*Foreign-Exchange Profits in Two Early Renaissance Money Markets**

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At the turn of the 15th century, there were several European cities that boasted well-developed money markets. Bankers used bills of exchange to exploit exchange-rate differences between these markets in order to earn a profit. de Roover in several publications provides anecdotal evidence that these bankers were successful. Using daily exchange rates from 1384-1411 for Bruges, Flanders and Barcelona, Spain, we confirm his conjecture by documenting that trading profits over this period may have averaged 12% to 13% after transaction costs.

1. Introduction

According to Braudel (1981, pp. 471-472), money historically has been associated with written documents, notes, orders and promises that serve in its stead. He points out that these devices existed at least 4000 years ago in Babylon and were used by merchants during Hellenistic and Roman times. In Europe, these business practices went into disuse during the continent's Dark Ages and it was not until the XIIIth century these financial ideas were "rediscovered" by the merchants of Florence, Genoa, and Venice. By 1400, in addition to the major Italian city states, which included the Court of Rome (when the pope was in residence), the use of these financial instruments had spread throughout Europe and were routinely used in the money markets of Avignon, Barcelona, Bruges, London, Paris

* Acknowledgements: We gratefully acknowledge Raymond de Roover (1904-1972) who made seminal contributions to the understanding of medieval finance. Boyce, Lane and Lyon (1973) provide a memoriam chronicling some of his accomplishments. We also acknowledge Harry Wang for his computer assistance and insightful questions. All errors are ours.

and Montpellier. Although very small by today's standards, these markets were fully operational and reasonably active. The expansion of this type of finance into central and northern Europe came much later.

The most important financial instrument of the time was the bill of exchange, which at that time was a non-negotiable, non-discountable written order by the issuer to pay another a specific sum in a foreign currency in a distance place. The issuing and settling of bills in different markets resulted their purchase (sale) being tantamount to granting (receiving) credit. It also resulted in a roundtrip transaction. The original transaction was consummated at the completion of the first leg of the journey. The second leg of the roundtrip was necessary in order to return the funds to the original market. These bills rapidly became the principal mechanism not only to extend credit but also to transfer funds among the major marketplaces and did so without the costs and risks involved with shipping specie or merchandise. This was especially useful for the movement of papal remittances.

Bills of exchange were primarily used by Italian merchant bankers, whose business consisted of banking, trade and other related activities and who conducted business using international branches and partnerships. Dealing in bills appears to have provided merchant banks with a significant portion of their profits. For example, de Roover (1944), after analyzing the income statements of the Francesco di Marco da Prato & Co.'s Barcelona branch from July 1397 to January 1400, reports that 31% of the merchant bank's gross profits were associated with bills of exchange. Similarly, Biscaro (1913) documents that 44% of the gross profits earned from 1436 to 1439 by the Filippo Borromei & Co. of London came from this source. de Roover (1963, pp. 116-120) provides a different perspective. After sifting through the incomplete records of the Medici & Co. of Florence from 1437 to 1464 that are housed in the State Archives of Florence, he finds evidence of 53 complete bill of exchange transactions between Venice and London (Venetian ducats and English sterling) and Venice and Bruges (Venetian ducats and Flemish groats). During that 27-year period, profits per transaction on an annualized basis ranged from -5.5% to 28.8% and averaged 14.2%.

The purpose of this article is to extend and complement de Roover's (1963) profit findings by analyzing Barcelonese denier and Flemish groat exchange rates reported in the Barcelona and Bruges money markets around the turn of the XVth Century. Our exchange-rate data are from the records of Francesco di Marco da Prato & Co., a Florentine merchant bank, and were compiled by de Roover (1968). We consider the possible roundtrip transactions between the two cities that originate in both Barcelona and Bruges. On an annualized basis we find that the gross profit associated with these transactions to be relatively volatile and, on average, ranged from 13% to 14%, with transactions costs amounting to about one percentage point. Our gross profit estimate is similar in magnitude to that reported by de Roover (1963, pp 116-121). It is also similar to the short-term commercial loan rates reported by Homer and Sylla (1996, pp. 103 and 110) that were in effect in Europe in the XIVth and XVth centuries.

