

Trading options before Black-Scholes: a study of the market in late- seventeenth-century
London¹

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SUMMARY

This article uses data from the ledgers of the financial broker Charles Blunt to explore the market in equity options that emerged in London during the stock market boom of the early 1690s. Blunt's ledgers provide a unique opportunity to observe the workings of an early modern derivatives market. They reveal a broadly based and highly active trade in options. The market functioned well, determined value using agreed criteria, and was utilised by a diverse range of individuals to facilitate both risk-seeking and risk-averse investment strategies.

In June and July 1694 John Houghton's *Collection for Improvement of Husbandry and Trade* included a series of essays that sought to explain the workings of London's newly-emerged financial market. Houghton gave his readers a brief history of joint-stock companies, explained their purpose, and outlined how the capital was divided and how companies were managed. Further essays told investors where to go to buy and sell shares and detailed the cost of brokerage. Four of the seven essays were concerned either partly or wholly with explaining the trade in equity options. Houghton explained that these instruments gave their purchaser 'liberty to Accept or Refuse such Shares at such a price, at any time within Six

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Months, or other time they shall agree for' and he reproduced the standard printed contracts that were used to seal the agreements. Houghton also demonstrated a close understanding of the advantages and disadvantages of trading in options. He informed his readership that the purchaser of an option 'for a small hazard, can have his chance for a very great Gain, and he will certainly know the utmost his loss can be'. But he also warned those considering selling options that they ran a very great risk for only a small potential profit.²

Houghton's detailed examination of the trade in equity options implied that, in a financial market that was less than a decade old, these sophisticated instruments were widely used. Yet, somewhat surprisingly, historians of the English financial revolution have made no attempt to corroborate Houghton's account. Even P.G.M. Dickson's seminal study made only passing mention of the trade in equity options.³ Thus, this article will present the first comprehensive study of a trade that, if Houghton was to be believed, is key to our understanding of the progress of the early financial revolution.

The source for this study is the hitherto unexplored ledgers of the financial broker Charles Blunt. Blunt's ledgers provide a unique insight into the workings of London's first derivatives market. They cover the period from January 1692 to mid-1695 and contain details of just under 1,500 transactions relating to twenty-three joint-stock companies. More than one-third of the transactions were derivatives. The article will begin by asking what Blunt's ledgers can tell us about the structure of the options market. Section II explains how options were used during the 1690s and by whom, and section III analyses prices in order to assess the extent to which those who traded in options accounted for the factors that are now understood to influence value. Finally, it will be acknowledged that, in spite of the sophistication of the market and varied utility of the instrument, many contemporaries regarded the trade in options as disruptive and dangerous. Their fears led to an ill-conceived and ultimately ineffective attempt to restrain the market.

² Houghton, *Collection for improvement*, 22 Jun. - 13 Jul. 1694.

³ Dickson, *Financial Revolution*.

The period immediately following the Glorious Revolution witnessed remarkable changes in the nature of public and private investment in England. Scott estimated that between 1688 and 1695 around 100 new English joint-stock companies were established offering investment opportunities in projects as fanciful as the quest to recover sunken treasure ships and as practical as the manufacture of linen, paper and glass.⁴ The increase in entrepreneurial endeavour was, in part, a consequence of a developing economy that was reaping the rewards of the revolution in foreign trade that had occurred during the 1670s and 1680s, and exploiting the capital and skills of the Huguenot refugees who had flooded into England after the revocation of the Edict of Nantes in 1685.⁵ Equally influential was the outbreak of the Nine Years' War (1689-1697), which restricted overseas trade and diverted funds that might otherwise have been sent abroad to domestic use.⁶ Merchants looking for outlets for their idle capital and talent became the chief supporters of the new financial market and often took on its broking and market-making functions.

It is well-known that this costly war also provided the impetus for the creation of England's first permanent funded long-term national debt.⁷ The state's first attempts to raise long-term capital have been defined by Dickson as being marked by 'haste, carelessness and episodic failure'.⁸ Moreover, the monies raised were small when compared to the state's

⁴ Scott, *Constitution and Finance*, Vol. I, p. 327.

⁵ For the revolution in foreign trade see Davis, 'English foreign trade'. Scott asserted that the ultimate importance of the influx of skilled Huguenot workers to the establishment of new joint-stock companies during the 1690s can scarcely be over-rated. It should, however, be noted that Holmes argues that their contribution was less significant and that many of the developments in the textile and other industries of this period were the product of domestic enterprise. Scott, *Constitution and finance*, Vol. I, p. 313; Holmes, *Making of a Great Power*, p. 54.

⁶ It was argued in 1694 by John Houghton that 'a great many *Stocks* have arisen since this War with *France*; for Trade being obstructed at Sea, few that had Money were willing it should lie idle'. Houghton, *Collection for improvement*, 15 Jun. 1694. The most comprehensive analysis of the contribution of merchant capital and the role of war in supporting the newly established financial markets may be found in Jones, *War and economy*.

⁷ Public expenditure rose from under £2m. per annum in 1688 to between £5 and £6m. per annum in the years from 1689 to 1702. Dickson, *Financial Revolution*, p. 46.

⁸ *Ibid.*, p. 57.

overall financial commitment.⁹ But the impact of the new methods of funding was significant. They marked the beginning of an important shift in personal investment habits and led to the successful establishment of the institutions on which Britain's financial systems are now based.

Although for many investors in London's first stock market such wide-ranging and vibrant financial activity offered a completely new experience, the development of a secondary market in equity and debt securities was rooted in knowledge and skills gained throughout the latter half of the seventeenth century. In particular, the practical and legal considerations necessary to support the regular transfer of share ownership were advanced by the 1690s.¹⁰ There was also a good understanding of the intricacies of finance and it is clear that trading in options was already familiar to some London investors. Indeed, as early as the 1620s Gerard Malynes had outlined the advantages of commodity options, which were at that time commonly used in the Low Countries and France.¹¹

Given this background it is not surprising that by 1691, several years before the emergence of the public funds, one pamphleteer was highlighting the widespread use of equity options in London's new financial market and indeed was already complaining that such instruments were being used by speculators to manipulate share prices.¹² Moreover, as noted above, by 1694 John Houghton considered it necessary to dedicate several essays in his *Collection for Improvement of Husbandry and Trade* to introducing the advantages of trading in options to a general audience. Thus, the contemporary published literature points to an

⁹ Between 1688 and 1702, out of a total government expenditure of £72m. only £6.9m. was raised through long-term funding: £1,000,000 in 1693 through a tontine loan and the sale of life annuities. In 1694, £1,000,000 in public funds was raised through the Million Adventure lottery, £1,200,000 was lent by the Bank of England and £300,000 was raised through the sale of further annuities. The Malt Lottery of 1697 was a failure and the anticipated £1,400,000 was only realised when the Treasury issued the unsold tickets as cash. The final £2 m. was lent by the New East India Company in 1698. Funds to cover the remaining government expenditure were raised through taxation and short-term borrowing; the majority coming through taxation with Customs yielding £13.2m., Excise, £13.6m., and the new Land Tax, £19.2m.

¹⁰ See Carlos et al. 'Learning and the creation of stock market institutions' and for developments in public finance pre-1688 see Roseveare, *Financial Revolution*.

¹¹ Malynes, *Lex Mercatoria*, p. 203. For further details of the use of options in the Amsterdam market see Barbour, *Capitalism in Amsterdam*, p. 74; Gelderblom and Jonker, 'Amsterdam as the cradle of modern futures trading'.

¹² Anon., *Plain Dealing*.

active trade in options that was by the early 1690s already advanced in understanding and widely used. This picture is confirmed by the data preserved in Charles Blunt's brokerage ledgers.¹³

Blunt kept annual accounts for each client in which he recorded details of the type of transaction, the price at which it was conducted, the number of shares, the name of the counterparty and the amount of brokerage owing. Although Blunt was a diligent bookkeeper, the data recorded in his ledgers were of variable quality and thus in a number of instances it is not possible to be precise about the nature of a trade. However, table 1, which gives a breakdown of the number of share and derivatives transactions in Blunt's ledgers by company, shows that derivatives comprised a significant proportion of his business.

¹³ NA, PRO, C114/165.

