

**Was Florence a Perfectly Competitive Market? Transactional Evidence from the Renaissance**



Paul D. McLean; John F. Padgett

*Theory and Society*, Vol. 26, No. 2/3, Special Double Issue on New Directions in Formalization and Historical Analysis. (Apr. - Jun., 1997), pp. 209-244.

Stable URL:

<http://links.jstor.org/sici?sici=0304-2421%28199704%2F06%2926%3A2%2F3%3C209%3AWFAPCM%3E2.0.CO%3B2-6>

*Theory and Society* is currently published by Springer.

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/springer.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

---

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## **Was Florence a perfectly competitive market? Transactional evidence from the Renaissance**

PAUL D. McLEAN and JOHN F. PADGETT

*University of Chicago*

To the extent that any location can be considered the birthplace of mercantile capitalism, northern Italy, and especially Florence, is that place. Double-entry bookkeeping, marine insurance, partnerships with branches, holding companies, bills-of-exchange, and international banking in general – all of these accoutrements of modern business and finance were invented in northern Italy in the late thirteenth and fourteenth centuries.<sup>1</sup> No one today, contra Weber, seriously questions that late-Medieval and early-Renaissance Italian merchants had passionately pursued but rationally disciplined acquisitive motives.<sup>2</sup> These facts, with the absence of big business and big government,<sup>3</sup> have led many to infer that northern Renaissance Italian economies must have been close to Adam Smith's dream – a world of unfettered individualist entrepreneurs, rationally wheeling and dealing in laissez-faire markets.<sup>4</sup> But was Florence a perfectly competitive market? Or even a close facsimile?

Florentine historiography has a rich tradition of business history – tracing the rise and decline of particular firms and business techniques. And debates about long-term macroeconomic trends in the Florentine economy go back a long time.<sup>5</sup> But Florentine historians are just beginning to address economic development at the level of the industry.<sup>6</sup> And no one, except in the market for art,<sup>7</sup> has studied Florentine economic markets, in the sense of patterns of transactions in and among industries. This is not for lack of effort at the level of firms.<sup>8</sup> But it is very difficult to aggregate across the voluminous, but often fragmentary, company account books that exist from the period.

In this article, we introduce new data that for the first time allow a comprehensive, statistical portrait of Renaissance Florentine markets in toto – namely, city-wide household and company lists of debtors and creditors, drawn from the 1427 tax census called the *Catasto*. As our first

step in the analysis of these multi-purpose data, we examine them from the perspective of a neoclassical economist. Microeconomic theory<sup>9</sup> purports to apply across time and space. In this article, we test this claim.

Within economic theory, neoclassicists such as George Stigler and many others have defined most precisely what is entailed in and what is required for a perfectly competitive market to exist – deconcentration, full information, atomized/anonymous trading, product homogeneity and divisibility, and, of course, maximization of profits.<sup>10</sup> Such theoretical precision is essential for the statistical tests we derive below. These tests are used as benchmarks against which to compare the real Florentine economy.

Within the particular domain of Florentine historiography, Richard Goldthwaite has posed the historical puzzle we study here. On the one hand, “the very structure of the Renaissance economy of Florence, with its wide-ranging and dispersed activities and lack of central focus, precluded dependency of its various parts on any one function, so that it was virtually impossible for any one operator to hold the key to the whole system.”<sup>11</sup> This deconcentration of economic activity is exactly what neoclassical economists are talking about. On the other hand, “for all the lack of structure that characterized their system, there nevertheless must have been some very complex and extensive relations among these men.”<sup>12</sup> This lack of anonymity points to something beyond the standard theory.

In this article, we test statistically both of these aspects of perfect competition theory – industry deconcentration and anonymous trading – for this long-ago but very modern-looking economy. We focus on the core internationally oriented sectors of Florence – the banking industry, the wool industry, the silk industry, and the cloth retailing and dyeing industries – as well as on input-output markets among them. We hope both to illustrate and to assess quantitatively both sides of Goldthwaite’s puzzle, showing empirically how they fit together. In the end, we do not conclude that neoclassical theory is monolithically either all right or all wrong. Rather, different industries were characterized by very different market structures, in a way not easily understood by existing tools. To be of greater historical validity and use, we argue, economic theory needs to open itself to a wider range of “rational” economic behaviors than Adam Smith’s elegant but austere “rational” vision permits.<sup>13</sup> In future publications, we will identify more precisely this wider range of Renaissance trading behaviors.

## Data and sampling

This study is based on one of the most comprehensive historical economic data sets ever compiled. It consists of two components. Firstly, through procedures identified below, 14,683 economic relations of indebtedness were coded among persons and companies in Florence in 1427. Of these economic debts, 4,913 were between companies alone. The coverage of our data is extensive: we estimate (see Table 1 below) that for firms involved in the core economy of Renaissance Florence – namely, the banking, merchant trading, silk, wool, cloth retailing, and cloth dyeing industries – about 26 percent of the number and 60 percent of the monetary value of all debits and credits (either to persons or to other companies) extant in the city in 1427 are registered in our data set. Secondly, in the course of constructing this transactional snapshot of the economy of Renaissance Florence, we have also compiled essentially a census of all 1427 partnerships and firms in the above-mentioned industries, information not previously available.

The original source for these unusual data is the 1427 Florentine *Catasto*, tax census, made famous among historians by the pathbreaking work of Herlihy and Klapisch-Zuber.<sup>14</sup> The 1427 *Catasto* provides detailed information about the wealth and the distribution of assets of 9,780 households located within the walls of the city of Florence, as well as for approximately 50,000 additional households located in the surrounding Florentine *contado*. For our purposes, the most crucial elements in the Florentine tax returns were the extensive lists of debits and credits each household head was allowed to submit as part of his tax return, in order to claim tax deductions. In 1427, Florence levied (massive) taxes on the basis of reported *net* wealth – that is, total gross wealth, minus liabilities. Thus, each household head had a substantial financial incentive to generate as long and as hefty a list of named debts/creditors as possible. In order to combat cheating, Florentine officials also demanded a parallel list of named credits/debtors, so that they could cross-check one person's claimed debt against another person's claimed credit.<sup>15</sup>

From these original tax returns, our data set was compiled in two stages – the first stage focused on personal tax declarations, and the second stage focused on transcribed company account books. In order to understand our sampling procedure, it is necessary to realize that the *Catasto* document physically exists as two series of volumes.<sup>16</sup> The Florentine *portate*, in forty-five volumes, are the original 9,780 tax returns submit-

ted by household heads. The Florentine *campioni*, in sixteen large volumes (one for each ward), are official copies of the original submissions, made by scribes in standardized format. Both the *portate* and the *campioni* original registers exist in the Archivio di Stato in Florence. In addition, due to the labor and generosity of the late David Herlihy, the *campioni* version is available in microfilm copy in the United States, at the Center for Research Libraries at the University of Chicago.<sup>17</sup> The first sampling stage, focused on persons, used the microfilm *campioni* readily available to us. The second sampling stage, focused on companies, used the *portate* in Florence.

The data employed in this article mostly come from the second sampling stage, so we describe the first stage here only briefly. Out of 9,780 personal *campioni* 1,936 were examined and coded in the first stage, yielding over 9,000 coded debts. The procedure for selecting *campioni* to examine and code in this first stage was to focus on political and economic elites.<sup>18</sup> “Political elite” was defined operationally as any household member of the 325 families/clans identified by Dale Kent as the 1433 ruling group, on the basis of eligibility for selection to the Signoria (city council) of Florence;<sup>19</sup> with disenfranchised but influential magnate families. “Economic elite” was defined as the wealthiest surnamed<sup>20</sup> 500 households in Florence (in gross wealth), as identified in the computer tape of Herlihy and Klapisch-Zuber. Naturally, these two target lists overlapped substantially. Covering as it does 20 percent of the city, this joint definition of “elite” is liberal indeed.

It was impractical to code every debit and credit of these 1,936 households. Therefore, among these households, only debits and credits of 10 florins or above in value were coded. In addition, we coded many (10+ florin) debits and credits from these households to some recurring households, and to very many firms, outside of our original target list of households.

Of great relevance to the second stage of company coding was the fact that a large number of the 9,000+ debts coded in the first household phase were to companies, not to other households per se. Operationally, this was indicated by an “& co” designation following the name of the debtor or creditor in the household’s declaration. Thus, we could identify almost a census of firms through their presence in the economy of household debts (except, that is, for small artisan firms, whose debts and credits were typically of less than 10 florins in value). Moreover, the tax declaration for a company frequently appears, as a separate module, in

the household declaration of the leading partner of the firm (with other partners simply referencing the declaration of their lead partner). Thus, in many cases the coding of company debts flowed naturally from the coding of *campioni* household debts.

If this were the end of the story, there never would have been a second stage of coding. However, in the case of large and even medium-sized companies, Florentine scribes employed the unfortunate (for us) transcription shortcut of copying only the first and the last entries, along with the total number of debtors and creditors and the total value of credits and debts, of very long lists of transactions in the *portate*, in order to save work (and sanity). Because of this, only small (and sometimes liquidated) companies' tax declarations were fully transcribed from the *portate* to the *campioni*. To get information on larger companies, we went to the original *portate* declarations of the lead partners themselves. In most cases, these company *portate* declarations appear to be almost literal transcriptions from company account books (*bilanci*).<sup>21</sup> Such *bilanci* were effectively legal documents, since they were available to court scrutiny upon litigation demand; hence, *portate* declarations had considerable (although hardly perfect)<sup>22</sup> foundation in economic transactional reality.

Given these sources, our second stage of sampling proceeded as follows: (a) From the first stage of household *campioni*, we identified a target list of 158 firms in the core sectors of the Florentine economy – namely, in the banking, merchant trading, silk, wool, cloth retailing (*ritagliatore*), and cloth dyeing (*tintore*) industries. These firms appeared to us, from first-stage lists of debts to and from them, to be the most important in Florence. These (often large) 158 *bilanci* were then coded<sup>23</sup> from the lead partners' *portate*. (b) While perusing *portate* volumes, looking for target firms, a smattering of 13 other cloth (but not wool or silk) companies' *bilanci* was also coded, basically at random. (c) The *campioni* of all households listed in the computer tape of Herlihy and Klapisch-Zuber as having the trade of banker, merchant, wool, or silk (and a portion of those listed as dyer) were examined,<sup>24</sup> if they had not already been so in the first “elite household” stage. This second pass through the microfilm *campioni* picked up the *bilanci* of smaller firms, often headed by partners with no surnames. (d) Finally, some households did not clearly segregate (usually small) company from personal modules in their tax returns, but their status as “company” was clear, both from self-descriptions of transactions and from many others' references to the household head as “& co.”

