Transparency, Contract Selection and the Maritime Trade of Venetian Crete, 1303-1351

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Abstract

The paper explores how merchants enabled long-distance trade in the Mediterranean before and after the Black Death. The Black Death disrupted the flows of information about commercial prospects upon which merchants depended for deciding when, where, and in which commodities to trade. With the emergence of plague, merchants lost contacts and agents in geographically dispersed markets, and they were not in a position to immediately ascertain the damage to their informational capital. No less importantly, the disruption of information impinged how merchants contracted the services of trading agents. Using agents enabled merchants to distribute their investments and managerial energies across portfolios of ventures that networks of agents could conduct simultaneously in geographically dispersed markets. Even so, agency introduced a problem of asymmetric information that impinged the design of agency contracts. Agents might cheat merchants by misreporting transactions – transactions that merchants could neither observe nor verify. In information-rich environments, merchants could effectively monitor agents and so could afford to finance the activities of their agents through contracts featuring risk-sharing. In information-poor environments such as the one attending the Black Death, merchants could no longer monitor their agents and had to resort to simple debt contracts – contracts that denied risk-sharing but also denied agents the opportunity to cheat.

[†] The views expressed in this paper do not necessarily reflect those of the US Department of Justice.

I Introduction

Business historians agree that by some point of the 10th century Western Europe had commenced an economic revival that persisted into the early 14th century. "Revival" implies that the economy had experienced decline before the 10th century, yet sorting out when and how decline occurred turns out to be a tricky matter. Denying that there was any decline might be like denying that Elvis died in 1977. Even so, the evidence of decline in the Middle Ages is circumstantial. Ideas about the factors that may have prompted decline – factors such as climate change, plague, and invasions – may abound, but these ideas have yet to be crafted into testable hypotheses, and, indeed, historians may never be able to assemble data they would need to operationalize and test most hypotheses.

To be sure, Western Europe experienced protracted and, perhaps, fitful economic decline at one or more stages between the fragmentation of Roman control of the Western Mediterranean in the 4th and 5th centuries and the eventual consolidation of most of the Mediterranean under Muslim control by the 9th century. The extent to which the fragmentation of Roman authority itself contributed, if at all, to commercial decline remains poorly understood, and, more generally, no one has sorted out the dynamic structure of decline through the Early Middle Ages. (See, for example, Pirenne 1925, Luzzatto 1961, Lopez 1971, Anderson and Lewit 1992.) Henri Pirenne had long ago advanced a formidable, if not widely accepted argument that the sequence of Muslim conquests in and around the Mediterranean in the 7th and 8th centuries had incrementally disabled trade between the Eastern and the Western Mediterranean. As the story goes, the Muslim conquests effectively partitioned the Mediterranean, thereby denying suppliers in the West the opportunity to provision Constantinople as well as cutting the West off from the

currents of the longest distance trade connecting India and the Far East to the Mediterranean. The vitality of the currents of intercontinental trade may very well have sustained the vitality of intra-Mediterranean trade currents. The Pirenne thesis amounts largely to suggesting that the destabilization of East-West trade routes in the Mediterranean forced the Frankish kingdoms of the West to fall back on their own resources and that falling back denied gains from trade.

Why Muslim raiders would not have converted themselves into traders and enabled themselves and their counterpart Christian traders to realize gains from trade is not a matter explored here. In a Coasean world of zero transaction costs, externalities get internalized, Muslim raiders get paid off, and profitable deals get made. Rather, the first point of this paper is simply that the mechanisms and exogenous factors that prompted decline and stimulated revival remain poorly understood. One thing business historians agree on, however, is that commercial practices of the Late Middle Ages enabled the revival of trade. Principally, historians have asserted a role for the technology of contracting in enabling long distance trade in the Late Middle Ages. (See, for example, Pirenne 1925, pg. 110; de Roover 1963, pg. 43; Lopez 1971, pg. 73; Kedar 1976, pg. 25; and Hunt and Murray 1999, pg. 55.) By the middle of the 1970's historians had synthesized from a century of archival research a thesis about how contracting practices enabled an expansion of trade in the Mediterranean. The kernel of the argument is that commercial contracts enabled the functionaries of trade to share risk and, in turn, to realize gains that a risk-averse agent operating alone with his own resources would have passed up.

In the 10th century the principal functionaries of trade were investors and trading agents. In the historical literature, investors are often labeled "merchants," but we can understand them as the

providers of capital and managerial energies. Trading agents provided labor as well as some managerial inputs of their own. Contracts joined an investor and a trading agent in a trade venture. In classical terms, a trade venture constituted a production technology that transformed the inputs of the investor and trading agent into a payoff. Typically, an investor advanced to the agent financing or other capital, the agent would travel to geographically dispersed ports to trade on the behalf of the investor, and the agent would return to the home port often with cargoes of commodities acquired abroad for re-export or for local distribution. The agent would account to the investor the net gain or loss from the entire round-trip venture, and the two parties would share the return according to some sharing rule. The return was stochastic and so implicated the risk preferences of the contracting parties.

Risk and risk-sharing alone are not what made trade ventures and the contracting technology interesting. Rather, a problem of asymmetric information that attended the use of agents introduced a contract design problem that has only been partially explored and partially understood in the historical literature. Contracting the services of agents enabled investors to deal with the geographic indivisibility of labor. Investors could, and often did, provide the services of a trading agent themselves, and, indeed, this is how much commerce had been organized up to the 14th century. (Lane 1973, pp. 48-50; Hunt and Murray 1999, pp. 54-57; de Roover 1963, pp. 42-43) "Itinerant merchants" tied up their time, finances, and managerial energies in single ventures; without agents they could not simultaneously participate in other trade ventures. Employing agents could enable investors to manage risk by diversifying their investments across a portfolio of ventures. At the same time, however, employing agents introduced a problem of asymmetric information. An agent would conduct transactions on

behalf of the investor in overseas markets. The investor could neither observe these transactions nor verify an agent's account of transactions at the termination of a trade venture. Accordingly, an agent might misrepresent transactions and expropriate part of the return that the agent otherwise would have rendered to the investor.[1]

The agent's ability to profit by misrepresenting transactions would depend on the way in which the investor and agent shared risk. Very often, investors advanced financing to agents under the terms of simple debt contracts. The agent would guarantee a fixed payoff to the investor – principal plus interest – and would bear all of the commercial risk. Such contracts denied the contracting parties the advantages (if any) of risk-sharing, but debt contracts also neutralized any advantage agents could gain by misrepresenting transactions. An agent could very well lie about the outcome of a venture, but the payoff to the investor remained invariant to the agent's report. At the same time, investors and agents often crafted terms of contract that featured simple, linear sharing-rules. Investors and agents often committed to share gains or losses equally or in proportions such as three-quarters and one-quarter or two-thirds and one-third. Under these contracts an agent could profit by under-reporting gains and losses and pocketing the difference. How could investors protect themselves from expropriation?

The use of debt contracts and contracts featuring risk-sharing demands a theory of contract selection, and it demands a theory that accommodates problems of asymmetric information. The historical literature does not provide a complete thesis according to which we might understand

[1] Some literature on contracting recognize this problem of asymmetric information as a problem of *ex post* adverse selection. "Adverse selection" constitutes a generic and, perhaps, somewhat misleading label for agency problems in which the agent privately knows or receives a private signal of some payoff-relevant information. The label "*ex*

the selection of contracts, but over many decades historians have developed a thesis that provides a way of understanding how and why contracting parties would use contracts featuring risk-sharing. Indeed, these contracts, known generically as *commenda* in the historical literature, are featured in a larger thesis about how contracting practices enabled the functionaries of trade to mobilize investment in trade in and around the Mediterranean in what later historians have come to call the "Commercial Revolution." (Lopez 1971)

The historical thesis joins concepts of trust and risk-sharing in explaining the role of *commenda* in enabling the revival of trade of the Commercial Revolution. Historians have been sensitive to the prospect that agents retained under the terms of a *commenda* contract might cheat their investors. The principal conclusion of the literature on this count is that investors could resort to *commenda* contracts if they could hire honest agents (Lane 1964, de Roover 1963, Lopez and Raymond 1955) or family members (Byrne 1916). Investors could, of course, trust honest agents to report gains or losses honestly, and family bonds, presumably, would again encourage agents to render truthful reports. The next part of the thesis indicates how *commenda* enabled an expansion of trade. The idea is that contracts featuring risk-sharing enabled contracting parties to participate in ventures yielding the most uncertain returns. (See, for example, Lane 1973a, pg. 139, Kedar 1976, pg. 25.) For example, in characterizing contracting practices in the 13th and early 14th centuries, both Lane and Kedar distinguish between ventures conducted within a physically secure "inner-core zone" conforming to most of the Eastern Mediterranean and an "outer zone" conforming to the fringes of the inner-core and beyond into India and Central Asia. Agents venturing beyond the inner-core would have faced both greater physical hazards and

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post" is intended to indicate that the agent receives his private signal *after* the investor and agent have had to

greater uncertainty over the availability of commercial prospects. During the earlier part of the Commercial Revolution *commenda* served the same function in the inner-core when it itself was subject to the same type and degree of hazard associated with the outer-zone in the latter part of the Commercial Revolution.