2. Economic Background

Beginning in the late Middle Ages and extending into the Renaissance one type of money was exchanged for another in one of two ways. The first was manual or petty exchange and involved the exchange by using a money-changer at a local bank. The exchange could not only involve foreign and domestic coins but also foreign only or domestic only coins. According to Booth and Gurun (2007) money-changers were savvy bankers who understood the impact of exchange rate volatility on their profits. Eventually an accounting system was developed that eliminated the need to physically exchange coins but instead allowed the exchange to be recorded by book transfer. Goldthwaite (1985), however, indicates that, although the actual transfers are well-documented, the recording of profits was purposely opaque, presumably in order to camoflague any interest that may have been earned. Usher (1943, pp. 3-25), among others, posits that the book transfer approach to exchange was the genesis of deposit banking.

The second type of exchange involved the financing of international trade. In this case, merchant bankers traded in foreign

exchange by using bills of exchange. These bankers worked through branch and partnership networks and dealt with the public through an extensive network of independent brokers. Trustworthy partners were necessary because someone had to honour a bank's bill and it was not economical to have a branch in every market. Typically the partners shared the same heritage so that Florentines partnered with Florentines, Lucchese with Lucchese and so forth[1]. Communication within these networks was typically accomplished by written correspondence using couriers. Some companies had their own couriers, while others shared a common post. Goldthwaite (1985) points out that it was not uncommon for a merchant bank to own a local bank, although the two units were separate legal entities[2]. For instance, Francesco di Marco da Prato & Co., in addition to having a merchant bank office in Florence, opened a local bank in the same city in 1400, although it closed two years later.

The profit from dealing in bills of exchange was determined by the spread between the exchange rate in the market where the bill was initiated and the market where the bill was payable. This spread was influenced by not only the interest rate but also changes in either market's monetary standard, changes in the balance of trade, speculation, and government regulations[3]. Because all the major

[1] Within each city strong social networks most likely prevailed. For example Wasserman and Faust (1974, pp. 254-262 and 657-658) report that XVth century Florence was characterized by business and marital ties among the families of the social elite

[2] de Roover (1948, p. 345) makes a clear distinction between merchant bankers, money-changers and pawnbrokers (typically Cahorsins, Jews and Lombards). Others, however, believe that the difference is not as clear cut. For example, Blomquist (1985) reports that in the XIIIth century Lucca all three types engaged in each other's business to some extent.

[3] According to de Roover (1948, p. 63), because distance and time are correlated, the spread tended to be positively related to the distance between the markets. Garbade and Silber (1979) illustrate this phenomenon in a XIXth century context. During this century the value of the dollar was not the same throughout the U.S. They show that the establishment of a telegraph connection between New Orleans and New York in 1848 increased the speed of communication between the two cities, which, in turn, led to a significant narrowing of the inter-market dollar price differences in bills of exchange.

money markets were interdependent as a result of merchant bank networks, shocks emanating from these other markets also influenced the spread[4]. As a result, de Roover (1948, p. 63) points out, the spread was highly volatile and sometimes negative. Moreover, according to de Roover (1968, p. 76), banks operated in the very short run, often measured in terms of weeks. The successful merchant banker, therefore, was an entrepreneur who was shrewd, knowledgeable, and skilled in accounting techniques and commercial mathematics[5].

Bills of exchange fell into three categories: merchant, dry and fictitious. Merchant exchange bills served to facilitate physical trade of goods and used market exchange rates. Dry exchange bills were similar to merchant exchange bills but were not associated with actual trade and, thus, were a pure financial transaction. Finally, fictitious exchange bills were those that were never sent abroad but kept on file for auditing purposes or those that were based on stipulated exchange rate values.

At this point it is natural to wonder why bills of exchange were used in cases where it might have been more straightforward to borrow or lend at an agreed rate of interest. The answer involves usury and the Roman Catholic Church. Throughout the first millennium, the received doctrine of the Church was that a loan was a gratuitous contract and any payment to the lender other than the return of principal was usury and usury was a sin. Loans during this period were typically made for consumption or agricultural purposes. That usury was a sin is based on the belief is that it is improper to take advantage

[4] Using exchange rate data from the first quarter of 1395 to the third quarter of 1410, Sardy (1968, pp. 96-97) reports that many of the exchange rates reported in Barcelona exhibit several significant correlations with each other. The same phenomenon holds for all the exchange rates reported in the Bruges market.