In addition to coding lists of debtors and creditors (along with the florin value of the credit/debt), which were our primary concern, other financial information was coded from these *bilanci*, when available: (a) type of transaction on which the debt was based; (b) list of partners in the firm; (c) the founding investment capital (*corpo*) of the firm; (d) the total number of value of all debts and credits outstanding of the firm (including the less-than-10-florins debts we did not code); (e) whether or not the firm was currently in business (as opposed to an old or bankrupt firm, with unpaid debts still outstanding); (f) the primary city location of the firm (usually this was Florence, but often Florentine firms did most of their trading or banking business in another city);<sup>25</sup> (g) for wool manufacturers only: the firm's annual production (in bolts, *panni*, of cloth), and the Florentine neighborhood location of the firm (an indicator of cloth quality); and (h) the estimated value of any current merchandise inventory (relevant especially for merchant warehouses, *fondachi*).

All in all, the *bilanci* of 226 companies were examined and coded directly. After elimination of duplicates (one firm's debt being another firm's credit), in this second stage of coding, over 5,000 additional company indebtedness relations (to either companies or households) were added to the 9,000+ household indebtedness relations (to either households or companies) already coded in the first stage. Together these two stages ensured comprehensive coverage of both households and companies, including numerous ties even to households and companies whose *campioni* or *portate* were not examined directly.

Table 1 presents more detailed information, by industry, on the percentage of the core Florentine economy covered in our company data set, as measured by comparing the sums of our explicitly itemized and coded (10+ florins) debts and credits with the subtotaled numbers and values reported in the *bilanci* themselves. Of our 226 coded firms, 195 were both in the core industries and were currently active in 1427. From these "seen *bilanci*" firms, we coded 33 percent of the total number of debts and credits in their lists, and almost 70 percent of the total florin value of these lists. In addition, through transactional references to them, we are certain of the existence of another 151 active firms in the core industries, whose *bilanci* we did not see or code in full *portate* version. By comparing coded references to these firms from other firms and households with these firms' own *campioni* summaries and totals,<sup>26</sup> however, we can estimate that our data set includes 13 percent of the number and 43 percent of the total florin value of the debts and credits of these "unseen *bilanci*" firms, even though we did not code these firms directly. Putting the two

halves together, we have in our data set 26 percent of the total number and 60 percent of the total value of all debts and credits of active companies in the core Florentine economy in 1427.

Table 1 also presents estimates of total industry size, as measured by the total value of debts and credits outstanding (of all firms, seen or unseen), by industry. Perhaps not too surprisingly, the banking industry overwhelming dominated company indebtedness in Florence. In monetary value, it was about 50 percent larger than all the other industries put together. The relative sizes (in florins) of the other core industries – merchant trading, silk manufacturing, wool manufacturing, and cloth retailing<sup>27</sup> – are also be of considerable historical interest. In particular, for a relatively new industry, silk was surprisingly vibrant.<sup>28</sup>

### **The 1427 Catasto as census of companies**

As noted above, the construction of our transactional data set entailed, as a byproduct, the compilation of a census of firms participating in various markets. Table 2 presents a breakdown of the number of companies in various industries in our data set. We have subdivided here all *catasto* references to companies, operationally defined as “& co” suffixes to names, between those companies that we feel certain actually to have existed and those companies that, while referenced as “& co” by some Florentines, probably only existed as households, not as companies per se.<sup>29</sup> The table further subdivides among Florentine companies located in Florence (albeit possibly with branches abroad), Florentine companies headquartered in other cities, and old defunct Florentine companies no longer in business in 1427. Industry rows with question marks appended (e.g., “Banking?”) identify firms whose existence was not in question, but whose industry membership was not explicitly given in the *catasto* documents. In these cases, type of business was only inferred by us through transactional information.

We regard the certainty half of Table 2, down through Cloth Retailing, as effectively a company/partnership census of all firms in Florence in those industries in 1427. In other words, depending on how one counts those firms whose industry memberships we only inferred (rather than found explicitly in the documents), there were 63–80 active Florentine banks in 1427; there were 23 active Florentine merchant-trading companies, other than banks;<sup>30</sup> there were 48–49 active silk manufacturing firms (*setaiuoli*); there were 134–136 active wool manufacturing compa-



nies (*lanaiuoli*) across all *conventi*; and there were 36–40 active cloth retailing firms (*ritagliatori*).

Our confidence in these figures is based primarily on our transactional method of identifying them: any firm that did not engage in business with other firms or households in Florence effectively did not exist.<sup>31</sup> However, we have independent confirmatory evidence for these estimates as well. Hoshino, in his definitive study of the Florentine wool industry,<sup>32</sup> identified 132 wool manufacturing firms from the 1427 *catasto*, two fewer than we have firmly identified. Also from the 1427 *catasto*, Florence Edler de Roover identified 47 silk manufacturing firms, one fewer than we have firmly identified.<sup>33</sup> Furthermore, excluding banking partnerships resident abroad, our estimate of 48–57 local Florentine banks fits smoothly on the downwardly sloping trend line from 70 local Florentine banks in 1399 to 33 such banks in 1460, as itemized in surviving guild records.<sup>34</sup>

Our cloth dyeing estimate of 17 *tintori* firms includes all of the largest of such companies, but we did not make a concerted effort to identify a full census in this industry. And the various artisan firms listed under “Other” include only a random smattering of the numerous such firms that truly existed.

### **The neoclassical theory of perfect competition**

Given the quality of our data set, we are in an unusually good position to test standard microeconomic theory. With his usual crispness, George Stigler has summarized the conditions that neoclassical economists demand for a single market to be judged “perfectly competitive”:<sup>35</sup>

1. A number of firms and consumers sufficiently large that no one can influence market price.
2. Complete knowledge of offers to buy and sell by the participants in the market.
3. Anonymity/impersonality of participants in the market, in the specific behavioral sense that all buying and selling actions are independent of each other.
4. Product homogeneity.<sup>36</sup>
5. Product divisibility.

For perfect competition at the level of the economy at large, the following relations among markets must also obtain:

6. Full mobility of resources (otherwise known as low barriers to entry and exit).
7. Complete knowledge of the yields on resources in alternative employments.

Given single-market conditions one through five and the economists' usual assumption about participants always maximizing profits or utilities, the following strong conclusions follow:

- a) A single competitive price will exist, which clears the market (that is, which equates the quantities offered by sellers to the quantities sought by buyers).
- b) That price will equal the marginal cost of producing the good.

Adding cross-market conditions six and seven produces the additional implications of efficient production and zero profits.

To what extent does this neoclassical model of perfect competition describe, or even approximate, the markets of Renaissance Florence? And with the trading data that we have, how could we possibly know?

In addition to his crisp restatement of the theory, Stigler also provides a useful survey of how empirically-oriented economists have operationalized such questions for contemporary markets.

Some economists have preferred to go straight to the “bottom line” and inquire whether price equals marginal cost. Practically speaking, this means finding out whether firms consistently have “too high” rates of return. Stigler notes that this approach, while originally appealing to economists, “has lost much popularity because of the difficulty of measuring profitability.”<sup>37</sup>

For the case of Renaissance Florentine firms, Stigler's point is well illustrated in Raymond de Roover's study of the 1302–1348 Alberti trading company.<sup>38</sup> De Roover calculated Alberti profit rates that differed drastically from the profit calculations made earlier, from the same account books, by the equally famous economic historian Armando Sapori.<sup>39</sup> The point is not that the calculation of profit is impossible. But it is a very tricky matter, fraught with accounting land mines (not to mention

Table 1. Percent coverage of catastro in data set<sup>a</sup>

	Total number of trans. <sup>b</sup> coded	Seen Bilanci			Unseen Bilanci			Overall			Estim. total market size <sup>c</sup>
		<i>n</i> firms	% trans. coded	% flor. value coded	<i>n</i> firms	est. % trans. coded	est. % value coded	% bilan. seen	est. % trans. coded	est. % value coded	
<i>Banking</i> <sup>d</sup>											
Florence <sup>e</sup>	3811	31	47.4	78.3	17	24.4	46.5	65	41.1	68.7	2,101,063
Foreign Banks? <sup>f</sup>	746	12	22.0	45.4	3	7.0	—	80	20.1	47.3	834,075
	278	5	16.2	43.0	12	—	—	29	18.4	45.8	253,922
Total Banking	4835	48	37.6	66.0	32	22.3	48.7	60	33.4	61.3	3,189,060
<i>Merchants</i> <sup>g</sup>	679	10	47.2	69.7	14	3.2	25.5	42	13.3	46.7	501,959
<i>Silk</i>	1552	32	29.5	80.3	17	17.3	54.8	65	26.8	72.3	298,907
<i>Wool</i>											
San Martino	1562	30	48.8	77.5	15	9.8	17.4	67	32.2	54.0	510,068
Garbo <sup>h</sup>	678	24	34.8	75.8	22	16.9	34.4	52	28.3	60.5	77,504
Unknown loc. Wool?	633	16	41.2	74.7	27	15.9	68.0	37	30.9	73.7	126,636
	14	1	—	—	1	—	—	50	8.3	22.9	3,897
Total Wool	2887	71	43.7	77.0	65	12.2	25.9	52	30.5	58.0	718,105
<i>Cloth retail</i>											
Ritagliatori	2502	23	22.9	70.4	13	12.0	42.0	64	19.7	61.3	486,362
Ritagliatori?	77	2	21.1	70.9	2	—	—	50	20.1	68.1	41,125
Total Ritaglia.	2579	25	22.8	70.4	15	12.0	42.0	63	19.7	61.8	527,487

Table 1. Continued

	Total number of trans. <sup>b</sup>			Seen Bilanci			Unseen Bilanci			Overall			Estim. total market size <sup>c</sup>
	n	% trans. coded	% flor. value coded	n firms	% trans. coded	% flor. value coded	n firms	est. % trans. coded	est. % value coded	% bilan. seen	est. % trans. coded	est. % value coded	
<i>Cloth dyeing</i>	503	27.8	56.6	9	27.8	56.6	8	16.9	31.4	53	25.8	47.4	- <sup>i</sup>
<i>Total</i>	-	195	33.1	68.4	151	12.7	43.2	26.1	60.1	-	-	-	-

<sup>a</sup>Table 1 is based on transactions between named-industry companies and either companies or households (not just between companies and companies, as in the rest of the paper). "Named-industry companies" here excludes low certainty firms (with certainty code = 0 or 1), and old or bankrupt firms.

<sup>b</sup>"Transactions" in this table are all debits and credits, excluding capital (*corpo*, etc.), of all of the live firms in that industry. Because of this, totals in this table, unlike later tables, do not correct for double-counting within industries – that is, one firm's debit may be another same-industry firm's credit.

<sup>c</sup>"Size" here is the sum of florin values of all transactions for all companies in the industry. Missing data were estimated with the aid of the "percent value coded" industry figures herein. Note that "size" in this transactional/debt sense may not be equivalent to "size" in other senses.

<sup>d</sup>Bankers often engaged in merchant trading as well as banking.

<sup>e</sup>"Florence" means the Florentine bank had a local *tavola*. "Foreign" means the Florentine bank was located/headquartered in another city.