Table 1: Annual number of stock and derivative transactions conducted by Charles Blunt's clients, 1692-1695

Company	1692		1693		1694		1695	
	Stock	Derivatives	Stock	Derivatives	Stock	Derivatives	Stock	Derivatives
Bank of England	-	-	-	-	1	0	3	11
Blue Paper Company	5	1	11	3	0	0	0	0
Carving	0	0	1	0	0	0	0	0
Company of Copper Miners	3	1	15	5	11	7	0	0
East India Company	29	22	14	26	3	14	0	0
Engine	0	0	2	0	0	0	0	0
Estcourt's Lead Mine	-	-	73	94	7	13	0	0
Glass-Maker's Company	104	26	53	75	13	10	0	0
Glass Bottle Company	0	0	0	0	1	0	0	0
Hudson's Bay Company	3	0	0	0	0	0	0	0
Irish Paper Company	0	0	4	3	1	0	0	0
Jersey Linen Company	5	2	3	0	2	0	0	0
Linen Company	302	124	95	70	19	2	0	0
Million Bank	-	-	-	-	-	-	3	2
Orphan's Bank	-	-	-	-	-	-	0	3
Pennsylvania	0	0	1	0	0	0	0	0

Company	1692		1693		1694		1695	
	Stock	Derivatives	Stock	Derivatives	Stock	Derivatives	Stock	Derivatives
Royal African Company	27	11	9	1	2	1	1	0
Royal Lustring Company	0	0	1	1	0	0	0	0
Salt Petre	0	0	2	1	0	0	0	0
Tap	0	0	6	2	0	0	0	0
Venetian Steel Company	0	0	0	0	1	0	0	0
Water Company	-	-	-	-	17	2	0	0
White Paper Company	28	10	36	33	3	0	0	0
Totals	506	197	326	314	81	49	7	16

Source: PRO, C114/165. In approximately one-third of the transactions recorded in his ledgers Blunt acted as broker for both the purchaser and seller of the stock or derivative. For the purposes of this table the two sides of the transaction are counted as one trade.

Blunt used short forms to record the details of his clients' trades, thus, not all of the unfamiliar companies listed above can be easily identified. The ones that can be readily identified are: the Blue Paper Company, the Company of the Copper Miners of England, the Company of the Royal Corporation of London for carrying on the Linen and Paper Manufacture within the Islands of Jersey and Guernsey, the Company of Glass-Makers of London, the Glass Bottle Company, the Irish Paper Company, Estcourt's Lead Mine, the King's and Queen's Corporation for the Linen Manufacture in England, the Orphan's Bank, the Royal Lustring Company of England, the Company of White Paper Makers of England, the Company for making Saltpetre in England and the Venetian Steel Company. For the most part the histories of those companies can be found in Scott, *Constitution and Finance*. Those that cannot be readily identified are Carving, Tap, Pensylvania, Engine, (which probably referred to Captain Poyntz's Engine for draining lands) and Water (possibly Marchmont's Waterworks).

Blunt's clients traded 576 derivatives during the period covered by the ledgers. This sum represented 39 per cent of all transactions. It is impossible to ascertain the proportion of the market formed by Blunt's clients so using his ledgers to estimate the number of derivatives traded in the market as a whole is problematic. Nevertheless we do know that there were a number of such brokers operating during the early 1690s, perhaps as many as thirty, thus Blunt's business did not dominate the market. We also know that brokers did not generally specialise in a particular company or instrument. In fact, in 1708 the brokers licensed by the City who were operating in joint-stocks and government securities not only traded in a broad spectrum of financial instruments but also found it necessary to be involved in other kinds of transactions in order to make ends meet.¹⁴ Given the diversity of the transactions in Blunt's ledgers and the fact that he continued to pursue his upholstery business even at the height of his success, we may conclude that he did not specialise in options trading and that his business was broadly representative of London's early stock market. This would imply that at the height of the stock market boom – the period between 1691 and the end of 1693 – several thousand derivatives were transacted each year against a variety of different joint-stock companies.

Although Blunt did not record precise details of all his clients' trades, where the nature of the trade can be identified, it is possible to discern a certain uniformity of structure. More than eighty per cent of the derivatives recorded in the ledgers appear to have been options. The remainder were either loans on stock or time bargains. Both puts and calls (known as refusals in the late seventeenth century) were used but calls, or contracts that gave their buyer the right to purchase stock, were traded far more frequently.¹⁵ Of the contracts in Blunt's ledgers that can be identified as options 79 per cent were calls.¹⁶

¹⁴ Anon., *Reasons humbly offered against altering*.

¹⁵ Puts gave the purchaser of the option the right to sell the underlying asset.

¹⁶ Calls have always been more frequently traded than puts and continue to be so in modern markets. Katz, 'Options strategies', p. 81. Duguid in his analysis of the stock market in the early twentieth century attributed this phenomenon to 'the optimism of human nature...or the fact that to buy is more natural than to sell'. Duguid, *Stock Exchange*, p. 74.

The option period generally ran for three, six or twelve months from the transaction date, but 86 per cent of calls and 78 per cent of puts in Blunt's ledgers were of six months duration. Thus a six-month option period was clearly the market standard.¹⁷ Such standardisation undoubtedly made it easier to match clients' needs in what were sometimes illiquid markets. There were some dated trades and some odd periods recorded in Blunt's ledgers. For example, in February 1693 Edmund Doughty, a merchant, sold to John Bellamy, a scrivener, a call on 15 Glass Company shares that expired on 3 April 1693.¹⁸ But such trades were few. It is likely that they were transacted to take advantage of an anticipated price move associated with a specific future event, for example, the closing of the transfer books for the election of directors or the calculation of dividend payments. There was no obvious need to transact specific dates as a perfect hedge for an existing trade since, according to the printed option contracts that survive from this period, an example of which is shown in figure 1, exercise of the option could take place at any time of the buyer's choosing within the contract period.¹⁹

The majority of trades were struck at-the-money, meaning that the strike price of the option (the price at which the trade would be executed, if exercised) was the same as the current market price of the stock. Deep in- and out-of-the-money options were relatively few.²⁰ Settlement of the option, if necessary, was effected by the physical transfer of stock.²¹ Thus, had the buyer of a call chosen to exercise the right to receive stock then the option seller was obliged to deliver the actual shares in return for payment at the agreed price. Equally, had the buyer of a put chosen to exercise to the option then he or she would have had the right to deliver shares in exchange for payment at the contracted price.

¹⁷ It was not until the mid-eighteenth century that standard exercise dates developed in the London market. Van der Wee 'Monetary, credit and banking systems', p. 346.

¹⁸ NA, PRO C114/165, Account of Edmund Doughty, 1693.

¹⁹ In modern financial parlance, therefore, they were American style options. European options may only be exercised on a specific date.

²⁰ An in-the-money option is one where the strike price gives the option an immediate value compared to the current price. Thus, the right to buy at 35 when the market is trading at 40 is said to be in-the-money. An out-of-the-money option has no intrinsic value. Thus, the right to buy at 35 when the market is trading at 30 is said to be out-of-the-money.

²¹ Houghton, *Collection for improvement*, 29 Jun. 1694.

The option transactions recorded in Blunt's ledgers were, therefore, typically six-month calls struck at-the-money for physical delivery of stock at any time of the buyer's choosing prior to expiry of the contract. However, these simple option structures were utilised by diverse investors for a multiplicity of purposes.