[5] Formal education in these skills was provided in "reckoning" schools, an institution that Poitras (2000, p. 28) suggests is a precursor to the modern business school. Although probability was not formally "discovered" until the XVIIth century, it is likely that its intuition was taught in these schools.

of a neighbour in distress. As Reed and Bekar (2003) point out, the Church appears to have believed that distress should be alleviated by charity (giving without the expectation of reciprocity) or pooling (giving or receiving with the expectation or reciprocity). Numerous biblical exhortations (e.g., Exodus 22:55, Deuteronomy 28:19-20, and Luke 6:35) proclaim this moral position[6].

By the XII[th] century, however, the European manorial society had evolved into a mercantile economy. As part of this process, canonists and theologians grew to understand that commercial credit was important to a society's economic well-being and that international credit mechanisms were necessary to facilitate trade as well as the transfer of papal monies. With this understanding came financial innovation, along with rationales (some being more convincing than others) demonstrating that these innovations were not usurious. A distinction was also made between usury and interest. Interest became viewed not as a gain to the lender but instead as compensation for damages associated with not having access to his funds and only excessive interest charges were considered usurious[7].

One of the most important innovations was the bill of exchange. Its proponents argued that because the profits involving bills of exchange depended on exchange rates whose values were not known at the initiation of the roundtrip contracts, the transaction involved risk. Thus, a bill of exchange could not be a loan. Because it was not a loan, the transaction was not subject to usury restrictions. Thus the Church's usury doctrine combined foreign exchange and money instruments into a single market. Under this line of thought,

[6] This is an application of the Golden Rule: Do not do unto others what you would not have done to you. Armstrong (2000, pp. xii-xiv) points out that this principle evolved during the Axial Age (900 to 200 BCE) and influenced, in addition to Christianity, the other major religions of the world including Confucianism, Daoism, Hinduism, and Judaism. Buckley (2000, pp. 187-190) reports that Islam also prohibits usury, and she notes that the revelations in the Qur'an indicate a concern for the borrower.

[7] Homer and Sylla (1996, p. 73) point out that the word interest is derived from the Latin verb *intero*, which means "to be lost".

the merchant and dry exchange contracts were licit, although the latter's legitimacy was sometimes questioned. The fictitious bill of exchange, however, was illicit because the profit was predetermined.

3. Exchange and Re-exchange Terms and Mechanics

A bill of exchange was a forward contract that transferred a monetary obligation from one market to another at a known rate of exchange. The contract's terms include its face value in one currency and the rate of exchange into a second currency. Also included are the parties involved with the transactions and the date of issuance. There were four legal parties: (1) the deliverer or lender, (2) the taker or borrower, (3) the payor, who was the correspondent of the borrower, and (4) the payee, who was the correspondent of the lender. Each of the parties may be separate entities but this was not required. For example, de Roover (1963, p. 133-134) points out, in the case of dry exchange it was common that in the first leg that the payor and payee were the same and in the second leg that the borrower and lender were the same. The bill's maturity date depended on the date of issuance and its usance. Usance, the time allowed by custom for payment, varied by market. According to da Uzzano's (1442, pp. 100-102 and 134-141) manual of merchant practices, usance was commonly a standard amount of time from the date the instrument was issued. For example, the usance between Bruges and all of the Italian markets was two months from date. The usance between Bruges and Barcelona, however, was 30 days from sight. Thus, in this case, the time to payment was determined by the amount of time that it took for a courier to travel between the two cities and present the bill for acceptance.

We present a sample bill of exchange in *Exhibit 1*. This bill documents that Giovanni Orlandini and Piero Benizi & Co. (taker) borrowed 600 écus from Jacopo Gosco in Bruges on December 12, 1399. Orlandini and Benizi & Co. ordered that this amount be paid to Domenico Sancio (payee) in Barcelona at usance using the exchange rate of 10 sous and 5 deniers per écu, where the écu is equal to 22

groats[8]. The bill was accepted by Francesco [di Marco] da Prato & Co. (payor), one of Orlandini and Benizi & Co.'s correspondents, on 11 January, 1400. Thus, da Prato & Co. was obligated to pay Sancio the amount owed 30 days from the acceptance date. It is likely that this transaction was handled on 10 February, 1400 by da Prato & Co. debiting Orlandini and Benizi & Co.'s account with them and crediting Sancio's account. Thus, from beginning to end the transaction took 60 days.