<sup>f</sup>A question mark indicates firms whose existence was certain, but whose industry membership was only inferred by us – not explicitly stated in the *portate*.

<sup>g</sup>"Merchants," as defined here, exclude merchant-traders also engaged in banking, but include both *mercatori*, large importer-exporters, and *merciai*, small peddlers.

<sup>h</sup>Higher quality wool was produced in the San Martino neighborhood. Lower quality "Garbo" wool was produced in via Maggio (Oltrarno), San Pancrazio, and San Pier Scheraggio.

<sup>i</sup>No exhaustive search was made to identify all *tintori*. Therefore, we cannot estimate total cloth-dyeing market size.

Table 2. Number of 1427 Companies/Partnerships

	Certainty code = 2, 3			Certainty code = 0, 1		
	Florence	Overseas	Old	Florence	Overseas	Old
<i>Banking</i>						
Banking	48	15	17	9	1	2
Banking?	9	8	2	7	3	2
<i>Merchants</i>						
Mercatori	7	9	0	6	8	0
Merciai	6	1	0	6	0	1
<i>Silk</i>						
Silk	41	7	0	10	3	0
Silk?	1	0	0	1	0	0
<i>Wool</i>						
San Martino	41	4	7	1	0	0
via Maggio	28	0	3	1	0	0
San Pancrazio	8	0	0	0	0	0
S Pier Scheraggio	10	0	0	0	0	0
Unclear Location	<u>36</u>	<u>7</u>	<u>3</u>	<u>18</u>	<u>2</u>	<u>0</u>
Total Wool Mfct.	123	11	13	20	2	0
Wool Mfct.?	2	0	0	9	0	0
<i>Cloth retail</i>						
Ritagliatori	33	3	1	7	1	0
Ritagliatori?	0	4	0	2	0	0
<i>Tintori/dyers</i>	17	0	3	8	2	0
<i>Others</i>						
Furriers	6	0	0	4	0	0
Goldsmiths	3	0	0	5	0	0
Rigattieri	9	0	0	3	0	0
Linaioli	6	0	0	11	0	0
Speziali	13	0	0	1	0	0
Misc. Artisans	12	1	0	4	0	0
<i>Industry unknown</i>	<u>12</u>	<u>10</u>	<u>6</u>	<u>104</u>	<u>24</u>	<u>18</u>
<i>Total</i>	348	69	42	217	44	23

occasional deceit on the part of company owners). In addition to this data problem, there remains the conceptual ambiguity of what level of profit rate is “too high” for a fully competitive market.

Likewise, the approach of testing the other prediction of perfect competition theory – that of a single, market-clearing price – has been abandoned. Again in the words of Stigler: “In a market of numerous sellers and buyers it is impossible that all prices in a short interval of time will be uniform.... Strict uniformity of prices has properly been viewed by the courts as a phenomenon more suggestive of collusion than of competition.”<sup>40</sup>

Because of these problems, economists in their empirical work on market competition have switched from testing the predictions of perfect competition theory to assessing its market-structure assumptions<sup>41</sup> – that is, conditions one through five.

The micro-level assumptions of complete knowledge (condition two) and of profit maximization (the general assumption of the economics discipline) are in principle testable, but only with the careful and detailed case studies of particular companies that de Roover used to do, and that Richard Goldthwaite still does. Our market-level data, for all its richness, cannot really penetrate down to this company case-study level. However, Goldthwaite, who has devoted much of his career to the detailed study of Florentine account books, has concluded the following about Florentine business micro-behavior:

It has rarely been remarked how seldom a competitive spirit comes into play in the relations among these merchants. The vast correspondence of Datini and of the Medici themselves (the largest collections of business letters to survive before the sixteenth century) yields hardly a hint of competition; and the subject does not come up for discussion in the exhaustive studies of business historians like Armando Saponi, Raymond de Roover, and Federigo Melis – all vigorous proponents of the “modernity” of Renaissance business practice and ever ready to describe it with the vocabulary of modern industrial and financial capitalism. Merchant bankers undoubtedly competed with one another for the sale of their goods and the attraction of clients – but not to the extent that they devised techniques for product variation and cost-cutting in their home industry and for underselling and market domination abroad, the techniques the Dutch and the English used to win out over the Italians when in the sixteenth century they moved into the latter’s home area of the Mediterranean. So, however individualistic the Florentine business world appears in contrast with the tight corporate structures elsewhere – the Venetian senate, the Hanseatic League, the south-German cartels, the London regulated companies – it was still permeated with something of the spirit of medieval corporatism. This

is what the *fiducia* Florentine business historians make so much of really comes down to – that sense of trust in one another that in a way also kept everyone in line.<sup>42</sup>

Our own canvass of a few of the most notable *ricordi* produced by merchant writers of the period reveals profit to be understood within a framework of honor. Goro Dati, a silk producer in our data set, explicitly averred in his *Libro segreto* that henceforth he would hold honor above earnings, and before God forswore profit-making on holy days.<sup>43</sup> Thoughts on commerce are tinged with moral and religious concerns throughout the fourteenth and fifteenth centuries, no doubt because of the vibrancy of the debate concerning the sins associated with money-making that persisted in this period. The scrupulous merchant Paolo da Certaldo praised the earning of profit,<sup>44</sup> but pointed more to virtue, good habits, and caution in revealing secrets or confiding in friends too easily as the bases for success, without mentioning competitiveness. Both da Certaldo and his successor, the neurotic and pessimistic Giovanni di Pagolo Morelli, counselled against placing untested trust in friends and business associates, concluding that tested friendship, not impersonal market mechanisms, formed the proper basis for interpersonal trust.<sup>45</sup> Weissman sums up the same point this way:

The medieval merchant, like his modern cousin, was obsessed with the calculation of profit and loss. Unlike the modern capitalist, however, the calculation of profit and loss was accompanied by another obsession: the calculation of honor and shame. The form of economic exchange that most clearly demonstrates its dependence on the entire cluster of beliefs and practices embedded in the personal economy of the Renaissance is the exchange of credit.<sup>46</sup>

Whether these texts constitute decisive evidence against the perfect competition model for the Florentine case can be debated. But likewise, whether the behavior to which Goldthwaite and Weissman evocatively refer was distinctive to the past can be debated as well.<sup>47</sup>

In the absence of appealing and practical alternatives, and with a commitment to more formal criteria, the dominant way contemporary economists evaluate the competitiveness of a market is to focus on condition one, and to measure industry concentration. In the following section, we also follow this approach, simply because it is so widespread. In our opinion, however, this standard method of testing is very weak, for a number of reasons: (a) “Industry concentration” measures only aggregate firm-size distribution, not actual market behavior. (b) Apart from less being better than more, perfect competition theory provides no con-

ceptual benchmark for deciding whether observed levels of concentration are “too high.” And (c) extant measures of industrial concentration are all ad hoc; no probabilistic foundation exists for any of them, within which to assess statistical significance.<sup>48</sup>

Our own approach to evaluating whether the core industries in Renaissance Florence were perfectly competitive, therefore, primarily is to zero in on condition three, and to assess the degree of anonymity/impersonality of trading in the Florentine markets. Specifically, in the section after next, we develop two statistical models of independence of company buying (and selling) decisions, and use these to generate explicit predictions about the probability distribution of repeat-trading behavior. These predicted distributional forms have statistical significance tests attached. If these null models are rejected by our rich transactional data, then we will conclude that trading was not anonymous/impersonal in Florence, and that, for the markets in which it fails, the neoclassical model of perfect competition is an inappropriate framework for our historical understanding of Florentine markets.

Product homogeneity and divisibility (conditions four and five) also are assumptions of the model of perfect competition. While we do not have explicit measures of these product variables, these conditions are very likely to have been satisfied in the case of Renaissance Florence. The primary goods in the core economy of Florence were textiles and bills of exchange, both highly standardized and divisible in nature. Wool cloth was standardized (and location segregated) into two types of quality – first through market practice and then through guild regulation.<sup>49</sup> It was easily divisible into *panni*. Banking bills of exchange involved the delayed exchange of currencies, for the purpose of short-term (10-day to 3-month) loans.<sup>50</sup> Money is, and always was, the most standardized and divisible good of all.<sup>51</sup> The remarks of Goldthwaite cited above also suggest the relative absence of product variation in Florentine manufacturing. In short, even though we cannot test conditions four and five directly, they appear not to be seriously at issue in early Florentine markets.

### **Measures of industrial concentration**

Levels of industrial concentration are relevant for perfect competition theory, since when a few large firms have “too large” a market share, they can, either unilaterally or in concert, drive market price above its “natural” marginal-cost level. While less concentration obviously is bet-



Table 3. Measures of industrial concentration<sup>a</sup>

	Corpo		Trans. total <sup>b</sup>		Transaction totals in data				
	n	Avg. Size	n	Avg. Tot.	n	Avg. Tot.	% top 3	H - H index	H - H - (1/n)
<i>Banking</i>	34	7,724	40	50,930	63	29,898	22.1	0.0374	0.0216
<i>Merchants<sup>c</sup></i>	4	4,431	4	31,830	17	13,326	*	*	*
<i>Silk</i>	26	3,418	27	5,390	45	4,843	18.4	0.0376	0.0154
<i>Wool</i>									
San Martino	30	3,348	29	9,037	44	6,489	19.5	0.0371	0.0144
Garbo	16	1,450	29	1,799	44	1,113	24.5	0.0436	0.0209
All Wool Co.	60	2,542	71	5,058	123	3,495	13.0	0.0207	0.0126
<i>Cloth retail</i>	19	3,839	18	17,723	35	8,518	37.0	0.0659	0.0373
<i>Cloth dyeing</i>	8	1,095	12	4,363	17	1,677	*	*	*

\* = n's too low for meaningful calculation.

<sup>a</sup> Only firms certain both of existence and of industry membership, and that are not old, are included in these and in all following analyses.

<sup>b</sup> Based on totals recorded in *bilanci*, not the sum of transactions in our data. Company overall totals for debits and credits from *bilanci*, including even the less-than-10-florin transactions, were available for only a subset of all firms. Similarly, *corpo* figures were not available for all firms.

<sup>c</sup> In this table, and in the following ones, "merchants" is defined as *mercatori* only, since *mercatori* (import-export) and *merciai* (local only) merchants were not really in the same market.

ter, unfortunately there is no precise theoretical benchmark for "too large." Goldthwaite, however, has argued forcibly that the Florentine banking industry was decentralized. Hoshino has argued the same for the Florentine wool industry.<sup>52</sup> Thus we enter our data analysis with strong prior expectations that Florence was indeed something like a perfectly competitive market.

