

30/9/08

## The Early History of Option Contracts

Geoffrey Poitras\*  
Faculty of Business Administration  
Simon Fraser University  
Vancouver, B.C.  
CANADA V5A 1S6

email: poitras@sfu.ca

### ABSTRACT

This chapter discusses the history of option contracts from ancient times until the appearance of *Theorie der Prämien-geschäfte* by Vincenz Bronzin in 1908. The history examines the use of contracts with option features prior to the introduction of trade in free standing option contracts on the Antwerp bourse during the 16<sup>th</sup> century. Descriptions of the Amsterdam share option market by de la Vega in the 17<sup>th</sup> century and de Pinto in the 18<sup>th</sup> century are reviewed. The specific language of a late 17<sup>th</sup> century English option contract is provided in detail. The development and practice of option trading in the 18<sup>th</sup> and 19<sup>th</sup> centuries, as reflected in merchant manuals of that period, is examined. The article concludes with an overview of late 19<sup>th</sup> century option trading in securities and commodities.

**Keywords:** Arbitrage; Option; Call Option; Privileges and Refusals; Put Option.; Put-call parity.

\* Geoffrey Poitras is a Professor of Finance. Thanks to Franck Jovanovic for helpful information on 19<sup>th</sup> century French option trading. Resume available for download at [www.sfu.ca/~poitras](http://www.sfu.ca/~poitras).

## **The Early History of Option Contracts**

### **What are Option Contracts?**

By standard definition, an option contract grants the right, but not the obligation, to buy or sell a real asset, commodity or security at a later date, under stated conditions. This contingent claim can be 'free standing', as with put and call options traded on the Chicago Board Option Exchange, or bundled with other features, as in a convertible bond indenture.<sup>1</sup> In ancient times, goods transactions contracts with embedded option features were important to commerce. The development of exchange trading for free standing option contracts took place from the 16th to 18th centuries. It is likely that trading in both forward and option contracts was a common event on the Antwerp bourse during the 16th century. By the mid-17th century, the active trade in such contracts on the Amsterdam bourse featured a sophisticated clearing process. In England, trading in both options and forward contracts was an essential activity in London's Exchange Alley by the late 17th century.<sup>2</sup> Despite this, prior to the mid-19<sup>th</sup> century, options trading was a relatively esoteric activity confined to a specialized group of traders.

The use of contracts with option features is not a modern development. The basis for such features arises from the fundamental process of exchange in markets. This process involves two steps. First, buyers and sellers agree on a market clearing price for the goods involved in the transaction. Second, the exchange is completed, typically with a cash payment being made in exchange for adequate physical delivery of the goods involved. In many transactions, time can separate the pricing agreement, the cash settlement or the delivery of goods. For example, a forward credit sale involves immediate pricing, delivery at maturity of the forward contract and settlement at an even later date. Commercial agreements in early markets often included option-like features that were bundled into

a loosely structured agreement that was governed largely by merchant convention. For example, because trading on samples was common in medieval goods markets, an agreement for a future sale would typically have a provision that would permit the purchaser to refuse delivery if the delivered goods were found to be of inadequate quality when compared to the original sample. As reflected in notarial protests stretching back to antiquity, disagreement over what constituted satisfactory delivery was a common occurrence.<sup>3</sup>

The contract for the German *prämiengeschäfte* differs from the options traded in modern markets which have inherited characteristics associated with historical features of US option trading. Following Emery (1896, p.53), the *prämiengeschäfte* “may be considered as an ordinary contract for future delivery with special stipulation that, in consideration of a cash payment, one of the parties has the right to withdraw from the contract within a specified time”.<sup>4</sup> As such, this option is a feature of a forward contract with a fee to be paid at delivery if the option is exercised. Circa 1908 on the Paris and Berlin bourses, the premium payment at maturity was fixed by convention and the ‘price’ would be determined by the setting the exercise price relative to the initial stock or commodity price. In Castelli (1877, p.7), the premium to be paid at maturity “fluctuates according to the variations of the Stock to be contracted”. In contrast, the modern call option is a tradeable ‘privilege’ of ‘refusal’ with fixed terms where an agreed upon fee would be paid in advance.<sup>5</sup> In the modern approach, both puts and refusals are buyer’s options. The seller writes the options. If the option is a feature of a forward contract, a call option arises because the buyer for future delivery can refuse to take delivery, a put option arises because a seller for future delivery can withdraw.<sup>6</sup>

### **Ancient Roots of Option Contracts**

Evidence that the use of option contracts was acceptable in ancient times appears during the Greek

civilization. Aristotle in his *Politics* provides a reference to the use of options involving a successful speculation by the philosopher Thales. Aristotle's specific reference to Thales in *Politics* is in Book I, Chapter 11, sections 5-10:

There is, for example, the story which is told of Thales of Miletus. It is a story about a scheme for making money, which is fathered on Thales owing to his reputation for wisdom; but it involves a principle of general application. He was reproached for his poverty which was supposed to show the usefulness of philosophy; but observing from his knowledge of meteorology (so the story goes) that there was likely to be a heavy crop of olives [next summer], and having a small sum at his command, he paid down earnest-money, early in the year, for the hire of all the olive-presses in Miletus and Chios; and he managed, in the absence of any higher offer, to secure them at a low rate. When the season came, and there was a sudden and simultaneous demand for a number of presses, he let out the stock he had collected at any rate he chose to fix; and making a considerable fortune he succeeded in proving that it is easy for philosophers to become rich if they so desire, though it is not the business which they are really about.<sup>7</sup>

Unfortunately, this often referenced Aristotelan anecdote is somewhat lacking. For example, it is not clear how Thales, who seems to have been a pure speculator rather than an olive grower, was able to accurately forecast the bumper olive crop in Miletus six months in advance. The precise nature of the contract is also not clear. Presumably, the payment of “earnest-money” was to take options on the use of all available olive presses in the surrounding area for the harvest season, rather than as a down payment associated with a forward contract. What if the bumper crop had not materialized? Would Thales still be required to take up the presses even though he was not able to lease the presses at a substantial premium? Aristotle rationalizes the limited examination of the details of the transaction: “the various forms of acquisition ... minutely and in detail might be useful for practical purposes; but to dwell long upon them would be in poor taste” (Book I, ch. 11, sec. 5).

Another often quoted ancient reference to a transaction with an option feature can be found in Genesis 29 of the Bible where Laban offers Jacob an option to marry his youngest daughter Rachel

in exchange for seven years labour. The story illustrates an important difficulty associated with options trading in early markets: the possibility of delivery failure. After completing the requisite seven years labour required to complete payment of the option premium, Jacob was to discover that Laban would renege on the agreement and only offer Jacob his elder daughter Leah for marriage. Fortunately for Jacob, the then socially acceptable practice of polygamy permitted the eventual completion of the transaction and Jacob's subsequent marriage to Rachel. There is some debate over the validity of this example as an options contract. In particular, it was Hebrew custom for a suitor to make payment when desiring marriage and this payment could be made in labour, instead of goods {Malkiel and Quandt 1969, p.7-8}. This would make the transaction a forward, rather than an option, contract.

While Aristotlean and Biblical anecdotes provide interesting evidence of options contracting in ancient times, tracing the evolution of options through time is complicated by the similarity of options contracts to other types of agreements such as gambles, and the embedding of option features in contracts for the future purchase or sale of a commodity or security.<sup>8</sup> Some method of contracting for forward delivery has been an essential feature of commerce since antiquity {e.g., Poitras 2000, ch.9; Bell et al. 2007}. With the expansion of trade and the rise in the importance of urban centres, forward contracting became essential to urban merchants contracting with agricultural producers for crops prior to harvest or with fisherman for catches prior to arrival in port.<sup>9</sup> Such contracts would have a range of implicit and, possibly, explicit buyer and seller option provisions that related to delivery dates, acceptable quality at delivery, and so on. As noted, the two most important buyer options concerned 'refusal' to take delivery and the privilege of 'putting' the deliverable back to the seller at a predetermined price. A key point in the development of option contracts is where market

liquidity was sufficient to permit the securitization of contingent claims associated with the privileges of 'put' and 'refusal'. As early as Ehrenberg (1928), it has been recognized that this required the emergence of sufficient speculative trading to sustain market liquidity.

### **The Antwerp Exchange**

The evolution of trading in free standing option contracts revolved around two important elements: enhanced securitization of the transactions; and the emergence of speculative trading. Both these developments are closely connected with the concentration of commercial activity, initially at the large medieval market fairs and, later, on the bourses. Though it is difficult to attach specific dates to the process, considerable progress was made by the Champagne fairs with the formalization of the *lettre de foire* and the bill of exchange, e.g., Munro (2000). The sophisticated settlement process used to settle accounts at the Champagne fairs was a precursor of the clearing methods later adopted for exchange trading of securities and commodities. Over time, the medieval market fairs came to be surpassed by trade in urban centres such as Bruges (de Roover 1948; van Houtte 1966) and, later, in Antwerp and Lyons. Of these two centres, Antwerp was initially most important for trade in commodities while Lyons for trade in bills. Fully developed bourse trading in commodities emerged in Antwerp during the second half of the 16th century (Tawney 1925, p.62-5; Gelderblom and Jonker 2005). The development of the Antwerp commodity market provided sufficient liquidity to support the development of trading in 'to arrive' contracts. Due to the rapid expansion of seaborne trade during the period, speculative transactions in 'to arrive' grain that was still at sea were particularly active. Trade in whale oil, herring and salt was also important (Gelderblom and Jonker 2005; Barbour 1950; Emery 1895). Over time, these contracts came to be actively traded by speculators either directly or indirectly involved in trading that commodity but not in need of either taking or

making delivery of the specific shipment.

