

2. History of Commerce and Finance

Developments Prior to 1478

The starting point selected for this early history of financial economics is 1478, which coincides with the publication of the first printed business text, the *Treviso Arithmetic*. This date is towards the end of the Renaissance Period, which Robert Lopez (1962) and others define to cover the years 1330-1530. The early Renaissance was marked by the drastic economic implications of the Black Death of 1348-1351(?). However, by 1478 the cultural revolution typically associated with the Renaissance was also accompanied by remarkable changes in commerce, industry and business organization. The social and intellectual contribution of the Renaissance was greatly enhanced by Gutenberg's development of printing with movable type during the 1440s. By 1500, the ensuing information revolution had progressed to the point where prices of printed books were sufficiently low that vast numbers of people had access to printed matter.

The intellectual foundation for the Renaissance was laid by the emergence of the European university starting around the 12th century. The earliest universities evolved out of the medieval cathedral or (Catholic) Church schools. An important social function of the clergy in medieval times was to provide education on both secular and religious matters. In the process, universities satisfied the Church's need to educate the clergy and others to be teachers. When available, there are typically two founding dates for various universities, one date associated with recognition by the State and the other date with recognition by the Church. For example, Oxford University was given State privileges in 1214 and Church recognition in 1296. Similar dates for the University of Paris are 1200 and 1283 and Cambridge University 1231 and 1318. Recognition by the Church was significant in permitting degree holders the right to teach in Church schools, for example, D. Smith (1958, pp.212-14).¹

The medieval university was typically composed of four faculties: theology, law, medicine and the arts. Teaching and research were centred on Christian theology and the Greek classics. The model arts curriculum involved sequential study in the subjects of grammar with

Donatus and Priscian, logic with Aristotle, rhetoric with Cicero, arithmetic with Boethius, music with Pythagoras, geometry with Euclid and astronomy with Ptolemy. Within this curriculum, the subjects of grammar, logic and rhetoric were generally considered to be more valuable than mathematical subjects such as arithmetic. Because Latin was the official language of the Church, it became the language of scholars. The Greek classics were read in Latin translation, often obtained through translation of Arab editions (Hald 1990, p.20).

Considerable intellectual effort in medieval scholarship was given to reconciling the teaching of Scripture with the Greek classics. The result was the philosophy of scholasticism, with Thomas Aquinas (1225-1274) being the most well known proponent. Heuristically, scholasticism adapts the reasoning of Aristotelian logic to provide a theological explanation of natural and metaphysical phenomena. The teachings of Aquinas and other 'schoolmen' were subsequently authorized by the Church and scholasticism became the dominant philosophy governing the evolution of Church doctrine on legal and other matters. This observation is fundamental for a study on the early history of financial economics. Understanding the evolution of Church doctrine on usury and interest is essential to interpreting the evolution of financial analysis on topics such as the pricing of securities.

The economic development of Europe during the medieval and Renaissance periods put increasing importance on proficiency in commercial arithmetic. However, the classical orientation of Church school and University instruction was not well suited to providing the requisite subject matter, for example, Schrader (1968). These limitations were further exacerbated by the increasing contacts of Italian merchants with Arab and other cultures and the resulting exposure to the Hindu-Arabic numeral system and algorithms. Traditional European arithmetic featured Roman numerals and the abacus. Over time this produced two interesting conflicts into European mathematics: between the use of Roman and Hindu-Arabic numerals; and between the use of the abacus method of calculation and the use of algorithms involving computations with Hindu-Arabic numerals.

More precisely, by the time of the *Treviso Arithmetic*, there were four basic types of European arithmetics (Swetz 1987, p.27): theoretical works in the Church school tradition, derived from the writings of Boethius; algorisms, featuring computational schemes involving Hindu-Arabic numerals; abacus arithmetics, involving computational methods using Roman numerals and abacus calculations usually done using counters on a computing table inscribed with columns and rows

Glossary of Some Useful Foreign Terms

Maestri d'abbaco, maistre d'algorisme and Rechenmeister: Italian, French and German terms for the reckoning master.

Banco: Italian for benches and origin of the word bank. Jewish money lenders doing business with Venetian merchants operated in one section of the city, the Ghetto Nuovo (new foundry). Money lending business was conducted over tables with the money lender sitting on a banco.

Banco ruptus: The process of disgracing a money lender found to be cheating by breaking the money lender's bench, origin of the English word bankrupt.

Practica: An algorism featuring problems dealing with business and commerce.

Calculi: Latin for the counters on the computing tables used in abacus arithmetic.

Societas: Latin for partnership. This is the form used in Roman law and, later, in the scholastic doctrine surrounding partnerships.

Compagnie: Italian plural term for a partnership, origin of the English word company, though the precise meaning does differ in the two languages. The law and doctrine surrounding *compagnie* evolved from the older *societas* usage, for example, Baskin and Miranti (1997, ch. 1).

Usance: A period of time determined by merchant custom. Usance was used to express the term to maturity of a bill of exchange. For example, a bill payable at usance between London and Amsterdam would have a maturity of one month, half-usance would be fifteen days and double-usance would be two months.

Corpo: the capital stock. Prior to the development of joint stock companies, this term was usually used in reference to the capital of a partnership. This term can be compared with the Latin *corporatio* which comes from *corpus* meaning a body.

Costo: Cost.

Tare and Tret: These are terms which appear in commercial arithmetics and are associated with the transportation of merchandise. Tare is the weight of cargo after deduction has been made for the containers used to transport the cargo. Sometimes tare was used to refer only to the amount of allowance provided. Tret was the allowance for spoilage, damage and waste associated with transporting the goods from one location to another. (Murray 1930, p.256 relates 'tret' to 'gifts' made by merchants to civic officials.)

denoting specific values; and *computi*, precursors of modern almanacs, that were concerned with determining dates for events such as church feasts and the various dates of Easter. In Italian commercial training,

algorithms came into increasing favour relative to the abacus arithmetics though it was not until the late 16th century that algorists dominated abacists in all parts of Europe.

One of the oddities of medieval mathematics and commercial arithmetic is that perhaps the most important contributor, Leonardo Fibonacci (also known as Leonardo Pisano, Leonardo of Pisa and Leonardo Bigollo, 1170-1250), was not a product of the Church school system.² Fibonacci was born in Pisa which, along with Genoa and Venice, was a major Italian commercial centre of the age. To facilitate trading activities, major Italian towns maintained large goods warehouses in major ports around the Mediterranean. At the time of his early education Fibonacci's father managed the warehouse facilities in Bugia (now known as Bougie or Bejaia in Algeria). In Bugia, Fibonacci received education from a Moorish schoolmaster. Later, Fibonacci travelled extensively throughout the Mediterranean area including travels to Egypt, Syria and Greece. In his travels, Fibonacci came into contact with the various pure and commercial arithmetic systems used by scholars and merchants in the Arab world.

Having returned to Italy, Fibonacci became a strong proponent for the advantages of the Hindu-Arabic methods of computation. Fibonacci's publication of the *Liber abaci* (1202) marks an important intellectual event. The title of the book is somewhat misleading, as there is little in the book of relevance to the abacus approach to arithmetic. As a statement of the contents reveals, much of the text is concerned with providing an introduction to Hindu-Arabic numerals and the associated algorithms, for example, D. Smith (1925, p.216):

Contents of the *Liber Abaci*

1. Reading and writing of Hindu-Arabic numerals;
2. Multiplication of integers;
3. Addition of integers;
4. Subtraction of integers;
5. Division of integers;
6. Multiplication of integers by fractions;
7. Further topics in fractions;
8. Prices of goods;
9. Barter;
10. Partnership;
11. Alligation (metallurgy);
12. Solutions to problems;
13. Rule of False Position;
14. Square and Cube roots;
15. Geometry and Algebra.

Though the *Liber abaci* was not the first exposition of the Hindu-Arabic system available in Europe (for example, Flegg et al. 1985, chap. 1; Boyer 1968, p.280), it was the first available in Italy. The book had a profound influence in the merchant houses of the important Italian commercial centres. The detailed attention to commercial applications

in chapters 8-10 and 12, serves to qualify the *Liber abaci* as the first modern commercial arithmetic.

For commercial applications, there are a number of fundamental advantages to the Hindu-Arabic system over using the abacus in combination with Roman numerals. One advantage is the ability to do and record calculations using pen and ink, as opposed to using the abacus and recording only the solution. Another advantage is the enhanced ability to record and manipulate fractions, particularly useful in barter and currency exchange calculations. The various advantages of the Hindu-Arabic system contributed significantly to producing a major commercial innovation by northern Italian merchants, the practice of double-entry bookkeeping, sometime around the beginning of the 14th century. By the early to mid-1400s, double-entry bookkeeping was a well established practice among merchant houses in Venice as well as other major Italian commercial centres.

The Reckoning Schools

The increasing size and sophistication of mercantile activity during the late medieval and early Renaissance period led to the emergence of reckoning masters, individuals specializing in computational skills (Figures 2.1 and 2.2). In addition to acting as mathematical consultants, reckoning masters also engaged in instruction of commercial arithmetic, particularly to the sons and apprentices of merchants (Swetz 1987, pp.19-21):

Traditional methods of education for entrance into a trade relied mainly on the institution of apprenticeship, under which a youth learned the required skills and knowledge of the desired profession either from family members or a respected master ... In some professions, guilds assisted in and supervised the training of apprentices but, in others, the learning of special knowledge still required the searching out of an individual teacher and the securing of his services. So it was with the learning of mathematics ... A merchant had to be literate, if not in several languages, at least in his own; therefore, boys aspiring to the merchant profession attended the basic grammar schools. Then, upon securing a fundamental literacy and numeracy they advanced onward at ages 11 to 12 to a special secondary school to study commercial arithmetic ... The existence of these ... schools ... was a testimony to the importance of mathematics and computational proficiency in the business world of the time. Quite simply, merchant apprentices had to bring with them a special knowledge of mathematics upon entering their apprenticeship. Then, while practising the merchant trade at the novice state, they perfected and expanded their mathematical techniques.

Figure 2.1 A 1535 woodcut print showing a father apprenticing his son to a reckoning master



Note: This picture was used in Petrarch's Mirror of Consolation to illustrate the duties of a just guardian..

Source: Reproduced from Swetz (1987, Figure 1.3).

Figure 2.2 A woodcut of a typical counting table



Source: Reproduced from Swetz (1987, Figure 1.3).

Though the wealthiest merchants could afford individual instruction for their children, group classes held at the reckoning master's place of business were more common. Formalization of these group classes led to the emergence of the reckoning school.

Demand for reckoning masters and reckoning schools expanded with the growth of trade and business. Not surprisingly, as well as being the focus of European commercial activity during this period, Italy was also a centre for excellence in commercial education with reckoning schools appearing during the 13th century (Swetz 1987). Circa 1338, Florence had six such schools. By the middle of the 15th century, the reputation and quality of the Italian reckoning schools attracted students from throughout Europe. While the reckoning schools can be loosely considered as precursors of modern business schools, the educational process was decidedly different from the humanist emphasis in the Church schools and universities.

A typical student of a reckoning school was the son of a merchant or civil servant, twelve to sixteen years old, having already completed a Latin grammar school education at a pre-university Church school. While it was possible to also obtain further education in commercial arithmetic at the pre-university and university Church schools, possibly even featuring the Hindu-Arabic system, the faculty at Church schools were not usually well suited to such instruction. The reckoning school was better suited to instruction in commercial arithmetic. As the Renaissance progressed, reckoning schools started appearing in commercial centres along the important European trade routes. For example, by 1613, it is reported that Nuremberg had 48 such schools. Reckoning masters in various centres were sufficiently numerous that guilds and associations were formed (Swetz 1987, p.17).

As reckoning schools became more numerous, the curriculum became more specialized. Books were produced that were also increasingly specialized to the reckoning school curriculum. Early Renaissance texts were influenced by the Church school tradition, with attention to theoretical as well as commercial aspects of arithmetic. By the time of the *Treviso Arithmetic*, texts were available that were concerned solely with commercial applications, though arithmetic books with a scholarly emphasis were also common, for example, D. Smith (1970). The approach and problems contained in these commercial arithmetics provide important insights into the business practices of the time. By the 16th and early 17th centuries, specialization had progressed to the point where books were available on specific subjects, such as Jan

Christoffel's 1543 Dutch book on accounting (Brown 1905, p.126) and Richard Witt's 1617 English book on the valuation of fixed income securities (Lewin 1970).