Taken together, trust and risk-sharing enabled the functionaries of trade to realize gains that risk-averse parties would have otherwise foregone. Two difficulties with this thesis are 1) it does not explicitly address the trade-offs (if any) encountered in choosing *commenda* over debt contracts or vice-versa and 2) it is motivated by heavy interpretations assigned to no more than two anecdotes that have been heavily cited in the literature. The first anecdote relates to the experiences of the Venetian Giovanni Loredan in India. Lopez (1943) indicated that in 1338-1339 Giovanni Loredan ventured to India via the Black Sea with financing provided by family members by *commenda* contracts. This example of traveling to the "outer zone" under a *commenda* has been presented in Lopez (1943, 1951, 1955, 1971), Lopez and Raymond (1955), Lane (1973a), and Kedar (1976) as evidence of the role of the *commenda* in enabling long distance trade. Meanwhile, Kedar (1976) and Lopez (1951) indicate the venture of the Genoese Benedetto Vivaldi in 1315 to India under the terms of a *commenda* contract as further evidence. Kedar (1976, pg. 25) explicitly outlines the thesis with these two examples:

> In the outer zone, the prevalent form of partnership was the *commenda*, or as the Venetians usually called it, the *colleganza*… This form of partnership… was perfectly suited to the commercial trips to the distant, only partially known lands of Further Asia. Indeed, both of the commercial voyages to India about which the financial details are known – the voyages of the Genoese Benedetto Vivaldi in 1315 and of the Venetian Giovanni Loredan in 1339 – were undertaken by men who entered into commenda contracts.

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commit to terms of contract. (See, for example, Faure-Grimaud and Mariotti 1999.)

> In earlier times, when voyages in the Mediterranean and in the Black Sea had not yet become regular and market conditions along their coasts were known only in part, the commenda was also the basic form of partnership in the sea trade of the inner-core zone.

This paper advances a simple theory of contract selection and then makes the theory stand up to a sizable, representative data set of contracts. The theory provides a way of characterizing salient patterns in the selection of contracts exhibited in a data set of 760 contracts. All of these contracts derive from unpublished sources maintained at the State Archives of Venice that I perused in the summer of 1997.[2] All of the contracts pertain to the financing of trade between Venetian Crete and other parts of the Mediterranean world in the years 1303-1351. Most contracts were either debt contracts, known in Venice as *prestitti marittimi* or "sea loans," by which the agent would guarantee to the investor a fixed payoff, or were *commenda* contracts, known in Venice as *colleganza* contracts. Other contracts, known as *cambi marittimi*, ("sea exchanges") were like the "sea loans" except they indicated repayment to the investor in currencies different from those in which the loan was made.

The empirical analysis suggests that *colleganze* tended to be applied to ventures in which investors could take advantage of informational externalities or spillovers derived from the ventures of other investors and agents. Participating in the trade of commonly traded commodities in markets that were commonly attended by other investors and trading agents could permit an investor to extract information about other parties' transactions against which the reports of the investor's agent could be measured. Information about market conditions or other parties' transactions could easily spillover to the investor thereby enabling the investor to

[2] All of these contracts can be found in the *protocolli* (records) of the cartularies (logbooks) of notaries preserved in the archival series the *Notai in Candia* maintained at the State Archives of Venice. The records of 19 notaries are featured. The cartularies of 17 of these notaries remain unpublished, but the cartularies of Andrea de Cartura and

effectively monitor the agent. Easy monitoring would enable the investor to detect cheating. Knowing this, the agent could commit to truthfully reporting transactions, in which case the investor and agent could commit to sharing risk under a *commenda* contract rather than revert to a debt contract. At the same time, debt contracts tended to be applied to ventures featuring trade in commodities that were uncommonly traded or were traded in uncommonly attended markets. Such trade precluded informational spillovers and so denied the investor the ability to monitor his agent. The outline of a Contract Selection Hypothesis is plain: investors and agents could share risks in contexts in which informational spillovers prevailed, whereas agents would guarantee fixed payoffs to merchants in contexts involving more exotic types of trade for which, accordingly, little or no information could spillover.

The Contract Selection Hypothesis does more than provide a way of understanding contract selection. It indicates a structural mechanism that can motivate a theory of economic decline and revival of a variety that Henri Pirenne himself started to motivate. Informational spillovers and risk-sharing could reinforce each other in a way that permits us to distinguish information-rich (hereafter, "transparent") environments that supported high volumes of trade from information-poor, low-volume environments. Spillovers contributed to the transparency of the trading environment, thereby enabling parties to share risk rather than revert to debt contracting. Risk-sharing encouraging further investment, further investment generated more informational spillovers, and further investment made trade expand. At the same time, a decline in trade would have threatened the integrity of the trading environment. A sharp decline could trigger a threshold effect – specifically, the loss of transparency – and the loss of transparency would have

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Donato Fontanella have recently been published in a single volume. (See Stahl 2000.) Ninety-two of the 760

forced contracting parties to resort to debt contracting in which case they would have had more difficulty mobilizing investment. The depression of trade in the Early Middle Ages might then be interpreted as a shift from a transparent, high-volume equilibrium to an information-poor, low-volume equilibrium.[3] In turn, the collapse of trade to a low-volume equilibrium in the Mediterranean contributed to decline in the Western Mediterranean.

The remainder of the paper is not occupied with testing a Spillover Hypothesis of decline and revival, but, rather, is occupied with the more modest task of articulating and testing the Contract Selection Hypothesis. While the richness of the data and the economic content of the entire exercise distinguishes the paper from previous work on Medieval contracting practices, the research owes a substantial debt to earlier work for providing a broadly researched landscape upon which I was able to establish my bearings in the current research. Moreover, inexpensive and portable microcomputing enabled me to pursue analysis of a variety those pioneers of the Italian archives might only have pursued with the assistance of large teams of graduate students slaving away to generate even just the simplest of cross-tabulations. Historians have traditionally appealed to case studies such as biographies of merchants (e.g., Lane 1944) or studies of Italian banking houses (e.g., Hunt 1994). In contrast, the research presented here involves a cross-sectional database of contracts. Historians used case-studies to illuminate commercial practices of the Late Middle Ages, but such research seems to have been exhausted

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contracts derive from the cartulary of Angelo de Cartura, and 3 derive from the cartulary of Donato Fontanella.

[3] To illustrate (and only to illustrate) the notion of threshold effects, consider a differential equation $y'(t)=-[y(t)-L][y(t)-T][y(t)-H]+\varepsilon(t)$ where t indicates an index of time, y indicates per capita income, y' indicates a time derivative, ε indicates a stochastic shock, $0 < L < T < H$ where L corresponds to "low" steady state, T corresponds to "threshold," and H corresponds to "high" steady state. Over time, y moves to H (the "high" steady state) if y initially starts at value greater than the threshold, T, and y moves to L (the "low" steady state) if y initially starts at a value less than the threshold, T. Income might at some point exceed the threshold T. Positive and negative shocks

by the mid-1970's after most of a century of active research. As one historian had remarked to me personally, the research on contracting practices "went out of style."