Van der Wee (1977) examines the emergence of forward and option contract trading on the new Antwerp Exchange that opened in 1531. This exchange was initially intended for both commercial and financial transactions, but commercial contracts were increasingly transacted on the “English Exchange”, which opened one hour before the monetary exchange. The gradual separation of goods and commodity transactions from finance provided a trading environment that facilitated the development of both commercial and financial contracting. The Antwerp Exchange was the model that Thomas Gresham used to establish a similar Exchange in London in 1571 (de Roover 1949). The concentration of liquidity on the Antwerp Exchange furthered speculative trading centered around the important merchants and large merchant houses that controlled either financial activities or the goods trade. The milieu for such trading was closely tied to medieval traditions of gambling (Van der Wee 1977): “Wagers, often connected with the conclusion of commercial and financial transactions, were entered into on the safe return of ships, on the possibility of Philip II visiting the Netherlands, on the sex of children as yet unborn etc. Lotteries, both private and public, were also extremely popular, and were submitted as early as 1524 to imperial approval to prevent abuse.”

With the Antwerp Exchange providing a systematic and organized environment for speculation, trading in ‘to arrive’ contracts evolved into trade in ‘futures’ contracts where the forward contracts involved standardized transactions in fictitious goods for a future delivery and payment that was settled by the payment of ‘differences’.<sup>10</sup> Purchasers of such contracts would speculate on the rise in prices before the due date. If such a rise occurred, the goods would then be sold and the speculator pocketed the difference in price. This ‘difference dealing’ was also conducted by goods vendors, selling for future delivery betting that prices would fall. In commodities where prices were

volatile, especially grain, whale oil, salt and herring, such speculation became common.<sup>11</sup> The development of an active market in time bargains facilitated the emergence of “premium transactions” where: “The buyer made a contract for future delivery at a fixed price, but with the condition that he could reconsider after two or three months: he could then withdraw from the contract provided that he paid a premium to the vendor (*stellet*)” (Van der Wee 1977). While financial speculators on the Antwerp exchange also used option contracts to gamble on the rise or fall of exchange rates at the Castilian or Lyons fairs, speculation in the bill of exchange market did not typically involve option contracting, e.g., de Roover (1944); Munro (2000); Poitras (2009).<sup>12</sup>

### **Option Trading in 17<sup>th</sup> Century Amsterdam**

The collapse of Antwerp in 1585 and the resulting diaspora of important merchants contributed substantially to the rise of the important financial and commodity exchanges in Amsterdam and in London, where the Royal Exchange was established in 1571. While Amsterdam had developed as an important commercial center prior to 1585 (van Dillen 1927; Gelderblom and Jonker 2005), the establishment of the Amsterdam bourse in 1611 marks a symbolic beginning of Dutch commercial supremacy. During the 17th and 18th centuries, trading of forward and option contracts on the Amsterdam exchange exhibited many essential features of exchange trading in modern derivative markets. By the middle of the 17th century trading on the Amsterdam bourse of options on the Dutch East Indies Company (VOC) and, to a lesser extent, the Dutch West Indies Company, had progressed to where puts and calls with regular expiration dates were traded (Wilson 1941; Gelderblom and Jonker 2005).<sup>13</sup> By the 18<sup>th</sup> century, the trade involved both Dutch joint stock shares and “British funds”. This trading on the Amsterdam bourse is the first historical instance of exchange trading in financial derivative securities. “With the appearance of marketable British



securities, and the application to them of a speculative technique that was already well understood, the Amsterdam bourse became the scene of international finance at its most abstract and most exciting – gambling in foreign securities” (Wilson, p.79).

While information about option trading in Antwerp is scattered and sparse, detailed accounts of option trading in Amsterdam are available in Josef de la Vega (1688) and Isaac de Pinto (1762). Both sources discuss options on joint stocks; option trading in commodities is not directly examined suggesting such trade was not a common source of speculative trading. *Confusion de Confusiones* (1688; Fridson 1996) is a remarkable book (Cardoso 2006). Though the central concerns are much broader, de la Vega does make a number of detailed references to options trading on the Amsterdam exchange. There is a general description (Fridson 1996, p.155) of the potential gains to options trading: “Give ‘opsies’ or premiums, and there will be only limited risk to you, while the gain may surpass all your imaginings and hopes.” This statement is followed by a somewhat exaggerated claim about the potential gains: “Even if you do not gain through ‘opsies’ the first time ... continue to give the premiums for a later date, and it will rarely happen that you lose all your money before a propitious incident occurs that maintains the price for several years.” Presumably, de la Vega has call options trading in mind, the possibility of trading put options appears later (p.156).

De la Vega proceeds to describe a crude call option trading strategy: “As the contracts are signed because of the premiums and as the payer of the premiums gains in reputation for his generosity as well as his foresight, keep postponing the terminal dates of your contracts, and keep entering into new ones, so that one contract in time becomes ten, and the business reaches a fine and simple conclusion.” The trading strategy described is uninteresting, as it depends on the naive assumption of a relatively constant upward movement in stock prices. However, the references to extension of

the option expiration dates, with regular marking-to-market, is interesting. De la Vega takes up the uncertain legal interpretation of option contracts at a later point (p.183) and explicitly recognizes that the Dutch restriction on short sales could impact put and call options differently.<sup>14</sup> The reference to extending contracts is further elaborated in de la Vega's discussion of the *rescontre* system (p.181), a major technical innovation in securities trading that emerged between 1650-1688, when the Dutch introduced quarterly settlements of share transactions on the Amsterdam bourse.<sup>15</sup> Prior to this time settlement procedures had been less formal. A key feature of the *rescontre* was the concentration of liquidity that, for example, permitted prolongations to be done more readily (Dickson 1967, p.491; van Dillen 1927).

De la Vega (p.155) goes on to describe an even more naive trading strategy: "If you are [consistently] unfortunate in all your operations and people begin to think that you are shaky, try to compensate for this defect by [outright] gambling in the premium business, [i.e., by borrowing the amount of the premiums]. Since this procedure has become general practice, you will be able to find someone who will give you credit (and support you in difficult situations, so you may win without dishonor)." The possibility that the losses may continue is left unrecognized. However, recognition of a "general" practice of borrowing funds to make option premium payments reflects the speculative mentality that motivated some option purchases. The extension of funds to settle positions appears to be tied into the *rescontre* settlement process. The bulk of option market participants appear to have been speculators, attracted primarily by the urge to gamble, usually "men of moderate wealth indulging in a little speculation" (Wilson 1941, p. 105). In contrast, drawing from de Pinto (1762), Wilson (p.84) observes that for trading conducted on the Amsterdam bourse during the 18<sup>th</sup> century had evolved to where: "Options were the province of the out-and-out gamblers."<sup>16</sup>

### **Tulipmania: Option Trading in Commodity Markets**

In contrast to the availability of primary sources concerning the trade in options contracts for financial securities on the Amsterdam bourse – joint stock, government debt issues and the like – there is a scarcity of sources on such trade in commodities. There are a number of possible reasons for the lack of sources, e.g., Gelderblom and Jonker (2005, p.200). The lack of significant price variability, the practice of using forward contracts with terms either in years or a few days, and the inability of speculators not connected to the trade to handle physical delivery acted to restrict speculative participation in the commodities market. The trade in securities did not have these features.<sup>17</sup> While the tulipmania of 1634-7 has attracted considerable modern attention and debate associated with whether the event qualifies as a ‘speculative bubble’, the primary sources associated with the tulipmania also provide insight into the use of forward and option contracts in the 17<sup>th</sup> century Dutch commodities trade. In the process of considering these sources, some modern misperceptions regarding the role that option contracts played in the tulipmania can be clarified.

The tulipmania was precipitated by the entrance, around the end of 1634, of purely speculative buyers into the tulip market which, prior to this time, had been conducted among merchants directly involved in the tulip trade. Following Posthumus (1929, pp.438-9): “People who had no connection with bulb growing began to buy ... Among these were weavers, spinners, cobblers, bakers, and other small tradespeople, who had no knowledge whatsoever of the subject. About the end of 1634 ... the trade in tulips began to be general, and in the following months the non-professional element increased rapidly.” The speculators were attracted by the specific characteristics of the tulip market: the significant separation in time of the purchase agreement from the delivery and payment provided a commodity where speculative buyers of bulbs, not intending to take delivery, could trade with

sellers that did not possess the bulb on the purchase agreement date. Payment and delivery considerations did not enter until it was certain that the actual tulip bulb was available for possession. “At the height of business most transactions took place without any basis in goods. Each succeeding buyer tried to sell his ware for higher prices; and, in the general excitement, one could make a profit – at least on paper – of several thousand florins in a few days. The craze spread rapidly with these high profits. All classes of population ended by taking part in it – intellectuals, the middle classes, and the labourers” (Posthumous 1929, p.440).

Due to the vagaries of tulip growing (e.g., Garber 1989), option contracts are well suited to trading of tulips for forward delivery. However, based on the fairly detailed record of the types of contracts used (Posthumous 1929; Poitras 2000, ch.10), merchant practice in the tulip trade of the time was to use forward contracts tailored to the needs of trade rather than option contracts. A number of different contracting methods were used, from the “promises and vouchers” of the most speculative and uninformed traders, to the formal notarized written contracts of tulip dealers. Some are quite basic, such as: “Sold to N.N. a quarter of Witte Kroonen for the sum of 525 gld. when the delivery takes place; and four cows at once, which may be now taken from the stable and led to the seller's house.” A more detailed example for the sale of a piece good is:

I, the undersigned, acknowledge to have bought from N.N., on conditions hereunder mentioned, one Gouda of 48 aces standing planted in N.N.'s garden, for the sum of 520 gld. in sterling. But in case 8 days after the notifying, the buyer were not to come to take the bulb, the seller may take it out of the ground, in the presence of two praiseworthy persons, and seal it in a box. And if a fortnight after this, the bulb has not been fetched by the buyer, the seller may sell it anew. If he gets more for it, the first buyer will not profit by it, and, when less, has to pay the difference. In case of any obscurity or misunderstanding or dispute arising out of this transaction, it will remain with two praiseworthy people, who know these things and who live in the place or town, where this transaction has taken place. And by default of payment of the aforesaid sum, I hereby engage all my goods, movable and immovable, submitting same in the power of all rights and magistrates; all this without arch

or cunning. Have signed this. Act in Haarlem on December 12th, 1636.