Social Attitudes Toward Business

The period under study, 1478-1776, was characterized by the emergence of commercial pursuits as a socially acceptable activity. The history of ideas during this period contains increasingly vociferous defenses of business life against religious and social criticism, for example Davis (1960). Circa 1478, business was not considered a suitable activity for the social elite throughout much of Europe, though the Italian city states had undergone recognizable evolution. The European social elite of this time was composed of the nobility and the clergy. The nobility was concerned primarily with soldiering or landholding. Business activities such as the buying, selling and transporting of merchandise or the lending and investing of money were often looked at with moral or ethical suspicion. Circa 1776, nobility throughout Europe were actively involved in various business activities. Success in commercial pursuits was an accepted avenue to purchase a claim to nobility.

The Protestant Reformation exerted a profound influence over the evolution of social attitudes toward business, for example, Weber (1958), Tawney (1954). The ethics of medieval Catholicism presented various obstacles to the capitalist spirit inherent in commercial expansion. The start of the Reformation is usually dated as Oct. 31, 1517 with the publication in Germany of the 'Ninety-Five Theses' by Martin Luther (1483-1546). However, Luther was, if anything, more hostile to trade and investment than the Schoolmen. Luther was a religious radical but an economic conservative. His attack was concentrated on the primacy of the papacy and canon law, arguing that the Bible was the only relevant guide to action. In the process, Luther did undermine the traditional distinction between sacred and secular occupations, which was beneficial to commercial development. On the other hand, his interpretation of the Bible gave primacy to Christian charity over commercial profit.

From the narrower perspective of commerce, the start of the Reformation can be dated from 1536 when John Calvin (1509-1564) published his *Institutes of Christian Religion*. 'While Luther saw economic life with the eyes of a peasant and a monk, Calvin approached it as a man of affairs, who assumed, as the starting point of his social

theory, capital, credit, large-scale enterprise, and the other institutions of commercial civilization' (Tawney 1925, p.111). Calvin was born in France and educated at various French universities, including the University of Paris. His association with Nicholas Cop, the rector of the University of Paris who announced support for Luther in 1535, forced Calvin to flee, settling eventually in Geneva where he was to reside for the remainder of his life.

As a Reformer, Calvin was not bound by canon law or scholastic doctrine. What Calvin proposed in its place was, like Luther, the Bible as the guide to action. In his interpretation of Biblical teachings, Calvin differed dramatically from Luther. On the essential question of usury, the influence of Calvin's position can be considered revolutionary. Calvin proposed that, in opposition to five centuries of canon law, lending at interest be governed by the biblical Golden Rule. The taking of interest is lawful with the provisos that it not exceed any official maximum, that loans be made free to the poor, that neither borrower nor lender gains an excess advantage, that excessive security not be required and that borrowing be an occasional activity and not a regular occupation. This interpretation freely admits the payment of reasonable interest from profits made by prosperous merchants.

The social revolution associated with the ascendancy of commercial pursuits is reflected in contributions to the early history of financial economics. In the late 15th century, there was a marked distinction between theoretical and commercial arithmetic.³ Theoretical arithmetics, often written in Latin, were associated with the academic mathematicians of the Church schools and universities. These texts were usually written or printed in an attractive fashion and contained detailed dedications to noble sponsors or academic mentors. The contents were either devoid of practical applications or contained only a chapter or two devoted to commercial arithmetic. In contrast, basic commercial arithmetics were usually written in the vernacular by individuals operating outside the university system. The texts were exclusively practical in nature, targeted at the merchant classes and reckoning schools, and featured rules and problems drawn from business (Davis 1960).

By the middle to late 16th century, academic mathematicians were producing commercial arithmetics, sometimes written in the vernacular, that were 'psychologically and physically accessible to members of the nobility' (Davis 1960, p.45). In conjunction with the evolution of commercial arithmetic, universities were also changing. One author of the new commercial arithmetics, Pierre Forcadel, was also noteworthy

for being given permission to lecture on arithmetic in French at the august University of Paris where Latin was well-entrenched as the language of instruction. Spreading out from the University of Paris, the intellectual assault on Aristotelian concepts and the sterility of university teaching was carried forward by Petrus (Peter) Ramus (1515-1572) who championed the need for university education, particularly mathematics, to have a practical connection with 'the uses of human life', for example, Tribe (1988).

Ramus's dictate about the need to redirect academic learning to more practical ends was carried forward by numerous students, not all of whom were French. In addition to being at the forefront of commercial and social change, the Dutch and Flemish were also leaders in the evolution of academic training. One of the Flemish mathematician Simon Stevin's (1548-1620) lesser known contributions involved drawing up the statutes and curriculum for a new mathematical school for engineers that was created at Leiden in 1600 (van Berkel 1988). The focus of the mathematical instruction was decidedly more practical than conventional university instruction and it was in Leiden that Frans van Schooten (1615-1660) instructed a number of important students including Christian Huygens (1629-1695), Jan Hudde (1628-1704) and Jan de Witt (1625-1672). These individuals, particularly the latter two, made fundamental contributions to the history of financial economics.

The Census⁴

The problem of recognizing usury was a fundamental economic issue confronting scholasticism. Due in part to the important place given to legal matters in scholastic education, substantial intellectual effort was given to recognizing the types of contracts that were licit or illicit. To the modern reader, the scholastic writings on whether this or that type of contract was usurious or not is almost bewildering. Contractual arrangements that appear to be almost identical except for semantics are given decidedly different treatment. These contractual differences were not trivial. The social and religious sanctions associated with the taking of usury could be severe, though the most overt sanctions, such as excommunication, were reserved for manifest usurers (Noonan 1957, pp.34-7). Even where explicit sanctions were not applicable, 'the real force of the usury law lay in its hold on men's souls, and there no evasion was possible'.

Two general types of business contracts, recognized as licit under canon law, were the *societas* and the *census*.⁵ The *societas* or

partnership was the contract typically governing capital investment in a business venture. This included not only conventional businesses, such as production facilities, but also investments in animal husbandry and shipping ventures. The *census* was recognized to be a licit investment in land or State credit but, as it evolved, it came to represent an investment in credit, generally. A *census* could be used by a nobleman to raise funds by undertaking an obligation to make an annual return based on the returns from his lands. The State could sell a *census* to raise finances by undertaking obligations to make payments from a State monopoly, tax receipts, or lands. It was even possible for an individual to sell a *census* against the labour services of themselves or another income producing individual.

The *census* was a form of investment dating at least to feudal times, though certain bequests arising with inheritances, such as maintenances and life incomes, can have cash flows similar to *census* agreements. Such bequests go back to prehistoric times. The English word annuity is an approximate translation, but annuity does not make the appropriate connection to the source of the *census* return being derived from a 'fruitful good' (Noonan 1957, p.155). In Roman law, the *census* was not used, though various types of annuities were available. For example, the value of a life annuity relative to a term annuity was given by the jurist D. Ulpian (?-228). His rule proposed that a life annuity be equated with a term annuity where the term was equal to the annuitant's life expectation. This valuation attracted the attention of Nicholas Bernoulli who demonstrated that the Ulpian valuation has a significant upward bias for the price of a life annuity (Homer and Sylla 1991; Hald 1990).

Census contracts were initially designed, in feudal times, as a type of barter arrangement, present goods for future goods. The contract appears to have originated in Continental Europe, with England not developing a long-term debt market until the end of the 17th century (Tracy 1985, pp.7-8):

Continental landholders had, since the twelfth century or earlier, been possessed of a technique for converting their property to credit. In France, at least, the practice of borrowing by 'constituting' a *rente* on one's land, or of extending credit on this basis, was pioneered by monastic institutions. As the agrarian economy improved, twelfth-century lords found they could obtain credit from the local monastery by pledging the usage fees (*cens*) paid by their peasants instead of having to mortgage the land itself. From this practice, there derived the idea of creating an artificial income on one's property by constituting a *rente* (=annual income) on it. In default of annual interest

payments at the stipulated rate, creditors had the right to seize the property against whose 'income' the contract had been secured. Such rents could either be for the life of the creditor or his assignee, or, at an appreciably lower rate, perpetual. By the late Middle Ages, however, all perpetual or 'heritable' rentes in France were generally considered redeemable in principle, in deference to canon law prohibitions against usury. It was this form of private credit, widely diffused in Spain, Germany, northern France, and the Low Countries, which subsequently became the basis for long-term public credit in the same regions.

The conventional *census* contract gradually took the form of a modern annuity where cash was received by the seller of the annuity in exchange for an agreement to make a stream of annual payments over time. By the time of the *Treviso*, the nobility, the church, the state and the landed gentry were all involved as sellers of *census*. Many different variations of *census* were offered: a life *census* in which payments were made over the life of a buyer, or their designee; a perpetual *census*, that had no fixed maturity date; and, a temporary or term *census* that ran for a fixed number of years, similar to a mortgage. A *census* could have conditions that permitted it to be redeemable at the option of either the buyer or seller. Noonan (1957) estimates that credit raised using *census* arrangements may have exceeded that raised through *societas*.

The Venetian *Prestiti*

Extending a classification inherited from the balance sheet, financial securities can be classified as either debt or equity. Debt markets can be further classified as either short-term or long-term. In modern terminology, the market for negotiable short-term debt is referred to as the money market. Securities traded in the modern money market include treasury bills, commercial paper, bankers' acceptances, and certificates of deposit. The modern market for negotiable long-term debt is the bond market, which features bonds issued by various levels of government, as well as corporations. Much of the trading in both the money market and bond market is 'over-the-counter', decentralized trading taking place outside a formal exchange setting. The market for negotiable equity claims is the stock market. Trading of equity securities occurs both on stock exchanges and over-the-counter, depending on the specifics of the equity security being traded.

Financial markets of the 15th to 18th centuries have marked differences with modern financial markets. One important difference

is that the rudimentary development of key financial intermediaries, such as banks, meant that individuals often had to directly access financial markets in order to obtain financing or make investments. While individuals in modern markets typically obtain various types of debt financing from depositary institutions, this avenue was limited, at best, during the period under study. There was a similar situation in the markets for life insurance and pension funds. Individuals were directly involved in financial markets to facilitate transactions that, in modern markets, have been intermediated by appropriate financial institutions. In the face of such rudimentary intermediation, security markets traded various instruments, such as life annuities, that have only a loose connection with modern securities.

Another key difference between modern financial markets and those of the 15th to 18th centuries has to do with the legal features of the securities traded. In particular, the period under study witnessed a dramatic evolution in instrument negotiability. For example, during the 16th and 17th centuries, the bill of exchange, the key instrument in the money market, evolved into a negotiable security laying the foundation for the development of paper credit and banknotes. The emergence of joint stock trading in the 17th and 18th centuries permitted equity claims in businesses to be securitized into negotiable instruments. Along with enhanced negotiability came a deepening and widening of trading in financial markets. This increased activity created a new range of problems, such as the need to devise laws and market rules to contain market manipulation.

Another important development in the period under study is the so-called 'financial revolution' that took place in government finance. A key feature of this 'revolution' was the transition of government finance from short-term to long-term loans. The short-term loans were typically advanced by financiers charging relatively high interest rates combined with the expectation that the principal would be repaid at maturity or within a small number of rollover periods. As a primary method of government finance, this put the national governments at the mercy of the large financiers. Further complicating factors included a potential scarcity of funds and the location of major financial centres in foreign locales, such as Lyons and Antwerp, that operated largely independently of government control. These features provide an essential backdrop to interpreting the early mercantilist musing of writers such as Gresham and Malynes.

The transition from short-term financing to long-term funding of government debt took place gradually. Starting in Italy during the

Middle Ages, the technique spread gradually to northern Europe, reaching the Hapsburg Netherlands during the 16th century and, eventually, reaching England following the Glorious Revolution in 1688. This long-term government debt was typically placed at lower interest rates with the repayment of principal being less certain. Unlike the short-term debt that was usually backed by the faith and credit of the monarch or other government entity, the long-term debt was typically funded; the interest payments were secured by sources of government revenue 'often with the stipulation that collectors of these revenues are legally bound to meet interest payments to debt-holders before employing these receipts for other purposes' (Tracy 1985, p.8).

