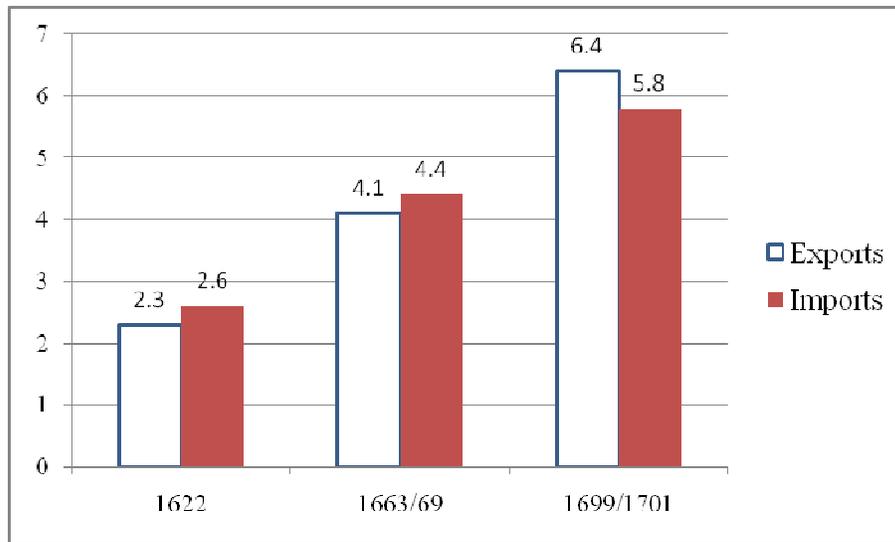
²⁵ 'Report from the select committee on marine insurance, 18 April 1810', British Parliamentary Papers, 226 (1810), reprinted 11 May 1824, p. 21; Supple, Barry: *The Royal Exchange Assurance: A history of British insurance 1720-1970*. Cambridge: University Press, 1970, p. 53.

²⁶ A subscriber to Lloyd's: *A letter to Jasper Vaux*, London: 1810.

²⁷ 'Report from the select committee on marine insurance, 18 April 1810', British Parliamentary Papers, 226

Whatever the precise numbers, a steady increase in the aggregate sums insured under marine insurance policies occurred over the course of the eighteenth century. The increase was driven by changes in both supply and demand, the most fundamental of which must have been the significant increase in underlying trade, both international and local. Ormrod estimated English domestic exports were valued at £2.32 million in 1622, and imports at £2.62 million.²⁸ Davis has tentatively estimated that total national exports, including re-exports, rose from £4.1 million in 1663/69 to £6.4 million in 1699/1701, while imports rose from £4.4 million to £5.8m. Over the period the value of manufactured goods exported from London alone increased from £222,000 to £420,000; the component of non-European exports amongst the total tripled, from £86,000 to £259,000.²⁹

Figure 1: The rise of English Trade, 1622-1699/1701, £ million



Sources: Ormrod 2003, Davis 1954

It is important to note the structure of marine insurance prices. Always they are calculate as a percentage of the value of the vessels, cargoes, or freight insured, and are expressed as a rate of that ‘insured value’. This has several implications. A rise in the value of commodities, or a

(1810), reprinted 11 May 1824, p. 58.

²⁸ Ormrod, David, *The rise of commercial empires: England and the Netherlands in the age of mercantilism, 1650-1770*. Cambridge: University Press, 2003.

²⁹ Davis, Ralph: English Foreign Trade, 1660-1700. *The Economic History Review*, New Series, Vol. 7, No. 2 (1954), pp. 154, 160.

change in the value of currency, for example, will not impact upon the rate. Cotton worth £100 insured at a rate of three per cent always costs £3 to insure, whether the volume of the cotton is one bushel or one hundred (the same is not true of, for example, freight charges, which vary according to the volume of goods shipped). However, marine insurance rates do fluctuate with changes in the price of the contingent capital which marine insurance provides, which is in turn affected by the supply of contingent capital available to be deployed by underwriters (on which more below). Brokers' commission, if any was also included in the rate. It was sometimes usual for underwriters to charge a rate in guineas (21 shillings, with 20 shillings to the pound), and pass the 'extra' shilling on to the broker.

When marine insurance prices – expressed as rates – had declined somewhat, insurance-buying decision-making was effected. Expected utility will have increased demand. If a merchant believes one in twenty vessels is likely to be lost, insurance of £1,000 has an expected value of £50. At a premium of four percent, the gain is £10. However, while underwriters may have calculated insurance prices in this way (and I have yet to uncover any direct evidence that they did so, although the accuracy of their floor-level pricing suggests they may have done), it seems unlikely that insurance buyers would have made such calculations. They were perhaps more likely to have considered the cost of insurance relative to the expected yield of a trading voyage. Margins in ocean-going trade could be very fine, and in ship-owning even narrower.³⁰ Further, early modern trade was an essentially precarious, unpredictable system. Huge distances greatly distorted the fundamentals of supply, demand, and pricing, by depriving merchants of current information. Such challenges produced an economic rationality, and hence a series of economic behaviours, 'widely different from that of the world of modern economics'.³¹ With trade profits on voyages thus inherently unpredictable, foregoing insurance may often have seemed a necessary choice.