The well known work of Avner Greif abundantly suggests that old styles of research on old topics may give way to new styles and new understandings. And, indeed, I would suggest that the research presented here complements Greif's work on the Maghribi traders of the 10th century in that both articulate mechanisms that enabled and sustained a revival of trade. (See Greif 1989 and 1993.) Grief does not work out of a set of contracts but, rather, works out of a set of commercial correspondence derived from the Cairo Geniza. (See Goitein 1967 and 1973.) Greif uses these merchants' letters to identify a set of commercial practices that were distinct from the contracting practices explored here. (Greif 1994) While the contracting practices explored here relate to the transparency of the commercial environment, the practices Greif examines may have contributed to the transparency of the environment, and may, in turn, have set the scene for those other traders who worked out of a *commenda* framework. Greif identified and examined a type of commitment mechanism, a reputation mechanism, that could explain how the Maghribi traders enabled agency relations and long distance trade. Geographically dispersed traders exchanged correspondence through which they consigned goods to each other and placed orders with each other. While the scope for cheating might seem abundant, the Maghribis established an institution that could support exchange and permit traders to manage risks and deal with unforeseen contingencies. These traders effectively comprised a network of agents that could deny membership to any merchant or could expel any merchant from

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may have buffeted the system over time, but at some point a large negative shock or sequence of shocks could shift y below the threshold T, prompting y to move toward L.

membership. Insofar as membership afforded benefits that could not be enjoyed outside of the network, the network could exert some discipline on its members.

While the contracting practices explored here relate to transparency and informational spillovers in a fundamental way, it may have been the case that other institutions such as the network of Maghribis induced degrees of transparency without which East-West trade may not have begun to revive That is a topic, however, that remains for further research. The remainder of this paper proceeds as follows: Part II briefly sets up operational issues, and Part III discusses trade in the Eastern Mediterranean in the 14th century. Part IV works off of the context described in Part III and sets up hypotheses. Part V describes the structure of the dataset, and Part VI applies the data to a set of statistical tests. The principal test derives from a standard discrete choice exercise or logit. The last part concludes.

II The strategy of the paper

The principal objective of the paper is to examine how contracts line up with attributes of trade ventures. The examination amounts to establishing how attributes of trade ventures map into discrete modes of contracting. (See O.E. Williamson 1996, especially pp. 46-47, on the discriminating alignment of contracts with hazards.) To enable examination of this relationship, we need strategies for addressing two operational issues, the identification of attributes of trade ventures and the stationarity of the contracting technology. First, data must be constructed that permit identification of attributes of observed trade ventures. In this paper trade ventures are distinguished between those that involved transactions conducted in transparent environments and those that involved transactions in less transparent environments. Four types of variables are

constructed for distinguishing environments. Second, an hypothesis maintained here is that the contracting technology remained stationary through the interval 1303-1351. This hypothesis restricts the degrees of freedom with which salient patterns in the selection of contract can be explained and enables the discrete-choice exercise. Specifically, it disciplines the empirical analysis by ruling out appeals to the innovation of contractual forms as the explanation for salient patterns in the contract data.[4] More generally, the hypothesis amounts to assuming that contracting parties know what they are doing when they select terms of contract. Economic agents are assumed to economize!

III Trade in the Eastern Mediterranean and Black Sea

An inspection of a map of Venetian trade routes in the Aegean, Black Sea, and Eastern Mediterranean might help distinguish transparent ventures from less transparent ventures. Figure 1 features two maps.[5] The upper map indicates four points in an intercontinental relay at which Mediterranean traders picked up trade goods coming from the East and dropped off goods going to the East. Some Eastern trade goods came over the Central Asian Steppes to the north side of the Black Sea. Venetian traders at their trade colony in Tana and Genoese traders at Kaffa, the Genoese colony on the Crimea, picked up Eastern goods as well as grain and slaves coming out of Central Asia itself. Some trade coming along the ancient Silk Road came through the Mongol Ilkhanate of Persia to the Persian capital of Tabriz and progressed on to the Greek kingdom of Trebizond in the southeast of the Black Sea. The Venetians often extended convoy

[4] Pirenne (1925), and Luzzatto (1954) each suggest that modes of contracting observed in the Late Middle Ages derived from much older trade practices. On my interpretation, the merchants of earlier times encountered much the same contracting problems encountered in the Late Middle Ages. The earlier "solutions" to these problems seem to have been reasonably robust.

[5] I made these maps by annotating in a wordprocessing package GIF files I had created using Tony Steinke's online Map Maker at http://life.csu.edu.au/cgi-bin/gis/Map.

traffic from Constantinople to Trebizond. At the same time, some traffic coming along the Silk Road moved through the Fertile Crescent starting in Baghdad. Much of this traffic ended up in the Mediterranean port of Lajazzo of Lesser Armenia. Traffic coming through the Persian Gulf or along desert routes on the periphery of the Gulf also joined traffic moving through Baghdad. Finally, much traffic going through and around the Red Sea was eventually picked up in Alexandria.

Before 1291, Italian merchant fleets picked up much commercial traffic through Crusader colonies in the Levant. The fall of Acre in 1291 to the Mamlukes put a definitive end to any European holdings in the Levant, and it precipitated, to be sure, a crisis among merchants. With Egypt and the Levant in Mamluke control, the Venetians, Genoese, and other European traders would either have had to cut new commercial treaties with the Mamlukes, or they would have had to find alternative access. In the immediate term, the Black Sea routes remained available. The Venetians quickly made a commercial treaty with the Mongol Khan of the Golden Horde to secure trading rights at Tana, and it was surely no accident that in 1294 the Genoese and Venetians made a point of starting a war with each other over access to the Black Sea. Historians suggest that at the same time the Mongol khanate in Persia, the Ilkhanate, profited by developing the links between the Persian Gulf and the Silk Road and the termini of Trebizond and Lajazzo. (Lane 1973a)

The data explored here were generated in a context in which the traditional routes to Egypt and the Levant had been compromised and in which traffic through the Mongol Ilkhanate of Persia constituted an important link between East and West. Merchants operating out of Crete or

traveling through Crete linked trade coming out of the Black Sea and out of Lesser Armenia with Venice. They also conducted irregular trade ventures to Alexandria and Damietta in Egypt. Before 1291, they could have participated in regular, nearly-annual convoy traffic between Venice, Crete, Alexandria, and the Levant. Indeed, the solid black lines in the upper map of Figure 1 indicate routes served at least occasionally by Venetian convoy traffic in the first half of the 14th century, whereas the dashed lines between Crete, Egypt and the Levant indicate those formerly regular routes that had been compromised after 1291.

The black box in the map indicates the boundaries of the lower map superimposed on the upper map. The lower map literally lays out the landscape in which most of the action in the paper occurs. The black dots and black circles indicate ports that show up in the contract data. Most of the ports are concentrated in the islands of the Venetian Duchy of Agripelago and along the portions of the Anatolian coast controlled by the Turks of Menteshe and Aydin. The solid black lines indicate Venetian convoy lines. The dashed lines indicate the route from Crete to Alexandria and, more importantly, the routes linking Rhodes to the principal Turkish ports and to ports controlled by various Genoese factions. Much of the activity indicated in the contract data involve trade ventures between Crete and Rhodes. The Crusaders of the Hospital of St. Thomas (the "Hospitallers") had established themselves in Rhodes some years after being expelled from the Levant in 1291. Soon afterwards, Italian banking houses set up branch offices at the port of Rhodes (Zachariadou 1983, Hunt 1994), and Rhodes became a principal hub aggregating traffic coming out of the Black Sea and Constantinople, coming from Venice, and coming from Cyprus and Lajazzo. Rhodes also aggregated traffic coming out of Turkish ports and from Aegean islands.