Perhaps some speculative fringe players in the tulipmania engaged in pure gambles that were configured as free standing options transactions. However, such deals, if any were ever done, were only obscure incidents in the tulipmania.<sup>18</sup>

The relevance of option contracts to the tulipmania arises from the legal outcomes associated with the collapse of prices from a peak which is usually traced to February 3, 1637. By the end of February 1637, there was widespread default on forward contracts. After a short period of political and legal wrangling, the bulk of contracts outstanding at the time of the collapse were voided on the basis of “appeals to Frederick” (De Marchi and Harrison 1994). Such appeals referenced the anti-speculative 1630 and 1636 edicts of Stadholder Frederick Henry that permitted a contract to be repudiated if the ‘short’ did not have possession of the commodity at the time the contract for sale was entered. These edicts reinforced and clarified similar edicts going back to 1610 which were initially aimed at the speculative trade in shares (Kellenbenz 1957, p.136). Significantly, where the courts determined that payments of differences were to be made, the forward contracts were to be interpreted as implied option contracts with payments by the longs to be made in the 1-5% range of the actual losses, consistent with the conventional size of refusal premiums. Hence, even though the contracts were written as forward contracts, the legal environment of the time interpreted such contracts to reflect the historical practice of merchants in the commodities trade permitting the buyer’s option to refuse delivery.

### **London Option Trading**

Following the Glorious Revolution of 1688, many of the speculative practices used in Amsterdam were adopted in England where stock trading had a highly developed spot market by the mid-1690s.

Dutch investors and speculators also conducted a considerable amount of their British securities trading outside the Amsterdam bourse at various locations in London, such as on the Royal Exchange and in Exchange Alley where curb and coffeehouse trading was conducted. After a collapse of share prices in 1696, dealing in shares of joint stock companies, especially so-called “stockjobbing” activities, left the Royal Exchange and business was conducted in other locations, most notably in coffeehouses such as Jonathan’s located in Exchange Alley near the Royal Exchange. While it is not possible to precisely date the beginning of the regular three month *rescontre* for time bargains and options on stock in London, there is considerable evidence that it was firmly established by the middle of the 18th century, prior to the formal establishment of the London Stock Exchange (1773). Trading in stock options was also widespread though the full impact of option trading in the market events such as the collapse of 1696 or the infamous South Sea Bubble is unclear.<sup>19</sup>

Unlike modern day markets, the process for purchase and settlement in the 18th century gave rise to 'stockjobbing' associated with the forward trading of securities. Following Mortimer (1761, p.32):<sup>20</sup>

the mischief of it is, that under this sanction of selling and buying the funds for time for foreigners — Brokers and others, buy and sell for themselves, without having any interest in the funds they sell, or any cash to pay for what they buy, nay even without any design to transfer, or accept, the funds they sell or buy for time. The business thus transacted, has been declared illegal by several acts of parliament, and this is the principal branch of STOCK-JOBING.

The history of stockjobbing in England reflected considerable and generally disapproving interest in Parliament. A number of attempts were made to regulate stockjobbing, starting in 1697 with an Act “To Restrain the number and ill Practice of Brokers and Stockjobbers”.<sup>21</sup> In addition to

restricting the number of practices of commodity brokers, this Act was designed to deal with three main difficulties associated with the trade in shares: unscrupulous promotion activities; manipulation of prices for shares; and, misuse of options. The pressures to further regulate stockjobbers intensified leading to the Bubble Act of 1720 and, following the South Sea Bubble, to the passage of “An Act to prevent the infamous Practice of Stock-jobbing” in 1733, also known as Barnard's Act. While this Act contained substantial penalties for speculative trading in options and time bargains, the Act was quite ineffective in restricting this trade. However, Barnard's Act was successful in removing legal protection for these transactions, making the broker a principal in speculative transactions, responsible for completion of transaction in the event of default by a client. The ensuing increased need for honesty and integrity in these speculative dealings was a significant factor leading a loose knit group of brokers to form the London Stock Exchange.

The first documented instance of a stock option contract traded in London is for 1687. Though Houghton (1694) reproduces examples of printed options contracts for both a put and a refusal, it was also common practice to use covenants and indentures drawn up by scribes, and the surviving contract is of this type. Following Dickson (1967, p.491), the earliest surviving English option contract is dated July 29, 1687, a covenant by Sir Bazill Firebrass of Mark Lane to deliver £1,000 East India stock at 200 to Sir Thomas Davill on or before March 1, 1688, in return for a premium of 150 guineas. Similar contracts from the summer of 1691 were used by Sir Stephen Evance, a leading banker, King's Jeweller, and Chairman of the Royal Africa Company. The contracts were mostly in shares of the Company of White Paper Makers, with smaller amounts in African and East India stock. In each contract Evance was undertaking to deliver stock in six months' time at a given price with a stated option premium of roughly 20%.

## Houghton on London Option Contracts

Houghton's 1694 contributions to his circular *A Collection for the Improvement of Husbandry and Trade* can be fairly recognized as containing possibly the first coherent and balanced description of early stock trading in London, e.g., Neal (1990, p.17), though the description provided by Houghton is so brief that Cope (1978, p.4) credits Mortimer (1761) with being the “first detailed description of the market”. Though Houghton (1694) does provide some description of stock trading, the most significant contribution is on the specific subject of options trading. For seven weeks in June and July 1694, Houghton dedicated the first page of his circular to discussing stock trading. About 2 1/2 of the seven weeks are dedicated to trading in “puts and refusals”. On June 22, 1694, Houghton provides the following insightful discussion of the profit to be obtained from call option trading:

The manner of managing the Trade is this: The Monied Man goes among the *Brokers*, (which are chiefly upon the *Exchange*, and at *Jonathan's Coffee House*, sometimes at *Garaway's* and at some other *Coffee Houses*) and asks how *Stocks* go? ... Another time he asks what they will have for Refuse of so many Shares: That is, How many Guinea's a Share he shall give for liberty to Accept or Refuse such Shares, at such a price, at any time within Six Months, or other time they shall agree for.

For Instance; When *India* Shares are at Seventy Five, some will give Three Guinea's a Share, Action, or Hundred Pound, down for Refuse at Seventy Five, any time within Three Months, by which means the Acceptor of the Guinea's, if they be not called for in that time, has his Share in his own Hand for his Security; and the Three Guinea's, which is after the rate of Twelve Guinea's profit in a year for Seventy Five Pound, which he could have sold at the Bargain making if he had pleased; and in consideration of this profit, he cannot without Hazard part with them the mean time, tho' they shall 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, as you shall see afterwards: So that if Three months they stand at stay, he gets the Three Guinea's, if they fall so much, he is as he was losing his Interest, and whatever they fall lower is loss to him.

But if they happen to rise in that time Three Guinea's, and the charge of Brokerage, Contract and Expence, then he that paid the Three Guinea's demands the Share, pays the Seventy Five Pounds, and saves himself. If it rises but one or two Guinea's, he secures so much, but whatever it rises to beyond what it cost him is Gain. So that in short, for a small hazard, he can have his chance for a very great Gain, and he will certainly know the utmost his loss can be; and if by their rise he is encouraged to demand, he does not matter the farther



advantage the Acceptor has, by having his Money sooner than Three Months to go to Market with again; so in plain *English*, one gives Three Guinea's for all the profits if they should rise, the other for Three Guinea's runs the hazard of all the losses if they should fall.

This insightful description is quite remarkable in that, unlike de la Vega or de Pinto, Houghton was not an active participant in the market; Houghton was “not much concern'd in Stocks, and therefore (had) little occasion to Apologize for Trading therein”.

An important, but overlooked, feature of Houghton's 1694 discussion appears in the contributions of June 29 and July 6 where samples of put and call option contracts are given in detail. That standard contracts were available indicates that the market was well developed and that brokers, in conjunction with notaries, were the likely vehicles for executing trades. Examination of the specific clauses in these contracts provides useful information about option trading practices.<sup>22</sup> In the June, 29, 1694 circular, Houghton provides a sample contract for a ‘refusal’ or call option, how “for Security to the giver out of Guinea's, the Acceptor gives him a contract in these or like words”:

In consideration of Three Guinea's to me A.B. of London, Merchant, in hand paid by C.D. of London, Factor, at and before the Sealing and Delivery hereof, the Receipt whereof I do hereby acknowledge, I the said A.B. do hereby for my self, my Heirs, Executors and Administrators, covenant, promise, and agree to and with the said C.D. his Executors, Administrators and Assigns, that I the said A.B. my Executors, Administrators or Assigns shall and will transfer, or cause to be transferred to the said C.D. his Executors, Administrators or Assigns, one Share in the Joint stock of the Governor and Company of Merchants of London, trading to the East-Indies, within Three Days next after the same shall be demanded, as herein after is mentioned, 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 (if any shall be) Provided the said C.D. his Executors, Administrators or Assigns shall make demand of the said One Share personally by Word of Mouth of me, my Executors or Administrators, or by a Note in Writing under his or their Hand, and leave such Note unto or for me, my Executors or Administrators, at my now dwelling House situated in Cornhill, London, at any time on or before the Nineteenth day of September now next coming. And also pay, or cause to be paid, or to the Use of me the said A.B. my Executors, Administrators or Assigns, for the said One Share, and Dividends as aforesaid, within the said Three Days next after demand, the full Summ of Seventy five pounds of lawful Money of England, at the place where the Transfer Book belonging to the

said Company shall for the time being be kept, together with all Advance-Money (if any shall be). But if the said C.D. his Executors, Administrators or Assigns shall not demand the said One Share, as aforesaid, within the time aforesaid; and also pay, or cause to be paid to, or to the Use of me, my Executors, Administrators or Assigns, the said Summ of Seventy five Pounds, and all Advance Money, as aforesaid, at the place of refund, within the said Three Days next after such Demand, then this present Writing to be utterly void and of none Effect. And the said Three Guinea's to remain to me the said A.B. my Executors and Administrators for ever. Witness my Hand and Seal the Nineteenth Day of June, Anno Dom 1694 and in the Sixth Year of the Reign of King William and Queen Mary of England, &c.