Because bills of exchange were honoured in a foreign market they were one-way contracts. The deliverer, however, may have found this unacceptable because he may have needed his funds to be in the city where he was located. This was rectified by simply initiating a second bill of exchange in the foreign market that redirected the funds to the desired location. It was the use of the two bills to create a roundtrip transaction that not only permitted lenders to charge, de facto, interest for the credit they extended but also made the transaction licit. This is because at the time the first bill was initiated the rate of exchange associated with the second bill was not known and was subject to market forces.

To illustrate how bills were used in an exchange and re-exchange transaction, let us consider the case of a dry exchange. Suppose that a Barcelonese merchant wants to borrow 600 deniers from Francesco di Marco da Prato & Co. The merchant (the taker) originates a bill of exchange that named da Prato & Co. the deliverer. The bill is payable at usance in Bruges at the current Barcelonese exchange rate of five

[8] The Carolingian Monetary Reforms (790-802) resulted in a counting system based on dozens and scores of dozens. This system is a combination of the Celtic-Gallic and the Babylonian-Greco-Roman traditions of using 12 and of 20, respectively, as counting bases. Thus, 12 deniers (d.) equal one sou (s.), and 20 sous equal one Barcelonese pound (£). Similarly, 12 groats (d. gr.) equal one shilling groat (s. gr.), and 20 shilling groats equal one Flemish pound groat (£ gr.). Over time other counting conventions emerged, some of which are inconsistent. For example, in Bruges, the Barcelonese exchange rate is quoted with an écu (being equal to 22 Flemish groats. The English pound sterling rate, however, is quoted on the basis of an écu equaling 24 Flemish groats. See Spufford (1988, particularly pp. 397-414) for a discussion of medieval monetary systems.

deniers per groat, which amounts to 120 groats. The bill is delivered to one of da Prato & Co.'s correspondents in Bruges who is named as the payor, say, Orlandini and Benizi & Co., and who will also serve as the payee. At usance the bill is considered paid and Orlandini and Benizi & Co. originate a second bill for which it is the deliverer and the taker. The bill indicates that da Prato & Co. is the payee and the Barcelonese merchant who originated the first bill of exchange is the payor. The terms of the second bill are that in Barcelona at usance 120 groats are to be converted to deniers at the current Bruges exchange rate of six deniers per groat. Thus, the Barcelonese merchant settles his original 600 denier debt to da Prato & Co. for 720 deniers, thereby earning da Prato & Co. a profit prior to any transaction costs of 120 deniers or 20%. If we reverse the example and initiate the first bill of exchange in Bruges instead of Barcelona and the exchange rates remain the same, the profit to the Bruges lender is also 20%. Thus, in both instances, it is the difference between the two bills' exchange rates that determines profitability. A profit is made as long as the denier-groat exchange-rate in Barcelona is smaller than in Bruges.

4. Data

Our database contains exchange rate citations that were recorded in the business records of Francesco di Marco da Prato & Co., which cover a 27 year span beginning in 1384. da Prato & Co. had a branch in Barcelona but relied on correspondents in Bruges to handle their business in that market. Many of the records, then, consist of letters from the firm's correspondents in Bruges, with the majority coming from the Giovanni Orlandini and Piero Benizi & Co[9]. Because he did

[9] Based on the unusual handwriting, de Roover (1968, p. 76) believes that most of the letters were written by Piero Benizi, who was the manager of the bank's Bruges branch. Handwriting played an important role in the bill market because it was used to determine the authenticity of the bill. Before being accepted for payment, the bill's script was compared to a handwriting sample that was on file.

not have a legitimate heir, da Prato, sometimes called by his family name, Datini, willed his papers to the Ceppo di Poveri Foundation along with an endowment to preserve them[10]. These records, which are archived in Prato and are typically referred to as the Datini papers or records, consist of routine business correspondence that often had a notation at the bottom indicating the exchange rate between the monies of the cities of the sender and receiver. These exchange rates were based on leaflets that were distributed by brokers to their customers. The exchange rate listed either reflected a current transaction or an assessment by a broker of the best estimate of the prevailing rate. It was the function of the brokers to intermediate between the buyers and sellers of the bills of exchange.