The basis for the long-term funded government debt has roots originating in the *census* contract. While initially associated with barter arrangements, over time certain types of *census* contracts became securitized and negotiable. Substantive deviations from theologically sanctioned *census* contracts often generated heated scholastic analysis about whether the contract was usurious. The *prestiti* of Venice are a significant example of how the feudal *census* contract evolved into a contract strikingly similar to a modern government bond, involving regular cash payment of interest and periodic repayment of principal on a security that was negotiable at a market determined price. By around 1400, the *prestiti* and the forced loan securities of other Italian city states had evolved beyond the scope of traditional *census* contracts.⁶ The ensuing scholastic controversy contributed significantly to the emergence of the extrinsic titles of *damnum emergens* and *lucrum cessans* as justifications of loan payments beyond return of principal (Noonan 1957, ch.V).

The *prestiti* was a security that arose from forced State loans in Venice. Under canon law, State loans secured by on-going revenue sources such as taxes were legitimate *census* contracts. However, around the 12th century, Venice, Genoa and Florence began to impose 'temporary' forced loans to finance government activities. As events unfolded, these temporary loans grew to a value far in excess of the value of State resources. In response, during the 13th century (1262 for Venice), these temporary loans were consolidated into a long-term fund called a *mons*. Venice, Genoa and Florence each had a separate fund, for example, the '*monte comune*' in Florence and the '*monte vecchio*' in Venice. In Venice, securitized claims against the fund were known as *prestiti*.

The *mons* was organized using shares, with the number of shares being based on the size of the forced subscription. Shares in the *mons*,

the *prestiti* in Venice, could be sold and transferred and were the object of open market trading. No certificates were issued, but claims were recorded in the Loan Office. This trading in shares marks an early historical instance of stock exchange transactions (Heckscher 1955, p.334). Initial subscriptions were imposed on wealthy citizens, largely in proportion to their real estate assets. One condition of the *mons* was that all state revenues, after deducting for expenses, would be applied to the repayment of debt. Principal would be repaid at par from time to time, as finances permitted. The Florentine *mons* had a statute that would provide for immediate redemption at 28% of par, but the value of the shares was almost always sufficiently high that this provision was not exercised.

The *prestiti* are important to financial history in providing a benchmark series of market interest rates covering a period of over two centuries. Selected price data for the *prestiti* are provided in Table 2.1. While Florence gradually reduced interest payments on the public debt from 15% in the 13th century down to 5% in 1390, the *prestiti* paid a nominal rate of 5% starting from 1262. While originally only issued to Venetian citizens, by the 14th century, the Council of Venice permitted designated foreigners to purchase *prestiti* and the security was conveyed to other major European centres, being considered a 'much sought after' secure investment (Homer and Sylla 1991). The demand for *prestiti* reflected the limited number of secure outlets for investment funds at that time. As Table 2.1 illustrates, the value of *prestiti* was sensitive to the risk of default and associated changes in size of outstanding government liabilities.

The *mons* of Florence, Venice and Genoa were also important in the scholastic debate over usury. Starting in the 14th century, considerable debate arose concerning whether payments on the *mons* constituted usury, for example, Armstrong (1998). Payments on the *mons* had many features that were similar to payments associated with contracts that were illicit under canon law. The problem of resolving the usury issue was further complicated by the wording of the statutes that authorized payments on the *mons*. These statutes clearly stated that the recipients of payments were not obliged to receive restitution for the forced loan, despite the stated best efforts of the State to make these payments. The flavour of this particular heated debate was played out over the years in a number of debates on other securities, such as the triple contract.

Table 2.1 Prices and yields of Venetian *prestiti*, 1309–1502

<i>Date</i>	<i>Events</i>	<i>Price*</i>
1309		63
1403	Small assessments	65-66
1405	Very large assessments	40-50
1407-10		43-58 $\frac{3}{4}$
1411	Very large assessments	54 $\frac{3}{4}$
1412	Very large assessments; victorious war with Hungary	41 $\frac{1}{2}$ -44 $\frac{1}{4}$
1413-15		47 $\frac{1}{2}$ -50
1416	War with Turks, easily won	56
1417		59 $\frac{1}{4}$
1419	Large assessments	41-56
1420	War with Milan	60
1421-22		64-66
1423	Long peace and prosperity	67
1424	Debt reduced	64-67
1425	Unfavorable war with Turks	65-67
1426	Successful war with Milan; heavy assessments	58
1427	Heavy assessments	55 $\frac{1}{2}$ -58
1429		57
1431-33	Heavy assessments	42-43
1434-35	Heavy assessments	36
1436-38	Heavy assessments	34-36
1439	Heavy assessments	20-24
1440-41	Very heavy assessments	20
1443	Very heavy assessments	23-28
1446-49	Heavy assessments	24-28
1450	War against Florence and Milan	28
1451	Fall of Constantinople, 1453	24-25
1458		24
1465	Disastrous war with Turks, 1464-79	22
1465-67		23-20
1482	New series of <i>prestiti</i> begin at 5%	Near 100
1495	Heavy assessments	80
1500		52
1502		74

*Prices are expressed as a percentage of face value.

Source: Homer and Sylla (1991). This source also has *prestiti* prices starting in 1299.

Societas and the Triple Contract

The *census* provided a basis for declaring a wide range of interest-bearing contracts to be licit under canon. Yet, this was not the only avenue permitting effective payment of interest on loans. Scholastic doctrine was almost continuously having to develop judgments on the acceptability of different forms of credit contracts. This process was made even more complicated by the emergence of insurance contracts, particularly maritime insurance. Using insurance, it was possible to construct an insured partnership contract that was effectively identical to an illicit interest-bearing loan. Early variations of this arrangement involved a shipping partnership where the underlying real purchase-transport-sale transaction was insured. This arrangement came to be applied in various other types of businesses and came to be known as the triple contract (Noonan 1957, ch. 10).

The triple contract was an ingenious method for rationalizing payment of interest that involved combining the notions of insurance and partnership. The triple contract was so-called because it involved three separate contracts: the conventional partnership or *societas* agreement between lender and borrower agreeing to sharing of profit and loss; an insurance contract specifying with the borrower guaranteeing the lender there will be no loss of capital; and another insurance contract with the borrower agreeing to pay the lender a fixed rate of return in exchange for the lender agreeing to forego a share in any eventual profit. In effect, in exchange for an initial investment by a passive partner, the active partner would guarantee that the passive partner received a predetermined rate of return. Because the promised rate of return on such agreements was often five percent, the triple contract was also popularly referred to as a five percent contract, especially in Germany.

The triple contract involved the merger of two notions: the partnership and insurance. Scholastic treatment of the *societas* was inherited from Roman law, where the partnership was a common form of commercial organization (Noonan 1957, ch. 6). While there were a number of other important forms of business organization, such as the regulated company and the joint stock company, the partnership was, arguably, the most important type of business organization during the period under study. Numerous variations on the partnership are possible and this form of business organization was used in virtually every type of commercial activity, from shipping to mining to retail trade. While the development of insurance was less fundamental, numerous variations on this form of contract also received scholastic

approval. As with other fundamental contributions to early financial economics, the credit for the combining the partnership and insurance contracts to create a payoff that mimics an illicit loan contract can only be given to the ingenuity of some anonymous merchant.

Yet, the triple contract was only one variation on the numerous permutations that the *societas* produced. As a means of financing business ventures, the traditional *societas* was quite restrictive. Because all partners were severally liable for debts of the enterprise, and personal bankruptcy was met with severe sanctions, this arrangement required strict loyalty and honesty from partners resulting in many partnerships being composed of family members. The expansion of business enterprise required a more flexible arrangement, a less onerous structure, for the contributors of capital (Baskin and Miranti 1997, p.38):

during the twelfth century, a new form (of business organization), the *compagnia*, started to displace the traditional *societas*. Although partner liability still remained unlimited, its more flexible capital structure attracted investors outside narrow family groups. For instance, the value and terms of each partners' contribution could be precisely stated. This made it easier for prospective investors to diversify their holdings among a variety of enterprises with different maturities. Beside equity, the *compagnia* were also financed by three classes of long-term liabilities, or *sopraccorpo* (above the capital). This included (1) partners' earnings retained in the business, (2) additional money contributed by partners beyond their basic equity, *fuori del corpo della compagnia* (outside of capital) and (3) time deposits accepted from outsiders, *depositi a discrezione* (discretionary deposits). Although each class was paid interest at rates, depending on circumstances, of between 5 and 10 percent, the payments were characterized as discretionary gifts made to lenders to avoid the church's strictures against usury.

Perhaps the most well known example of a firm that exhibited the *compagnia* form of business organization was the Medici bank of Florence.

The *compagnia* was not the only variation on the *societas* that emerged during Renaissance times. Due at least partially to the greater reliance of the Venetian economy on shipping compared to inland city states such as Florence, Venice evolved the *colleganza* (Baskin and Miranti 1997, p.48):

The *compagnia* form ... which was popular at inland towns such as Florence, was not used extensively in ordering business affairs at Venice. Although a hybrid of the *compagnia* known as the *fraterna* emerged there and enabled

heirs to administer jointly inherited wealth for either commercial or personal purposes, its permanent duration was far from ideal for accommodating the risks associated with financing sea voyages. What was necessary for this latter class of activity were contracts that could be tailored more narrowly to the specific requirements of a specific venture.

By the 13th century, Venetian merchants had come to rely increasingly on the *colleganza*, or *collegantia* (the Venetian term for what was known at other locations including Genoa as *commenda*), because it limited high risks of overseas commercial voyages. Under the *colleganza* one coventurer donated capital and goods and remained resident in the home port, while the other contributed his time and energy to transporting and selling the wares overseas. Like the sea loan of Greco-Roman law, this contract lasted only for the duration of a particular voyage, and the lender's liability was limited to the amount invested. It also enjoyed the primary feature of partnership, the sharing of any resultant gains and losses. Moreover, since these contracts specifically indicated that risk was borne by the coventurers, the returns earned by the sedentary party were not considered usurious. In addition to those of Venice, notarial records in Marseilles, Genoa and the Hanseatic towns testify to its widespread use throughout the twelfth and thirteenth centuries.

From the early roots in the *societas* contract and the Renaissance arrangements such as the *compagnia* and *colleganza*, by the 18th century business organization had evolved into forms such as the regulated company and the joint stock company.

The Bill of Exchange

In addition to the *census* and *societas*, canon law also considered exchange contracts (*cambium*) to be licit. Due to inherent vagaries in the relevant transactions involved, the process of making foreign exchange transactions produced one of the most popular commercial techniques for avoiding the usury prohibition on short-term borrowings. In particular, forward foreign exchange rates were inherent in trading in bills of exchange, producing a process that was readily adapted to disguising the payment of interest. The exchange market convention was to quote exchange rates at 'usance' or with a time factor involved. Quotes involved a receipt of domestic currency in one location, say London, combined with a repayment in foreign exchange at a later date in another location, say Antwerp. Using an exchange into foreign currency combined with a re-exchange back into domestic currency, the time and location factors in the foreign exchange quotes facilitated the payment of interest in domestic currency terms.

In general, four different types of exchange transactions can be identified. In terms of chronological development, the different types are: manual exchange; merchants' exchange or 'real' exchange; dry exchange; and, fictitious exchange (de Roover 1944). Of these types, the processes of real exchange, dry exchange and fictitious exchange give rise to a bill of exchange, a security that was almost certainly the most important instrument of credit and trade during the early history of financial economics. The bills of exchange arising in these three types of exchange all could be used to facilitate the payment of interest, disguised in the forward exchange transactions. However, the three types of transactions differed substantively in the risk inherent in the interest payment that was paid.

Manual exchange has to do with exchanging one type of coin for another. This was an important exercise in a time where different locales featured different coinage systems, minted with different metals, and adulterated or 'clipped' to varying degrees. Development of the manual exchange process was the basis for the emergence of financial institutions such as banks. For various reasons, such as the inconvenience of counting coin, money-changers developed a system of local payments by book transfer for regular merchant customers. From the process of book transfer, deposit or transfer banking evolved and, in turn, the payment of interest on deposit and the granting of loans emerged. As early as 1200, Genoese money-changers were involved in accepting interest bearing time deposits and extending credit (Hall 1935).