Arguably, trade ventures going between Crete and Rhodes constituted transparent activity. Anyone could go to Rhodes to deliver or pick up cargoes coming from or being delivered to major termini such as Lajazzo and Venice, and any number of trading agents could be involved in such traffic. The upshot is that traders could go to Rhodes to participate in a vigorous and well-attended re-export business. Informational spillovers would have enabled investors to monitor their agents. More interesting are trade ventures going through Rhodes to further destinations on the Anatolian peninsula and other destinations. Trade along minor routes feeding Rhodes such as the routes extending from Rhodes to Turkish ports including Palatia (formerly Miletus) and Theologo (formerly Ephesus) constituted activity in less transparent environments. (These routes are indicated by dashed lines in the lower map.) Similarly, the routes feeding Rhodes from the ports on Chios and Smyrna – both of which the Genoese seized in 1346 – and Phocea were also, from the perspective of traders operating out of Crete, less transparent. Also, the infrequent ventures to Alexandria were less transparent than the trade between Crete and Alexandria that had persisted when the Venetians had organized regular convoys between Venice, Crete, Egypt, and the Levant. Indeed, of the 19 contracts involving Egypt that show up in the data, 17 or 89% are debt contracts. Consider the contrast with the experience of the years 1190 - 1220: In these years the Venetian Republic regularly sponsored convoys between Venice and Egypt, and available contract data indicate that more than 83% of the contracts involving trade with Egypt were *colleganze*. (D.V. Williamson 1996)

IV Hypotheses

I construct four variables labeled "Rhodian Trade," "Turkish Trade," "Plague," and "Informed Investor" to explore whether or not parties to contract actually select contracts in ways that relate to the types of hazards they anticipate encountering and to test whether or not informational asymmetries account for the more salient hazards. I use these variables to distinguish ventures that involved transparent transactions from ventures that entailed transactions specific to an agent. The first variable involves distinguishing ventures that strictly involved trade at hubs along established convoy routes. These ports include Constantinople, Venice itself, Candia in Crete, and Rhodes. Just as Crete, which Venice had annexed in 1211, provided a secure transit point for commercial and naval traffic coming into the Aegean, so too fortress Rhodes provided a convenient transit point for traffic going into the Turkish beyliks of Aydin and Menteshe on the Anatolian peninsula and eastward to Cyprus and Lajazzo.

Trade in Turkish territories (the "Turkish trade") itself provides the second variable. While the Turkish presence on the Anatolian peninsula had begun to emerge in the 11th century, consolidation of Turkish beyliks – and the disruption that attended such consolidation – persisted vigorously through the 14th century and into the 15th century with the consolidation under the Ottoman Turks. The Venetian authorities in Crete established trade treaties with the Turkish beyliks of Aydin and Menteshe in the late 1320's and reaffirmed a commercial treaty with Menteshe in the late 1330's. (Zhachariadou 1983) To be sure, the treaties formalized, to some degree, trade activity that was already underway. Important details had to be established such as the rights of traders in Turkish ports. Also, some provision had to be made for protecting commercial traffic from piracy. Treaties aside, policing pirates remained difficult, and crusading activities against "the Turks" in the 1330's and 1340's complicated trade. (Vidulich 1976) All

such complications, arguably, made the commercial environment less secure and less transparent.

The third variable, the Black Death or "Plague," also provides a way of distinguishing less transparent from more transparent environments. The Black Death (bubonic plague) descended from Central Asia into the Aegean in 1347, and in the succeeding few years it moved through Western Europe, wiping out a third to a half of the population. Of interest here are the commercial consequences of plague. An interpretation advanced here is that the Black Death delivered a negative shock to the informational structure of the economy. Production and transit of commodities to ports may have been disrupted. Likely, uncertainty about the status of production and availability of commodities in ports in and around the Aegean emerged. Moreover, traders may have lost contacts through whom they would have gathered information about commercial prospects. A consequence of all this would be the loss of transparency in the entire trading environment.

While plague may have exacerbated informational hazards encountered in contracting agency services and may, in turn, have implicated contract selection, more obviously plague imposed physical hazards. An implication for contracting, conceivably, was that physical hazards may have complicated contract selection and may have, in some contexts, dominated contract selection. Indeed, patterns in the data suggest that one form of contracting that I had not anticipated tended to be used during particular crises that threatened the physical well-being of trading agents. This mode of contracting, indicated here as the "pooling contract," first appear in the data set in 1339, the year that a broad coalition of Turks launched a massive offensive across

the Aegean region. (Zhachariadou 1983) These contracts were like *colleganze* except that they indicated the distribution of profits as a function of the number of investors who had outfitted a team of agents on a particular vessel. These contracts suggest that a team of agents who would travel and trade collectively in overseas markets. These contracts appear most prominently in the data in 1347.

The fourth variable is derived from the data itself. I identify ventures that involved investors who themselves had previously provided agency services. Arguably, these ventures involved a party who was better informed about particular commercial prospects in foreign markets. The investor may have been advantaged, for example, by having established contacts in overseas markets through whom intelligence about the availability of selected commodities may have been transmitted. The consequence of this is that the investor – hereafter, the "informed investor" – may have endeavored to secure transactions in environments that were less, rather than more, transparent.

I use the 760 contracts to identify informed investors, and, to be sure, I under-represent the frequency with which they show up in the data. Even so, informed investors show up in distinctive ways. None of the trade ventures that terminate in Rhodes feature informed investors, yet more than a third of trade ventures going through Rhodes and terminating in Turkish territories feature these informed investors. Informed investors were also more likely than all other investors to have secured agency services by means of contracts (debt contracts) that impose residual claimancy on trading agents, and, indeed, they relied almost exclusively on debt contracts for the Turkish trade going through Rhodes. At the same time, all other parties of

investors were also more likely to have relied on debt contracts in the Turkish trade going through Rhodes. The data also indicate that the emergence of plague in 1347 motivated substitution out of contracts featuring risk-sharing into debt contracts.

The data also indicate some patterns that could not have obviously been anticipated. The data suggest that the Turkish trade can be partitioned into at least two parts: the Menteshe trade and all other Turkish trade. Informed investors show up prominently in the Menteshe trade whereas they participated in the other Turkish trade – the trade with Aydin, the Ottoman territories, and all other Turkish territories – with no greater frequency than other investors. Meanwhile, pooling contracts seem to have been motivated by concerns investing parties may have had for the survival of their trading agents. Losing a trading agent overseas could complicate efforts to extract one's investments, but engaging one's investments in a pool under the management of a team of agents promoted the prospect that some subset of agents on the team would survive and would, accordingly, be able to remit payments. At the same time, concerns about informational hazards may also have motivated the selection of pooling contracts. The team of trading agents operating under a pooling contract would make transactions conducted by the team transparent to the team members. The agents might collude to cheat the investors who did not physically participate in the trade ventures, but transparency itself might complicate collusion. Accordingly, these contracts may have been applied to environments that were themselves less conducive to transparency, and, indeed, it turns out these contracts were heavily used in the environment dominated by plague.

The four variables enable examination of a simple qualitative hypothesis:

Hypothesis 1: Debt contract prevail in non-transparent environments. *Colleganza* contracts prevail in transparent environments.

The data set discussed here features contracts that involved ventures in which the investor was required to rely exclusively on the agent's report of realizations and ventures that involved abundant (and low cost) public information against which agents' reports could be compared. Accordingly, "sea loans" should dominate contracting of the former variety of ventures whereas *colleganza* contracts should only appear among ventures involving public information.

Pooling contracts lend themselves to a third prediction that relates not to informational hazards but rather to physical hazards:

Hypothesis 2: During the emergence of plague, contracting parties substitute out of debt contracts and *colleganza* contracts into pooling contracts.

Hypotheses 1 and 2 setup a question that can only be explored empirically: When transactions are not transparent and the physical hazards such as plague prevail, do debt contracts or pooling contracts dominate? Any one of three answers might obtain: informational hazards dominate, in which case debt contracts more likely obtain; physical hazards dominate, in which case pooling contracts more likely obtain; or neither hazard may dominate the other. The data, it turns out, suggest that the informational hazards tend to dominate the physical hazards.

V Data

The contract data all derive from the notarial series *Notai in Candia* maintained at the State Archives of Venice. The data set is comprised of 760 contracts sampled from the years 1303-

1351. These years include various phases of the Venetian experience in trade in and around the Aegean. In 1347 The Black Death descended from Central Asia into the Aegean region. One might have expected that plague might have distracted the merchant community in Crete, but casual inspection of the notarial records suggests that trade activity remained unabated. Indeed, Western Europe yet remained untouched by plague, and the traders in Crete, seeing half of their competitors perish, may have been particularly keen to capitalize on the thinning of the ranks of the competition.

The data derive from the cartularies of 19 notaries, each of whom is indicated in Table 1. Table 1 indicates the distribution of contracts across notaries aggregated in intervals of 5 years. I concentrated my data collection in four intervals around 1305, 1328, 1339, and 1347. Within these intervals I randomly selected notaries. Forty-five percent of the data or 342 contracts fall around 1347 in the nine-year interval 1343-1351.