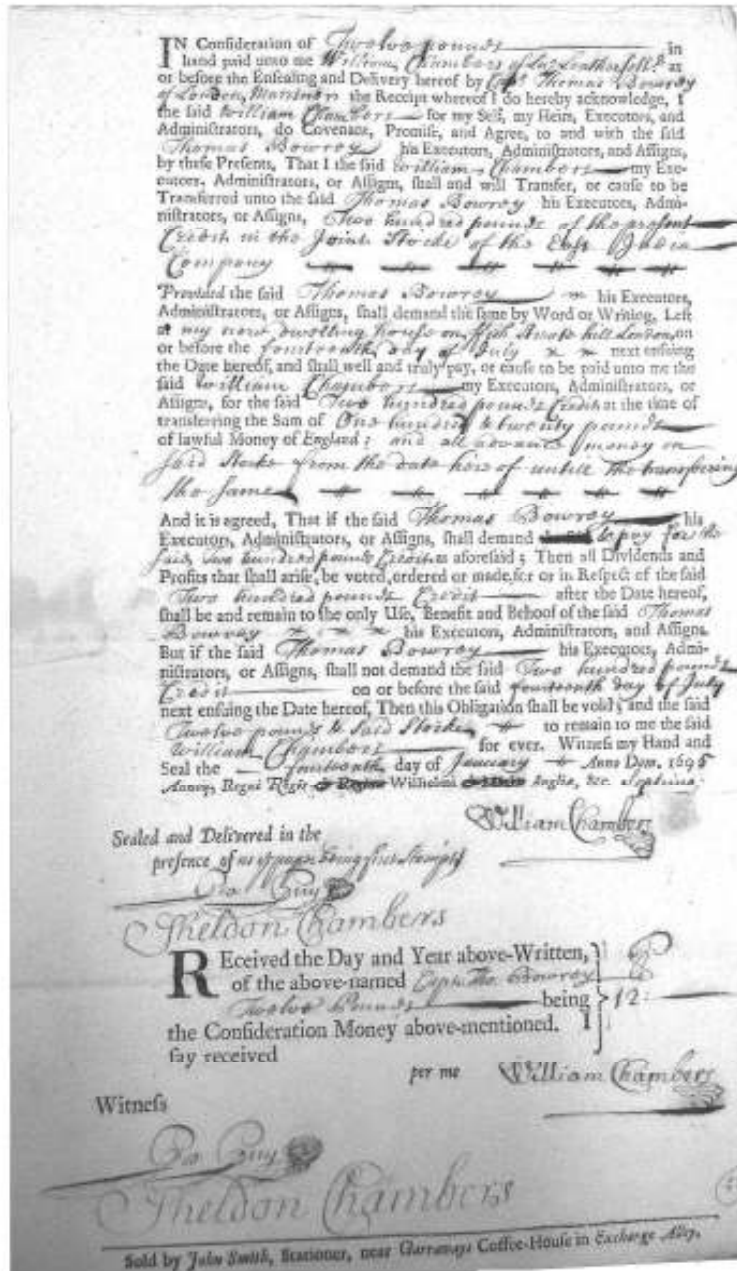


Figure 1: Example of a standard printed options contract
 Source: Guildhall Library London, Papers of Thomas Bowrey, MS3041/9.

II

Blunt's ledgers contain the brokerage accounts of 155 investors: 151 men and four women. Although Blunt did not always record the occupation or social status of his customers, those who can be identified include four titled men, five gentlemen, twelve men who used the title 'esquire', twelve merchants, three goldsmiths (including William Sheppard, the most active stock-jobber of the period), three scribes, an apothecary (John Houghton), a captain, a colonel, a dyer, an excise officer, a glass grinder, a grocer, a haberdasher, a jeweller, five linen drapers, a mercer, an upholsterer, a vintner and a watchmaker. Thus, Blunt's customers came from quite diverse backgrounds.²²

Many of Blunt's clients used his services on only one or two occasions. It may be assumed that they did so not because of a relationship with the broker but because Blunt provided the only contact to someone with compatible interests. Forty of Blunt's clients traded with him ten or more times between 1692 and 1695. It may be supposed that their activity, as recorded in the ledgers, gives a good indication of their overall trading strategies. Of those forty individuals, only one did not include some derivatives in their portfolio and many traded options regularly. Of the entire community of Blunt's clients, two-thirds used some form of derivative to achieve their investment aims. These figures imply a surprisingly widespread use of derivative instruments among investors during the late seventeenth century.

It is important to acknowledge the diversity of those who dealt in options. A market cannot exist unless it attracts participants with varying needs and attitudes towards risk nor will it survive if it cannot accommodate those needs. In the latter respect it is clear that during the 1690s options were used to facilitate a variety of investment strategies.

Notably, because purchasers of options have the right to walk away from a trade without penalty thus limiting their losses, early modern writers often equated the purchase of an option with insurance. Joseph de la Vega, for example, described options as 'ropes which

²² NA, PRO C114/165.

secure the vessel against shipwreck and anchors which resist the storm'.²³ This characteristic was undoubtedly valued both by speculators and risk-averse investors and while it is, of course, impossible to discover the motives of individual investors from the details preserved in Blunt's papers, trades recorded in the ledgers, supported by commentaries in the contemporary published literature, strongly indicate this type of option use.

For example, Houghton argued that options could be used to manage the risks of investment in new and untried enterprises. He stated this as one of the advantages of purchasing puts in combination with an existing share-holding and suggested that 'By this means many are encouraged to come into new Stocks, the success whereof is very uncertain'.²⁴ Equally investors might have chosen to use calls to create a position in a new stocks without the risks associated with the purchase of shares. Blunt's ledgers contain trades that appear to be calls on the subscription to the Orphan's Bank, established in 1695. The details recorded in the ledger are sparse but it is possible that the calls were the equivalent of warrants, giving investors the right, but not the obligation, to subscribe to the newly-issued stock at a certain price.²⁵ In the modern stock market warrants are often used as 'sweeteners' to entice participation in an uncertain new issue.

Options also afforded some protection to investors involved in the market in government debt. During the recoinage crisis of the mid-1690s, for example, options were used to insure against falls in the value of tallies and bank-notes.²⁶ One commentator noted the use of options by those who had 'sold Goods at time, for which they were Obligated to take Bank-Notes, and had no other way to make to themselves a reasonable Profit, but by being Insured that they should not lose above a certain Rate'. It was argued that many investors who had been forced to liquidate holdings in order to meet other obligations had 'made

²³ de la Vega, *Confusion*, p. 7.

²⁴ Thus the put would provide protection against a fall in the value of the shares. Houghton, *Collection for Improvement*, 6 Jul. 1694.

²⁵ See for example NA, PRO, C114/165, Account of Samuel Cudworth, 1695.

²⁶ The term 'tallies' referred to the government's short-term securities. They encompassed the traditional wooden laths issued by the Exchequer as receipts for short-term loans and by government departments as payments for goods and services (the wooden sticks were cut with notches to represent the amount owed in pounds, shillings and pence and split down the middle to form foil and counter-foil of the receipt) and also the newer printed Treasury Order first introduced during the 1660s.

Agreements to receive back the said Stocks and Notes on certain Terms, whereby they [knew] their certain Loss'.²⁷ Options were also used by investors in the state's Million Adventure lottery. Prior to the draw for the Million Adventure lottery the price lists in John Houghton's *Collection for Improvement* included prices for calls and puts on tickets.²⁸ It is probable that many lottery players used options to ensure a market for unwanted blank, or non-prize-winning, tickets after the draw. Others would have been willing to purchase the right to own tickets that, if prize-winning, represented a reasonable to good medium-term investment.²⁹

Trades recorded in Blunt's ledgers indicate that similar strategies were used to manage the risks of investment in established joint-stock companies. In December 1692, for example, Sir Thomas Estcourt, one of the most celebrated speculators of the age, purchased 500 Royal African Company stock. An unprotected purchase would have been a risky strategy since at this time the Royal African Company was suffering due to wartime losses and a political environment that threatened its monopoly.³⁰ Perhaps understanding the risks, Estcourt also purchased a put on 500 Royal African Company stock at a price of five guineas per 100 shares. Thus, he was protected against falls in the value of the stock but retained the right to participate in future rallies.³¹

A strategy that was common to Blunt's clients was the liquidation of a physical position in stock and its replacement with the purchase of calls. In June 1693, for example, Thomas Cross sold five shares in the Royal Lustring Company to Gabriel Glover, a linen draper, and at the same time purchased a six-month call of five shares at a cost of four guineas per share, plus total brokerage charges of £5.³² Thus, Cross eliminated his physical position in Royal Lustring stock but retained the right to participate in further price rises without risk of

²⁷ Anon., *Reasons humbly offered against a clause*.

²⁸ Houghton, *Collection for improvement*, May-Nov. 1694.

²⁹ For further details of the secondary market in Million Adventure tickets see Murphy, 'Lotteries in the 1690'.

³⁰ For further on the difficulties facing the Royal African Company during the early 1690s see Davies, *Royal African Company*.

³¹ In effect, therefore, Estcourt had created a call. NA, PRO, C114/165, Account of Sir Thomas Estcourt, 1692. For further on the relationships between puts and calls and their implications for trading strategies see Johnson and Giaccotto, *Options and futures*, pp. 51-100.