The need to advance funds to merchants for payment at another locale was a natural outcome of the expansion of trade. The most important variation of this is real exchange where the underlying transaction facilitates the purchase of goods. Because different locales used different coinage, this type of transaction, the basis for the bill of exchange, was largely the preserve of the foreign exchange dealers and merchant banks. Real exchange required the merchant banker to have a sizeable stock of capital as well as a network of branches or agents in foreign locales willing and able to act as a correspondent in exchange transactions. In a merchant's exchange transaction, the exchange rate at which the re-exchange was done was unknown at the time the initial loan transaction was completed.

Merchant's exchange was distinguished from dry and fictitious exchange by the motivations for the underlying transactions. In merchant's exchange, there were real goods transactions underlying the bill of exchange. Funds were advanced to provide for the purchase of

goods offshore. The sale of these goods enabled the bill to be settled or generated a further bill transaction of foreign currency back into domestic currency. Dry exchange mimicked the currency transactions involved in merchant's exchange but did not have the underlying goods transactions. The objective of dry exchange was to use the exchange and re-exchange process to earn interest income. While there was some uncertainty about the exchange rate applicable to the re-exchange, market conventions were such that exchange rates quoted in different financial centres almost always provided for a positive return, for example, de Roover (1944, p.190)

The uncertainty of interest paid in the dry exchange process led to the creation of fictitious exchange where the exchange rate for the re-exchange contract was determined at the time the initial exchange was initiated. Because this type of contract provided a predetermined rate of interest, scholastic doctrine considered this type of exchange to be illicit. The uncertainty of the interest inherent in dry exchange and merchant's exchange was sufficient for these types of transactions to be considered licit, though there was some debate over the licitness of dry exchange, e.g, Wilson (1572).

Two major developments to the bill of exchange transaction took place during the 17th century: the widespread use of negotiable bills; and, the emergence of the inland bill in England. Negotiability of the bill of exchange was a major development, both for the evolution of the short-term debt market as well as for emergence of paper currency. The creation of the inland bill was a further step in the evolution of the money market. The inland bill differed from the conventional bill of exchange in that all the transactions were in the same currency. Inland bills involved transactions between different geographical locations using the same units of account, for example, between Bristol and London. Due to an imbalance of funds flows between London and the outer areas, the exchange and re-exchange transactions would not typically provide a fixed return, though the progression into a modern type of money market was evident.

Lombards, Jews and Pawnbroking

The various social, legal and ecclesiastic restrictions on usury did not prevent overtly usurious activities from being conducted. While mainstream merchants sought to avoid usury sanctions by engaging in lending practices that were deemed to be licit, there were merchants

who openly engaged in lending of money at profit. These 'manifest usurers' often conducted business as pawnbrokers, a business where borrowers would leave personal property as security for a cash loan.⁷ In order to get the pawned security out of 'hock' — the storage area in the pawnshop where goods were kept — the loan had to be repaid in full together with interest. Pawnshop interest rates varied by location, with legal maximums sometimes being imposed, though 43½ % per annum appears to have been a regularly observed rate for private pawnshops during the 15th century (Noonan 1957, p.34).

Pawnbroking has ancient origins, being practised by temples in Babylonia, Greece and Rome. By the Middle Ages, though 'manifest usurers' usually suffered the canon law sanctions of excommunication, usurers often were protected by civil authorities. Various jurisdictions licensed moneylenders and charged sometimes heavy licensing fees. For example, in the Low Countries, 'the public usurers were under the special protection of the prince, and the State directed its chief efforts in this field toward eliminating the competition of unlicensed usurers' (Noonan 1957, p.34). From time to time, Church-inspired reform efforts led to the suppression of the professional moneylenders, but such attempts were only successful for a short time. Eventually, social vigour supporting the reform movement would subside and the professional moneylenders would reappear.

In the absence of enabling civil sanctions, the penalties of excommunication were primarily social and personal. Good Christians would be burdened with a guilty conscience and shunned by friends and neighbours. Such sanctions did not weigh heavily on non-Christians and foreigners. As a consequence, by the 15th and 16th centuries, professional moneylending in the important commercial centres of Europe was dominated by two groups, Jews and Lombards. The presence of Jews was understandable, though the importance of Jews is often overstated. Jewish religious codes did not prohibit the taking of interest from non-Jews and various medieval regulations, such as guild laws, prevented the Jews from participating in many types of economic activity. The sanctions imposed on Christians for professional moneylending gave Jews an advantage in this business.

The participation of the Lombards is more complicated. Lombardy is an area of Northern Italy that includes Milan, as well as various hill towns. Along with the spread of Italian commerce to the various commercial centres of Europe came Italians who 'showed a strange insensitivity to ecclesiastical and social censure' (de Roover 1948, p.113ff). These Italians came primarily, though not exclusively, from

the hill towns of Lombardy leading to the convention of referring to public Christian usurers as 'lombards'.⁸ Though not all Lombards were lombards and not all Italian Christian lombards were from Lombardy, there was and is a common convention to refer to these Italian money lenders as Lombards. Both Jews and Lombards experienced considerable social stigmatism as a result of their public moneylending practices, particularly from the poorer classes who, if anything, felt exploited by the high rates of interest being charged on what were often small consumption-related loans.

One of the historical features of modern European cities is the presence of a 'Lombard Street' near the centre of the commercial district. Starting from the revival of trade in the Middle Ages, in various European commercial centres it was typical and often required for foreigners to live in a specific area. Though Italians would assemble according to their area of origin in Italy, the various Italian communes were often geographically close together. The importance of Italians in commercial activities led to presence of a Lombard Street in close proximity to places of important business activity. As the moneylending, exchange and deposit taking activities became more common and socially accepted, 'Lombard Streets' became associated with the part of town where banks, goldsmiths, moneychangers and other financial activities were located. Pawnshops could still be found, but not featured as prominently as in earlier times.

An interesting chapter in the history of pawnbroking commenced in 1461 when Barbarus, the Governor of Perugia in Italy, founded the first public pawnshop funded by charitable donations, the *mons pietatis*. The objective of the *mons pietatis* was to make loans to the poor in exchange for a small fee, initially set at 6%, associated with safekeeping the pawned goods and other administrative costs. The scheme was successful enough that, by the end of the 15th century, about 80 *montes pietatis* had been established throughout Italy. The success of *montes* resulted in the removal of the restriction that capital be raised by charitable donation and, during the 16th century, various *montes* were authorized to accept deposits and pay interest (Noonan 1957, p.303). These 'mixed' *montes* came to operate like early savings banks, eventually making loans to businesses as well as the poor.⁹

The *montes* spread in various forms to other parts of Europe. Starting around 1600, the government of the southern Netherlands attempted to legislatively reduce the public moneylender rates from 33% to 22%, attempts that proved unsuccessful. As an alternative, Leonard de Leys Lessius (1554-1623) proposed establishing a *mons pietatis* and,

in 1618, the plan was adopted and public usurers were banned. Funds were raised by the sale of *census* at 6¼ % and borrowers charged a rate of 15 %, the difference going to cover administrative expenses. As in Italy, the plan was successful and soon spread throughout Belgium. Unfortunately, the *montes* were quickly seen by the State as a potential source of funds and, starting in 1625, Queen Isabella was requiring the *montes* to make forced loans at a legally reduced rate of 10 %. This ultimately led to suspension of payments on the *census* loans. Despite these setbacks, government pawnshops did become an established feature of lending in Northern Europe.

The Emergence of the Early Bourses

In addition to being focal points for trading activities, the medieval fairs were also important financial events. The fairs, such as those at Champagne, featured well organized money markets that, in addition to manual foreign exchange transactions, included substantial dealings in bills of exchange (de Roover 1954, p.204).¹⁰ Because the larger fairs involved transactions between merchants from a number of different regions, it was not practical to settle all transactions using manual exchange of coin. This was a primary impetus for dealings on credit. Starting as early as the 12th century in Champagne, the period before the beginning and after the end of trading at a fair involved a relatively sophisticated clearing process. Debits and credits for the various fair participants were calculated and settlements of the net balance were made in cash or, following the practice introduced at the Champagne fairs, using bills of exchange and 'bills obligatory'.¹¹

The actual clearing process differed from fair to fair (Parker 1974, p.546). For example, at the Lyons fairs, clearing involved the participation of all merchants attending the fair. At other fairs, such as the fairs of Besançon or Medina del Campo, clearing was controlled by a restricted group of merchant-bankers who were responsible for setting exchange rates and for handling the book-transfers between the accounts of merchants at the various clearing member banks. The growing economic importance of the medieval fairs was reflected in the size and volume of credit and other banking transactions, particularly involving bills of exchange. This led to the emergence of fair participants specializing in banking activities. Banking activities at the fairs were often dominated by Italian merchant-banking houses, of which the Medici bank is perhaps the most well known. Being merchant banks,

these Italian banking houses typically engaged in trading and underwriting as well as banking activities.

Ehrenberg (1928, p.284) describes the clearing process used in Lyons:¹²

Before the merchants attended the fair they entered in their 'market book' ... all the payments due from or to them in the fair. At the beginning of the fair these payments books were compared with one another. In the case of every entry found correct the person from whom the payment was due made a mark which was taken as a binding recognition of the debt; later he had to sign his whole name. The bill — for, generally speaking, there was no question of anything but bills — was *accepted* in this way. If an item was not recognized, the owner of the book would write by it 'S.P.' (*sous protest*).

After the acceptance of the old bills there followed the new business with foreign markets, which originated wither at the preceding fair or as the result of the acceptance, or otherwise. Here we meet for the first time a peculiar arrangement, the settlement of an official average price for each species of bill, the so-called Conto.

(T)he Conto in Lyons was done as follows: The bill dealers met on a certain day and formed a circle (*Faire la Ronde*); the Consul of the Florentines then asked the dealers of the different nations in turn what they thought the price ought to be. The answers were noted and an average taken. This was the official rate for bills which was noted in the bulletins ... and sent abroad. The dealers themselves were naturally not bound by this, their business was left free to bargaining. Yet the Conto at the beginning had some meaning for the market itself, as previously many transactions had been concluded at the average rate which had not yet been settled ...

The payment proper closed the fair. It was affected chiefly by *virement de parties*, *giro* or *scontro*, as follows: Two persons were commissioned to collect and compare ... all the fair books. They then cancelled the payments against one another, and only paid the balances in cash ... The fair payments at Lyons owe their form to the Florentines, a fact which is clearly shown by the development of the Lyons Bourse.

Various features of the clearing process at Lyons were adapted for use at other important fairs. From the 14th century onwards, bills of exchange were typically used to settle accounts at the end of the fair. It is even arguable that, because Lyons had four fairs held at quarterly intervals, the end-of-fair settling process was later adapted to exchange trading of securities in 17th century Amsterdam and, in the 18th century, to England. Specifically, the method of offset used in this settling process was later incorporated into the *rescontre* system.

The Lyons fairs first assumed importance circa 1463 due to the explicit mercantilist policies of Louis XI. As early as 1419, various

French kings had granted privileges to merchants doing business in Lyons in an attempt to counteract the success of the fairs held in Geneva. These privileges included freedom to engage in various financial transactions, such as manual exchange of coin and dealing in bills of exchange, activities that were tightly regulated elsewhere in France. Even more than the economic benefits associated with the commodities trade, the French monarchs were motivated by the gains associated with the financial dealings of the fairs. By the 15th century, the capital that could be raised at important fairs such as those of Geneva was substantial. This capital was essential to securing financing for the military adventures in which the national monarchs were, almost continually, engaged.

While the fairs served an important step in the growth of trade and payments, by the late 15th century economic activity was outgrowing the restrictions of the fixed fair dates. A network of international merchants had established permanent offices and warehouses throughout the key commercial centres of Europe. To support the associated trading activities, sizeable communities of foreign merchants were established. These changes meant that liquidity was sufficient to support trading throughout the year. This growth sustained the creation of bourses in various cities, designed to facilitate dealings in both physical and financial commodities. The bourses were, effectively, meeting places where merchants of various countries could meet to transact financial and commodities business (Ehrenberg 1928, p.54):

A bourse or exchange is an assembly meeting at frequent intervals, usually daily, consisting of the merchants and other persons, who meet for the purpose of dealing without exhibiting, delivering or paying for their goods at the same time.