As prices fell and London's market developed, the use by foreign insurance buyers of the London marine insurance market increased. During the English Civil War (1642–1651) Dutch merchants sometimes bought insurance in London, as Samuel Lamb revealed in 1657: 'It is the Hollanders custom ... that when they send any single ship to the southward for their

³⁰ Brulez, W.: 'Shipping profits in the early modern period'. *Acta Historiae Neerlandicae*, XIV (1981), p. 83.

³¹ Musgrave, P.: 'The economics of uncertainty: the structural revolution in the spice trade, 1480-1640', in *Shipping, trade, and commerce: essays in memory of Ralph Davis*. Leicester: University Press, 1981, pp. 10-19.

own accounts, oftentimes to insure them in England'.³² Further, the agency/broker system developed very early to bring foreign risks to London. It was evidently common, for example, for intermediaries outside England to accept risk from foreign merchants, then reinsure those risks at a lower price in London. John Barnard's testimony to a 1720 Parliamentary committee illustrates. 'Foreigners have allowed their correspondents here a *Premium* to Insure the Insurers, which ... has been occasioned by Foreigners not knowing the Insurers here, and that they can afford to give it, by reason of the Lowness of the *Premiums*'.³³

The practice became widespread. In 1756 the London merchant Robert Plumstead, who arranged insurance for his overseas customers, wrote to a client in New England that 'insurance [of] £600 on the *Molly Geo. Eckles M[aste]r* from Jamaica to the [Chesapeake] Bay and Back to Philadelphia I have got done at 20 Guineas percent'.³⁴ The price was high because underwriters were aware of the impending Seven Years War. Plumstead's clients had choices, however. Insurance was available locally to buyers in the U.S. The first known insurance office there was opened in Philadelphia in 1721, from which the broker John Copson coordinated private underwriting.³⁵ In 1753 Obadiah Brown, a merchant of Providence, underwrote 'On snow *Dolphin Thomas Mangester Master* 300 £ @ 3 to Surinam', amongst many other insurances he recorded in his extant risk-book.³⁶ Local underwriters such as Brown had clear information advantages over London for risks in their hemisphere, they paid losses locally (which customers preferred), and they eliminated both a level of agency cost and significant problems of delay. However, insurance was 'generally cheaper' in London, where underwriters were perceived to be more creditworthy. The U.S. insurance sector, which was divided between its major commercial ports, was unable to

³² Lamb, S.: 'Seasonal observations humbly offered to his Highness the Lord Protector' (London: 1657). Reprinted in Scott, W. (editor): *A collection of scarce and valuable tracts of the most interesting and entertaining nature, vol. sixth*. London: Printed for T. Cadell and six others, 1811, p. 448.

³³ Testimony of John Barnard, *Attorney General's Report, The special report, from the Committee Appointed to Inquire into, and Examine the several Subscriptions for Fisheries, Insurances, Annuities for Lives. House of Commons: London, 1720*, p. 44.

³⁴ R. Plumstead to W. Plumstead, *Plumstead Letterbook*, 12 March 1756, University Library Add. 2798, pp. 40-41.

³⁵ *A history of the Insurance Company of North America of Philadelphia*, Philadelphia: Press of Review 1885, p. 15.

³⁶ Brown, Obadiah: 'Marine insurance book, 1753-1762'. Rhode Island Historical Society (RIHS), MSS 315/SS4/2/32, p. 496.

match the concentration or organisation achieved at Lloyd's, and had little international diversification.³⁷

Thus the London product must have been more appealing due to price, security, or some other significant factor or factors, since distance alone meant that it certainly was not more straightforward to purchase or claim against. For most of the period of review, a significant proportion of American risks were added to London risk pool. 'Our Premium are about 70 per Cent more then are paid in London', the New York merchant-underwriter Waddell Cunningham reported to his business partner in 1756.³⁸ Although the institutions of U.S. marine insurance were to diverge and develop along a different, more corporate path following the War of Independence, a large share of the country's marine insurance continued, and continues, to be underwritten in London, as ship owners and merchants reap the benefits of the price revolution of the seventeenth century.

It should be observed that the preference for London was not universal. A century before Cunningham's correspondence, the Restoration-period merchant-insurer Charles Marescoe wrote to a Swedish business partner that:

We do not find it advisable to have insurance done here [in London] as most of the insurers are not to our liking. In case of loss one has to wait, 3, 4, or 6 months, and then they deduct 15 or at least ten per cent, as well as the premium, before they pay up. Therefore it is better to have it done in Hamburg or Amsterdam by those friends on whom you could draw the money ... if you want the business to remain with us we shall arrange the insurance with the rest, remaining satisfied with ½ per cent for our outlay.³⁹

Despite these statements, however, Marescoe acted as an underwriter in London, and did buy many insurance policies there to cover his own trading voyages. It is also worth noting that the deduction from claims payments he referred to could be avoided through payment of an additional or higher premium, much like a deductible on a modern insurance policy can be increased to reduce the cost. Many buyers may have seen this option as flexibility, a

³⁷ Kingston, C.: 'Marine insurance in Britain and America, 1720–1844: a comparative institutional analysis'. *Journal of Economic History*, Vol. 67, No. 2 (June 2007), pp. 391-393.

³⁸ Cunningham to Thomas Greg, 10.05.1756. *Ibid.*, p. 114.

³⁹ Roseveare, Henry (editor): *Markets and merchants of the late seventeenth century: the Marescoe-David letters, 1668-1680*, Oxford: University Press, 1987, p. 569.

characteristic for which the London marine insurance market was known, and it represents, in the jargon of the modern insurance industry, 'vertical self-insurance'.