³² NA, PRO, C114/165, Account of Thomas Cross, 2 Jun. 1693.

significant loss if the share price fell. Such a transaction would have been a logical choice for investors who anticipated increased risks in the future but did not wish to abandon completely their position in a particular stock.

While the purchasers of options limit their losses, sellers, for a fee or premium, must be prepared to deliver or accept shares at off-market prices at the buyer's pleasure. An example will serve to illustrate the risks of this strategy. In November 1693 John Haddon sold a six-month call on five Copper Company shares to Benjamin Collyer at a strike rate of £10 for a fee of 2 guineas per share.³³ Had the share price risen to £20 and Collyer exercised the option, Haddon would have been obliged to deliver shares at £10, thus incurring a £10 per share loss with only a small premium to offset that loss. Had the share price risen to £100 before Collyer exercised his option, Haddon still would have been obliged to deliver shares at £10.

The Black-Scholes model, developed in the early 1970s, now allows the risks of selling options to be managed, although by no means eliminated.³⁴ However, during the late seventeenth century, the hedging choices available to the sellers of options were limited to two: creating a complete hedge (thus the sale of a call on 100 shares would be covered by the purchase of 100 shares) or leaving the position open. It was understood by early modern investors that neither action gave the seller effective cover. John Houghton, who assumed that option sellers would automatically completely hedge their positions, explained the problems, noting that the seller 'has his Share in his own Hand for his security...he cannot without Hazard part with them the mean time, tho' they should fall lower, unless he will run the hazard of buying again at any rate if they should be demanded; by which many have been caught, and paid dear for...'.³⁵ However, as Houghton was quick to acknowledge, employing

³³ *Ibid.*, Account of Thomas Haddon, 9 Nov. 1693.

³⁴ The Black-Scholes model provides a systematic means of option valuation and a method managing the resulting risk. The search for a model to manage option risk had been a long one. Indeed, modern attempts by academics to develop a method of determining and controlling option risk can be traced back to the work of Louis Bachelier. His dissertation, written in 1901 and entitled 'The Theory of Speculation', outlined the use of Brownian motion to model options on French government bonds. Bachelier's dissertation is reprinted in Cootner, *Random character*, pp. 18-92. Black and Scholes findings were first published in 1973 in the *Journal of Political Economy*. This paper appeared almost simultaneously with one by Robert Merton, which proposed some useful extensions to the Black-Scholes model. Black and Scholes 'Pricing of options'. Merton 'Theory of rational option pricing'.

³⁵ Houghton, *Collection for Improvement*, 22 Jun. 1694.

such a hedge exposed the option seller to losses if the market did move lower. ‘[I]n plain English, [the buyer] gives Three Guinea’s [the premium] for all the profits if they should rise, [the seller] for Three Guinea’s runs the hazard of all the loss if they should fall’.³⁶

In spite of the difficulties of managing a short option position, there were reasons to sell. Options could, of course, be sold for purely speculative purposes. Most notably, given the strong association between options and insurance, it may be argued that while the purchaser of an option sought the advantage of such insurance, the seller predicted that either the anticipated future event would not occur or, if it did, the sum received in premium would be more than sufficient to cover the resulting losses. Another reason often cited by contemporaries was that selling options offered some investors the opportunity of taking a position in the stock market without initial outlay. It was alleged that many who could not have afforded to invest in shares used the options market in this way. Perhaps in support of this allegation, in 1701 Defoe compiled ‘a black List of 57 Persons, who within this ten years past have rais’d themselves to vast Estates, most of them from mechanick and some of them from broken and desperate Fortunes’.³⁷

Options could also be sold as part of a profit-taking strategy. For example, John Houghton purchased Estcourt’s Lead Mine shares at a price of £10 in February 1693. In October 1693 he could have sold the shares at £17, yielding £7 per share profit. Instead, he sold a call on Estcourt’s Lead Mine shares at £17 for a price of around 4 guineas per share. As a result of this combination of trades, as long as prices remained above £12, Houghton’s profit was secure, but limited. Nevertheless, as with all trade combinations that contain a short option, some risks remained. Had prices dropped back to £10 a share, for example, the profit on Houghton’s shares would have disappeared, but he would have retained the four guineas received in premium. Had prices dropped to £5 per share, Houghton would have still retained the premium received on his call, but would also have incurred a £5 per share loss on his physical stock, thus creating an overall loss on the combined trades. Houghton’s strategy,

³⁶ Ibid.

³⁷ Defoe, *Villainy of Stock-Jobbers*, p. 26.

therefore, while yielding a limited profit in a rising market, did involve retaining some residual exposure to a falling market.

The varied uses to which options were put were little appreciated by contemporary commentators who focused instead on the flaws in the market. Notably, one pamphleteer alleged that some:

who having whole Stocks or the whole Number of Shares of a Stock in their power, gave or would have given Guineas for the refusals [calls] of certain Parcels therof, when they knew the takers could not comply with such Contracts but upon terms which they would afterwards please to permit them.³⁸

In other words, individuals were thought to have purchased calls despite already being in possession of the majority of the stock of a company. The consequent shortage of tradable stock forced prices higher as the sellers of calls sought to make purchases to cover their positions, at which point the buyers of the calls would release their own shares back into the market at a profit and then take a further profit as the same shares were returned to them as a result of the exercise of their options.

The accusation, although seemingly far-fetched, is substantiated by the history of Estcourt's Lead Mine. The mine, which was located in Flintshire, North Wales, was owned by Sir Thomas Grosvenor who, disappointed by the local miners' inability to exploit it, granted the mining rights to his 'cousin and friend' Phineas Bowles, a prominent London stock-jobber, and John Blunt, Charles's cousin and later the chief architect of the South Sea Bubble.³⁹ Bowles, Blunt and Sir Thomas Estcourt, apparently without Grosvenor's knowledge, turned the project into a joint-stock company. An initial investment of £5,000 was made in the mine and the prospects for creating a profitable business seemed good. Most notably, in February 1693 Parliament had passed an Act that freed mine owners to develop their pits and profit from all mineral resources without Crown interference.⁴⁰ The Company

³⁸ Anon., *Plain Dealing*, pp. 4-5. See also Houghton, *Collection for improvement*, 13 Jul. 1694.

³⁹ Rhodes, 'London Lead Company', pp. 30-31.

⁴⁰ Previously base mineral mines that might contain gold or silver were subject to the control of the Crown. Lewis, *Mining in Wales*, p. 9.

would also have been able to benefit from recent technical advancements, including the use of gunpowder for blasting and new techniques for smelting and refining lead ore. But in all other respects it would seem that the company was typical of those complained of by contemporary observers. In particular, the proprietors were all City merchants or moneyed-men who, arguably, knew little of the practice of lead mining. Furthermore, an accumulation of calls in an account registered in Charles Blunt's ledgers as 'John Blunt and Company', together with an unexplained rise in stock price in late 1693 and early 1694 seems to indicate that the company was ultimately used for speculative purposes.

Between April and December 1693 John Blunt and Company accumulated calls of a minimum of 282 shares at strike prices of between £10 and £20 and at an average cost of just over two guineas per share for each contract.⁴¹ Throughout much of this period the price of stock remained steady at between eight and twelve pounds but in late October and early November 1693 prices began to rise, reaching £20 in December and £25 by mid-January 1694. On 22 January stock was trading at £35, and by 26 January 1694 at £100. Although no subsequent trades were conducted by Blunt's clients to substantiate the claim, in April 1694 John Houghton was quoting the price of Estcourt's Lead Mine stock at £150.⁴²

Interestingly, John Blunt's purchase of calls of Estcourt's Lead Mine stock was generally combined with the sale of shares to the option seller. For example, on 16 October 1693 Blunt and Company bought a six month call of five shares from Henry Evans, a gentleman, at a strike price of £12 and a cost of 2 guineas per share and, at the same time, sold five shares to Evans at a price of £11.⁴³ Thus, Evans had a hedged position but could not participate in any future price rises, while Blunt and Company had eliminated part of their physical position in the stock in order to buy the right to riskless participation in a rising market.