The use of the term 'bourse' (beurs) is indicative of the historical development, the term being taken from a square in Bruges 'where the Florentines, Genoese and Venetians had their consular houses'.¹³

Bourse trading was a major development on trading at fairs and markets for at least two reasons. First, trading at the fairs was restricted to specific time periods. While initially useful as a method of concentrating mercantile activity, the growth of trade soon surpassed the narrow time windows provided by the fairs. Bourse trading involved both financial transactions and trading in goods. These two activities were complementary. Commercial trade in goods generated financial transactions, activities that were both facilitated by the

concentrated activity of the fair. Yet, as evidenced in the activities of merchant bankers in centres such as Bruges (for example, de Roover 1948), there were other reasons for financial activity, such as trading in bills of exchange. These financial activities formed the basis of bourse trading that can be traced back to the Middle Ages in southern Europe, particularly Italy.

By medieval times, financial bourse trading can be found in certain northern European centres, such as Bruges (Ehrenberg 1928, p.55):

in the trading cities of Italy, [bourse trading] arose from the business which developed at the banks of the money-changers native to the city, when the notaries likewise had stalls in the open air ... there arose ... the characteristics of the exchange business as early as the fourteenth century ... In the countries north of the Alps bill business ... developed in closest connection with the factories of the Italians. The streets and market places where they lived, and more especially where they had their consular houses or Loggias, were the localities where the bourse business first developed.

Bruges was well situated to have the first significant bourse trading in northern Europe. The opening of seaborne trade routes through the Straits of Gibraltar contributed to the decline of fairs along the land trade routes, such as the Champagne fairs. In addition, the Hansards developed important seaborne trade from northern Europe. All this growth in seaborne traffic contributed to the initial rise of Bruges as perhaps 'the greatest market of Christendom in the fourteenth century' (van Houtte 1966, p.37).

In addition to being a main seaport, Bruges was also the locale for one of the five fairs of Flanders. The importance of Bruges peaked in the mid-1300s due, at least partly, to the comparatively faster growth of other commercial markets and bourses, and to two primary local factors: the silting of the waterway connecting Bruges to the ocean; and, the various restrictions imposed by Bruges on foreign merchants trading there. The growth of trade meant that Portuguese, Spanish, South German and Italian merchants had sufficient reason to establish permanent colonies in locales such as Bruges and Antwerp where, before, these merchants sojourned to the fairs. Hence, in addition to geographical and other factors, the freedoms granted to merchants played a key role in determining where bourse trading was concentrated. By the early 16th century, Antwerp emerged as the epitome of unfettered mercantile activity.

A second factor favouring bourse trading was that fairs required goods to be transported to the fair's geographical location for inspection

in order to conclude specific transactions. The goods were then transported to another district to be sold. As trade expanded, factors such as acceptable levels of standardization and the growth of mutual merchant confidence allowed goods transactions to be made without actual inspection of goods at the time the sale was completed. This significantly reduced transactions, transport and other costs. By providing enhanced liquidity and cheaper execution, this aspect of bourse trading was an essential impetus to the emergence of speculative trading in commodities which led, ultimately, to the progression of derivative security trading. Active levels of speculative trading, where merchants take positions in commodities with the sole objective benefiting from price changes, is a key feature of modern commodity and financial markets.

Another related development contributing to the emergence of bourse trading was the extension of commercial liberties beyond the time period of the fairs. Restrictions on activities of foreign merchants, typically suspended during fair time, were removed throughout the year. Medieval commerce was riddled with onerous restrictions on trade. Yet, the development of perhaps the two most important bourses of the Renaissance period, at Antwerp and Lyons, were both closely connected with enhanced freedoms enjoyed by merchants operating in those cities. As early as the end of the 13th century, the dukes of Brabant encouraged the growth of Antwerp by granting privileges to alien merchants visiting it (van Houtte 1966). For example, while merchants trading in Bruges, the northern European centre of medieval commerce, were required to use local brokers to transact commodity business, such rules were not imposed in Antwerp.

Though the transition from fairs to bourse trading was gradual, the 16th century does provide a transition period: at the beginning of the century, the fairs still played an important role in providing fixed dates and locations at which concentrations of liquid capital were assembled; by the end of the century, general economic activity was such that bourse trading predominated. During the century, bourse trading in Antwerp and Lyons was especially important, though by the end of the century both these centres were in decline. In 1531, Antwerp opened a new building designed exclusively for bourse trading.¹⁴ The advantage of such a centralized exchange location was recognized and adapted in other centres, with Sir Thomas Gresham personally advancing the funds for the building of a similar exchange in London, the Royal Exchange, opening in 1571. In 1613, trading started at the new building for the Amsterdam Exchange.

The Evolution of Financial Securities

The growth of markets, the Reformation, and a host of other factors contributed to the further evolution of securities derived from the *census*, *societas* and *cambium*. In turn, this led to the evolution of security pricing techniques. By the 16th century, financial markets had developed to the point where an array of investment securities were available. There were short-term commercial loans, often implicitly constructed in the form of bills obligatory or bills of exchange that disguised the direct payment of interest. Other short-term financial securities included bank deposits and triple contracts. The conventional *census* contract had also evolved. There was a range of mortgage contracts, secured by land and there was a range of life annuities often, though not always, issued by states and municipalities. Other instruments of government finance included long-term and perpetual annuities.

The growth in security markets was not just associated with the variety of securities traded, there was also a complementary evolution in securities trading. The introduction and development of bourse trading facilitated the market liquidity needed to support a key feature of modern securities contracts: transferability. Security markets provide a mechanism for pricing that depends, in an essential way, on the presence of speculation. Cash traders will not always generate sufficient liquidity on both sides of the market, providing trading opportunities for speculators associated with market clearing. Bourse trading enhanced market liquidity by enabling the active participation of speculative traders. This applied to trade in commodities as well as securities, even supporting the emergence of trading in pure derivative securities such as forward and option contracts.

One important example of the benefits associated with bourse trading is the trade in joint stock. In particular, the early 17th century English joint stock companies were constituted in a fashion that made it difficult to transfer shares while the shares of the Dutch East Indies Company (VOC) were quite the opposite. The resulting trade in VOC shares on the Amsterdam bourse, complete with active trading in forward and option contracts, is one of the remarkable stories of 17th century financial markets. By the latter part of the 17th century, the transferability restrictions on issues of English joint stocks roughly corresponded in design to VOC shares, propelling active trade on the Royal Exchange and in Exchange Alley. Enhancements to transferability, and the associated implications for the evolution of

securities trading, appeared in almost all other securities, including bills of exchange and various government annuities.

The variety of available financial instruments substantially increased the need for methods of comparing the relative value of the different cash flows presented. In the case of long-term investments, these calculations required recognition of compound interest or 'profit on profit'. As such, the gradual social acceptance of this practice represented a considerable evolution in religious tolerance of commercial practice as compound interest had historically been deemed to be prohibited under canon law. By the early 17th century, various works were appearing that reflected a modern level of understanding for the pricing of fixed income securities. In 1671, the seminal contribution to contingent claims analysis by de Witt, on the pricing of life annuities, appeared. This analytical effort was dramatically expanded and surpassed by de Moivre in the first half of the 18th century.

A major impetus to the development of securities markets was provided by the various 'financial revolutions' in government finance. These revolutions started at different times, in different countries, starting with the Italian city states and, somewhat later, with the cities in northern France and Flanders. The key feature of these revolutions was the transition of government debt from the status of a short-term loan to an individual, debt as an obligation of the sovereign, to a long-term loan to a political entity independent of the ruler (Hamilton 1947, p.118):

The nascent states of Western Europe began to borrow by the middle of the thirteenth century, and modern methods of issuing and transferring public obligations arose even earlier in the Italian city states. But owing to the scarcity of liquid capital, the canonical and civil opposition to interest upon loans, and the instability of central governments, the sums borrowed were never large. The debts were usually guaranteed by pledges of jewelry, specific revenues, or real property; and almost invariably they were regarded as personal obligations of the reigning sovereign. The prevalent tendency for monarchs to default upon the debts of their predecessors prevented continuity and accumulation.

The revolutions in government finance transformed government debt operations from the realm of individual borrowing, which was typically short-term and secured by assets, to long-term borrowings which were secured by specific funding sources and were, to varying degrees, independent of the creditworthiness of the monarch.

The earliest forms of 'public debt', issued by Italian city states and the northern European cities and municipalities, were either forced loans on wealthy citizens, for example, the *prestiti*, or were *rentes* backed by specific revenue sources of the sovereign or town government. Northern European towns favoured annuities or *rentes* secured by urban taxes. As early as 1260, such early issues of *rentes heritables* and *rentes vagieres* appeared in the French cities of Calais and Douai, spreading to the Low Countries and German towns such as Cologne (Tracy 1985, p.13). Between 1275 and 1290 the city of Ghent in Flanders issued *lijfrenten* or life annuities followed by issues of *erfrenten* or redeemable *rentes*. There was a form of guarantee by the sovereign associated with some of these municipal issues, for example, the Court of Flanders 'undertook to see that the city lived up to its promises'. Municipalities, particularly in Holland, Flanders and Brabant, continued to issue life and redeemable annuities leading to increasingly larger stocks of public debt and, ultimately, to repayment difficulties for some towns by the 16th century.

The transition for municipal to national public debt issues was gradual. Though claims could be made for certain German territories, Dutch provinces or the Spanish monarchies, Hamilton (1947) traces the beginnings of national public debt to 16th century France. For some centuries before, the French had a tradition of the monarch selling long-term *rentes*, supported by the income from royal properties. These sales were often sold at deep discounts to royal officials and could not be considered 'public debt' but, rather, were obligations of the sovereign. Hamilton (1947, p.119) marks 1522 as a turning point:

For practical purposes, the national debt began in the reign of Francis I. Following the loss of Milan, the key to northern Italy, on September 15, 1522, Francis I borrowed 200,000 francs, then called *livres tournois*, at 12 1/2 per cent from the merchants of Paris, to intensify the war against Charles V. Administered by the city government, this loan inaugurated the famous series of bonds based on revenues from the capital and known as *rentes sur l'Hotel de Ville* ... the public debt rose to 100 million francs by 1576 and to 300 million, of which 157 million were funded, by 1595.

Though sovereigns had recognized the importance of the debt market in financing state military ventures for some time, the emergence of the public debt gave the debt market a new status as an instrument of state power.

Despite this claim to first-mover status by the French, there were numerous difficulties with the administration of the French public debt.

Large increases in outstanding principal to sustain various military adventures led to periods of suspended interest payments and forced reduction of through partial bankruptcy. By the beginning of the 18th century, French national finances were in a sorry condition. The Dutch were decidedly more successful in developing their public debt. The Dutch provincial governments pioneered various innovations in public debt issues during the 16th century, including the development of a 'free market' for provincial *renten* issued in Holland (Tracy 1985, ch.IV). The English were relative late comers in developing public debt issues, with the beginnings of English public debt starting only with the reign of William and Mary in 1688.¹⁵ However, by the mid-18th century the English had assumed front-runner status and the system of English public debt had become a model for European governments.¹⁶

In conjunction with the growth of financial markets, the 16th century also exhibited a shift of the focus of economic activity from southern to northern Europe. First Antwerp and then Amsterdam and London developed well organized, centralized exchanges dealing in a range of commodities and financial securities. Significantly, the activities of these exchanges featured active trading in derivative securities, contracts aimed at trading for future delivery, 'time bargains' as well as options. Modern analysis, for example, Feiger (1978), recognizes that active trading in derivative securities requires participation by both hedgers and speculators in order for markets to clear. Cash traders alone are not generally sufficient to provide the liquidity needed to clear markets, speculative participation is needed. Such speculative participation in the financial markets of the 17th and 18th centuries reflects a relatively modern state of development.

By the latter part of 17th century, the realm of individual and government finance featured a variety of complicated fixed income securities such as redeemable perpetual annuities, annuities with sinking funds, life annuities, lottery bonds and tontines. Advancement in financing techniques also extended to the realm of business finance where another distinctly different security emerged: issues for the earliest form of publicly traded corporation, the joint stock company. Prior to the emergence of joint stock financing, business finance was dominated by partnership arrangements. In some cases, the basic partnership could be enhanced by inclusion of the partnership within a regulated company. Equity participation could be supplemented with debt-type arrangements such as triple contracts. Joint stock ownership evolved from the partnership model. As such, the early joint stock

ventures did not fully possess the modern elements of limited liability and ready transferability (Shannon 1931).