Table 3 presents the relevant data, industry by industry, on industrial concentration. The two standard measures in the empirical economics literature are the concentration ratio and the Hirschman–Herfindahl index. The concentration ratio is simply the percentage of the total value of transactions<sup>53</sup> in the market engaged in by the top *k* firms. Here, because the number of firms is not huge, we choose *k* = 3. This simple and easy concentration ratio is the most popular measure in the litera-

ture. The Hirschman–Herfindahl index is the sum, across firms, of each firm’s market share squared. This data-demanding index is the one most advocated in the literature.<sup>54</sup> Other measures of industrial concentration exist, but they almost all have problems that explain their lack of favor.<sup>55</sup> These two measures, presented in Table 3, were both calculated on the basis of all non-capital<sup>56</sup> transactions recorded in our data set (summing both debits and credits). As in all of the Tables 3–5, our operational definition of “industry” includes only active firms, about whom we are certain of both their existence and their business.

As explained above, our transactional data are a sample. To provide mental calibration, we also provide in Table 3 average value of capital (*corpo*) per firm and average total value of transactions per firm, calculated over the subset of firms about which we had such information.

One major problem with both the concentration ratio and the Hirschman–Herfindahl index is that they are affected by  $n$ , the total number of firms in the industry. The concentration ratio is affected because  $k$  is fixed, regardless of  $n$ . The Hirschman–Herfindahl index is affected because the lowest the index can go is  $1/n$ , not zero.<sup>57</sup> Because of this, comparisons across industries are treacherous. We have dealt with this comparability problem by presenting in Table 3 also a “normalized” Hirschman–Herfindahl index – namely, the Hirschman–Herfindahl index minus  $1/n$ .

Our data speak most clearly on the issue of the relative rank ordering of concentration across Florentine industries. Ignoring the cases of the merchants and the dyers, whose number of firms was too low to generate reliable measures, we have the following rank order to Florentine industries by concentration: cloth retailing was the most concentrated; banking was the second most concentrated; and wool and silk production were equally the least concentrated industries in Florence. In terms of size measured as *corpo* capital, banks were on average about twice as big as silk and cloth retailing companies, and three times as big as wool firms. In terms of size measured as total value of transaction debits and credits, banks were almost ten times as large as wool and silk companies, and about three times as large as cloth-retailing firms.<sup>58</sup>

Are these banking facts inconsistent with Goldthwaite’s claim that “the basic features of the Florentine commercial-banking system that limited the exercise of power throughout the sector were the large number of firms and their relatively small size”?<sup>59</sup> Appearances notwithstanding,

the answer is not clear, since economic theory provides no absolute concentration standard sufficiently sharp to measure deviation from the perfect-market “no price-setting power” ideal. On the one hand, Renaissance Florentine concentration levels were all very low compared to modern U.S. industries.<sup>60</sup> And in the far more relevant Florentine context, not one 1427 Renaissance banking firm, the famous Medici bank included, came even close to approximating the “massive” sizes (100+ employees) of the largest late-Middle Ages banking firms of the early fourteenth century.<sup>61</sup> In these senses, all the markets in Renaissance Florence were indeed quite deconcentrated.

On the other hand, another of Goldthwaite’s central conclusions seems quite overstated:

The Medici, in short, although the largest company on record, and the one with the most geographically extensive organizational structure, did not have a commanding position in the system. The history of international banking and commerce in Medicean Florence could be written without so much as mentioning the Medici – and such a study would be a healthy corrective to the current historiographical situation.<sup>62</sup>

The core Medici banks of Cosimo and Lorenzo di Giovanni and of Averardo di Francesco de’ Medici together comprised 24.0 percent of the Florentine transactional banking market. And the nine banks in the Medici clan as a whole comprised 30.5 percent of the banking market. We don’t know the standard for calling such market positions “dominant,” but the Medici presence in the large banking market was impressive, for sure.<sup>63</sup>

Whether the data in Table 3 add up to “perfectly competitive markets” or not, however, is simply undecidable. The standard criterion used in the field is, in our opinion, too ambiguous.

### **Stochastic models of anonymity in the market**

A basic assumption of all economic-market theory, perfect competition or not, is anonymity or impersonality – that is, people will take the best deal,<sup>64</sup> regardless of who offers it. Perfect competition theory (under the conditions listed above), in turn, implies that at equilibrium everyone is offering the same deal. Therefore, who buys from whom is random. Except in the supply-and-demand aggregate, mediated through price alone, buying and selling decisions are independent of one another.

These ideas can be operationalized into simple and testable statistical models of who trades with whom. We have no data on prices of transactions, but we have massive data on who traded with whom (not to mention the value of those transactions).<sup>65</sup> The identity of traders should be irrelevant in a perfect competition market, as buyers and sellers both cast their search nets wide, constantly looking for slightly better deals.<sup>66</sup> Because of this, observable portfolios of trading partners should be dispersed, not concentrated on a few high-density trading partners.

Trading “at random,” however, can mean two different things: (a) Buyers go to all sellers with equal probability [ $p = 1/n$ ]. Or (b) buyers go to a seller with probability equal to that seller’s market share [ $p = s_i$ ]. The first approach defines “at random” with reference to firms, implying just as much search over small firms’ offerings as over large. The second approach defines “at random” with reference to prior transactions in the market, implying greater likelihood of searching large firms’ offerings (perhaps because past market success is taken as a signal of anticipated future success in transaction).

Inspired by the similar, but not identical, work of Joel Cohen,<sup>67</sup> we show in an appendix that the first approach leads to the prediction of a Homogeneous Binomial probability distribution of number of purchases from different sellers in each buyer’s portfolio. And the second approach leads to the prediction of a Heterogeneous Binomial distribution of number of purchases from sellers in each buyer’s portfolio.

The fundamental metaphor behind these models is this: Imagine buyers as ball-throwers, each of whom is throwing a possibly different number of balls [transactions] at a fixed array of urns [sellers]. There are  $m$  buyers ( $j = 1, \dots, m$ ), and there are  $n$  sellers ( $i = 1, \dots, n$ ). There are  $K$  total balls [transactions] in the market, subdivided into  $K_j$  balls from each (different-sized) buyer. All buyers’ balls land independently on the  $n$  urns [sellers], in accordance with one or the other of the two “at random” probability schemes above. The appendix derives how buyers’ balls should land on sellers, if buying is occurring in this anonymous, impersonal way. Clearly, this statistical model presumes that, except perhaps for market share, all sellers are fundamentally the same. But this is precisely what should be true, at equilibrium, in a perfectly competitive market.

This model is tested here in two different ways. We use only company-to-company trading data<sup>68</sup> – that is, data collected primarily in stage two

Table 4. Global test of equal-probability perfect competition model<sup>a</sup>

$X^2$ p-values	Creditors/sellers					
	Banking	Merchants	Silk	Wool	Cloth retail	Dyeing
Debtors/ buyers						
Banking	0.0000* (332,50)	0.0000* (78,16)	0.0000* (107,30)	0.0000* (247,73)	0.9996 (62,22)	0.9170 (8,5)
Merchants	0.9657 (77,32)	0.9902 (15,8)	0.9963 (24,17)	0.9685 (28,21)	0.8323 (6,4)	– (0,0)
Silk	0.0000* (186,41)	0.3208* (32,10)	0.9974 (137,33)	0.9975 (25,16)	0.9872 (68,17)	0.3490 (23,4)
Wool	0.0000* (212,34)	0.0000* (71,7)	0.9969 (20,13)	0.0000* (200,69)	0.0000* (96,21)	0.4317 (191,12)
Cloth retail	0.6608 (110,29)	0.5676 (13,4)	0.9994 (53,19)	0.0000* (713,91)	0.8063 (67,21)	0.0000* (37,8)
Cloth dyeing	0.9965 (24,12)	– (0,0)	0.7925 (14,11)	0.9996 (48,35)	0.9848 (33,18)	– (0,0)

<sup>a</sup>  $X^2$  tests based on  $p = (1/n)$ , where  $n$  includes only those selling/creditor firms that deal with the buying/debtor industry in question. Cell entries give (a)  $X^2$  p-values, with asterisk attached if  $p < .05$ , and, in parentheses, information used to construct these tests: (b)  $K$ , the observed number of transactions between the two industries, and (c)  $n$ , the number of participating selling/creditor firms.

of our coding, from company *bilanci*. The most straightforward approach to testing these data is to disaggregate by buyer size,  $K_j$ , because that is a central parameter in both the homogeneous and the heterogeneous equations (see appendix). In other words, for each market, we can group all buying firms of the same  $K_j$  classes where we have sufficient data. We present these disaggregated results, for both the equal-probability and the market-share models, in Table 5. Alternatively, we can try to use all of our data by pooling across all  $K_j$  size classes to develop a single global test for each industry. Because the mathematics of binomials is nice, we can do this for the equal-probability homogeneous case, and we present these results in Table 4. But in the Heterogeneous Binomial case, estimating the market-share parameters unfortunately uses up all degrees of freedom, to produce an untestable saturated model. Throughout Tables 4 and 5, Chi-square is used as our test for statistical significance, in accordance with the “testing discrete probability distributions” procedure recommended by Bickel and Doksum.<sup>69</sup>

Table 5. Disaggregated tests of equal-probability and market-share perfect competition models<sup>a</sup>

Number and percentage of  $K_j$  “firms” not fitting models (at  $p < .05$ )

Debtors/ buyers	Creditors/sellers			
	Banking	Wool	All others	Totals
Banking	10/15 = .667	3/12 = .250	7/20 = .350	20/47 = .426
	10/15 = .667	4/12 = .333	7/20 = .350	20/47 = .447
	(332: 228, 795)	(247: 31, 266)	(255: 58, 583)	(834: 318, 644)
Wool	5/7 = .714	3/11 = .273	1/15 = .067	9/33 = .273
	5/7 = .714	3/11 = .273	4/15 = .267	12/33 = .364
	(212: 54, 424)	(200: 38, 047)	(378: 43, 646)	(790: 136, 117)
All others	10/32 = .313	4/31 = .129	6/45 = .133	20/108 = .185
	8/32 = .250	4/31 = .065	7/45 = .156	17/108 = .157
	(397: 98, 556)	(814: 96, 703)	(522: 68, 247)	(1733: 263, 506)
Creditor totals	25/54 = .463	10/54 = .185	14/80 = .175	49/188 = .261
	23/54 = .426	9/54 = .167	18/80 = .225	50/188 = .266
	(941: 381, 775)	(1261: 166, 016)	(1155: 170, 476)	(3357: 718, 267)

<sup>a</sup>The first line of each cell reports the number of rejections of the Homogeneous Binomial model (significant at  $p < .05$ ), out of all the disaggregated  $K_j$  tests in that market cell. The second line does the same for the Heterogeneous Binomial model. The third line, in parentheses, reports interpretative information: (a)  $K$ , the total number of transactions used in all the  $K_j$  tests; and (b) the total florin value of trading in these market cells.