Coding the contracts first entailed coming up with a data-entry form for mapping the Medieval Latin texts of each contract into records of a database. The dataset is comprised of 760 records, one for each contract, and each record is comprised of fields that I use to capture categorical features of contract as well as real-valued components. Categorical data included indications of types of sharing rules (residual claimancy versus linear sharing rules or pooling) and specifications of agents' itineraries. Real-valued data included sums invested, the length of the ventures, the principal and interest to be paid to the investor (where appropriate), and the sharing rule (where appropriate). Debt contracts typically obscured interest rates by failing to note sums

invested, and the sharing rules under *colleganze* contracts were often indicated simply as "according to custom" (*secundum usum*).

Table 2A indicates eighteen dimensions of the structure of contracts. In general, one might use some set of these dimensions to establish a taxonomy of contracts. Certain syndromes of contract attributes might manifest themselves, suggesting that contracts could be categorized in a systematic way. In this paper I use only the structure of profit sharing to partition contracts between debt contracts, *colleganze*, and pooling contracts. Other dimensions of contract are common to each of these three types of contract. Almost all contracts, for example, assigns the risk of losses obtaining from shipwreck or piracy to parties on one side of the contract or the other, but not both, and, in fact, of the 760 contracts only one assigns such losses to the agent. The cartulary of Giovanni Similiante indicates that on March 1326 Giovanni Cutaioti, a long-time, seasoned investor, advanced a loan of 12 *hyperpera* to Iani Clado and Theodoro Raza. Iani and Theodoro were to travel and trade wherever they saw fit for a term of 8 months, and they agreed to bear the "sea risk." As with almost all loan contracts, the contract does not explicitly indicate the rate of interest.

Table 2B provides some descriptive statistics. Of the 760 contracts, 314 (41%) were debt contract, 364 (48%) were colleganza contracts, and the remaining 82 (11%) were pooling contracts. All of the pooling contracts show up after 1338. Curiously, 429 contracts (56%) explicitly indicate itineraries that agents were to follow. In the remaining 331 contracts the notary failed to note any indication of an itinerary or, less often, indicated that the agent was free to travel wherever he saw fit. Nearly half of these 331 contracts show up between 1303 and

1307, and each of those contracts is a *colleganza*. All of these contracts derive from the cartularies of Angelo de Cartura and Stefano Bono, and, taken alone, these cartularies seem strikingly uninformative along many dimensions of contract. An analysis that would have depended on these cartularies alone would have had to conclude that parties to contract usually selected *colleganze*, yet at the same time the data could not have supported obvious tests of any contract selection hypotheses without constructing variables like Informed Investor. Indeed, these data dilute the hypothesis tests conducted in the next section.

Why the cartularies of Angelo de Cartura and Stefano Bono seem so spare in the details they report is something about which I can only speculate. We might speculate that notaries in Crete around 1305 systematically ignored certain contract details, but then why did notaries start to record details more completely in later years? We might speculate that the contracts featured in these earlier cartularies represent all the details of contract. Would that indicate that the trading environments in which investors and agents participated were almost uniformly transparent? I have not as yet constructed any clever devices other than Informed Investor for explaining the variation – or striking lack of variation – in these data from 1303-1307.

All but 39 of the 760 contracts were dominated in *hyperpera*, the currency of the Late Roman Empire. Of these 721 contracts, only 51 exceeded 60 *hyperpera*. One contract, which can be found in Stahl (2000) pg. 180, features something of a hybrid sharing rule. The most striking feature, however, is that it involves an investment valued at more than 1402 *hyperpera*, a sum that that exceeds by more than a factor of two the investment of the next largest contract in the dataset. Finally, 673 of the contracts indicate the duration of trade ventures in months. Of these

673, 500 indicate a duration of 6 months. Agents were obligated usually within 15 days of returning to Candia to render an account to their investors. Most other ventures did not exceed 4 months.

VI Estimation and Discussion

Analyzing contracts can be challenging in that 1) contracts may constitute complex bundles of attributes that span a broad number of dimensions, 2) some or all of the dimensions of contract may be endogenous, and 3) even the matching of parties to contract is endogenous. The parties on one side of a candidate contract may have preferences over the identities of the parties on the side. How might analysis jointly capture matching and the selection of contracts? Ideally, we would have a structural model of a market for contracts that accounts for the preferences of agents and investors over all candidate dimensions of contract as well as over candidate matches between investors and agents. Even so, the types of data that are available constrain the types of analyses we might pursue. Absent a joint analysis of matching and contract selection, what more modest analyses may be implemented? The point in this paper is simply to tease out the principal phenomena driving contract selection.

Classical models of market exchange put much structure on some of the simplest types of contracts. In a spot market a contract may be identified simply by two parameters: price and quantity. In such contexts, transactions are "sharp-in by clear agreement," and "sharp-out by clear performance." (MacNiel 1974, pg. 738). Indeed, in competitive markets for homogeneous goods, the identities of the parties to contract are unimportant. In markets such as the various FCC spectrum auctions for wireless licenses, the attributes of the assets being exchanged may be

fixed, but the identities of the candidate buyers may be important in that buyers may be more or less well equipped to realize value from the assets, and external economies may favor one distribution of property rights over another. (See, for example, Cramton 1998.) In the market explored in this paper, the attributes of the assets being exchanged are entirely endogenous, and exchange is not "sharp-out by clear performance" but, rather, involves a complex sequence of performance that unfolds subsequent to contracting.

Plott and Williamson (2000) explores exchange in an experimental market for contracts that join parties in a sequence of strategic interactions. In that paper, the structure of market exchange and of follow-on strategic interactions were simple enough to be captured in a simple, static model, and the experimental design permitted the authors to distinguish features of the dynamic process by which the market selected an equilibrium and then converged to that equilibrium. In contrast, the context explored here is not, as yet, amenable to an analysis that would jointly characterize the matching of parties to contract and the selection of terms of contract. Rather, the point of the paper is to use available data to explore the roles of informational hazards (if any) in the selection of contracts. Along the way we include the role of physical hazards imposed by plague. The principal exhibit of this section of the paper is a multinomial logit, a discrete choice regression exercise, that points up the role of informational capital in contract selection. This section serves up two simpler exhibits like hors d'oeuvres on the way to motivating the logit.

The four variables Rhodian Trade, Turkish Trade, Informed Investor, and Plague provide the basis for two sets of statistical exhibits. In the first set of exercises, the first three variables point

up the special role of informed investors. Informed investors show up in distinctive ways in the trade going through Rhodes and in the trade going through Turkish ports. More to the point of this paper, informed investors are much more likely than other investors to rely on debt contracts. A simple interpretation presents itself: informed investors are less likely to organize ventures that principally involve trade at major hubs and are more likely to participate in less transparent types of trade that extends beyond the principal hubs. In the second set of exhibits, Informed Investor and Plague and the three modes of contracting – debt, *colleganza*, and pool – motivate the multinomial logit exercise.

The Rhodian trade

Soon after the Hospitallers conquered Rhodes (1306), Rhodes became a hub in intercontinental re-export trade and became important as a secure base from which to extend ventures to Turkish ports and other destinations such as the Genoese held ports of Chios, Smyrna, and Phocea in the northern part of the Aegean.

Four salient patterns emerge in the Rhodian trade. First, of 22 ventures that terminated in Rhodes, zero involved informed investors. This is striking. Of these 22 contracts 12 were *colleganze*. Second, of the 37 ventures going through Rhodes, only 6 involve *colleganze*, and third, more than one third (14) of these 37 ventures involved informed investors. Finally, all of the pooling contracts show up in 1339, the year a Turkish offensive across the Aegean commenced. Three of these patterns are indicated Tables 3A and 3B.

The strongest predictions would be that all of the trade terminating in Rhodes would be organized by means of *colleganza* contracts. Of the 22 contracts, 8 are loans and 2 are pooling contracts. The two pooling contracts might be explained away by reference to the increased physical hazards that renewed war with the Turks entailed. The remaining 8 loan contracts would be more difficult to explain, but the idea that *colleganza* contracts should dominate in the terminal Rhodian trade is, at least, suggestive.[6]

The 6 *colleganza* contracts that appear in the trade going through Rhodes are not explained here, but the predominance of loan contracts (73%) is also suggestive of the basic thesis that loan contracts should prevail and is suggestive, if not entirely dispositive, of the idea that informed investors would be more likely to organize their trading activities by means of debt contracts.