Over the century more foreign merchants did choose to insure in London, however, including some unlikely customers. The annual *flota*, the Spanish South America treasure convoy, typically comprising about fifteen richly laden merchant vessels and their escorts, was the subject of 'insurances to a very large amount every year made in London'.⁴⁰ French merchants established the French East India Company in 1783, and from 1787 to 1789 insured their ventures in London to the value of 8.75 million *livres*, comprising nearly half the total cover they purchased.⁴¹

The resulting spread of risks gave London's underwriters a competitive advantage over rival countries and insurance centres, where underwriting typically was fragmented between regional ports, and focussed on local trade. In the Low Countries both Amsterdam and Rotterdam were important underwriting centres, but each employed different contractual terms, as the smaller city attempted to win international business from the larger. Groningen merchants employed closed, mutual insurance structures called *compacten*.⁴² French underwriting was even more diffuse, such that insurance in the ports was 'so restricted and uncertain that ships were usually covered by two, three, or more policies purchased in as many different cities'.⁴³ Trade specialisation in French ports meant the country possessed no centre which concentrated mercantile wealth as London did, and thus no insurance market able to accept the amount of merchant risk underwritten there.⁴⁴ Insurance rates charged by underwriters in Cadiz on both Spanish and English ships were frequently double those charged in London on the same vessels.⁴⁵ The once-dominant Venetian market had already suffered serious contraction, prompting a contemporary to write in 1693 that 'the insurance business has declined from its former flourishing conditions... to the extent that formerly one

⁴⁰ Weskett, J.: *A complete Digest of the Theory, Laws, and Practice of Insurance*. London: Printed by Frys, Couchman, & Collier, 1781, p. 223.

⁴¹ Harlow, Vincent: *The Founding of the Second British Empire, 1763-1793, Vol. II*. London: Longmans Green & Co., 1963, p. 493.

⁴² Go, Sabine Christa: *Marine insurance in the Netherlands 1600-1870: a comparative institutional approach*. Unpublished PhD thesis, Free University of Amsterdam, 2009.

⁴³ Boshier, J.F.: 'The Paris business world and the seaports under Louis XV'. *Histoire Sociale* XII (1979), p. 282.

⁴⁴ John, A.H.: 'The London Assurance Company and the marine insurance market of the eighteenth century'. *Economica*, New Series, vol. 25, No. 98 (May, 1958), pp. 135-136.

⁴⁵ Testimony of John Barnard, *Special report*, p. 44.

could find insurers [to provide] 50,000 ducats on a ship, whereas now it is a hard task to find them for 6,000'. Prices rose dramatically.⁴⁶

A serious circularity of causality is apparent, and woven into this analysis of price-driven demand increases. This circularity was not lost on contemporaries. 'The Cheapness of Insurances, and the Eagerness of Foreigners to insure here, reciprocally contribute to each other; we are often applied to, because we insure at an easy Rate, and we can insure at an easy rate, because we are often applied to,' the parliamentarian William Guidott told the House of Commons in 1742.⁴⁷ Yet regardless of this circularity, increased demand in London for marine insurance clearly fed the risk pool. A larger set of available risks allowed the law of large numbers to have a greater effect on underwriting results, which led to downward pressure on prices.

Risk diversification was another advantage of the growing market, especially the entry of foreign insurance buyers, an advantage which contemporaries were keenly aware of two centuries before Lowenfeld first outlined the basic concept of portfolio theory.⁴⁸ The ability to assume a portfolio of risks including vessels and cargoes *en route* to a variety of destinations would minimise the impact on individual underwriters of losses such as the 1693 taking by the French of the Anglo-Dutch Smyrna fleet, travelling in convoy to the eastern Mediterranean (although at this early stage diversification was insufficient to prevent underwriter failures arising from this catastrophic event). As Lloyd's Chairman John Julius Angerstein told parliament in 1810, underwriters' focus on specific geographical branches of marine risk was 'less at Lloyd's than at any other place' because of the 'variety of business' available and 'his interest to mix the whole, that if there is a storm at one place he is safe at another'.⁴⁹ This practice began hundreds of years earlier. Marescoe, for example, frequently underwrote insurance on voyages to and from Virginia, Barbados, and India – destinations to which his own Baltic trade did not extend.⁵⁰

⁴⁶ Stefani, G.: *Insurance in Venice from the origins to the end of the Serenissima*, vol. I. Trieste: Assicurazioni Generali, 1958, p. 120.

⁴⁷ Johnson, Samuel (attributed): 'Debate in the House of Clinabs, on the second reading of a bill to prevent inconveniences arising from the insurance of ships'. *Gentleman's Magazine*, vol. XII, January 1742, p. 12.

⁴⁸ Lowenfeld, H.: *Investment an Exact Science*, London: 1907.

⁴⁹ Testimony of Angerstein, John Julius: 'Report from the Select Committee on Marine Insurance (Sess. 1810), 18 April, 1810'. House of Commons, BPP (226) 1810 IV 247, reprinted 11.5.1824, p. 67.

⁵⁰ Roseveare, Henry (editor): *Markets and merchants of the late seventeenth century: the Marescoe-David letters, 1668-1680*, Oxford: University Press, 1987. See especially Appendix E, p. 582-588.