Though the roots of joint stock ownership can arguably be traced to earlier times, it is conventional to identify the first joint stock companies with certain English trading and mining ventures of the 16th century, such as the Russia Company or the Mines Royal. These early English companies were motivated by the grant of a monopoly on a specific branch of trade. Almost all of these early English companies had limitations, such as restrictions on share transferability, and met with limited economic success. Credit for the most successful of the early joint stock companies is due to the Dutch East India Company (VOC) that was founded in 1602. Public trading in VOC company shares began almost immediately with the issue of shares, providing VOC shares with ready transferability. Within a decade, the VOC had proved to be an economic success, providing shareholders with a healthy dividend stream that continued for over a century.

Life Annuities and Tontines

In the late 17th and early 18th centuries, analytical solutions were proposed to the problem of valuing life annuities. Arguably, these analytical solutions represent the most important theoretical contributions to the early history of financial economics. The intellectual preliminaries required to sustain these contributions start around the latter part of the 16th century in Holland where important university mathematicians, such as Simon Stevin, were drawn to solving practical financial valuation problems, complementing the work of the commercial algorists. Even though the development of discounting and compounding techniques were important for determining the return from partnerships and valuing commonly traded term annuities such as mortgages and lease-purchase transactions, these techniques were not sufficient to value life annuities, tontines and other types of securities involving life contingent claims. Such problems were important because, in the absence of pension funds and life insurance, life annuities performed an essential social function.

The life annuity usually was a contract between three parties, the subscriber who provided the initial capital, the shareholder who was entitled to receive the annuity payments and the nominee on whose life the payout was contingent, for example, Weir (1989). Different variations were possible: one person could be subscriber, shareholder and nominee; a parent could be a subscriber and designate a child as the

nominee with the shareholder status passing from parent to child as an inheritance; or, joint life annuities could be specified where more than one nominee was designated and payments continued until both nominees died. The life annuity was further complicated by the need to establish proof of survival of the nominee prior to each annuity payment date. While it was technically possible to resell most life annuity contracts to third parties, the difficulties associated with verifying the survival and probability of survival for the nominee made resale difficult. Oddly enough, until the 19th century, market practice usually involved selling life annuities without taking accurate consideration the age of the nominee.

Life annuities have a long history, possibly dating back to Roman times or earlier. The earliest transactions involved individuals. Issues of *rentes vagieres* by municipalities in northern France, such as Calais, appeared around 1260 (Tracy 1985, p.13). The practice of raising municipal funds using life annuities soon spread to the Low Countries and the German towns. By the 15th century, it was common for cities and religious orders to use life annuities to raise funds in Germany and the Low Countries, though Italian public finance appears to have adopted the practice somewhat later with 'the Venetian mint (*zecca*) offering life annuities at 14% between 1536 and 1540'. Issues of life annuities for national financing appear somewhat later in France and England; the French government first using *rentes vagieres* during the Nine Years' War (1688-1697) and the English government making a first issue of life annuities in 1693 (Velde and Weir 1992).

Though there were larger and less frequent issues of life annuities by the emerging nation states starting in the 17th century, the typical government issuers of life annuities were municipalities, with prices varying widely from town to town depending on prevailing local interest rates and pricing conventions. Amsterdam, for example, sold municipal annuities at regular intervals starting in 1402, typically 'charging flat rates 9 1/11 percent for annuities on two heads and 11 13/17 percent for one, regardless of age' (Daston 1988, p.121). Annuity prices were quoted in 'years' purchase', which is the price of the annuity divided by the annual annuity payment. For a perpetual annuity, years purchase is the inverse of the annual yield to maturity.

Nicholas Bernoulli (1709) provides historical examples of life annuities selling for 6 to 12 years' purchase, without allowance being made for the age of nominee.¹⁷ De Witt quotes a 1671 price for a single life annuity in Amsterdam of 14 years' purchase with a 4% interest rate and no allowance for age of nominee; this is compared with

a price of 25 years' purchase for a redeemable annuity, effectively a perpetual annuity with an embedded option for the borrower to redeem at the purchase price. Houtzager (1950) quotes a 16th and early 17th century Dutch pricing convention of 1.5 to 2 times the years' purchase for a redeemable annuity to determine the price for life annuities.

In the medieval and Renaissance periods, difficulties associated with valuing a life annuity were advantageous from the perspective of avoiding usury laws. However, by the later 17th century financial markets required more precise methods of handling the pricing risks associated with issuing life annuities. In addition to improvements in pricing techniques, different variations on the life annuity were proposed to deal with the difficulty of valuing the life contingency risk. The most important of these proposals was the tontine, a funding scheme recommended to Cardinal Mazarin of France in 1652 by Lorenzo Tonti, an expatriate Neapolitan banker living in Paris.

While a number of variations were used, for example, compound tontines, the generic tontine classified the subscribers' nominees into groups, by age class, creating a fund for each group. Each of the surviving persons in a group would share the interest from the fund associated with that group. When the last member of a group was dead, payments would cease. After two aborted 1653 attempts at issuing state tontines in France and Denmark, the first tontine was issued in 1670 by the Dutch town of Kampen. Following an initial issue in 1689, the tontine became an important source of state finance in France during the 18th century (Weir 1989; Alter and Riley 1986). Starting in 1693, the tontine was also used, though less extensively, for state finance in England.

Joint Stock Companies

Shares in joint stock companies are the precursors of modern common shares. The joint stock form of ownership evolved somewhat slowly. Most of the early joint stock companies retained some the essential features of partnerships, though Hecksher does make an important distinction between partnerships and joint stock companies by referring to the latter as 'capital associations of a corporative character'. The early joint stock companies were an alternative form of business organization to the regulated companies which were effectively an evolution of the medieval guilds. More precisely, the regulated companies were associations of independent traders and merchants, each with their own independent capital, operating under a grant of

monopoly in a specific type of trade. The Fellowship of Merchant Adventurers was an important English regulated company.

As late as the 18th century, transferability of joint stock shares was restricted in various ways, such as limiting the number of shares and requiring approval and registration of new shareholders. Many of the initial joint stock companies were involved in long-distance trade, with paid-in capital being dispersed together with any profits after the completion of a voyage. Increases in capital were achieved by making calls on existing shareholders, rather than issuing new shares. It was during the 17th century that joint stock companies with modern features started to emerge (Parker 1974). Starting with the Dutch East India Company, these more modern joint stock companies included ready transferability of shares, a permanent capital stock, profits-only distributed as dividends and new capital requirements being raised by new stock issues.

Joint stock companies could be created in a number of different ways. In England and other countries, where the company charter involved a grant of monopoly in a particular line of trade, the company charter involved an act of the national legislature. This was the case with the early joint stock companies of the 16th and 17th centuries, such as the VOC and the Bank of England, as well as the major joint stock companies of the 18th century, such as the Royal Exchange Assurance Company. At various times in England, it was also possible for private individuals to issue shares in joint stock companies that did not have a Royal charter. One of the provisions of the English 'Bubble Act' of 1720 was to ban all such issues of stock. For this reason, the Bubble Act is often taken as a watershed in the history of the corporation, for example, 'The Bubble Act ... cast a shadow on the joint stock company as a form of business organization for more than a century' (Harris 1994, p.611).

The financial revolution in English government finance induced an important innovation in joint stock issuance. The idea was to fund a significant portion of the emerging government debt using the paid-in capital of joint stock companies, initially the Bank of England, the British East Indies Company and the South Sea Company. The basic operation was to bundle the Royal and parliamentary grant of a lucrative monopoly with the requirement that the proceeds of the joint stock issue be used to purchase government debt. Regular government debt payments would provide regular and, hopefully, safe cash flow, with the profits from the monopoly further enhancing earnings. In some cases, there was an exchange of stock for previously issued debt,

with the resulting rate of exchange being a source of manipulation in both the Mississippi scheme and the South Sea Bubble.

Starting with the trading of Dutch East Indies Company (VOC) shares on the Amsterdam bourse at the beginning of the 17th century, joint stock shares proved to be an excellent trading vehicle for the merchants populating the bourses. Shares were allocated a designated area within the bourse and were traded alongside a range of other commodities such as spice goods and copper. Even though there was sporadic trading in Dutch West Indies Company shares and selected Dutch government debt issues, VOC shares were the primary security being traded. During the 17th century, the Amsterdam share market achieved an extremely sophisticated level of development featuring both forward and option transactions. In addition, possibly as early as 1640, the *rescontre* system of clearing and settling accounts was perfected. This system used quarterly settlement intervals that permitted payment of differences and allowed for 'continuations'.

By the late 17th century, trade in shares was also conducted on the Royal Exchange in London where 'dealers in stocks and shares ... had a "walk" near the centre of the building between the salters, the Italian merchants and the Canary merchants' (Morgan and Thomas 1962, p.27). However, share trading was fairly considered to be a relatively undesirable occupation for the Royal Exchange. Phoney promotions, manipulation of pricing by groups of dealers and abuse of options trading were apparently quite common. The period leading up to 1696 had a considerable upsurge in both the number of issues and share prices. The ensuing collapse led to 'the usual crop of pamphlets and a Parliament inquiry'. The Parliamentary inquiry led to the passage in 1697 of an Act 'To Restrain the number and ill Practice of Brokers and Stockjobbers' that led to a number of restrictions being put on the number and practices of brokers in shares.

The considerable public and legal antipathy towards trading in stocks and shares created an environment that contributed significantly to the relocation of stock trading from the Royal Exchange to the coffeehouses surrounding the exchange, especially Jonathan's and Garraway's situated in Exchange Alley. Though some sources date this transition around 1697, for example, Morgan and Thomas (1962), there are sources such as Houghton (1694) which indicate that coffeehouse trading of shares was being conducted in conjunction with trading on the Royal Exchange much earlier. Ultimately, coffeehouse trading came to be centred at Jonathan's. However, the coffeehouse was an open a venue which did not permit exclusion of undesirables. The

demands for exclusivity progressed to the point where, in 1773, a 'group of brokers acquired ... a building in Threadneedle Street, which, for the first time, was called the Stock Exchange'.

Increasing supplies of both joint stock issues and marketable government debt provided the basis for the emergence of stock exchanges. Around 1695 there were approximately 100 joint stock companies in England with organized share trading in London, centred around Exchange Alley and the Royal Exchange. Organized share trading, for both English and Dutch joint stocks and government debt, also took place on the Amsterdam Bourse. Unlike the pricing theories for fixed income securities, much of the analysis of joint stock companies in the period under study was concerned with describing manipulative trading practices by stockjobbers and proposing remedies for the 'infamous practice', rather than with developing methods of security valuation. Fuelled by a gambling craze that 'so riveted the imaginations of Europeans after 1690 that it became a metaphor for civil society itself' (Daston 1987, p.244), the excesses associated with English joint stock trading culminated in the South Sea Bubble of 1720; a financial market event that captures the rudimentary level of public understanding about security pricing which prevailed at the time.

Private Credit Markets in the 18th Century

In modern financial markets, individuals seeking an extension of credit access funds through corporate financial institutions, such as chartered or commercial banks. Credit cards, personal lines of credit, consumer loans, house mortgages and overdraft accounts are conventional contracts through which modern financial institutions extend credit to individuals. The rudimentary financial institutions of the 18th century were ill-equipped to provide such conveniences, though incorporated financial institutions had developed some avenues for individuals to access short-term borrowings.¹⁸ For example, the Bank of England would extend credit by issuing banknotes as part of a short-term loan that involved the discounting of 'real bills'. Yet, borrowings from corporate financial intermediaries were the exception rather than the rule. Many of the personal credit transactions were done in the private credit markets.

Individuals seeking credit during the 18th century were not without recourse. Social mechanisms for providing credit have been part of the economic landscape since ancient times. Instead of borrowing from a corporate bank, individuals could approach a merchant banking house,

a specialist broker or, as was common in France, a notary (Hoffman, et al. 1992, pp.294-5):

Until the late nineteenth century credit markets in France were decentralized. The usual intermediaries were not banks but rather notaries, semipublic officials who drew up certified private legal documents ... As in a number of other European countries, notaries in France had recorded wills, prenuptial agreements, estate papers, and financial contracts since the Middle Ages ... The number of notarial offices (*etudes*) in which notaries carried out their private business was regulated but the *etudes* themselves were the private property of the notaries, who could sell or bequeath them to their children ... Often a notarial *etude* recorded a family's financial transactions for generations; as a result, notaries enjoyed unequal access to information about the wealth and income of individuals. Because smoothly functioning credit markets required reliable estimates of wealth and income, notaries were ideally suited to mediate between borrowers and lenders. On behalf of lenders, they could locate borrowers with enough assets to seem creditworthy; for borrowers, they could use their lender clientele to mobilize funds on short notice.