The Datini records contain exchange-rate data for the Barcelona and Bruges markets. The Bruges market was called the *Place del la Bourse* (Flemish) and was named after the van der Beurse family, who not only were brokers but also owned an inn that was adjacent to the physical marketplace. The Barcelona market was referred to as the *longja de cambios* (Spanish) or *iltotja de cambis* (Catalonian). This market still serves as the home to the Barcelona Stock Exchange. Bills of exchange using eight different exchange rates were traded on the Barcelona market and five were traded on the Bruges market. The Barcelona data cover the period beginning on 11 October 1386 and ending 20 September 1408. The corresponding dates for Bruges are 29 August 1384 and 8 June 1411. However, because we are concerned about the profitability of a roundtrip contract, we are only interested in the exchange rate between the Barcelonese denier and the Flemish groat in both markets. In both markets the exchange rate was expressed in sous and deniers in terms of one écu, indicating that Bruges was the head of the exchange. For computational purposes we express the exchange rate in both markets in terms of deniers per groat.

[10] According to de Roover (1968, pp. 27-28), most of the merchant bankers operating in Bruges were Italian. However, some of these bankers were more engaged in business and others were more engaged in banking. It was the Florentine merchant bankers that focused more on banking.

Our working data sample begins 1 September 1390 and ends 31 December 1408. These dates fall within the available data set and, according to de Roover (1968, pp. 51 and 73), define a period in which there were no changes to the Bruges' monetary standard. The exchange rates are recorded at irregular dates. Often there are large and irregular lapses of time between observations and infrequently there is more than one observation on a given day. The former may be because of spotty correspondence or because records have been lost or not properly archived. Missing records for whatever reason is the most likely explanation[11]. The latter is caused by receiving multiple letters in a day, which is the result of da Prato & Co. having more than one correspondent. We resolve this difficulty by taking the arithmetic average so that there is only one observation per day. Three days fall into this category for Barcelona and 50 for Bruges. We end up with 463 exchange-rate observations for Barcelona and 680 for Bruges.

5. Measuring Exchange Profitability

To measure potential profitability we construct hypothetical roundtrip transactions that are initiated in both markets. These transactions are constructed, for example, by pairing an exchange rate observation in time t in Barcelona with an observation in time $t + u$ in Bruges. In this example, the bill of exchange is initiated in Barcelona and payable in Bruges. Later (u days), this contract is honoured and a new bill of exchange is initiated in Bruges and is payable in Barcelona. As indicated in Section 3, the value of u depends on the travel time between the two markets and the bill of exchange's sight provisions. Although da Uzzano (1442, p. 103) suggests that the trip could be covered in 19 to 20 days, de Roover (1968, p. 22), reports that the Datini

[11] Origo (1957), p. vi reports that the Datini papers were lost for at least 300 years and were found "... in sacks in a dusty recess under the stairs" in his home in Prato, a Florentine satellite city.

papers indicate that the trip normally was completed in 22 or 23 days and there were often delays. Moreover, our actual bill of exchange that is displayed in *Exhibit 1* shows that it took 60 days to complete a one-way transaction that originated in Bruges and was completed in Barcelona. Thus, it is not unreasonable to believe that u may be as low as 50 days and as high as 60 days or more and that it varies by transaction.

We create our hypothetical transactions by selecting one of the two markets to be where the roundtrip was initiated. We use this procedure to match the exchange rate at day t in this market with the other market's rate in $t + u$, where u represents the usance of the first leg of the roundtrip. We permit u to range from 50 to an upper limit, which we denote as U. Our algorithm first sets u equal to 53, which represents 23 days in travel time and 30 days after sight. If there is no match, u becomes 54. If there is still no match, u equals 52. Given the preset boundaries, we continue until either a match is obtained or u is equal to 57. If the latter obtains, u continues to increase by one until U is reached. If there is no match the initial exchange rate is discarded and the next exchange rate in the time sequence is selected and the algorithm begins again.