Further, ‘price discovery’ in a market so integrated that many buyers were also sellers must have led to an equilibrium price in everyday transactions. Knight states specifically:

It is generally not enough that the insurer who takes the ‘risk’ of a large number of cases be able to predict his aggregate losses with sufficient accuracy to quote premiums which will keep his business solvent, while at the same time imposing a burden on the insured which is not too large a fraction of his contingent loss. In addition he must be able to present a *fairly plausible contention* that the particular insured is contributing to the total fund out of which losses are paid as they accrue in an amount corresponding reasonably well with his real probability of loss.⁵¹

The need for a fairly plausible contention that prices are reasonable must have been imperative in the early London marine insurance market, where buyers were often also sellers, where brokers controlled the majority of the business (they had been important since at least the late sixteenth century – at least thirty were active in London in the 1570s⁵²), and where the business was concentrated within Lloyd’s Coffee-house. The combination of competition, intermediation, and mutual interest should, in combination, have had the effect of ensuring that marine insurance prices reached a risk-based minimum, at least where the extent of specific relevant perils was known. Competition and intermediation will have pushed prices downwards; vertical integration and information-sharing (symbolised famously by the publication of *Lloyd’s News* and *Lloyd’s List* since at least 1692⁵³) among merchant-insurers provided a floor-price sufficient to limit underwriter failure due to under-pricing.

Supply also has an impact on marine insurance prices. The modern phenomenon known as the ‘insurance cycle’, which typically operates over seven to ten years, sees capital pile into the market when prices are high. Barriers to entry are low, requiring only assets to be committed to support risks assumed. Such assets are typically also invested elsewhere, allowing double-use of underwriting capital (a benefit extolled in the twentieth century by the renowned investor Warren Buffet). In the absence of exogenous price factors such as war, the influx of capital has the effect of forcing prices down to their floor level, sometimes to

⁵¹ Emphasis added. Knight, *Risk, uncertainty, and profit*, p 235.

⁵² Stow, John: *A survey of the cities of London and Westminster (Styve’s edition)*. First published 1598. London: printed for A. Churchill and nine others, 1720, pp. 242-3.

⁵³ McCusker, John J.: *European bills of entry and marine lists: early commercial publications and the origins of the business press*. Cambridge, MA: Harvard University Press, 1995, p. 53.

uneconomic levels. Losses at the trough of the cycle usually lead to underwriter failures and withdrawals, which shrink demand and allow a price recovery.

It appears that the underwriting community in London was growing as prices fell, and was sufficiently robust to ensure they were near their floor level. Over forty-seven months from 1664, Marescoe purchased 108 policies underwritten by just thirty-one discrete individuals, ten of whom accounted for almost 84% of the total value of the policies.⁵⁴ As trade expanded, so too did the underwriting market. Between 1709 and 1717 Ralph Radcliffe purchased policies underwritten by eighty-six discrete underwriters.⁵⁵ No comprehensive enumeration exists for the sixteenth or seventeenth centuries, but a 1718 petition was signed 163 individuals in London who had ‘actually underwritten policies’.⁵⁶ Not all of these men would have been regular underwriters: in 1720 ‘there [were] about one hundred Persons of very Good Repute [in London], who Insure Ships and merchandizes at Sea’.⁵⁷

Institutional impacts also brought prices down, as transaction costs in the London marine insurance market were reduced. As demand began to grow, the institutional structures of the market were adapted to cope with the arrival of ‘individualist’ traders into a fundamentally ‘collectivist’ market.⁵⁸ External enforcement of the ‘rules of the game’, which evolved from the Law Merchant, were introduced to keep that component of transaction costs at its lowest. In part as a result, contracts were standardised, and over time underwriters modified the terms and conditions of cover to improve the utility of their insurance offer. Meanwhile, the market took institutional development steps in the three key areas outlined by North as important to the reduction of transaction costs: those which increased the mobility of capital, those which lowered information costs, and those which spread risk.⁵⁹ The third may be taken for granted. The first, in which North includes centralisation of trade, was met in part by concentration of London’s insurance business, first in Lombard Street, and ultimately in a single Coffee-house, Lloyd’s. This concentration played a key role in the transformation of uncertainty into

⁵⁴ Roseveare, *Markets and merchants*, pp. 582-588

⁵⁵ Insurance policies of Ralph Radcliffe, Hertfordshire Archives and Local Studies Centre, DE/R/B293/1-47.

⁵⁶ Wright, C. & Fayle, C.E.: *A history of Lloyd’s*. London: Macmillan & Co., 1928, p. 50.

⁵⁷ Barnard, *Attorney General’s Report, 1720*, p. 44.

⁵⁸ The collectivist and individualist division, in the context of New Institutional Economics, is proposed in Greif, Avner: *Institutions and the path to the modern economy: lessons from Medieval trade*, Cambridge: University Press, 2006.