We begin with the global Chi-square tests of the equal-probability Homogeneous Binomial model, aggregated across  $K_j$ . Table 4 presents the results in the form of significance levels, for each market interface, along with collateral information used in the construction of these tests – namely,  $K$ , the total number of observed transactions/balls in that market,<sup>70</sup> and  $n$ , the total number of seller firms observed in that market.<sup>71</sup>

The findings in Table 4 are quite sharp (in the sense that there are no borderline Chi-squares): Banking and wool were not anonymous/impersonal markets. But the others – non-banking merchants, silk, cloth retailing, and dyeing – probably were. More specifically, both from their perspective as buyers and from their perspective as sellers, banking and wool firms engaged in significantly more repeat-business or “relational” trading than perfect competition theory permits. This was true not only internal to the banking and wool sectors themselves, but, more importantly, between the banking and wool firms and a majority of all other

sectors. The hypothesis of impersonal and dispersed trading, however, cannot be defeated for the other industries – other than when they were trading with banking and wool.

At first glance, two out of six industries may not seem like many, but one must remember that, in terms of total financial indebtedness, the banking industry alone dwarfed the rest of the Florentine core economy put together (see Table 1). Through bills of exchange, it brokered much of the business of everyone else, especially the import-export business. And both in terms of number of companies (Table 2) and in terms of total employment, the wool industry was the largest in Florence. Twenty-nine percent of the workers in Florence were employed in the wool industry,<sup>72</sup> far higher than in any other sector. The banking and the wool industries, in other words, were the core of the economy in Florence.

Table 5 summarizes the analogous disaggregated results, based on one Chi-square test for each  $K_j$  size class (except the untestable  $K_j = 1$ ) within each market interface. Summary is in the form of the percentage of  $K_j$  “firms”<sup>73</sup> that behaved significantly different from each of our two perfect competition models, at the  $p < .05$  level. In this sense, Table 5 measures the magnitude of the deviation from the perfect competition ideal, in addition to measuring statistical significance. Since there was no patterning to test results within the four anonymous industries, we simplified Table 5’s presentation into market relations among banking, wool, and “all other” industries (even though statistics were computed on the basis of actual markets). In Table 5, moreover, unlike in Table 4, we can compare the relative performances of the equal-probability and the market-share models.

The first point to note about the results in Table 5 is that switching to the heterogeneous version of the perfect competition model does not improve goodness-of-fit over the homogeneous version. In spite of the large  $(n-1)$  number of market-share parameters fitted to column marginals, the Heterogeneous Binomial models fit slightly (very slightly) worse than the Homogeneous Binomial models. For technical reasons, we could not construct a global test for the market-share model. But the results in Table 5 say that it wouldn’t have made any difference if we could have. In retrospect, this conclusion probably should not have surprised us, because of the deconcentrated nature of most Florentine markets. Be that as it may, there is no evidence here that buying firms looked more frequently at the offerings of large firms than of small firms.

For the most part, the disaggregated findings in Table 5 are consistent with the global results in Table 4. But Table 5 adds order-of-magnitude information to the binary yes-no approach of Table 4. In particular:

- a) Two-thirds of banking “firms” engaged in relational, not impersonal, trading when dealing with each other.
- b) Likewise, about 70 percent of wool “firms” engaged in relational, not impersonal, buying from banks.<sup>74</sup>
- c) In trading among wool “firms” and in all types of buying and selling between banking “firms” and everyone else, 25 percent to 35 percent of wool and banking “firms” engaged in relational, not impersonal trading.
- d) But in trading relations among “all others” and between “all others” and wool, only 5 percent to 15 percent of such “firms” engaged in relational trading – barely above the 5 percent level expected by chance.

The only real point of disagreement between the results in Tables 4 and 5 is the fact that the global approach in Table 4 uncovered significant evidence of non-perfect-competition “relational” trading (in both directions) between cloth retailers (*ritagliatori*) and wool producers (*lanaiuoli*), whereas the disaggregated approach in Table 5 did not. Hopefully, we can resolve this ambiguity in future research.

## Conclusion

This article fulfills two purposes. The first of these is to begin the process of learning something new about Renaissance markets – purportedly the foundation of modern capitalism. The second purpose is to add a statistical tool to the repertoire of empirical economists, to enable them to test their theories with greater rigor.

With regard to the second goal, the importance of pushing beyond simple concentration indices is underlined by a schematic summary of the results in the previous two sections (see Table 6).

As this summary shows, satisfaction of Stigler’s first condition for a perfectly competitive market (deconcentration) in no way implies satisfaction of Stigler’s third condition for such a market (impersonal trading). In addition to the outcomes of being clearly in violation of perfect competition ideals (banking) and of being clearly consistent with them



Table 6. Schematic description of Florentine markets.

	Relatively not anonymous trading	Relatively anonymous trading
Relatively concentrated	Banking	Cloth retailing
Relatively deconcentrated	Wool	Silk

(silk), industries can be deconcentrated without being anonymous (wool), and they can be anonymous without being deconcentrated (cloth retailing). Entire theoretical/interpretive frameworks should not be quickly accepted just because one selected aspect of them is consistent with reality.<sup>75</sup>

With regard to the more important first goal of this article, we have taken only one step toward a fuller understanding of the historical development of markets in the Renaissance. Most clearly, we need now to investigate both the causes and the consequences of relational, as well as impersonal, trading in Florence. Indeed, given the dense social world that was Florence, explaining the impersonality of some markets may be as problematic as explaining relational trading. In our view, Weissman offers a crucial initial clue about the cultural matrix of Florentine trading:

Several basic assumptions should be highlighted. First, exchanges between strangers were considered to be quite hazardous. To achieve necessary leverage in social interactions these relations had to be converted into personalized relations, that is, relations bound by a sense of moral obligation that was perceived as transcending the immediate business at hand. There were two principal methods of achieving this: directly, by befriending the party in question, or indirectly, through the mediation of some third party who exercised influence over the other party. Second, all social exchanges had to be reciprocated, and such reciprocation had to be weighed and balanced on the scales of honor and shame.... It is useful to remember that although personal relations in the Renaissance were often accompanied by demonstrations of strong affection, it was the perception of moral obligation, not the modern criterion of psychological intimacy, that distinguished relations between friends from relations between strangers. And Florentines could be cold and calculating in their acquisition and cultivation of personal relations.<sup>76</sup>

Thus, we believe that the starting point for understanding Florentine markets is to abandon the modernist syllogism that equates relational to personal, and anonymous to instrumental.<sup>77</sup> Economic, personal, and moral calculations could not be easily parsed in the Renaissance – even

when trading was so-called “impersonal.” Information available to both exchange partners about their respective social contexts and histories was usually too rich for social scientists’ discipline-segregating concept of “the differentiation of market from society” to make much sense.

The next step, therefore, is to examine exactly how Florentine economic trading patterns, sketched above, were embedded in the dense, and often contradictory, social networks that constituted Florence. Family, marriage, political partisanship, class, and neighborhood are but obvious hypotheses for the ligaments around which (or across which) Renaissance markets congealed.<sup>78</sup> Given Medici preeminence both in banking and in politics, the possible political ramifications of the structure of the banking industry are especially intriguing.<sup>79</sup> And, most abstractly, the existence of relational trading in as deconcentrated, product homogeneous, and technologically stable an industry as wool poses a challenge to economic theory.<sup>80</sup> All these issues, alas, are merely tantalizing topics for future research. But of one thing we can now be certain. Goldthwaite was completely on target when he argued:

Yet, in another sense, for all the lack of structure that characterized their system, there nevertheless must have been some system to the very complex and extensive relations among these men. They could not have conducted the kind of business activity they engaged in without continual contact with one another and without an implicit trust in one another, for independent as they were in an organizational sense, they had to work through the far-flung web of relations they all depended upon.<sup>81</sup>

Now that we know statistically that such an implicit system did indeed exist, and now that we also know the topology of where it existed, it is time to uncover the exact relational nature of what that Florentine – and hence early capitalist – economic market system really was.

### **Acknowledgments**

The first author is responsible for the coding and collection of the data described herein, in the context of a broader study of Florentine social networks being conducted by the second author. Both authors are responsible for analysis. We thank Roberto Franzosi, Richard Goldthwaite, John Mohr, and Duncan Snidal for their very helpful comments. Financial support is gratefully acknowledged from the Social Science Division of the University of Chicago and from the National Endowment for the Humanities.

## Appendix: Ball-throwing models of perfect competition

### I. The homogeneous binomial model

Imagine  $m$  buyers ( $j = 1, \dots, m$ ) and  $n$  sellers ( $i = 1, \dots, n$ ). Each buyer throws  $K_j$  balls [transactions] at random at an array of  $n$  urns [sellers]. If “at random” means that each urn/seller has an equal probability of receiving any of  $j$ 's balls, then the probability of any urn receiving any one ball thrown is

$$p = (1/n), \quad \text{for all } i.$$

In this homogeneous case, all urns/sellers are equivalent, so independent ball-throwing by each buyer  $j$  represents the same Bernoulli trial sequence for each urn  $i$ . [See William Feller, *An Introduction to Probability Theory and Its Applications* (New York: Wiley, 1968), 146–150 for details.] In this simple setup, it is well known that the probability for any urn to receive  $k$  out of the  $K_j$  balls thrown by  $j$  is Binomial:

$$p(k|K_j) = \binom{K_j}{k} (1/n)^k (1 - 1/n)^{K_j - k}, \quad \text{for all } i.$$

Indeed, since Binomials have the very nice property of being closed under convolution, the unconditional distribution  $p(k)$  of all balls thrown, across all  $m$  ball-throwers, is also Binomial:

$$p(k) \binom{K}{k} (1/n)^k (1 - 1/n)^{K - k}, \quad \text{for all } i,$$

where  $K = \sum_{j=1}^m K_j$ .

[If the same Bernoulli trials were viewed from the perspective of the sellers, not the buyers, then for fixed number of seller balls received,  $K_i$ , the probability of  $k$  balls having been received from thrower  $j$  would be Hypergeometric. [See Norman L. Johnson and Samuel Kotz, *Discrete Distributions* (Boston: Houghton-Mifflin, 1969), 55 for details.] The Hypergeometric converges into the Binomial as  $n$  becomes large. But since Binomials are easier to work with than hypergeometrics, we approach testing this model from the perspective of buyers – that is, by fixing  $K_j$  rather than  $K_i$ .]

### II. The heterogeneous binomial model

Alternatively, “at random” could be conceptualized on the basis of transactions, not of firms. That is, “at random” could mean “the probability of any new ball landing on urn  $i$  is proportional to the number of balls that have landed on urn  $i$  in the past.” This makes the likelihood of a firm receiving new business propor-

tional to its current market share (thereby, on average, maintaining that market share);

$$p_i = s_i, \quad \text{for each } i.$$

Here of course,  $\sum_{i=1}^n s_i = 1$ .