Since many, although by no means all, of the investors who sold options to Blunt and Company in late 1693 were similarly purchasing stock as a hedge, it would seem that Blunt's

⁴¹ NA, PRO, C114/165, Account of John Blunt and Company, 1693.

⁴² Houghton, *Collection for improvement*, 13 Apr. 1694.

⁴³ NA, PRO, C114/165, Account of John Blunt and Co., 16 Oct. 1693.

actions did not conform precisely to the accusations made by contemporary observers. Yet, it is clear that Blunt and Company systematically accumulated an option position that would benefit from higher share prices. The subsequent rally from £10 to £100 may have been a happy coincidence but equally John Blunt and the managers of the Company could have spread false information to inflate the stock price. There is unfortunately no surviving source that allows us to identify the cause of the rise in prices at the end of 1693, but John Blunt's subsequent career with the South Sea Company gives us little reason to regard him as above suspicion.⁴⁴

Little is known of the histories of other companies established during the 1690s. Thus, it is impossible to provide a more broadly based test of accusations of stock manipulation involving options. Contemporary critics of the market certainly held that such actions were ubiquitous and when the commissioners of the Board of Trade examined the state of the English economy in 1696 they apparently found evidence to support this assertion.⁴⁵ Yet, an examination of John Blunt's personal account in Charles Blunt's ledgers shows that, although he was certainly risk-seeking in his approach to option use and did speculate in a large number of companies, including the Blue Paper, Copper, Irish Paper, Linen, and East India Companies and the Bank of England, he did not habitually accumulate large amounts of stock or options.⁴⁶ Moreover, concerted action against a company's stock required cooperation among a group of investors. Thus, it was only possible to conduct such actions against a company with a small capital and limited group of major shareholders. Undoubtedly, therefore, John Houghton was correct in his assertion that 'in small Stocks 'tis possible to have Shares rise or fall by the Contrivances of a few Men in Confederacy; but in great Stocks 'tis with more difficulty'.⁴⁷

⁴⁴ For details of John Blunt's involvement with the South Sea Company see Dickson, *Financial Revolution*, pp. 90-156.

⁴⁵ 'The Commissioners of Trade and Plantations Report on the State of Trade, 1697' in Thirsk and Cooper eds., *Seventeenth-century documents*, p. 576.

⁴⁶ NA, PRO, C114/165, Accounts of John Blunt, 1692-1695.

⁴⁷ Houghton, *Collection for improvement*, 6 Jul. 1694.

III

The fact that the equity options market of the late seventeenth century facilitated a diverse set of investment strategies indicates that investors gave some consideration to the factors that determined the value of an option. The high degree of standardisation evident in the market also indicates that those factors were the subject of agreement among participants. This is not surprising. Life in late-seventeenth-century England was fraught with risk, both economic and personal, and consequently individuals, particularly the type of person regularly active in the financial market, knew how to assess its causes. But, of course, agreeing upon risk factors and placing a value on them are two different things. Prior to the emergence of the Black-Scholes model in the early 1970s, there was no systematic means of option valuation. Moreover, very few early modern investors would even have been familiar with complex mathematical techniques.⁴⁸ Importantly, probability was a relatively new concept and not one that was generally understood in anything more than intuitive terms.⁴⁹ Even in insurance, a similarly complex and far more widely used instrument, price was arrived at not by statistical analysis of risk but ‘by haggling and guess between insurer and insured’.⁵⁰ Similarly, early modern options traders relied on rules of thumb when making pricing decisions and made adjustments to their method of pricing as a result of trial and error and accumulated experience.

The question of how well the intuitive pricing used by early modern traders took into account the factors that are now understood to influence option prices is an interesting one. Previous studies have addressed this question by using the Black-Scholes model to evaluate historical prices. Results from such studies have been illuminating. In an analysis of the

⁴⁸ In spite of the proliferation of textbooks on arithmetic, particularly commercial arithmetic and book-keeping skills, and the increased understanding of the utility of such skills among men of business in the early modern period, mathematical skills remained difficult to master and utilise effectively. Thomas, ‘Numeracy in early modern England’, p. 109.

⁴⁹ For an analysis of the development of the concept of probability see Hacking, *Emergence of probability*.

⁵⁰ Barbour, ‘Marine risks’, p. 591. Equally, Clark argues that in spite of the attention given by political arithmeticians to compiling statistical data on birth and death rates, ‘[l]ife insurance underwriters continued to follow their rules of thumb in setting policy premiums...until the appearance of the Equitable Society in 1762’. Clark, *Betting on lives*, p. 116-117.

options market in post-Civil War New York, Kairys and Valerio found a consistent degree of over-pricing relative to a theoretical options model but concluded that ‘the financial markets of the 1870s exhibited a degree of sophistication that would be easily recognized by investors of today’.⁵¹ And Juh and Moore’s examination of the equity options market in early twentieth-century Johannesburg concluded that ‘[w]hile the development of the formal theory has been invaluable for a complete understanding of the factors influencing the value of derivatives, early twentieth century investors in Johannesburg appear to have been able to process relevant information and come close to determining the fair value of derivatives’.⁵²

However, investigating how well Blunt’s clients valued risk by drawing direct comparisons between the prices at which they traded and those generated by the Black-Scholes model would be wholly inappropriate for two reasons. First, since it is impossible to know with any certainty the future price path of a stock, even with the benefit of the Black-Scholes model, the calculation of premium is not an exact science. A live price – the price at which an investor is willing to trade – takes into account factors that cannot always be input into a theoretical pricing model, as Fischer Black and Myron Scholes discovered in the early 1970s when, seeking to test their new model, they bought warrants that seemed undervalued. Black admitted that they ‘did not make money’ on this trade because the warrants in question were low in value for reasons that could not be factored into their formula.⁵³ Similarly, a theoretical price generated by the Black-Scholes model using data from Blunt’s ledgers would not take into account risks, market conditions, and buyers’ and sellers’ preferences that are not and cannot be known to us. Secondly and most importantly, Black-Scholes produces the theoretical, or fair, value of an option. Fair value can be thought of as ‘the “production cost” of the option. It is the value at which the option can be sold...so that neither a profit is made nor a loss incurred in the transaction’.⁵⁴ Implicit in the notion of fair value is the construction

⁵¹ Kairys and Valerio, ‘Market for equity options’, p. 1718.

⁵² Moore and Juh, ‘Derivative pricing’, p. 23. I am grateful to Steve Juh and Lyndon Moore for allowing me to see this paper prior to publication.

⁵³ Black, ‘Living up to the model’, p. 17.

⁵⁴ Chriss, *Black-Scholes and beyond*, p. 27.

of a riskless or delta hedge.⁵⁵ As noted above, such precise hedging was beyond the capabilities of early modern investors. Consequently, the Black-Scholes formula can account for neither the risks nor the costs incurred by early modern options traders.

Nevertheless, using Charles Blunt's ledgers, a more rudimentary analysis of early modern option prices is feasible. In particular, it is possible to construct a dataset of trades in Linen Company stock and options that, because of their high degree of standardisation, allows for the isolation of the various factors that might have affected price.⁵⁶ The factors that influence option price are defined in the modern market as the length of time to expiry, the relationship between the current price of the stock and the strike price of the option, and the volatility of the underlying stock, which for this purpose is defined as the variability of the stock price.⁵⁷ The prevailing rate of interest is another, less influential, determinant of price. With regard to the market in the late seventeenth century a statutory maximum interest rate of six per cent was imposed. There were undoubtedly many ways to circumvent this rule, but for the purposes of this study it will be assumed that options traders, when they took account of costs, presumed an interest rate of six per cent.⁵⁸

Time value is one of the more straightforward determinants of option price. Put simply, longer time periods should command a higher premium. Because six-month options were the

⁵⁵ The delta of an option is a measure of its sensitivity to changes in the underlying share price. Thus consider an investor who owns a put option that gives the right to sell 100 shares in one month's time. The option is at-the-money and thus has a delta of around 0.5. To all intents and purposes, therefore, the option will behave (make or lose money) as though it were a position of short 50 shares. To hedge the buyer could buy 50 shares and have a delta-neutral or fully hedged position. However, delta is not static. It changes as options move in- or out-of-the-money. The advantage associated with the purchase of an option is that the delta will almost always move in the purchaser's favour. Thus in a falling market the option will become in-the-money and the delta will increase. If we imagine that the delta increases to 0.6 then the option will be equivalent to a position of short 60 shares, while the original hedge will be unchanged at long 50 shares. If the market rises the opposite occurs, delta decreases reducing the short exposure to the market through the option while the original hedge maintains the long exposure to the market. Once again the advantages that accrue to the buyer of an option through this process are clear, it is only in the event of a stagnant market that losses will occur and even then the ultimate loss will be limited to the premium paid. For the seller, hedging becomes a much more complex and cumbersome task.