⁵⁹ North, Douglass: ‘Institutions, Transaction Costs, and the Rise of Empires’, in Tracy, James (editor): *The Political Economy of Merchant Empires*. Cambridge: University Press, 1991, pp. 26-29.

risk by increasing the number of cases of loss which could be considered when prices were set. The second is evident in the publication, as early as 1692,⁶⁰ of *Lloyd's News* and its successor, *Lloyd's List*, and the later introduction of the *Lloyd's Register of Shipping*, which by 1764 recorded details of vessels for risk assessment purposes. These innovations advanced the classification of outcomes, with similar impact.⁶¹

The factors which affect marine insurance pricing described so far are primarily endogenous, market factors. However, exogenous factors can also have a significant effect on marine insurance pricing, and can snap the ergodic predictability which allows the conversion of uncertainty into risk. Uncertainty is of two types: epistemological – a lack of understanding of the world – and ontological – arising from unpredictability of the world itself.⁶² The collective underwriting experience of a market cannot transform uncertainty into risk when the world changes, and the ergodic maxim does not hold. This can occur when serial correlations arise, for example when concentrated privateering increases the number of vessel losses on a specific sea route. Such losses have long been insured, since marine insurance policies cover two broad classes of exogenous perils: those of the seas, and those of men. Into the latter category fall acts of war and piracy. War in particular introduced dramatic uncertainty into marine insurance underwriting – and war at sea was a frequent characteristic of early modern commerce. Further, preying upon merchant shipping – by both vessels of states' navies and by privateers licensed to do so by their governments – was a matter of policy. For example, France implemented such a naval strategy in the later years of the Nine Years' War (1688-1697). It chose to concentrate its diminishing naval resources on privateering and squadron attacks against merchant shipping. Developed by the military engineer Sébastien le Prestre de Vauban, the new strategy recognised the reliance of the allied war effort on seaborne trade. It sought to destroy the English ability to prosecute the war by devastating this commerce, and to bankrupt England in the process.⁶³ One

⁶⁰ McCusker, John J.: *European bills of entry and marine lists: early commercial publications and the origins of the business press*. Harvard University Press, 1995, p. 53.

⁶¹ For an extensive discussion of London's marine insurance market in this framework, see Leonard, Adrian: 'Contingent commitment: the development of English marine insurance in the context of New Institutional Economics', in Coffman, D'Maris, Leonard, A.B., and Neal, Larry: (eds): *Questioning 'Credible Commitment': Re-thinking the Glorious Revolution and the Rise of Financial Capitalism*, Cambridge: University Press, forthcoming 2013.

⁶² Scazzieri, Roberto: 'Similarity and uncertainty', in Brandolini, S.M. and Scazzieri, R (eds.), *Fundamental uncertainty: rationality and plausible reasoning*, London: Palgrave MacMillan, 2011, p. 73.

⁶³ Rodger, *Command of the Ocean*, p. 172.

consequence was the successful attack on the Smyrna fleet, described above. Another was a sharp rise in insurance prices.

A familiar risk – for example, the insurance of vessels between London and the Netherlands – can become an uncertainty due to the unknown and therefore unpredictable nature of the new threat of military or privateering attacks in wartime. The practical effect of this reduction is the substitution of wagering for insurance. Prices rise, often dramatically. The underwriting records of the merchant-insurer William Braund for voyages to and from American in 1759 and 1764 clearly illustrate this. In 1759, during Atlantic naval conflicts of the Seven Year's War, Braund charged ten discrete rates, including seven different rates in the month of March alone, for the voyage from London to a named American port. The destination specified does not correlate with the fluctuation of rates between 2.5% and 20%. The mean rate is 7.1%; the standard deviation 5.1. In sharp contrast, Braund charged only three discrete rates in 1764 (2.5%, 3%, and 4%), for a mean of 3.2%, and a standard deviation of 0.76%. From March 1764 his rate for the voyage did not vary from 2.5%. When rates rise in this dramatic fashion, capital typically piles into the underwriting market, as merchant-insurers are attracted by high rates. While uncertainty remains, rates are often higher than the unknown level of actual risk warrants, and therefore underwriting in such periods of uncertainty was very often profitable.

Such shifts into uncertainty create spikes in long-term insurance price trends, and are not the main concern of this paper. Instead it is the long-term decline in prices arising from increased demand which advanced uncertainty into risk, and brought greater portfolio diversification, which the following section illustrates. These constitute the drivers of the marine insurance pricing revolution.

III

Analysis of marine insurance prices before the middle of the eighteenth century is made challenging due to the paucity of data which exists. I have compiled a database of nearly 10,000 prices to insure vessels on voyages from or to London or other English ports, but the vast bulk of these are from the latter half of the eighteenth or early nineteenth century, along with two large data sets from the mid eighteenth century. Many more price-points have yet to be digitised. The bulk of the data is from the handful of surviving underwriters' risk books, in

which insurers recorded the details of each underwriting deal they made. The earliest is that of Peter du Cane, dating from 1738 . Before that period, however, the details of insurance agreements can be drawn only from rare extant policies, from buyers' ledgers (which rarely record the rate paid), and from merchant correspondence. As a result, the number of data points available for the years before 1738 is much smaller than for later years, which frustrates both econometric analysis and the depiction of the marine insurance pricing revolution, which occurred primarily before this date. Nonetheless, a very early initial analysis of the data compiled so far, including scattered references to the cost of marine insurance during the period of the pricing revolution, paints a surprisingly consistent picture. Marine insurance in the late sixteenth, seventeenth, and early eighteenth centuries was more expensive than in later years, often much more expensive, but was declining steadily in price.