Sealed and Delivered in the Presence of E.F. G.H. A.B.

Upon signing of the contract and payment of the three guineas, the Acceptor then provides the purchaser with a receipt for payment.

The first useful piece of information in Houghton's sample contract is the price, three guineas for a three month call option, with exercise price of seventy-five. Though Houghton does give weekly quotes for East India stock, a price is not available for June 19. Houghton quotes prices for June 15 and 22 at £73, so £75 could represent an option that is at-the-money. This is consistent with the option practices observed by Cope (1978, p.8) where the “price at which the option was exercisable was the same as, or very close to, the price of the stock for ready money when the option was arranged”. The precise details of how the option price is determined is not examined by Houghton. Kairys and Valiero (1997) report that US stock option pricing in the 1870's kept the premium constant and adjusted the exercise price, quoting call prices as the difference between the the exercise price and the cash stock price. This may have been the case here, as a cash stock price of £74 would make the option slightly out-of-the-money. For the late 19<sup>th</sup> century, Emery (1896, p.81) indicates that the option writers had a preference for near-the-money transactions in order to “get larger privilege money”. The premium would be increased if the stock price volatility increased.

The next point of interest concerns the description of the parties. The writer of the option is described as “A.B., my Heirs, Executors and Administrators” while the purchaser is “C.D. his Executors, Administrators or Assigns”. This wording binds the writer to the contract, whether in death or bankruptcy, while permitting C.D. to ‘assign’ the contract to another party. The well-developed case law on negotiable instruments, e.g., Munro (2000), is found to apply to the option contract with the result that the option purchaser could resell the contract to another party, prior to the expiration date. While this feature substantially enhances potential market liquidity, the mechanism for assigning a contract, particularly where there has been a significant change in the price and there has been dividends or other advantages paid in the interim, is unclear. In contrast, the regular *rescontre* settlement used in Amsterdam trading significantly reduced the element of default risk. In addition, regular settlement dates facilitate the use of European options with premium payment at maturity.

Modern exchange traded options contracts, such as those traded on the Chicago Board Options Exchange, are American style, that is, the option can be exercised at any time up to and including the expiration date, and are not dividend-payout protected. Houghton's sample contract provides information about related features at his time. The sample contract contains the agreement to transfer the share together with “all Dividends, Profits, and Advantages whatsoever, that shall after the Date hereof be voted, ordered, made, arise or happen thereon”. Taking the “Date hereof” to be the date the option contract is signed, this feature provides what in modern terms is known as ‘dividend payout protection’. This feature is combined with the feature that, upon proper notification, the writer agrees to sell one share of stock “at any time on or before the Nineteenth day of September”. The Houghton option contract is American-style with dividend-payout protection.

Perhaps the most important theoretical result in the modern study of option pricing is the Black-Scholes formula (Black and Scholes 1973). As originally presented, this formula provides a closed form solution for the price of a European call option on a non-dividend paying stock. Hence, even though most traded options are American, the European feature plays an important theoretical role. As conventionally presented, a European option can only be exercised on the expiration date. In general, the price of an American option is equal to the price of a European option, plus an additional non-negative early exercise premium. An American *call* option on a non-dividend paying security is a special case where the early exercise premium is zero because, in the absence of transactions costs, the option will never be exercised early. Significantly, inclusion of a dividend payout protection provision in the option contract converts the option valuation problem for a dividend paying security to the non-dividend paying case.

What has all this to do with Houghton? The origins of the European and American features in options contracts are obscure, though early sources such as Bachelier (1900) indicate that the European feature predates the American. What Houghton provides is evidence that late 17th century option contracts were transferable, dividend payout protected, American options with premium payments up front and settlement that required physical delivery of the security. If settlement was to be made by payment of differences, this was not stated in the contract. Yet, in the absence of transactions costs, an American call option with dividend payout protection will not rationally be exercised early; it will always be more profitable to sell the option.<sup>23</sup> This effectively equates the American option to a European option. Instead of restricting exercise to the expiration date, the late 17<sup>th</sup> century London option contract was structured with transferability and dividend payout protection provisions that made early exercise unprofitable resulting in irrelevance of the American

feature.

A number of other less significant features of Houghton's option contract that are of some modern interest can also be identified. In particular, modern exchange traded option contracts permit cash settlement, in lieu of the exchange of stock for money. The Houghton contract only allows for the actual purchase of stock. The possibility of a *rescontre* method of settlement is not admitted, though de la Vega's option contracts would seem to be designed for *rescontre* trading. There is also a provision in Houghton's contract for advance money, which may have been akin to a margin account, to ensure that the option purchaser actually has sufficient funds to complete the transaction. However, why this would be required in an options transaction is unclear. Finally, as evidenced by the issue of a receipt, the option contract did require that the three guinea premium be paid up front. The possibility of delaying the premium payment until the expiration date is not admitted.

### **Restrictions on Options Trading**

The modern perception of option contracts as a sophisticated risk management tool is not consistent with the long history of attempts to impose legal restrictions on options trading. The basis for such restrictions is the close correspondence between option contracts and gambles. In Roman times, games of chance played for money were forbidden under penalty of a fine fixed at four times the value of the stakes. Such a law was unusual in relatively permissive Roman society but was considered necessary as gambling was a social obsession. However, the laws on gambling were not unambiguous. Gambling on certain activities, such as horse races and gladiatorial combat, was permitted and the general gambling restriction was suspended during the week-long Saturnalia festival. Enforcement of gambling laws was lax and gaming conducted at private clubs was generally overlooked. This historical perception of gambling is reflected in the history of restrictions

on options trading. Because such contracts were often employed for gambling purposes, parties to the contract could not expect the protection of the courts if the transaction did not go as planned. Brokers and other agents with public recognition or registration were not permitted to facilitate such contracts. As a consequence, options trading was usually restricted to a private transactions between individuals where professional or social reputation was used to control the risk of contract default.

During the emergence of trade in free standing option contracts, the conventional legal view was that, while technically a gambling transaction, such contracts could be entered into by private parties willing to conduct such business without the guarantee that the courts could be used to enforce such contracts. However, in periods of speculative excess, the abuse of option contracts produced a subsequent demand for regulation. By the 1690s, an organized options market had emerged in London in support of the increasing number of joint stock issues.<sup>24</sup> Houghton provides the following account of a market manipulation involving options:

But the great *Mystery* of all is, That some Rich Men will join together, and give money for REFUSE, or by Friendship, or some other way, strive to secure all the Shares in a Stock, and also give Guinea's for Refuse of as many Shares more as Folk will sell, that have no Stock: and a great many such they are, that believe the Stock will not rise so high as the then Price, and Guinea's receiv'd or they shall buy before it does rise, which they are mistaken in; and then such takers of Guinea's for Refuse as have no Stock, must buy of the other that have so many Shares as they have taken Guinea's for the Refuse of, at such Rates as they or their Friends will sell for; tho' Ten or Twenty times the former Price.

In modern parlance, this is a classic example of a short squeeze being executed against uncovered call option writers. The Act of 1697 limited some of the potential abuses that were perpetrated with options, but did not eliminate such trading. This left forward trading as the favoured vehicle for manipulating security prices, an undesirable outcome of the “villanous” practice of stockjobbing.

There was considerable disagreement in the broker community about whether options transactions

were reputable. While potentially useful in some trading contexts, reputable brokers felt that options contributed to the speculative excesses common in the early financial markets. While trading in options and time bargains did contribute to the most important English financial collapse of the 18th century, the South Sea Bubble of 1720, this event was due more to the cash market manipulations of “John Blunt and his friends” (Morgan and Thomas, ch. 2). In any event, dealing in time bargains and, especially, options were singled out as practices that were central to “the infamous practice of stock-jobbing”. In 1721, legislation aimed at preventing stockjobbing passed the Commons but was not able to pass the Lords. It was not until 1733 that Sir John Barnard was able to successfully introduce a bill under the title: “An Act to prevent the infamous Practice of Stock-jobbing.” This Act is generally referred to as Barnard's Act.

The abuses associated with stockjobbing were due, at least partly, to the standard market practice of a significant settlement lag for purchases of joint stock. While there was a cash market conducted, often at or near the company transfer office, dealing for time had a legitimate basis in the practical difficulties associated with executing a stock transfer. This meant that when stock was sold for time, the short position had a considerable lead time to deliver the security. Trading involved establishing a price for future delivery of stock and paying a small deposit against the future delivery. In cases where the selling broker did have possession of the underlying stock when the transaction was initiated, there was little or no speculative element in the time bargain. However, this was not the case when the seller did not possess the stock. In addition, the purchaser for time did not usually have to take possession of the stock at delivery but, rather, could settle the difference between the agreed selling price and the stock price on the delivery date.

Barnard's Act (1733) was designed to regulate those features of stock dealings associated with

excessive speculation, e.g., Morgan and Thomas (1962, p.62). The main provision of the Act states: “All contracts or agreements whatsoever by or between any person or persons whatsoever, upon which any premium or consideration in the nature of a premium shall be given or paid for liberty to put upon or deliver, receive, accept or refuse any public or joint stock, or other public securities whatsoever, or any part, share or interest therein, and also all wagers and contracts in the nature of wagers, and all contracts in the nature of puts or refusals, relating to the then present or future price or value of any stock or securities, as aforesaid, shall be null and void.” A penalty of £500 was levied on any person, including brokers, who undertook any such bargain. All bargains were to be “specifically performed and executed”, stock being actually delivered and cash “actually and really given and paid”, and with a £100 penalty for anyone settling a contract by paying or receiving differences. It was further provided: “whereas it is a frequent and mischievous practice for persons to sell and dispose of stocks and securities of which they are not possessed”; anyone doing so would incur a penalty of £500. There is disagreement among modern writers, such as Cope (1978) and Dickson (1967), concerning the extent to which Barnard's Act actually limited options trading. That it had some impact is evident. However, the extent of the impact is less clear.