⁵⁶ Blunt's clients traded a total of 592 times in Linen stock between 1692 and 1693. Of those transactions, 196 were derivatives, mostly six-month at-the-money calls.

⁵⁷ For a more detailed explanation of these factors and other influences on the value of options see Cox and Rubinstein, *Options markets*, pp. 34-39.

⁵⁸ Houghton's analysis of the uses of options makes it clear that early modern traders did account for the costs associated with option trading. He identifies the buyer's costs as the premium, 'and the Interest of his Money, besides Brokake [brokerage], and petty Charges'. Houghton, *Collection for improvement*, 6 Jul. 1694.

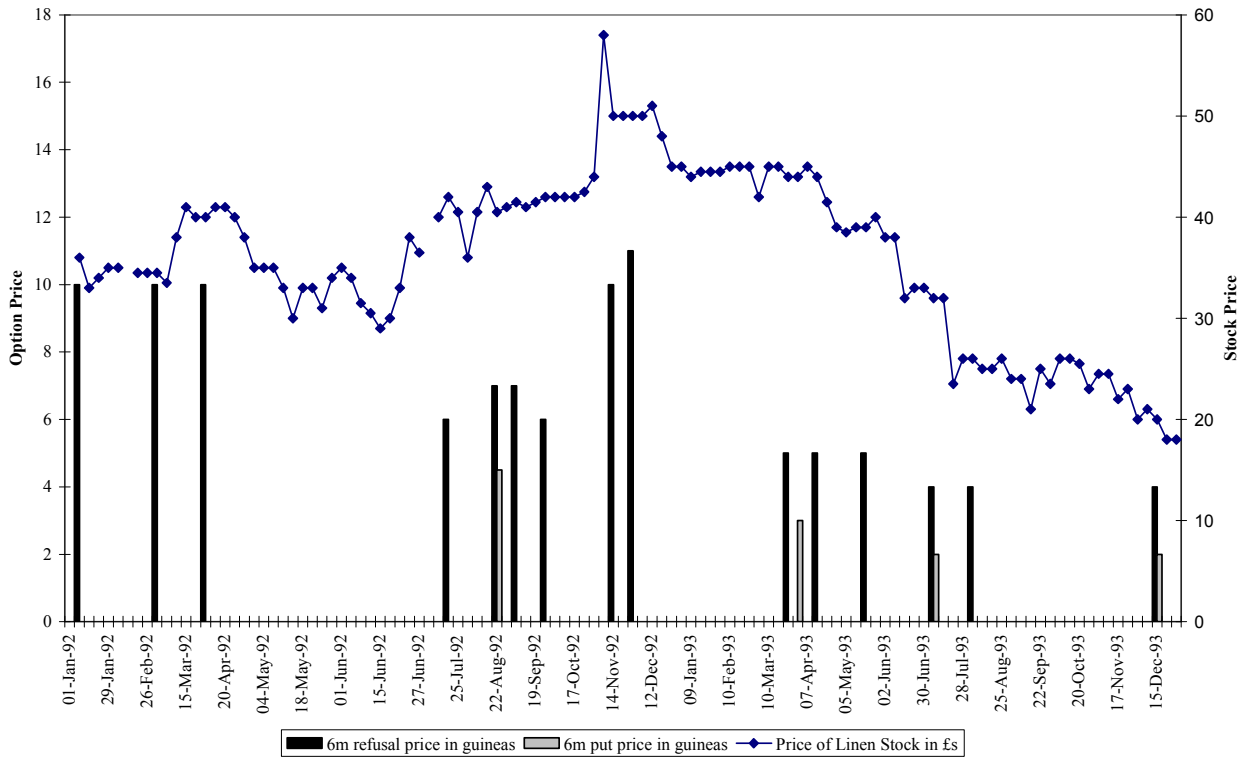
market standard in the late seventeenth century, there were few occasions when Blunt's clients traded different time periods on the same or consecutive days. However, between 14 and 16 February 1693 Blunt's clients purchased two, three and four month at-the-money calls on Linen stock at prices of three, four and five guineas per share respectively.⁵⁹ Similarly, on 5 December 1692 purchases of two and three month at-the-money calls were recorded at prices of five and six guineas per share respectively.⁶⁰ These trades were all struck at-the-money, thus a constant cost based on the relationship between the strike price of the option and the price of the stock may be assumed. It may also be argued that since the transactions were conducted on the same or consecutive days a similar assumption of the future volatility of the share price was applied to each set of trades. Thus, the differences in option prices can only be accounted for by the different times to expiry. Clearly, therefore, although there are very few examples in Blunt's ledgers, there is a strong indication that, as may be expected, longer time periods were considered to be more valuable.

The dominance of six month at-the-money transactions in Blunt's ledgers, while constraining analysis of time value does make it possible to present detailed information on the impact of perceptions of future volatility on price. All such trades have the same time to expiry (six months) and because they are at-the-money a constant cost based on the relationship between the strike price of the option and the price of the stock must have been applied. Thus, differences in option prices indicate how the future volatility of the share price was perceived over time. To demonstrate the relationship between the volatility of the stock and option price, figure 2 presents a comparison of the price of six month at-the-money puts and calls in Linen stock with the price of the stock itself.

⁵⁹ NA, PRO, C114/165, Account of William Monson, 14-15 Feb. 1693; Account of Joseph Cope, 16 Feb. 1693.

⁶⁰ Ibid., Account of John Bellamy, 5 Dec. 1692.

Figure 2: Price of Linen stock/Price of 6m ATM options in Linen stock, 1692-1693



Source: PRO C114/165; Houghton, *Collection for Improvement*, passim. The stock price curve has been constructed using prices recorded in Blunt’s ledgers supplemented, where necessary, by prices listed in Houghton’s *Collection for Improvement*.

Figure 2 shows the Linen Company share price to have been volatile, particularly during 1692. This analysis is supported by what little is known of the history of the Company.⁶¹ The King’s and Queen’s Corporation for the Linen Manufacture in England was established in 1690 with an initial issue of 340 shares at a price of £10 each. The prospects for the Company in a time of war when foreign imports were restricted were good, and the share price advanced rapidly in 1690 and 1691. A further issue of shares at £50 in April 1691 was apparently well-received by the market. However, the Company did not fulfil its early promise. It was beset by internal friction, attacks from outside rivals and, according to MacLeod, the Company’s directors were guilty of financial mismanagement and technical

⁶¹ See Scott, *Constitution and finance*, Vol. III, pp. 90-9; Harte ‘Protection and the English Linen Trade’.

incompetence.⁶² Interest in the Company was briefly revived in November 1692 when it conducted a public sale of 10,000 pieces of high-quality white linen. But thereafter Linen Company stock began a slow decline eventually reaching a low of just £5 in 1697.⁶³

With regard to the prices of puts and calls, figure 2 shows a level of consistency in pricing that is supportive of the assumption that option price was based on criteria that was agreed by all participants in the market. It also shows that, in spite of the volatile nature of the stock, the pricing of at-the-money calls during 1692 and 1693 responded to the Linen Company's changing risk profile. Most notably, call prices rose rapidly in November 1692 as the Company's sale of linen increased uncertainty about the future direction of prices. Fewer examples of six month at-the-money puts can be found but a similar response to the Company's changing risk profile is observable. It cannot necessarily be assumed from this analysis that early modern investors regarded volatility in the same way as modern options traders (i.e.: as a measure of the variability of prices rather than as a measure of the risk of future rises or falls in price). However, a clear and, most importantly, consistent response to periods of increased and decreased uncertainty is evident. Moreover, the fact that both put and call prices declined during 1693 indicates that volatility was indeed perceived as the variability of price. Had volatility been defined as the risk of future rises or falls in price, following the period of sustained falling prices in the second half of 1693, the price of puts would have been higher than that of calls.