In this heterogeneous case, all urns/sellers are not equivalent, so independent ball-throwing by each buyer  $j$  represents a different Bernoulli trial sequence for each urn  $i$ . Viewed from the perspective of each buyer  $j$ , therefore, the probability distribution of its  $K_j$  balls landing on  $n$  heterogeneous urns is a superposition of Binomials:

$$\begin{aligned} p(k|K_j) &= \sum_{i=1}^n p(k|K_j, s_i) p(s_i) \\ &= \sum_{i=1}^n p(k|K_j, s_i) (s_i) \\ &= \sum_{i=1}^n s_i \binom{K_j}{k} (s_i)^k (1 - s_i)^{K_j - k}, \end{aligned}$$

since here urns have fixed market-share parameters  $s_i$ . Aggregating across  $K_j$  in this heterogeneous case results in a nontestable, fully-saturated model.

---

[It should be noted that the Heterogeneous Binomial is quite similar in spirit to the standard independence modal of contingency table analysis, wherein row and column marginals are controlled. There is an important conceptual difference, however: contingency table analysis assumes an underlying Multinomial distribution and then tests for differences between observed and expected values of cells. Here we are testing the underlying Multinomial distribution itself – since each row of a Multinomial is a Binomial. In general, the distributional forms of probabilities are more revealing about underlying *process* than expected values, which only reveal parameters of (usually just assumed) processes. For further discussion of this, see Padgett, “Bounded Rationality in Budgetary Research,” *American Political Science Review* 74 (1980): 354–372, and “Hierarchy and Ecological Control in Federal Budgetary Decision Making,” *American Journal of Sociology* 87 (1981): 75–129.

More traditional contingency table analysis cannot be performed on the company buyer/seller trading matrix in any event, since expected cell sizes are below one; see Stephen E. Fienberg, *The Analysis of Cross-Classified Categorical Data* (Cambridge: MIT Press, 1980), Appendix IV. This is not because the volume of our data is low, but rather because the number of companies (rows and columns of the trading matrices) is so large. Companies would have to be aggregated for the contingency table approach to work, and such a procedure would be arbitrary.]

---

## Notes

1. More specifically, in Genoa, Lucca, Siena, and Florence. While new techniques diffused rapidly among these four cities, making precise attribution in the face of fragmentary evidence treacherous, the standard opinion is that Genoa took the lead in inventing double-entry bookkeeping and marine insurance; Siena was first to create sedentary partnerships with branches; and Florence innovated in holding companies, bills-of-exchange, and banking generally. See Raymond De Roover, "The Development of Accounting prior to Pacioli according to the Account Books of Medieval Merchants," in *Studies in the History of Accounting*, ed. A. C. Littleton and B. S. Yamey (London: Sweet and Maxwell, 1956), 114–174, and the beginning of de Roover's article, "The Organization of Trade," in *Cambridge Economic History of Europe*, ed. M. M. Postan et al. (Cambridge: Cambridge University Press, 1965), 42–118. Venice, so prominent in later trade, was not an innovator in business technique.
2. See Richard Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," *Past and Present* 114 (1987): 3–31; Armando Saporì, *The Italian Merchant in the Middle Ages* (New York: Norton, 1970).
3. Guilds played an important role in standardizing measures, upholding quality, defining fair business practices, adjudicating disputes, and maintaining trade secrets; see Luciano Artusi, *Le arti e i mestieri di Firenze* (Roma: Newton Compton, 1990). But they never controlled volume of production, pricing, or trading partners. (In the mid-fourteenth century, the wool guild tried unsuccessfully to control wool production levels – with disastrous political effect; see John M. Najemy, "Audiant omnes artes: Corporate Origins of the Ciompi Revolution," in *Il tumulto dei Ciompi: un momento di storia fiorentina ed europea*, ed. Istituto Nazionale di Studi sul Rinascimento (Firenze: Leo S. Olschki, 1981), 59–93, and especially 70–71. According to de Roover in his classic book, *The Rise and Decline of the Medici Bank* (New York: Norton, 1966), only local banking, not international, was regulated at all.
4. See, for example, Henri Pirenne, *Medieval Cities: Their Origins and the Revival of Trade* (Princeton, N.J.: Princeton University Press, 1925); N. S. B. Gras, *Business and Capitalism* (New York: F. S. Crofts, 1939); Robert S. Lopez, *The Commercial Revolution of the Middle Ages, 950–1350* (Cambridge: Cambridge University Press, 1976).
5. For prominent examples of the former sort of research, see Armando Saporì, *La crisi delle compagnie mercantili dei Bardi e dei Peruzzi* (Firenze: Leo S. Olschki, 1926); Saporì, *Una compagnia di Calimala ai primi del Trecento* (Firenze: Leo S. Olschki, 1932); Federigo Melis, *Aspetti della vita economica medievale (studi nell'archivio Datini di Prato)*, volume 1 (Siena: Monte dei Paschi, 1962); Raymond de Roover, *The Rise and Decline of the Medici Bank* (New York: Norton, 1966). On the latter score, see Carlo M. Cipolla, "The Trends in Italian Economic History in the Later Middle Ages" *Economic History Review* 2 (1949): 181–184; Robert S. Lopez, "Hard Times and Investment in Culture," in *The Renaissance: A Symposium* (New York: Metropolitan Museum of Art, 1953); Judith C. Brown, "Prosperity or Hard Times in Renaissance Italy?" *Renaissance Quarterly* 42 (1989): 761–780.
6. For excellent examples of this work, see Hidetoshi Hoshino, *L'arte della lana in Firenze nel basso medioevo* (Firenze: Leo S. Olschki, 1980); Richard A. Goldthwaite, *The Building of Renaissance Florence: An Economic and Social History* (Baltimore: The Johns Hopkins University Press, 1980); Goldthwaite, "The Medici Bank and the World of Florentine Capitalism." *Past and Present* 114 (1987): 3–31.
7. Richard A. Goldthwaite, *Wealth and the Demand for Art in Italy, 1300–1600* (Baltimore: Johns Hopkins University Press, 1993).

8. See for example, Florence Edler de Roover, "Andrea Banchi, Florentine Silk Manufacturer and Merchant in the Fifteenth Century," in *Studies in Medieval and Renaissance History*, volume III, ed. William M. Bowsky (Lincoln: University of Nebraska Press, 1966), 223–285; Hidetosi Hoshino, "Francesco di Jacopo Del Bene – cittadino fiorentino del Trecento," *Annuario di Istituto Giapponese di Cultura in Roma* 4 (1966): 29–119.
9. One of many standard texts is Edwin Mansfield, *Microeconomics: Theory and Applications* (New York: Norton, 1991).
10. George J. Stigler, *The Organization of Industry* (Chicago: University of Chicago Press, 1968). John Roberts notes, "In the competition between economic models, the theory of perfect competition holds a dominant market share: no set of ideas is so widely and successfully used by economists as is the logic of perfectly competitive markets. Correspondingly, all other market models (collectively labelled 'imperfectly competitive'...) are little more than fringe competitors." See Roberts, "Perfectly and Imperfectly Competitive Markets," in *The New Palgrave: A Dictionary of Economics*, ed. John Eatwell et al. (New York: Norton, 1987), 231–240.
11. Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," 1.
12. Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," 23.
13. We are not the first to come to this conclusion. Annales-school historians (for example, Fernand Braudel, *The Wheels of Commerce* (Berkeley: University of California Press, 1992)), economic sociology (Mark Granovetter, "Economic Action and Social Structure: The Problem of Embeddedness," *American Journal of Sociology* 91 (1985): 481–510; Neil J. Smelser and Richard Swedberg, editors, *The Handbook of Economic Sociology* (Princeton: Princeton University Press, 1994)), and transaction-cost economics (Oliver E. Williamson, *Markets and Hierarchies* (New York: The Free Press, 1975); Douglass C. North, *Institutions, Institutional Change and Economic Performance* (Cambridge: Cambridge University Press, 1990); Avner Greif, "Reputation and Coalitions in Medieval Trade: Evidence on the Maghribi Traders," *Journal of Economic History* 4 (1989): 857–882; Greif, "On the Political Foundations of the Late Medieval Commercial Revolution: Genoa During the Twelfth and Thirteenth Centuries," *Journal of Economic History* 54 (1994): 270–289) have argued much the same thing from very different perspectives. While our sympathies lie mostly with the second approach, we do not try here to adjudicate empirically between these contending next steps.
14. See David Herlihy and Christiane Klapisch-Zuber, *Census and Property Survey of Florentine Domains in the Province of Tuscany, 1427–1480* (Madison: University of Wisconsin, Data and Program Library Service, 1981); David Herlihy and Christiane Klapisch-Zuber, *Tuscans and Their Families: A Study of the Florentine Catasto of 1427* (New Haven: Yale University Press, 1985).
15. See Herlihy and Klapisch-Zuber's work for more details on the history and accounting procedures of this unique document. These authors coded and analyzed much demographic, occupational, and wealth information from the 1427 *catasto*, but they did not code the (extensive) lists of debtors and creditors.
16. A third series of four summary volumes (*sommarii*) was also generated, but only one volume of this series has survived.
17. Before his death, David Herlihy kindly verified for us the existence of a few microfilm reels that we had had trouble obtaining.
18. The reason for this original focus on "elites" is the fact that the broader project in which this economic study is embedded is concerned first and foremost with political transformation. See John F. Padgett and Christopher K. Ansell, "Robust Action and

- the Rise of the Medici, 1400–1434,” *American Journal of Sociology* 98 (1993): 1259–1319, for background.
19. Dale Kent, “The Florentine Reggimento in the Fifteenth Century,” *Renaissance Quarterly* 28 (1975): 575–638.
  20. Wealthy households headed by individuals with only *common* Christian names – but who were not, in Herlihy’s and Klapisch-Zuber’s coding, and could not be, by our own research efforts, assigned a last name – were omitted from the sample because of the difficulty of identifying them uniquely in other households’ lists of debts. However, any such individuals who operated companies in our core industries, or who financed such companies, were picked up in our second stage of company coding, described below. For example, debts of and to Iacopo di Agnolo were not coded in our data set, but debts of and to Iacopo di Agnolo & co, *setaiuolo* (*Cat.* 77: 151), were.
  21. Since the content of debts/credits was specified in only a minority of cases, we cannot be sure whether partners, or their scribes, aggregated multiple debts/credits to single creditors/debtors into a single reported debt/credit or not. Such an accounting practice would undercut the conceptual identity of “current debt” and “past transaction.” Goldthwaite (personal communication) is of the opinion that many, if not most, *catasto* records were based on *bilanci* current accounts, which aggregated transactions into a single net debt. But if this practice were widespread, we would not find the multiple-transaction “relational” trading reported below. An example helps both to illustrate this accounting issue and to show how we dealt with it. Whenever one party to the trade reported summary current accounts and the other reported more detailed transactions, we always disaggregated in our coding to the most detailed transactional level possible. For instance, Cosimo and Lorenzo de’ Medici’s bank claimed to be owed money by Michele di Salvatore del Caccia & co, *setaiuoli*, in four separate entries (107 florins, 581 florins, 606 florins, and 431 florins) and to owe that company 66 florins, 159 florins and 248 florins in three separate entries. This seems to be fully transactionally organized. But in del Caccia’s accounts, only one entry for 66 florins owed by the Medici bank is found (corresponding to one of the entries in the Medici debit ledger), along with two separately recorded debts owed to the Medici of 431 florins (corresponding to one of the Medici credit entries) and 887 florins. Note that this 887 florins equals the other three reported Medici credits minus the other two reported Medici debts  $[(107 + 581 + 606) - (159 + 248) = 887]$ . Thus the Medici bank accounts adopt a transactional approach, listing all ties, while the del Caccia silk company adopts a hybrid approach, listing some transactions and summing others. Whenever we had the choice, we retained the more disaggregated “Medici” version of trading in our data set. The most important point to note about this accounting complication is that to the extent that current-account reporting remains in our data set (and there is no doubt that some does), this biases test statistics in favor of the perfect competition models to be tested below. Put another way, it is almost certainly the case due to accounting practices that some (perhaps much) relational trading is hidden from us, even in those markets our tests infer to be “perfect competition.”
  22. See de Roover, *The Rise and Decline of the Medici Bank*, 73, for an example from 1457 of how the Medici hid banking assets even within the context of their own account books.
  23. Again, under the “code only debits/credits of greater than or equal to 10 florins in value” constraint.
  24. In principle, we could have sampled on this Herlihy and Klapisch-Zuber data directly. The Herlihy and Klapisch-Zuber coding is faithful to the *campioni* documents, in