Despite Barnard's Act making options trading illegal, options trading continued to the point where, in 1820, a controversy over the trading of stock options nearly precipitated a split in the London Stock Exchange.<sup>25</sup> A few members of the Exchange circulated a petition discouraging options trading. The petition passed, and members formally agreed to discourage options trading. However, when an 1823 committee of the Exchange followed up on this with a proposal to implement a rule forbidding Exchange members from dealing in options (which was already illegal under Barnard's Act), a substantial number of members voted against. A dissident group even began raising funds



for a new Exchange building. In the end, the trading ban rule was rejected because options trading was a significant source of profits for numerous Exchange members who did not want to see that business lost to outsiders.

### **Put-Call Parity and the Pricing of Options Contracts**

What methods were used for pricing option contracts?. The limited information that is available for trading on the Amsterdam bourse, for example, de la Vega's *Confusion* (1688) and de Pinto's *Jeu d'Actions en Hollande* (1771), indicates that options were used primarily for speculating and not for risk management by cash market participants. By the middle of the 17th century, speculative trading on both time bargains and options in Amsterdam had progressed to the point where gains or losses on positions were settled on *rescontre* (settling day) without delivery of the cash securities, and positions could be carried forward to the next *rescontre*. By the late 17th century a regular monthly (changing to quarterly) *rescontre* process was in place. In the absence of a primary source directly concerned with the methods of pricing of derivative securities, it is still possible to infer that while prices were, at times, determined by forces of supply and demand, there was also some understanding and application of the concept of cash-and-carry arbitrage, especially for time bargains (Wilson 1941, pp.83-4):<sup>26</sup>

Unlike time bargains, arbitrage requirements seem to have had less impact on option prices. Wilson (1941, p.122), for example, provides quotes for options on East India Company and South Sea Company shares in 1719 that reflect some pricing inefficiencies. Consistent with information from Kairys and Valerio (1997) for US option markets in the 1870's, option prices reflect a general pricing advantage for writers, supporting the view that most buyers were “out-and-out gamblers”.<sup>27</sup> Option writers quoted prices at premiums consistent with exploiting market sentiments. The

tendency of options trading, at least in England, to be concentrated among less reputable brokers (Morgan and Thomas 1962, pp.61-2) and to be associated with market manipulation also argues against sophisticated understanding of option pricing. However, there is evidence that option writers did understand put-call parity and, as a consequence, could have created fully hedged written option arbitrage profits. Put-call parity is an arbitrage-based relationship between the price of put and call options. For practical purposes, put-call parity is, arguably, the most important distribution-free property of option prices. Both de la Vega (1688) and de Pinto (1771) contain statements indicating that put-call parity was understood, as it applied in specific circumstances of late 17th century and 18th century Amsterdam option markets. The exact specification of put-call parity depends on the underlying commodity being traded and the restrictions imposed on the arbitrage transactions, for example, transactions costs, timing of transactions, and the difference between lending and borrowing rates.

Assuming perfect markets, at any time  $t = 0$  put-call parity for European options written on a spot position in a non-dividend paying security can be stated:

$$P_0[X,T] = C_0[X,T] + \frac{X}{1 + rT} - S_0$$

where  $C_0[X,T]$  and  $P_0[X,T]$  are the  $t = 0$  prices of call and put options with exercise price  $X$  and time to expiration  $T$  (measured in fractions of a year),  $r$  is the annualized interest rate and  $S_0$  is the security price at  $t = 0$ .<sup>28</sup> In the absence of market imperfections, put-call parity has to hold because, if not, then it is possible to execute an arbitrage. For example, if  $P < C + (X/(1 + rT)) - S$  then the following trades can be executed: write the call, borrow  $X/(1 + rT)$ , buy the put and buy the stock. By assumption, this transaction would generate positive cash flow at  $t = 0$ , yet the value of the position

will always be zero at  $t=T$ .

Modern textbook presentations of put-call parity use European options on a spot security to motivate the explanation of put-call parity because the underlying arbitrage trades are more intuitive. Recognizing that stock could be traded on both a cash and a forward basis, similar arbitrage conditions apply to options written on forward contracts. The precise statement of put-call parity in this case depends on whether the forward contract underlying the transaction will mature on the expiration date of the option, permitting delivery of the spot commodity, or whether a forward contract is to be delivered on the option expiration date. For de la Vega and de Pinto the exchange traded options typically corresponded to forward contracts with the same expiration date. In this case, put-call parity requires:

$$P_0[X,T] = C_0[X,T] - \left\{ \frac{F[0,T] - X}{1 + rT} \right\}$$

The arbitrage condition is slightly different from the spot case because taking a position in the security no longer involves a  $t = 0$  cash flow associated with purchasing the security.

For example, if  $P[X,T] < C[X,T] - \{F[0,T] - X\}/(1 + rT)$  then the arbitrageur will buy the put, write the call, take a long forward position in the security at  $F[0,T]$  and borrow  $\{F[0,T] - X\}$  if  $F[0,T] < X$  that will convert to an investment in the fixed income security if  $F[0,T] > X$ . The intuition behind the net investment if  $F[0,T] > X$  is that, if the call is in the money, then the put will be out of the money, and there will be money left over after the proceeds from the written call position have been used to purchase the call. This surplus is invested in a riskless, zero coupon, fixed income security maturing at  $T$ . Similarly, if the put is in the money, the call will be out of the money and the proceeds from writing the call will be insufficient to purchase the put so funds have to be borrowed

to fully fund the arbitrage at  $t = 0$ . This follows by definition because an arbitrage is a riskless trading strategy requiring no net investment of funds.

Neither de la Vega or de Pinto directly discuss the put-call parity condition or the underlying arbitrages. What is presented is a ‘conversion’ strategy that converts a call option position to a put option. De la Vega (p.156) describes the strategy as follows:

I come to an agreement about the (call) premium, have it transferred [to the taker of the options] immediately at the Bank, and then I am sure that it is impossible to lose more than the price of the premium. And I shall gain the entire amount by which the price [of the stock] shall surpass the figure of 600 ... In case of a decline, however, I need not be afraid and disturbed about my honor nor suffer fright which could upset my equanimity. If the price of shares hangs around 600, I [may well] change my mind and realize that the prospects are not as favorable as I had presumed. [Now I can do one of two things.] Without danger I [can] sell shares [against time], and then every amount by which they fall means a profit ... and with a rise in price I could lose only the bonus (premium).

In effect, this says that a long position in a call at  $C[X,T]$  combined with a short forward contract at  $F[0,T]$  ( $= X$ ) produces a position with a payoff equal to that of a long position in a put at  $P[X,T]$ . Because the options involved are both at the money, this strategy reduces to the replication strategy underlying put-call parity for at-the-money options written on forward contracts with the same expiration date as the option contracts.

As an aside, the second strategy suggested by de la Vega for a trader confronted with a change in expectations about the future movement in prices is also of interest. De la Vega (p.156) suggests that “if I reckon upon a decline in the price of stock”, then the trader with a long call position ought to “now pay premiums for the right to deliver stock at a given price”. In modern terms, de la Vega is suggesting that the trader undertake a straddle, in this case a combination of a long call with a long put, both options being at-the-money. De la Vega provides no further discussion of the strategy. There is no recognition that the straddle is not a bet on the direction of stock prices but, rather, is a

play on volatility. In effect, an at-the-money straddle is a bet that the actual future volatility of prices will be greater than the volatility implicit in the quoted option premiums. Merchant manuals from the 19<sup>th</sup> century also recognize straddle trading. Making reference to Castelli (1877), Emery (1896, p.81) observes: “A ‘straddle’ is much more common in securities than in produce. A straddle reading at the market price in a fluctuating security would rarely be sold, and then only at a very high price, but in more stable stocks they are not infrequent.”

Writing over eighty years after de la Vega, it is not surprising that de Pinto has a much more developed understanding of options trading. De Pinto also has an example with a trader, Paul, holding a long position in a call option, in this case with an exercise price of 150. De Pinto (1771a, p.300) considers what happens if “the speculation stops”:

Another transaction, more curious, is to convert this premium to deliver, which was betting for an increase, into a premium to receive. First we thought the stock was going to increase a lot, we paid 2½% to deliver at 150. The stock took indeed some value, but we heard that the cause for this increase has disappeared. Therefore, we sell on the Closed Market for the same *rescontre* £1000 at 150 and we convert by this process the premium to deliver into a premium to receive.

In this case, the recognition of the put-call parity relationship is explicit. De la Vega goes on to describe a more sophisticated variation of this strategy. After the initial call option has been successful and the stock price has risen to 155, the trader can lock in the 5% profit and create a put option by shorting the forward contract at 155.

### **The Extent of Option Trading**

Prior to the financial collapse associated with the Mississippi scheme, Paris was on a path to be included with London and Amsterdam as a key European financial center. Despite the political and economic importance of France, various French characteristics retarded the development of financial

markets during the 17<sup>th</sup> century. France tended to be a nation of small farmers; the explorers and traders that brought glory to her neighbors were relatively absent. It was the state that dominated economic development rather than the individual entrepreneurs that thrived in Holland and, after the Glorious Revolution, in England. Major state sponsored commercial ventures – such as Richelieu’s Company of One Hundred Associates (1627) and Colbert’s Company of the West Indies (1664) – were relatively unsuccessful compared to similar efforts by the Dutch and English. At the time of the Mississippi scheme, Paris lacked the central bourse that characterized trade in London and Amsterdam. Despite these drawbacks, the economic importance of France meant that Paris was an integral part of the international commercial network and that trading practices similar to those used in London and Amsterdam were the norm in financial markets, e.g., Neal and Quinn (2001).