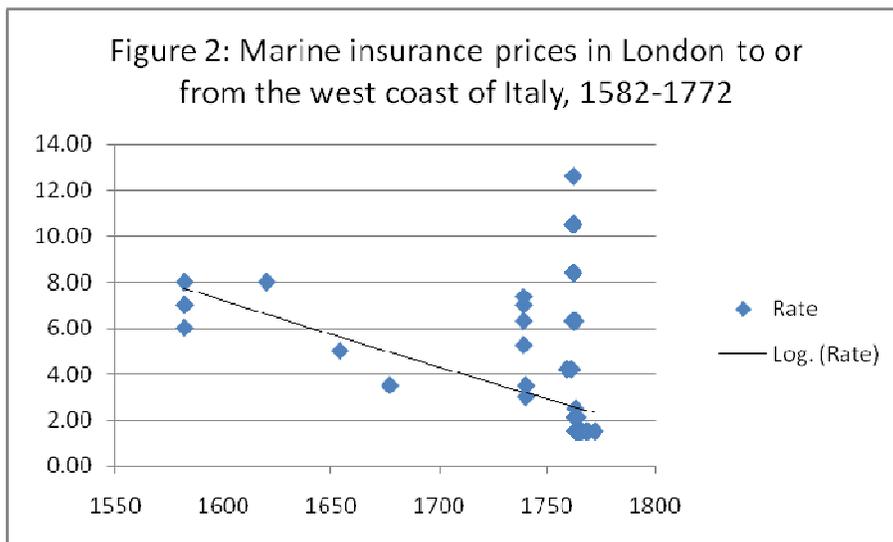
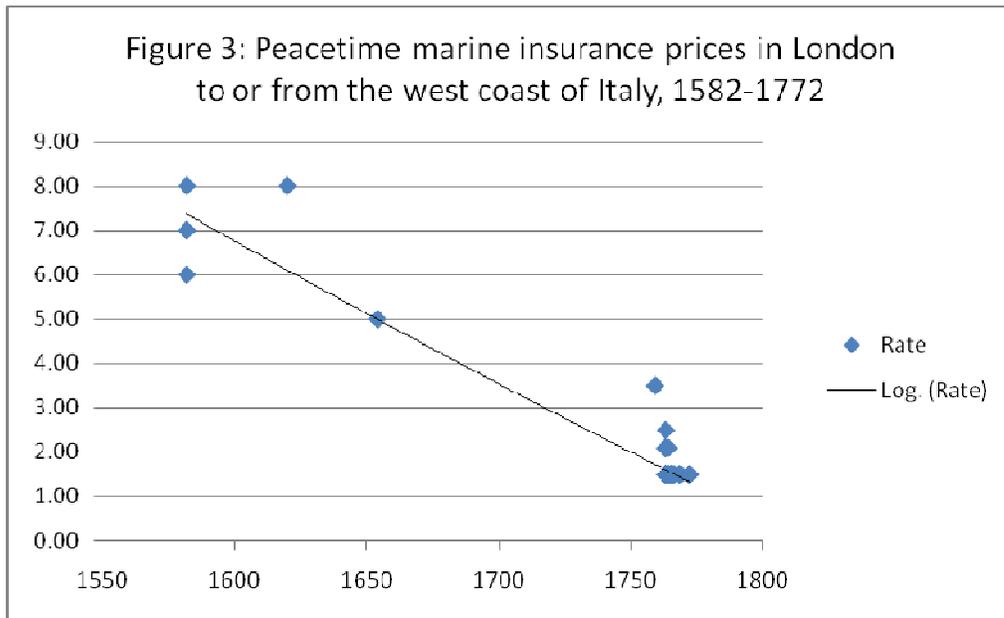


Figure 2 shows the clear decline in rates for insuring vessels and/or cargoes for the voyage to or from Livorno and Genoa in the period 1582 to 1772. The rate – which is the cost of insurance expressed as a percentage of the policy limit, or the ‘sum insured’ – is shown on the y axis; the year on the x axis. At the beginning of the period, rates for the voyage from London to the Western Italian peninsula fluctuated between six and eight percent. By the 1760s it had stabilised at a floor price of 1.5% in peacetime, a reduction of at least 75%.

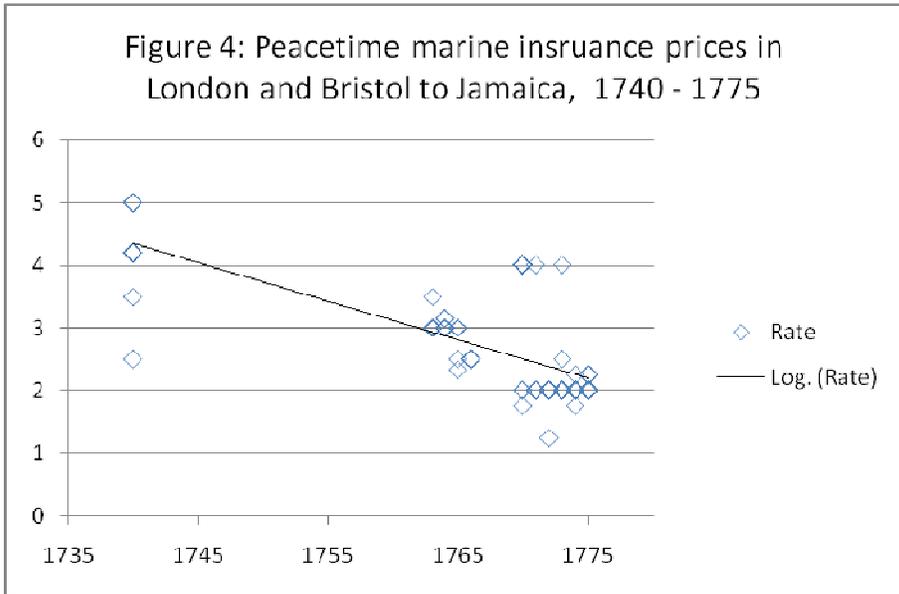
The effect of war on rates is clearly apparent in the periods of the Seven Years’ War (1756-1763) and the American Revolutionary War (1775–1783). In wartime prices rose

dramatically, to above their maximums two centuries before. When these price spikes are removed, as in Figure 3, a clearer picture of the transformation from uncertainty to risk is shown by the remaining data (although the frequency of eighteenth-century wars leaves some rather large gaps in the series).