We execute the algorithm for U equal to 65 and 70. We choose these values because they represent sensible values for the upper limit as well as providing a credible number of matches. By construction, all of the observations in the $U = 65$ sample are contained in the $U = 70$ sample. As we report in *Table 1*, if U equals 65, there are 19 matches if the bill of exchange originates in Barcelona. The average u is 61.2 days. If the bill is initiated in Bruges, there are 33 matches and the average u is 59.8 days. Increasing, the upper limit by five to 70 days noticeably increases the number of matches. In this case, the number of matches is 50 and 97 for Barcelona and Bruges, respectively. The corresponding values for the average u are 65.8 and 65.5 days. Thus, the magnitude of the average usance for both values of U is close to the usance implied by the actual bill of exchange that we illustrate in *Exhibit 1*. We calculate trading profits assuming that the initiator of the bill is the lender (deliverer) with and without transaction costs. If the

initiator is the borrower (taker), our calculation results in the cost of borrowing. For convenience we adopt the perspective of the lender. As we discuss in Section 3, gross profits are determined by the spread between the exchange rates in Barcelona and Bruges. More formally, let *Ba* and *Br* represent the exchange rates in Barcelona and Bruges, respectively. If the roundtrip transaction originated in Barcelona, the gross percentage profit, PBa_{t+u}, earned in period u is $100(Br_{t+u}-Ba_t)/Ba_t$, where t is the time that the first bill of exchange is initiated. Similarly, if the transaction originated in Bruges the profit earned, PBr_{t+u}, is $100(Br_t-Ba_{t+u})/Ba_{t+u}$. These transaction returns are not comparable because the usance is not the same for each of the hypothetical roundtrip transactions. We remedy the lack of comparability by annualizing the percentages by assuming that 53, the initial value of our matching algorithm represents the likely usance of the second leg of the roundtrip transaction. Thus we multiply each return, PBa_{t+u} and PBr_{t+u}, by $365/(u + 53)$[12].

6. Exchange Profit Estimates

We present our roundtrip profit results in *Table 1*. The results for the $U = 65$ and $U = 70$ samples are similar for both markets. There are, however, instances of negative profits in the $U = 70$ samples for Barcelona and Bruges. This phenomenon is not present in the $U = 65$ samples. Because of the similarity of the results and because the number of hypothetical transactions is noticeable larger in the $U = 70$ samples, we focus on the $U = 70$ sample results.

From the perspective of a lender in Barcelona the average roundtrip transaction trading profit is 12.8% per year and for the 50 hypothetical transactions in our sample profits range from -5.0% to 39.7%. In Bruges

[12] There are two competing ways to view the nature of the length of time that the money was in use. First, u represents a realistic estimate of the actual number of days between the bill's date of issuance and its payment. Second, the usance is always approximately 53 days. If this is so, the exchange rate at $t + u$ is a good estimate of the exchange rate at $t + 53$.

the trading profit ranges from -7.4% to 48.8% and averages 14.3% for the 97 roundtrip transactions. Recall that the trading profit includes compensation for extending credit. Thus a negative return indicates that the impacts of the other factors that affected the spread between the Barcelona and Bruges exchange rates were severe. This occurs in 2.0% of the cases for roundtrip transactions originating in Barcelona and 5.2% for those beginning in Bruges. The Sharpe Ratio, a performance measure that, assuming that the risk-free rate is zero, is the mean return divided by the standard deviation, is 1.2 Barcelona and 1.4 for Bruges. Both the mean and the range of the Barcelona and Bruges trading profits are very similar to the values reported by de Roover (1968, pp. 116-121) for bill of exchange transactions between Bruges and Venice and Venice and London[13]. Nevertheless, our results are always calculated from the perspective of the lender (borrower) and this need not be the case. After all, the merchant bankers were savvy businessmen who were acutely aware of money-market conditions. In fact, they sometimes indicated in their business correspondence whether the conditions were easy (*larghezza*), tight (*strettezza*) or changing (e.g., getting tighter (*ristretto*)). It is highly likely that merchant bankers used this information and followed da Uzzano's (1442, p. 153) advice and borrowed when there was a surplus of loanable funds and lent when there was a shortage. Nevertheless, because of exchange-rate volatility, it was difficult to be able to time the market and reap the corresponding profits. To the extent that the bankers are able to do so, however, our profits estimates are understated. Although the Datini data provide some indication of whether the money markets are tight or easy, there are too few entries to use this information as part of any meaningful empirical analysis. Thus, we resort to assuming that the merchant banker made the correct