that they coded occupation or trade of household head only when the head (and hence the scribe) explicitly designated it as such. However, our own transaction-based procedure is far more reliable than these occupation codes for four reasons: (a) Households and firms are not the same thing. Many, if not most, firms have multiple partners, and individual households can be involved in multiple firms. (b) Lead partners of the largest firms in Florence typically gave no occupation, because they engaged in numerous and heterogeneous economic activities – both because they were partners in multiple firms, and because “banking” firms often engaged in merchant trading as well. (c) The self-reports did not distinguish between individuals actively engaged in the trade in question and individuals active only in the past. And (d) Herlihy and Klapisch-Zuber lumped wool manufacturers (*lanaiuoli*) and cloth retailers (*ritagliatori*) together in their coding, thereby eliding what for us is an important distinction. [This was simply a sign of their pioneering times: IBM-card constraints forced them to squeeze the number of occupations/trades down to 99 – a two-digit number.] The net result of these serious problems is that using the Herlihy and Klapisch-Zuber tape of household data to get a picture of economic firms is a highly unreliable procedure. [This in no way is intended as a criticism. Herlihy’s and Klapisch-Zuber’s explicit intent was to study households, not firms.] We have only used their occupation/trade information, therefore, to supplement our search for firm *bilanci*, which alone give us the information we seek.

25. Large “holding company” firms, like the Medici bank, were composed of multiple partnerships – one for the Medici branch in Rome, one for their branch in Venice, one for their home *tavola* in Florence, etc. For details, see de Roover, *The Rise and Decline of the Medici Bank*, passim. In our data set, these are coded as the multiple companies that they legally are. But through our lists of partners, we can (and will in the future) reconstruct co-ownership, or equity, links among firms.
26. This is a sampling comparison, based on 31 percent of the unseen firms, because we did not start collecting *campioni* subtotal information on “unseen *bilanci*” firms until part of the way through the coding exercise. In addition, there are a few *campioni*, such as that of Palla di Nofri Strozzi, which offer *bilancio* summary information, but the original *bilanci* have been lost from the relevant *portata*.
27. As explained in the table, we have not identified all *tintori* companies in Florence, only the most substantial ones. Therefore, given the large (but unknown) number of small *tintori* firms, we cannot compare the relative market size of the dyeing trade with the others.
28. This speaks to an historiographical controversy in the literature. Lopez, “Hard Times and Investment in Culture,” and Lopez and Miskimin, “The Economic Depression of the Renaissance,” *Economic History Review* 14 (1962): 409–26, have argued for a fifteenth-century Florentine economic decline, perhaps even depression, in part on the basis of declining wool production. More recent authors, such as Cipolla, Goldthwaite, Hoshino, and Brown (see notes 5 and 6 for bibliographic details) have denied this, in part on the basis of a rising silk industry that offset the decline in wool. While we do not have the over-time data necessary to resolve this dispute, the clear strength of the silk industry in 1427 is consistent with the second interpretation.
29. A “certainty code” was constructed to measure the likelihood of the firm’s actual existence. Cases where a *bilancio* (or equivalent) existed and where all partners mentioned the same consistent list of partners were given a certainty code of 3. Cases where a *bilancio* (or equivalent) existed, but where different partners gave somewhat inconsistent lists of partners in their *campioni*, were given a certainty code of 2. Cases where only one partner cited the firm, without himself providing a *bilancio*, were



given a certainty code of 1. And cases where the firm existed only in “& co” references to it by others, without any reference to it by any of the alleged partners, were given a certainty code of 0. The only exception to this last rule was when ten or more (10+ florin) “& co” debt or credit references existed, but ownership could not be verified. In these few cases, we tentatively recoded from 0 to 2. [An example of such recoding is the wool production firm of Lionardo and Cosimo di Niccolo Barbadori, identified by Hoshino in *L'arte della lana in Firenze nel basso medioevo* as existing in 1430. Although not mentioned at all in the *campione* of household head Niccolo Barbadori in 1427, the company appears as debtor or creditor in fourteen different transactions in our data set.] For purposes of this article, we define “the firm existed” as a certainty code of either 2 or 3.

30. Bear in mind that bankers – that is, dealers in currency exchange and, more importantly, in bills of exchange – frequently engaged in merchant trading as well. The so-called “merchants” in this table did not engage in banking activities. *Mercatori* were the classic export-oriented merchant-traders described by Saporì in *The Italian Merchant in the Middle Ages*. *Merciai* were only small-time traders – essentially peddlers. If this second category is excluded from the definition of “merchants,” then there were 16 Florentine merchant-trading companies (other than banks) in 1427.
31. Our only caveat to this claim would be for possible firms who never incurred debts or credits over 10 florins in magnitude, to anyone. This might be possible for small artisan firms operating outside the core sectors of the Florentine economy. But within the core industries of Florence, this would have to be a truly small company indeed. In fact, we doubt that there were any.
32. Hoshino, *L'arte della lana in Firenze nel basso medioevo*, 229.
33. Edler de Roover, “Andrea Banchi, Florentine Silk Manufacturer and Merchant in the Fifteenth Century,” 226.
34. The Cambio guild’s company registers for the years of 1400–1459 unfortunately no longer exist. The annual lists of local banking partnerships in *Arte del Cambio* volumes 11, 14 and 15, covering the period 1340 to 1487 (with the above gap) have been coded and computerized by the second author for another purpose.
35. See Stigler, *The Organization of Industry*, 5–8.
36. For Stigler, a homogeneous good is tantamount to the definition of a market. Chamberlin was the main proponent of analyzing markets in terms of differentiated products, but his and other “imperfect competition” approaches have not found favor with neoclassical economists. See Edward H. Chamberlin, *The Theory of Monopolistic Competition* (Cambridge: Harvard University Press, 1946); Stigler, *The Organization of Industry*, 309–321; Roberts, “Perfectly and Imperfectly Competitive Markets.”
37. Stigler, *The Organization of Industry*, 15; also see Marshall W. Meyer, “Measuring Performance in Economic Organizations,” in *The Handbook of Economic Sociology*, ed. Neil J. Smelser and Richard Swedberg (Princeton: Princeton University Press, 1994), 556–587.
38. Raymond de Roover, “The Story of the Alberti Company of Florence, 1302–1348, as Revealed in Its Account Books,” *Business History Review* 32 (1958): 14–59.
39. Armando Saporì, editor, *I libri degli Alberti del Giudice* (Milano: A. Garzanti, 1952).
40. Stigler, *The Organization of Industry*, 14.
41. We note here a deep irony. Mainstream theoretical economists have monolithically rejected behaviorist challenges to their neoclassical theory of the firm on the basis of Milton Friedman’s passionate demand to judge “as if” theories on the basis of their empirical predictions, not on the basis of their (admittedly unrealistic) assumptions. See Milton Friedman, “The Methodology of Positive Economics,” in *Essays in Pos-*

- itive Economics* (Chicago: University of Chicago Press, 1953). Yet in the heartland of neoclassical theory – the perfectly competitive market – empirical economists have (rightly) done exactly the opposite.
42. Goldthwaite, “The Medici Bank and the World of Florentine Capitalism,” 23–24. Weber’s conceptual distinction between the organizational form of money-making enterprises and the spirit of capitalism in chapter two of *The Protestant Ethic and the Spirit of Capitalism* may also be considered à propos here.
  43. Vittore Branca, editor, *Mercanti scrittori: ricordi nella Firenze tra medioevo e rinascimento* (Milano: Rusconi, 1986), 549, 552. Branca’s volume contains editions of the *ricordi* of Buonaccorso Pitti, Domenico Lenzi, Donato Velluti, Lapo Niccolini, and Bernardo Machiavelli, in addition to the works of Paolo da Certaldo and Giovanni di Pagolo Morelli cited below. See also Branca’s excellent introduction to the volume, especially page xxii.
  44. Branca, *Mercanti scrittori*, 60, 21, 3, 91.
  45. Branca, *Mercanti scrittori*, 177ff. In Leon Battista Alberti’s famous *Libri della famiglia*, a more studied version of the private *ricordi*, the young Lionardo Alberti comes close to expounding a competitive view of commercial activity with his image of life as a regatta, where the most skilled captain (who chooses a vessel suitable to his own nature) gains the most riches and thus enjoys the greatest stature among his companions. See Leon Battista Alberti, *The Family in Renaissance Florence [I Libri della famiglia]*, trans. Renee Neu Watkins (Columbia: University of South Carolina Press, 1969), 140, 146. According to Lionardo, riches are for most people the only reason for working at all, and profit grows only with a continual expansion of one’s affairs. But Lionardo’s youthful voice is perhaps overshadowed by that of the elder Giannozzo in Book III, who defends choosing a sturdy “honorable” occupation, like wool or silk production, and who claims that his own wealth grew through thrift rather than acquisitiveness. In Giannozzo’s words, “a seller who is well liked always has plenty of customers,” suggesting a focus on trust, dependability, and friendship. See especially pages 196 and 163. Even Lionardo must admit that business should be a place where we put our virtues into practice (136). Alberti’s text is typically multivocal, about economic motivations as about everything else. It at least suggests, between Giannozzo and Lionardo (and the banking-oriented Adovardo), a variety of legitimate motivations that might animate economic practice.
  46. Ronald F. E. Weissman, *Ritual Brotherhood in Renaissance Florence* (New York: Academic Press, 1982), 35–36.
  47. Whereas economists are stalwart in dismissing actors’ statements about motivation as mere rationalization, our own position is that it is dangerous for an analyst to assume that he knows more about the actors than do they themselves. Concerning the nature of typical or ideal economic behavior today, see for example, Brian Uzzi, “Embeddedness and Its Paradoxes,” *American Sociological Review*, forthcoming.
  48. This last point has been made forcibly by the British statistician P. E. Hart. See his “Entropy and other Measures of Concentration,” *Journal of the Royal Statistical Society, Series A* 134 (1971): 73–85; and “Moment Distributions in Economics: An Exposition,” *Journal of the Royal Statistical Society, Series A* 138 (1975): 423–434.
  49. Hoshino, *L’arte della lana in Firenze nel basso medioevo*, 206–211.
  50. De Roover, *The Rise and Decline of the Medici Bank*, ch. 6.
  51. Only the risk of nonrepayment (in different currency) makes this even an issue. All the firms in our data set were engaged in repetitive face-to-face patterns of business; hence overt cheating was not an important problem. Possible firm bankruptcies were an issue; but given the shortness of the loan period, many of these were foreseeable.