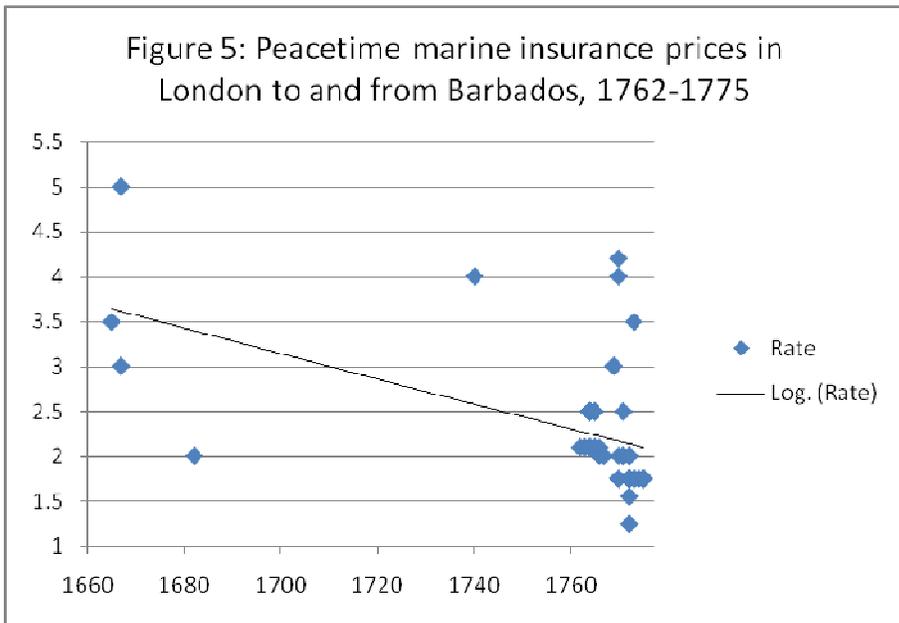


A further example, for voyages to Jamaica from London and Bristol, shows in Figure 4 a less dramatic decline, although data points for voyages before 1740 are not yet included in the analysis. A dozen rates for 1740 ranged from between 2.5% and 5%, and averaged 4.3%. The sixteen peacetime rates of 1775, by contrast, ranged from 2% to 2.25%, and averaged 2.04%.

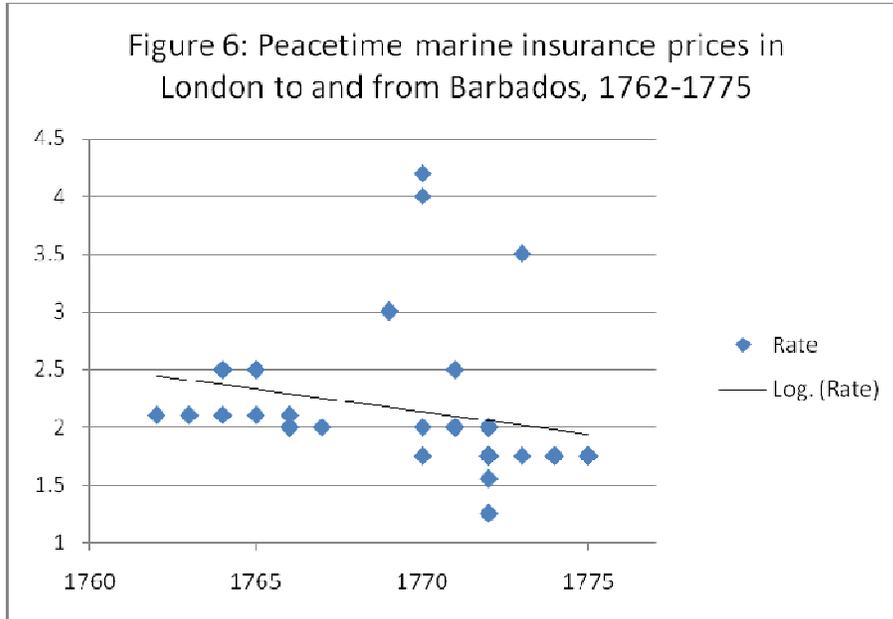
In considering these and any marine insurance prices, it should be remembered that many factors specific to the individual vessel insured, or to the vessel on which insured cargo is to be carried, can affect the price. Some vessels and some captains were considered less likely to make a voyage safely, and therefore may have been assessed a higher rate of premium. In other cases customers may have been afforded a discount due to the volume of their business, or for other reasons. Some cargoes, such as bullion, were less expensive to insure than the regular market rate – precious metals due to resilience to potential damage by seawater. Unfortunately price records very rarely reveal these factors of adjustment.