[13] Our results are qualitatively the same as we report if we assume the roundtrip usance to be either 106 (twice 53 days) or $2u$ (twice the usance of the first leg) instead of u + 53. For example, for the former the mean return is 14.4% and for the latter is 11.8% for transactions originating in Barcelona. For those originating in Bruges the corresponding figures are 15.9% and 13.1%.

financial decision and declare that if a roundtrip transaction's profit is positive, the banker is the lender and if it is negative, he is the borrower. Under this scenario, the profit (cost) associated with a lending (borrowing) transaction originating in Barcelona is 13.0% (5.0%). The corresponding lending (borrowing) profit (cost) for Bruges is 14.9% (4.1%). The profit estimates associated with lending are only marginally higher than our initial results and the cost of borrowing percentages are probably unreasonably low. Because the number of negative returns is relatively small, these results can only be considered suggestive.

Gross profits ignore transaction costs, which include brokerage fees, taxes and various administrative expenses. What remains after deducting these costs is the opportunity cost of money and the compensation for associated credit and other risks. Customary broker fees were usually published in merchant manuals, but data concerning the administrative and other costs are very scarce. Biscaro (1913), however, provides income data showing that in 1436 the total of these transaction costs amounted to 10.3% of the profits on exchange for Filippo Borromei & Co. Applying this cost percentage to our trading profit results indicates that the average roundtrip profit after accounting for transactions costs for transactions originating in Barcelona is 11.5% and in Bruges is 12.8%.

To put the Barcelona and Bruges risk and return results in a modern perspective, we compare them to similar statistics for the U.S. prime commercial paper rate during the 1975-1996 period and the Standard & Poor's 500 implied stock returns in 1975-2006. Commercial paper is used by businesses to facilitate short-term credit. Stock is associated with long-term financing, which may take the form of permanent short-term credit. For commercial paper we use the monthly observations of the 3-month annualized rate. This specific rate is used because its maturity is the closest to the roundtrip usance between Barcelona and Bruges. For stock we create an analogous series using monthly observations of the Standard & Poor's 500 index to calculate the annualized rate of return associated with buying a stock and selling it three months hence.

The commercial paper rate averaged 7.7% had a Sharpe Ratio of 2.5. In contrast, the mean return of the Standard & Poor's 500 stock index for January 1975 to March 2007 was 9.0% and its Sharpe Ratio was 0.3[14]. Thus, the trading profits associated with the bills of exchange originating in Barcelona and Bruges are not dissimilar to those associated with modern markets. Although the average return for these bills is somewhat higher than that for commercial paper or stock, the gap is not unreasonably large and may simply reflect cyclical or other differences in the demand and supply of loanable funds. A more important observation is that the return per unit of risk for the bills falls in the middle. Thus, in terms of being compensated for risk, Barcelona and Bruges bills are less risky than U.S. stock but more risky than U.S. commercial paper[15].

7. Concluding Remarks

de Roover (1948, p. 13) points out that the creation of the bill of exchange plus the development of sophisticated accounting techniques by the Italians gave them a virtual monopoly on trade in Western Europe throughout the early Renaissance. Italian merchant bankers used bills of exchange to adjust their international balances and often used them to exploit any arbitrage opportunities present in the markets. They also used them to extend credit not only to their own business customers but also to other merchants.

In the case of credit, bills were used instead of a traditional loan in order to avoid the charge of usury, although using bills for this purpose

[14] We obtained the Standard and Poors data from Yahoo! Finance (http://finance.yahoo.com) and the U.S. prime commercial paper rates from the Federal Reserve (http://federalreserve.gov). The commercial paper rate was not reported from 1997 onward. Instead, it bifurcated into financial and non-financial paper. From their inception until March 2007, the mean of the two new commercial paper series was 3.9% and their Modified Sharpe Ratio was 2.1. These data are from the St. Louis Federal Reserve Bank (http://alfred.stlouisfed.org).