In the absence of a central bourse, stock trading and other financial activities such as trading bills of exchange took place at different locales around Paris. At the time of the Mississippi scheme, between 1716 and 1720, stock trading was centered in the Rue Quincampoix. It was here that John Law established the offices of the *Compagnie des Indes* (Mississippi Company) for the issue of shares in the company and, as a consequence, the legendary throngs gathered at the peak of share prices to purchase “les primes”, effectively at-the-money six month warrants to purchase a share of company stock (Murphy 1997, p.213-7). It is one of the ironies of the Mississippi scheme that Law issued primes to undermine the stockjobbing by private traders – in this case trading of three to six month time bargains in company stock at prices (12000-14000 livres per share) considerably above the price (10000 livres) that the stock had achieved at that point in the speculative bubble. Law reasoned that by issuing large amounts of primes with an exercise price of 10000 livres, this trade would be ended. What Law did not anticipate was that the speculation had progressed to where

shareholders would rush to sell a share at 10000 to raise cash to purchase primes at a premium of 1000 that granted the right to buy 10 shares in the future at 10000 each. The resulting downward pressure on cash share prices led, ultimately, to the collapse of the scheme.

The issuing of “les primes” by the *Compagnie des Indes* at the height of the Mississippi scheme speculation is, perhaps, the most remarkable event in the history of option contracts. The extent of the Mississippi scheme went far beyond the considerable losses of investors. For two generations and longer, the French were wary of financial securities such as bank notes, letters of credit and company shares. While there were government efforts to organize the share market, such as a 1724 order authorizing the creation of a stock exchange in Paris, scepticism of joint stock financing was widespread. At the 1785 peak of an *agioteur* driven speculative frenzy on the Paris bourse (Taylor 1962), the bear speculator Étienne Clavière was able to commission the great French revolutionary, orator and politician M. le comte de Mirabeau (1749-1791) to produce anti-*agiotage* polemics and tracts designed to support an uncovered bear squeeze of longs with forward contracts (*vente à terme*). The squeeze involved spreading negative sentiment, depressing the cash price in order to permit the bear syndicate to purchase shares for values well below the delivery price. Because it is difficult to sustain the negative sentiment, the squeeze would have been difficult if the forward contracts had option features.

The closing of the Paris Bourse and the abolition of French joint stock companies were two consequences of the turmoil of 1793. These events mark a symbolic end to the rudimentary financial transactions of the 18<sup>th</sup> century, just as the official recognition of the new-style Paris Bourse in 1801 marks the beginning of the more sophisticated and accepted option trading practices that concerned Bronzin (1908). While important merchant manuals of the 18<sup>th</sup> century, such as Jacques Savary,

*Dictionnaire Universel de Commerce* (1730) and Malachy Postlethwayt *The Universal Dictionary of Trade and Commerce* (1751), have detailed discussion of the trade in *actions*, there are no entries for privileges, *prime à délivrer* or *prime à recevoir*; premiums; *jeu d'actions*; or puts and refusals. With the exception of Houghton (1694), the important sources on the 17<sup>th</sup> and 18<sup>th</sup> century stock options trade are either sufficiently obscure or were part of the numerous legislative attempts to regulate or abolish the trade. It is not until the second half of the 19<sup>th</sup> century that knowledge and understanding of options trading moved outside the narrow confines of a small group of specialized traders and gradually acquired increased reputation in Europe.

Though primary sources are scarce, it is likely that privilege trading in the US was present from the late 18<sup>th</sup> century beginnings of trade in securities, perhaps earlier in the produce markets. Over time, this trade developed differently from Europe due to differing settlement practices. In the US, “each day is a settling day and a clearing day for transactions of the day before ... This is a marked difference from European practice” where “trading for the account” (*prolongationsgeschäfte*) involves monthly or fortnightly settlement periods with allowance for continuation of the position until the next settlement date (Emery 1896, p.82). The continuation process for a buyer seeking to delay delivery involves the immediate sale of the stock being delivered and the simultaneous repurchase for the next settlement date. As this transaction would involve the lending of money, an additional ‘contango’ payment would typically be required. As a consequence of these settlement differences, in the US (American) options developed with fixed exercise prices, possible exercise prior to delivery and premiums paid in advance. In Europe, premiums for (European) options would be due on the scheduled future delivery date which coincided with a regular settlement date, exercise could only take place on the delivery date and the exercise price would be adjusted to determine a



market clearing ‘price’ for the option at the time of purchase.

### **Option Trading at the end of the 19<sup>th</sup> Century**

The history of economic thought on option contracts is sparse. Relatively little of substance on the theory of option pricing was written until the appearance of Bachelier (1900; Dimand and Ben-El-Mechaiekh 2006) and Bronzin (1908; Zimmermann and Hafner 2006), though Lefèvre (1873; Jovanovic 2006) does introduce valuation using expiration date profit diagrams. Significantly, each of these sources is continental European. Prior to this time, there is some evidence that market participants had a subtle understanding of option pricing, though market convention rather than competitive pricing was more important for determining actual premiums paid, e.g., Cope (1978, p.8). For a variety of reasons, including a history of speculative abuses, option trading was held in low esteem by the bulk of stock and commodity market participants, especially in the US. As a consequence, the trade was generally conducted by a specialized group of traders catering to a relatively small clientele. Circa the end of the 19<sup>th</sup> century, trading in privileges was only conducted in the after market and on ‘the curb’ as such trading was prohibited on all US stock and commodity exchanges.

The increased popularity of options trading during the 19<sup>th</sup> century can be traced to the dramatic expansion of stock issues associated with railway, canal and industrial expansion. For example, on the Paris bourse the number of share issues increased from 7 in 1800 to 63 in 1830 and 152 by 1853. As indicated in Viaene (2006), this led to a considerable expansion in the trading of puts and calls which was a natural outcome of the ‘trading for account’ process. At some point, this trade expanded to include retail investors. While important merchant manuals from the first half of the century such as Tate (1820) contain no discussion of options, similar manuals at the time of Bronzin

(1908), such as Deutsch (1904), do contain a detailed discussion indicating active trading of options on stocks and shares in Paris and, to a lesser extent, in London and Berlin. Evidence of the pace at which option trading evolved is found in the passing mention that options initially receive in the trade publication by Cohn (1874). Castelli (1877, p.2) identifies “the great want of a popular treatise” on options as the reason for undertaking a detailed treatment of mostly speculative option trading strategies. In a brief treatment, Castelli uses put-call parity in an arbitrage trade combining a short position in “Turks 5%” in Constantinople with a written put and purchased call in London. The trade is executed to take advantage of “*enormous contangoes* collected at Constantinople” (p.74-7), effectively interest payments on the balance raised by the short position.

In the US, the views of option trading were more circumspect. By the end of the 19<sup>th</sup> century, all US stock and produce exchanges had banned option trading, though some trade did take place in other venues. Evidence for such trade in stock options is provided by Kairys and Valerio (1997, p.1709) where an 1873-5 sample of over-the-counter US option contracts is examined. This sample was obtained from advertisements in the *Commercial and Financial Chronicle*. The prices were only ask quotes, exclusive of bids, and were aimed at generating business from buyers of options. The option prices were found to favor the option writer. Following the European practice, these contracts determined prices by keeping the premium constant and adjusting the exercise price:

Whereas current option prices are quoted after fixing the strike price, the cost of a privilege was fixed at \$1.00 per share for all contracts and the strike price was adjusted to reflect current market conditions. Furthermore, the strike price was expressed as a spread from the current spot price of the underlying stock with the understanding that the spread was then the “price” that was quoted for the privilege contract.

Based on Emery (1896), this method of pricing options was also customary in the Chicago grain markets where contract maturities varied from one day to a week. This indicates the prevalence of

European practices in the US option market at this time.

Kairys and Valerio (1997, p.1719) pose the question: why did the option markets fail to develop further given the apparent level of refinement? Unfortunately, the explanations provided are lacking. In contrast, Emery (1896, p.80) provides a more insightful explanation for the disappearance of stock options trading:

In the last few years ... privileges have been less common than they formerly were. The trade in privileges depends chiefly upon a few men of large means. The public buy, but seldom sell, privileges, and if the men who are accustomed to dealing in that way stop selling, the field for such practices becomes very circumscribed.

The disappearance of the ‘men of large means’ in 1875 is possibly due to the substantial deterioration in the public perception of options induced by the stock projector Jacob Little’s use of options to manipulate the price of Erie stock in that year. According to Clews (1915, p.10): “Mr. Little had been selling large blocks of Erie stock on seller’s option, to run from six to twelve months.” The resulting attempt to corner the stock and squeeze Little is one of the fascinating stories of the 19<sup>th</sup> century robber barons. The upshot was, yet again, a public black eye for stock option trading in the US and the imposition of a restriction on the maximum term of stock option contracts to sixty days.

### **Bibliography**

Barbour, V. (1950), *Capitalism in Amsterdam in the 17th Century*, Ann Arbor, Mich.: University of Michigan Press.

Bell, A., Brooks, C., and Dryburgh, P. (2007), “Interest Rates and Efficiency in Medieval Wool Forward Contracts”, *Journal of Banking and Finance* 31: 361-80.

Black, F. and M. Scholes (1973), ‘The Pricing of Options and Corporate Liabilities’, *Journal of Political Economy* 81 (May-June): 637-659.

Cardoso, J. (2006), “Joseph de la Vega and the ‘Confusion de Confusiones’”, chapter 3 in G. Poitras (ed.), *Pioneers of Financial Economics* (vol.I), Cheltenham, UK: Edward Elgar.

Castelli, Charles (1877). *The Theory of “Options” in Stocks and Shares*, F. Mathieson, London.

Clews, H. (1915), "Fifty Years in Wall Street", New York: Irving Publishing, reprinted by Arno Press (1973).

Cohen, J. (1953), ‘The Element of Lottery in British Government Bonds, 1694-1919’, *Economica* (Aug.): 237-46.

Cohn, Maurice (1874). *The London Stock Exchange in Relation with the Foreign Bourses. The Stock Exchange Arbitrageur*, Effingham Wilson, London.

Cope, S. (1978), ‘The Stock Exchange Revisited: A New Look at the Market in Securities in London in the Eighteenth Century’, *Economica* 45: 1-21.