The Turkish Trade

The data indicate that "Turkish Trade" did not uniformly constitute particularly idiosyncratic trade and did not invite uniform contractual remedies. The distinguishing features of the Turkish trade all pertain to the trade with Menteshe. First, trade involving Menteshe accounts for 157 of all 210 ventures (75%) to Turkish ports. Second, informed investors account for nearly half of the Menteshe trade whereas they account for one-quarter of all other Turkish trade. Finally, and more to the point of this paper, the informed investors distinguish themselves by how they contract agency services in the Menteshe trade whereas they do not distinguish themselves in the

[6] The two tables together constitute a three-dimensional contingency table in which the three dimensions are mode of contracting, type of investor ("informed" or "other"), and type of trade (terminal or through-Rhodes). A simple test of the independence of the marginal distributions is a χ^2 test. In this case, the corresponding χ^2 statistic is 51.39, and the critical value with 7 degrees of freedom and 99% confidence is 14.07. The maintained hypothesis that the marginal distributions are independent would be rejected under this test suggesting that "informed principals" and other investors did, indeed, engage in the Rhodian trade in distinctive ways.

other Turkish trade. Specifically, informed investors overwhelmingly participate in the Menteshe trade by means of debt contracts. All other investors who participated in the Menteshe trade also relied most heavily on debt contracts but not in the heavier proportion that distinguishes the informed investors. These results present themselves in the Tables 4A and 4B.[7]

In the Menteshe trade, 42 of the 51 ventures (82%) featuring informed investors are debt contracts whereas all other investors participating in the Menteshe trade use debt contracts in 57 of 106 ventures (54%). In all other Turkish trade informed investors use debt contracts in 5 of 13 ventures (38%), and the other investors use debt contracts in 19 of 40 ventures (48%).

Multinomial Logit Models

The patterns observed in the Rhodian Trade and Turkish Trade suggest that information and physical hazards go some way toward characterizing the selection of contracts, and they suggest that a more systematic analysis of the variation in modes of contract across destinations might be illuminating. Such as exercise would involve mapping one endogenous variable, mode of contracting, against another endogenous variable, destination, and would use destinations as a proxy for the transparency of trading environments. The Contract Selection Hypothesis suggests that debt contracts obtain in environments that feature informational hazards whereas risk-sharing can obtain in transparent environments

There are at least three difficulties with using destinations as a proxy for transparency across environments. First commercial conditions in most ports were not obviously stationary. As

[7] The corresponding χ^2 statistic is 318.61, and, again, the critical value with 7 degrees of freedom and 99%

hubs in intercontinental traffic, Rhodes, Venice, Constantinople, and Candia in Crete maintained stable trading environments. In contrast, ports like Negroponte that were located along convoy routes were nonetheless periodically threatened by Turkish raiding fleets and even by Christian armies coming from the Greek mainland. The Aegean islands were periodically raided by Turkish fleets and overrun again by Venetian, Genoese, and Hospitaller forces. Conditions in Turkish ports were themselves subject to flux often despite the efforts of Turkish and Cretan authorities to stabilize conditions through various negotiations of commercial treaties. Second, we should not use destinations *per se* as a unit of analysis but should distinguish between the sequences of destinations that comprise agents' itineraries. Finally, more than 40 destinations show up in the data and even larger number of distinct itineraries show up. We would need some means of ascertaining conditions in all destinations or, similarly, we would need some means of coming up with a taxonomy of destinations. Distinguishing between hubs and non-hubs would be useful, and, indeed, that is the kind of thing the variables Rhodian Trade and Turkish Trade operationalize. Even distinguishing between ports along the principal convoy routes could be useful, although the experiences of places like Negroponte might diminish the value of the exercise. Even so, most commercial traffic going through Crete seemed occupied with feeding the convoy routes by reaching beyond the convoy routes to the Aegean islands and to the Turkish ports. Coming up with groupings that capture stationary features of the trading environment in ports off the convoy routes might be more problematic.

The strategy implemented in the logit exercise is to use the exogenous variables Plague and Informed Investor to distinguish transparent trading environments from less transparent

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confidence is 14.07.

environments. Using such variables relieves us of having to sort out environmental conditions year-on-year in the various ports that show up in the data, and it permits us to exploit the entire data set in a systematic way rather than to rely on judiciously selected subsets of the data.

Discrete choice models, of which logits are one variety, generate estimates of the probabilities with which contracting parties select modes of contracting. The "independence of irrelevant alternatives" property of logits permits us to express a problem of unordered choice with N modes of contract s as a system of N equations of which N-1 are log-odds ratios. Each ratio is a function of the choice probabilities of only two rather than N modes. Moreover, these log-odds ratios can be expressed as linear functions of the regressors. In the first logit exercise implemented here, the system can be expressed as a system of three equations:

$$\log\left(\frac{\Pr(\text{mode}_i = \text{Debt})}{\Pr(\text{mode}_i = \text{Colleganza})}\right) = \beta_{\text{Debt,Intercept}} + \beta_{\text{Debt,Plague}}\text{Plague}_i + \beta_{\text{Debt,Informed}}\text{Informed}_i \quad (1)$$

$$\log\left(\frac{\Pr(\text{mode}_i = \text{Pool})}{\Pr(\text{mode}_i = \text{Colleganza})}\right) = \beta_{\text{Pool,Intercept}} + \beta_{\text{Pool,Plague}}\text{Plague}_i + \beta_{\text{Pool,Informed}}\text{Informed}_i \quad (2)$$

$$\Pr(\text{mode}_i = \text{Colleganza}) = 1 - \Pr(\text{mode}_i = \text{Debt}) - \Pr(\text{mode}_i = \text{Debt}) \quad (3)$$

where i = 1, …, 760 and $\text{mode}_i \in \{\text{Debt, Pool, Colleganza}\}$.

The system features 6 parameters, and these can be estimated by maximizing the log-likelihood function

$$\log L = \sum_{i=1}^{760} \left\{ \sum_{N \in \{Debt, Pool, Colleganza\}} \delta_{iN} \log \Pr(\text{mode}_i = N) \right\}$$

where $\delta_{iN} = 1$ when $\text{mode}_i = N$ and zero otherwise. (See Train (1986) pp.18-19 and 44-46 or Maddala (1983) pp. 34-37.)

The 6 parameters do not lend themselves to ready interpretations. The parameter estimates do not correspond to the marginal effects of the explanatory variables on the choice probabilities, but such marginal effects and corresponding standard errors can be extracted with some manipulation and extensive computation. The marginal effects are functions of the predicted probabilities, and this leaves the prospect of reporting marginal effects for each of the 760 data points. A more informative exercise is pursued here: Table 5B reports means of the marginal effects and corresponding asymptotic standard errors. (See Greene (1993) pp. 108 and 645-646 for the corresponding linear approximation theorem and application to discrete choice models.) Note what Table 5 does not report: It does not report marginal effects that would correspond to the mean contract. This alternative approach is commonly used, but it would introduce an inconsistency in the way average choice probabilities and average marginal effects are calculated. (See Train (1986) pp. 41-44 specifically on this point.)

Table 5A indicates the parameter estimates that obtain from the maximum likelihood estimation, and Table 5B indicates the predicted signs of the marginal effects on the choice probabilities of the variables Plague and Informed Principal. The probability the parties to contracting engaged a debt contract is predicted to be increasing in Informed Principal. The probability with which parties select pooling contracts is predicted to increase with the emergence of Plague as contracting parties substitute out of *colleganze*. The effects on the selection of *colleganze* contracts should, for the most part, run counter to the effects on the selection of loans. Principally, Informed Principals substitute out of *colleganze* into loans except possibly in the plague year when their informational advantage may have been marginalized.

The impact of Plague on the selection of debt contracts presents a puzzle. On one hand, parties might respond to the physical hazards presented by plague by substituting out of debt contracts and into pooling contracts. On the other hand, the greater informational hazards that attend plague may motivate a wholesale substitution out of pooling contracts as well as out of *colleganze* contracts into debt contracts. While the data will speak to this puzzle, no *a priori* prediction can be stated without qualifications.

Table 5B indicates three things: 1) the signs of the four marginal effects for which predictions are furnished match the four predictions, and each of these marginal effects are statistically significant; 2) the marginal effect for which no prediction was furnished is not statistically significant; and 3) the marginal effect for which no unambiguous prediction could have been furnished turns out to be positive and statistically significant. Specifically, the probability assigned to pooling contracts is increasing in Plague whereas the effect of Informed Investor on

the same probability is effectively zero. The probability assigned to *colleganze* contracts is decreasing in both Plague and Informed Investor. The probability assigned to debt contracts is also increasing in Informed Investor. Each of these effects line up with the simple qualitative predictions. Only the marginal effect of Plague on the probability assigned to debt remains, and the data indicate that this effect is positive. An interpretation that proceeds from this empirical result is that the effect debt contracts have in neutralizing informational hazards dominates the substitution out of debt contracts motivated by the physical hazards attending plague. Taken all together the results indicate that informed investors tended to rely more heavily on debt contracts. Debt contracting proved to be a remedy to informational problems exacerbated by the Black Death, but at the same time plague motivated a shift into pooling contracts.