[15] We find qualitatively similar results for when we use 6-month commercial paper and stock returns, assuming a four month holding period. The former is consistent with a roundtrip usance of 180 days and the latter with 120 days.

was sometimes viewed by Church authorities as being suspiciously close to usury[16]. In response bankers routinely sought new loopholes to exploit as soon as the old ones were closed by the Churchmen. Nevertheless, the Church was a good customer and the threat of excommunication was always present. Thus, usury was not taken lightly by the merchant bankers. For example, Origo (1957, pp. 157-159) reports that Francesco da Prato, the owner of the previously mentioned Francesco di Marco da Prato & Co. merchant bank, maintained that he never earned illicit profits. In fact, his correspondence shows that he once severely rebuked one of his branch managers for making a questionable foreign-exchange transaction. Using a database that has not been fully exploited and a measurement approach new to this application, we find that the trading profits for dealing in bills of exchange are, on average, 12% to 13% for transactions originating in Barcelona and 13 to 14% for those originating in Bruges. Accounting for transaction costs reduces these percentages by approximately one percentage point. Moreover, in each of these markets the returns are highly volatile. Our empirical results are very similar to those reported by de Roover (1963, pp. 116-121), who used actual instead of hypothetical transactions and did not account for transaction costs. From the perspective of the lender these profits are compensation but for the borrower they are the cost of borrowing. Because the Church's proclamations on usury effectively tied the cost of short-term to volatile exchange rates, raising funds by selling bills to finance trade was very expensive and risky. As de Roover (1963, p. 121) points out, the Church's usury doctrine did the opposite of what the Church intended. Using bills instead of interest-bearing loans to raise money did not protect the businessman. Instead, it subjected him to higher financing costs. Lane (1966, p. 68), however, argues that, at least in the case of Venice, usury restrictions tended to encourage wealthy individuals to

[16] In 1429 a law was passed in Florence that outlawed "dry exchange". The law was suspended in 1431 and repealed four years later. de Roover (1963, p. 135) suggests that the law was never resurrected because it was not in the interest of Florence's leading bankers.

direct their monies toward commercial loans rather than consumer loans. He concludes that insofar as it was effective, the usury doctrine stimulated economic growth. Whether restrictions on usury are good or bad is still being discussed by economists, politicians and others. This is not surprising as judgment depends on spiritual beliefs.

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Appendix

Foreign-Exchange Profits in Two Early Renaissance Money Markets

EXHIBIT 1. A sample bill of exchange that originated in Bruges and was paid in Barcelona

This sample is an Italian – to English – translation by de Roover of an original document (no. 1146) in the Datini Archives. The words within the brackets are added by de Roover for clarification. "Verso" indicates that the writing that follows is on the back of the document. The sample in its original Italian is also provided by de Roover (1948, p. 56). The Italian version shows that the year of acceptance is 1399. This is because at that time the Florentines used the Incarnation calendar in which the calendar year begins on March 25 instead of January 1.

Source: de Roover (1948, p. 72).

In the name of God, amen. December 12, 1399

Pay at usance by this first of exchange to Domenico Sancio six hundred écus at 10 s. 5d. [barcelonese] per which 600 at 10s. 5d. per écu are for value received [here] from Jacopo Gosco, and charge them to our account. God be with you.

Giovanni Orlandini and Piero Benizi & Co. in Bruges

TABLE 1. Annualized trading profits for roundtrip bill-of-exchange transactions between Barcelona and Bruges, 1390-1408

This table contains the annualized trading profits in percent for hypothetical bill-of-exchange transactions using actual Barcelona and Bruges exchange-rate data from de Roover (1968, pp 105 – 154). For bills originating in Barcelona the roundtrip transaction profit is $PBa_{t+u} = 100(Br_{t+u} - Ba_t)/Ba\ t$ and in Bruges is $PBr_{t+u} = 100(Br_t - Ba_{t-u})/Ba_{t+u}$, where PBa (PBr) is the gross percentage transaction roundtrip profit for a bill originating in Barcelona (Bruges) at day t and u is the usance (in days) between the two markets for the first leg of the roundtrip transaction. The usance for the individual transactions ranges from 50 to U days, with U equaling 65 or 70. PBa_{t+u} and PBr_{t+u} are annualized by dividing them by 365/(u + 53).

	Originating in Barcelona		Originating in Bruges	
	U = 65	U = 70	U = 65	U = 70
Trading Profits (%)				
Maximum	36.9	39.7	44.6	48.8
Mean	12.0	12.8	18.2	14.3
Minimum	0.0	-5.0	4.2	-7.4
Standard Deviation	11.1	10.3	10.0	10.5
Mean usance (days)	61.2	65.8	59.8	65.5
Number of observations	19	50	33	97

problems

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