Even when not directly involved in connecting borrowers and lenders, throughout Europe scribes and notaries played an essential role in the credit process, drawing up legal contracts for the two parties involved.

As in modern times, the 18th century European credit markets differentiated between long-term and short-term debt. Even though still in a rudimentary state of development, institutions such as the Bank of Amsterdam and the Bank of England were playing a role in the money market (Hyse 1971, pp.813-14):

It must be emphasized that the A.W.B. (Bank of Amsterdam) was not a bank in today's sense. It created paper deposits for the Dutch East India Company only on a very moderate scale, nor did the A.W.B. act as a lender of last resort. Founded in 1609 after the pattern of the Bank of Venice (Rialto Bank) by the Amsterdam city fathers to restore monetary order, the A.W.B. acted primarily as cashier and clearing house to the Amsterdam financial community. Deposits were guaranteed against seizure and theft by the city and book transfers were made free of charge till 1683. (After 1683, one stuyver was charged for account keeping, and after 1715, two stuyvers.) In 1683, the A.W.B. received the privilege of lending on specie deposits, a recognition of a long-standing practice which changed the character of the bank in no way. The new privilege merely strengthened a position the bank had already acquired during the 17th century: main trader and supplier of specie metal in the United Provinces. Now the A.W.B. became also a European centre of gold and silver trade, a position which it retained well into the 18th century.

Similar banks were also operating in other European countries, for example, van Dillen (1934).

It must be emphasized that the role played by the 18th century bank of deposit was not comparable to modern money markets. Even in the most developed financial market of the 18th century, John (1953, p.139) observes:

the money market, although to a diminishing extent after 1770, was personal and individual, rather than institutional. Much was made available to the state by direct advances from the merchants, not only in the funded debts but also in annual short-term credits. In commerce, a great deal of what self-financing failed to accomplish was provided by loans between merchants. This stage in the development of the money market was reflected in the variety of credit instruments used in the City, ranging from direct pledging of goods to the use of tea-, pepper-, and dividend-warrants.

The private credit market functioned with different rules than in the impersonal markets of modern times (John 1953, p.140):

This private provision of credit functioned, as did most of the commercial transactions of the time, upon personal contract; whether arising from membership of the same trade interest, of important racial groups within the City, or from close ties of kinship. In this, it was similar to the organization by which international movements of capital ebbed and flowed with such remarkable efficiency. This personal contact included that existing between directors of contemporary business corporations and their shareholders and clients; and many such companies, like the big insurance offices, provided loans, not only on government and other stock, but also on the security of their own shares.

The reliance on private banking was an important precondition of the speculative excesses of the South Sea Bubble and the Mississippi scheme. A number of contributors to 18th century financial economics, such as Richard Cantillon, were private bankers. Others, such as Thomas Mortimer and Isaac de Pinto, were almost certainly members of the client base.

Other 18th Century Contributions

Much as with the beginning date, there are a number of possible endpoints that could be chosen for the early history of financial economics. The selection of 1776 permits the inclusion of the contributions of Abraham de Moivre (1667-1754). In addition to his

seminal contributions to mathematical statistics during the 18th century, de Moivre also provided fundamental results in the theoretical and practical valuation of life contingent claims and annuities. Edmond Halley was still productive until the 1730s. Though written much earlier, Richard Cantillon's *Essai* was not published until 1755. Thomas Mortimer, Isaac de Pinto and Richard Price all made contributions to the sinking fund debate well after 1750. Mortimer published the first edition of *Everyman his Own Broker* in 1761. These contributions argue for an endpoint in the latter half of the 1700s.

The specific endpoint of 1776 was selected to permit an examination of the financial economics that Adam Smith contained in the *Wealth of Nations*. While the contributions of Adam Smith to the primary topic of security pricing were not nearly as significant as his contributions in other areas of economic thought, Smith did have some modern, if largely unrecognized, ideas on topics such as the impact of agency costs on joint stock valuation. Smith also made useful observations on other topical issues in the financial economics of his time, such as the role of fictitious bills of exchange in the functioning of a banking system where the issue of paper currency is based on bank discounting of 'real bills'. There are also a number of not-so-flattering observations that can be made about Smith's contributions, such as his views on stockjobbing contained in the *Lectures*.

The 1776 endpoint also permits coverage of the *Observations on Reversionary Payments* (1772) by Richard Price (1723-1791).¹⁹ Benjamin Franklin has been quoted as describing the *Observations* as 'the foremost production of human understanding that this century has afforded us'.²⁰ Even though the *Observations* is a reflection of Price's eclectic character, Karl Pearson has referred to this contribution as 'perhaps the most remarkable textbook ever issued on actuarial science'. The book became the standard text in actuarial science until well into the 19th century. The *Observations* also contains contributions on numerous other issues of relevance to financial economics, such as the use of sinking funds for the National Debt and the introduction of universal old age pensions. Also included in Price's contributions are the calculation of widely used mortality and life annuity tables. In addition to his academic achievements, Price played an important early part in the Equitable Life Assurance Society (founded 1762), the first life insurance company to utilize the principles of actuarial science in setting premiums (Ogborn 1962; Daston 1987).

By 1776, financial markets had achieved a remarkable level of sophistication, including a developed understanding of notions that

Markowitz and others were to explore almost two centuries later under the guise of 'modern portfolio theory'. In particular, an investment scheme appeared in the early 1770s that reflected intimate understanding of the gains accruing to portfolio diversification (Alter and Riley 1986; Velde and Weir 1992). The scheme, colloquially referred to as '*trente demoiselles de Geneve*' involved a number of Genevan banks creating 'investment trusts' that were formed by pooling life annuities issued by the French government. At this time the French government was still using flat-rate pricing of life annuities, that took little account of the age of the nominee in setting the price. Using actuarially sound pricing methods, the flat-rate prices were fairly priced for an adult about age 50 (Velde and Weir 1992).

Even though there was an expected gain to purchasing life annuities written on young nominees, there was still the risk of unforeseen events. According to Velde and Weir (1992), the Genevan banks:

developed lists of young girls from Genevan families to name as the contingent lives. The families were selected for their record of health and longevity. The girls were mostly between the ages of five and ten, and were selected only after surviving smallpox ... The Genevan banks purchased large amounts on each life to reduce transactions costs, but pooled together annuities on enough different lives to reduce the risk. The most common number of lives in a pool was 30, hence the name of the scheme.

The banks then 'resold small fractions of their pools of annuities to individual investors'. Sometimes the cash flows from the life annuities were passed-through directly to investors, in other cases the cash flows were repackaged in other forms, such as tontines.

All this reflects a relatively modern state of financial sophistication. In addition to capturing the gains from risk pooling, claims against the pools were 'an easily negotiated asset ... because the bank's dispassionate selection of lives eliminated problems of asymmetric information and moral hazard' associated with life annuities written on single lives (Velde and Weir 1992). This process was facilitated by the substitution of 'the paper of the investment trust for the paper of the annuities themselves'. In addition to capturing the French government's sizable mispricing of life annuities written on young, healthy lives, the pools were able to capture the risk premium available from portfolio diversification. The result was that the claims against the pools could be sold at yields well below those directly paid on individual life annuities issued by the French government.

Over time, the investment technology developed by the Genevan banks spread to other countries, most notably the Dutch republic. The Dutch schemes, often organized by important brokers instead of banks, introduced an additional wrinkle. This involved using the surplus of interest received from the French government over interest paid to claim holders to buy back shares in the pool. In some cases, the allocation of surplus was not complete, with the residual cash flow going to the brokers who originated the scheme (Alter and Riley 1986, p.28). In any event, the 'share buyback' feature would act to reduce the number of claims on the fund, thereby increasing potential future returns of pool claimholders. In summary, the pooling scheme involved many modern notions including: the gains to diversification; investment trust/mutual fund origination; security pass-through; and share buybacks.

Appendix: Selected Life Annuity Price Series and Issue Sizes

Starting in the late 17th century, life contingent claims were an important source of French and English government finance. Prior to this time, life annuities were also important sources of municipal finance. Alter and Riley (1986) provide information on the selected life annuities issued by the city of Amsterdam. Working mainly from primary sources, Weir (1989) and Velde and Weir (1992) provide details on the life contingent financing used by the French and English governments, including estimates of the degree of underpricing that seemed to be a feature of this type of debt issue, for example, life annuities were sold at prices that did not accurately account for the age of the nominee.

Tables 2.2 and 2.3 document the degree of mispricing in the life annuities issued by the city of Amsterdam (Alter and Riley 1986, pp.28-9):

The first annuity sold in Amsterdam from 1586 to 1590 made no distinctions regarding the age of the nominee. The second annuity, sold in 1672 and 1674 again in Amsterdam, was offered at prices varying by age on the advice of Johan de Witt and Johannes Hudde. Although both annuities were underpriced at almost all ages, investors did show sensitivity to the relative advantages of some ages over others.

The 1586-1590 life annuity was sold at a price of 6 years' purchase, translating to a coupon return of $16\frac{2}{3}\%$ on the initial investment. Perpetual annuities at this time had coupons that were returning $8\frac{1}{3}\%$.

Examining the last column of Table 2.2 reveals that for all purchasers below the age of 60, the life annuities were underpriced. Though the pricing of the 1672-1674 life annuity was somewhat more accurate, there still was considerable underpricing.

The usage of life annuity and tontine financing by the French and English governments is detailed in Tables 2.4 to 2.7. As indicated in Table 2.4, the tontine was a popular financing vehicle for the French government. Though the tontine was used by the English government, this method of financing was not as popular with English investors.

As indicated in Table 2.5, the problem of mispricing life contingent debt issues was not avoided by the introduction of tontines. Even though the tontine is theoretically easier to price, the French government did not translate this feature into more accurate pricing. Table 2.6 details the role of the life annuity within the French government debt program in the period 1747-1771. Tontines, which had been important in previous years, were superseded by conventional life annuities.

Even after considerable experience with life contingent financing, life annuities were inaccurately priced by the French government throughout the 18th century. The terms of the 1758 issue appear to be particularly attractive. As indicated in Table 2.7, some attempt was made to differentiate prices across age groups. However, it seems likely that the French government had other objectives than accurate pricing when setting the terms of a specific life annuity debt issue. In the absence of widely available pension plans and life insurance schemes with modern features, life annuity issues also served certain government social objectives. The advantages of purchasing life annuities written on young, healthy nominees are still apparent. This observation was not lost on the Genevan bankers who were able to exploit this mispricing through the creation of unit trusts of French life annuities written on the lives of young, healthy female nominees.

Table 2.2 Number and percent of nominees and estimated fair value of the 1586-1590 Amsterdam life annuity by age

Age	Number	Percent	Estimated Fair Value
0	0	0.0	8.04
1	61	4.1	9.37
2	64	4.3	9.89
3	93	6.2	0.15
4	89	6.0	10.30
5	96	6.4	10.38
6	96	6.4	10.36
7	77	5.2	10.34
8	87	5.8	10.31
9	64	4.3	10.29
10-14	292	19.5	10.27
15-19	178	11.9	9.98
20-24	125	8.4	9.73
25-29	63	4.2	9.51
30-34	39	2.6	9.27
35-39	30	2.0	9.01
40-44	18	1.2	8.69
45-49	17	1.1	8.25
50-54	6	0.4	7.60
55-69	0	0.0	6.88
60-64	0	0.0	6.02
65+	0	0.0	5.21
Total	1495	100.0	

Source: Alter and Riley (1986).