Courtadon, G. (1982), “A Note on the Premium Market for the Paris Stock Exchange”, *Journal of Banking and Finance* 6: 561-5.

de la Vega, J. (1688). *Confusion de Confusiones*; reprinted in M. Fridson (ed.) (1996).

De Marchi, N. and P. Harrison (1994), ‘Trading ‘in the Wind’ and with Guile: The Troublesome Matter of the Short Selling of Share in Seventeenth-Century Holland’, in N. de Marchi and M. Morgan (eds), *Higgling: Transactors and their Markets in the History of Economics*, Annual Supplement to *History of Political Economy* 26.

de Pinto, Isaac (1771), *An Essay on Circulation of Currency and Credit in Four Parts and a Letter on the Jealousy of Commerce*, translated with annotations by S. Baggs (1774), London; reprinted by Gregg International Publishers (1969).

\_\_\_\_\_ (1771), *Jeu d'Actions en Hollande*, Amsterdam; reprinted by Gregg International Publishers (1969).

de Roover, R. (1944), “What is Dry Exchange? A Contribution to the Study of English Mercantilism”, *Journal of Political Economy*: 250-66

\_\_\_\_\_ (1948), *Banking and Credit in Medieval Bruges*, Cambridge, Mass.: Harvard University Press.

\_\_\_\_\_ (1949), *Gresham on Foreign Exchange*, London: Harvard University Press.

Deutsch, Henry (1904). *Arbitrage in Bullion, Coins, Bills, Stocks, Shares and Options*, Effingham

Wilson, London (3<sup>rd</sup> ed., 1933).

Dickson, P. (1967), *The Financial Revolution in England*, New York: St. Martin's Press.

Dimand, R. and H. Ben-El-Mechaiekh, "Louis Bachelier", chapter 10 in Poitras (ed.)(2006), *Pioneers of Financial Economics*, (vol.1).

Ehrenberg, R. (1928), *Capital and Finance in the Age of the Renaissance*, translated from the German by H.M. Lucas, London: Jonathan Cape.

Emery, H. (1896), *Speculation on the Stock and Produce Exchanges of the United States*, New York: Columbia University Press; reprinted by AMS Press, New York (1968).

Fridson, M. (ed.) (1996), *Extraordinary Popular Delusions and the Madness of Crowds; and, Confusion de Confusiones* (reprints of classic texts), New York: Wiley.

Garber, P.(1989), 'Tulipmania', *Journal of Political Economy*: 535-60.

Gelderblom, O. and J. Jonker (2005), "Amsterdam as the Cradle of Modern Futures and Options Trading, 1550-1630", chapter 11 in W. Goetzmann and K. Rouwenhorst (eds.), *The Origins of Value*, Oxford, UK: Oxford University Press.

Gherity, J. (1995), "The Option Clause in Scottish Banking, 1730-65: A Reappraisal", *Journal of Money, Credit and Banking* 27:713-27.

Hoppit, J. (2002), "The Myths of the South Sea Bubble", *Transactions of the Royal Historical Society* 12: 141-65.

Houghton, J. (1692-1703), *A Collection for Improvement of Husbandry and Trade*, London: Taylor, Hindmarsh, Clavell, Rogers and Brown; reprinted by Gregg International Publishers (1969).

Jovanovic, F. (2006), "Economic Instruments and Theory in the Construction of Henri Lefevre's 'Science of the Stock Market'", chapter 8 in Poitras (ed.)(2006), *Pioneers of Financial Economics*, (vol.1).

Kairys, J. and Valerio, N. (1997), "The Market for Equity Options in the 1870s", *Journal of Finance* 52: 1707-23.

Kellenbenz, H. (1957), 'Introduction' to de la Vega *Confusion de Confusiones*; reprinted in Fridson (1996).

Malkiel, B. and R. Quandt (1969), *Strategies and Rational Decisions in the Securities Options Market*, Cambridge, Mass.: MIT Press.

Morgan, V. and W. Thomas (1962), *The Stock Exchange*, New York: St. Martins.

Mortimer, T. (1761), *Everyman his own broker; or a Guide to Exchange Alley* (2nd ed.), London: S. Hooper; with the 13th ed. published (1801).

Munro, J. (2000). English 'Backwardness' and Financial Innovations in Commerce with the Low Countries, 14th to 16th Centuries, p.105–167 in P. Stabel, B. Blondé, and A. Greve (eds.) *International Trade in the Low Countries (14th - 16th Centuries)*, Garant, Leuven-Apeldoorn.

Murphy, A. (1997), *John Law, Economic Theorist and Policy-Maker*, Oxford: Clarendon Press.

Neal, L. (1990), *The Rise of Financial Capitalism, International Capital Markets in the Age of Reason*, Cambridge: Cambridge University Press.

Neal, L. and S. Quinn (2001). Networks of information, markets, and institutions in the rise of London as a financial centre, 1660-1720. *Financial History Review* 8: 7-26.

Poitras, G. (2000), *The Early History of Financial Economics, 1478-1776*, Cheltenham, UK: Edward Elgar.

\_\_\_\_\_ (ed.) (2006), *Pioneers of Financial Economics: Contributions Prior to Irving Fisher* (vol.I), Cheltenham, UK: Edward Elgar.

\_\_\_\_\_ (2009), "Arbitrage: Historical Perspectives" in R. Cont. (ed.) *The Encyclopedia of Quantitative Finance*, New York: Wiley (forthcoming).

Posthumus, N. (1929), 'The Tulipmania in Holland in the Years 1636 and 1637', *Journal of Economics and Business History* 1: 434-66.

Postlethwayt, Malachy (1751). *The Universal Dictionary of Trade and Commerce*, John and Paul Napton, London (4<sup>th</sup> ed. 1774).

Rich, E. and C. Wilson (1977), *The Cambridge Economic History of Europe*, vol.5, London: Cambridge University Press.

Savary des Bruslons, Jacques (1730). *Dictionnaire Universel de Commerce* vol.3, Chez Jacques Etienne, Paris.

Schaede, U. (1989), 'Forwards and Futures in Tokugawa-Period Japan', *Journal of Banking and Finance* 13: 487-513.

Shea, G. (2007), "Financial market analysis can go mad (in the search for irrational behaviour during the South Sea Bubble)", *Economic History Review* 60: 742-765.

\_\_\_\_\_ (2007a), “Understanding financial derivatives during the South Sea Bubble: the case of the South Sea subscription shares”, *Oxford Economic Papers* 59: 73-104.

Tate, William (1820), *The Modern Cambist: Forming a Manual of Foreign Exchanges, in the Different Operations of Bills of Exchange and Bullion*, Effingham Wilson, London (6<sup>th</sup> ed. 1848).

Tawney, R. (1925), ‘Introduction’ to *A Discourse Upon Usury* by T. Wilson (1572); reprinted by London: Frank Cass (1962).

Taylor, G. (1962), “The Paris Bourse on the Eve of the French Revolution”, *American Historical Review* 67: 951-77.

Unger, R. (1980), “Dutch Herring, Technology and International Trade in the Seventeenth Century”, *Journal of Economic History* 40 (June):253-280.

van der Wee, H. (1977), ‘Monetary, Credit and Banking Systems’, in Rich and Wilson (eds) (1977, ch. V).

van Dillen, J. (1927), ‘Termijnhandel te Amsterdam in de 16de en 17de eeuw’, *De Economist*: 503-23.

van Houtte, J. (1966), ‘The Rise and Decline of the Market of Bruges’, *Economic History Review* XIX: 29-47.

Viaene, A. (2006), “Les marchés à terme et conditionnels à la Bourse”, in G. Gallais-Hamonno. (ed.), *Le marché financier français au XIX<sup>e</sup> siècle: Aspects quantitatifs des acteurs et des instruments à la Bourse de Paris* (vol.2), Paris: Les Publications de la Sorbonne.

Wilson, C. (1941), *Anglo-Dutch Commerce and Finance in the Eighteenth Century*; reprinted by London: Cambridge University Press (1966).

Zimmermann, H. and W. Hafner (2006), “Professor Bronzin’s Option Pricing Models: Contents, Contribution and Background”, chapter 11 in Geoffrey Poitras (ed.) (2006), *Pioneers of Financial Economics* (vol.1).

## NOTES

1. The rudimentary, single event insurance contracts used up to the 17<sup>th</sup> century also qualify as options within this definition. The connection between put option and insurance contracts is not examined here. The ‘free standing’ terminology is consistent with Statement of Financial Accounting Standard #133 issued by the Financial Accounting Standards Board in the US.

Alternative terminology is also used, e.g., Poitras (2000) refers to ‘pure derivative securities’. For decades, the accounting profession has grappled with the difficulties of distinguishing between possibly equivalent cash flows from portfolios including combinations of ‘free standing derivatives’ and the underlying real asset, security or commodity.

2. There are numerous instances of explicit and implicit call or conversion provisions in 14th to 18th century security issues. For example, the Venetian *prestiti* had a call provision that allowed for principal value to be repaid at par, as finances permitted. Various 18th century government debt restructuring plans involved the introduction of conversion provisions. For example, there was the conversion of English government life annuities, issued under William III and Queen Anne, into long annuities, or John Law's Mississippi scheme which introduced conversion provisions for exchanging French government debt obligations into *Compagnie des Indes* stock. Options features have even been attached to bank notes, as in the option clause included on the notes issues by Scottish banks from 1730-65 which reserved the right to suspend specie payment for a period up to six months, with interest to be paid in the interval (Gherity 1995).

3. Some of the earliest examples of written language, the Sumerian cuneiform tablets, contain such notarial protests. See, for example, [http://www.sfu.ca/~poitras/Brit\\_Mus.ZIP](http://www.sfu.ca/~poitras/Brit_Mus.ZIP) which provides a picture of a Sumerian tablet circa 1750 BC from the British Museum collection: “A letter complaining about the delivery of the wrong grade of copper after a Gulf voyage.”

4. Emery (1896, p.51-3) provides a number of references to late 19<sup>th</sup> century German and French sources on options trading that would have been accessible to V. Bronzin. The connection between German and English terminology is also discussed ( p.91).