One particular point of interest highlighted by figure 2 is the differences between put and call prices struck at-the-money and transacted at the same time. Modern options pricing models demonstrate a strong relationship between the value of puts and calls. Indeed, European options that pay no dividends should display put/call parity. And, as Cox and Rubinstein state, if parity is violated, and if transaction costs, margin and taxes are ignored, a profit could be made 'by selling the relatively overpriced option and using the proceeds to buy the relatively underpriced option, together with an appropriate position in the stock and

⁶² MacLeod, 'The 1690s Patents Boom', p. 564.

⁶³ Houghton, *Collection for improvement*, 10 Sep. 1697.

borrowing and lending'.⁶⁴ Put more simply, if put/call parity is violated then arbitrage is possible. Poitras argues that put/call parity was implicitly understood in the early modern market.⁶⁵ To substantiate this claim he cites Joseph de la Vega's recommendation of using straddles (the simultaneous purchase of a put and a call) in uncertain markets and, more importantly, quotes a description of how to convert a call position into a put position. As de la Vega explained if, having purchased a call, an investor changes his mind about the future prospects of a stock 'Without danger [he] can sell shares [against time], and then every amount by which they fall means a profit...and with a rise in price [he] could lose only the bonus [or premium]'.⁶⁶ Sir Thomas Estcourt's above-mentioned combined purchase of Royal African Company stock and a put on the same stock is an example of just such a conversion. Through this trade Estcourt was, in effect, purchasing a call, suggesting that London investors also understood the relationship between puts and calls.

Yet, the persistent differential between at-the-money puts and calls was not an anomaly or an error. In part it reflected the nature of the options traded in the London market, which, as noted above, could be exercised at any time during the option period. Put/call parity does not apply under these circumstances because an arbitrage package could be broken up by the early exercise of one of the options.⁶⁷ The consistent two guinea differential between put and call prices also implies that a more constant cost was being accounted for in pricing decisions. This was, in all probability, the cost of holding stock as a hedge. Thus, prices were higher for calls because the sale of a call theoretically involved purchasing shares to protect the position thus incurring interest charges and an opportunity cost. The sale of a put, on the other hand, did not require stock to be held as a hedge and so no such charges were incurred and the put could be sold more cheaply.

The final determinant of price is the relationship between the strike price of the option and the current price of the stock. An option that is in-the-money has an intrinsic value that

⁶⁴ Cox and Rubinstein, *Options markets*, p. 42.

⁶⁵ Poitras, *Early History of financial economics*, pp. 361-363.

⁶⁶ de la Vega, *Confusion de Confusiones* cited in Poitras, *Early history of financial economics*, p. 362.

⁶⁷ For an analysis of the relationship between American style puts and calls see Cox and Rubinstein, *Options markets*, pp. 150-153.

should be accounted for in pricing decisions, whereas an option that is out-of-the-money, having no intrinsic value, should be inexpensive relative to an equivalent at-the-money or in-the-money option. Table 2 shows the range of prices at which in-, out- and at-the-money six-month Linen Company calls traded in each calendar month between January 1692 and December 1693. It shows a relationship between the various categories of call that is consistent with the assumption that early modern options traders understood the connection between the price of the stock and the strike price of the option and made allowance for it in pricing decisions.⁶⁸ In November 1692, for example, at-the-money options traded at prices between ten and eleven guineas. Two options that were between £6 and £10 out-of-the-money traded, as we might expect, at lower prices and one option that had an intrinsic value of £10 was valued at a price of 20 guineas.

⁶⁸ One anomaly is evident in July 1692. This cannot easily be accounted for but it is likely that it stems from an error in Blunt's bookkeeping.

Table 2: Range of prices (in guineas) for six month refusals of Linen Company stock, 1692-1693

Month	Stock* Price	£6-£10 O.T.M**	£1-£5 O.T.M	A.T.M	£1-£5 I.T.M	£6-£10 I.T.M
Jan-92	38.5-32		6	10		
Feb-92	35-34				10	
Mar-92	40-34		6 – 7	10	10	
Apr-92	40-35			10	11	
May-92	35-30				7	
Jun-92	36-29					
Jul-92	42-40		8	6	7	
Aug-92	41-36			7		
Sep-92	42-40			6 – 7		
Oct-92	44-42		5		7	
Nov-92	58-50	5 – 6		10 – 11		20
Dec-92	50-45		7			
Jan-93	45-44	3 – 4	5 – 6			
Feb-93	45-44					
Mar-93	45-42	4 – 5		5		
Apr-93	45-39		4	5		
May-93	40-38.5			5		
Jun-93	38-32					
Jul-93	32-26		4 – 3	4		
Aug-93	26-25			4		
Sep-93	25-21	2				
Oct-93	25-23	2				
Nov-93	24-22	2			6 – 7	
Dec-93	21-18			4		

Source: PRO C114/165; Houghton, *Collection for Improvement*, passim.

* This column shows the highest and lowest price each month derived from Houghton's *Collection for Improvement* and Blunt's Ledgers.

** O.T.M. – out-of-the-money; A.T.M. – at-the-money; I.T.M. – in-the-money.

When examining the relationship between the current price of the stock and the strike price of the option, it would also be desirable to know how price responded to the prospect of any future dividends payable by the Company. Unfortunately, little is known about actual dividend payments made during the early 1690s but the printed contracts produced at this time do take account of potential payments. Hence, as can be seen in figure 1, the contract for

a call states that, in case of exercise, shares will be transferred ‘together with all Dividends, Profits and Advantages whatsoever, that shall after the Date hereof be voted, ordered, made, arise or happen thereon, or in respect thereof...’.⁶⁹ The principal purpose of the clause was undoubtedly to head off any disagreements regarding unexpected dividend payments but such a comprehensive coverage of eventualities also implies that known or anticipated dividend payments were factored into the price of options.

Since early modern investors showed such a close understanding of the factors that influence the pricing of options, it may finally be asked whether the options sold at this time represented fair value. In other words, did the pricing of options during the late seventeenth century favour either buyers or sellers? A simple analysis of all six-month at-the-money Linen Company calls recorded in Blunt’s ledgers reveals that of the 153 transactions that are fully identifiable, even disregarding all costs, profitable exercise would only have been possible in 28 per cent of cases. An analysis of the puts recorded in the ledgers reveals a different picture. Of the 23 trades that are fully identifiable, disregarding costs, it would have been possible profitably to exercise 19 trades, or 82 per cent of the total. This figure does, however, include ten puts transacted at the highs of November and December 1692 and a further five transacted prior to the collapse in prices in mid-July 1693. Overall, therefore, these findings are consistent with much of the recent literature on the subject, which shows that the pricing of options prior to the advent of the Black-Scholes model favoured sellers.⁷⁰

This finding has prompted some to suggest that the purchase of an option ‘is, statistically speaking, an “inferior act” compared to the alternative of buying stock or doing nothing’.⁷¹ Yet, this conclusion, although reasonable and well-supported, must be tempered by two factors. Firstly, it is derived from studies of simplified trading strategies that assume

⁶⁹ See Houghton, *Collection for improvement*, 29 Jun. 1694.

⁷⁰ See for example, Boness, ‘Some evidence’; ‘Kairys and Valerio, ‘Market for equity options’; Moore and Juh, ‘Derivatives pricing’. This finding was, however, contradicted by Kruiuzenga who examined the purchase of options over a ten year period between 1946 and 1956 finding that due to the positive effects of the bull market between 1953 and 1955 premiums were, on average, lower than the final values of the option thus resulting in a profit for the consistent option buyer. Kruiuzenga, ‘Profit returns’.

⁷¹ Raiffa H. and Schlaiffer R., *Applied statistical decision theory* (Cambridge, 1961), pp. 97-98 quoted in Boness, ‘Some Evidence’, p. 579.

the purchaser was aiming to realise a profit from the option rather than using it for insurance purposes or to protect or enhance other market activity. As demonstrated above, in reality even in the late seventeenth century, some option buyers took a far more imaginative approach to their investments. Secondly, the above-mentioned studies often choose to ignore the risks borne by sellers of options and notably take no account of their hedging costs.⁷² With regard to the late seventeenth century options market, had sellers of Linen Company calls followed John Houghton's advice and retained their stock in anticipation of future delivery they too would have lost money.