Tables 6A and 6B indicate results from an expanded logit exercise. In this exercise I replace the variable Plague with a variable indicating the persistence of plague, "Persist," and I interact Persist with Informed Investor. Persist distinguishes the years 1347-1351 from all the other years in the data set and constitutes a simple way of capturing the persistence of bubonic plague in the Aegean beyond its initial outbreak in early 1347. Modeling plague as persistent may or may not capture the impact of plague on the trading environment in a superior way, but assigning more explanatory power to plague makes tests of the effect of Informed Investor more demanding. The exercise will show that while this second logit exercise assigns more weight to the impact of plague and diminishes the effect of Informed Investor, Informed Investor still emerges as statistically significant.

This exercise involves estimating 8 rather than 6 coefficients and can be expressed as the following system of equations:

$$\log\left(\frac{\Pr(\text{mode}_i = \text{Debt})}{\Pr(\text{mode}_i = \text{Colleganza})}\right) = \beta_{\text{Debt,Intercept}} + \beta_{\text{Debt,Persist}}\text{Persist}_i + \beta_{\text{Debt,Informed}}\text{Informed}_i + \beta_{\text{Debt,Persist*Informed}}\text{Persist}_i * \text{Informed}_i \quad (1)$$

$$\log\left(\frac{\Pr(\text{mode}_i = \text{Pool})}{\Pr(\text{mode}_i = \text{Colleganza})}\right) = \beta_{\text{Pool,Intercept}} + \beta_{\text{Pool,Persist}}\text{Persist}_i + \beta_{\text{Pool,Informed}}\text{Informed}_i + \beta_{\text{Pool,Persist*Informed}}\text{Persist}_i * \text{Informed}_i \quad (2)$$

$$\Pr(\text{mode}_i = \text{Colleganza}) = 1 - \Pr(\text{mode}_i = \text{Debt}) - \Pr(\text{mode}_i = \text{Debt}) \quad (3)$$

where i = 1, …, 760 and $\text{mode}_i \in \{\text{Debt, Pool, Colleganza}\}$.

Tables 6B indicates the same qualitative results as 5B. Informed Investors are more likely to use debt contracts and less likely to use *colleganze*. Persistent plague motivates substitution out of *colleganze* into pooling contracts. Also, the persistent plague motivates a shift out of *colleganze* into debt contracts that is much larger than the effect suggested by the first logit exercise.

Finally, Tables 7A and 7B indicate results from applying the expanded logit to the dataset that excludes data dated earlier than 1308 from the cartularies of Angelo de Cartura and Stefano Bono. The same qualitative results obtain, but the effects that derive from Informed Investor are a little stronger, and the results that derive from Persistent Plague are a little weaker. As before, informed investors tend to favor debt contracts, and plague motivates parties to contract to substitute out of *colleganza* contracts into pooling contracts and debt contracts.

III Conclusion

The research suggests first that contract selection is an important phenomenon in the maritime trade of the Late Middle Ages and, second, that a combination of informational asymmetries and risk-sharing can go some way toward explaining contract selection. The paper goes some way toward characterizing contract selection in a context that involves the financing and conduct of risky commercial ventures. Ventures involved transactions that investors could neither observe nor verify, yet ventures could be distinguished between those in which transactions were transparent and those in which transactions were not transparent. Contracts featuring risk-sharing may obtain in the former case, whereas contracts featuring little or no risk-sharing obtain in the latter. Specifically, contracts featuring payoffs that are independent of agents' reports should emerge in contexts in which principals have no cost-effective means of inducing agents to render truthful reports. At the same time, contracts featuring risk-sharing (if any) should emerge only in trade along well-traveled routes involving commonly traded commodities. The data indicate that parties involved in *colleganza* contracts were more likely to participate in trade along established, well-traveled trade routes. On my interpretation, investors could exploit informational spillovers; they could easily obtain independent reports on the performance of

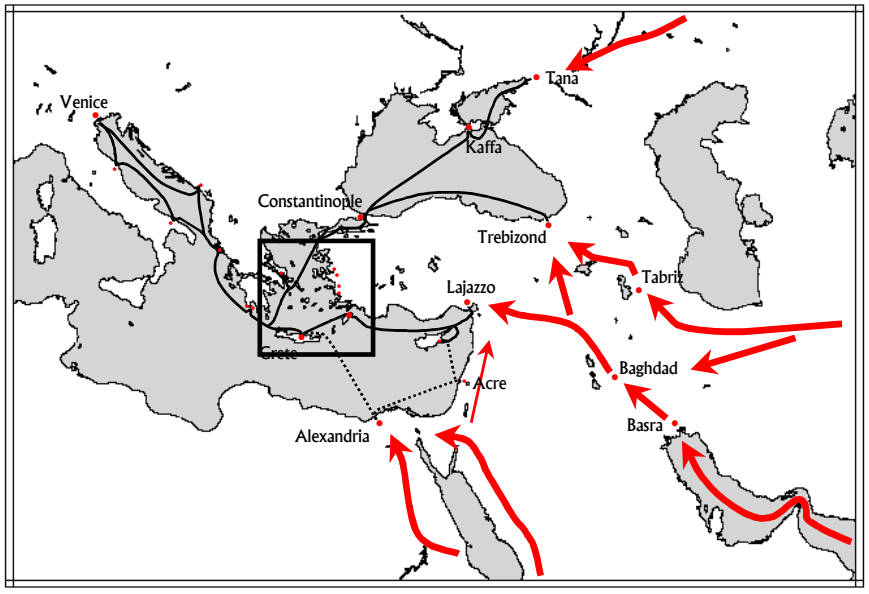
other trading agents operating along these routes thus permitting them to gauge the performance of their own agents. At the same time, debt contracts were found to be applied with greater regularity to ventures along less established routes. Trade along less well traveled routes generated more opportunities for transactions that precluded informational spillovers.

Finally, the data indicate some unanticipated results. Most notably, pooling contracts had not been anticipated, yet they seem to have used to manage physical hazards encountered in the trading environment. At the same time these contracts can be partly understood by the way in which they relate to informational hazards. Sending a team of agents on a venture could complicate the prospect that any one agent could cheat the investors in the pool, and, indeed, the data suggest that the selection of these types of contracts were at least partly motivated as a response to informational problems.

The contract data suggest that problems of asymmetric information go some way toward characterizing the selection of contracts. This conclusion contrasts markedly with the conclusion established in the historical literature. The literature asserts that contracts featuring risk-sharing tended to be applied to the most uncertain, idiosyncratic ventures. The conclusions of the literature, it turns out, derive from anecdotal evidence, whereas the evidence presented here derives from a broad dataset of contracts. Both types of evidence need to folded into a larger theory of contract selection.