5. Various alternative terms such as ‘privileges’ or ‘premiums’ are used to describe option contracts. While trade publications such as Castelli (1877) and Deutsch (1904) refer to “options”, this usage is in conflict with the use of ‘option’ in the various late 19<sup>th</sup> century US ‘anti-option’ legislation proposals that refer to contracts where delivery is not obligatory; this would include both futures and options contracts. As a consequence, sources such as Emery (1896) refer to privileges and futures. Similarly, ‘premiums’ also identify the element that distinguishes futures from options.

6. Following Deutsch (1904, p.170), “Options to deliver stocks and shares (“puts”) are not quoted in Paris.” Deutsch goes on to observe that this is “not of much importance” because a call combined with a sale of the stock produces a put. As such, the ‘privilege’ to ‘put’ a commodity back to the seller on the delivery date, at the initial purchase price, could also be obtained by the payment of a ‘premium’ on the settlement date.

7. Aristotle goes on to say: “The story is told as showing that Thales proved his own wisdom; but ... the plan he adopted — which was, in effect, the creation of a monopoly — involves a principle which can be generally applied in the art of acquisition.” A further connection is made to a Sicilian who cornered the cash market for iron by buying up all available supplies. Aristotle questioned the use of derivative securities transactions to manipulate the cash market without recognizing that Thales may have benefited in the absence of any monopoly. This reflects the relative lack of



understanding that ancient writers had concerning speculative transactions.

8. Further to the discussion in note 2, the government debt issues in the 18<sup>th</sup> century provide, arguably, the most productive period for inclusion of the widest variety of option provisions in debt issues, e.g., Marco and Malle-Sabouret (2007), Shea (2007a), Cohen (1953).

9. The medieval era was not without restrictions on forward contracting. Emery (1896, p.34) reports that sales of grain prior to threshing or of herring before being caught were forbidden in the German Hanse cities in 1417. Similar ordinances were also reported in England in 1357. Such known instances are consistent with the ethics of medieval scholasticism that condemn unearned profits including, but not limited to, interest on money loans (usury), e.g., Poitras (2000, ch.3). Gelderblom and Jonker (2005) provides details of 16<sup>th</sup> Dutch restrictions on forward contracting.

10. The identification of this early trade as ‘futures’ contracting is found in Gelderblom and Jonker (2005). This approach is at variance with the conventional view that futures trading began in Chicago in the 19<sup>th</sup> century or the less conventional view that such trading began in the 18<sup>th</sup> century Japanese rice market (Schaede 1987). In what follows, the distinction between futures contracts and forward contracts will not be explored. Futures and forwards will both be referred to as ‘time bargains’.

11. Unger (1980) provides detailed information on the herring industry during this period. The Dutch herring trade to the Baltic was intimately connected to the grain trade to southern Europe. Due to a number of technological developments introduced over the fourteenth to sixteenth centuries, the Dutch herring fleets dominated this trade until the second half of the 17<sup>th</sup> century. The evolution of the herring fishery depended on increased capital requirements; as a consequence the role of brokers also evolved: “By the mid-fifteenth century the brokers were becoming owners and operators of ships as well. They were merchants with an interest in more assured supplies of preserved fish ... even individuals with no direct connection with fishing can and did invest in the boats and their supplies” (p.258).

12. Financial transactions revolved around the bill of exchange which involved an initial exchange followed by a re-exchange at a later date in a different location. While various maneuvers were used to reduce or eliminate the uncertain rate on the re-exchange, e.g., de Roover (1944), the sequence of transactions in a bill of exchange transaction is not well suited to the securitization of the associated options.

13. The acronym VOC is a reference to the English to Dutch translation of the Dutch East India Company, as the *Verenigde Oostindische Compagnie*.

14. De la Vega's well reasoned discussion (p.183) of the legal implications of option contracts stands in stark contrast to his naive views on profitable option trading strategies: “As to whether the regulation (banning short sales) is applicable to *option contracts*, the opinions of experts diverge widely. I have not found any decision that might serve as a precedent, though there are many cases at law from which one [should be able to] draw a correct picture. All legal experts hold that the

regulation is applicable to both the seller and buyer [of the contract]. In practice, however, the judges have often decided differently, always freeing the buyer from the liability while holding the seller [to the contract] ... If ... the opinion is correct that it applies only to the seller, the regulation will be of no use to me [as a person wanting to seek shelter] when I receive call premiums, for in this case I am in fact a seller; but it will help me if I have received a put premium, as I am then the buyer of stocks. With regard to the put premium... law and legal opinion, the regulation and the reasons for the decisions are contradictory. The theory remains uncertain, and one cannot tell which way the adjudication tends”.

15. The term ‘*rescontre*’ was derived from the practice of Dutch merchants to “indicate that a bill had been paid by charging it to a current account — ‘*solvit per rescontre*’ as distinct from ‘*per banco*’, ‘*per wissel*’ and so on” (Dickson 1967, p.491; Mortimer, *Everyman*, 5th ed., p.28n). The technique of speculation in the British Funds at Amsterdam ... was a kind of gamble carried on every three months: no payments were made except on *rescontre* (settlement or carry-over), i.e., the period for which funds were bought or sold and for which options were given or taken. *Rescontredag* (contango day) occurred four times a year, and on these occasions representatives of the speculators gathered round a table to regulate or liquidate their transactions, and to make reciprocal payments for fluctuations or surpluses. Normally these fluctuations were settled without the actual value of the funds in question being paid — only real investors paid cash for their purchases. Speculative buyers paid to sellers the percentage by which the funds had fallen since the last contango day, or alternatively received from them the percentage by which funds had risen in the same interval. After surpluses had been paid, new continuations were undertaken for the following settlement. In such a *prolongatie* (continuation) the buyer granted the seller a certain percentage (a contango rate) to prolong his purchase to the next *rescontre*: in this way he stood the chance of benefiting by a rise in quotations in the interval, without tying up his capital: he was only bound to pay any possible marginal fall.

16. Wilson (1941, p.84-5) describes the options trade: “A *prime à délivrer* (a call) was the option which A gave to B, obliging him to deliver on the following *rescontre* certain English securities — say £1000 East India shares — at an agreed price. If the speculation of the giver of the option was unsuccessful, he merely lost his option: if, on the other hand, the funds rose, he had the benefit of the rise. The *prime à recevoir* (a put) was the option given by A to B by which B was pledged to take from A on *rescontre* £1000 East India shares, say, at an agreed price. B became, in fact, a kind of insurance for A, obliged to make good to him the margin by which the funds might diminish in the interval.”

17. Emery (1896, p.80-1) explores the reasons that speculative privilege trading is concentrated in stocks. Among the reasons, Emery stresses the importance of greater price variability in stocks relative to produce. Also, options on produce tend to have shorter terms to maturity.

18. The basic mechanics of tulip production argue against widespread option trading for those directly involved in the tulip trade. Tulip growers wanted to sell bulbs for future delivery, not to take option premiums. Due to potential and actual limitations in the supply of bulbs, other potential market participants were not in a position to quote call option prices.

19. The intricate dealings that were involved in the South Sea Bubble are discussed in various sources, including: Morgan and Thomas (1962, ch. 2); Mackay (1852, ch. 2); Wilson (1941, ch. IV); Hoppit (2002); Shea (2007).

20. Mortimer makes no reference to the use of options in stockjobbing activities, giving some support to the position that Barnard's Act of 1734 was effective in deterring this activity. In contrast to Mortimer, another early source – Defoe (1719) – makes no reference to forward trading, using examples which usually relate to cash transactions, for example, using false rumours to influence the stock price, the idea being to buy low on negative rumours and selling high on positive rumours (pp.139-40). However, it is not clear that Defoe had the best grasp of the financial transactions which were being done.

21. A broker in this period was an intermediary or mutual agent who served as a witness, for a commission, to contracts between two parties. In London, brokers had to be licensed and sworn. While much of the commodity and joint stock business was conducted through brokers, dealing was not confined to sworn brokers and, at various times, many unlicensed dealers operated in the market.

22. From de la Vega's sketchy description of Amsterdam options contracts, it is likely that Houghton's English contract was similar to those traded in Amsterdam: "For the *options business* there exists another sort of *contract form*, from which it is evident when and where the premium was paid and of what kind are the signatories' obligations. The *forms of hypothecating* are different also. Stamped paper is used for them, upon which the regulations concerning *dividends* and other details are set down, so that there can be no doubt and disagreement regarding the arrangements" (de la Vega 1688, p.182).

23. Early exercise for a dividend payout protected put option can occur if the security price is sufficiently close to zero that there is insufficient potential for further increase in the put value due to further reduction in the stock price. In this case, the put can be exercised and the profit invested at interest. In Houghton's time, the securities on which options were traded had prices that were sufficiently above zero that the early exercise event had such a low probability that the early exercise premium for the put can also be set to zero.

24. The early history of options trading in England can be found in Morgan and Thomas (1962). An early discussion can be found in Duguid (1901). Barnard's Act was repealed in 1860.

25. Cope (1978) takes a somewhat different view of these events.

26. Wilson (1941, ch.III (iii) and ch.IV (v)) provides a useful summary of de la Vega, de Pinto and some correspondence between David Leeuw and Peter Crellius.

27. By definition, a 'gambler' is willing to undertake trades that have a negative expected value. While this definition raises a number of difficulties, e.g., the Friedman-Savage paradox, it is sufficient for present purposes.

28. An European option can only be exercised on the expiration date. An American option has the additional feature that it can be exercised at any time up to and including the expiration date. Being intimately connected to the *rescontre* settlement process, the options being examined by de la Vega and de Pinto were European options. As stated the options are written for one unit of stock though for modern options contracts, such as those traded on the Chicago Board Options Exchange, 100 units of stock is the typical contract size. More generally,  $C$  and  $P$  would be the option premium paid for the contract of  $Q$  units of stock, the bond would have par value  $QX$  and  $Q$  units of stock would be traded.