- The real risk in bills of exchange was fluctuation in rates of currency exchange: bills of exchange were, to some extent, a type of speculation on currency markets. See, for example, Raymond de Roover, *The Bruges Money Market Around 1400* (Brussels: Paleis der Academien, 1968). But these important fluctuations affected everyone the same, and hence do not interfere with our anonymity tests.
52. Again, see Goldthwaite, "The Medici Bank and the World of Florentine Capitalism;" Hoshino, *L'arte della lana in Firenze nel basso medioevo*.
  53. Sometimes, for lack of better data, other indices of size are selected as the informational base – e.g., capital, assets, or number of employees. Clearly, however, the theory prescribes market share, in terms of value of sales, as the proper unit for analysis.
  54. Albert O. Hirschman, *National Power and the Structure of Foreign Trade* (Berkeley: University of California Bureau of Business and Economic Research, 1945); Stigler, *The Organization of Industry*; Leslie Hannah and J. A. Kay, *Concentration in Modern Industry: Theory, Measurement, and the U.K. Experience* (London: MacMillan, 1977).
  55. The entropy measure ( $E = - \sum s_i \log s_i$ ), while not superior to the simpler Hirschman-Herfindahl index, does not appear to be fatally flawed. Why it is not more common, we do not know. See B. Curry and K. D. George, "Industrial Concentration: A Survey," *Journal of Industrial Economics* 31 (1983): 203–255.
  56. We purged *accomanda*, *corpo*, *sopraccorpo*, *deposito di discrezione*, and "profit"/*guadagno* ties from these, and all other, analyses. To include such capital-investment items with normal operating, buying-and-selling transactions would skew our data.
  57. This fact means that sampling theory for the Hirschman-Herfindahl index is a nightmare.
  58. This does not imply that banks, or any other firms, were large by modern standards. In the context of the time, a firm with twenty employees was quite large.
  59. Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," 9.
  60. See Ralph L. Nelson, *Concentration in the Manufacturing Industries of the United States* (New Haven: Yale University Press, 1963). Among modern U.S. industries, the closest industry in Nelson to wool production – "cotton broad-woven fabrics" – was itself among the lowest in concentration of modern industries. But the substantive value of statistical comparisons between the Renaissance and modern times is dubious, to say the least.
  61. See Saporì, *La crisi delle compagnie mercantili dei Bardi e dei Peruzzi*.
  62. Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," 17.
  63. In fairness to Goldthwaite, he based his conclusion about the lack of Medici dominance on *corpo* figures, not on (unavailable to him) market shares. Based on the *corpo* sample that we have (and extrapolating average non-Medici *corpo* levels to missing-data firms), we estimate that only 8.7 percent and 16.7 percent of the total Florentine *corpo* invested in banking firms was held in the core Medici and in all Medici banking companies, respectively. Obviously, these figures are more in line with Goldthwaite's conclusion. The reason for the large discrepancy between these two approaches is drastic undercapitalization in the core Medici banks. In particular, the Rome branch of Cosimo and Lorenzo, the largest value-of-transactions bank in Florence and probably in the world, had a *corpo* level of zero. Concerning this, see de Roover, *The Rise and Decline of the Medici Bank*, 53. Most of the business of this bank involved the Pope, but our data show extremely large amounts of business with Florentines as well (probably Florentines who also were doing business with the Pope). A second complication in comparing our argument to Goldthwaite's is the fact that he is referring to banking throughout Europe, whereas our data refer to the Florence market alone.

- Given that most of the Medici business was abroad (especially in Rome), however, it is unclear which way this cuts. In any event, the fact remains that a quarter to thirty percent of the Florentine banking market in 1427 flowed through Medici hands.
64. Of course, complications can arise in the meaning of “best,” especially under conditions of imperfect information.
  65. Of course, what we actually have is 1427 debits and credits. But a contemporaneous debt reflects a past transaction. The only accounting complication in this equation has already been mentioned in note 21: To an unknown degree, household heads may have lumped together multiple transactions with a single party into a single overall debt. Our informal impression is that this practice was not widespread – especially with company *portate* data that were copied from company account books. But to the extent that this accounting aggregation occurred, it creates an artificial bias in favor of confirming the perfect competition models.
  66. This situation of “slightly better” can only exist for fleeting moments under perfect competition. Once other firms realize the situation, they will quickly match their competitor’s temporary advantage.
  67. Joel Cohen, *A Model of Simple Competition* (Cambridge: Harvard University Press, 1966).
  68. Company-to-household data will be examined in future work. To a significant extent, as Hoshino notes, the core-industry firms we analyze here were producing for export, not for domestic consumption. However, the large number of debts – typically for small amounts – we found owed by Florentine households to *ritagliatori* firms, who in turn owed the largest number of their consignment debts to wool production firms, suggests that there may well have been a larger domestic market for Florentine woolen goods than Hoshino realized.
  69. See Peter J. Bickel and Kjell A. Doksum, *Mathematical Statistics: Basic Ideas and Special Topics* (San Francisco: Holden-Day, 1977), 313–316. In past work, one of us has relied extensively on the Kolmogorov-Smirnov test, which is the continuous-probability analogue of the discrete-probability test employed here. See Padgett, “Bounded Rationality in Budgetary Research,” *American Political Science Review* 74 (1980): 354–372; Padgett, “Hierarchy and Ecological Control in Federal Budgetary Decision Making,” *American Journal of Sociology* 87 (1981): 75–129; Padgett and Ansell, “Robust Action and the Rise of the Medici, 1400–1434.”
  70. As noted by Bickel and Doksum (315),  $K-1$  is the degrees of freedom for the Chi-square test.
  71. The number of seller firms,  $n$ , observed in a particular market interface, is often less than the total number of firms in the seller industry, because not all firms participated in all markets. Only firms actively engaged in markets were used for the calculation of  $P = (1/n)$ . This procedure gives the models the best chance for fit.
  72. Herlihy and Klapisch-Zuber, *Tuscans and Their Families: A Study of the Florentine Catasto of 1427*, 127. This figure was calculated by dividing the number of household heads declaring a wool occupation in the 1427 *catasto* by the total number of household heads reporting an occupation. “Employment” is defined in a mercantile putting-out system sense, not in an industrial factory sense.
  73. “Firms” is in quotes here because actually we disaggregated by  $K_j$  size class, not by firm. In cases of larger firms, size classes and firms are mostly the same thing, since then there was usually only one firm in that size class. But for small  $K_j$ , usually many small firms were pooled, producing a single generic small- $K_j$  “firm.”
  74. Further research is required to ascertain whether this *lanaiuoli* purchasing behavior is related to banks in their role as merchant-traders, who brought raw wool from

- England, or in their role as banks per se, which extended loans through bills-of-exchange (or to both of these roles).
75. In this respect, historians' ways of handling evidence are often more rigorous than those of social scientists.
  76. Weissman, *Ritual Brotherhood in Renaissance Florence*, 40.
  77. For an excellent argument to this effect, see Allan Silver, "Friendship in Commercial Society: Eighteenth-Century Social Thought and Modern Sociology," *American Journal of Sociology* 95 (1990): 1474–1504.
  78. For a cogent discussion of the Florentine relation of family to economics, see Richard A. Goldthwaite, "Organizzazione economica e struttura familiare," in *I ceti dirigenti nella toscana tardo comunale (atti del III convegno, 1980)* (Firenze: Francesco Pappafava, 1983); and Goldthwaite, *Private Wealth in Renaissance Florence: A Study of Four Families* (Princeton: Princeton University Press, 1968). Also see Bruce Caruthers, *City of Capital: Politics and Markets in the English Financial Revolution* (Princeton: Princeton University Press, 1996) for an account of how the seventeenth-century London stock exchange emerged from party politics.
  79. In this connection, the 1427 timing of the *catasto* – only seven years before the 1434 Medicean takeover of the state – is remarkably fortunate for future research. A variety of authors have begun this investigation of the links between Medici-as-banker and Medici-as-political-boss, but from the perspective of personal and public finance loans, not from the perspective of banking-industry structure. See Anthony Molho, *Florentine Public Finances in the Early Renaissance, 1400–1433* (Cambridge: Harvard University Press, 1971); Molho, "Cosimo de' Medici: Pater Patriae or Padrino?" *Stanford Italian Review* 1 (1979): 5–33; Dale Kent, *The Rise of the Medici: Faction in Florence, 1426–1434* (Oxford: Oxford University Press, 1978); Padgett and Ansell, "Robust Action and the Rise of the Medici, 1400–1434."
  80. From the perspective of transaction-cost economics, rather than neoclassical economics, the finding of relational trading in banking may not be too surprising. Assessing "credit-worthiness" requires detailed personal information. Given how brief were the terms of bills-of-exchange loans (less than three months), this informational requirement was not as binding as it might seem, but it nonetheless did exist. Wool is more puzzling from this informational perspective, since inspection for quality is straightforward for experienced buyers. Even more damning is the fact that higher quality silk had less relational trading than wool – the opposite of what transaction-cost theory would predict. We probed this issue further by running Homogeneous Binomial tests on the two segments of the wool industry separately – the higher quality San Martino and the lower quality Garbo *conventi*. This exercise was inhibited by the large number of "unknown location" wool firms, but for what it is worth we obtained mixed results. Two cases out of the seven statistically significant relational wool markets (bank debtor/wool creditor, and wool debtor/dyeing creditor [which became significant upon disaggregation]) behaved consistently with transaction-cost reasoning: the higher quality San Martino *convento* had relational trading while the lower quality Garbo *convento* did not. But in four other cases (wool debtor/bank creditor, wool debtor/retail creditor, retail debtor/wool creditor, and wool debtor/wool creditor), there were no measurable differences in relational trading behavior between the two *conventi*. The merchant/wool case had too few Garbo transactions to use. While this hardly defeats the intriguing transactions-cost approach, which can be operationalized in a number of ways, it at least raises serious empirical doubts.
  81. Goldthwaite, "The Medici Bank and the World of Florentine Capitalism," 23.