IV

The evidence presented above depicts a market that was orderly and effective, and in which value was derived using criteria that were consistent and clearly agreed upon by the majority of participants. But outside the market the value and the utility of derivative instruments and indeed of the financial market itself was contested. It was argued that those who used the financial market were engaged in 'a Trade found in Fraud, born of Deceit, and nourished by Trick, Cheat, Wheedle, Forgeries, Falshoods and all sorts of Delusions'.⁷³ Such activity turned honest men away from commerce and 'occasion[ed the] loss of precious Time, and ruine of Estates'.⁷⁴ Options were especially problematic in this regard because they required only a relatively small outlay in premium thus allowing speculators who could not afford to purchase shares to participate more easily in the market. Because trading in such instruments was viewed as speculation rather than risk-management there was also a moral dimension to the critics' fears. They condemned the pursuit of wealth that would necessitate a loss to

⁷² On this point see also Black and Scholes, 'Valuation of option contracts', p. 413.

⁷³ Defoe, *Anatomy of Exchange Alley*, p. 3.

⁷⁴ Anon., *Plain Dealing*, p. 6.

another individual and argued that ‘subtil and designing’ men grew rich from the misery of those that had ‘as much Honesty, but fewer Brains’ than themselves.⁷⁵

However, the greatest concerns of contemporaries were aroused when the actions of speculators appeared to disrupt markets and damage potentially beneficial economic enterprises. For example, when many of the companies set up in the early 1690s failed to thrive, the failures were blamed on the actions of speculators. The report of the new Board of Trade set up in 1696 to examine the state of the English economy made especial mention of ‘the linen manufacture in this kingdom [which] hath made [no] great progress of late. The stock subscribed for that purpose was soon diverted by a stockjobbing trade, and thereby all the Corporation disabled to promote it...’.⁷⁶ Equally, speculators were cited as the main cause of the depression in the prices of short- and long-term government debt during the mid-1690s. Notably, although some defended the use of options to protect the value of government debt during this difficult time, others alleged that ‘divers Brokers and Stock-Jobbers, or pretended Brokers, have lately set up and carried on most unjust Practices and Designs, in Selling and Discounting of Talleys, Bank Stock, [and] Bank Bills’.⁷⁷

The actions of speculators and stock-jobbers were viewed as so damaging that, in 1697, when the Bank of England agreed to engraft a considerable proportion of the government’s short-term debt into its capital, one of the concessions it demanded in exchange was the enactment of legislation to restrain speculators and limit their use of derivative instruments.⁷⁸ In response to the demands of the Bank, legislation was passed that made void all contracts for puts and calls and attempted to restrict their future use.⁷⁹

Clearly many contemporaries regarded such harsh legislation as justified. Their opinions were undoubtedly hardened by the actions of speculators like John Blunt who did apparently use derivatives to manipulate prices. Moreover, it must be acknowledged that the

⁷⁵ Anon., *Plain Dealing*, p. 3; p.6. For a further discussion of this issue with reference to the financial market in Amsterdam see De Marchi and Harrison ‘Trading “in the wind”’.

⁷⁶ ‘The Commissioners of Trade and Plantations Report on the State of Trade, 1697’ in Thirsk and Cooper eds., *Seventeenth-century documents*, p. 576.

⁷⁷ Quoted in Morgan and Thomas, *Stock Exchange*, p. 23.

⁷⁸ Bank Archives, G7/1, 4 Jan. 1697.

⁷⁹ Dickson, *Financial Revolution*, p.517.

market in options was beyond the control of any authority. Whereas a straightforward sale and purchase of stock had to be registered in a company's transfer book, signed by both parties to the trade and witnessed, no such procedures were necessary for options transactions unless and until the option was exercised.⁸⁰ Thus, although companies could keep track of transfers and maintain control over who transferred stock and when they did so, the market in derivatives was not controllable in this way.⁸¹

Yet, in spite of the very many reasonable concerns of contemporaries, it should not be automatically assumed that this lack of scrutiny rendered the options market dangerous and disruptive. The failure of any enterprise is generally the result of a wide range of factors and during the early 1690s many companies were subject to a high level of taxation, attracted the hostility of already established industries, and were poorly managed and inadequately capitalised. Equally, the market in government debt was adversely affected by the poor progress of the Nine Years' War, the disruptive effects of the recoinage and by the state's failure to maintain its interest payments.⁸² The condemnation of speculators was therefore based on a superficial understanding of the causes of economic crisis during the mid-1690s.

It is also reasonable to argue that in a market of restricted size where participants would often have been known to one another, the necessity of maintaining one's honour, credit and reputation ensured that the market did not become disorderly and that the risk of default was not high. Interestingly, Gelderblom and Jonker have found that in Holland, even during the early seventeenth century, 'private and more or less informal arrangements sufficed to provide derivatives trading in commodities with a sound infrastructure to reduce the risk of bad deals and noncompliance'.⁸³ The strongest evidence to indicate that the London options market also operated in this way comes from the printed contracts used by investors at this

⁸⁰ For a full account of the procedures for transferring stock see Neal, *Rise of financial capitalism*, pp. 15-16.

⁸¹ For example in 1696 the Bank of England ordered its chief accountant, Thomas Mercer, to prevent the transfers by any persons who had not paid in their latest subscription. Bank Archives, G4/1, 11 Nov. 1696.

⁸² For details of the shortfall in interest payments during the mid-1690s see Dickson, *Financial Revolution*, p. 354.

⁸³ Gelderblom and Jonker 'Amsterdam as the cradle of modern futures trading', p. 204.

time. As may be seen in figure 1, the contracts show a focused understanding of the practical risks involved in the trading of options and a particular concern to ensure that all transfers of funds went smoothly.⁸⁴ It is most notable that, in a market where daily prices were not published and when there was as yet no official meeting place for investors and brokers, details of how the exercise of an option was to be effected were precisely specified. Although it is unlikely that such contracts would automatically have been considered binding in law, their very existence and the precise wording of the clauses contained within them strongly suggests that they acted as a check on potential defaulters. Furthermore, the same wording was still being used in 1720, confirming that the contracts did indeed serve their purpose well.⁸⁵

A final indicator of the value of the trade in options is the fact that the market proved remarkably resilient against repeated attempts by legislators to restrain or eliminate it. Even John Barnard's Act, finally passed in 1737, which introduced £500 fines for those who paid or received premiums on puts or calls, had little effect on the market.⁸⁶ Moreover, as Dickson noted, 'the legislature was constantly left behind by the appearance of new speculative techniques'.⁸⁷ It is clear, therefore, that although the authorities considered the market in options to be of little value, investors continued to find that the benefits of using these instruments outweighed the potential risks.

V

This article has shown that the focus on equity options in John Houghton's 1694 analysis of London's financial market was quite justified. Indeed, Houghton was merely drawing attention to a market that had been in existence for a number of years and was already supporting a broadly based and highly active trade. The data preserved in Charles Blunt's

⁸⁴ For an analysis of the history of derivatives markets with particular regard to the regulation and legal history of the instruments see Swan, *Building the global market*.

⁸⁵ Dickson, *Financial Revolution*, p. 491.

⁸⁶ *Ibid.*, p. 519.

⁸⁷ *Ibid.*

ledgers confirm that this market attracted a diverse range of participants and, although it is impossible to determine the individual motives of Blunt's clients, there are strong indications that options were used for both risk-management and risk-seeking purposes. Moreover, in spite of some contemporary anxieties about the potential for using options for speculative and even manipulative purposes, the market appears to have functioned well. Most importantly, the pricing of options reflected a sophisticated understanding of the factors that are now known to determine risk and showed an overall consistency and responsiveness to changing risk environments.

This rich picture of activity in London's first derivatives market not only provides a unique insight how such instruments were priced and used by early modern investors, it also confirms that our image of the early progress of the English financial revolution must be modified. Most notably, it shows that the diversity, innovativeness, and liquidity identified by Ann Carlos and Larry Neal as having supported London's financial market during and after the shock of the South Sea Bubble, had been more than a generation in the making.⁸⁸ If we seek explanations for the resilience of England's financial system during the eighteenth century, therefore, we would do well to look beyond the South Sea Bubble to the origins of London's financial market.

⁸⁸ Carlos and Neal, 'Micro-foundations of the early London capital market', p. 499.

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