Table 2.3 Percent of nominees, price and fair value of 1672-1674 Amsterdam life annuity by age and sex

Age	Percent of Nominees			Price	Age	Estimated Fair Value		Ratio of Fair Value to Price	
	Female	Male	Total			Female	Male	Female	Male
0-4	8.8	12.6	10.6	10.00	0	12.87	12.65	1.29	1.27
5-9	12.6	13.9	13.2	10.00	4	15.76	15.77	1.58	1.58
10-14	12.7	13.6	13.1	10.00	5	15.82	15.82	1.58	1.58
15-19	9.7	8.6	9.2	10.00	10	15.50	15.43	1.55	1.54
20-24	7.1	8.2	7.6	9.50	15	14.95	14.76	1.50	1.48
25-29	5.6	6.3	5.9	9.50	25	13.96	13.53	1.47	1.42
30-34	8.5	6.1	7.3	9.00	30	13.43	12.86	1.49	1.43
35-39	7.9	3.3	5.7	9.00	35	12.85	12.12	1.43	1.35
40-44	6.7	6.7	6.7	8.50	40	12.17	11.32	1.43	1.33
45-49	6.2	6.6	6.4	8.00	45	11.30	10.45	1.41	1.31
50-54	6.7	5.4	6.1	7.50	50	10.21	9.46	1.36	1.26
55-59	3.2	2.5	2.9	6.75	55	9.03	8.42	1.34	1.25
60-64	2.5	2.0	2.3	6.00	60	7.74	7.26	1.29	1.21
65-69	1.0	1.0	1.0	5.00	65	6.53	6.13	1.31	1.23
70-74	0.3	2.5	1.4	4.00					
75+	0.6	0.9	0.7	3.00					
Total	100	100	100						
Number		876	794	1670					

Source: Alter and Riley (1986).

Table 2.4 Tontines in France and Britain, 1689-1789

<i>French Tontines</i>						
Year	# of Age Classes	# of Nominee s	Capital Sought	Capital Raised	Shares/ Nominee	Percent Under 25
1689	14	5,912	19.600	3.611	2.04	22.40%
1696	15	4,105	14.320	2.928	2.38	20.9
1709	16	2,642	3.000	2.996	3.78	28.2
1733	7	14,270	12.000	11.126	2.60	27.0
1734	15	12,653	15.000	15.365	4.05	22.7
1743	15	4,275	6.300	[6.300]	4.91	48.9
1743	15	3,822	6.300	[6.300]	5.49	44.8
1744	15	7,131	9.000	9.000	4.21	43.5
1745	15	10,397	9.000	8.820	2.83	22.0
1759	8	49,463	30.000	46.870	4.74	21.3
<i>British Tontines</i>						
1693	1	1,002	£1000	£108.1	1.08	93.80%
1757	5		2,500.0	[cancelled]		
1765		900	300.0	18.0	[1.0]	
1773-7 (Irish)	3	3,384	928.0	928.0	2.97	77
1789	6	3,495	1,000.0	421.9	1.21	77.1

Notes: Capital raised for the French tontines is given in millions of *livres tournois*; Capital raised for the English tontine is in thousands of pounds sterling. See Weir (1989) for the calculation of the number of nominees in the French tontines. Capital sums in the lottery-tontines have not been reduced for the prizes paid out.

Source: Adapted from Weir (1989).

Table 2.5 Yield, fair return and percent of investors by class in the French tontine of 1696

Class	Age	Yield (%)	Fair Return (%)	Premium to Investors	Percent of Investors
1	0-5	7.14	6.04	1.10	1.7
2	5-10	7.14	6.06	1.08	2.4
3	10-15	7.14	6.08	1.06	2.5
4	15-20	7.14	6.11	1.03	1.8
5	20-25	7.14	6.14	1.00	1.5
6	25-30	7.14	6.19	0.95	2.4
7	30-35	7.14	6.25	0.89	3.5
8	35-40	7.14	6.35	0.79	4.7
9	40-45	8.33	6.47	1.86	11.0
10	45-50	8.33	6.64	1.69	7.8
11	50-55	10.00	6.90	3.10	24.8
12	55-60	10.00	7.27	2.73	11.7
13	60-65	12.50	7.82	4.68	14.0
14	65-70	12.50	n/a	n/a	6.1
15	70+	14.29	n/a	n/a	4.1
				Total:	100.0

Notes: Fair return is calculated at the highest age in the class using interest at 6%.

Source: Alter and Riley (1986).

Table 2.6 Direct loans of the French Government, 1747-1771

Date of Edict	Finance Minister	Loan Term	Net Sum Raised	Loan Yield	Bond Yield
November 1740	Orry	life	6.0	5.88	
October 1741		life	8.0	5.82	
June 1742		15 years	12.0	5.00	

December 1743		life	8.4	?	
November 1744		life	4.7	8.18	
July 1747	Machault	life	11.8	7.95	6.03
October 1747		12 years	30.0	6.71	6.22
September 1748		12 years	20.0	6.71	5.70
May 1749		12 years	36.0	5.00	5.18
May 1751		22 years	< 30.0	?	4.88
May 1751		life	21.8	6.04	4.88
October 1752		9 years	22.5	6.17	4.55
November 1754	Séchelles	life	56.7	5.10	4.36
November 1755		12 years	30.0	5.86	5.86
July 1756	Moras	10 years	36.0	5.00	4.95
March 1757		12 years	36.0	6.20	5.02
June 1757		11 years	40.0	7.35	5.08
November 1757	Boullongne	life	60.0	6.4-9.0	5.15
April 1758		30 years	40.0	6.65	5.19
November 1758		life	39.0	7.0-9.0	5.20
April 1759	Silhouette	'shares'	72.0	6.50	5.23
December 1759	Bertin	tontines	46.9	9.53	6.85
May 1760		10 years	20.0	9.66	6.87
May 1760		32 years	< 60.0	?	6.87
July 1761		32 years	< 30.0	?	6.58
November 1761		life	43.5	6.4-9.0	7.30
January 1766	Laverdy	life	60.3	5.2-8.0	6.15
December 1768	Maynon d'Inveau	life	44.6	5.2-8.0	6.34
June 1771	Terray	life	62.4	8.8-11.0	10.32

Notes: The Loan Yield is the expected internal rate of return on the loan at the government's offer price. Yields on life annuities are based on Deparcieux's life table. When the age of distribution of annuitants is unknown, the rates apply to lives at age 52 and age 7 at nomination, respectively. Bond Yield is the market yield on the October Loan at the date of the edict. Sums raised (in millions *livres*) exclude the value of old debt accepted as payment. Missing values represent incalculable yields.

Source: Adapted from Velde and Weir (1992).

Table 2.7 French life annuity prices

Ages	Years' Purchase				
	1689	1740	1744	1754	1758
0-5	14	14	13.0	15	10.00
5-10	14	14	13.0	15	10.00
10-15	14	14	12.0	15	10.00
15-20	14	14	12.0	14	10.00
20-25	14	14	11.0	14	10.00
25-30	12	14	11.0	14	10.00
30-35	12	12	10.0	13	10.00
35-40	12	12	10.0	13	10.00
40-45	10	11	9.0	12	10.00
45-50	10	11	9.0	12	10.00
50-55	9	10	8.5	11	9.52
55-60	9	10	8.5	11	9.09
60-65	8	9	8.0	10	8.33
65-70	8	9	8.0	10	7.69
70-	7	8	7.0	9	7.14

Source: Adapted from Weir (1989).

Notes

1. The fascinating subject of the origins of modern universities during the Middle Ages ventures too far beyond the present scope to make more detailed discourse on this topic possible. More detailed discussion of the early historical development of universities is provided in Haskins (1923) and Rashdall (1895).

2. Vogel (1971) provides more detailed biographical information on Fibonacci. Though Fibonacci was not a product of the Church schools, he does make reference to a master ("the wizard") Michael Scott who likely influenced his more developed contributions to mathematics. Scott spent considerable time studying at medieval universities, for example, D. Smith (1958, v.1, p.221).

3. D. Smith (1970) is an essential source for descriptions of the primary texts.
4. Useful tables outlining the date, type and geographical sources of the various types of fixed income securities examined in this paper can be found in Homer and Sylla (1991): p.103 for the Venetian *prestiti* from 1299-1403 and p. 109 for 1399-1502, for other types of securities issued in various geographical locations, p.102-3 for the 14th century, p.110 for the 15th century, p.120-1 for the 16th century, and p.131 for the 17th century.
5. Together with contracts and agreements for exchange (*cambium*), the *societas* and *census* form the general set of contracts which evolved into the securities which form the basis of trading on modern financial markets. The *cambium* contract, as reflected in the bill of exchange, was the basis for money market securities. The *societas* was the precursor for contracts associated with equity finance for business, such as stocks and partnerships. The *census* evolved contracts which roughly correspond to the modern bond market, long term fixed income securities.
6. Tracy (1985, p.10) identifies 1172 as the beginning of forced loans by the Venetian state. Florence and Siena were other Italian city states which also used forced loans. Another alternative to forced loan was the sale of *rentes*, of which the *compera* of Genoa is an important early example.
7. The modern symbol used to denote pawnshops, three gold balls, can be traced to the Middle Ages where the gold roundels (*bezants*) were the heraldic symbol for money.
8. Ehrenberg (1928, p.50) relates the following about the Jews and Lombards: "The inhabitants of the cities of Piacenza and Asti in North Italy, and Cahors in Southern France, were the first who began to drive Jews out of dealing in money in the regions north of the Alps. In the course of the thirteenth century they in turn were replaced by the Tuscans, then by the people of Bologna and Siena, and later by the Florentines; but the name of Lombards or Caorsins still cling to all professional moneylenders who were Christians."
9. The *montes* generated considerable scholastic discussion, as the method of financing and charging for services was close to violating usury prohibitions (Noonan 1957, Chp.15).
10. De Roover (1954, p.205) traces the progression of the banking practices from the fairs to fixed metropolitan locations: "By 1325...the role of the fairs of Champagne was played out, both as trading and financial centres. In the fourteenth and fifteenth centuries, the banking places of Europe were: Bologna, Florence, Genoa, Lucca, Milan, Naples, Palermo, Pisa, Siena, Venice and the court of Rome in Italy; Avignon, Montpellier, and Paris in France; Barcelona, Valencia, and Palma de Mallorca in Spain; Bruges in Flanders; and London in England... Paris declined shortly after 1400... and its place was taken by the fairs of Geneva and, after 1465, by those of Lyons. There were no banking places east of the Rhine, although the fairs of Frankfurt-on-the-Main began to emerge as a clearing centre toward the end of the fifteenth century."
11. Until the latter part of the 16th century, the bill of exchange was the dominant means of settlement in southern Europe, while the bill obligatory (letter obligatory, writings obligatory) was prevalent in the north: "The bill of exchange was definitely not unknown in the north; on the contrary. But before 1550 the bill of exchange was certainly not yet the characteristic, dominant instrument of foreign trade. Within the Hanseatic League the bill of exchange remained marginal. From the second third of the sixteenth century... use of the bill of exchange quickly became general in the north... The letter (or bill)

obligatory, based on extension of payment, had from the late Middle Ages been the characteristic, dominant security in the foreign trade of the north. It continued to hold this position in the fifteenth and sixteenth centuries" (van der Wee 1977, p.324-5).

12. A similar description can be found in van der Wee (1977, p.318-9).

13. In turn, the square was named for an inn on the square owned, at one time, by the van Beurs family. This inn was a popular meeting place for foreign merchants.

14. The entrance to the exchange exhibited the dedication: *Ad usum mercatorum cujusque gentis ac linguae*.

15. Prior to this time, English government debt was almost exclusively short term. Tracy (1985) examines the implications of this for the relatively slower development of English financial markets, relative to those in northern Europe.

16. A major part of the success of the English public debt system is due to the allocation of control over taxation to the Parliament, arising from the Glorious Revolution. With this reform, Parliament was able to ensure that the funding of interest payments with specific taxes was removed from the meddling of sovereigns.

17. Daston (1987, n.5) quotes James (1853) for a 14% rate on English life annuities, for any age, issued by the state under William III. This translates into approximately 7 years' purchase.

18. Financial intermediation in the 15th to 18th centuries was even less developed.

19. The 1772 publication date refers to the third edition. The first edition appeared in 1771. A sixth edition, in two volumes and supplemented with contributions from William Morgan, appeared in 1803.

20. The accuracy of this statement is somewhat suspect. Firstly, the precise date for the statement is not given by Ogborn (1962), but it was likely made before 1776 leaving a comparison with the *Wealth of Nations* unrecognized. In addition, Benjamin Franklin was well known to Price as evidenced by a chapter in Price's *Observations* which is concerned with a letter Price wrote to Ben Franklin. Other connections between Franklin and Price can be found in Price's sympathetic writings about and direct participation in the American Revolution.