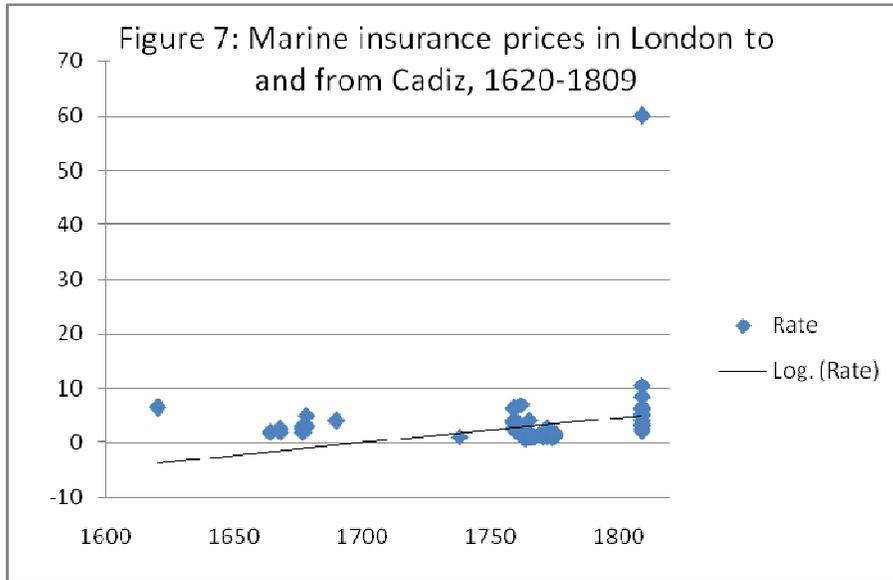
Including early data points which are few in number but consistently higher than later prices serves to lengthen the price series and show the extent of the pricing decline in marine insurance over time. However, the steady decline in prices can be illustrated in data sets which begin later in time. Consider the revolution in pricing of marine insurance to Barbados from the mid-seventeenth century to the outset of the American Revolutionary War, shown in Figure 5.



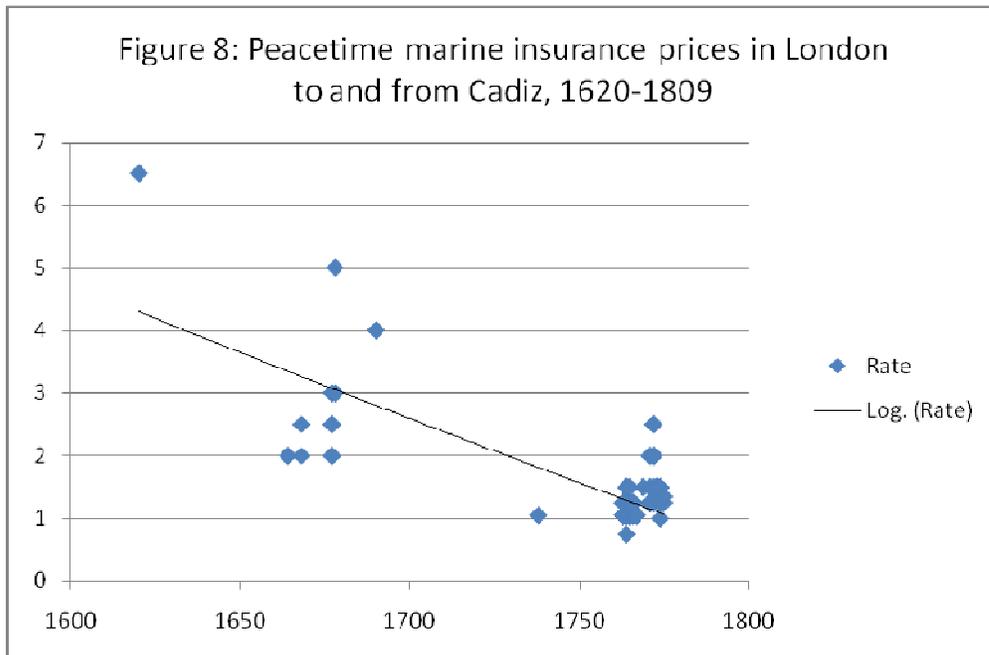
The price decline is dramatic, but the data points on which the earlier prices are based are few in number. However, when they are removed, the decline is still clearly illustrated by the 41 price-points which remain, and are plotted in Figure 6.



The effect of the uncertainty caused by war could be dramatic, upsetting prices on well-travelled routes. One of these was London to Cadiz, which since medieval times has seen English cloth transported south, and wine brought north. The Napoleonic Wars brought, in 1809, one of the highest prices recorded (and seen on two occasions): 60% for the cost of insuring cargoes on this route. The price is so exceptionally high that it has reversed the trend-line of declining prices evident for other routes, shown in Figure 7.



However, removal of the spiky wartime rates returns, in Figure 8, to the now-familiar declining price series. In this example, 106 data points remain. The price for 1620 is the 'market price' for this voyage recorded contemporaneously by Gerard Malynes.⁶⁴



⁶⁴ Cited in Magens, Nicolas (merchant): *An essay on insurances, vol. I*. London: J. Haberkorn, 1755, p. 83.

Much more work remains to be done to illustrate the marine insurance pricing revolution more completely, and more data remains to be collected, or added to the data set. However, this preliminary work shows that a clear fall in the price of marine insurance accompanied the boom in Britain's trade which occurred in the seventeenth and eighteenth centuries. As underwriters were able to select risks from a broader, more diversified, and much larger risk pool, they were able to charge significantly lower rates for the underwriting of insurance risk, rather than for wagering on uncertain commercial outcomes. This can only have prompted increased purchasing of insurance by merchants, contributing – in a virtuous circle – to a further fall in rates, and thus to reduced costs for merchants.

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