Figure 1

Venetian Routes in the Aegean, Black Sea, and Eastern Mediterranean



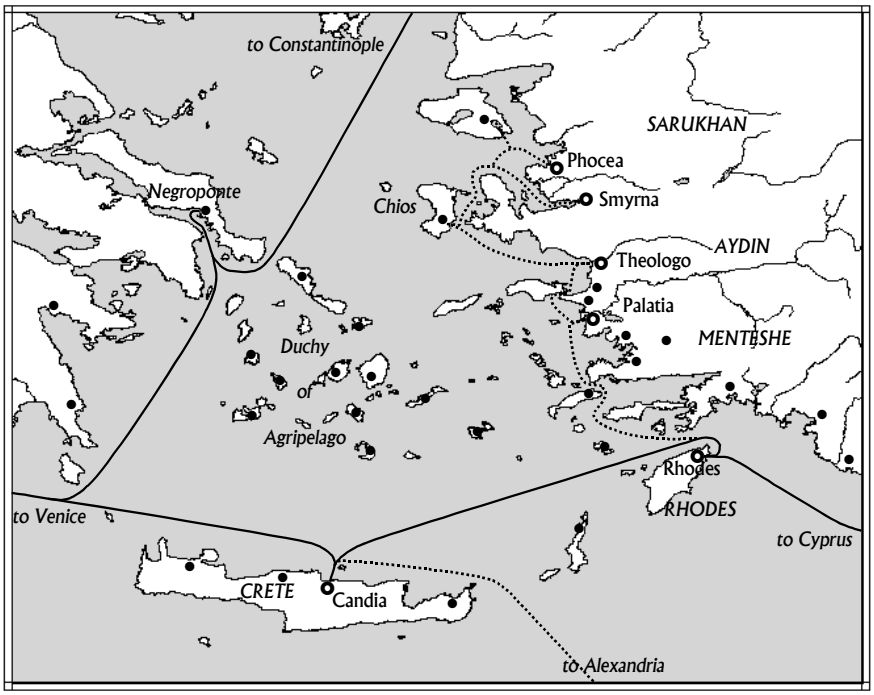


Table 1

The Distribution of Contracts Across Notaries and Time

Notary	1303-07	1308-12	1313-17	1318-22	1323-27	1328-32	1333-37	1338-42	1343-47	1348-51	Totals
Andrea de Bellamore						12					12
Angelo Bocontolo									157	65	222
Angelo Cariola		5									5
Angelo de Cartura	92										92
Angelo Donno			6								6
Antonio Brixiano										4	4
Bartholomeo Francisci								120			120
Donato Fontanella				3							3
Filippo Malpes										1	1
Francisco de Cruce								14			14
Giorgio da Milano I									6	4	10
Giorgio di Ligardo								1			1
Giovanni Gerardo						40		4	39	20	103
Giovanni Similiante					23	14					37
Iacobus de Firmo								2			2
Leonardo de Vegla									8	30	38
Marco da Piacenza								6	8		14
Nicolo Brixiano							2				2
Stefano Bono	58	7	9								74
	150	12	15	3	23	66	2	147	218	124	760

Table 2A: Structure of the Contract Data

Data Fields	
Type of Contract	Debt, *Colleganza*, or Pool
Date of Enactment	Year, Month, Day
Place of Enactment	City in which contract was drafted
Place of *ex post* accounting	City in which agent renders accounts to investor
Agents' names	List of agents
Agents' residences	City or town of residence
Investors' names	List of investors
Investors' residences	City or town of residence
Family relations between Agent and Investor	Binary: yes/no
Investments by investors	Number of units invested
Composition of investments	currency or commodities
Itinerary	List of destinations
Vessel	Type and owner of vessel
Linear Sharing Rule	Proportion of profit or loss going to investors
Term	Term of contract indicated in months
Assignment of "sea risk" to investors or agents	Binary: investors or agents bear loss from shipwreck or piracy
Witnesses	List of witnesses to the contract
Notary	Name and parish of notary

Table 2B: Descriptive Statistics

Debt contracts	314	Term in months	Frequency
Colleganza contracts	364	1	1
Pooling contracts	82	1.5	1
Total Contracts	760	2	7
		3	47
Contracts specifying itineraries	429	3.5	2
Itineraries including the following destinations:		4	65
Aydin	24	5	13
Black Sea (Tana)	8	6	500
Constantinople	31	7	6
Cyprus	39	8	27
Egypt (Alexandria or Damietta)	19	9	2
Menteshe	157	12	2
Rhodes	59		673
Venice	12		
Contracts denominated in hyperpera	721		
Minimum	3		
Maximum	1402		
Mean	31		

Table 3A

Trade Terminating in Rhodes

	Pool	Loan	*Colleganza*	
Informed Investors	0	0	0	0
All Other Investors	2	8	12	22
	2	8	12	22

Table 3B

Trade Going through Rhodes

	Pool	Loan	*Colleganza*	
Informed Investors	1	13	0	14
All Other Investors	3	14	6	23
	4	27	6	37

Table 4A

The Turkish Trade less Menteshe

	Pool	Loan	*Colleganza*	
Informed Investors	2	5	6	13
All Other Investors	4	19	17	40
	6	24	23	53

Table 4B

The Menteshe Trade

	Pool	Loan	*Colleganza*	
Informed Investors	4	42	5	51
All Other Investors	17	57	32	106
	21	99	37	157

Table 5A

Regression Results

Variable	Equation (1) Coefficient Estimate	Equation (1) Standard Error	Equation (2) Coefficient Estimate	Equation (2) Standard Error
Intercept	**-0.44920**	0.09321	**-2.16644**	0.17647
Plague	**1.10113**	0.21574	**2.10842**	0.28071
Informed	**0.70756**	0.21842	**0.72899**	0.33146

Number of observations = 760

Likelihood ratio test of the significance of the regression:

Likelihood ratio statistic = -2(-728.10 + 690.29) = 75.62.
The corresponding critical value with 4 d.f. at the 1% significance level is $\chi^2 = 13.28$.

Table 5B

Mean Marginal Effects

Variable	**Debt** Predicted Sign	**Debt** Marginal Effect	**Debt** Standard Error	**Pool** Predicted Sign	**Pool** Marginal Effect	**Pool** Standard Error	***Colleganza*** Predicted Sign	***Colleganza*** Marginal Effect	***Colleganza*** Standard Error
Intercept		**-0.10%**	2.17%		**-17.45%**	0.88%		**17.56%**	2.56%
Plague		**15.87%**	4.29%	*positive*	**13.75%**	1.90%	*negative*	**-29.62%**	5.99%
Informed	*positive*	**13.25%**	4.63%		**3.16%**	1.96%	*negative*	**-16.41%**	6.39%

Table 6A

Regression Results

Variable	Equation (1) Coefficient Estimate	Equation (1) Standard Error	Equation (2) Coefficient Estimate	Equation (2) Standard Error
Intercept	**-0.90357**	0.11251	**-2.84054**	0.25720
Persistent Plague	**1.95962**	0.20184	**2.86116**	0.32771
Informed	**1.20724**	0.26216	**0.50535**	0.65703
Persistent*Informed	**-1.52570**	0.48083	**-0.28480**	0.79703

Number of observations = 760

Likelihood ratio test of the significance of the regression:

Likelihood ratio statistic = -2(-728.10 + 637.77) = 180.66.
The corresponding critical value with 6 d.f. at the 1% significance level is $\chi^2 = 16.81$.

Table 6B

Mean Marginal Effects

Variable	Debt Predicted Sign	Debt Marginal Effect	Debt Standard Error	Pool Predicted Sign	Pool Marginal Effect	Pool Standard Error	*Colleganza* Predicted Sign	*Colleganza* Marginal Effect	*Colleganza* Standard Error
Intercept		**-4.44%**	1.69%		**-20.08%**	1.99%		**24.52%**	1.19%
Persistent Plague		**21.81%**	3.46%	*positive*	**15.68%**	3.10%	*negative*	**-37.49%**	2.25%
Informed	*positive*	**11.41%**	5.59%		**3.15%**	6.18%	*negative*	**-14.56%**	4.43%

Table 7A

Regression Results

Variable	Equation (1) Coefficient Estimate	Equation (1) Standard Error	Equation (2) Coefficient Estimate	Equation (2) Standard Error
Intercept	**-0.34709**	0.12815	**-2.21588**	0.26298
Persistent Plague	**1.40368**	0.21097	**2.23646**	0.33229
Informed	**1.37813**	0.32704	**0.60645**	0.68524
Persistent*Informed	**-1.69698**	0.51906	**-0.38601**	0.82046

Number of observations = 610

Likelihood ratio test of the significance of the regression:

Likelihood ratio statistic = -2(-599.72 + 552.49) = 94.46.
The corresponding critical value with 6 d.f. at the 1% significance level is $\chi^2 = 16.81$.

Table 7B

Mean Marginal Effects

Variable	Debt Predicted Sign	Debt Marginal Effect	Debt Standard Error	Pool Predicted Sign	Pool Marginal Effect	Pool Standard Error	*Colleganza* Predicted Sign	*Colleganza* Marginal Effect	*Colleganza* Standard Error
Intercept		**%**	%		**-%**	%		**%**	%
Persistent Plague		**14.33%**	3.93%	*positive*	**14.20%**	3.09%	*negative*	**-28.53%**	3.47%
Informed	*positive*	**17.87%**	5.86%		**2.35%**	6.53%	*negative*	**-20.22%**	5.90%

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